Bells Line of Road – Chifley Road upgrade

Review of Environmental Factors

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Roads and Maritime Services

Bells Line of Road Corridor – Chifley Road upgrade

Review of Environmental Factors

September 2016

Prepared by Coffey Environments Australia Pty Ltd
Provide Roads and Maritime Services Publication Number

Bells Line of Road Corridor – Chifley Road Upgrade Project

Prepared for NSW Roads and Maritime Services

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Executive summary

The proposal

Roads and Maritime Services (Roads and Maritime) propose to upgrade parts of Chifley Road between Bell and Lithgow. Chifley Road, becomes Bells Line of Road at the Darling Causeway intersection at Bell, and provides a secondary connection between the Central West of NSW and Sydney. The road also provides a local connection to residents along Chifley Road, Darling Causeway, Bells Line of Road and Lithgow.

A strategic corridor plan completed by the Australian and NSW Governments in October 2012 identified improvement work for the Bells Line of Road corridor, including safety and traffic improvements for Chifley Road.

Chifley Road is about 20 kilometres long and is located in the western section of the Bells Line of Road corridor between Bell and Lithgow in NSW. The proposal would upgrade the Scenic Hill and Clarence road over rail bridge sections of Chifley Road. Scenic Hill is located about three kilometres east of Lithgow and the Clarence road over rail bridge is located about five kilometres west of Bell.

The proposal includes the replacement of the existing Clarence road over rail bridge and providing a descending lane and improvements to the grade and curve at Scenic Hill. Key features of the proposal include:

- Widening and realigning Chifley Road at Scenic Hill and providing an additional descending lane and median barrier
- Improving the intersection at the Lithgow Ex-Prisoner of War Memorial Tower (located on Scenic Hill)
- Providing improved concrete drains along road cuttings
- Replacing and demolishing the existing road bridge over the railway line along Chifley Road at Clarence
- Widening and realigning the approaches to the new bridge over the railway line
- Improving the Clarence Colliery Road intersection with Chifley Road.

Need for the proposal

The Bells Line of Road and its westerly extension, Chifley Road, form one of two major routes which link the Sydney urban area with Lithgow and the NSW Central West region, through the Blue Mountains.

Chifley Road currently exhibits a high crash rate. The average annual casualty rate per kilometre is currently 0.36, which is over four times the rate of 0.074 for similar rural roads. The combination of narrow lanes and shoulders and poor vertical and horizontal road alignment has led to a high crash rate along the road. The curve improvements, road widening and the provision of an additional descending lane would reduce interactions between heavy and light vehicles, improving traffic flow and travel times. The replacement of the road over rail bridge would bring the bridge up to Australian Standards.

Improvements to this corridor have been identified as necessary in the *2012 Bells Line of Road Long Term Strategic Corridor Plan*. The proposal is required to provide long-term road safety benefits, provide more reliable travel times and improve freight access and efficiency in the region.

Proposal objectives

The objectives of the proposal are aligned with the strategic need and are to:

- Reduce the overall crash rate on Chifley Road
- Reduce the present rail safety risks at Clarence rail bridge
- Improve vehicle travel times and their operating costs on the road corridor
- Provide efficiency and consistency of traffic flows
- Minimise environmental impacts.

The objectives of the proposal are consistent with the Bells Line of Road Long Term Strategic Corridor Plan as they include significant road safety aspects.

Options considered

Roads and Maritime started to investigate options for upgrading Chifley Road between Bell and Lithgow in 2014.

The options considered by Roads and Maritime included:

1. Widening of the narrow (former) railway cuttings east of Clarence
2. Widening and barrier treatments for the Clarence road over rail bridge
3. Providing a descending lane at Scenic Hill
4. Improving the final westbound curve at Scenic Hill
5. Other safety improvement work as detailed in the Strategic Business Case (October 2014, updated June 2015).

A strategic assessment was then carried out to evaluate and prioritise the options. The assessment considered a range of safety, design, environmental and financial factors and drew on the findings of the road safety review and crash analysis, benefit-to-cost ratio analysis, preliminary environmental investigation, constructability review, geometric road design and various cost estimates.

Scenic Hill (comprising Options 3 and 4) and Clarence road over rail bridge (Option 2) were selected. These options provide the most effective use of available funds to deliver the necessary improvements to safety and travel conditions for Chifley Road between Bell and Lithgow.

Statutory and planning framework

The objective of State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) is to facilitate the effective delivery of infrastructure across NSW. Clause 94 of ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the current proposal is for a road and is to be carried out on behalf of Roads and Maritime, it can be assessed under Part 5 of the *Environmental Planning and Assessment Act 197*9 (EP&A Act). Development consent from council is not required.

This Review of Environmental Factors (REF) fulfils the requirements of Section 111 of the EP&A Act and has been prepared in accordance with Clause 228 of the Environmental Planning and Assessment Regulation 2000.

Community and stakeholder consultation

Consultation with potentially affected property owners, relevant government agencies and other stakeholders has been carried out. In February 2016, a community update brochure was released informing the community about the commencement of the design and the REF process. The preliminary concept design was displayed from 15 February to 21 March 2016 for community and stakeholder feedback to help guide future decision-making and design. Information about the proposal has also been placed on the Roads and Maritime project website.

Twelve submissions were received during the consultation period. Of the 12 submissions received, four were in support or conditional support of the proposal, seven were neutral and one did not support the proposal.

The main comments received included:

- Concerns about other sections of Chifley Road not proposed to be upgraded
- Consideration of other road users
- Consideration of biodiversity impacts
- Suggested changes to the proposal
- Requests for further information.

Roads and Maritime consulted with Lithgow City Council in February 2016 in accordance with the requirements of ISEPP. A Health and Safety in Design (HSiD) Workshop was held on 26 June 2016 with representatives of relevant government agencies. The workshop provided an opportunity to provide input to the design and to identify health and safety risks associated with the proposal.

Roads and Maritime will continue to consult with the community and stakeholders throughout development of the proposal. In particular, the REF will be placed on public display and comments invited. Submissions received as a result of the display will be addressed in a formal submissions report and considered when finalising the concept design and during development of the detailed design.

Environmental impacts

Roads and Maritime commissioned technical experts to assess the potential impacts of the proposal and to identify safeguards and management measures to avoid or limit these impacts. The main impacts that are likely to occur as a result of the proposal are summarised below.

Hydrology and water quality

Clearing of vegetation and earthwork needed to make the road improvements would expose the ground surface. During rainfall, runoff from these disturbed areas will carry into nearby waterways causing sediment build up in watercourse channels, potentially affecting flow regimes and water quality. Waterways and/or drainage lines could also be partially blocked or temporarily diverted during the earthwork. Standard measures to reduce erosion and control sediment runoff would be implemented throughout construction. Disturbed areas outside the footprint of the new road alignment would be progressively rehabilitated following construction in each area.

The proposal would increase the area of hard, impermeable surfaces (at Scenic Hill in particular), leading to an increase in the volume (and velocity) and potential pollutant load of stormwater running off the road. Scouring (and subsequent erosion) could also occur to the banks and watercourse channels downstream of the new culvert that will carry Dargans Creek under Chifley Road. The drainage system has been designed to limit the potential for scour and erosion and to effectively manage the speed of runoff from the road.

A Neutral or Beneficial Effect Assessment (NorBE) was carried out as the proposal area is located in the Sydney drinking water catchment. This assessment is included in Appendix B. The assessment concluded that the proposal is unlikely to have a detrimental impact on overall water quality in this catchment and impacts would be neutral.

Overall, the impacts on hydrology and water quality from the proposal would be temporary and minor, largely confined to the period of construction, and can be managed effectively through the implementation of the management and mitigation measures identified in sections 6.1 and 6.2 of this REF.

Biodiversity

The majority of the proposal footprint would overlie already disturbed areas within the existing road corridor, but would result in the clearing of about 13 hectares of native vegetation. Of this, about 0.03 hectares of Newnes Plateau shrub swamp ecological community in the Sydney Basin Bioregion (listed under the *Threatened Species Conservation Act 1995* (TSC Act)) which is a component of the Temperate Highland Peat Swamps on Sandstone ecological community listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), would be removed.

This vegetation clearance would remove habitat for seven fauna and one flora species listed under the TSC Act and/or the EPBC Act, which were recorded or had the potential to occur in the proposal area, including the gang-gang cockatoo (*Callocephalon fimbriatum*), diamond firetail (*Stagonopleura guttata*) and varied sittella (*Daphoenositta chrysoptera*).

The impact assessment concludes that the proposal would not have a significant impact on any threatened species, populations or ecological communities. The proposed vegetation being removed is relatively minor compared to the available occupied habitats in the area. Impacts would be further minimised through the implementation of management and mitigation measures identified in Section 6.4 of this REF, including avoidance through design.

Biodiversity offsets may be required in accordance with the Roads and Maritime Biodiversity Offset Guidelines (RMS, 2011b) and will be confirmed during detailed design dependent on the final vegetation clearance required for the proposal.

Noise and vibration

The use of construction equipment needed to build the road is expected to be the main source of noise for the proposal. Construction would, as far as practicable, be carried out during standard construction working hours – 7am to 6pm Monday to Friday, and 8am to 1pm Saturday.

Noise criteria have been set by the NSW Environment Protection Authority (EPA) to manage construction noise. During construction, noise levels may exceed EPA guidelines at three locations identified as noise sensitive at Scenic Hill and at two locations at the proposed Clarence road over rail bridge work site. For two residences near to the Scenic Hill proposal, the criteria is predicted to be exceeded by between 15 decibels and 19 decibels during standard work hours. For the two residences near to the Clarence road over rail bridge work site, the criteria is predicted to be exceeded by between 14 decibels and 18 decibels during standard work hours. There would be no exceedances of the highly noise affected criteria at any of the sensitive receivers.

A Noise and Vibration Management Plan will be prepared to manage noise and vibration through implementing mitigation measures to reduce construction noise levels to the extent that is feasible and reasonable. The Plan will generally follow the approach in EPA's Interim Construction Noise Guideline (ICNG) and Roads and Maritime guidelines and will include measures such as scheduling of works to minimise ongoing noise impact, and notification of all sensitive receivers prior to works commencing.

Management of work outside normal working hours would be addressed via the Noise and Vibration Management Plan.

Aboriginal Heritage

No Aboriginal heritage sites were found within or near the proposal area during database searches or field surveys. No areas of potential for Aboriginal heritage sites were identified in the proposal area.

The potential for sites to be present within the proposal area is limited by the geology and landscape of the site. No major changes to the landscape are proposed and the majority of work

would be within or next to the existing road corridor. The potential for a cultural heritage find during the work is considered to be low.

The Standard Management Procedure - Unexpected Heritage Items would be followed in the event that a known or potential Aboriginal object is found during construction. All personnel working on site would be provided with environmental training to achieve a level of competence and awareness of potential impacts on Aboriginal heritage.

Non-Aboriginal heritage

The proposal would not have any direct impacts on any heritage items listed under relevant State or Commonwealth legislation.

A number of potential heritage items assessed as being of local significance occur within the proposal area and 13 of these sites would be directly impacted by the work through burial, excavation or demolition. These items include the Clarence road over rail bridge, culverts and sandstone walls. The significance of potential impacts has been assessed as low, particularly after the application of the safeguards and management measures.

A non-Aboriginal Heritage Management Plan would be prepared and implemented with specific guidance on measures and controls to be implemented to avoid and mitigate impacts to non-Aboriginal heritage. Measures to be included in the Plan would include archival recording of sites to be buried or demolished and establishing exclusion zones around sites close to work areas.

Traffic and access

Chifley Road would remain open to traffic throughout the work. Road users may experience short-term disruptions including travel delays during traffic switches, safety barrier work and paving, when traffic controls or lane closures are in place. Speed limits would also be reduced during the work. These disruptions would be short-term, with minor impacts on road users expected.

Access to properties along Chifley Road and nearby businesses would be maintained during the work. Access to the Ex-POW Memorial may be restricted for short periods to enable the work to be completed safely.

Confirmation of the relocation of utilities and associated strategies would be carried out during detailed design in consultation with utility authorities.

Once the proposed work is complete, road users, pedestrians and cyclists are expected to benefit from improved safety, access and reduced travel times along Chifley Road.

Justification and conclusion

The proposal has substantial benefits relating to improved road safety, more reliable travel times and improved freight access and efficiency. The proposal is consistent with the NSW and Australian Governments' strategic priorities of improving the highway's safety performance and efficiency, and would help meet ongoing and future road network needs.

These benefits would not be realised if the proposal did not proceed, with subsequent implications for road safety along Chifley Road.

The concept design process has been instrumental in avoiding or reducing the severity of several potential environmental impacts from the proposal, relating to hydrology and drainage, terrestrial biodiversity, landscape and visual amenity and non-Aboriginal heritage. Safeguards and mitigation measures as detailed in this REF would reduce the significance of the expected impacts.

The benefits of the proposal would outweigh the potential negative environmental impacts from the proposal, which can be managed effectively with implementation of the safeguards proposed.

Display of the Review of Environmental Factors

This Review of Environmental Factors is on display for comment from Wednesday 28 September to Wednesday 26 October 2016. You can access the documents in the following ways:

Internet

The documents will be available as pdf files on the Roads and Maritime Services website at http://www.rms.nsw.gov.au/projects/sydney-west/bells-line-of-road/chifley-road-upgrade.html.

Display

The REF can be viewed at the following locations:

- Lithgow City Council
  180 Mort Street
  Lithgow NSW 2790
  Open weekdays 8.15am to 4pm
- Lithgow Library
  157 Main Street
  Lithgow NSW 2790
  Open weekdays 9am to 6pm
  Saturday 9am - 12pm
- Roads and Maritime Services Bowenfels District Office
  15-33 Cooerwull Road
  Bowenfels NSW 2790
  Open weekdays 9am to 4pm

How can I make a submission?

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

Bells Line of Road/Chifley Road Upgrade project team

Roads and Maritime Services

PO Box 973

Parramatta NSW 2124

Or

ChifleyRoadUpgrade@rms.nsw.gov.au

We are seeking community and stakeholder feedback on the proposal by Wednesday 26 October.

Privacy information

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

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

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

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

The information will be held by the Roads and Maritime Services, Bells Line of Road/Chifley Road Upgrade project team.

What happens next?

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

After consideration of the comments, Roads and Maritime will determine whether the proposal should proceed as proposed or whether any alterations to the proposal are necessary. The community will be kept informed about this Roads and Maritime determination.
If the proposal proceeds, Roads and Maritime will develop 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 1800 874 897.

Contents

Appendices

1 Introduction

This chapter introduces the proposal and provides the context of the environmental assessment. The objectives and history of the proposal are detailed and the purpose of the report explained.

1.1 Proposal identification

Roads and Maritime Services (Roads and Maritime) propose to upgrade parts of Chifley Road between Bell and Lithgow. Chifley Road, which turns into Bells Line of Road at the Darling Causeway intersection at Bell, provides a secondary connection between the Central West of NSW and Sydney. The road also provides a local connection to residents along Chifley Road, Darling Causeway and Bells Line of Road and Lithgow.

A strategic corridor plan completed by the Australian and NSW governments in October 2012 identified improvement works for the Bells Line of Road corridor including safety and traffic improvements for Chifley Road.

Chifley Road is about 20km long and is located in the western section of the Bells Line of Road corridor between Bell and Lithgow in NSW. The proposal would upgrade the Scenic Hill and Clarence road over rail bridge sections of Chifley Road (approximately 2.5km and 1.5km respectively). Scenic Hill is located about 3km east of Lithgow and the Clarence road over rail bridge is located about 5km west of Bell. The proposal area is shown in Figure 1.1.

The proposal includes the replacement of the existing Clarence road over rail bridge, and a descending lane and grade and curve improvements at Scenic Hill. Key features of the proposal include:

- Widening and realigning Chifley Road at Scenic Hill with an additional descending lane and median barrier
- Improving the intersection at the Lithgow Ex-Prisoner of War Memorial Tower (located on Scenic Hill)
- Providing improved concrete drains along road cuttings
- Replacing and demolishing the existing road bridge over the railway line along Chifley Road at Clarence
- Widening and realigning the approaches to the new bridge over the railway line
- Improving the Clarence Colliery Road intersection with Chifley Road.

Two potential locations for ancillary sites (site compounds/stockpiles) have been identified for the work associated with Scenic Hill. One potential compound/ stockpile location would be used for the Clarence road over rail bridge and one ancillary site will be used for work at Scenic Hill and Clarence road over rail bridge. Ancillary site locations are shown in Figure 1.2a (Scenic Hill) and Figure 1.2b (Clarence road over rail bridge).

The proposal is located in the Roads and Maritime Services Western Region within the Lithgow City Council local government area (LGA). Blue Mountains National Park and the World Heritage listed Greater Blue Mountains Area are located to the east of the proposal area. The Newnes State Forest is located about 3km to the north of the proposal area. The proposal is located in the Hawkesbury-Nepean Catchment Management Authority (HNCMA) within the boundary of the Upper Coxs River sub catchment and Mid Coxs River sub catchment.

Roads and Maritime estimates that the proposal would take between 18 and 24 months to complete with construction expected to start in mid-2018. The proposal is estimated to cost about $55 million to construct. The NSW government would fund the proposal as part of the Bells Line of Road corridor improvement program.

1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by Coffey Environments Australia Pty Ltd (Coffey) on behalf of Roads and Maritime's, Greater Sydney Program Office. For the purposes of the works, Roads and Maritime is the proponent and the determining authority under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

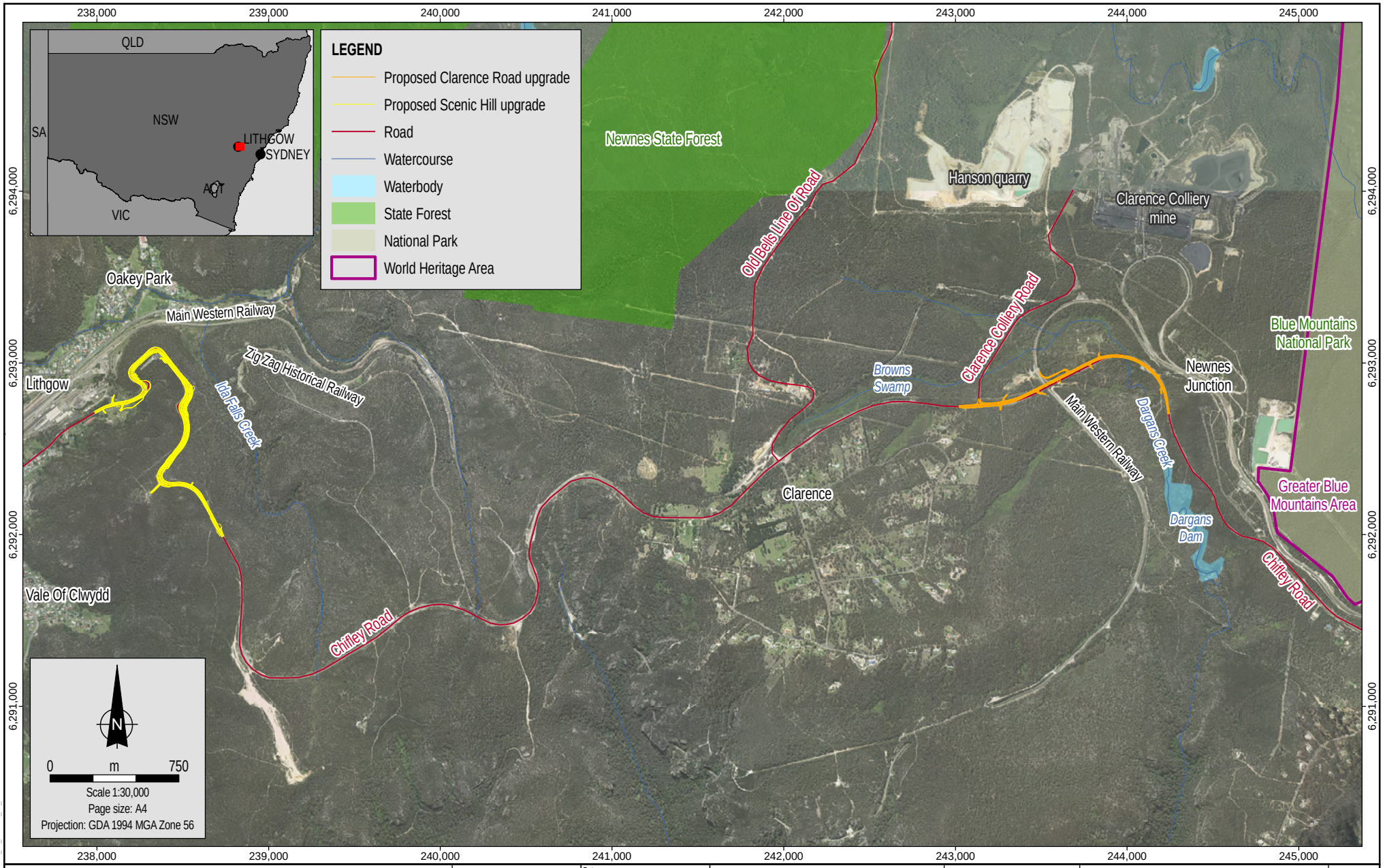
The purpose of the REF is to describe the proposal, document the likely impacts of the proposal on the environment, and to detail protective measures to be implemented.

The description of the proposal and associated environmental impacts have been undertaken in context of clause 228 of the Environmental Planning and Assessment Regulation 2000, 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 requires Roads and Maritime 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 strategic assessment approval granted by the Commonwealth Government under the EPBC Act in September 2015, with respect to the impacts of Roads and Maritime activities on nationally listed threatened species, ecological communities and migratory species.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning 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 other matters of national environmental significance or Commonwealth land and the need to make a referral to the Australian Government Department of the Environment for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.



Source:
Proposed road upgrade data and aerial imagery from NSW Roads and Maritime Services.
Project features and waterbodies digitised by Coffey.
WHA from DSEWPC (data currency 2007).
National Parks from OEH.
State forests from GEODATA250k (optimum scale 1:250,000).

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Date: 25.07.2016
Project: ENAURHOD03119AB
File Name: 3119AB_01_F01.01_GIS

NSW Roads and Maritime Services

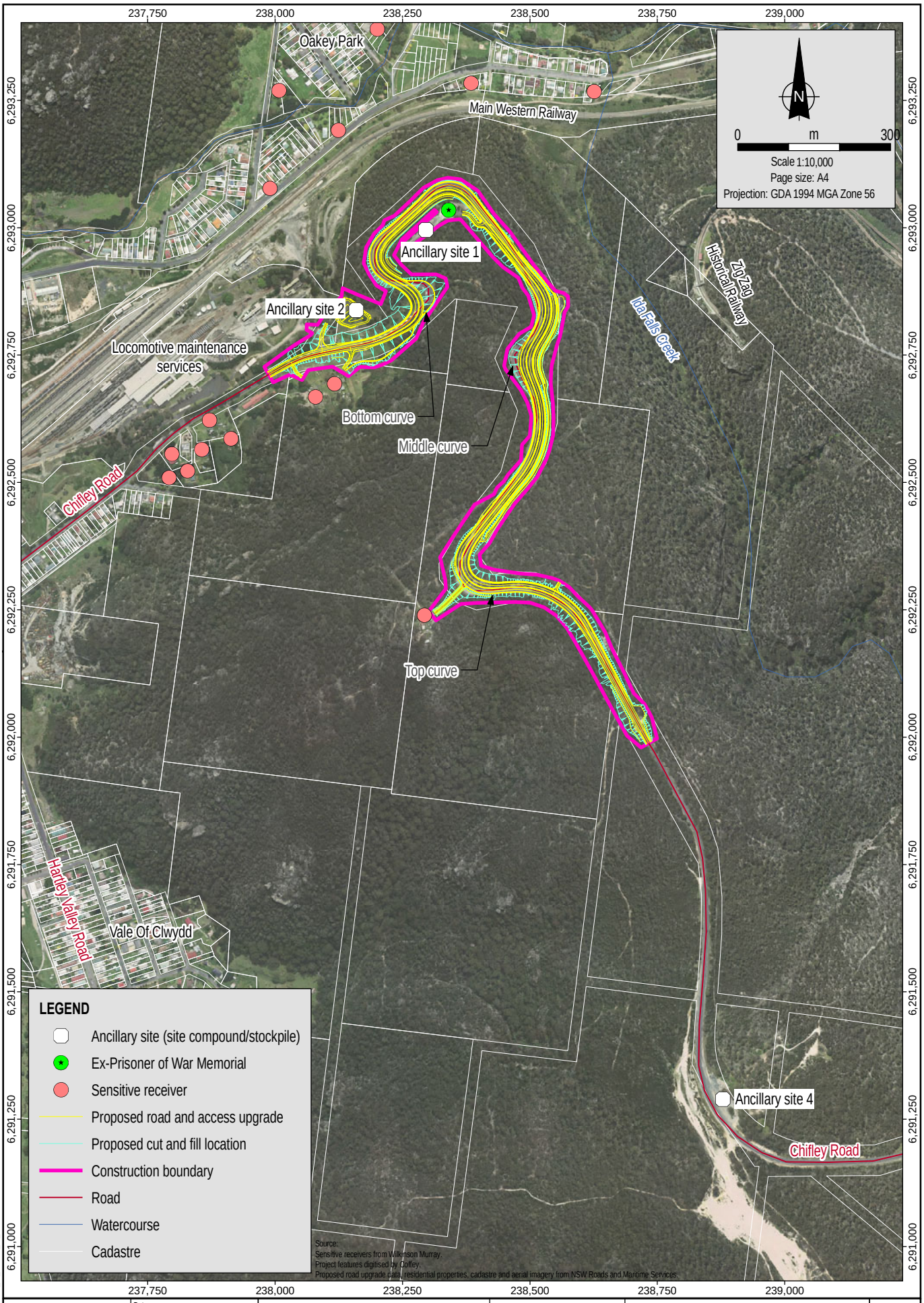
Bells Line of Road – Chifley Road upgrade

Transport Roads & Maritime Services

The proposal location

Figure No: 1.1

MXD Reference: 3119AB_01_GIS001_v0_6



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Date: 25.08.2016
Project: ENAURHOD03119AB
File Name: 3119AB_01_F01.02a_GIS

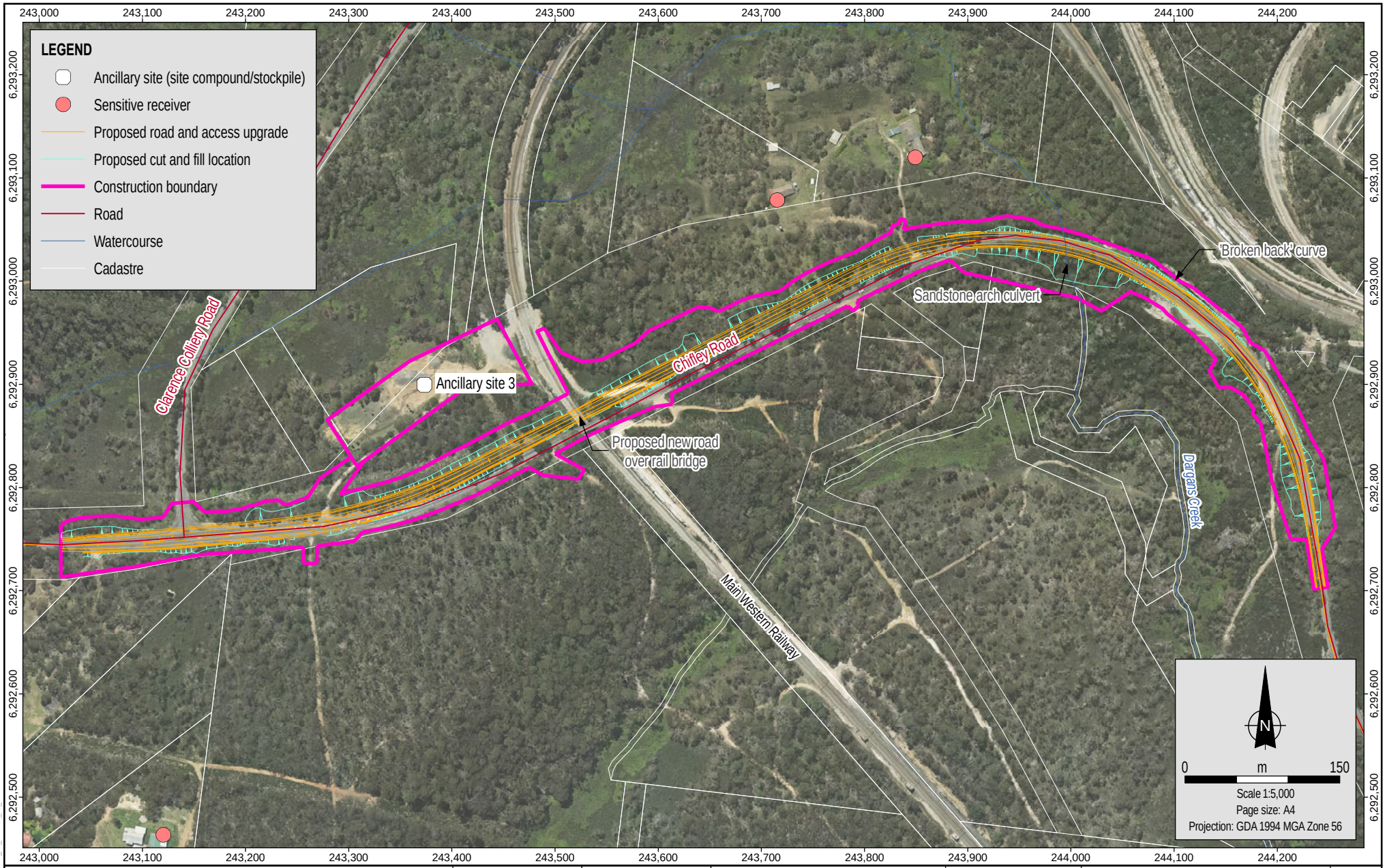
NSW Roads and Maritime Services

Bells Line of Road – Chifley Road upgrade

Transport Roads & Maritime Services

Scenic Hill proposal area and ancillary site locations

Figure No: 1.2a



Source:
Project features digitised by Coffey.
Sensitive receivers from Wilkinson Murray.
Proposed road upgrade data, residential properties, cadastre and aerial imagery from NSW Roads and Maritime Services.

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Date: 16.09.2016
Project: ENAURHOD03119AB
File Name: 3119AB_01_F01.02b_GIS

NSW Roads and Maritime Services

Bells Line of Road – Chifley Road upgrade

Transport Roads & Maritime Services

Clarence road over rail bridge proposal area and ancillary site locations

Figure No: **1.2b**

MXD Reference: 3119AB_01_GIS003_v0_8

2 Need and options considered

This chapter describes the need for the proposal and the options that Roads and Maritime have considered in selecting the preferred option.

2.1 Strategic need for the proposal

The Bells Line of Road and its westerly extension, Chifley Road, form one of two major routes which link the Sydney urban area with Lithgow and the NSW Central West region, through the Blue Mountains. The Great Western Highway is the other major route which links the Sydney urban area to the Central West of NSW.

Chifley Road was constructed during the mid-1940s and construction standards were largely governed by the terrain. The road has generally poor horizontal and vertical alignment and does not meet the current requirements for typical rural roads in NSW. More than 70 per cent of shoulders along the road are narrower than 1m and grades are very steep on the Scenic Hill section immediately east of Lithgow. Grades from Bell to the top of Scenic Hill are between 50 to 90 per cent less than seven per cent grade, with Scenic Hill having less than 50 per cent grade of the length less than seven per cent grade. Ideally lengths of grade greater than six per cent should be limited to less than 300m. The Scenic Hill section has two lengths of more than 300m with grades greater than 10 per cent.

The combination of narrow lanes and shoulders and poor vertical and horizontal road alignment has led to a high crash rate along the road. Chifley Road has an average annual crash rate per kilometre of 0.36 which is over four times the average annual crash rate for similar rural roads in NSW. Further crash data and discussion is provided in Section 2.2.

The proposal is required to improve road safety, provide more reliable travel times and improve freight access and efficiency.

2.1.1 Strategic planning and policy context

The following strategic planning and policy documents provide a framework and guidance for the delivery of the proposal:

- National Road Safety Strategy 2012–2020 (Australian Transport Council, 2011)
- NSW 2021: A Plan to Make NSW Number One (Department of Premier and Cabinet, 2012a).
- NSW Long Term Transport Master Plan (Transport for NSW, 2012)
- NSW Road Safety Strategy 2012–2021 (Transport for NSW, 2012)
- First Things First: State Infrastructure Strategy 2012–2032 (Infrastructure NSW, 2012)
- NSW Freight and Ports Strategy November 2013 (Transport for NSW, 2013)
- Central West Regional Action Plan (Department of Premier and Cabinet, 2012b)
- Central West Regional Transport Plan December 2013 (NSW Government, 2013)
- Bells Line of Road Long Term Strategic Corridor Plan (Australian Government and NSW Government, 2012).

These documents and their relevance to the proposal are discussed in this section.

National Road Safety Strategy 2011–2020

The National Road Safety Strategy provides a framework for national collaboration on road safety improvement and is framed by the guiding vision that *no person should be killed or seriously injured on Australia's roads*. The Strategy presents a 10-year plan to reduce the annual numbers of deaths and serious injuries by at least 30 per cent.

The proposal is aligned with this vision as it contributes to improvements to road user safety by improving road geometry, providing additional lanes and installing safety barriers.

NSW 2021: A Plan to Make NSW Number One

NSW 2021: A Plan to Make NSW Number One is a 10-year plan to guide policy and decision making. The Plan outlines a number of strategies and goals, the intent of which are to rebuild the economy, provide quality services, renovate infrastructure, restore government accountability and strengthen the local community and environment.

The proposal contributes to achieving the following NSW 2021 priorities and goals including:

- Goal 7: Reduce travel times – by increasing the efficiency of Chifley Road by improving curve alignment and providing the descending lane on Scenic Hill
- Goal 10: Improve road safety – by providing safety improvements such as increasing lane and shoulder widths, replacing (and therefore widening) the Clarence road over rail bridge and upgrading crash barriers, improving the curve at the base of Scenic Hill and reviewing options to improve wet-weather skid resistance
- Goal 19: Invest in critical infrastructure – by continuing to invest in Chifley Road to improve access for freight vehicles.

NSW Long Term Transport Master Plan

The NSW Long Term Transport Master Plan outlines the framework for the NSW Government to deliver an integrated, modern transport system.

A key aim of the NSW Long Term Master Plan is to provide essential access for regional NSW. Of relevance to the proposal are the short to long term actions of improving freight efficiency and productivity and preserving future transport corridors.

The Master Plan includes action to deliver rural highway upgrades across the rural road network (p. 236). It specifically mentions improvements on Bells Line of Road – “RMS will also review the existing Bells Line of Road (B59) to identify safety issues, including potential improvements such as overtaking lanes, safer intersections and better local access arrangements”.

The proposal would meet existing and future travel demands in addition to improving freight and general access and travel efficiency along Chifley Road. It would also contribute to the overall improvement of Bells Line of Road, preserving the transport corridor between urban Sydney and the Central West Region.

NSW Road Safety Strategy 2012 – 2021

The NSW Road Safety Strategy establishes the direction of road safety in NSW for the next 10 years. Consistent with the National Safety Road Strategy, the target is the reduction of the annual number of fatalities and serious injury by at least 30 per cent.

The proposal is aligned with this vision as it contributes to improvements to road user safety by improving road geometry, providing additional lanes and installing safety barriers.

First Things First: State Infrastructure Strategy 2012–2032

The State Infrastructure Strategy outlines the 20-year strategy to identify and prioritise the delivery of critical public infrastructure that will assist in driving economic growth and productivity. The Strategy provides the NSW Government with clear and strategic options for delivering infrastructure and market reform to provide best value for taxpayers.

The proposal is aligned with the intent of the State Infrastructure Strategy as it provides improvements to Chifley Road, which is an important connection between the Central West of NSW and Sydney.

NSW Freight and Ports Strategy November 2013

The NSW Freight and Ports Strategy aims to create a transport network where goods move efficiently to their markets. The Bells Line of Road Corridor Strategy is mentioned within this

strategy in the context of preserving the corridor for necessary future development and prioritising the necessary road upgrades to enable improved access.

Bells Line of Road is specifically mentioned – "On 9 November 2009, the Australian Government and NSW Governments announced a Long Term Strategic Corridor Plan for the Bells Line of Road. The $2.9 million plan is jointly funded. This plan was completed by Roads and Maritime and published on 31 October 2012. The plan recommends a road corridor should be reserved for a future upgrade linking the Bells Line of Road with the Sydney motorway network near Kurrajong Heights. The next phase of the project includes safety works, realignments, improved overtaking opportunities as well as planning for future works".

The proposal is aligned with the following strategy objectives:

- Delivery of a freight network that efficiently supports the projected growth of the NSW economy: The proposal supports future improved freight access and contributes to reducing heavy vehicle operating costs
- Balancing of freight needs with those of the broader community and the environment: The proposal aims to support more efficient through travel of freight vehicles by improving the road alignment and widening of the road pavement.

The proposal reflects the importance of the freight transport network in creating a competitive and productive NSW economy.

Central West Regional Action Plan

The Central West Regional Action Plan is a short term strategy which has been developed to support the NSW 2021: A Plan to Make NSW Number One strategy.

Key relevant regional priorities include improving and investing in regional infrastructure. The proposal will support these priorities through the continued improvement of transport routes that connect Sydney and the Central West.

Central West Regional Transport Plan

The Regional Transport Plan for Central West targets opportunities to improve the road network and maintain road freight efficiency by improving safety of roads such as Bells Line of Road (P6). The Plan recognises constraints in some areas – "The road challenging geometry of some sections of some of the major roads (such as Bells Line of Road)". The Plan also includes a commitment to "review the existing Bells Line of Road to identify safety issues, including potential improvements such as overtaking lanes, safer intersections and better local access arrangements (P26)".

Bells Line of Road Long Term Strategic Corridor Plan

In 2012, the Australian and NSW governments completed a Long Term Strategic Corridor Plan for Bells Line of Road to identify improvement works and set priorities for the next 20 years and beyond.

The Plan identified some locations where the existing horizontal and vertical road geometry falls below current road standards and guidelines. Bells Line of Road was also identified as having a poor crash record, with crash rates about twice what is typical for rural roads in NSW. The crash rate for Chifley Road is even higher, as discussed in Section 2.2.

The objectives for the Bells Line of Road corridor as outlined in the Plan are as follows:

- Objective 1: Safety – improve road safety for all road users, including vehicle users, motorcyclists, pedestrians and cyclists
- Objective 2: Transport and access – provide an efficient road corridor for moving people and goods
- Objective 3: Land use development – respond to present and future land uses
- Objective 4: Environment – respect the natural and built environment and community values.

The objectives of the Plan are considered relevant in the context of the proposal, particularly Objective 1, Objective 2 and Objective 4.

2.2 Crash data

Consideration of the crash data is relevant to the proposal and provides further context for the purpose of the proposed upgrades, particularly at Scenic Hill.

The combination of poor vertical and horizontal road alignment and narrow lanes and shoulders has led to a high crash rate on Chifley Road. A summary of crash data for the five years 2009–2014 for the proposal length includes:

- 144 crashes
- No fatal crashes
- 28 (19.4 per cent) injury crashes (injuries to 33 people)
- 120 (83.3 per cent) single vehicle crashes
- 87 (60.4 per cent) wet weather and a further 27 (18.8 per cent) overcast weather crashes
- 108 (75 per cent) crashes on curves
- 17 (11.8 per cent) head on crashes
- 125 (86.8 per cent) crashes involved speed and 10 (6.9 per cent) involved fatigue
- Eight (5.6 per cent) heavy vehicle crashes.

The crash rates are high at 144 per million vehicle kilometres travelled and 1.8 crashes per kilometre. Scenic Hill has a crash rate of more than 300 per million vehicle kilometres travelled (the worst rate for the Bells Line of Road corridor).

From 2008 to 2011, the number of crashes on Scenic Hill increased significantly (from 19 to 37 per annum). Three measures were implemented in response to this increase. Firstly, in early 2012 a system of four weather-activated warning signs were implemented. In mid-2012, 750m of road surface was resurfaced with an asphaltic concrete overlay between the Ex-Prisoner of War (Ex-POW) Memorial access and the top curve. Lastly, in late 2013, four speed-activated warning signs were put in place.

Installation of the warning signs and road resurfacing has been associated with an immediate reduction in the number of crashes – with no crashes being reported for 2015. However, with the existing road geometry issues for Scenic Hill and the other risks identified below in Section 2.3, consideration of a raft of treatments is warranted. Proposed improvements to Scenic Hill would have long-term benefits in providing a safe road environment which minimises interaction between light and heavy vehicles providing travel benefits for both.

2.3 Existing road and infrastructure

Consideration of the existing road and infrastructure is also relevant to the proposal and provides further context for the purpose of the proposed upgrades.

2.3.1 Clarence road over rail bridge

The existing Clarence road over rail bridge is a reinforced concrete bridge built in 1943. The bridge structure is owned and maintained by Sydney Trains. Its features include:

- The bridge is 6.7m between kerbs and 15.2m long
- The substructure is reinforced concrete sill beams founded on rock
- The superstructure is three reinforced concrete beams linked by a reinforced concrete deck
- Post and chain wire barriers, which do not meet current standards
- Bridge Health Index (BHI) is poor due to flexural cracks in the concrete beams and concrete diaphragm
- Vertical clearance to the rail lines is 8.6m

- There are 30 passenger services and 50 freight trains travelling under this bridge on average each day.

The poor BHI rating requires the bridge superstructure to be regularly inspected by Sydney Trains as the asset owner. No further deterioration of the existing flexural cracks has been noted from these inspections.

2.3.2 Scenic Hill

Chifley Road descends 143m over the 1.6km length of Scenic Hill via a single descending lane. An uphill climbing lane runs for the length of the grade from east of the sharp curve at the bottom of Scenic Hill.

The bottom curve at Scenic Hill has a very tight (about 25m) radius and a high crash rate with 16 crashes over the last five years over a distance of about 100m. The grade on the inside edge line of the curve is about 20 per cent, with the grade on the centreline of the curve being about 12 per cent. Works have been carried out on the curve over the years. Funding limitations and the steep grade and curvature have limited opportunities for significant improvement. Aquaplaning conditions can occur on the bottom curve and the curve around the Ex-POW Memorial (and associated steep grades) due to inadequate drainage during rain events.

The combination of the tight radius and steep grade of the bottom curve also present significant challenges to heavy vehicles and large light vehicles unfamiliar with the conditions. These vehicles have been known to become stuck as a result of stalling or mounting the safety barrier. Road and Maritime's maintenance crews are called out several times a year (on average) to assist with traffic control, vehicle recovery and/or associated clean up.

The existing road drainage and negligible shoulder widths on Scenic Hill present an additional major traffic hazard. The road drainage includes a 'mountain drain' – a slot-style drain about 0.5m wide and 0.3-0.5m deep. Wheels of light vehicles could become lodged in the drain due to its dimensions and proximity to the travel lanes.

2.4 Proposal objectives

The objectives of the proposal are aligned with the strategic need and are to:

- Reduce the overall crash rate on Chifley Road
- Reduce the present rail safety risks at Clarence Rail Bridge
- Improve light vehicle travel times and operating costs on the road corridor
- Provide efficiency and consistency of traffic flows
- Minimise environmental impacts.

The objectives of the proposal are consistent with the Bells Line of Road Long Term Strategic Corridor Plan as they include significant road safety aspects.

2.5 Options considered

In 2014, Roads and Maritime investigated options for upgrading Chifley Road between Bell and Lithgow to allow for strategic assessment and prioritisation of projects should funding become available.

These options included:

1. Widening of narrow former railway cuttings east of Clarence
2. Widening and barrier treatments for the Clarence road over rail bridge
3. Provision of a descending lane at Scenic Hill
4. Improvements to the final west bound curve at Scenic Hill
5. Other high-value safety work.

The final alternative (Alternative 5) was a package of treatments that included additional overtaking lanes, overtaking lane extensions, intersection improvements, shoulder widening and truck stopping bays.

The strategic assessment of the options considered road safety review and crash analysis, benefit-to-cost ratio analysis, preliminary environmental investigation, constructability review, geometric road design and cost estimation in the evaluation and prioritisation of projects.

Scenic Hill (comprising Options 3 and 4) and Clarence road over rail bridge (Option 2) were selected. These options would provide the most effective use of available funds to deliver the necessary improvements to safety and travel conditions for Chifley Road between Bell and Lithgow.

The assessment also noted that any remaining funds following the construction of Scenic Hill and Clarence road over rail bridge should be made available to other high value safety work (Option 5). This work is subject to further investigation and development and does not form a primary part of the proposed upgrade work.

2.5.1 Methodology for selection of options

A number of options (and sub-options) were developed for both Clarence road over rail bridge and Scenic Hill. These options were evaluated against the criteria detailed in Table 2.1.

Table 2.1 Option evaluation criteria and analysis description

Criteria	Analysis description
Economic	Economic modelling of the proposal options undertaken by Roads and Maritime consistent with Transport for NSW requirements. The modelling and analysis determined the Benefit Cost Ratio (BCR) associated with each option, which is an indicator used to summarise the overall value of each proposal option.
Environment	A preliminary environmental investigation (PEI) was completed by GHD Pty Ltd in October 2014 (RMS, 2014a). The PEI did not review and compare the proposed options but did include recommendations to make informed decisions when developing the concept design. The PEI generally concluded that road upgrades occurring within the existing road reserve would likely have low environmental and social constraints, as these areas have been previously subjected to disturbance from road building and/or maintenance. Based on the findings of the PEI, options requiring less vegetation clearance and earthworks would have less environmental impact.
Constructability	A constructability review was undertaken by Land Team Australia Pty Ltd in June 2014 in consultation with Roads and Maritime project staff. The review identified engineering constraints associated with the proposal options.
Risk	Specific to the Clarence road over rail bridge, Tactix Group Pty Ltd undertook an Options Risk Review in 2014 (Tactix Group, 2014) to assess the construction and operational safety risks associated with upgrade of the bridge.

2.5.2 Options identified for Clarence road over rail bridge

The existing Clarence road over rail bridge safety barriers cannot be upgraded without significant upgrade to superstructure or replacement of the bridge, due to its design and current condition. Roads and Maritime developed four strategic options to determine the best method of upgrading the structure and providing barriers to meet current requirements.

Each of the options considered includes the following safety improvements east and west of the Clarence road over rail bridge:

- Realignment of the existing alignment west of the Clarence cuttings to an 80km/h design (currently 70km/h) and removal of the broken back curve

- Improvements to the Clarence Colliery Road intersection with Chifley Road, including improved sight distances, intersection delineation and construction of an eastbound acceleration lane from the intersection.

Table 2.2 provides a summary of the identified options for the Clarence road over rail bridge and the associated analysis.

Table 2.2 Summary of options and analysis for Clarence road over rail bridge

Option	Details	Summary of analysis
Clarence road over rail bridge		
1. Do minimum	• Retains the existing bridge with its current geometry and load rating • Repairs and monitors existing flexural cracks • Replaces the existing traffic barrier but does not to comply with current Australian Standards.	• Maintains a bridge with a BHI rating of poor which requires ongoing monitoring • Bridge not adequate to manage impact loadings of a current Australian Standard barrier • Upgrading of performance level to address risks identified in the Options Risk Review would not be possible • Cost estimate of $9 million • Low environmental impact • Would not meet objective to reduce rail safety risks.
2. Widening of existing bridge	• Widen the existing bridge to its north • Two sections of the widened bridge would be separated by a 10mm gap • Widening would be 6.35m wide with an ultimate width of 5.5m for each lane • Traffic would need to be reduced to one lane during construction.	• Deliver an inconsistent appearance of the two sections of the bridge with differing barrier performance levels • Upgrading of performance level to address risks identified in the Options Risk Review would not be possible. • Cost estimate of $10 million • Construction under traffic control would introduce higher constructability risks compared to Option 4 • Low environmental impact • Would not meet objective to reduce rail safety risks.
3. Staged replacement of existing bridge	• New bridge in existing location built in halves to facilitate the staging of construction and traffic • Traffic would need to be reduced to one lane during construction • End result would have 5.5m for each traffic lane • Longitudinal stitch joint would need to be cast to connect the two stage deck construction. This may impact on the setting of concrete if traffic could not be diverted. The differential creep and shrinkage of the two deck concrete halves would need to be accounted for in design.	• Would achieve performance level to manage all risks identified in the Options Risk Review and together with Option 4 presents the lowest operational safety risk • Construction methodology would introduce higher constructability risks compared to Option 4 • Uncertain as to whether existing bridge is of adequate structural capacity to allow for partial demolition to facilitate construction of the new bridge • No cost estimate undertaken • Low environmental impact • Greatest impact to road users during construction, particularly heavy vehicle movements associated with Hanson Quarry and Clarence Colliery.

Option	Details	Summary of analysis
4. Replacement of existing bridge	• New bridge offset approximately five metres to the north of the existing bridge • Result in an 11m wide two-way carriageway and provide a bridge single span of 18.5m • Two-way traffic on the existing bridge could be maintained during construction • Additional roadwork would be required on the approaches to merge the new bridge alignment with the existing road.	• Would achieve performance level to manage all risks identified in the Options Risk Review, and together with Option 3, presents the lowest operational safety risk • Low constructability risks to road users and construction personnel due to off-line construction • When factored into the Options Risk Review, presented the lowest safety risk and would not introduce any new or novel risks or require additional operational treatments to be managed • Cost estimate of $14 million • Moderate environmental impacts compared to other options due to additional clearing for new approaches. Clearing would be within highly disturbed road reserve and known high and moderate environmental constraints are avoided.

For Option 3 and Option 4, the cross section of the proposed bridge would include two 3.5m wide lanes with two metre wide shoulders.

2.5.3 Options identified for Scenic Hill

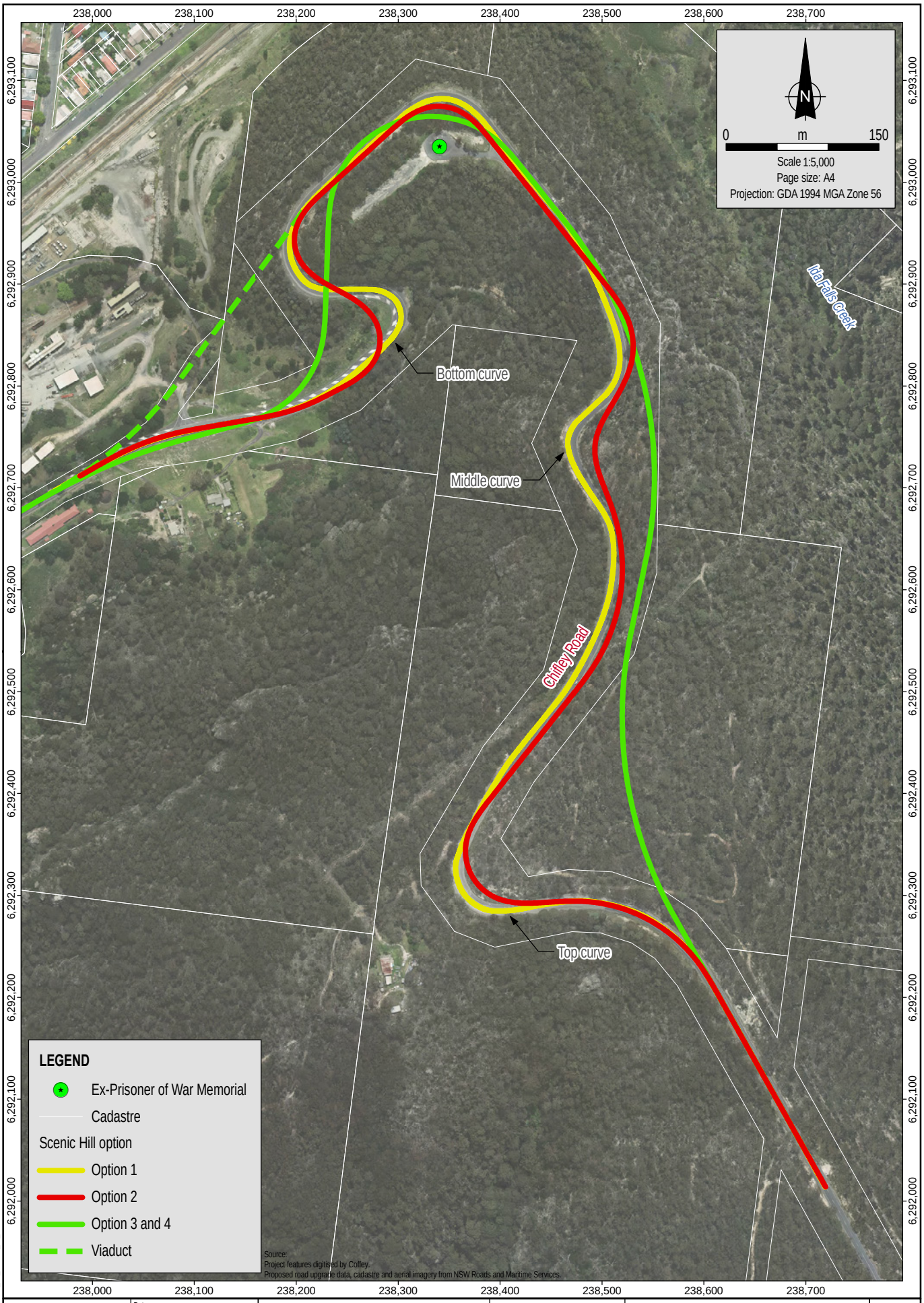
Roads and Maritime developed four strategic options to determine the best method of addressing the existing road geometry and safety issues. Figure 2.1 identifies the location and alignment of the identified options for Scenic Hill. Table 2.3 summaries the details for each option and the associated analysis.

Table 2.3 Summary of options and analysis for Scenic Hill

Option	Details	Summary of analysis
Scenic Hill		
1. Do minimum	• Retain the existing alignment with one westbound lane • Provide a median barrier from the top curve down to the Ex-POW Memorial access • Build two new truck pull-over bays in the vicinity of the top curve and Ex-POW Memorial access • No works proposed for the bottom curve.	• Does not improve the bottom curve at Scenic Hill and associated safety hazards • Existing ‘mountain drain’ not replaced • Would not meet objectives to reduce the overall crash rate on Chifley Road or provide efficiency and consistency for traffic flows • Low visual impact • Low environmental impact • Avoids significant earthworks and geotechnical risks • Cost estimate of $19 million.

Option	Details	Summary of analysis
2. Widen the existing alignment	• Widen the existing alignment with minor curve improvement the top and middle curves to provide two west-bound lanes and a median barrier from the top curve down to the Ex-POW Memorial access • Minor grade improvements beyond the Ex-POW Memorial access and continuation of a median barrier to the start of the bottom curve • Realign bottom curve to a 40m curve radii with minor grade improvements • Upgrade existing drainage.	• Moderate improvements to the bottom curve • Existing grade improved by 2-3% and curve radius improved to 40m – would remove associated safety hazards • Replaces existing 'mountain drain' • Would meet objectives to reduce the overall crash rate on Chifley Road or provide efficiency and consistency for traffic flows • Moderate visual impact • Moderate environmental impact – largely confined to area of low environmental constraint • Major earthworks required – geotechnical risks lower compared to Option 3 and 4 and widening and realignment maximises use of the existing road formation to reduce earthworks • Cost estimate of $28 million.
3. Realignment of the full length to a minimum 60km/h standard with an additional westbound lane down	• Realignment of the full length to a minimum 60km/h standard with an additional west-bound lane down to the Ex-POW Memorial access • Significant cut in rock to realign top and middle curves • Significant cut and fill required to realign the bottom curve • Realignment of the Ex-POW Memorial access and median barrier from the Ex-POW Memorial access to the start of the bottom curve • Likely requirement for retaining walls from the Ex-POW Memorial access to the start of the bottom curve • Upgrade existing drainage.	• Minimum 60km/hr standard achieved for full length of Scenic Hill including final curve • Replaces existing 'mountain drain' • Would meet objectives to reduce the overall crash rate on Chifley Road or provide efficiency and consistency for traffic flows • High visual impacts due to significant cut and fill requirements • High environmental impact due to large area of vegetation required to be cleared outside of road reserve and potential impact to Ex-POW Memorial Tower • Significant earthworks required and high geotechnical risks • Cost estimate of $65 million.

Option	Details	Summary of analysis
4. Same as Option 3 above but including a viaduct	• As for Option 3, realignment of the full length to a minimum 60km/h including an additional west-bound lane and significant cut in rock and realignment of the Ex-POW Memorial access • Viaduct is provided to realign bottom curve • Three options for viaduct construction including steel, concrete and balanced cantilever and concrete girders.	• Minimum 60km/hr standard achieved for full length of Scenic Hill including final curve replacement with a viaduct • Replaces existing 'mountain drain' • Would meet objectives to reduce the overall crash rate on Chifley Road or provide efficiency and consistency for traffic flows • High visual impacts due to significant cut and fill requirements • High environmental impact due to large area of vegetation required to be cleared outside of road reserve and potential impact to Ex-POW Memorial Tower • Significant earthworks required and high geotechnical risks • Cost estimate of $86 million.



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Project: ENAURHOD03119AB
File Name: 3119AB_01_F02.01_GIS

NSW Roads and Maritime Services

Bells Line of Road – Chifley Road upgrade

Transport Roads & Maritime Services

Scenic Hill options

Figure No: 2.1

2.6 Preferred option

The preferred option for the Clarence road over rail bridge is Option 4 and Option 2 for Scenic Hill. These options are described in detail in Section 3.1.

Both options satisfy the proposal objectives and are consistent with the intent of the Bells Line of Road Corridor Long Term Strategic Plan.

In summary, the preferred options would:

- Improve road user safety and help reduce the crash rate on Chifley Road by providing long-term benefits through a safe road environment which minimises interaction between light and heavy vehicles
- Reduce rail safety risks at the Clarence road over rail bridge by providing a new bridge with standard travel lane widths and shoulders and the inclusion of Australian Standard safety barriers
- Improve light vehicle travel times and traffic efficiency for all road users by separating slow moving heavy vehicles from the faster moving light vehicles at Scenic Hill
- Minimise environmental impacts due to the minimal disturbance to the surrounding natural environment. A more consistent traffic flow will also reduce emissions and vehicle noise in the road corridor.

Approval to the preferred options from the Minister for Roads, Maritime and Freight was provided on 7 January 2016.

3 Description of the proposal

3.1 The proposal

The proposal involves upgrades to the Scenic Hill and Clarence road over rail bridge sections of Chifley Road. Chifley Road is about 20km long and is located in the western section of the Bells Line of Road corridor, between Bell and Lithgow in NSW. Scenic Hill is located approximately 3km east of Lithgow and the Clarence road over rail bridge is located about 5km west of Bell.

The proposed upgrades include the replacement of the existing Clarence road over rail bridge, and grade and curve improvements at Scenic Hill. The proposal area is shown in Figure 1.1 and is defined as all areas potentially disturbed by proposal activities including the physical footprint of the proposed road upgrades, replacement road over rail bridge and all site compounds and stockpile locations (ancillary sites).

The area studied for this REF (study area) generally encompassed an area about 50m from either side of the centre of the new road alignment. The actual study area was specific for each specialist studies carried out (refer to Chapter 6).

Two potential locations for ancillary sites have been identified for the work associated with Scenic Hill and one for the Clarence road over rail bridge work. A fourth ancillary site would be used for work at both Scenic Hill and Clarence road over rail bridge. Ancillary site locations are shown in Figure 1.2a and Figure 1.2b.

The proposed upgrade work at the Clarence road over rail bridge would include the following activities:

- Constructing a new road bridge over the Main Western Railway, offset by about five metres to the north of the existing bridge. The bridge work would comprise:
  - A bridge superstructure consisting of five precast concrete bridge girders (beams). The 1m-deep girders provide a single span of 18.5m over the railway and an overall width of the bridge surface (deck) of about 12m
  - Bridge supports (abutments) consisting of reinforced concrete ‘sill’ beams founded on rock (similar to the existing bridge).
- Demolishing the existing Clarence road over rail bridge
- Additional roadwork on the bridge approaches in both directions to merge the alignment of the new bridge with the existing road alignment
- Realigning the existing curve (440m of road) at the north-east end of the work (about 350m from the bridge) to remove the existing ‘broken back’ curve. Improving the intersection between Chifley Road and Clarence Colliery Road including better sight distances, intersection marking and providing an eastbound acceleration lane away from the intersection
- Extending the existing sandstone arch culvert on the broken back curve approximately 400m west of the road over rail bridge on the downstream (southern) side for about 12-14m with associated minor waterway work within Dargan Creek
- Upgrading the existing drainage of surface water off the road including measures to manage water quality.

The proposed upgrade to the Scenic Hill road would include the following activities:

- Widening the existing road with curve improvements for the top and middle curves; and providing two westbound lanes from the top curve down to the access to the Ex-POW Memorial
- Realigning the bottom curve to a 40m radius with minor grade improvements
- Building a concrete median barrier for the full length of the Scenic Hill road, with a break in the barrier to allow access to the Ex-POW Memorial
- Improving the access road to the Ex-POW Memorial including an 80m-long right-turn lane from Chifley Road
- Building a retaining wall about 120m long to the east of the Ex-POW Memorial access

- Upgrading the existing drainage of surface water off the road including measures to manage water quality
- Providing a maintenance track on the eastern side of the road at the middle curve of Scenic Hill to allow access to the top of the large cutting associated with this curve
- Removing the heavy vehicle safety ramp next to the bottom curve
- Retaining the existing speed and weather activated warning signs.

An overview of the proposal showing key features is shown in Figure 1.2a (Scenic Hill) and Figure 1.2b (Clarence road over rail bridge). Cross sections through the road at Scenic Hill and Clarence road over rail bridge are provided as Figures 3.1 and b. A detailed description of the concept design is included below. Concept design plans for the proposal are discussed in Section 6.9.

3.2 Design

The concept design was prepared to provide road geometry with a design speed of 90km/hr for the Clarence road over rail sections and between 40km/h and 60 km/h for the Scenic Hill improvements. The concept design is described below and would be further refined during detailed design.

3.2.1 Design criteria

The concept design for the proposal has been developed using the following guidelines and standards:

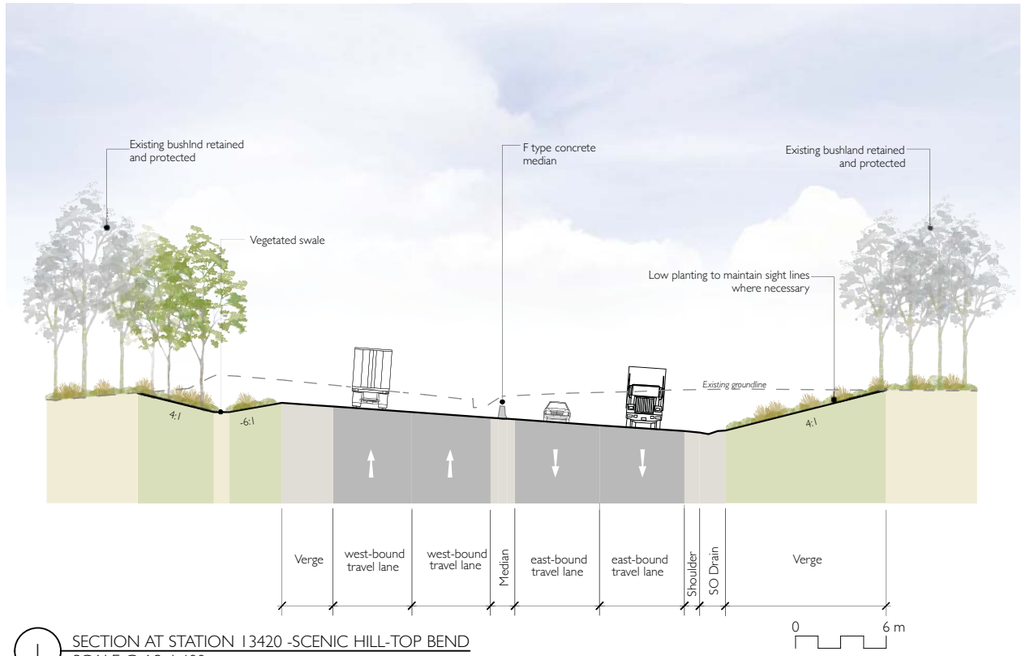
- Austroads Guide to Road Design (Austroads, 2009) and Roads and Maritime supplements to the Austroads Guide
- Austroads Guide to Road Safety (Part 6: Road Safety Audit) (Austroads, 2002)
- Roads and Maritime Services Road Design Guide (Roads and Maritime, 1989)
- Roads and Maritime Services Delineation Guidelines (Roads and Maritime, 2008)
- Beyond the Pavement – Urban Design Policy (RTA, 2009)
- Asset Standards Authority (ASA) standard T HR CI 12030 ST Overbridges and footbridges and ESC 215 Transit Space (ASA, 2010).

The adopted design criteria for the proposal are set out in Table 3.1, with further detail provided in the following sections.

Table 3.1 Design Criteria

Clarence road over rail bridge	
Design speed	80km/h signposted 90km/h design speed horizontal 90km/h design speed vertical
Bridge design	4.6% longitudinal grade falling towards Bell 3% crossfall 8.6m clearance height (track level to the base of the bridge girders)
Number of lanes	Two lanes, with single lane travel in each direction.
Lane width	3.5m (minimum)
Shoulder width	2m
Verge width	1.5m

Road surface design	Total depth of road pavement about 900mm with: • Drainage layer in rock cuttings • An upper zone of formation • One select layer • Two base layers • One seal layer. The existing road surface is generally in good condition. Base and sub-base layers will be used to overlay the existing road surface. Alternatives to the road surface design may be further investigated during detailed design.
Grade	0.8% minimum 6.1% maximum
Batter slope	Fill batter 4:1 minimum and 1.5:1 maximum Cut batter 4:1 minimum and 2:1 maximum
Design vehicle	26m B-double
Cycle/pedestrian provision	No formal facilities provided. Cyclist/pedestrian access along upgraded sections would be via the widened shoulders.
Scenic Hill	
Signposted speed	60km/h signposted with curve advisory signs where required 40km/h design speed horizontal 60km/h design speed vertical
Number of lanes	Four lanes with two-lane travel in each direction from east of the top curve down to the Ex-POW Memorial access. Three lanes with one lane descending and two lanes ascending from the Ex-POW Memorial access to west of the bottom curve.
Lane width	3.5m (minimum) with curve widening where required.
Shoulder width	1m for dual lanes 2m for single lanes
Verge width	1.5m
Road surface design	Total depth of pavement about 850mm with: • Drainage layer in rock cuttings • An upper zone of formation • One select layer • One seal layer • Asphaltic concrete layer Other heavy duty asphalt pavements may be further investigated during detailed design.
Grade	0.8% minimum 12.0% maximum
Batter slope	Fill batter 6:1 minimum and 2:1 maximum Cut batter 4:1 minimum and 0.5:1 maximum
Design vehicle	26m B-double
Cycle/pedestrian provision	No formal facilities provided. Cyclist/pedestrian access along upgraded sections would be via the widened shoulders.



1 SECTION AT STATION 13420 -SCENIC HILL-TOP BEND
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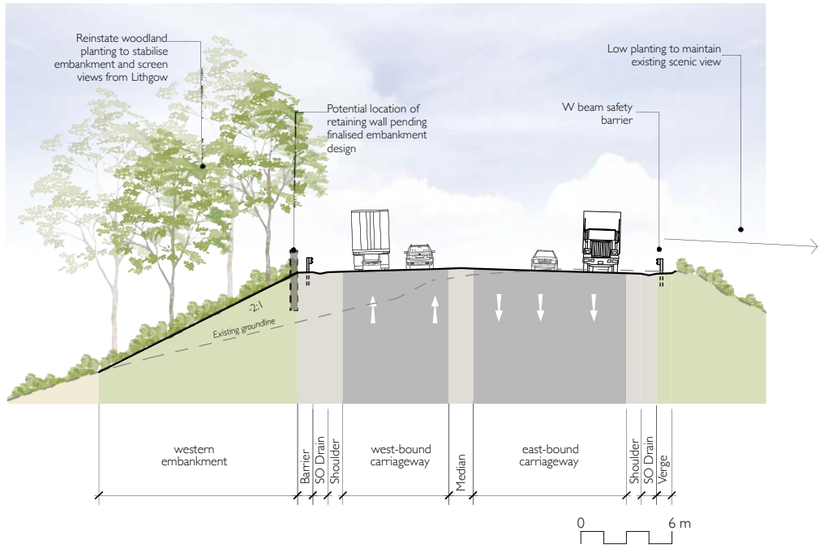

2 SECTION AT STATION 14160 -SCENIC HILL EMBANKMENT
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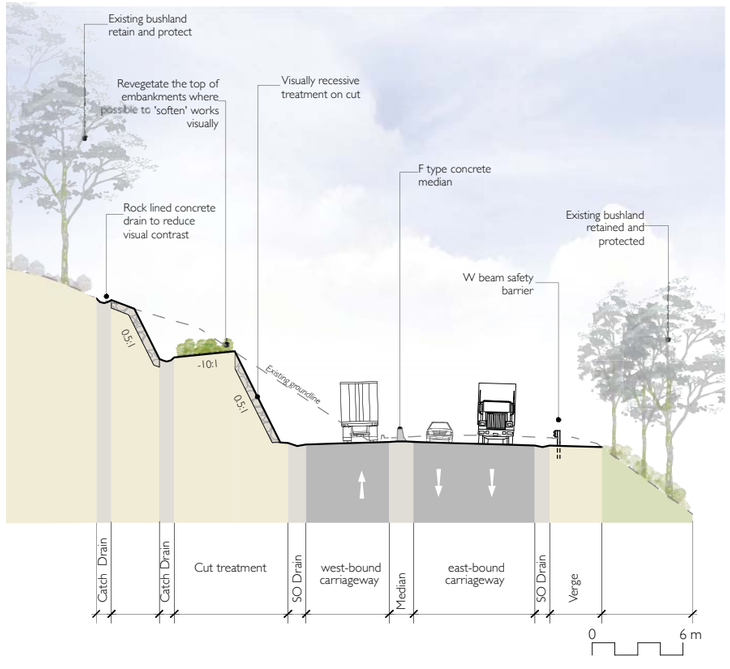
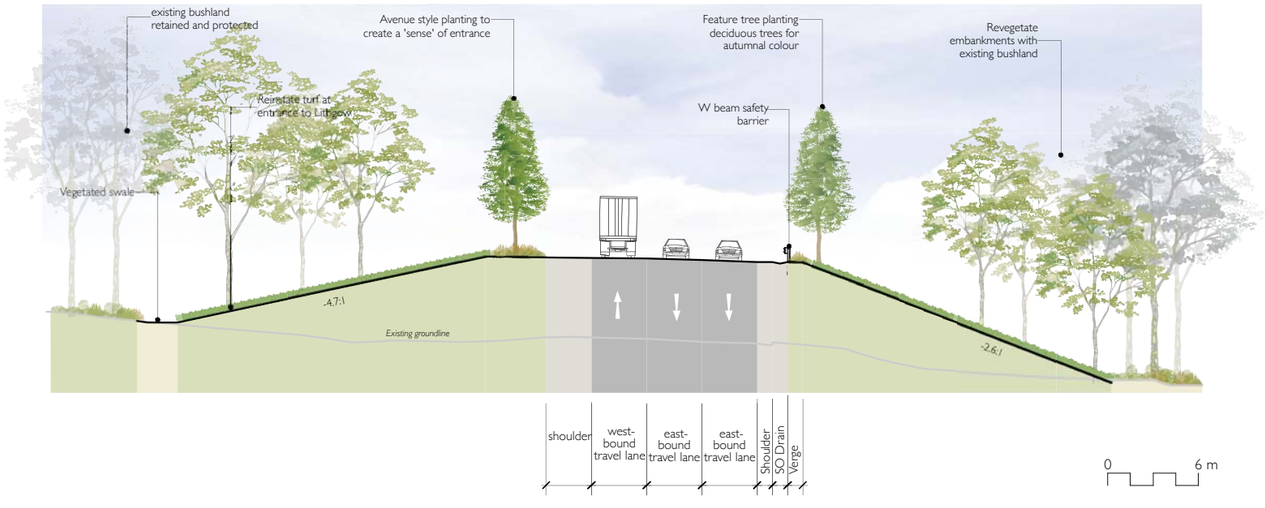


3 SECTION AT STATION 14380 -SCENIC HILL CUT
SCALE @ A3: 1:400



4 SECTION AT STATION 14780 -SCENIC HILL-LITHGOW ENTRANCE
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Source:
Spackman Mossop Michaels, August 2016.

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NSW Roads and Maritime Service

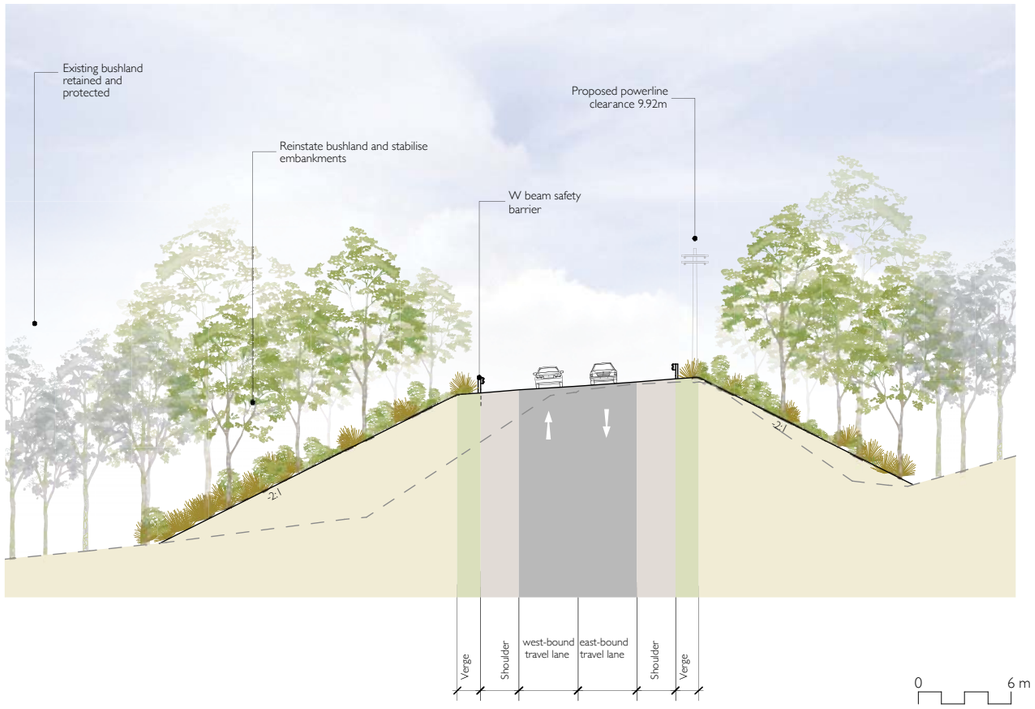
Bells Line of Road – Chifley Road upgrade

NSW GOVERNMENT Transport Roads & Maritime Services

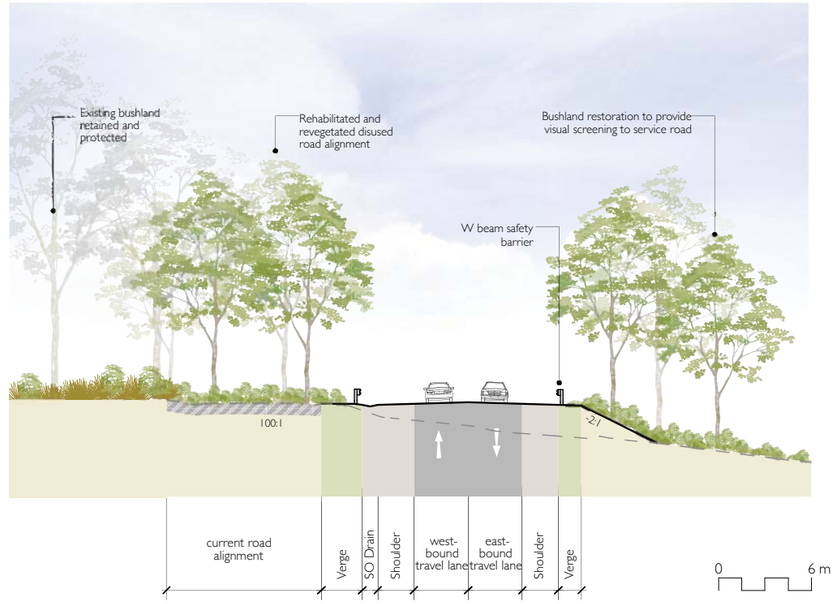
Cross Section at Scenic Hill

Figure No: 3.1a

All Reference: 3119AB_01_GRA001.ai



5 SECTION AT STATION 5700 -CLARENCE BEND
SCALE @ A3: 1:400



6 SECTION AT STATION 6220 -CLARENCE ROAD OVER RAIL BRIDGE APPROACH EAST
SCALE @ A3: 1:400

Source:
Spackman Mossop Michaels, August 2016.

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Project: ENAURHOD03119AB
File Name: 3119AB_01_F03.01b_GRA

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Bells Line of Road – Chifley Road upgrade

NSW GOVERNMENT Transport Roads & Maritime Services

Cross Section at Clarence Road over rail bridge

Figure No: 3.1b

All Reference: 3119AB_01_GRA002.ai

3.2.2 Engineering constraints

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

Table 3.2 identifies the main issues and constraints for the Clarence road over rail bridge and Scenic Hill road sections. These issues and constraints have informed the development of the concept design. Further discussion of the issues and constraints is provided in Chapter 6 where environmental impacts are expected.

Table 3.2 Engineering issues and constraints

Constraint	Comment
Clarence road over rail bridge	
Natural features	• The study area contains steep to undulating slopes east of the existing road over rail bridge and is associated with Dargan Creek Reserve • Local perched water tables are common and often give rise to localised swamps • The ground conditions at the bridge site comprise residual soils up to 1.5m thick overlying weathered sandstone. The sandstone is massive, widely bedded, highly weathered near the ground surface, and moderately weathered toward the base of the existing cutting.
Environmental considerations	• Eleven items of potential non-Aboriginal heritage significance are located within the study area • Newnes Plateau Shrub Swamp endangered ecological community and a stand of threatened *Acacia meiantha* is located within the study area • No EPBC Act listed fauna species were identified during field surveys. Three species listed as Vulnerable under the TSC Act were recorded – gang-gang cockatoo (*Callocephalon fimbriatum*), diamond firetail (*Stagonopleura guttata*) and varied sittella (*Daphoenositta chrysoptera*) • Contaminants from the railway and associated facilities, and use of the area for illegal dumping, may be encountered • The proposal area is located within the Mid Coxs River sub catchment of the Sydney Drinking Water Catchment.
Rail corridor	• The rail corridor provides multiple constraints through the presence of overhead wires supplying electricity to the rail network.
Utilities	• Telecommunication cables and overhead power lines are located within proposal area • A major underground optic fibre and rail communications are located within the rail corridor.
Staging of proposal and traffic management	• The proposal would be built generally on the same alignment as the existing road – posing staging challenges, as traffic flows in both directions and access to the rail corridor and properties would need to be maintained • Hanson Quarry and Clarence Colliery operations and associated heavy vehicle movements need to be considered within the proposal staging and traffic management plans.
Scenic Hill	
Natural features	• The landform in the study area comprises steep to undulating slopes. Scenic Hill is dominated by steep slopes which are on average up to, or greater than, a 15 per cent gradient • The steep slopes limit access and available work areas over the majority of the study area.
Geology	• Springs and water seepage can be expected in the lower parts of Scenic Hill at the boundary of the Caley Formation and underlying coal measures • The claystone and siltstone elements of the Caley Formation tend to be weak and friable • The properties of the rock elsewhere within the proposal area suggest hard to very hard ripping conditions would be encountered. Blasting may be needed

Constraint	Comment
	• The design of new fill embankments and retaining walls on the down slope of the road will need to consider the highly variable foundation conditions • Preliminary investigation of historic mine workings indicate the New Vale Mine (now closed) is directly under Scenic Hill and the seam levels at the bottom of Scenic Hill are about 98m below road level. At the top of Scenic Hill, seam levels are about 213m below road level.
Environmental considerations	• Fifteen items of potential non-Aboriginal heritage significance are located within the study area • The proposal area is located within the Upper Coxs River sub catchment of the Sydney Drinking Water Catchment • Native vegetation in moderate to good condition dominates the study area and could be potential habitat for threatened fauna species, although none were recorded during biodiversity surveys • The landscape and visual character of the study area is dominated by native vegetation, steep slopes and rock outcrops. There are prominent views of Scenic Hill and surrounds from Lithgow.
Utilities	• Telecommunication cables, water mains and overhead power are located within proposal area.
Staging of proposal and traffic management	• The proposal would be built on the same alignment as the existing road and would pose significant staging challenges, as traffic flows in both directions (and property access) would need to be maintained. The landform also limits the number of available work areas.

3.2.3 Drainage

An average recurrence interval (ARI) of 1-in-10 years has been adopted for the design of road surface water drainage. Design for the cross-drainage culverts running under the road (and associated drainage) has adopted an ARI of 1-in-100 years.

Generally, the drainage design for the new and replacement road would be a new pit and pipe system with shallow (SO) and standard (SK) guttering and concrete-lined catch drains. Rock mattresses would be provided at kerb outlets. Trench drains and interface drains would be provided below the kerbs and adjacent to the existing pavement. A rock drainage layer would be provided in the cuttings where required.

Scour protection would be required at the outlets of all cross-drainage culverts to prevent erosion and scour and may include rock rip-rap aprons with energy dissipation structures. Specific features of the concept drainage design for Clarence road over rail section and Scenic Hill section are described below.

A holistic approach to water management has been taken for the proposal which aims to rationalise the number of water quality and quantity control structures included in the design. The drainage design (including water quality treatments) has been modelled to identify potential pollutant loads. An assessment of the proposed drainage design is provided in Section 6.1, including consideration of the requirements of State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011. The final design and configuration of the culverts and drainage systems for both road sections would be confirmed during the detailed design phase.

Information in this section is based on water quality and drainage assessments undertaken by Lyall and Associates (2016) which are discussed further in Section 6.1.

Clarence road over rail section

The topography for the Clarence road over rail section provides opportunity to implement a range of ‘at-source’ and ‘end-of-drainage-system’ type water quality measures for the retention of pollutants. The main features of the drainage design and operational water quality strategy includes:

- Grassed swales to treat runoff from pavement drainage outlets throughout the length of the road, including rock drop structures and bunding to limit grades and stormwater flow velocities and improve the retention of runoff
- Vegetated buffer strips along sections of the eastbound and westbound carriageways between about 200m and 400m east of the new road bridge and along the eastbound carriageway east of the Clarence Colliery Road intersection for about 100m
- A sediment basin on the southern side of Chifley Road about 500m east of the new road bridge to treat runoff from the road pavement before it discharges into Dargans Creek. The inlet to the sediment basin would include a bio-retention swale to assist in the treatment of runoff prior to discharge into the basin
- Replacement of the existing 750mm diameter pipe culvert under Chifley Road about 200m east of Dargans Creek with two 450mm diameter pipe culverts, including remediation of existing scouring of the channel at the downstream outlet
- Extending the sandstone arch culvert on the downstream (southern) side of the road for about 12 to 14m. Some minor re-alignment of the creek would be required to maintain flow capacity and minimise erosion and scour in the channel downstream.

Scenic Hill section

The steep nature of the land in the Scenic Hill section and limited scope for maintenance access means that it is not feasible to incorporate 'end-of-drainage-system' type measures such as a sediment or bio-retention basins to treat runoff for the majority of the westbound and eastbound carriageways. Runoff from the westbound and eastbound carriageways between the top and bottom curves would be controlled by pavement drainage systems that discharge in a westerly direction from the road corridor. Structures would be installed to dissipate energy and manage flow velocities and scour risks at the discharge points.

Other main features of the drainage design and operational water quality strategy include:

- A vegetated buffer strip along a section of the westbound carriageway for about 400m east of the top curve to treat pavement runoff
- A short section of vegetated buffer strip, about 40m long, to treat runoff from the westbound carriageway about 200m west of the bottom curve
- Replacement of existing pipe culvert under Chifley Road at the bottom curve and about 200m west of the bottom curve
- A combined sediment and bio-retention basin located at the base of Scenic Hill on the northern side of Chifley Road. This basin would treat runoff from the westbound and eastbound carriageways between the top and bottom curves and the catchment upslope of the road corridor that comprises the natural bushland to the east. The basin would comprise a sedimentation zone to target gross pollutants such as suspended solids, and a bio-retention zone to target total phosphorus and total nitrogen. A baffle arrangement on the outlet of the sedimentation zone would provide for spill containment.

The basin would also incorporate temporary detention storage to control stormwater runoff prior to it discharging into the drainage channel that flows through the Lithgow Locomotive Maintenance Centre. This storage capacity would help to maintain existing flow levels. The basin design currently includes a maximum depth of 3.5m (incorporating a 1.5m deep detention storage zone) with a total surface area of 1510m^2. The design also includes a 12m wide spillway a staged outlet arrangement to control the rate of discharge for storms with an ARI ranging from between one and 100 years.

3.2.4 Road furniture and signage

For the Clarence road over rail bridge section, 1400m of safety barriers would be provided, mainly on the outside of the realigned curves. An 820mm high concrete parapet with a single rail would be installed on the new bridge. Signposting would be reinstalled at the Chifley Road and Clarence Colliery Road intersection.

For Scenic Hill, about 1500m of safety barrier would be installed, mainly on the outside of the realigned curves. The existing speed and weather activated warning signs would be reinstalled as well as curve advisory signs where required. Signposting of the Ex-POW Memorial would be installed in both directions.

3.2.5 Line marking and road pavement markers

Existing line marking would be re-applied. New line marking would be applied in accordance with Roads and Maritime specification R141.

New line marking in the area of widening work would be provided in accordance with the Roads and Maritime delineation guidelines.

3.2.6 Urban Design

Reports on urban landscape design and landscape character and visual impact assessment (Section 6.9) have been prepared for the proposal to meet Roads and Maritime urban design objectives and principles.

The overall aim of the urban design strategy is to physically and visually integrate the proposal with its surrounding environment, reduce visual impact and where possible, maximise engagement of the road user in a local context to provide a more enjoyable and interesting driving experience.

The general approach to the landscape design is to provide a well-vegetated road corridor that integrates the road with the surrounding landscape and provide motorists with a sense of place along the road journey.

3.3 Construction activities

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

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

- Identification and location of underground utilities and services
- On-site conditions identified during pre-construction activities
- Ongoing refinement of the detailed design
- Outcomes of community consultation including submissions on the REF.

A construction environmental management plan (CEMP) would be developed for the proposal. The methods used would be consistent with statutory requirements, including any work, health and safety (WH&S) regulations and all conditions of approval issued following determination of the proposal. Environmental mitigation and management measures specific to this proposal are included Chapter 7. The CEMP would be consistent with these measures.

3.3.1 Work methodology

The likely construction activities and their sequencing are presented in Table 3.3. Unless otherwise stated, the activities and sequencing described in Table 3.3 are consistent for both the Scenic Hill and Clarence road over rail bridge upgrades.

Table 3.3 Proposed construction phases and activities

Construction phase	Activities
Early work	• Undertake land acquisition • Survey the construction site • Relocate fencing • Notify residents of the start of work • Undertake site establishment • Establish the site compounds • Fence the site boundaries and areas to be used for stockpile sites • Fence environmentally sensitive areas and sensitive places • Install erosion and sediment controls and construct temporary sedimentation control basins.
Service relocations	• Adjust/relocate utility infrastructure (water, electricity and telecommunications) where required.
Site preparation	• Remove and mulch vegetation in stages, and grub along new sections of the road alignment and widened road • Strip and stockpile topsoil in stages • Prepare the surface using graders, dozers and other equipment • Establish access tracks • Erect traffic barriers • Undertake temporary pavement widening.
Earthworks	• Excavate cuttings • Controlled rock blasting for Scenic Hill, if required, to remove hard rock material where mechanical excavation would potentially not be economical. Rock breaking alternatives such as penetrating cone fracture and hydraulic rock breakers may also be used • Create fill embankments • Place select materials • Construct roadside cuts and fill batters • Prepare batter treatments • Erect retaining walls (Scenic Hill only).
Clarence road over rail bridge	• Site preparation • Construction of abutments • Place bridge girders using crane • Construct bridge deck and kerbs • Complete road approaches for new bridge • Switch traffic from the existing to new bridge and approaches • Demolish existing road over rail bridge and stabilise top of cut.
Drainage	• Install/extend culverts • Realign small section of Dargan Creek (Clarence road over rail bridge only) • Install catch drains and drainage blankets • Install permanent water quality/retention basins.
Paving	• Gravel base/sub-base layers and asphaltic concrete paving • Apply asphaltic concrete pavement using pavers and rollers • Remove redundant road pavement and rehabilitate.
Finishing works	• Conclude property access • Complete tie-ins • Install safety barriers • Install kerbs, gutters and verges • Landscape and revegetate work sites • Install line marking, signs and guide posts • Decommission temporary facilities (eg compound sites) • Clean-up the site and dispose of all surplus waste materials.

3.3.2 Construction staging and program

The proposal would be constructed in a number of stages as the road needs to remain open to traffic and because of the engineering constraints, largely associated with the steep terrain (refer to Section 3.2.2).

The specific challenges associated with Scenic Hill led to a detailed review of the potential work staging (Land Team Australia Pty Ltd, 2015). Three potential stages (extending over about 24 months) were identified which would involve reducing and/or moving the lanes available to traffic as the work progresses. Some temporary pavement would also be required with live traffic separated from the construction site by concrete traffic barriers. Access for affected residences would be maintained during construction.

A review of the potential construction staging for the Clarence road over rail bridge upgrade has not been undertaken at this stage. The existing bridge would remain open to two-way traffic as the new bridge is constructed, minimising the impact to road users.

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

3.3.3 Construction hours and duration

Roads and Maritime expects construction to start in early 2018 subject to approval and available funding and work would take about 18–24 months to complete. The Scenic Hill and Clarence road over rail bridge upgrades are proposed to be undertaken at the same time.

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

Standard construction working hours would be employed in accordance with the Interim Construction Noise Guideline (DECC, 2009) as follows:

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

The majority of work would be undertaken during the proposed working hours. Certain activities would need to take place during the evening and night-time periods (‘out-of-hours’) due to technical considerations, to ensure the health and safety of the public and construction crews, and to minimise disruption to the travelling public. Work undertaken outside of standard working hours (if required) would be in accordance with the Office of Environment and Heritage’s Interim Construction Noise Guideline (DECC, 2009) and the Roads and Maritime’s Construction Noise and Vibration Guideline (2016). The community would be notified prior to any proposed works outside the standard hours.

Any blasting required at Scenic Hill would only be undertaken between the hours of 8am to 5pm Monday to Friday, and 8am to 1pm on Saturday.

3.3.4 Plant and equipment

Typical plant and equipment to be using during the work are detailed in Table 3.4. The type of equipment and plant requirements would be refined by the contractor following detailed design. Cut and fill volumes for both road sections would be confirmed during the detailed design phase.

Table 3.4 Indicative plant and equipment for the proposed works

Construction phase	Plant and equipment	
Early work, service relocations and site preparation	• Light vehicles • Trucks • Excavators • Chainsaws • Mulchers	• Generators • Back hoes • Water carts • Cranes • Hand tools
Earthworks	• Excavators • Dump trucks • Compactors • Graders • Front-end loaders • Blasthole drill rig	• Water carts • Profilers • Bulldozers • Vibratory rollers • Rock breakers • Mobile crushing / screening plant
Clarence road over rail bridge	• Concrete trucks • Concrete pumps • Generators • Hand tools	• Trucks • Cherry pickers • Welding equipment • Cranes
Drainage	• Excavators • Concrete pumps • Concrete trucks	• Trucks • Bulldozers • Cranes
Paving	• Concrete trucks • Concrete pumps • Vibratory rollers • Compactors • Concrete saws • Compressors • Bitumen sprayers	• Generators • Milling machines • Trucks • Asphalt paving machines • Asphalt trucks • Rollers
Finishing works	• Generators • Trucks	• Cranes • Light vehicles

3.3.5 Earthworks

The proposal would require major earthworks along some sections of the upgrade work. Earthworks generally involve removing and stockpiling topsoil and the temporary stockpiling of suitable material cut out of earthwork areas prior to its use as fill elsewhere. Movement of materials between work sites would be required, from cutting, to fill and embankment areas, and batter treatments. Considered together, both Scenic Hill and Clarence road over rail bridge upgrades have been designed to minimise the generation of excess spoil and/or the need to import large quantities of fill.

Cut and fill volumes for the proposed works at Scenic Hill and Clarence Road over bridge are presented in Table 3.5.

Table 3.5: Estimated cut/fill volumes for the proposal

Activity	Clarence road over rail bridge (m^3)	Scenic Hill (m^3)	Total (m^3)
Cut	3,000	89,000	92,000
Fill	16,000	73,000	89,000

3.3.6 Source and quantity of materials

The source and quality of materials required to build the proposal would be finalised during detailed design in a construction materials and resources plan or similar.

A large amount of the required fill material would be sourced from materials cut out of embankments and other areas, particularly for the Scenic Hill upgrade. Where feasible, excavated materials would be reworked (if necessary) and used to meet general fill material needs. The accuracy of estimates of the fill material required for the work is subject to variations in bulking factors for excavated material, relative compaction achieved for placed material, and the volume of usable material once it has been excavated. Volume estimates would be refined during detailed design.

Any fill and pavement materials imported to site would be sourced from licensed quarries and commercial suppliers in the local Lithgow region, wherever possible.

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

- Transfer to other nearby Roads and Maritime projects for immediate use
- Transfer to an approved Roads and Maritime temporary stockpile site for future use during projects or routine maintenance
- Transfer to a Roads and Maritime approved site for reuse on concurrent private/local government projects (with appropriate approvals as required)
- Disposal at an approved materials recycling or waste disposal facility
- As otherwise provided for by the relevant waste legislation including relevant resource recovery exemptions under the Protection of Environment Operations (Waste) Regulation 2014.

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

Water would be required for the earthworks construction and for dust control. Water would be sourced from authorised off-site sources, including recycled, re-used and farm-dam water or groundwater bores with appropriate licences. Water from the on-site water retention/sedimentation basins would also be used during the work. The volume of water required for the work is expected to be about 30-50 megalitres for both Clarence road over rail bridge and Scenic Hill upgrade. The quantity and quality of the water required for the work is readily available from existing sources in the local area and would be determined by the contractor.

3.3.7 Traffic management and access

Chifley Road would remain open to traffic throughout the work and access to properties would be maintained.

For Clarence road over rail bridge upgrade, truck movements during the work are expected to increase by 10-20 movements per day. Truck movements may increase to about 40 per day at certain stages of the work.

For Scenic Hill upgrade, truck movements during the work are expected to increase by 50-70 movements per day. Truck movements may increase to about 90 per day at certain stages of the work. Chifley Road would be the main haulage route for the proposal.

Traffic would be managed through a traffic management plan (TMP) in accordance with AS 1742 3 – 2009 and Traffic Control at Work Sites (RTA, 2010). The TMP would include the guidelines, general requirements and procedures to be used when activities or areas of work have a potential impact on existing traffic arrangements. Details of any haulage routes, detours and temporary lane closures would be included in the plan, in accordance with the Road Occupancy Licence (ROL). Standard traffic management measures would be used to minimise short-term traffic impacts, and maintain traffic flow along Chifley Road throughout the work.

Some short-term work under traffic control or lane closure would be required during traffic switches, safety barrier work and asphalting. Traffic delays would be minimal due to the relatively low traffic volumes on Chifley Road.

Access to properties along the road would be maintained during the work. Temporary property access would be provided to residences where required. The management of property access would be considered by the contractor and detailed in the final staging plan.

During the work, a large amount of on-site excavated materials would be moved from cuttings to fill areas. Any requirement for haulage across or along Chifley Road would be in accordance with the TMP.

An assessment of potential traffic and access impacts and associated safeguards and management measures is provided in Chapter 6. A detailed construction traffic and access assessment would be undertaken prior to construction when the detailed staging and work methodology has been developed.

3.4 Ancillary facilities

Compound and stockpile sites of varying sizes would be required to support the work. The main compound for each upgrade section would typically include demountable offices, meal rooms, toilets/showers and parking facilities. Other stockpile facilities would typically allow for lay down facilities, equipment storage, maintenance sheds, chemical/fuel stores and stockpile of earth and construction materials.

The potential compound/stockpile sites are identified in Figure 1.2a (Scenic Hill) and Figure 1.2b (Clarence road over rail bridge). One central location has been identified for the Clarence road over rail bridge upgrade, and two locations as potential compounds and/or stockpile sites for the Scenic Hill upgrade. One additional location would be shared by both sites. Details of these locations are provided in Table 3.6.

Table 3.6 Compound and stockpile sites

Site	Lot and DP	Owner	Description	Proposal activities
Scenic Hill				
Ancillary Site 1	N/A – within road reserve	Roads and Maritime	• Located at the rear of the Ex-POW Memorial on the western side of Chifley Road • An existing cleared area which can be accessed via Chifley Road (refer to Figure 1.2a) • Located within the road corridor • Surface is a sealed asphalt surface • No sensitive receptors in the vicinity • Nearest residential property at the base of Scenic Hill approximately 500m south-west of the Ex-POW Memorial • Surrounded by dense vegetation to the north, west and south • Ex-POW Memorial would remain open to the public during work, where possible.	• Stockpiling • Materials laydown and storage
Ancillary Site 2	Lot 11 of DP 239627	Lithgow City Council (LCC)	• Located at the base of Scenic Hill on the northern side of Chifley Road • Site surface is grass • No vegetation clearance required • Access to the compound would be via the access driveway to the adjacent Lithgow Locomotive Maintenance Centre, located west of the site • Site bordered by Scenic Hill (road and vegetation) to the north and east and Chifley Road to the south, beyond which lies more vegetation • Nearest sensitive receptor is a residential property located approximately 90m to the south. • Once site gets to a stage that the stockpile site is no longer needed it will be converted into the permanent combined sediment and bio-retention basin.	• Site compound for Scenic Hill site • Potential location of crushing/screening plant.
Clarence road over rail bridge				
Ancillary Site 3	Road reserve Lot 1 DP 1111744 Lot 1 DP 1091929	Roads and Maritime Rail Corp	• Located at the base of the bridge on the western side of the rail line • An existing cleared area within the rail corridor in land owned/operated by Sydney Trains • Access is via an unsealed track off Chifley Road • Entry to this road would need to be extended to ensure appropriate notice for vehicles entering this area	• Main construction compound • Stockpiling • Materials laydown and storage

Site	Lot and DP	Owner	Description	Proposal activities
			• Unsealed road would require resurfacing and levelling (surface is potted, causing water ponding and erosion) • Overhead power lines located across the access road at the entry to the site. Height of the lines is unlikely to limit access • Site surface is ballast mixed with some fill material (tiles, rubber) closest to the rail line, and ballast and sand to the west of the rail line • Previously used as a compound based on the presence of a silt fence at the northern boundary and a small ballast stockpile, located in the north of the site • Surrounded by dense vegetation to the north, east and south while to the west is the rail line beyond which lies vegetation • Nearest sensitive receptor is a residential property about 400m east of the site.	
Scenic Hill and Clarence road over rail bridge				
Ancillary Site 4	Road reserve	Roads and Maritime	• Located within the road corridor in an area previously cleared and utilised as an informal rest area adjacent to the airstrip • Access would be via Chifley Road • Site surface is unsealed gravel hardstand • Surrounded by dense vegetation to the north, east and south, Chifley Road to the west beyond which lies an unsealed airstrip and more vegetation • Nearest residential property is about 1km to the north.	• Stockpiling • Materials laydown and storage

Additional or revised compound and/or stockpile sites may be needed following completion of detailed design. If required, locations would be selected using the criteria set out in Roads and Maritime's Stockpile Site Management Guideline (RTA, 2011). Any additional or revised compound and/or stockpile sites would ideally meet the following criteria:

- On relatively level ground and up-slope of sediment control barriers
- Have ready access to the road network or direct access to the construction corridor.
- Away from areas of ecological and heritage conservation value
- In areas previously disturbed within the proposal area that do not require the clearing of native vegetation
- Away from residential buildings
- At least 5m clear of all areas of possible concentrated water flow and at least 10m from a waterway (any Class 1 or Class 2 fish habitat waterways as described in the NSW Fisheries guidelines).

Any additional or revised compound and/or stockpile sites proposed by the contractor would be discussed with Roads and Maritime's Environment Manager, Greater Sydney Program Office to determine if any additional environmental assessment is required.

Each compound and/or stockpile site would be securely fenced with temporary fencing. Signage would be erected advising the general public of access restrictions. Upon completion of work, the contractor would remove the compound and stockpiles sites, including any waste materials. Sites would be rehabilitated in consultation with the relevant property owner.

3.5 Public utility adjustment

Roads and Maritime identified and located existing utilities as part of the development of the concept design to incorporate utility authority requirements for relocations and/or adjustments.

Preliminary investigations identified that some public utility assets would be affected by the proposal. Preliminary information was obtained from *Dial Before You Dig* searches and utilities surveys. Water, electricity, telecommunications and Sydney trains-owned assets would be affected by the proposal. Confirmation of the relocation of utilities and associated strategies would be carried out in consultation with utility authorities during detailed design.

Prior to the commencement of works:

- The location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners
- Any proposed utility relocation works outside of the assessed proposal scope and footprint would be discussed with Roads and Maritime's Environment Manager, Greater Sydney Program Office to determine if any additional environmental assessment is required.

3.6 Property acquisition

The Scenic Hill upgrade would require partial acquisition of eight properties. Table 3.7 lists the properties that would be partially acquired as part of the proposal. No private property acquisition is proposed for Clarence road over rail bridge upgrade. The area of Crown Land that would need to be acquired totals 18,500 m^2.

Table 3.7 Properties to be acquired as part of the proposal

Lot and DP	Property Owner	Approximate area to be acquired (m^2)
Lot 106 DP751650	Private	2,130
Lot 2 DP 574705	Private	1,465
Lot 107 DP 751650	Private	830
Lot 100 DP 1088253	Private	980
Lot 11 DP 239627	Lithgow City Council	7,400
Lot 12 DP 239627	Lithgow City Council	2,650
Lot 3 DP 1006666	Pacific National (NSW) Pty Ltd	1,740
Lot 4 DP 100666	Railcorp	1,020

Roads and Maritime has consulted with affected landowners informing them of the area of acquisition that would be required. These areas would be finalised during detailed design.

Some additional land may be required to be leased by Roads and Maritime during the work period for use as compound and stockpile sites (refer to Section 3.4). These areas would be confirmed during detailed design. Areas that are leased by Roads and Maritime would be returned to the landowner following the completion of work.

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

4 Statutory and planning framework

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

4.1 State environmental planning policies

4.1.1 State Environmental Planning Policy (Infrastructure) 2007

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

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

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

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

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

4.1.2 State Environmental Planning Policy 55 – Remediation of Land

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

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

- Ancillary site 3, located adjacent to the rail corridor, which includes stockpiled materials (predominantly rail construction materials) and a site surface consisting of ballast and some demolition material
- The existing road, as a result of potential illegal dumping of waste materials adjacent to the road alignment (including asbestos containing material (ACM)) and use of potentially contaminated fill material in construction
- The Lithgow Locomotive Maintenance Centre, located at the base of Scenic Hill, adjacent to proposed ancillary site 2
- Agricultural land within and surrounding the proposal area, where there may have been a history of chemical use, fuel storage and use, contaminated fill, stock dips, and/or waste disposal.

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

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

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

The SEPP (Sydney Drinking Water Catchment) is applicable to the proposal as the proposal area is located within two sub catchments of the Sydney Drinking Water Catchment.as defined under the SEPP. The Scenic Hill section is located in the Upper Coxs River sub catchment and the Clarence road over rail bridge section in the Mid Coxs River sub catchment.

Clause 9 of the SEPP states that any development or activity within this catchment should incorporate the Sydney Catchment Authority's (now WaterNSW) current recommended practices and performance standards that relate to the protection of water quality.

Clause 12 of the SEPP (Sydney Drinking Water Catchment) states that: 'A public authority must, before it carries out any activity to which Part 5 of the Act applies, consider whether the activity would have a neutral or beneficial effect on water quality.'

Once the proposed mitigation measures are implemented (refer to Section 6.2.4), the proposal is not anticipated to have an adverse impact on the quality of water being discharged into the Upper and Mid Coxs River sub catchments. In accordance with Clause 9 of the SEPP, the mitigation measures for the proposal would also consider the relevant WaterNSW recommended practices and performance standards.

While the SEPP does not affect the permissibility of the proposal, the proposal's impact on water quality has been considered through a qualitative Neutral or Beneficial Effect (NorBE) water quality assessment (refer to Section 6.2.2).

4.1.4 State Environmental Planning Policy No.44 Koala Habitat Protection

State Environmental Planning Policy (SEPP) No. 44 – 'Koala Habitat Protection' (SEPP 44) aims to encourage the conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range, and to reverse the current state trend of Koala population decline. SEPP 44 is applicable to the local government area the proposal spans.

SEPP 44 requires that developments within LGAs listed in Schedule 1 consider the presence of "Potential" or "Core" Koala Habitat. The criteria for determining Koala habitat relate to the percentage cover of known feed trees, and whether this cover is greater or less than 15 per cent of the total tree canopy.

The proposal area falls within the Lithgow City Council Local Government Area. Lithgow City Council has been identified within Schedule 1 of State Environmental Planning Policy 44 (SEPP 44) as a local government area (LGA) in which Koalas are known to occur.

Lithgow City Council is located within Koala Management Area No. 5 (Central and Southern Tablelands), as listed in the Recovery Plan for the Koala (NSW DECC, November 2008). Lithgow City Council is also directly adjacent to Koala Management Area No. 2 (Central Coast).

Specific attention was given to assessing the presence of potential Koala habitat in the study area as a part of the Biodiversity Impact Assessment (RPS Consultants, 2016) completed for the Proposal. None of the tree species recorded in the study area are listed under Schedule 2 of SEPP 44 as a primary feed tree. Based on these finding, the study area does not comprise any lands that would constitute 'Potential Koala Habitat'. No records of breeding Koala's were identified within or

adjacent the study area. The area is not classed as Koala habitat under SEPP 44. Further information is provided in Section 6.4.

4.2 Other relevant state legislation

Other legislation and its relevance to the proposal is summarised in Table 4.1.

Table 4.1: Summary of relevant legislation and applicability to the proposal

Relevant Legislation	Summary of Relevant Legislation	Applicability to the Proposal
Heritage Act 1977 (Heritage Division, under NSW Office of Environment and Heritage)	The Office administers this Act, maintains the State Heritage Register and operates the NSW Heritage Council. Approval must be obtained from the Heritage Council where the proposal affects a place listed on the State Heritage Register, or where excavation may affect an archaeological relic.	Three identified heritage items listed as state significant are located near the proposal area. The proposal would not affect the curtilage of the state heritage items physically and would not impact the items. No consents are required under the Act. Refer to Section 6.8 for further information.
Environmental Planning and Assessment Act 1979 (NSW Department of Planning and Environment)	This Act provides an assessment framework for consideration of impacts on threatened species and communities listed under the Threatened Species Conservation Act 1995. Section 5A of the Act lists seven factors to be considered in assessing the impacts of a project, and is used to determine if a project is likely to have a significant impact on threatened biodiversity, and the need for further assessment. This Act also requires impacts from proposed development on heritage values to be appropriately assessed. The Act requires local governments to establish environmental plans for their areas including items of state and local heritage significance, and authorises the making of other instruments including State Environmental Planning Policies.	A strategic assessment, prepared in accordance with Section 146 of the EPBC Act and approved by the Federal Minister for the Environment, ensures that Roads and Maritime activities currently assessed under Part 5 of the EP&A Act will no longer require an additional Commonwealth approval for specified matters.

Relevant Legislation	Summary of Relevant Legislation	Applicability to the Proposal
Protection of the Environment Operations Act 1997 (NSW Office of Environment and Heritage, Environment Protection Authority (EPA))	This Act regulates and controls pollution of land, air, water, and noise and provides for notices and offences. Scheduled activities (as defined in schedule 1 of the Act) require licensing in the form of an Environment Protection License (EPL). Schedule 1 Section 19 of the Act deals with the extraction, processing or storage of extracting materials, either by sale or re-use, by means of excavation, blasting, tunnelling, quarrying or other such land-based methods. Extractive materials are defined as clay, sand, soil, stone, gravel, rock, sandstone, or similar substances.	The proposal will involve the extraction, processing or storage of between 380,000 and 420,000 tonnes of material over a 18-24 month period, which exceeds the 30,000 tonnes per year trigger for an EPL. A licence would therefore be required under the Act. Attachment A of the Management of Wastes on Roads and Maritime Services Land Procedure (RMS, 2014) lists potential waste streams for a proposal and whether the proposed waste activity triggers the need for an EPL. The contractor will be required to review this Attachment once estimated waste volumes are known. The Protection of the Environment Operations (Waste) Regulation 2014 (NSW) sets out requirements related to the storage and transportation of waste, as well as reporting requirements including environment levy fees for disposal of waste at licenced facilities. Waste is classified under the NSW EPA Waste Classification Guidelines (EPA, 2014) as being special waste (eg clinical waste, asbestos waste, waste tyres), hazardous waste (eg batteries, containers previously containing a Class 1, 3, 4, 5 or 8 substance under the Transport of Dangerous Goods Code) or general waste. Once a waste is correctly classified it can be managed as required under this regulation. Resource recovery exemptions are available for certain waste types, including excavated spoil, raw mulch and reclaimed pavement asphalt or aggregate, if it is shown the waste type is being beneficially re-used. Acceptable beneficial re-uses on road projects include: • Construction of acoustic and visual mounds where there is a benefit to residents and other sensitive receivers • Flattening of road batters • Rehabilitation of borrow pits • Engineered fill • Approved improvements to flood prone land.

Relevant Legislation	Summary of Relevant Legislation	Applicability to the Proposal
Noxious Weeds Act 1993 (NSW Department of Primary Industries (Fisheries NSW))	This Act classifies noxious weeds in each LGA of the State and imposes obligations on landowners or occupiers to control weeds declared in their LGA.	Blackberry (*Rubus fruticosus*) which was recorded in the study area is a Locally Controlled Weed (Class 4). The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed.
Threatened Species Conservation Act 1995 (NSW Office of Environment and Heritage)	This Act grants protection status to species and communities of conservation significance in NSW, and seeks to conserve biological diversity and promote sustainable development. The Act categorises threatened species and communities under schedules 1 and 2, and key threatening processes under Schedule 3. The Act also provides for the preparation of recovery and threat abatement plans and specifies requirements for further assessment of impacts. Section 5A of the Act outlines seven factors that must be considered to determine the significance of the impact of a development or activity on threatened species, populations or endangered ecological communities (EEC) known or considered likely to occur in the study area and environs.	The biodiversity study completed for the proposal identified 0.03ha of a listed EEC within the proposal footprint; observation of an endangered plant species within the study area (*Acacia meiantha*), numbering 145 specimens; three threatened fauna species listed under the TSC Act, and native vegetation in moderate to good (high) condition giving rise to potential habitat for fauna species listed under the Act. Further information, including management and mitigation of these items is provided in Section 6.4.
Mine Subsidence Compensation Act 1961(NSW Mine Subsidence Board)	This Act aims to ensure that areas at risk of subsidence from mining activities are identified as Mine Subsidence Districts. The Act makes the Mine Subsidence Board responsible for reducing the risk of mine subsidence damage to properties by assessing and controlling the types of buildings and improvements which can be erected in Mine Subsidence Districts. The effects of subsidence on roads and bridge structures can be limited by designing them to accommodate specified strains and displacements, or by carrying out mitigation works.	The Scenic Hill proposal area lies within the Lithgow Mine Subsidence District. Under Section 15 of the Act, approval is required to carry out construction in this area. The Board may grant approval unconditionally or subject to conditions, or refuse approval. This approval will be sought during detailed design of the proposal.

Relevant Legislation	Summary of Relevant Legislation	Applicability to the Proposal
Fisheries Management Act 1994 (NSW Department of Primary Industries (Fisheries NSW))	This Act controls the management of fish and fish habitat in the State and conservation of fisheries resources. A Part 7 Fisheries Management Act permit is required when works require dredging or reclamation work on waterfront land as defined in the *Water Management Act 2000*, or if the proposed work site is within or adjacent to a waterway that is considered Key Fish Habitat.	Tributaries adjacent to the proposal area are not mapped as Key Fish Habitat. The proposed extension of the stormwater culvert at Dargans Creek approximately 400m west of the road over rail bridge may constitute dredging under the Act as it will potentially involve excavation of water land (land submerged by water) and/or removal of material from water land. Under Section 199 of the Act, a public authority may carry out dredging if it gives the Minister written notice of the proposed work and considers any matters concerning the proposed work received within 28 days of giving notice.

4.3 Relevant Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), a referral is required to the Australian Government for proposed 'actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land. Proponents are required to determine the likelihood of a proposal having a significant impact on matters of national environmental significance. Regulatory approval is required for actions likely to have a significant impact. A decision must be made by the proponent whether to refer the action to the DoE.

A referral is **not** required for this proposal for proposed actions that may affect nationally listed threatened species, ecological communities and migratory species. The 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.

The assessment of the proposal on matters of national environmental significance, and the environment of Commonwealth land is presented in Appendix A and summarised below.

Findings – matters of national environmental significance (other than biodiversity matters)
The proposal is not expected to result in any significant effects on matters of national environmental significance. Matters of national environmental significance applicable to this proposal are listed threatened ecological communities and nationally listed threatened and migratory species. The Blue Mountains World Heritage Property and National Heritage Place are both listed but are not predicted to be significantly impacted by the proposal, being disjunct from the proposal area. Proposed safeguards and management measures would prevent any significant indirect impacts on this area from the proposal (eg impacts downstream from Dargans Creek).

Findings – nationally listed biodiversity matters
The biodiversity study (RPS Consultants, 2016) identified evidence of an EPBC Act-listed Endangered Ecological Community (Temperate Highland Peat Swamps on Sandstone) within the study area. Native vegetation, in moderate to good (high) condition, was recorded across the study area giving rise to potential habitat for fauna species listed under the Act. No EPBC Act listed species were recorded during field surveys.

The assessment of the proposal's impact on these nationally listed items found that there is unlikely to be a significant impact from the proposal on relevant matters of national environmental significance. Section 6.4 describes the safeguards and management measures to be applied.

4.4 Local environmental plans

4.4.1 Lithgow City Local Environmental Plan 2014

The proposal is located within the Lithgow LGA. The road alignment is zoned SP2 – Infrastructure and the surrounding lands are zoned E3 – Environmental Management under the Lithgow Local Environmental Plan 2014.

The objectives of the SP2 zone are:

- To provide for infrastructure and related uses
- To prevent development that is not compatible with or that may detract from the provision of infrastructure
- To maintain or improve the water quality of receiving water catchments.

Within the SP2 zone, roads are permitted with consent. As stated in Section 4.1.1 above, clause 94(1) of the ISEPP outlines development for the purpose of a road or road infrastructure may be carried out by, or on behalf of, a public authority without consent on any land. As such, the ISEPP provisions prevail over the LEP provisions.

Objectives of the E3 zone are to:

- To protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values
- To provide for a limited range of development that does not have an adverse effect on those values
- To facilitate the management of environmentally sensitive lands and riparian areas
- To protect and conserve the vegetation and escarpment landscape surrounding Lithgow
- To maintain or improve the water quality of receiving water catchments.

4.5 Conclusion and confirmation of statutory position

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

Roads and Maritime is both the proponent and the determining authority for the proposal. The proposal can be carried out without development consent, as per Clause 94 of ISEPP. Development consent from Lithgow City Council is therefore not required and the proposal is subject to assessment under Part 5 of the EP&A Act.

The proposal would require an EPL under Schedule 1 Section 19 of the *Protection of the Environment Operations Act 1997*. The proposal will also require approval from the Mine Subsidence Board under Section 15 of the *Mine Subsidence Compensation Act 1961.*

5 Stakeholder and community consultation

This chapter discusses the consultation undertaken to date for the proposal and the consultation proposed for the future. The consultation strategy and approaches used to consult on the proposal are described along with the results of consultation with the community, the Aboriginal community and relevant government agencies and stakeholders.

5.1 Consultation strategy

A community consultation and stakeholder engagement plan (communications plan) was developed and implemented to guide consultation activities. The communications plan identifies key objectives and outcomes of consultation activities with the community, stakeholders and government agencies.

The communication and engagement objectives for the proposal include:

- To keep the local community and other key stakeholders regularly informed of proposal progress
- To provide the community and stakeholders with regular and targeted information to build awareness about the proposal
- To provide clear information about what we are seeking feedback on, when and why
- To ensure community and stakeholder feedback is continuously fed into communication, engagement and development and delivery of the proposal
- To be transparent in all that we do
- To encourage participation from communities and other stakeholders
- To listen to feedback, investigate suggestions and report back
- To engage in a manner that is collaborative, innovative, adaptive and sustainable
- To ensure that community and stakeholder enquiries about the proposal are managed and resolved effectively
- To ensure that proposal information is distributed in an effective and timely manner.

The proposal has incorporated consultation with directly and indirectly affected landowners, interested local and regional individuals as well as the wider community. Consultation has also included involvement of local interest groups, local businesses, Lithgow City Council and State government agencies.

A summary of consultation undertaken to date is provided in section 5.2 to section 5.6. Roads and Maritime will continue to consult with the community and stakeholders throughout development of the proposal. In particular, the REF will be placed on public display and comments invited. Submissions received as a result of the display will be addressed in a formal submissions report and considered when finalising the concept design and during development of the detailed design.

The following sections outline the consultation that has been carried out specifically for the proposal.

5.2 Community involvement

Consultation with the community has involved the following activities:

- Consultation with affected property owners commenced in 2016 and included face-to-face meetings with property owners as part of the land acquisition planning process
- A community update was released in February 2016 informing the community about the commencement of the design and REF process
- Information on the proposal was placed on the Roads and Maritime website, http://www.rms.nsw.gov.au/projects/sydney-west/bells-line-of-road/chifley-road-upgrade.html. A

preliminary concept design was displayed for community and stakeholder feedback to help guide our future decision making and design. Interested parties were given until 21 March 2016 to provide feedback regarding the proposed Bells Line of Road Corridor – Chifley Road upgrade

- A community consultation report (RMS, 2016a) was placed on the Roads and Maritime website. This report summarises the 12 submissions received via email, on feedback forms and from government agencies during the consultation period.

The most frequently raised issues are summarised in Table 5.1. The main concerns expressed related to other sections of Chifley Road not proposed to be upgraded, consideration of other road users, and biodiversity impacts. Comments received also suggested changes to the proposal and requests for further information.

Table 5.1 Main issues raised by the community

Issue category	Description of issue category	Summary of issues raised	Relevant REF section/s
Recommendations for further upgrade	Clarence cuttings	Section of Chifley Road through Clarence cuttings (east of railway line) is considered to be unsafe and should be included in the proposal.	Section 2.5. Roads and Maritime investigated widening this area and identified several environmental and constructability constraints, as well as low road-user benefit.
	Valley View Road	The intersection of Chifley Road and Valley View Road at Dargan should be upgraded.	Section 2.5. Roads and Maritime investigated a number of upgrade opportunities, and prioritised certain high value safety work required. This work is subject to further investigation and does not form a primary part of the proposed upgrades.
	Service Road at Dargan and informal property accesses	These areas are unsafe given the 80km/h speed limit.	Section 2.5. These areas fall outside of the proposal area upgrades, and should be discussed with Lithgow City Council.
	Intersection of Chifley Road and Petra Avenue at Clarence	Intersection does not provide adequate sight-distance to the west for vehicles entering Chifley Road.	Section 2.5. Roads and Maritime investigated several upgrade opportunities and prioritised certain high value safety work required. This work is subject to further investigation and does not form a primary part of the proposed upgrades.
	Access into Dargan Creek reserve from Chifley Road	Intersection is unsafe and requires improvement.	Section 2.5. Access will be considered during the design of the road over rail bridge at Clarence.

Issue category	Description of issue category	Summary of issues raised	Relevant REF section/s
	Access to Clarence/Dargan rural fire brigade premises	Access is in poor condition and unsafe.	Section 2.5. This area falls outside of the proposal area upgrades, and should be discussed with the property owner.
	Intersection of Chifley Road and Clarence Colliery Road	Impacts to this intersection should be minimised as it is essential to facility operations and local residents of Newnes Junction.	Section 3.3.2. Chifley Road and Clarence Colliery Road would remain open to traffic throughout the construction. Some short-term work under traffic control would be required. Roads and Maritime would keep parties informed of work and staging to minimise impacts.
Design changes	Alternative upgrade to Scenic Hill	Alternative proposed that would remove the unsafe bends.	Section 2.5. Roads and Maritime considered a number of design options including an option that removed a number of bends. This option had significant environmental and constructability issues and was not considered further.
Road safety	Cyclist safety	Concerns over cycling access and safety on Chifley Road due to narrow shoulder width	Section 3.2.1. The proposal would provide consistent widened shoulders on both sides of the road and increase safety for cyclists.
Biodiversity	Threatened plant species	Location of the proposal is known to contain threatened flora species which should be considered in the design.	Section 6.4. Targeted flora surveys undertaken in the proposal area are being used to guide the design. The surveys identified an endangered plant species under the TSC Act, *Acacia meiantha*, in proximity to the road over rail bridge at Clarence. The proposal would take place to the north of the existing road so avoiding this species. Other potential threatened plants were targeted in the surveys and not found. Management measures are proposed to safeguard against inadvertent impact during construction, or chance finds of threatened species.
Further information	Project schedule	Information requested on when construction would be completed.	Sections 3.3.2 and 3.3.3. The proposal is estimated to be completed by early 2020, subject to approval and funding.

Issue category	Description of issue category	Summary of issues raised	Relevant REF section/s
	Project design	Information requested on how the alignment of the final bend on Scenic Hill would be upgraded.	Section 3.2 and 3.3. The Scenic Hill proposal would improve the existing grade by two to three per cent and the curve radius would be improved to 40m. Road drainage would also be improved.
Strategic need	Requirements for road upgrade at Clarence	Justification of why the road over rail bridge at Clarence is being upgraded ahead of the Great Western Highway bridge at Mount Victoria	Section 2.5. The upgrades to Chifley Road are being developed to address road safety in this section. The long-term upgrade of the Great Western Highway between Mount Victoria and Lithgow includes a new highway alignment to the eastern side of the Mount Victoria township (bypassing the existing road bridge over the railway line). An independent review has recommended that this upgrade be included in the Blue Mountains Local Environmental Plan 2015.

Two community information sessions will be held during the display of the REF.

5.3 Aboriginal community involvement

Aboriginal consultation has been conducted by the Roads and Maritime Aboriginal cultural heritage advisor in accordance with Stage 2 of the Roads and Maritime's Procedure for Aboriginal Cultural Heritage Consultation and Investigation (RMS, 2011a). The study area is within the boundary of Bathurst Local Aboriginal Land Council (LALC).

The consultation involved:

- The participation of Bathurst site officers in field investigations and review of the Aboriginal heritage report (Section 6.7). The LALC responded stating that it agreed with the report, and had no further comment
- Provision of a draft version of the Aboriginal Survey Report to Bathurst LALC for review.

Consultation is discussed further in Section 6.7.

5.4 ISEPP consultation

Clauses 13 – 15 of the ISEPP states that development that may have an impact on council-related infrastructure or services, local heritage items or flood-liable land may require consultation with the relevant council, in this case Lithgow City Council.

The proposal is unlikely to have an impact on council-related infrastructure or services. The proposal is unlikely to affect sites listed on the Lithgow LEP 2014 within the vicinity of the study area. Other items of local heritage significance were identified during the site survey undertaken by Cosmos Archaeology Pty Ltd (Cosmos) (refer to Section 6.8). Potential impacts to these items would be managed through implementation of the mitigation measures discussed in Section 6.8. The proposal is not located within flood-liable land.

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

a) *development adjacent to land reserved under the National Parks and Wildlife Act 1974 – the Office of Environment and Heritage,*
b) *development adjacent to a marine park declared under the Marine Parks Act 1997 – Marine Parks Authority,*
c) *development adjacent to an aquatic reserve declared under the Fisheries Management Act 1994 – the Office of Environment and Heritage,*
d) *development in the foreshore area within the meaning of the Sydney Harbour Foreshore Authority Act 1998 – Sydney Harbour Foreshore Authority,*
e) *development comprising a fixed or floating structure in or over navigable waters – Roads and Maritime Services (maritime branch),*
f) *development for the purposes of an education establishment, health services facility, correctional centre or group home, or for residential purposes, in an area that is bush fire prone land (as defined by the Act) – NSW Rural Fire Services.*

The proposal is located in the vicinity of the Blue Mountains National Park, which is located a minimum of 500m away. No part of the proposal would be located on land next to a declared marine park, declared aquatic reserve or foreshore area. The proposal would not involve development over navigable waters or for the purposes of an educational establishment, health services facility, correction centre, group home or for residential purposes. None of these matters apply to this proposal and no consultation in accordance with Clause 16 is required.

The Lithgow City Council has been notified of the works and had no objections to the proposal.

5.5 Government agency and stakeholder involvement

Consultation with government authorities and agencies has been carried out throughout the proposal's development. This has involved early engagement and/or ongoing consultation with Lithgow City Council, Sydney Trains, WaterNSW, Mine Subsidence Board and the NSW Rural Fire Service.

Initial feedback and comments provided by these authorities and agencies has been considered during the design development of the proposal. Roads and Maritime would to continue to consult with government authorities and agencies throughout subsequent project phases and consider any issues raised where reasonable and feasible.

The NSW Office of Environment and Heritage provided a submission on the proposal during the feedback period associated with the community update. Issues raised by the Office included known threatened species in the vicinity of the proposal and the potential for other threatened flora species to also be present. These issues have been considered during design development and the biodiversity impact assessment undertaken for the proposal (see Section 6.4).

5.6 Ongoing or future consultation

This REF will be placed on public display and community comments will be invited in September 2016. Following the submissions period, Roads and Maritime will collate submissions. After consideration of community comments, Roads and Maritime will determine whether the proposal should proceed as proposed, or if any alterations to the proposal are necessary.

Roads and Maritime will also continue to update the project website (http://www.rms.nsw.gov.au/projects/sydney-west/bells-line-of-road/chifley-road-upgrade.html) and issue community update newsletters during the display of this REF and during construction.

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

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

5.7 Conclusion

Roads and Maritime commenced formal consultation with the local community, Aboriginal community, government agencies and stakeholders in December 2015. As a result, Roads and Maritime is confident that the proposal has been well-publicised, and that all interested individuals and stakeholders have had an opportunity to learn about the proposal and to comment on it.

Feedback received has been generally supportive of the proposal. Roads and Maritime will continue to consult with the local community, the Aboriginal community, government agencies and stakeholders.

6 Environmental assessment

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

- Potential impacts on matters of national environmental significance under the EPBC Act
- The factors specified in the guidelines Is an EIS required? (DUAP 1995/1996) as required under clause 228(1) of the Environmental Planning and Assessment Regulation 2000 and the Roads and Related Facilities EIS Guideline (DUAP 1996). The factors specified in clause 228(2) of the Environmental Planning and Assessment Regulation 2000 are also considered in Appendix A.

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

6.1 Hydrology and drainage

This section describes the existing environment, potential impacts on hydrology and drainage of the proposal, and proposed safeguards and management measures in the proposal area. Water quality aspects are described separately in the following section.

Information presented in this section has been drawn from a desktop review of hydrology of the study area, and validation at the proposal area through a site walkover. The desktop review included a search of topographical mapping, aerial imagery and groundwater bore licences.

6.1.1 Existing environment

The proposal is located in the Hawkesbury-Nepean Catchment Management Authority within the Upper Coxs River sub-catchment and the Mid Coxs River sub-catchment, both of which are part of the Sydney Drinking Water Catchment. Consequently, Roads and Maritime require an assessment to be carried out to determine the impact of the proposed road work on the quality of stormwater runoff in the receiving drainage lines and to also develop a concept strategy of operational stormwater quality controls (Appendix B).

Significant surface water bodies near the proposal area include Browns Swamp, Dargans Creek, and Ida Falls Creek (Figure 1.1). Unnamed minor drainage lines and culverts are also located within the proposal area.

Browns Swamp is located north of Chifley Road between Lithgow and Clarence and drains to Dargans Creek. The creek is a perennial water feature and within the proposal area runs through a sandstone culvert where it crosses under Chifley Road. The creek channel is narrowly incised in this area. After crossing the road, Dargans Creek runs through the north east corner of the Dargan Creek Reserve, where water then drains through a series of swamps before being dammed in two places. The reserve is used for recreational activities including adventure sports as well as passive recreation such as swimming.

Ida Falls Creek rises above Chifley Road between the Zig Zag Railway Line and Scenic Hill. The creek flows for about 3km generally north by west into Farmers Creek. Farmers Creek then runs west through Lithgow. The terrain drops off steeply to the east of Chifley Road with the creek ultimately receiving rainfall runoff from the road.

Within the proposal area, the catchment has been impacted by linear infrastructure development (ie Main Western Railway and local road network), extractive industries, such as Clarence Colliery underground coal mine and rural residential development.

The area of the work proposed for Scenic Hill drains to the north towards a natural gully which runs through the Lithgow Locomotive Maintenance Yard before crossing the Main Western Railway Line and Bells Road before joining Farmers Creek. Farmers Creek drains to the west through Lithgow and into the Coxs River at Lake Lyall.

The area of the work proposed for the Clarence road over rail bridge section to the east of the railway line drains to the south towards Dargans Creek, and onwards into the River Lett, which joins the Coxs River to the southwest of Hartley. West of the railway line the area drains to the north through a series of natural gullies into Newnes Swamp. The swamp drains to the east to join Dargans Creek.

Groundwater is present in the proposal area with an upper aquifer confined within two geological formations (Banks Wall Sandstone and Burralow Formation). Another rock layer separates this aquifer from those below. Local 'perched' water tables are common above the upper aquifer and form where shale and claystone beds prevent the downward flow of rainwater. These perched water tables often give rise to localised swamps (Bowden, 2014), a feature of the proposal area. Consequently, groundwater levels are likely to be near the surface in many places.

Uses of groundwater in the proposal area can be inferred from a search of the NSW Natural Resource Atlas. The atlas indicates the presence of groundwater bores within the wider area and potentially within the proposal area. The majority of bores are used for water supply or irrigation (RMS, 2014). A search of groundwater bore licences was carried out on 2 February 2016 for groundwater bores within 500m of ancillary sites 1 to 3. The results identified two registered groundwater bore within a 500m radius of the sites. Bore GW054416 is located about 360m north west of ancillary site 1 and 280m to the north west of ancillary site 2, and is authorised for use for domestic purposes, with groundwater present at a depth of approximately 5m below ground surface. Bore GW10933,2 about 200m to the north of ancillary site 3 is authorised for use for monitoring purposes, with groundwater present at a depth of about 9m below ground surface.

The Australian Bureau of Meteorology atlas of groundwater dependent ecosystems did not identify any groundwater dependent ecosystems near the proposal area.

6.1.2 Policy setting

Further to the statutory and planning framework discussed in Section 4, the following policy documents are relevant to hydrology.

Dargan Creek Reserve Plan of Management

The Plan of Management for the Dargan Creek Reserve (Ecological Australia, 2012) was prepared in 2012. The plan reflects the primary purpose of the reserve, which is public recreation. Values and threats to the reserve are identified, along with objectives and actions for the long-term sustainable management of Dargan Creek Reserve. The action plan for the reserve includes a key objective of protection of upland swamps through restoration work and stakeholder education.

Lithgow City Council Interim Policy for Flood Liable Land (1992)

This policy aims to reduce the amount of flooding and flood liability in the Lithgow area and adopt a merit approach to all development in consideration of social, economic and environmental issues, together with flooding. The policy aims to prevent the introduction of unsuitable land uses to land identified as being flood liable. The proposal area is not on flood prone land.

6.1.3 Potential impacts

The proposal activities would include clearing of vegetation to allow for the road widening and curve realignment. Various earthworks would be needed to create suitable gradients on which to lay the road surface. Improved waterway crossings (extended and new culverts) are also required.

These activities occur during the work and would disturb the ground surface and/or existing drainage lines and creeks within the proposal footprint, and potentially watercourses downstream.

Given the scale and extent of the work, the main potential impact on hydrology is expected to be limited to:

- Sediment-laden runoff from disturbed areas entering waterways and causing sedimentation and affecting flow regimes. Such impacts are most likely where waterways cross or flow close to the disturbed areas, such as Dargans Creek
- Greater quantities of stormwater and increased flow velocities through the Scenic Hill site and at discharge points
- Potential for bank and channel scouring downstream of the new culvert at Dargans Creek
- Partial blocking or temporary diversion during earthworks and other construction activities of waterways or drainage lines crossed by Chifley Road that receive road surface runoff leading to localised flooding upstream or restricted flow downstream.

These impacts would be temporary and minor, for the period of construction. Although the work is planned over 18-24 months, not all areas would be disturbed at the same time. The impact is expected to be minor and would be able to be managed effectively through the implementation of the safeguards and management measures provided below and standard erosion and sediment controls (refer to Sections 6.2 and 6.3).

At the Scenic Hill section, modelling to predict stormwater runoff volumes and associated water quality (Appendix B) shows that there will be a minor reduction in the flow rate of drainage line 1 but an increase in the rate of flow for drainage line 2 for all storms up to the 100-year ARI event. The increase in peak flows can be attributed to the increase in paved area, as well as the diversion of flows that currently discharge from the road corridor.

The proposal includes changes to the existing road drainage regime. In most places, drainage infrastructure (including drains and culverts) would be modified to accommodate the widened/realigned road. Changes to existing impervious areas and in horizontal/vertical alignment associated with the proposal could affect the flooding regime downstream.

Specifically, for the Scenic Hill upgrade, the new pit and pipe system described in Section 3.2.3 and increased impervious area could potentially result in greater quantities of stormwater and increased flow velocities through the site and at discharge points. The concept drainage design has included scour protection treatments and energy dissipation structures to manage any increase in flow velocities. The water quality/retention basin at the base of Scenic Hill has a surface area of 1,510m^2 and would be sufficient to manage potential increases in stormwater quantity. The final design and configuration of the culverts and drainage systems for both road sections would be confirmed during the detailed design phase.

The proposed extension of the stormwater culvert at Dargans Creek from 12 to 14m in length may impact the existing flow regime within the waterway and result in bank and channel scouring downstream of the proposal area. As detailed in Section 3.2.3, some minor re-alignment of the creek would be required to maintain flow capacity and minimise erosion and scour of the banks and in the channel downstream.

6.1.4 Safeguards and management measures

Section 3.2.3 outlines a series of design measures to manage water quantity and runoff in the proposal area, as a result of recommendations in Appendix B.

Safeguards and management measures proposed to avoid, reduce or manage impacts on hydrology are discussed in Table 6.1. Safeguards and management measures relating to water quality and erosion and topography, geology, soils and contamination, discussed in Sections 6.2 and 6.3 respectively will also manage impacts on hydrology of the study area.

Table 6.1 Safeguards and management measures relating to hydrology

Impact	Environmental safeguards	Responsibility	Timing
Changes to hydrology	• Prior to construction commencing, final hydrology and drainage assessments will be undertaken to inform detail design measures to minimise risks to the environment, properties and the project. This will include selection of appropriate scour protection treatments, energy dissipation and retention structures. Consultation will be undertaken with Water NSW on the final design measures.	Roads and Maritime/ Contractor	Detailed design/ pre-construction
Culvert extension within Dargans Creek	• The culvert extension and re-alignment of Dargans Creek will be designed to maintain downstream bed stability, minimise changes to existing waterway length, and maintain existing flow velocity.	Contractor	Detailed design
Blocking or diverting drainage channels	• Duration and length of any temporary drainage channel diversions will be minimised where reasonable and feasible.	Contractor	Construction
Blocking or diverting drainage channels	• Temporary drainage channel diversions will include appropriate scour protection and energy dissipation measures, such as check dams.	Contractor	Construction
Hydrology and flow regime	• Any dewatering activities will be undertaken in accordance with the RTA Technical Guideline: Environmental management of construction site dewatering in a manner that prevents pollution of waters and scouring of drainage channels or waterways.	Contractor	Construction

6.2 Water quality

This section describes the existing environment, potential impacts on water quality of the proposal, and proposed safeguards and management measures in the proposal area.

Information presented in this section has been drawn from a desktop review of information relevant to the study area and the results of water quality sampling and analysis carried out by RPS in 2016 (Section 6.4). The desktop review included a search of mapping and aerial imagery.

6.2.1 Existing environment

The proposal is located within the Sydney Drinking Water Catchment. The main surface water features include Dargans Creek, and Ida Falls Creek as well as Browns Swamp (Figure 1.1). Unnamed minor drainage lines and culverts are also located within the proposal area. The hydrology of the proposal area is discussed above in Section 6.1.1.

Water quality sampling of Dargans Creek was carried out at four sites in March 2016 (RPS, 2016) due to the proximity of the waterway to the proposal and potential impacts during construction. Samples were taken in the creek and surrounding wetland/swamp system upstream and downstream of Chifley Road (see Section 6.4). No water quality sampling of Browns Swamp or Ida Falls Creek was undertaken as these waterbodies/waterways are located upstream of the proposal area or at a distance such that potential impacts would be negligible.

The data provided a snap-shot of ambient water quality in the creek. The results were reviewed against the guideline values for physical and chemical parameters for upland rivers in south-east Australia from Australian and New Zealand Environment and Conservation Council (ANZECC) 2000 and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) guidelines (see Section 6.2.2 below).

The results (RPS, 2016 see Section 6.4) show that the water quality in the Dargans Creek and associated wetland system is characteristic of relatively undisturbed waterways. The levels recorded of typical indicators of water quality were low, including for turbidity, total suspended solids and trace metal concentrations. Water quality at all of the sites was slightly acidic (measured as pH) and would be expected in a peat swamp system. Dissolved oxygen levels at one of the downstream sites were slightly below the lower limit. All filterable and total metal concentrations were below reporting limits, with the exception of nickel, which was well within the ANZECC guidelines. Oil and grease concentrations from all sampling sites were below the reporting limit of <5mg/L.

As noted in Section 6.1.1, groundwater is present in the proposal area with groundwater levels likely to be near surface in many places. Vulnerability mapping (Department of Land and Water Conservation, 2001) indicates that groundwater to either side of Chifley Road has a moderate risk of contamination. The vulnerability is determined by the hydrological, geological and soils present in an area. Within the proposal area, the moderate vulnerability is likely to be due to the shallow nature of groundwater, and the relatively short pathways that contaminants would follow to reach it.

6.2.2 Policy setting

Further to the statutory and planning framework relevant to water quality discussed in Section 4, the following policy documents are also relevant.

State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011
As discussed in Section 4.1.3, the proposal area is located in the Sydney drinking water catchment as defined by the SEPP. Accordingly, a qualitative Neutral or Beneficial Effect (NorBE) water quality assessment has been carried out for the proposal and is included in Appendix B.

National Water Quality Management Strategy
The strategy was developed to improve water quality in Australian and New Zealand waterways, originally endorsed by ANZECC and ARMCANZ. The strategy aims to protect the nation's water resources, improving water quality while supporting businesses, industry, environment and communities that depend on water. Water quality guidelines were prepared in 2000 under the strategy to provide an authoritative guide for setting water quality objectives required to sustain environmental values for water resources in Australia and New Zealand. These guidelines are often referred to as the ANZECC (2000) guidelines.

New South Wales Water Quality and Flow Objectives
These objectives set agreed environmental values and long-term goals for New South Wales surface waters. The objectives include community values and water quality indicators consistent with the ANZECC 2000 guidelines.

NSW Groundwater Protection Policy
This policy provides a set of policy principles to protect groundwater quality, and guidance to resource managers.

6.2.3 Potential impacts

The proposal activities would include clearing of vegetation to allow for the road widening and curve realignment. Various earthworks would also be needed to create suitable gradients on which to lay the road surface. Improved waterway crossings (extended and new culverts) are also required.

These activities all occur during the work and would disturb the ground surface and/or existing drainage lines and creeks within the footprint of the works, and potentially downstream. Groundwater is not expected to be intersected by any excavations required for the proposal. Safeguards and management measures have been included below to minimise any potential for contamination of groundwater in the proposal area.

Given the scale and extent of the work, the potential impacts on water quality are expected to be limited to:

- Sediment in runoff from disturbed areas entering waterways and causing sedimentation, affecting water quality (eg increased turbidity). Such impacts are most likely where waterways cross or flow close to the disturbed areas, such as Dargans Creek
- Potential for increased turbidity and contamination (from accidental spills) during construction of the culvert extension work at Dargans Creek. Once completed, the culvert extension could cause bank and channel scouring downstream, with subsequent effects on water quality (particularly increased turbidity)
- Accidental spills of contaminants such as fuels used in vehicles and machinery affecting surface and ground water quality, particularly at the ancillary sites and refuelling areas, and potential downstream areas
- Increased levels of litter from construction activities polluting downstream watercourses.

The assessment presented in Appendix B, shows that stormwater quality measures proposed in Section 3.2.3 will generally provide either a reduction, or no change, in the average annual weight of pollutants discharging from the road corridor to the receiving drainage lines when compared to present day conditions.

The average annual weight of total nitrogen at Scenic Hill would increase by 4 per cent. The steep nature of the proposal area means that there is no opportunity to implement additional bio-retention measures to avoid this impact.

A 4 per cent increase in the average annual weight of total nitrogen generated within the headwaters of Farmers Creek is unlikely to have any impact on the receiving environment in relation to adverse effects on native plants, potential nuisance plant growth and eutrophication. This is largely due to the sandstone geology within the proposal area, which is naturally low in nutrients, and the relatively small area affected within the wider Farmers Creek catchment.

The downstream developed lands of the Lithgow urban and industrial environs are likely to make considerably greater contributions to total nitrogen loading in the overall catchment. The 4 per cent increase in the average annual weight of total nitrogen as a result of the proposal is not significant in this context.

Most water quality impacts would be temporary and minor, for the period of construction. Although the work is planned over 18-24 months, not all areas would be disturbed at the same time. The impact on water quality is expected to be minor and would be able to be managed effectively through the implementation of standard erosion and sediment controls, hazardous substance management measures and other mitigation measures. As detailed in Section 3.2.3, minor realignment of Dargans Creek would minimise erosion and scour of the banks and in the channel downstream.

Potential impacts on aquatic biodiversity from changes in water quality are assessed in Section 6.4 below.

6.2.4 Safeguards and management measures

Design measures to manage water quantity and runoff in the proposal area are discussed above in Section 6.2.3 and are based on the recommendations contained in Appendix B.

Additional safeguards and management measures proposed to avoid, reduce or manage impacts on water quality are discussed in Table 6.2.

Table 6.2 Safeguards and management measures relating to water quality

Impact	Environmental safeguards	Responsibility	Timing
Sedimentation/ decreased water quality	• Batters will be designed and constructed to minimise risk or exposure, instability and erosion, and to support long-term, on-going best practice management, in accordance with the Roads and Maritime *Guideline for Batter Stabilisation Using Vegetation* (RMS, 2015a).	Contractor	Detailed design
Sedimentation / decreased water quality	• A site specific erosion and sediment control plan will be prepared and implemented and included in the construction environmental management plan (CEMP). The plan will identify detailed measures and controls to be applied to minimise erosion and sediment control risks including, but not necessarily limited to: runoff, diversion and drainage points; sediment basins and sumps; scour protection; stabilising disturbed areas as soon as possible, check dams, fencing and swales; and staged implementation arrangements. The plan will also include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather. Prior to commencement of the activity, the Soil and Water Management Plan will be reviewed by a soil conservationist on the RMS list of Registered Contractors for Erosion, Sedimentation and Soil Conservation Consultancy Services. The review will assess the adequacy of measures in the Plan and recommend any revisions or additional measures required. The Soil and Water Management Plan will then be revised to address the outcomes of the review.	Contractor	Pre-construction/ construction
Sedimentation/ decreased water	• A detailed environmental work method statement (EWMS) will be prepared and implemented for work	Contractor	Pre-construction/ construction

Impact	Environmental safeguards	Responsibility	Timing
quality of Dargans Creek	activities within 100m of Dargans Creek, including the culvert extension and earthworks associated with the curve realignment. The EWMS will detail: measures to avoid or minimise risks from erosion and sedimentation to water quality and biodiversity maintain fish passage during construction monitoring requirements to assess the performance of implemented mitigation measures. The EWMS will be prepared in accordance with relevant guidelines including, but not limited to: RMS Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects NSW DPI (Fisheries) guidelines Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings.		
Contamination of surface waters and groundwater related to accidental spills	• Spill management measures and procedures will be prepared and implemented as part of the CEMP to minimise the risk of pollution arising from spillage or contamination on the site and adjoining areas. The measures and procedures will address, but not necessarily be limited to: management and storage of chemicals and potentially polluting materials; any bunding requirements; refuelling requirements; maintenance of plant and equipment; and emergency management, including notification in accordance with Roads and Maritime guidelines, response and clean-up procedures.	Contractor	Pre-construction/ construction
Sedimentation/ decreased water quality	• The rehabilitation of disturbed areas will be undertaken progressively as construction stages are completed, and in accordance with: Landcom's Managing Urban Stormwater: Soils and Construction series Roads and Maritime Guideline for Batter Stabilisation Using Vegetation (RMS, 2015a)	Contractor	Construction
Disturbance of contaminated soil / contamination of environment	• Emergency spill kits will be kept at areas identified as having spill risk at all times.	Contractor	Construction
Contamination of surface waters and groundwater	• Refuelling will not take place within 50m of waterways, and will occur in a suitably located and bunded area.	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
Contamination of surface waters and groundwater	• Washdown of plant, equipment and vehicles will occur in a designated bunded area away from waterways and drainage lines.	Contractor	Construction

6.3 Topography, geology, soils and contamination

This section describes the existing environment, potential impacts and proposed safeguards and management measures in relation to topography, geology and soils in the proposal area.

Information presented in this section has been drawn from the report of geotechnical investigations carried out by Bowden Geological Pty Ltd (Bowden) in 2014 to support preparation of the strategic concept design for the proposal (Bowden, 2014). The geotechnical study area focussed on Chifley Road between the junction of Bells Line of Road and The Darling Causeway at Bell and the Great Western Highway at Lithgow.

The Australian Soil Research Information Service (ASRIS) map (CSIRO, 2006) was accessed to provide a preliminary indication of the risk of acid sulfate soils at the site. Contaminated land information is primarily based on the findings of the site visit carried out by Coffey on 20 January 2016 (Appendix C). Information from the non-Aboriginal Heritage Assessment and Statement of Heritage Impact (Cosmos, Appendix D), and desktop searches has also been used to supplement the findings.

6.3.1 History

Prior to the 1870s, land between Bell to Lithgow was largely unoccupied and consisted of native bushland. In the early 1870s, following the construction of the western railway, land adjacent to the railway began to be utilised by private settlers for pastoral and agricultural use. Numerous mining leases were also acquired to exploit coal deposits associated with the Illawarra Coal Measures. Construction of a road network adjacent to the railway allowed residential population settlement to increase in the area until the late 1930s when mining operations at Newnes diminished.

The current Chifley Road began to be constructed during upgrades to transport routes in the area which commenced in World War II, as an alternative military transport and evacuation route from Sydney. The current road alignment was gazetted as a road reserve in 1956.

A search of the NSW EPA CLM register carried out on the 5 February 2016 for sites located within the suburbs of Bell and Clarence, and the Lithgow LGA found that whilst there are some notices for properties located within the Lithgow LGA, none were located within 1km of the proposal area.

A search of the online list of sites notified to the NSW EPA under Section 60 of the *Contaminated Land Management Act 1997* (CLM Act) carried out on the 4 February 2016 found no notified sites are located within 1km of the proposal area, with the exception of the Clarence Colliery mine which is located approximately 900m north of the proposal area at the Clarence road over rail bridge.

No potentially contaminating industries were noted within the proposal area during site investigations, with the exception of the Locomotive Maintenance Centre located at the base of Scenic Hill. Demolition material (brick, stone and concrete) and potential asbestos containing material within the vegetated road reserve at the top of Scenic Hill was also observed. The source of this stockpile is most likely from illegal dumping in the area (see Section 4.17 of report in Appendix D).

Information regarding the history of ancillary sites 1 to 3 as determined from the Phase 1 investigation is summarised below and provided in Appendix C.

6.3.2 Existing environment

Topography
The topography in the study area is steep to undulating and follows an east to west trending ridge of high ground known as the Newnes Plateau. Elevations along the Newnes Plateau range from about 1070m AMSL at Bell in the east to 950m AMSL at the base of Scenic Hill in the west. The ground surface slopes steeply down from the plateau to the north and towards the Hartley Valley in the south.

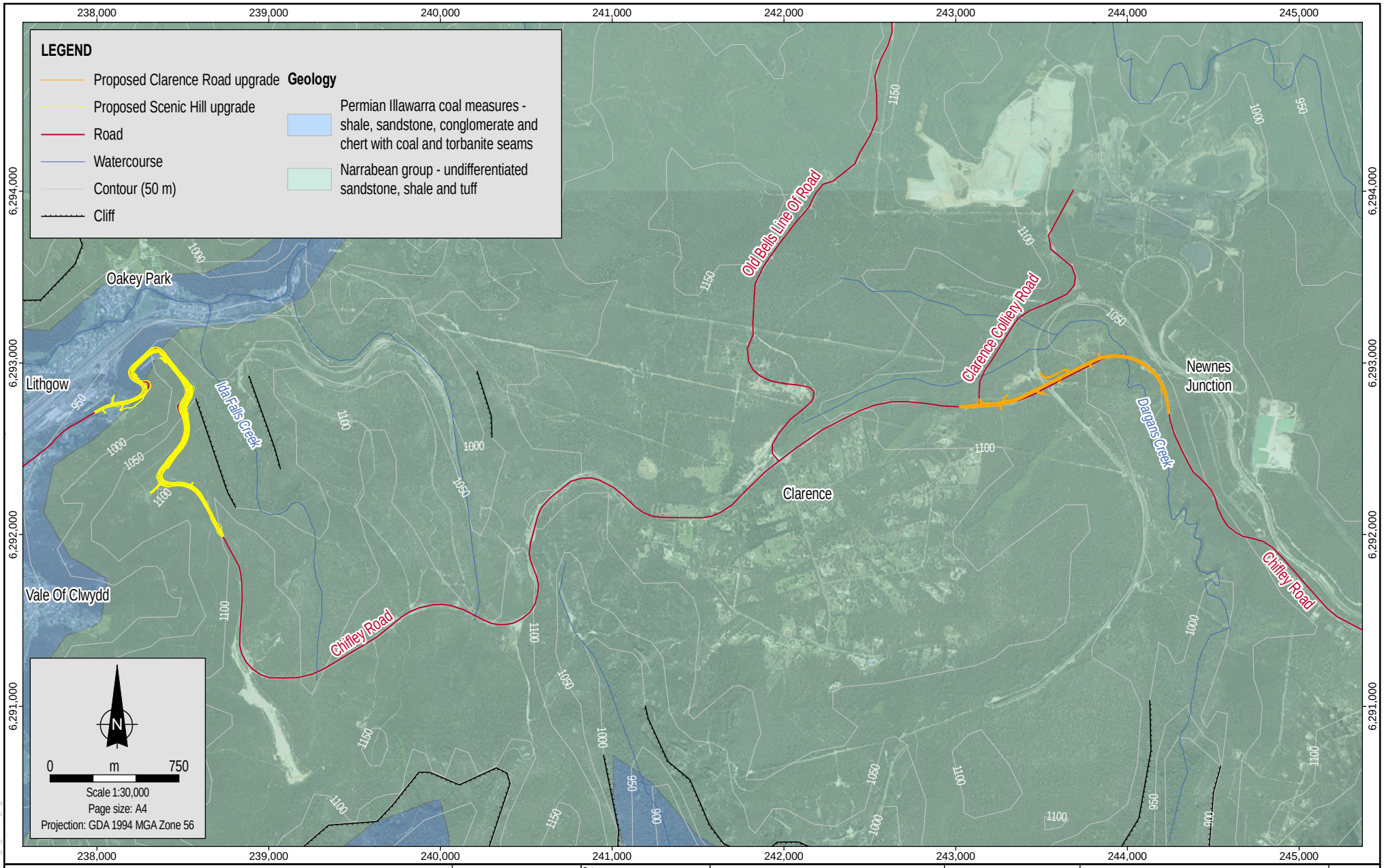
Geology and soils
The geology of the Western Blue Mountains is summarised below and illustrated on Figure 6.1.

The Sydney 1:250,000 Geological series sheet shows Permian deposits of Illawarra Coal Measures at Scenic Hill consisting of shale, sandstone, conglomerate, and chert with coal and torbanite seams. At Scenic Hill, Triassic Hawkesbury sandstone is evident – sandstone and quartz with some shale (Sydney 1:250,000 Geological series sheet).

A large number of soil landscapes occur in the vicinity of the proposal area. The Scenic Hill area is characterised by the Lithgow, Hassans Walls and Wollangambie soil landscapes and the Clarence area is characterised by the Deanes Creek, Wollangambie and Mount Sinai soil landscapes. Details of these soil landscapes are summarised in the Aboriginal Heritage Assessment (Section 3.1.2 of Appendix E).

The area has a long history of coal mining. Information from the NSW Geological Survey suggests that Chifley Road was undermined both in the east at Bell and west at Lithgow. The Clarence road over rail bridge section is protected from mining subsidence by a subsidence protection zone. Preliminary consideration of mining activity in the proposal area indicates that the New Vale Mine (now closed) is directly under Scenic Hill. Seam levels at the bottom of Scenic Hill are about 98m below road level and at the top of Scenic Hill about 213m below road level.

The proposal lies within the Lithgow Mine Subsidence District as discussed in Section 4.2.



Source:
Proposed road upgrade data, geology and aerial imagery from NSW Roads and Maritime Services.
Project features digitised by Coffey.
Contours and cliffs from GEODATA250k (optimum scale 1:250,000).

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Date: 25.07.2016
Project: ENAURHOD03119AB
File Name: 3119AB_01_F06.01_GIS

NSW Roads and Maritime Services

Bells Line of Road – Chifley Road upgrade

Transport Roads & Maritime Services

Geology and topography at location

Figure No: 6.1

MXD Reference: 3119AB_01_GIS005_v0_4

Site observations

In the vicinity of the Clarence road over rail site, Chifley Road generally overlies the Banks Wall Sandstone. Soils overlying rock in this area are typically thin (< 1m) or absent, and consist of sands, gravelly sands and clayey sands. The Banks Wall Sandstone, which can be observed in cuttings in this area (Plate 6.1), consists of medium to coarse grained sandstone which is yellow or orange in colour.

Plate 6.1 Sandstone at road cutting (left); steep embankments next to road corridor (right)

At the base of the road over rail bridge site, residual soils up to 1.5m thick overlie weathered sandstone. The soils comprise gravelly sand and sandy gravel with minor clay. The sandstone is highly weathered near the ground surface and moderately weathered toward the base of the existing cutting.

The Scenic Hill section of road descends through almost the entire suite of Narrabeen Group rocks and into the Illawarra Coal Measures. Ground conditions are variable along this section as the road overlies different rock types, from sandstone at the top of the hill passing through further sandstone as well as siltstone and claystone in the middle sections to coal bearing rocks at the base. Soils are generally very thin with gravelly and sandy material present over weather sandstone.

Acid sulfate soils

The ASRIS map shows that the proposal area is categorised as an area of no known occurrence of acid sulfate soils.

Acid sulfate rock contains sulfide and sulfate minerals which result in acid formation and acid rock drainage when exposed to oxygen and water, such as in cuttings. Acid sulfate rock is known from the general region and could occur within the proposal area. Geotechnical testing will be undertaken to confirm this categorisation and should acid rock be found, suitable management measures and safeguards would be developed and implemented.

Contaminated land

Historical aerial photographs indicate that the areas surrounding Scenic Hill and the Clarence road over rail bridge have remained largely undeveloped (bushland) since 1950, with the exception of the Lithgow and Clarence.

A search of the NSW EPA CLM register was carried out on 5 February 2016 for ancillary site 1 and ancillary site 2, and returned some current and former notices for properties within the City of Lithgow LGA. These properties are not located within 1km radius of either of the ancillary sites.

Based on the site visit, database searches and Phase 1 investigation of ancillary sites 1 to 3 (Appendix C), the following contamination could be present within the proposal area:

- Soil contamination, including potential asbestos containing material, associated with illegal dumping adjacent to and within the road corridor
- Soil contamination from fill material used at or near the surface at ancillary site 3. The extent of contamination at this location is likely to be localised
- Potential soil and/or groundwater contamination from contaminating industry located in the vicinity of the proposal area, namely:
  - The Clarence Colliery mine, although contamination is low given the distance to the proposal area and the location of the proposal area on a plateau (ie upslope) of potential contaminant sources
  - The Locomotive Maintenance Centre located at the base of Scenic Hill. Potential contaminants could include petroleum hydrocarbons and metals from workshop activities and leaks and spills, and asbestos containing material from breakdown or repair of rail parts such as brakes. Contamination of soil and groundwater will be localised given the location of the centre downslope from Scenic Hill
  - The rail corridor adjacent to the Clarence road over rail bridge and ancillary site 3 with potential contaminants including petroleum hydrocarbons from leaks and spills and asbestos containing material
  - Historical and current agricultural land uses (eg orchards, animal grazing, cropping) which use and store chemicals, including pesticides and herbicides, and petroleum hydrocarbon fuels. Waste materials, including demolition materials and asbestos containing material, could also be stored on the land or used for infilling. The potential for contamination from agricultural activities in the area is low given the downslope location of the proposal area on a plateau (ie upslope) of potential contaminant sources.

6.3.3 Potential impacts

The proposal would result in disturbance of the surface of the site at the ancillary facilities and along the road alignment through removal of vegetation, excavation and earthworks (cut and fill), stripping of topsoil and stockpiling and movement of machinery. Full details of proposed activities are contained in Section 3. Both Scenic Hill and Clarence road over rail bridge upgrades have been designed to minimise the generation of excess spoil and/or the need to import large quantities of fill.

During construction, exposed loose soils could become mobilised with increased potential for soil erosion. Such sediments may be mobilised into nearby watercourses. Impacts associated with sedimentation of watercourses are addressed in Section 6.1.3. Controls to avoid and reduce erosion and mobilisation of soils that would be put in place during construction are detailed in Section 6.2.4. Rehabilitation of exposed soils would occur progressively to reduce the area of exposed soils in the proposal area. Soil and erosion impacts from the proposal are predicted to be low for most areas of the Clarence road over rail bridge section and moderate at the eastern end of this area where steep slopes coincide with the location of the majority of earthworks. For the Scenic Hill section, potential soil and erosion impacts are moderate to high due to the steep topography and extent of earthworks required. Extensive safeguards and management measures will be required in this area to reduce the extent and severity of the impacts.

The work is not expected to encounter and disturb acid sulfate soils as the risk of acid sulfate soils occurring in the area is extremely low. Should geotechnical testing identify the presence of acid rock, run-off from these areas could impact on the water quality of receiving watercourses.

To date, site inspections, and geotechnical investigations, have uncovered no evidence of contaminated soils within the proposed alignment. However, during earthworks to construct the road, unexpected contaminated soil could be brought to the surface or bought on to the site. Disturbance of potentially contaminated materials may expose construction workers or the public to these contaminants if controls are not put in place. Construction activities also have the potential to

release contaminants to the environment through accidental spills of hazardous materials such as fuel and chemicals. Management of potential contamination unearthed unexpectedly, including asbestos containing material, is discussed in Section 6.12.

Without proper management, contaminants may run off into the local waterways, particularly during rainfall events. Surface water runoff could become contaminated with, for example, petrochemicals and construction litter and could degrade water quality in local waterways (see Section 6.2.4).

Overall, the potential impact as a result of the proposal of contamination of soils or water in the proposal area and surrounds is negligible to low.

During operations, predicted impacts are expected to be negligible along the road corridor as exposed areas are paved or rehabilitated greatly reducing erosion potential and the potential for contamination is significantly reduced.

6.3.4 Safeguards and management measures

Safeguards and management measures proposed to avoid, reduce or manage impacts on topography, geology and soils are discussed in Table 6.3. The safeguards and management measures relating to erosion and sedimentation impacts are in addition to those included in tables 6.1 and 6.2 and should be read in conjunction with the measures in this table.

Table 6.3 Safeguards and management measures relating to topography, geology, soils and contamination

Impact	Environmental safeguards	Responsibility	Timing
Acid sulfate rock	• Geotechnical testing will be carried out to assess the likelihood that cuttings will be through acid sulfate rock, and the potential this will have to generate acid leachate. If present, acid sulfate rock will be managed in accordance with the Guidelines for the Management of Acid Sulfate Materials: Acid Sulfate Soils, Acid Sulfate Rock and Monosulfidic Black Ooze (RTA, 2005).	Contractor	Detailed design
Management of excess or unsuitable material	• A Waste Management Plan will be prepared and implemented as part of the CEMP. The plan will identify the locations of spoil stockpiles, and methods to re-use or dispose of excess or unsuitable spoil material including estimated volumes and disposal sites.	Contractor	Pre-construction
Soil erosion	• Areas of high erosion risk, such as steep areas or highly erodible soils, will be identified during the development of the site specific erosion and sediment control plan and appropriate management controls implemented.	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
Soil erosion	• A registered Soil Conservation Consultant will be engaged during construction to advise on the types of controls required in areas of high erosion risk. The Soil Conservation Consultant will undertake regular inspections and surveillance of the work to ensure that erosion and sediment controls are being implemented and maintained.	Contractor	Construction
Soil erosion	• Stockpiles will be designed, established, operated and decommissioned in accordance with the Roads and Maritime's Stockpile Site Management Guideline 2015 (RMS, 2015b).	Contractor	Construction
Soil erosion	• Stockpile management will consider the following: On relatively level ground and up-slope of sediment control barriers Have ready access to the road network or direct access to the construction corridor Away from areas of ecological and heritage conservation value In areas previously disturbed within the proposal area that do not require the clearing of native vegetation Away from residential buildings At least 5m clear of all areas of possible concentrated water flow and at least 10m from a waterway (any Class 1 or Class 2 fish habitat waterways as described in the NSW Fisheries guidelines) Limit topsoil stockpile height to 2m where practical Cover or otherwise protect from erosion, stockpiles that will be in place for more than 20 days as well as any stockpiles that are susceptible to wind erosion, within 10 days of forming each stockpile.	Contractor	Construction
Soil erosion	• Activities will be planned and sequenced to minimise the length of time disturbed soil remains exposed, and limit the time of soil stockpile storage before the material is reused or removed from the site.	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
Soil erosion	• Consistent with any specific requirements of the approved erosion and sediment control plan, a monitoring program will be implemented during construction to ensure effective implementation of all temporary and permanent soil, erosion and water pollution safeguards. The timing and frequency of monitoring inspections will be set out in the plan. The inspections will assess implementation and success of the controls, actions required to ensure on-going effective operation, and compliance with any statutory approvals. A register of inspections will be established.	Contractor	Construction
Disturbance of contaminated soil / contamination of environment	• Visual inspections will be undertaken during excavation activities to ensure no waste material from dumping is present. If encountered, stockpile separately from other spoil. An unexpected finds procedure will be developed as part of the Waste Management Plan.	Contractor	Construction
Disturbance of contaminated soil / contamination of environment	• If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other work that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA.	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
Disturbance of contaminated soil / contamination of environment	• Prior to the acceptance of any soil onsite (regardless of volume), the following actions must be taken to reduce the risk of receiving contaminated material: Ensure that all fill used is virgin excavated natural material (eg clay, gravel, sand, soil or rock) that is not mixed with any other waste Request the supplier provides formal certification that the fill material is clean VENM Request the supplier provide information on what activities previously occurred onsite where there fill was sourced Check for signs of contamination, such as odours (chemical/petrol), staining from chemicals, and rubbish such as bricks, timber, masonite, etc Supervise the delivery of the material to ensure the material received matches the material ordered Material from a known or potentially contaminated site must not be accepted without EPA approval Maintain all documents and records.	Contractor	Construction
Disturbance of contaminated soil / contamination of environment	• Hazardous materials such as fuel and chemicals will be stored in suitably located and bunded areas, in accordance with DECC's Storing and Handling Liquids: Environmental Protection Participants Manual (DECC, 2007).	Contractor	Construction

6.4 Biodiversity

This section describes the existing environment, potential impacts and proposed safeguards and management measures in relation to terrestrial and aquatic biodiversity in the proposal area. RPS Australia East Pty Ltd carried out terrestrial and aquatic biodiversity surveys and assessments for the proposal area in 2015 and 2016 (RPS, 2016; Appendix F and Appendix G). The assessment sought to:

- Describe biodiversity occurring or likely to occur in the study area through desktop and field studies, with a focus on species or communities listed under the *Threatened Species Conservation Act 1995* (TSC Act), *Fisheries Management Act 1994* (FM Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Assess potential impacts on ecological values as a result of the proposal and present recommendations to manage these impacts.

The study area for the assessment was defined as the area of proposed work at Scenic Hill and Clarence over rail bridge and a surrounding 50m buffer. The aquatic biodiversity study area focussed on the Clarence over rail bridge area, in particular reaches of Dargans Creek upstream and downstream of the road corridor.

Desktop database searches and literature reviews for both terrestrial and aquatic biodiversity assessments included a broader area around the site, including the Lithgow region and Blue Mountains area. Database searches for the proposal included a 10km radius from the site.

Database reviews included records contained in the OEH Atlas of NSW Wildlife, Department of the Environment (DoE) Protected Matters Search tool, Vegetation of the Western Blue Mountains (DEC, 2006a), Mitchell Landscapes (NPWS, 2003), region and subregion mapping (IBRA7) and aerial imagery.

From the desktop review, a preliminary likelihood of occurrence assessment was made to guide field survey effort and method. Field surveys of the study area were carried out in four periods between October 2015 and March 2016, over 15 days in total (terrestrial biodiversity), and in March 2016 over two days (aquatic biodiversity). Field investigations for terrestrial biodiversity included vegetation mapping, inventories of plants found, targeted searches for plants of conservation significance, use of camera traps other recording devices to identify wildlife species including bats, bird census, spotlighting at night, opportunistic searches and assessment of the condition and value of habitat across the study area. Field investigations for aquatic biodiversity included water quality, macroinvertebrate sampling of and habitat assessments of the Dargans Creek corridor.

Terrestrial and aquatic biodiversity survey sites are shown on Figure 6.2.

From the results of the desktop searches and field surveys, potential biodiversity constraints were mapped using a combination of factors such conservation significance and landscape features. Survey results including vegetation community mapping and threatened species habitat condition assessments were fundamental to this process.

Full details of the method employed when carrying out these assessments is provided in Appendix F and Appendix G.

6.4.1 Existing environment

The proposal site is part of the Chifley Road corridor connecting Lithgow and Richmond, and is a sealed road corridor surrounded by areas of native vegetation. Some weeds are present. The road corridor has been in place since the 1940s, and as such the ecological values of the habitat surrounding the proposal site have been influenced and shaped by its presence for a long period. The study area for the proposal is situated in the Sydney Basin bioregion, and the Wollemi subregion. The site is characterised by ridge formations in the west and steep slopes, whilst the east comprises a plateau formation bisected by ephemeral and permanent drainage lines, including Dargans Creek. This drainage flows south into the nearby Blue Mountains National Park.

The vegetation of the site predominantly comprises native vegetation, with areas of disturbed roadside weeds.

Protected areas

The Blue Mountains National Park is located to the east of the study area and is part of the Greater Blue Mountains Area, listed on the National Heritage List and the World Heritage List under the EPBC Act. At its closest point, the Blue Mountains National Park is approximately 500m to the southeast of the Clarence road over rail bridge proposal area along the current road alignment.

No direct impacts are predicted on the values of the National Park, although the vegetation communities of the study area are contiguous with those of the adjacent National Park. Dargans Creek, which flows under the current road alignment at the Clarence road over rail bridge section, also drains into the National Park. Section 6.4 discusses potential indirect impacts on the Blue Mountains National Park.

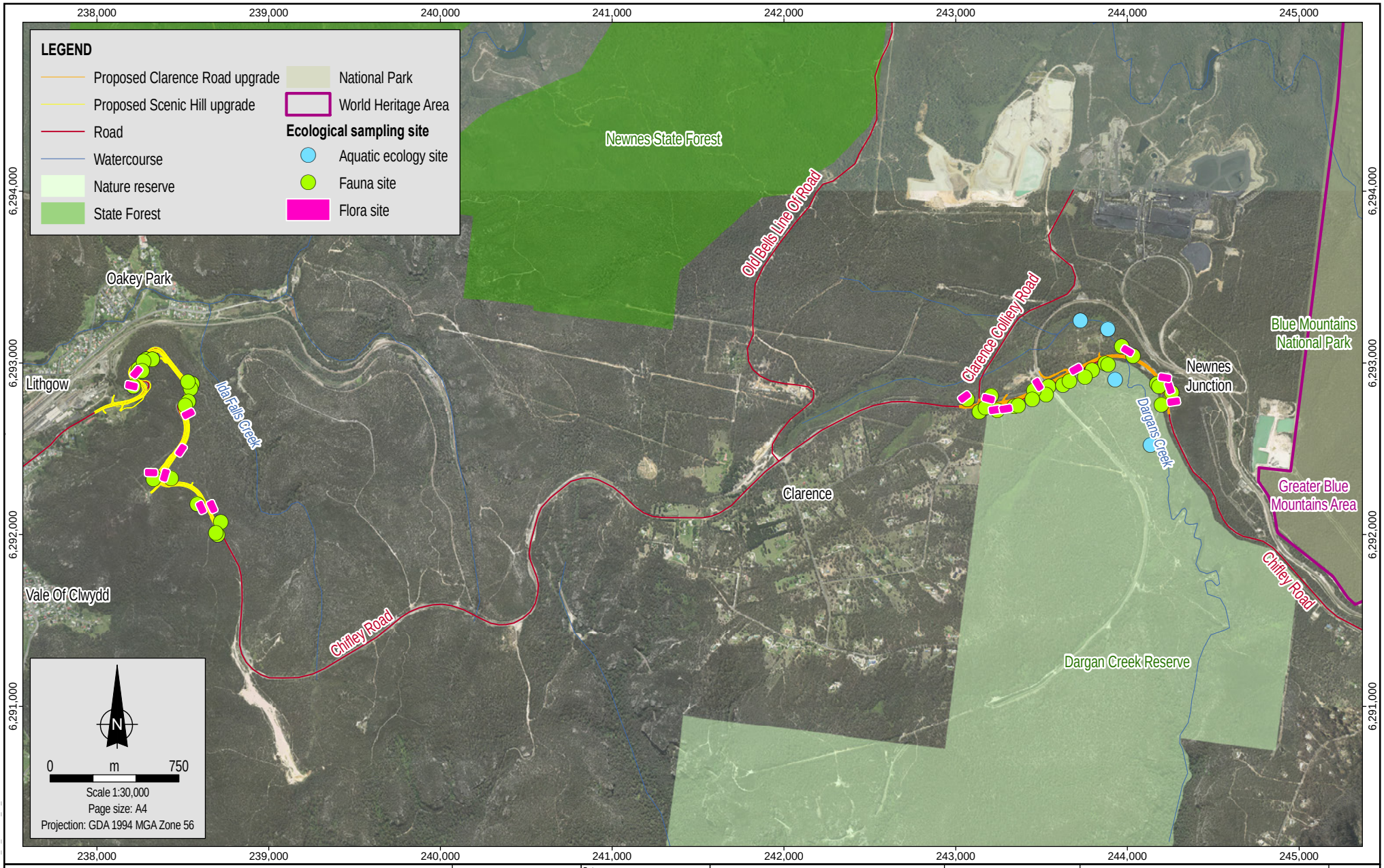
Newnes State Forest is about 1km to the north of Chifley Road and this area is not predicted to be impacted by the proposal (and is not discussed further in this report).

Dargan Creek Reserve is located immediately to the south of the Clarence road over rail bridge section.

Protected areas in the vicinity of the proposal are shown on Figure 6.2.

Vegetation communities

About 44ha of native vegetation was mapped in the study area. Regional native vegetation mapping (DEC, 2006a) was ground-truthed and inaccuracies in vegetation type and boundaries were corrected. Ground-truthed vegetation communities mapped at the site (following DEC nomenclature) are shown on Figure 6.3a and 6.3b and detailed in Table 6.4.



Source:
Proposed road upgrade data, ecological sites and aerial imagery from NSW Roads and Maritime Services.
Project features and reserves digitised by Coffey.
WHA from DSEWPC (data currency 2007).
National Parks from OEH.
State forests from GEODATA250k (optimum scale 1:250,000).

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NSW Roads and Maritime Services

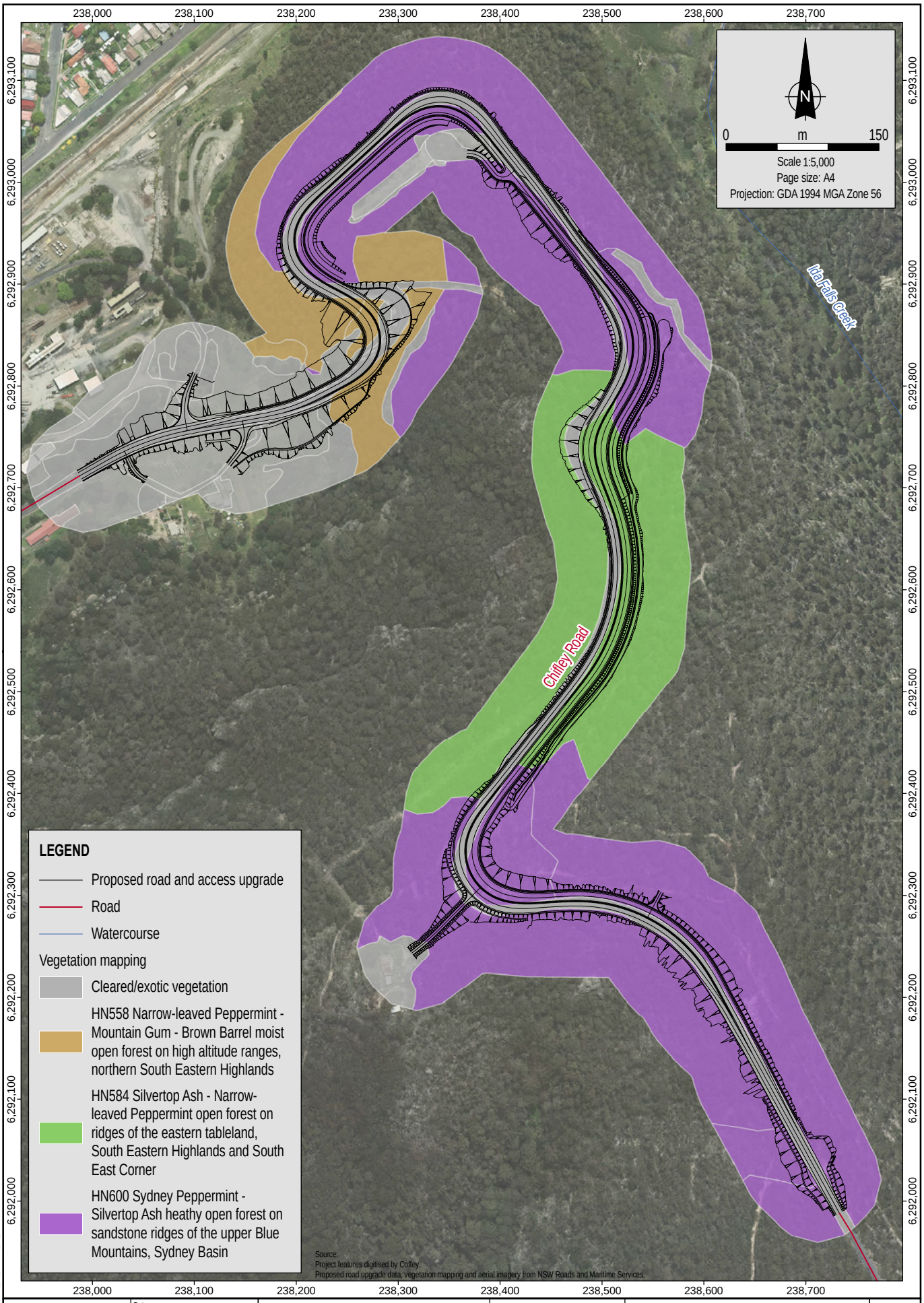
Bells Line of Road – Chifley Road upgrade

Transport Roads & Maritime Services

Ecological survey sites and protected areas

Figure No: 6.2

MXD Reference: 3119AB_01_GIS07_v0_5



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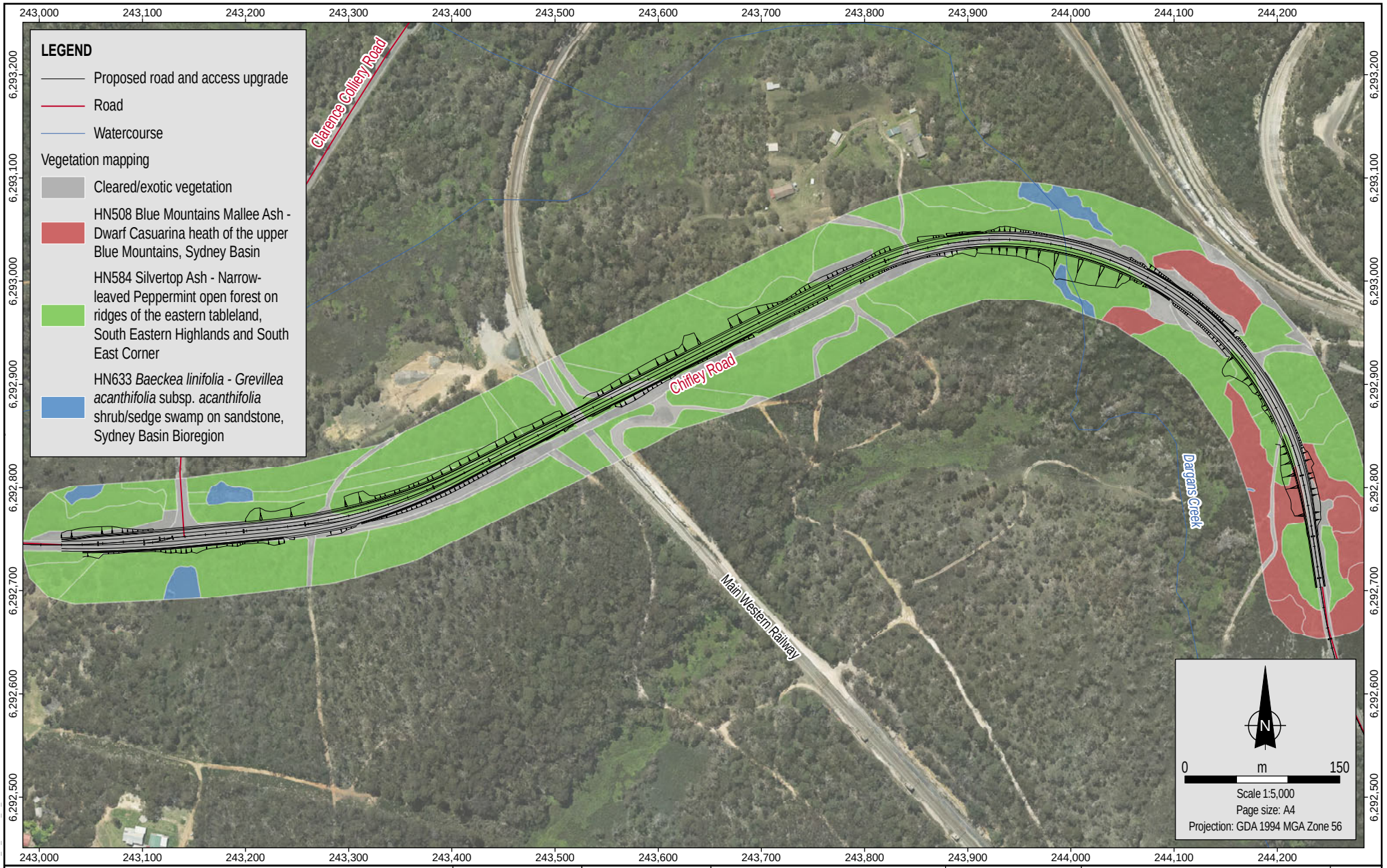
Bells Line of Road – Chifley Road upgrade

Transport Roads & Maritime Services

Vegetation communities in the study area at Scenic Hill

Figure No: 6.3a

MXD Reference: 3119AB_01_GIS009_v0_5



Source:
Project features digitised by Coffey.
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NSW Roads and Maritime Services

Bells Line of Road – Chifley Road upgrade

Transport Roads & Maritime Services

Vegetation communities in the study area at Clarence road over rail bridge

Figure No: **6.3b**

MXD Reference: 3119AB_01_GIS010_v0_7

Table 6.4 Vegetation communities mapped in the study area

Map unit	Community	Area (ha)	Description	Native Plant Community Type (PCT) equivalent
6	Montane sheltered narrow-leaved peppermint forest	4.9	Found in the western part of the study area on southwest facing slopes. This community is not representative of a threatened ecological community under the TSC Act or EPBC Act.	HN558 Narrow-leaved peppermint - mountain gum - brown barrel moist open forest on high altitude ranges, northern south eastern highlands.
26	Newnes Plateau narrow-leaved peppermint – silver-top ash layered open forest (Plate 6.2)	22.3	Widespread across the study area, with most vegetation in the east comprising this community. Open forest on the top of ridges and plateaux. Recent evidence of bushfire apparent in understorey regeneration. This community is not representative of a threatened ecological community under the TSC Act or EPBC Act.	HN584 Silvertop ash - narrow-leaved peppermint open forest on ridges of the eastern tableland, south eastern highlands and south east corner.
26a	Newnes Plateau gum hollows variant: brittle gum – mountain gum, scribbly gum – snow gum shrubby open forest	6.5	Occurs in slight depressions in the study area, differs from the above community in shorter heights and community composition. This community is not representative of a threatened ecological community under the TSC Act or EPBC Act.	HN584 Silvertop ash - narrow-leaved peppermint open forest on ridges of the eastern tableland, south eastern highlands and south east corner.
28	Sandstone plateau and ridge scribbly gum – silver-top ash shrubby woodland	1.1	Occurs in the west of the study area on ridge tops with shallow soils.This community is not representative of a threatened ecological community under the TSC Act or EPBC Act.	HN600 Sydney peppermint - silvertop ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin
30	Exposed Blue Mountains Sydney peppermint – silver-top ash shrubby woodland (Plate 6.3)	6.6	Occurs in west and northeast of the study area, forming open woodland with dense understorey along slopes near ridge tops. This community is not representative of a threatened ecological community under the TSC Act or EPBC Act.	HN600 Sydney peppermint - silvertop ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin
45	Newnes Plateau tea tree – banksia – mallee heath	1.3	Occurs in the east of the study area on shallow soils on exposed crests of the Newnes Plateau. This community is not representative of a threatened ecological community under the TSC Act or EPBC Act.	HN508 Blue Mountains mallee ash - dwarf casuarina heath of the upper Blue Mountains, Sydney Basin
46	Newnes Plateau dwarf sheoak – banksia heath	0.5	Occurs in small patches in south of the study area on thin soils on rock shelves. This community is not representative of a threatened ecological community under the TSC Act or EPBC Act.	HN508 Blue Mountains mallee ash - dwarf casuarina heath of the upper Blue Mountains, Sydney Basin

Map unit	Community	Area (ha)	Description	Native Plant Community Type (PCT) equivalent
50	Newnes Plateau shrub swamp (Plate 6.4)	0.4	Occurs along open drainage lines in the study area, forming a wet heath with tussocky grassland. Occurs in areas of low relief particularly drainages in the Clarence section. This community corresponds to the Newnes Plateau shrub swamp in the Sydney Basin bioregion Endangered Ecological Community (EEC) listed under the TSC Act and a component of the Temperate Highland Peat Swamps on Sandstone EEC listed under the EPBC Act.	HN633 *Baeckea linifolia* - *Grevillea acanthifolia* subsp. *acanthifolia* shrub/sedge swamp on sandstone, Sydney Basin Bioregion
62	Cleared and severely disturbed lands	10.8	Mainly comprises the area of hard standing of the road and associated verges.	N/A
-	Exotic vegetation cover (Plate 6.5)	5	Occurs mainly along the roadsides but also in large patches in the west of the study area. Comprised various exotic species including *Rubus fructosis, Bidens pilosa* and *Paspalum dilatatum.*	N/A

Plate 6.2 Newnes Plateau Narrow-leaved Peppermint - Silver-top Ash Layered Open Forest (Map Unit 26)

Plate 6.3 Exposed Blue Mountains Sydney Peppermint - Silver-top Ash Shrubby Woodland (Map Unit 30)

Plate 6.4 Newnes Plateau Shrub Swamp (Map Unit 50)

Plate 6.5 Exotic vegetation cover

Flora records

The surveys identified 179 flora species, including nine exotic species. These species are listed in Appendix 4 of Appendix F. The noxious introduced blackberry (*Rubus fruticosis*) was widespread in the proposal area, in particular along the roadsides. This species is a Class 4 locally controlled weed in the Lithgow area under the *Noxious Weeds Act 1993* (Section 4.2).

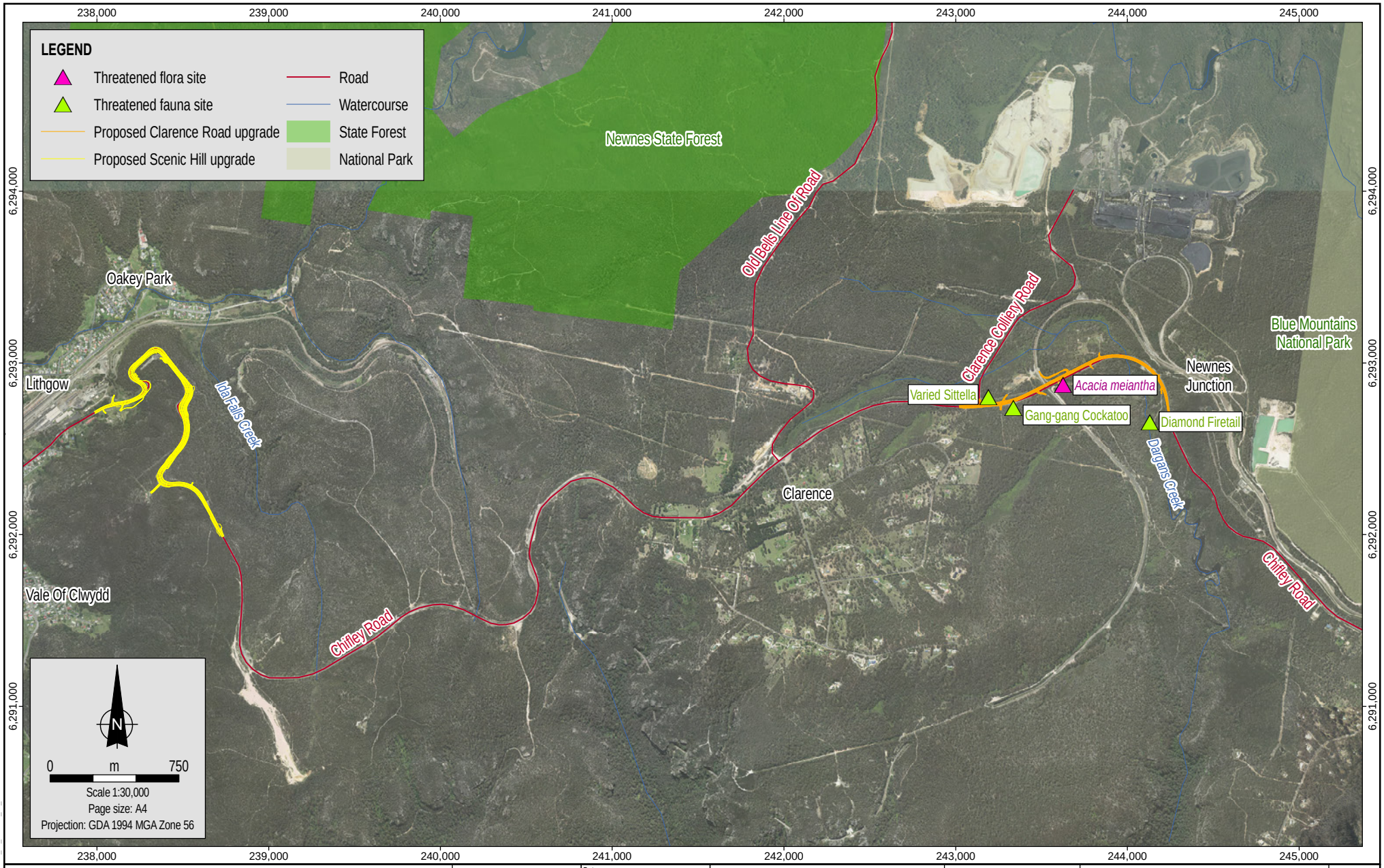
Mjadwesch Environmental Service Support (2010) also recorded weed species in the proposal area, particularly near the road verges and the inside of the first curve on Scenic Hill. Class 4 species recorded included Scotch Broom (*Cytisus scoparia*), Privet (*Ligustrum sinense*) and African Lovegrass (*Eragrostis curvula*),

A search of threatened flora records in the OEH Atlas of NSW Wildlife, found 53 species have been recorded or have the potential to be recorded within 10km of the study area. The majority (30) of these species were assessed as being unlikely to occur, as suitable habitat or micro-habitat does not exist (see Appendix 3 of Appendix F). Twenty-three species were assessed as having the potential to occur and were targeted during field surveys.

No EPBC Act listed flora species were identified during field surveys. One species listed under the TSC Act was recorded - *Acacia meiantha* (listed as Endangered). This species was recorded in the

eastern section of the study area (south of the road alignment) and comprised a total of 145 specimens beneath the power line easement east of the railway crossing. The location of this record is shown on Figure 6.4.

Threatened flora species listed under the EPBC Act or TSC Act known to occur, or with potential to occur are summarised in Table 6.5.



MXD Reference: 3119AB_01_GIS008_v0_5

Source:
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NSW Roads and Maritime Services

Bells Line of Road – Chifley Road upgrade

Transport Roads & Maritime Services

Threatened flora and fauna sightings during ecological surveys

Figure No: 6.4

Table 6.5 Threatened flora species known to occur or potentially occurring

Common name	Scientific name	TSC Act status	EPBC Act status	Habitat and likelihood of occurrence
-	*Acacia baueri* subsp. *aspera*	Vulnerable	-	Occurs in low, damp heathlands, often on exposed rocky outcrops. Habitat and microhabitat present at the site, species may occur.
Bynoe's wattle	*Acacia bynoeana*	Endangered	Vulnerable	Grows in heath and dry sclerophyll on sandy soils. Habitat and microhabitat present at the site, species may occur.
Flockton wattle	*Acacia flocktoniae*	Vulnerable	Vulnerable	Occurs in dry sclerophyll on sandstone. Habitat and microhabitat present at the site, species may occur.
-	*Acacia gordonii*	Endangered	Endangered	Restricted to northwest of Sydney including lower Blue Mountains in dry sclerophyll, heath or sandstone platforms. Habitat and microhabitat present, species may occur.
-	*Acacia meiantha*	Endangered	-	Occurs in open eucalypt forest on sandy soil over sandstone. Species observed.
-	*Boronia deanei*	Vulnerable	Vulnerable	Scattered populations in New South Wales including Blue Mountains in wet heath and along streams. Habitat and microhabitat present at the site, species may occur.
Small pale grass-lily	*Caesia parviflora*	Endangered	-	Found in damp areas of open forest on sandstone. Habitat and microhabitat present at the site, species may occur.
Thick-lip spider orchid	*Caladenia tessellata*	Endangered	Vulnerable	Found in grassy sclerophyll woodland on clay or sandy soils. Habitat and microhabitat present at the site, species may occur.
-	*Carex klaphakei*	Endangered	-	Occurs with other sedges and rushes on sandstone above 600m AMSL. Habitat and microhabitat present at the site, species may occur.
-	*Derwentia blakelyi*	Vulnerable	-	Found in Blue Mountains near Clarence at fewer than 20 locations in eucalypt forest on moist areas. Habitat and microhabitat present at the site, species may occur.
Leafless tongue-orchid	*Cryptostylis hunteriana*	Vulnerable	Vulnerable	Known from a range of communities including swamp heath and woodland. Habitat and microhabitat present at the site, species may occur.

Common name	Scientific name	TSC Act status	EPBC Act status	Habitat and likelihood of occurrence
-	*Darwinia peduncularis*	Vulnerable	-	Occurs in coastal New South Wales with isolated populations in the Blue Mountains on rocky outcrops with sandy soils. Habitat and microhabitat present, species may occur.
-	*Epacris hamiltonii*	Endangered	Endangered	Occurs in creek catchments on the northern side of the Blue Mountains flowing into Grose Valley on or near Narrabean cliffs along perennial creeks, often below hanging swamps. Habitat and microhabitat present at the site, species may occur.
-	*Persoonia acerosa*	Vulnerable	Vulnerable	Occurs in dry sclerophyll, scrubby woodland and heath on poor soils. Habitat and microhabitat present at the site, species may occur.
-	*Persoonia hindii*	Endangered	-	Occurs in dry sclerophyll on sandy soils. Habitat and microhabitat present at the site, species may occur.
Hairy geebung	*Persoonia hirsuta*	Endangered	Endangered	Large area of occurrence including the Blue Mountains in small populations. Found on sandy soils in sclerophyll woodland and heath on sandstone. Habitat and microhabitat present at the site, species may occur.
-	*Persoonia marginata*	Vulnerable	Vulnerable	Favours dry woodland on sandstone, and higher densities in disturbed areas. Habitat and microhabitat present at the site, species may occur.
Tawny leak-orchid	*Prasophyllum fuscum*	Critically endangered	Vulnerable	Only known from upper catchment of Georges River, on the margins of swamps at moderate altitudes. Habitat and microhabitat present at site, species may occur.
-	*Prasophyllum pallens*	Vulnerable	-	Grows in low, dense heath in moist soils above sandstone. Habitat and microhabitat present at the site, species may occur.
Tarengo leek-orchid	*Prasophyllum petilum*	Endangered	Endangered	Occurs in grassy woodland or natural grassland. Habitat and microhabitat present at the site, species may occur.
-	*Prasophyllum* sp. *wybong*	-	Critically endangered	Occurs in grassy woodland or natural grassland. Known from seven populations in eastern New South Wales. Prasophyllum sp. Wybong is now included with P. *petilum* (see above). Habitat and microhabitat present, species may occur.
-	*Pultenaea glabra*	Vulnerable	Vulnerable	Occurs in swamp margins within sclerophyll forest and in tall damp heath on sandstone. Habitat and microhabitat present at the site, species may occur.

Common name	Scientific name	TSC Act status	EPBC Act status	Habitat and likelihood of occurrence
Eastern underground orchid	*Rhizanthella slateri*	Vulnerable	Endangered	Only known from ten locations but difficult to detect. Habitat requirements poorly understood. Habitat and microhabitat present at the site, species may occur.

Fauna records

Thirty-five fauna species were detected during the field surveys through a variety of techniques (see in Appendix 5 of Appendix F).

A search of threatened fauna records in the OEH Atlas of NSW Wildlife found 50 species have been recorded or have the potential to be recorded within 10km of the study area (see Appendix 3 of Appendix F). The majority (28) of these species are assessed as having potential to occur and were targeted during field surveys. Twenty-two species were assessed as being unlikely to occur as suitable habitat or micro-habitat does not exist in the study area to support them.

No EPBC Act listed fauna species were identified during field surveys. Three species listed as Vulnerable under the TSC Act were recorded – gang-gang cockatoo (*Callocephalon fimbriatum*), diamond firetail (*Stagonopleura guttata*) and varied sittella (*Daphoenositta chrysoptera*). These species was recorded in the Clarence road over rail bridge section of the study area. The location of these records is shown on Figure 6.4.

Threatened fauna species listed under the EPBC Act or TSC Act known to occur, or with potential to occur are summarised in Table 6.6.

Table 6.6 Threatened fauna species known to occur or potentially occurring in the study area

Common name	Scientific name	TSC Act status	EPBC Act status	Habitat and likelihood of occurrence
Gang-gang cockatoo	*Callocephalon fimbriatum*	Vulnerable	-	Occupies tall montane forests and woodlands, moving to lower altitudes in winter. Species was observed.
Speckled warbler	*Pyrrholaemus sagittatus*	Vulnerable	-	Occurs in a wide range of eucalypt communities. Habitat and microhabitat present at the site, species may occur.
Brown treecreeper	*Climacteris picumnus victoriae*	Vulnerable	-	Found in eucalypt woodlands, usually with a grassy understorey. Habitat and microhabitat present at the site, species may occur.
Varied sittella	*Daphoenositta chrysoptera*	Vulnerable	-	Inhabits a wide range of dry eucalypt woodlands. Species was observed.
Little lorikeet	*Glossopsitta pusilla*	Vulnerable	-	Occurs in mainly dry woodlands in coastal New South Wales and the Great Dividing Range. Habitat and microhabitat present at the site, species may occur.
Little eagle	*Hieraaetus morphnoides*	Vulnerable	-	Favours a wide variety of woodland and open habitats, nesting in tall trees. Habitat and microhabitat present at the site, species may occur.
Square-tailed kite	*Lophoictinia isura*	Vulnerable	-	Inhabits a variety of forest types, particularly close to watercourses. Habitat and microhabitat present at the site, species may occur.
Barking owl	*Ninox connivens*	Vulnerable	-	Found in woodland, open forest and scrub. Habitat and microhabitat present at the site, species may occur.
Powerful owl	*Ninox strenua*	Vulnerable	-	Found in wet or dry forests and rainforests, roosting in gullies and requiring trees with hollows for nesting. Habitat and microhabitat present at the site, species may occur.
Scarlet robin	*Petroica boodang*	Vulnerable	-	Occurs in dry, open eucalypt woodlands. Habitat and microhabitat present at the site, species may occur.
Diamond firetail	*Stagonopleura guttata*	Vulnerable	-	Occurs in open forests. Species was observed

Common name	Scientific name	TSC Act status	EPBC Act status	Habitat and likelihood of occurrence
Masked owl	*Tyto novaehollandiae*	Vulnerable	-	Inhabits a diverse range of woodland habitats, with tall trees with hollows for roosting and nesting. Habitat and microhabitat present at the site, species may occur.
Eastern pygmy-possum	*Cercartetus nanus*	Vulnerable	-	Inhabits range of woodlands, including rainforest, sclerophyll or dry heath. Roosts in nest hollows or a constructed nest. Habitat and microhabitat present at the site, species may occur.
Large-eared pied bat	*Chalinolobus dwyeri*	Vulnerable	Vulnerable	Found in a variety of dry habitats, roosting in caves. Habitat and microhabitat present at the site, species may occur.
Spotted-tailed Quoll	*Dasyurus maculatus maculatus*	Vulnerable	Endangered	Found in eastern Australia, although only common in Tasmania. Occurs in a range of habitats. Habitat and microhabitat present at the site, species may occur.
Southern brown bandicoot	*Isoodon obesulus obesulus*	Endangered	-	Favours sandy soils with scrubby vegetation. Post fire regeneration is required for the species. Habitat and microhabitat present at the site, species may occur.
Little bentwing-bat	*Miniopterus australis*	Vulnerable	-	Roosts in caves or under bridges, breeding in large aggregations and travelling large distances to feeding areas, mostly in moist eucalypt forest or banksia heath. Habitat and microhabitat present at the site, species may occur.
Eastern bentwing-bat	*Miniopterus schreibersii oceanensis*	Vulnerable	-	Roosts in caves or under bridges or other structures. Habitat and microhabitat present at the site, species may occur.
New Holland mouse	*Pseudohydromys novaehollandiae*	-	Vulnerable	A disjuncted, fragmented population inhabiting heath and open woodlands. Habitat and microhabitat present at the site, species may occur.
Grey-headed flying-fox	*Pteropus poliocephalus*	Vulnerable	Vulnerable	A canopy feeding frugivorous species in a variety of woodlands, commuting large distances from communal roosts to feed. Habitat and microhabitat present at the site, species may occur.
Yellow-bellied sheathtail-bat	*Saccolaimus flaviventris*	Vulnerable	-	Roosts in tree hollows or buildings, and forages in a variety of habitats. Habitat and microhabitat present at the site, species may occur.

Common name	Scientific name	TSC Act status	EPBC Act status	Habitat and likelihood of occurrence
Giant burrowing frog	*Heleioporus australiacus*	Vulnerable	Vulnerable	Occurs in a range of waterbodies associated with sandy habitats. Breeds in hanging swamps, perennial creeks or permanent pools. Habitat and microhabitat present at the site, species may occur.
Littlejohn's tree frog	*Litoria littlejohni*	Vulnerable	Vulnerable	Occurs in dry sclerophyll forest or heathland associated with sandstone outcrops. Favours wide range of waterbodies. Habitat and microhabitat present at the site, species may occur.
Red-crowned toadlet	*Pseudophryne australis*	Vulnerable	-	Occurs on wetter ridge tops and upper slopes of sandstone formations. Breeds in small ephemeral streams lined by dense grasses and shrubs. Habitat and microhabitat present at the site, species may occur.
Blue Mountains water skink	*Eulamprus leuraensis*	Endangered	Endangered	Restricted to isolated permanent sedge and hanging swamps on sloping rock faces in open forest or heath. Habitat and microhabitat present at the site, species may occur.
Rosenberg's goanna	*Varanus rosenbergi*	Vulnerable	-	Specialises in Hawkesbury – Narrabean sandstone outcrops in coastal heaths, humid woodland and sclerophyll forest. Habitat and microhabitat present at the site, species may occur.
Broad-headed snake	*Hoplocephalus bungaroides*	Endangered	Vulnerable	Found among exposed sandstone outcrops in woodland or heath. Habitat and microhabitat present at the site, species may occur.
Giant dragonfly	*Petalura gigantea*	Endangered	-	Found in permanent swamps and bogs mostly east of the Great Dividing Range but known occurrences in Blue Mountains near Clarence. Habitat and microhabitat present at the site, species may occur.

The endangered Blue Mountains water skink (*Eulamprus leuraensis*) was not observed, although suitable habitat has been recorded nearby on the Newnes Plateau. The species could reasonably be expected to occur in shrub swamps in the study area. The failure to detect this species is likely due to the current post fire condition of these swamps (altered vegetation structure, depleted peat and reduced soil moisture).

The habitat of the study area for fauna generally comprises extensive forest, with dense ground cover for small terrestrial species, and moderate amounts of leaf litter on moist soils. Vegetation was considered to be in good condition. A lack of hollows was noted in vegetation limiting roosting and nesting habitat for species such as arboreal mammals, bats and owls. Much of the study area was mapped as being a high biodiversity constraint with areas of very high constraint linked to occurrence of EECs and threatened species habitat (eg occurrence of *Acacia meiantha*).

No koala primary food trees listed for the LGA under Schedule 2 of SEPP 44 were noted, and there are no records of breeding koalas near the study area. The study area is not classified as core koala habitat. Additionally, an analysis performed in accordance with the Commonwealth referral guidelines for the Koala concluded that the proposal does not require referral for impacts on the Koala.

Aquatic biodiversity

The vegetation community adjacent to the Dargans Creek corridor is a dense, wet heath with tussock grass. The community corresponds to the Newnes Plateau shrub swamp in the Sydney Basin bioregion EEC listed under the TSC Act, and to a component of the Temperate Highland Peat Swamps on Sandstone EEC listed under the EPBC Act, as discussed below (Plate 6.6).

Dargans Creek (Plate 6.7) is a perennial watercourse which drains a series of swamps before being regulated by two dams downstream of the road. The creek is a Class 2 fish habitat waterway as described in the NSW Fisheries guidelines. The wider catchment has been impacted by disturbance from the local road network, Clarence rural-residential development and the Clarence Colliery underground mine. The creek channel is narrowly incised, potentially as a result of concentration of flows through a culvert under the existing road alignment.

Plate 6.6 Small drainage line associated with the Newnes Plateau Shrub Swamp

Plate 6.7 Dargans Creek

One threatened species listed under the FM Act, the Macquarie perch (*Macquria australasica*) is recorded in the LGA. This record was 40km to the north of the proposal area and no suitable habitat is present in Dargans Creek.

Results of water quality sampling in Dargans Creek are summarised in Section 6.2 and in full in Appendix G. All water quality parameters were characteristic of an undisturbed site. Low levels were recorded of a number of parameters including electrical conductivity, turbidity, total suspended solids and trace metals.

Macroinvertebrate surveys revealed increasing taxonomic richness progressively downstream most likely a result of increased habitat complexity (including tree roots and trailing vegetation).

An EPBC protected matters search found that two fish species listed under both the TSC Act and EPBC Act have been recorded or have the potential to be recorded within 10km of the study area. An assessment of suitable habitat found both species were unlikely to be present at Dargans Creek and the species were not observed during field survey.

No endangered populations listed under Schedule 4, Part 2 of the FM Act have been recorded in the vicinity of the proposal area.

6.4.2 Potential impacts

Potential impacts on biodiversity values as a result of the proposal consist of direct and indirect impacts. These impacts are discussed below, along with their applicability to key threatening processes listed under Schedule 3 of the TSC Act or under the EPBC Act (Part 13), where applicable.

Direct impacts consist of vegetation and habitat loss, and impacts on aquatic ecosystems in Dargans Creek from temporary changes to flow regimes.

Direct impacts

Vegetation clearance

The proposal would require clearance of about 13.1ha of native vegetation. The vegetation types included in this area are detailed in Table 6.7. The majority of the proposal footprint would overlie disturbed areas within the existing road corridor.

Table 6.7 Predicted areas of vegetation clearance

Vegetation type (PCT)	Area (ha)
HN508 Blue Mountains mallee ash - dwarf casuarina heath of the upper Blue Mountains, Sydney Basin	0.20
HN558 Narrow-leaved peppermint - mountain gum - brown barrel moist open forest on high altitude ranges, northern south eastern highlands	1.23
HN584 Silvertop ash - narrow-leaved peppermint open forest on ridges of the eastern tableland, south eastern highlands and south east corner	5.83
HN600 Sydney peppermint - silvertop ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin	5.82
HN633 *Baeckea linifolia* - *Grevillea acanthifolia* subsp. *acanthifolia* shrub/sedge swamp on sandstone, Sydney Basin Bioregion	0.03

Clearing of native vegetation is a key threatening process under the TSC Act and EPBC Act. The proposal would require the removal of approximately 13.1ha of native vegetation contribute to this key threatening process. The contribution and impact from the proposal is insignificant as the

vegetation loss is associated with types that are not recognised as overcleared or highly overcleared within NSW. The proposal would not make a significant contribution to any progression of these vegetation types to such a status.

Clearing of vegetation may also contribute to the key threatening process, Anthropogenic Climate Change. Large-scale vegetation clearance worldwide is associated with global warming and climate change. The contribution and impact from clearing associated with the proposal on global warming and climate is considered insignificant.

Vegetation type HN633 corresponds to the Newnes Plateau shrub swamp ecological community in the Sydney Basin Bioregion (listed under the TSC Act) and to a component of the Temperate Highland Peat Swamps on Sandstone ecological community listed under the EPBC Act.

An impact assessment has been undertaken on this community in accordance with the 7-part test of significance (Section 5a of the EP&A Act) and in accordance with the EPBC Act Matters of National Environmental Significance – Significant Impact Guidelines 1.1 (DoE, 2013). These assessments found that the proposal would not be likely to cause a significant impact on the threatened community, given the small area (0.03ha) that would be cleared and that the majority of this vegetation within the study area would be avoided by the proposal.

Full details of these tests are contained in Appendix 6 and Appendix 7 of Appendix F. The impact on this community is low.

Habitat loss and fauna mortality

Vegetation clearance and earthworks as a result of the proposal would reduce the habitat available to local flora and fauna species. Habitat predicted to be cleared would largely be adjacent to the existing road corridor, and mostly avoiding the large contiguous areas of higher condition forest. In particular, loss of hollow bearing trees (which play a disproportionate role in habitat resources for wildlife) may impact on species present, and is a key threatening process under the TSC Act. Field surveys indicated no hollow bearing trees were observed in the proposal area, reducing the likelihood of many species occurring. Losses of hollow bearing trees are predicted to be insignificant and the proposal would not significantly contribute to this process.

The majority of threatened species assessed as potentially occurring in the study area were considered unlikely to be significantly impacted by the proposal, either as they were predicted to be absent, or the proposal would have a negligible impact.

Seven fauna species and one flora species were identified as potentially receiving impacts above negligible. Direct impacts may include habitat loss through vegetation clearance and habitat loss and mortality through earthworks. These species were:

- *Acacia meiantha*
- Gang-gang Cockatoo
- Varied Sittella
- Scarlet Robin
- Eastern Pygmy-possum
- Spotted-tailed Quoll
- Blue Mountains Water Skink
- Giant Dragonfly.

Loss of potential habitat for the first six listed species was estimated at 13.1ha, and for the latter two named species as being approximately 0.03ha. An impact assessment has been undertaken on these species in accordance with the 7-part test of significance (Section 5a of the EP&A Act) and (where applicable) in accordance with the EPBC Act Matters of National Environmental Significance – Significant Impact Guidelines 1.1 (DoE, 2013). These assessments found that the proposal would not be likely to cause a significant impact on the threatened species. Additionally, the stand of *Acacia meiantha* has been avoided through the development of the proposal design.

Full details of these tests are contained in Appendix 6 and Appendix 7 of Appendix F. The impact on these species is low.

Vehicle strike

Construction traffic could strike animals crossing the work area to areas of adjacent habitat. Vehicle speeds on works sites would be less than open road speeds and the impact from vehicle strike during construction is predicted to be low.

Impacts on Dargans Creek

Direct impacts on the aquatic ecology of Dargans Creek may eventuate through extension of the existing culvert and realignment of the creek in the vicinity of the culvert.

The proposal is unlikely to cause permanent changes to the drainage and flow regime due to the relatively small size and duration of the work. The potential to alter the hydrology of the catchments within the study area on a local scale is low, provided culverts are appropriately designed and engineered.

Earthworks during construction, particularly those in the vicinity of Dargans Creek, may destabilise the bed and banks of this watercourse and expose them to scouring effects. Resulting sedimentation could smother aquatic habitats downstream, increase nutrient and contaminant loading and alter the composition of species in aquatic communities. The potential for impacts on downstream receiving environments such as Dargan Creek Reserve is low.

Degradation of native riparian vegetation along NSW watercourses is a key threatening process under the TSC Act. The proposal may contribute to this process through vegetation clearance adjacent to Dargans Creek. The small-scale nature of the clearance and implementation of safeguards and management measures proposed in this area would limit the contribution to this process.

The catchment is currently moderately disturbed, with low macrophyte levels and limited habitat complexity. Any increased sedimentation would be unlikely to have significant long term effects on aquatic biodiversity. Appropriate management measures would address impacts and contain them to the immediate area of work, reducing downstream impacts to negligible.

These activities are unlikely to reduce opportunities for fish passage as the watercourse is small with no larger waterbodies upstream. The habitat and aquatic complexity of the watercourse associated with the upper reaches of Dargans Creek is low and direct impacts are predicted to be low.

Indirect impacts

Indirect impacts as a result of the proposal comprise edge effects, introduction of weeds and pests, increased levels of noise exposure for wildlife, vehicle strike and runoff (spills and increased sedimentation).

Edge effects

Edge effects result from the combined impact of processes that influence the presence of species at a boundary and in the case of disturbance often occur following disturbance of some kind (eg cleared corridors). Some species within these areas adapt to the effects of an edge, while some are partially or wholly reliant on edge effects. Edge effects have been estimated on average to occur approximately 50m from the road edge, and are more pronounced the more edge occurs (eg a small patch of vegetation with a large cleared perimeter).

Potential edge effects as a result of this proposal include:

- Establishment of weeds along boundaries between native vegetation and cleared areas, with potential for weeds to infiltrate into native vegetation areas

- Modification of habitat through increased light and noise levels, drying through increased wind levels, changes to vegetation structure, soil nutrient levels and species diversity and assemblages
- Changes to fauna assemblages, including domination of woodland bird assemblages by edge specialists. Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners (*Manorina melanocephala*) is a key threatening process under the TSC Act and EPBC Act. The proposal may increase the dispersal potential of this species, although the high vegetation density of surrounding areas means potential to invade far into surrounding habitat is reduced
- Increased predation by species that use forest edges for foraging.

The potential for significant impacts as a result of edge effects is predicted to be low given the relatively small area of clearance in the context of an existing road corridor, and large areas of contiguous vegetation next to the site.

Introduction of weeds and pests

There is potential for weeds to be introduced and further spread of existing weeds where the proposal intersects native vegetation and in particular, cleared areas on the margins. Activities which may disperse seeds include clearing vegetation, stockpiling during earthworks and the movement of soil with associated seed material, and attached seed material to construction vehicles and machinery. Impact may follow on vegetation condition including the identified endangered ecological communities in the study area. Weeds would be managed in accordance with Guide 6: Weed management of the biodiversity guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011). In particular, the growth of class 4 weeds must be managed to continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed.

The proposal is unlikely to increase the invasion of pest fauna species. Rabbits are known to occur in the study area, but are not expected to increase in numbers as a result of the proposal.

Management measures to control weed spread and pest fauna are predicted to manage the impact to low levels.

Increased levels of noise and dust

Construction plant and vehicle movements would temporarily increase noise and air pollution in the study area. These activities could disrupt the activities of wildlife, lead to coating of vegetation in dust and temporary displacement in areas close to the work. Species along the road alignment are likely to be habituated to some disturbance from traffic noise in particular. The impact on biodiversity from increased noise and dust is predicted to be low.

Runoff

The removal of vegetation and earthworks activities will increase runoff particularly from stormwater, and any spilled contaminants or sediment on the exposed surface. This is particularly prevalent near ephemeral drainage lines and the perennial Dargans Creek (also see Section 6.1), although can occur throughout the proposal area.

Operational impacts

Impacts during operation of the upgraded road are not predicted to vary beyond those already occurring on Chifley Road (eg noise levels, traffic movement and runoff). The road alignment would not create a greater barrier to fauna movements than is already present, with a minor increase in width in some areas, and would not result in additional fragmentation of areas of vegetation and habitat. The improvements are not expected to generate additional traffic on the road.

6.4.3 Safeguards and management measures

Safeguards and management measures proposed to avoid, reduce or manage impacts on terrestrial or aquatic biodiversity are discussed below in Table 6.8.

The safeguards and management measures are in addition to those included in Table 6.1 and Table 6.3 respectively, relating to hydrology and erosion and sedimentation, and should be read in conjunction with Table 6.8.

Biodiversity offsets may be required in accordance with the Roads and Maritime Biodiversity Offset Guidelines (RMS, 2011b). The proposal would require the removal of approximately 13.1ha of native vegetation which includes 0.03ha of vegetation classified as Newnes Plateau shrub swamp ecological community in the Sydney Basin Bioregion (listed under the TSC Act) and the Temperate Highland Peat Swamps on Sandstone ecological community listed under the EPBC Act.

In accordance with Table 1 of the Roads and Maritime Biodiversity Offset Guidelines, the above clearing triggers the criteria in Category 4. The construction footprint would be reviewed and refined during detailed design of the proposal and prior to construction. The need for biodiversity offsets, in accordance with the Guidelines would be determined at this time.

Table 6.8 Safeguards and management measures relating to biodiversity

Impact	Environmental safeguards	Responsibility	Timing
Removal of vegetation / fauna habitat	• Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	Contractor	Detailed design
Removal of vegetation / fauna habitat	• Pre-clearing surveys will be undertaken in accordance with Guide 1: Preclearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Pre-construction
Biodiversity impacts	• A Flora and Fauna Management Plan will be prepared in accordance with Roads and Maritime's Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RTA, 2011) and the biodiversity and aquatic assessments prepared for the proposal (RPS, 2016) The Plan will be implemented as part of the CEMP and will include an induction program for construction personnel on the management of biodiversity values.	Contractor	Pre-construction
Removal of vegetation / fauna habitat	• Vegetation and habitat removal will be undertaken in accordance with Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Pre-construction /construction
Removal of vegetation / fauna habitat	• The unexpected species find procedure is to be followed under Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011) if threatened ecological communities or species, not	Contractor	Pre-construction /construction

Impact	Environmental safeguards	Responsibility	Timing
	assessed in the biodiversity assessment, are identified in the proposal site.		
Removal of vegetation / fauna habitat	• Exclusion zones will be set up at the limit of clearing in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Pre-construction/ construction
Habitat loss and fauna mortality	• Fauna will be managed in accordance with Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Pre-construction/ construction
Introduction of weeds and pests	• Weed species will be managed in accordance with Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Pre-construction/ construction
Introduction of weeds and pests	• Pest species will be managed within the proposal site.	Contractor	Pre-construction/ construction
Introduction of weeds and pests	• Pathogens will be managed in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Pre-construction/ construction
Impacts on Dargans Creek	• Aquatic habitat will be protected in accordance with Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011) and Section 3.3.2 Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013 (DPI (Fisheries NSW) 2013).	Contractor	Pre-construction/ construction
Removal of vegetation / fauna habitat	• Native vegetation and habitat will be re-established in accordance with Guide 3: Reestablishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011), Guide 5: Reuse of woody debris and bushrock and Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Operation

6.5 Traffic and access

This section describes the current transport network, and traffic and access arrangements in the proposal area, potential impacts on traffic and access from the proposal, as well as proposed safeguards and management measures.

6.5.1 Existing environment

Road network
Chifley Road, which turns into Bells Line of Road at the Darling Causeway intersection at Bell, provides a secondary connection between the Central West of NSW and Sydney. The road also provides a local connection to residents along Chifley Road, Darling Causeway and Bells Line of Road and Lithgow. Newnes Junction, Dargan and Clarence are three settlements near the proposal that are accessed from Chifley Road. Chifley Road is a two lane single carriageway rural road that is about 20km long.

No local roads intersect with Chifley Road on the Scenic Hill section of the proposal area. The Clarence Colliery Road intersects with Chifley Road at the western extent of the Clarence road over rail section. A number of fire trails intersect with Chifley Road within both of sections of the proposal area, and various access roads join the road.

Crash data for Chifley Road is provided in Section 2.2.

Public transport
Lithgow Buslines operate school bus services to Lithgow schools which travel through the proposal area. No public bus services travel through the proposal area.

The Main Western Railway is crossed by Chifley Road at the Clarence road over rail bridge. The line is used by passenger and freight trains. Trains travelling on the Blue Mountains Line run between Central Station in Sydney and Bathurst with stops at Bell (approximately 4.5km south east of the proposed works at Clarence road over rail bridge), Zig Zag (approximately 700m east of Scenic Hill) and Lithgow (approximately 2.5km south east of the proposed works at Scenic Hill).

Other infrastructure
Within the Scenic Hill proposal area, a parking area is provided at the Ex-POW Memorial. No parking is provided along Chifley Road within the Clarence Road over rail bridge proposal area although informal parking does occur along the road. Maintenance access tracks associated with the Main Western Railway, and surrounding telecommunications and other public utilities also branch off Chifley Road. Access to Dargan Creek Reserve is via the maintenance access tracks south of the road. A network of fire trails are accessed from Chifley Road within the proposal area.

No formal bike paths or foot paths are located within the proposal area and Chifley Road has relatively narrow lanes and shoulders which could present challenges to cyclists.

6.5.2 Potential impacts

The majority of potential impacts from the works would occur during construction as discussed below. The main impacts during operation would be beneficial due to improved safety, access and reduced travel times along Chifley Road.

Construction
Chifley Road would be the main haulage route for the proposal. The number of light vehicle movements largely relate to workforce numbers which are expected to peak at about 120 personnel per day across the work sites. An additional 50 to 120 light vehicle movements per day are expected across the proposal area during the work period. Truck movements are expected to increase by 10 to 20 movements per day at the Clarence road over rail section of works, with 50 to 70 movements per day at Scenic Hill. During certain stages of the work, truck movements may increase to 40 per day and 90 per day at the Clarence road over rail and Scenic Hill sections respectively. Over-size vehicles are not expected to be used as a part of the work.

Chifley Road has relatively low existing traffic volumes and would be able to accommodate the increases in traffic as a result of the proposal. Most light vehicle movements would occur outside of peak periods and peaks in truck movements associated with specific sections of the proposal area would be temporary (over a few days). The road would remain open to traffic throughout the work.

Road users are expected to experience short-term disruptions including delays during traffic switches, safety barrier work and paving, when traffic controls or lane closures are in place. Speed limits would also be reduced during the work. These disruptions would be short-term, with minor impacts on road users expected.

Work associated with the proposal also has the potential to impact on access to residential properties, businesses nearby and potentially the Ex-POW Memorial. As outlined in Section 5.2, stakeholders raised concerns over the potential impact on access at the Chifley Road and Clarence Colliery Road intersection during work. This intersection is important for the operation of Clarence Colliery, Hanson Quarry and residents of Newnes Junction.

Access to properties along Chifley Road and nearby businesses including to Clarence Colliery Road will be maintained during the work. Access to the Ex-POW Memorial may be restricted for short periods to enable the work to be completed safely. Impacts of the proposal on access will be short term and minor.

Maintenance access tracks would be maintained during the work or an alternative arrangement provided in consultation relevant stakeholder, eg Sydney Trains. Access to all fire trails within the proposal area would be maintained during construction of the work.

Operation
Once the proposed work is complete, road users, pedestrians and cyclists are expected to benefit from improved safety, access and reduced travel times along Chifley Road. Users and operators of the passenger services and freight trains that travel under the Clarence Road over rail bridge would also benefit from the improved safety provided by the new bridge.

The replacement of the road over rail bridge would improve the intersection of Chifley Road and the Clarence Colliery Road through the inclusion of an eastbound acceleration lane from the intersection. These arrangements will support heavy vehicle movements from the neighbouring Clarence Colliery mine and Hanson Quarry.

No existing property accesses or maintenance access tracks would be removed during operation. Minor adjustment or realignment may be required to incorporate access into the proposal area. The proposal's design facilitates access to all existing fire trails from Chifley Road.

6.5.3 Safeguards and management measures

Safeguards and management measures proposed to avoid, reduce or manage impacts on traffic and access are set out in Table 6.9.

Table 6.9 Safeguards and management measures relating to traffic and access

Impact	Environmental safeguards	Responsibility	Timing
Changes to local access arrangements	• Requirements for any changes to local access arrangements, including to the Ex-POW Memorial will be confirmed during detailed design.	Contractor	Detailed design

Impact	Environmental safeguards	Responsibility	Timing
Changes to traffic conditions	• A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP in accordance with the Roads and Maritime *Traffic Control at Work Sites Manual* and Roads and Maritime Specification G10. 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 Measures to maintain fire trail access 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	Pre-construction
Changes to traffic conditions	• Consultation will be undertaken with potentially affected residences prior to the commencement of and during work in accordance with the RTA's *Community Involvement and Communications Resource Manual*. Consultation will include but not limited to door knocks, newsletters or letter box drops providing information on the proposed work, working hours and a contact name and number for more information or to register complaints.	Roads and Maritime / Contractor	Pre-construction / construction
Changes to traffic conditions	• Road users and local communities will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.	Contractor	Construction
Disruption to school bus services	• Access for public transport services, including school bus services, will be maintained. The requirements for any temporary changes will be confirmed following consultation with local bus operators and the community.	Roads and Maritime/ Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
Changes to property access during work	• Access to properties will be maintained during construction. Where that is not feasible or necessary, temporary alternative access arrangements will be provided following consultation with affected landowners.	Contractor	Construction
Changes to maintenance access tracks during work	• Maintenance access tracks will be maintained during construction. Where this is not feasible or necessary, temporary alternative access arrangements will be provided following consultation with affected stakeholders.	Contractor	Construction

6.6 Noise and vibration

This section describes the existing environment, potential impacts and proposed safeguards and management measures in relation to noise and vibration in the proposal area. The information is drawn from the assessment of potential noise and vibration impacts carried out by Wilkinson Murray (2016). The Construction and Operational Noise and Vibration Impact Assessment is included in Appendix H.

Traffic noise monitoring was carried out using noise loggers to understand existing noise levels along Chifley Road and to provide inputs to noise modelling. Two locations were monitored over nine days in February 2016. Traffic counts were also conducted during the noise monitoring. The monitoring locations are shown in Figure 6.5 and include:

- L1: Lot 4, Chifley Road
- L2: 677 Chifley Road.

Data from the noise loggers was separated into representative noise levels for different times of the day - daytime (7am to 6pm), evening (6pm to 10pm) and night-time (10pm to 7am).

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. A number of noise descriptors were used to describe this noise environment. Noise levels are presented as A-weighted decibels (dBA) for differing noise descriptors. Environmental noise and road traffic noise are often presented as L_{Aeq} which represents a noise level that is equivalent to the level of a constant noise which contains the same energy as the varying noise environment (as often occurs along a road). L_{Aeq} is the standard descriptor for traffic noise in NSW. The rating background level (RBL) provides an indication of the typical background noise level at a site in each of the three measurement periods (daytime, evening and night-time).

Traffic noise was modelled to predict existing noise at the closest potentially affected receivers to the road and to then predict any changes once the work is completed. The modelling used a range of factors and information to generate likely noise levels at different locations including the existing traffic volumes, vehicle speeds, road surface and gradient, different vehicle noise emissions, sensitive receiver locations, and topography along the proposal area. Predicted noise from traffic travelling along the upgraded road was also determined.

Human exposure to vibration during work was assessed through calculations based on the DEC publication *Assessing Vibration: A Technical Guideline provides guidance for assessing human exposure to vibration* (2006). The potential for building damage from vibration was assessed using calculations based on German Standard German DIN 4150:1999 (in lieu of an Australian standard).

6.6.1 Existing environment

The proposal area is largely surrounded by vegetated areas with topography ranging from very steep to undulating. Residences are located intermittently along the road. Existing noise reaching these sensitive receivers is likely to come from road traffic and environment sources such as wind in the trees.

Figure 6.5 shows the location of sensitive receivers, all of which are residences, nearest to the work at Scenic Hill and Clarence road over rail bridge. At Scenic Hill, the closest sensitive receivers are located from around 75m south of the work areas. Nearby sensitive receivers are also located south east, south west, north east and north west of the work areas in Lithgow and Oakey Park.

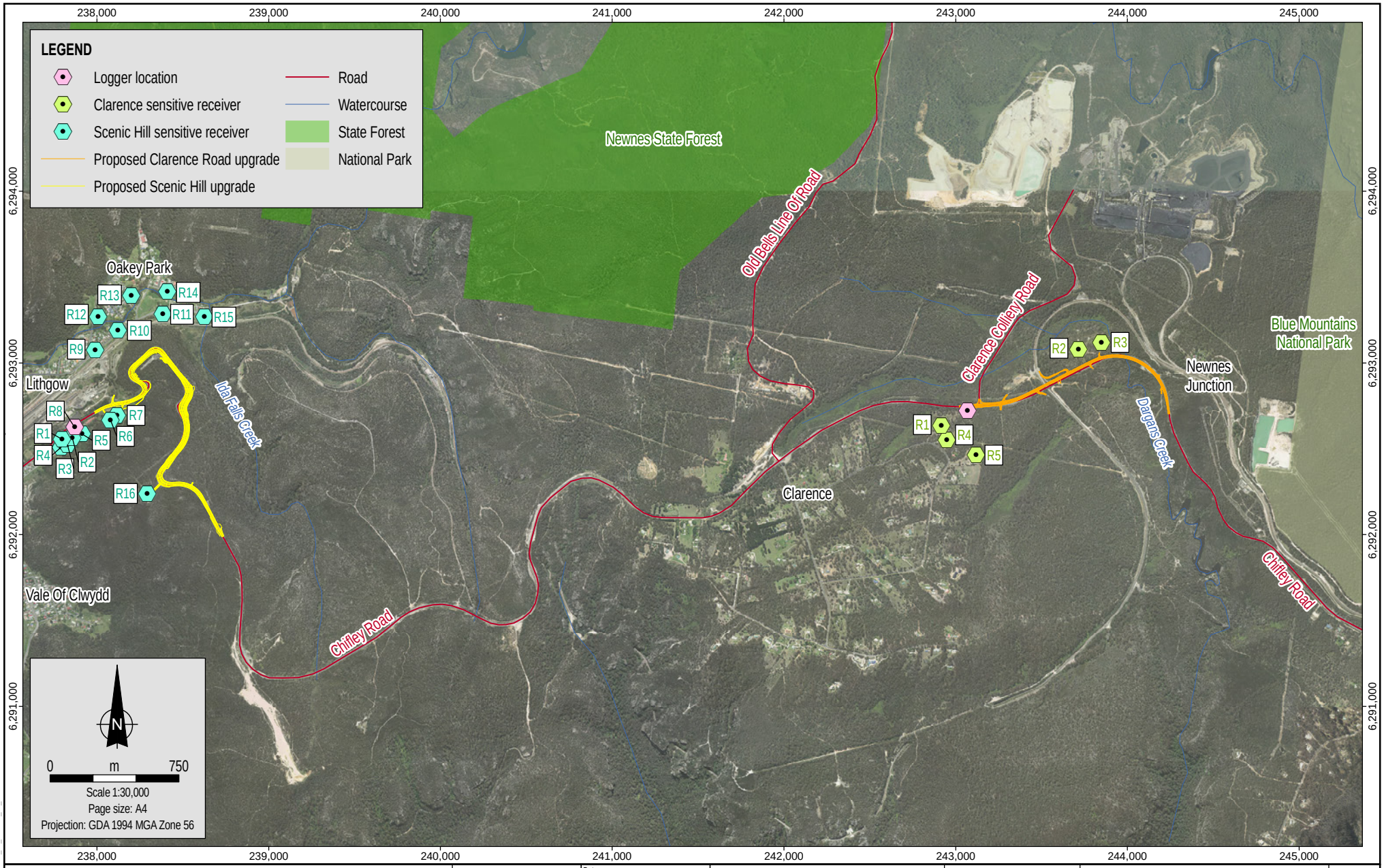
The closest sensitive receivers to the Clarence road over rail bridge work are located from around 85m north of the work area. Sensitive receivers are also located nearby to the south west of the proposal area.

Existing noise levels measured at the two monitoring locations are presented in Table 6.10.

Table 6.10 Summary of measured noise levels (dBA) along Chifley Road (2 to10 February 2016)

Site	Setback to carriageway (m)	Daytime $L_{Aeq,15hr}$	Night-time $L_{Aeq,9hr}$	Rating background level (RBL)		
				Day	Evening	Night
L1	11	62	55	38	34	31
L2	17	62	58	36	34	32

Source: Wilkinson Murray (2016)



Source:
Noise monitoring locations from Wilkinson Murray.
Proposed road upgrade data and aerial imagery from NSW Roads and Maritime Services.
Project features digitised by Coffey.
National Parks from OEH.
State forests from GEODATA250k (optimum scale 1:250,000).

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Date: 25.07.2016
Project: ENAURHOD03119AB
File Name: 3119AB_01_F06.05_GIS

NSW Roads and Maritime Services

Bells Line of Road – Chifley Road upgrade

Transport Roads & Maritime Services

Noise monitoring and sensitive receiver locations

Figure No: 6.5

MXD Reference: 3119AB_01_GIS004_v0_4

6.6.2 Policy setting

The noise and vibration assessment was informed by guidelines and policies prepared by the Australian and New Zealand Environment and Conservation Council (ANZECC), the former DEC, Roads and Maritime, and international authorities. These include:

- Road Noise Policy (DECCW, 2011)
- Noise Criteria Guideline (RMS, 2015c)
- Noise Mitigation Guideline (RMS, 2015d)
- Environmental Noise Management Manual (RTA, 2001)
- German Standard DIN 4150, Part 3: Structural Vibration in Buildings: Effects on Structures
- Assessing Vibration: A Technical Guideline (DEC, 2006b)
- Interim Construction Noise Guideline (DECC, 2009)
- Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (ANZECC, 1990).

6.6.3 Criteria

A range of criteria have informed the noise and vibration assessment. These criteria include construction noise criteria, road traffic noise criteria, vibration criteria relating to human exposure and the potential for building damage from vibration, and blasting criteria relating to minimising human annoyance and prevention of structural damage. The outputs of the noise model have been compared to these criteria where relevant.

Construction noise management levels at residences, as specified in the NSW Interim Construction Noise Guideline (ICNG), are summarised in Table 6.11.

Table 6.11 ICNG construction noise management levels - residences

Time of day	Management level $L_{Aeq,15min}$
Recommended standard hours: Monday to Friday 7am to 6pm, Saturday 8am to 1pm, no work on Sundays and Public Holidays	Noise affected RBL + 10dBA
	Highly noise affected 75dBA
Outside recommended standard hours	Noise affected RBL + 5dB

Project specific construction noise management levels have been developed and are summarised in Table 6.12.

Table 6.12 Project specific construction noise management levels

Time of day		Scenic Hill residential receivers	Clarence residential receivers
Recommended standard hours: Monday to Friday 7am to 6pm, Saturday 8am to 1pm, no work on Sundays and Public Holidays	Noise Affected Level $L_{Aeq,15min}$ dB(A)	48	46
	Highly Noise Affected Level $L_{Aeq,15min}$ dB(A)	75	75
Outside recommended standard hours	Noise Affected Level – Day $L_{Aeq,15min}$ dB(A)	43	41
	Noise Affected Level – Evening $L_{Aeq,15min}$ dB(A)	39	39

Time of day		Scenic Hill residential receivers	Clarence residential receivers
	Noise Affected Level – Night $L_{Aeq,15min}$ dB(A)	36	37

The Roads and Maritime Road Noise Policy also states that for minor work, where a proposal's ('build') noise level exceeds the criterion and there is an increase of more than 2.0dBA (ie 2.1dBA) relative to the existing noise levels ('no-build') then the receiver qualifies for consideration of noise mitigation.

The Noise Criteria Guideline defines minor work as those that primarily improve safety including minor straightening of curves, intersection widening and minor road alignments. The guideline recommends noise target levels as defined in Table 6.13 below.

Table 6.13 Road traffic noise criteria

Road category	Noise criteria	
	Day 7am to 10pm	Night 10pm to 7am
Freeway/arterial/sub-arterial roads	$L_{Aeq,15\ hour}$ 60 dBA	$L_{Aeq,9\ hour}$ 55 dBA

For the purposes of the assessment, a sleep disturbance screening criterion of LA1, 1min 46 dBA was applied externally to dwellings. The criterion is only applicable to night time (10pm to 7am) operations. Typical noise reduction through a bedroom facade with partially open windows was assumed to be 10dB, with an external noise level of 60-65dBA therefore unlikely to cause sleep disturbance.

Vibration impacts from construction activities are considered using two components; human exposure to vibration and potential for building damage from vibration. Human exposure to vibration is assessed under the EPA guideline, Assessing Vibration: a Technical Guideline (2006), based on British Standard BS 6472:1992. The vibration dose value goals for human comfort are described in Table 6.14.

Table 6.14 Human comfort vibration goals – VDV ($m/s^{1.75}$)

Place	Day (7am to 10pm)		Night (10pm to 7am)	
	Preferred	Maximum	Preferred	Maximum
Residences	0.20	0.4	0.13	0.26

There are no Australian Standards or guidelines for assessing the potential for building damage from vibration. British Standard BS 7385:1993 and German Standard DIN 4150:1999 both provide goal levels, below which vibration is considered insufficient to cause building damage. Of these, DIN 4150 is the more stringent, and is based upon the goal levels on the highest vibration level in each component (Peak Component Particle Velocity – PCPV).

The EPA guideline, Assessing Vibration: a Technical Guideline defers to the Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration prepared by the Australian and New Zealand Environment Council (1990). Human annoyance criteria for blasting for any privately-owned receivers or other sensitive location are:

- Maximum overpressure due to blasting should not exceed 115 dB for more than 5% of blasts in

any year, and should not exceed 120 dB for any blast; and

- Maximum peak particle ground velocity should not exceed 5 millimetres per second (mm/s) for more than 5% of blasts in any year, and should not exceed 10 mm/s for any blast.

Full details on the criteria used in the assessment are provided in Appendix H.

6.6.4 Potential impacts

Construction

Noise
Work is expected to commence in early 2018 and take about 18-24 months to complete. The Scenic Hill and Clearance road over rail bridge sections would be upgraded concurrently. The main sources of noise during the work is expected to come from the use of construction equipment ranging from light vehicles and trucks to excavators, generators, back hoes, front loaders, mobile crushing plants, piling rigs, cranes and asphalt paving machines. The timing and location of the use of this equipment was considered in the noise assessment.

Construction would as far as practicable be undertaken during standard construction working hours (Monday to Friday 7am to 6pm and Saturday 8am to 1pm). Drainage and earthworks are anticipated to only occur within standard hours. Other work activities may need to take place during the evening and night time for technical or health and safety reasons, and to minimise disruption to the travelling public. Blasting may be required at Scenic Hill. Most blasting work would be undertaken during standard hours. Some work may need to be undertaken outside these hours to minimise disruption to road users.

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

At Scenic Hill, construction noise criteria are predicted to be exceeded during standard hours at three sensitive receiver locations - receivers R6 and R7 of up to 15dB and 19dB respectively during standard work hours. A minor exceedance of around 1dB is predicted at receiver R8. At the Clarence road over rail bridge work site, exceedances are expected at receivers R2 and R3 of up to around 14dB and 18dB respectively during standard work hours.

Should work need to be conducted outside of standard construction work hours, exceedances of up to 28dB are predicted during the evening period; and up to 31dB during the night-time period at the more exposed receiver at Scenic Hill (R7). At Clarence road over rail bridge, exceedances of up to 25dB are expected during the evening period and up to 27dB during the night time period for the more exposed receivers (R3).

No exceedances of the ‘highly affected’ 75 dBA criterion were predicted at any sensitive receivers.

In the event of night time work, sleep disturbance criterion were predicted to be exceeded at two receivers at Scenic Hill (R6 and R7, by 8dB and 12dB respectively) and two at Clarence (R2 and R3, by 5dB and 9dB respectively).

Overall, during standard hours some exceedances of the relevant noise criteria are predicted at a limited number of residences, though these receivers would not be highly affected. Out-of-hours work has the greatest potential to generate noise impacts. Some very high exceedances of the night-time criteria were indicated for the most exposed residential receivers. All feasible and reasonable work practices would be considered to limit the extent of construction noise impacts at these locations as recommended in Section 7.4 of Appendix H.

Vibration
The vibration assessment found that there is a minimal risk exists that vibration levels will exceed human comfort criteria for exposure to vibration. The risk is reduced due to the setback distance of sensitive receivers from the proposed work at Scenic Hill and Clarence road over rail bridge (from around 75m and 85m respectively) and the progressive nature of the work. The vibration dose value criterion, which is used to assess human exposure to intermittent vibration, will be readily achieved for all receivers assessed.

The assessment also identified that there is no material risk of structural damage to buildings associated with vibration during the work. Predicted vibration levels are substantially below the conservative structural damage criteria.

Blasting
A construction blasting assessment was conducted in the event that blasting work is required at Scenic Hill. The findings indicate that to readily achieve compliance with blasting criteria, blast sizes should be restricted to no more than a maximum instantaneous charge of around 6kg to meet airblast overpressure and vibration criteria. The need for blasting would be confirmed during detailed design.

Operations
Traffic noise modelling indicates that operational noise levels ('build' scenario) will be similar to existing levels ('no-build' scenario) with traffic noise increases of less than 2dB at all but one location. The exception is a sensitive receiver at Scenic Hill (R15) where traffic noise levels are expected to increase at night by 2.1dB. The predicted night-time noise level, even with this increase, is still well below the target criteria.

6.6.5 Safeguards and management measures

Safeguards and management measures proposed to avoid, reduce or manage noise and vibration impacts are discussed below in Table 6.15. All measures relate to the construction stage of the proposal.

Table 6.15 Safeguards and management measures relating to noise and vibration

Impact	Environmental safeguards	Responsibility	Timing
Construction noise and vibration	• A Noise and Vibration Management Plan will be prepared and implemented as part of the CEMP. The Plan will generally follow the approach in EPA's *Interim Construction Noise Guideline* (ICNG) and identify: All potential significant noise and vibration generating activities associated with the activity Feasible and reasonable mitigation measures to be implemented, taking into account the Roads and Maritime Beyond the Pavement urban design policy, process and principles and site specific mitigation options detailed in the noise assessment (Wilkinson Murray, 2016) A monitoring program to assess performance against relevant noise and vibration criteria Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.	Contractor	Pre-construction
Construction noise and vibration	• All personnel working on site will receive training to ensure awareness of requirements of the Noise and Vibration Management Plan. Site-specific training will be given to personnel when working in the vicinity of sensitive receivers.	Contractor	Pre-construction / Construction
Construction noise and vibration	• Any variations to the standard construction hours will follow the approach in Roads and Maritime Services Construction Noise and Vibration Guideline, including consultation with the affected local community.	Contractor	Construction
Construction noise and vibration	• All sensitive receivers (eg 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 include details of: the project; construction period and construction hours; contact information for project management staff; complaint and incident reporting; and how to obtain further information.	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
Construction blasting and vibration	• Specific measures to manage blasting, if required at Scenic Hill will be included in the Noise and Vibration Management Plan including: Recommended blast sizes consistent with that detailed in the noise assessment (Wilkinson Murray, 2016) An overpressure monitoring program to assess performance against relevant blasting criteria Exclusion zones for the section of Chifley Road within 500m of blasting activities Management of livestock close to blast sites.	Contractor	Construction

6.7 Aboriginal heritage

This section describes the existing environment, potential impacts and proposed safeguards and management measures in relation to aboriginal heritage areas and items in the proposal area. Biosis Pty Ltd was commissioned to carry out an Aboriginal heritage investigations and assessment for the proposal (Biosis, 2016; Appendix E).

The archaeological investigations were carried out through a combination of desktop review of the proposal area, previous cultural heritage investigations and surrounding region for context and field survey. The study area for desktop review was a 16 km by 16 km square centred on the proposal area. Full details of the methods used to carry out these investigations are provided in Appendix E.

The desktop review included analysis of a large number of cultural heritage surface and sub-surface investigations in the region, including six investigations carried out near the proposal area (see Section 6.7.2 below).

A search of the OEH and Heritage Aboriginal Heritage Information Management System (AHIMS) database (5 January 2016) was carried out to identify Aboriginal archaeological sites within the study area. Searches of the Australian World Heritage Places List, Commonwealth Heritage List, National Heritage List, Register of the National Estate (non-statutory) and National Trust Register (non-statutory) were also carried out (22 April 2016).

A model was developed based on the outcomes of the desktop review to predict the type of Aboriginal cultural heritage sites likely to occur in the proposal area, and where they are likely to be located.

A field survey of the proposal area was also carried out on 20 and 21 January 2016 and included representatives from the Bathurst Local Aboriginal Land Council. The field survey sampled all landforms with the potential to contain Aboriginal heritage, noting areas of exposure, the overall visibility, and any disturbances at these locations.

6.7.1 History

The distribution and character of archaeological material within a landscape requires an understanding of the characteristics of the physical environment and geomorphological processes as well as historic land use patterns in an area. Certain processes, such as fire, can destroy traces of previous occupation, while other features (such as ridges or overhangs) can contribute to the cultural significance of the area.

Landscape context

The majority of the proposal area is located in the Narrabean Group of sandstone formations (see Section 6.3). An abundance of sandstone raises the potential for sites such as rock engravings, grinding grooves and rock shelters to be present.

The Scenic Hill area is at relatively high elevation and characterised by crests, cliffs and steep slopes. No permanent watercourses are evident in this area although a number of drainage lines run down the slope towards Lithgow. The Clarence road over rail bridge section has a more gentle relief with small watercourses and drainage lines running through it.

Predictive archaeological models developed for this region tend to favour proximity to a stable source of water (used as a resource by Aboriginal groups), potentially increasing the likelihood of finds in such areas.

Land use history

The proposal is located within the boundaries of the Bathurst Local Aboriginal Land Council. The area is described as a zone of interaction between the Wiradjuri, Darug, and Gundungurra groups (Bowdler, 1984) although exact nature of traditional boundaries is unclear. The Wiradjuri are the traditional owners of the areas to the west and south-west of the Blue Mountains, the Darug of the area to the east of the proposal area, and the Gundungurra to the south.

In more recent history, the proposal area has been used as a road. Previous culverts and alignments associated with earlier forms of the road are also present.

Predictive model

A predictive model for the proposal area allowed the field survey to focus on areas of highest potential for Aboriginal cultural heritage sites. Flaked stone artefact scatters and isolated artefacts, rock shelters with art and rock shelters with deposit were all assessed as having high potential to be present, due to the frequency of their recording in the regional and local area and association with landforms found in the proposal area, particularly crests and hillslopes.

6.7.2 Existing environment

Details of the existing environment pertaining to Aboriginal heritage were established through a number of sources.

Previous cultural heritage investigations

Six previous cultural heritage investigations are known to have been conducted within a 10km buffer of the proposal area. The main findings of these investigations are summarised below in Table 6.16.

Table 6.16 Previous cultural heritage investigations within a 10km buffer of the proposal area.

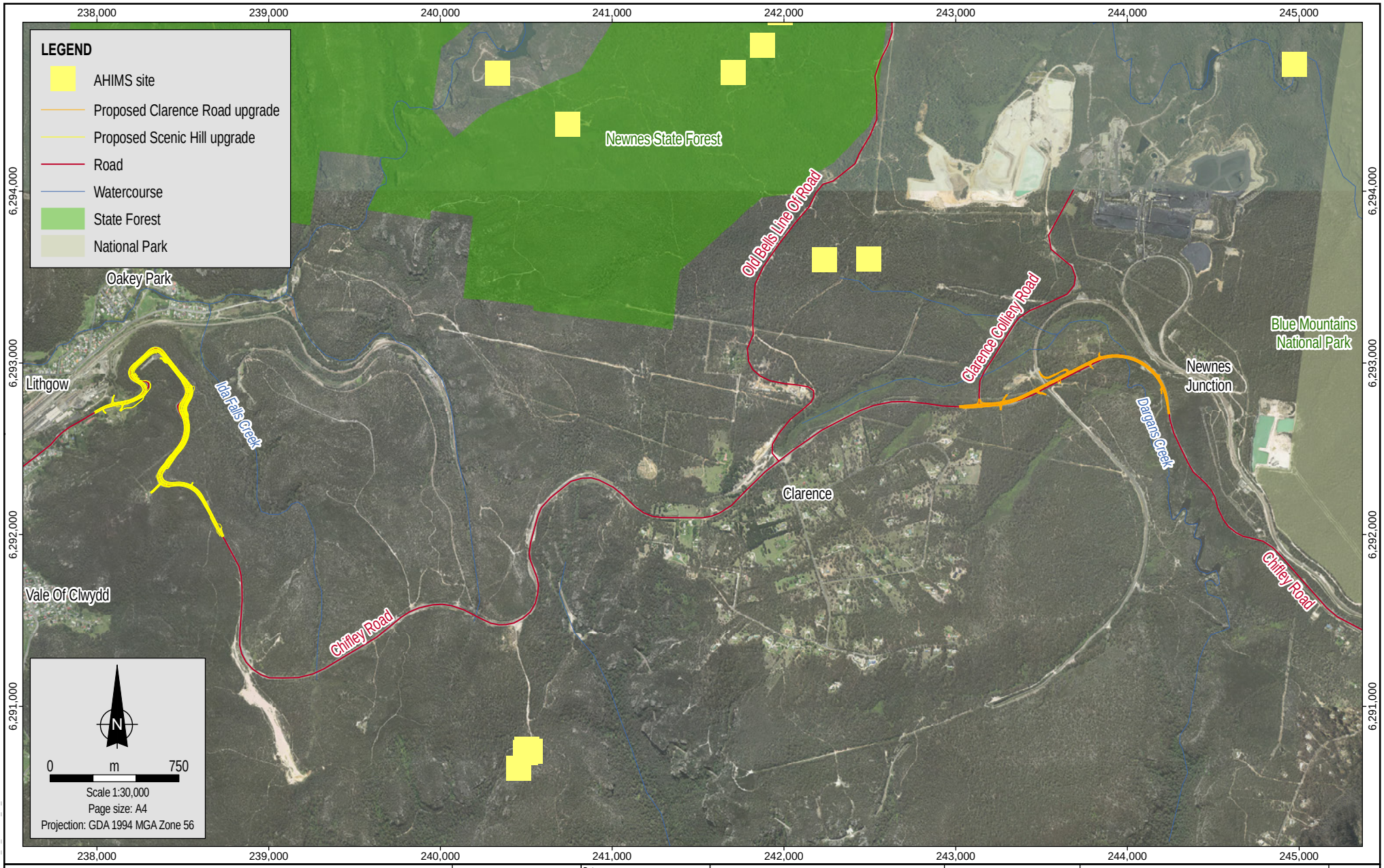
Investigation site	Findings
Bell sand quarry, 200m east of Clarence Road survey area (Kohen, 1994)	No artefacts or sites recorded
Clarence Colliery, 1km north of Clarence Road survey area (Mills, 2000)	Six camp sites, five potential archaeological deposits, two scarred trees, two isolated finds and six areas of potential archaeological sensitivity recorded
Clarence Water Transfer Scheme, 1km north of Clarence Road survey area (OzArk, 2012)	One grinding groove site and one chert core. Predictive modelling stated most likely sites to be artefact sites along waterways, shelter sites under rock overhangs and grinding grooves at sandstone outcropping

Investigation site	Findings
Unnamed sand quarry and mine, 500m east of the proposal area (Mills, 2000)	No artefacts or sites recorded. Predictive modelling stated most likely sites to be camp sites associated with creeklines, grinding grooves and rock shelters in sandstone landform areas, scarred trees where old growth remains and isolated artefacts most likely along ridgelines
Newnes sand quarry and mine, 500m east of Clarence Road survey area (RPS, 2012)	No artefacts or sites recorded. Predictive modelling identified potential for isolated finds, rock shelters, grinding grooves, artefact scatters and scarred trees to be low
Marangaroo Department of Defence site, 3km northwest of the proposal area (Kelton, 2000)	Twelve rock shelters, four open campsites, one isolated artefact and three areas of potential archaeological sensitivity recorded. Predictive modelling stated sensitive areas would most likely be swamp edges, creeklines, eroding bases of sandstone escarpments, exposed sandstone ridgelines, and isolated sandstone outcrops in close proximity to water sources.

Database searches

A search of the AHIMS database identified 97 Aboriginal archaeological heritage sites within a 16km by 16km search area centred on the proposal area. None of these sites are within the proposal area, the closest being over 1km from the proposal area (Figure 6.6). Artefact sites were the most common, accounting for over 50 per cent of identified sites. Rock shelters accounted for about 25 per cent of sites. Sites such as grinding grooves, scarred trees, potential archaeological deposits and burials accounted for a small proportion of sites.

No Aboriginal heritage sites were found within or near the proposal area during searches of the Australian World Heritage Places List, Commonwealth Heritage List, National Heritage List, Register of the National Estate (non-statutory) and National Trust Register (non-statutory).



Source:
Proposed road upgrade data, AHIMS sites and aerial imagery from NSW Roads and Maritime Services.
Project features digitised by Coffey.
National Parks from OEH.
State forests from GEODATA250k (optimum scale 1:250,000).

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NSW Roads and Maritime Services

Bells Line of Road – Chifley Road upgrade

Transport Roads & Maritime Services

Aboriginal heritage sites on AHIMS register

Figure No: **6.6**

MXD Reference: 3119AB_01_GIS011_v0_5

Field survey

The field survey did not identify any Aboriginal heritage sites or areas of potential for Aboriginal heritage sites in the proposal area. Based on the predictive model, the site types most likely to be present, and their revised likelihood of presence following the field survey, were as follows:

- Artefact sites – the potential for these sites was limited by heavy disturbance of parts of the proposal area
- Rock shelters with art or deposit and grinding grooves – the potential for these sites was reduced by the lack of sandstone overhangs and outcrops. Four sandstone outcrops were present, and there was enough exposure to sample the landform
- Potential archaeological deposits – these areas are typically found within 100m of water in the study area, and associated with Mount Sinai soil. One area was identified that met this broad criteria but it was considered to have low potential for subsurface deposits.

The proposal area was considered to have low potential to contain Aboriginal heritage sites. Areas of artificial embankments in many areas reduced the potential for intact archaeological sites to virtually nil in these areas.

6.7.3 Policy setting

The investigations were carried out under Part 6 of the *National Parks and Wildlife Act 1974*, in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales which specifies standards for archaeological investigations in New South Wales.

6.7.4 Potential impacts

The proposal will not impact on any known Aboriginal heritage sites.

No major changes to the landscape are proposed and the majority of work would be within or next to the existing road corridor. The significance of any impacts on Aboriginal heritage sites through an unexpected find is low, as the potential for a find is assessed to be low, and the nature of sites potentially present is limited by the geology and landscape of the site.

The proposal area has been assessed as having low potential to contain Aboriginal sites, and no further input from an Aboriginal heritage perspective is recommended. Measures to address chance finds and worker awareness are described in Section 6.7.5 below.

6.7.5 Safeguards and management measures

Safeguards and management measures proposed to avoid, reduce or manage impacts on Aboriginal heritage are discussed below in Table 6.17.

Table 6.17 Safeguards and management measures relating to Aboriginal heritage

Impact	Environmental safeguards	Responsibility	Timing
Unexpected find of Aboriginal heritage artefact or site	• The *Standard Management Procedure - Unexpected Heritage Items* will be followed in the event that a known 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 recommence once the requirements of that Procedure have been satisfied.	Contractor	Pre-construction/ Construction

Impact	Environmental safeguards	Responsibility	Timing
Unexpected find of Aboriginal heritage artefact or site	• All personnel working on site will be provided with environmental training to achieve a level of competence and awareness of the environmentally issues associated with Aboriginal heritage, including the need to protect these areas. Training will include the application of the *Standard Management Procedure - Unexpected Heritage Items*.	Contractor	Pre-construction/ Construction

6.8 Non-Aboriginal heritage

This section describes the existing environment, potential impacts and proposed safeguards and management measures in relation to non-Aboriginal heritage in the proposal area. Cosmos Archaeology Pty Ltd was commissioned to carry out a non-Aboriginal heritage investigations and assessment for the proposal (Cosmos Archaeology, 2016; Appendix D). This section draws on the findings of that assessment.

The archaeological investigations were carried out through a combination of desktop review of the proposal area and surrounding region for context, and field survey of the proposal area. The assessment focused on heritage items next to or within the proposal area which may be directly affected by proposal activities. As such a 50-m wide corridor from the existing road alignment was surveyed. Full details of the method employed when carrying out these investigations is provided in Appendix D.

The desktop review included review of one previous non-Aboriginal heritage assessment carried out in the study area, for the Bells Line of Road Corridor – Chifley Road Corridor (MR516) Preliminary Environmental Investigation (RMS, 2014). A general history of the locality was also sourced through review of literature, including secondary sources, parish maps, Deposited Plans and Crown Plans.

Searches of statutory and non-statutory listings for non-Aboriginal heritage sites, objects and places were carried out in February 2016 including:

- Lithgow Local Environmental Plan 2014
- State Heritage Register
- Heritage and Conservation Register Section 170 (Section 170 of the New South Wales *Heritage Act 1977* requires government agencies to keep a register of heritage items)
- National Heritage List
- Australian World Heritage Places List
- Register of the National Estate (non-statutory)
- National Trust Register (non-statutory).

A field survey of the proposal area was carried out on 20 and 21 January 2016. The field survey focussed on areas outside of the current road alignment that are proposed to be disturbed.

Significance of heritage values was determined in accordance with the principles and guidelines of the Burra Charter, the NSW Heritage Manual (NSW Heritage Office, 1996) and Assessing Heritage Significance guidelines (NSW Heritage Office, 2001).

6.8.1 History

The Blue Mountains region north of the Grose River valley was opened up to European settlement in the 1820s after the establishment of a second route across the mountains from Sydney to Bathurst Plains. Settlements and pastoral stations followed. In subsequent decades, construction

of a rail corridor opened up lands from Bell to the Lithgow Valley for pastoral and agricultural purposes, and numerous mining leases were established to access coal deposits.

A road named Bells Line of Road passed through the Clarence area towards the Lithgow Valley from approximately 1869. The current alignment of Chifley Road was established when the road was upgraded during World War II.

6.8.2 Existing environment

Previous cultural heritage investigations

One non-Aboriginal cultural heritage investigation is known to have been conducted near the proposal area, prior to this proposal to support the Preliminary Environmental Investigation (RMS, 2014). The study area for the investigation included the whole Chifley Road corridor and identified five single or groups of sites pertaining to non-Aboriginal heritage, listed either on the World Heritage List, State Heritage Register or Lithgow City Local Environmental Plan.

Three of these sites (the Greater Blue Mountains Area World Heritage and National Heritage listing, the Lithgow Heavy Anti-aircraft Gun Stations and Dummy Station and the Zig Zag Railway and Tunnels) are relevant to this proposal and discussed below under statutory and non-statutory listings searches.

Of the remaining two sites, the Main West Line Railway is no longer listed in the Lithgow Local Environmental Plan, and a number of sites in the Lithgow locality are not of relevance to this proposal (due to distance from the study area).

Statutory and non-statutory listings searches

A search of the State Heritage register identified three heritage sites near the study area:

- Great Zig Zag Railway and Reserves (Listing Number 00542) - opened in 1869 to provide an ascent of the western flank of the Blue Mountains as part of the Main Western Line
- Great Zig Zag Railway deviation tunnels (Listing Number 01037) - a deviation to the above constructed in early 1900s to alleviate issues of gradient
- Lithgow Heavy Anti-aircraft Gun Stations and Dummy Station (Listing Number 01862) - the only known inland heavy anti-aircraft gun stations of their type in New South Wales.

The Greater Blue Mountains Area is listed on the World Heritage List and the National Heritage List. This area is on the World Heritage List and National Heritage List for outstanding natural universal values and covers one million hectares of sandstone plateaux, escarpments and gorges and temperate eucalypt forest.

A search of the Lithgow Local Environment Plan 2014 identified the following heritage items identified to have cultural significance in the vicinity of the proposal area (Table 6.18). The study area is not located in a heritage conservation area (Lithgow LEP, 2014).

Table 6.18 Heritage items listed on the Lithgow Local Environment Plan 2014

Locality	Item name	Address	Property description	Significance	Item no.
Clarence	Oakey Park Colliery Site (Archaeological Site A095) - The Oaks	off Chifley Road	Lot 16, DP751650	Local	I222
Lithgow - Oakey Park	Oakey Park Colliery Site (Archaeological Site A095) - Colliery Managers Cottage	off Chifley Road	Lot 17 DP1099804	Local	I236

Locality	Item name	Address	Property description	Significance	Item no.
Lithgow - Oakey Park	Railway culvert of Ida Falls Creek (Archaeological Site A133)	off Chifley Road	N/A	Local	A133
Clarence	Clarence House	off Chifley Road	Lot 16, DP 751650	Local	I221
Clarence	Clarence Homestead	855 Chifley Road	Lot 191, DP 875912	Local	I223
Lithgow - Oakey Park	Former Zig Zag Brewery and Residence	Victoria Avenue	Lot 1 and 2 DP1098480	Local	I238
Lithgow	Eskbank Railway Station Group including signal box	Inch Street	Main Western Railway	Local	I434
Lithgow	Gun emplacements	Chifley Road/ Hassans Walls Road	Lot 1, DP 413551: Lot 90, DP 751650	State	A176

No sites listed on the Register of the National Estate (non-statutory) or National Trust register (non-statutory) were located in the proposal area or vicinity.

Field survey

Twenty-four potential heritage items were located in the study area during the field survey, with an additional two items added following further historical research. Of these, 17 were assessed as having local heritage significance (following Historic Cultural Heritage Significance Criteria (NSW Heritage Office Guidelines) outlined in Appendix D), and nine were assessed as not being heritage items.

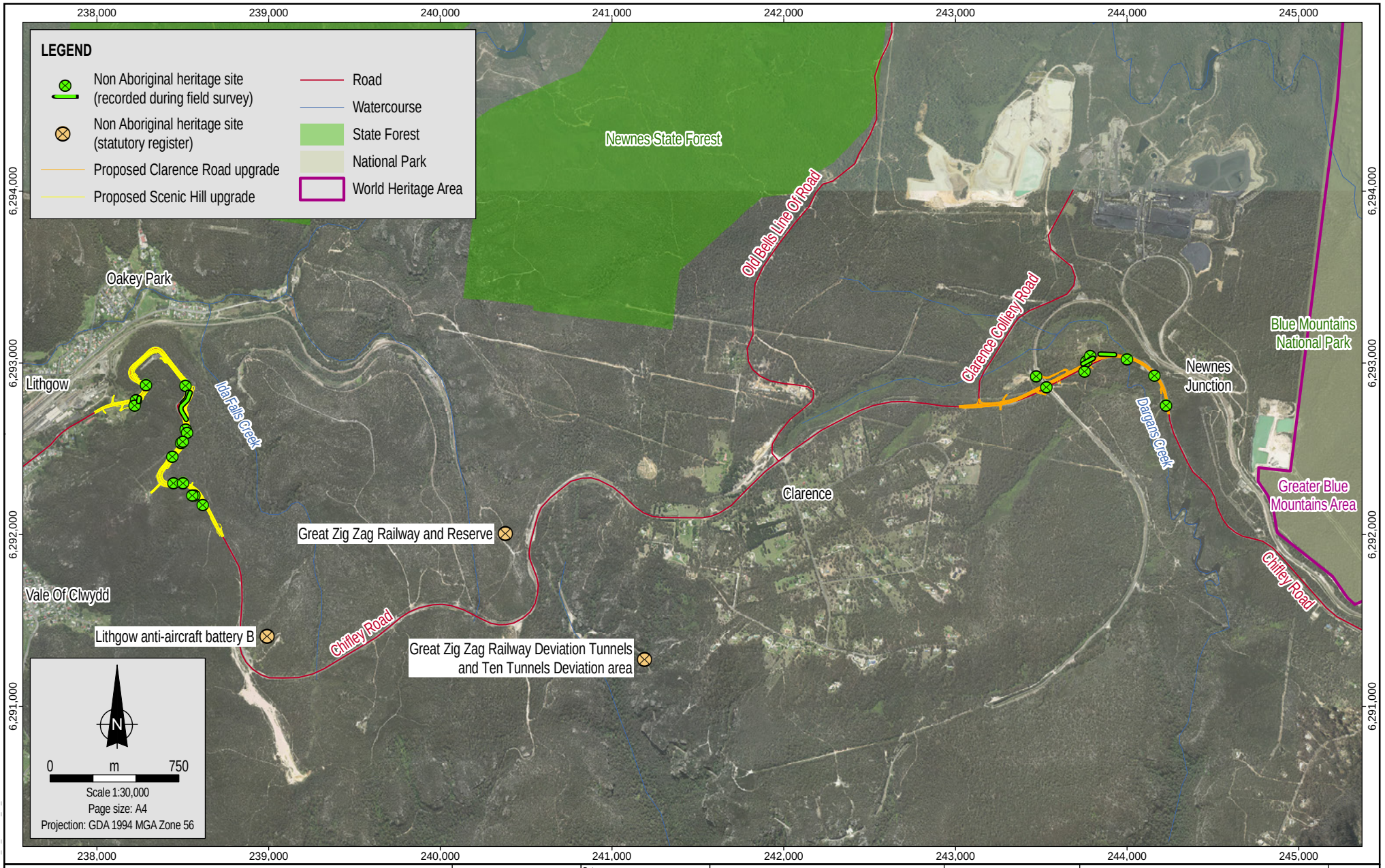
The Ex-POW Memorial located at Scenic Hill is discussed separately in Section 6.10.

A summary of non-Aboriginal heritage items encountered during the field surveys is presented in Table 6.19 below. These sites are shown on Figure 6.7 and in plates 6.8–6.11.

Table 6.19 Non-Aboriginal heritage sites encountered during investigations

Site	Item	Location	Significance
CRC 01	Clarence road over rail bridge	6255	Local (criterion A)
CRC 02	Sandstone culvert at Dargans Creek	5740	Local (criteria A, C, E, F and G)
CRC 03	Formation	5815 to 5900	Local (criteria A and E)
CRSH 04	Stone lined gutter	13315	Local (criteria A and C)
CRSH 05	Culvert	14720	Local (criterion A)
CRSH 06	Benched track	14695 to 14715	Local (criteria A and E)
CRSH 08	Culvert	14615	Local (criterion A)
CRSH 09	Stone lined gutter	13315, 13740, 13640	Local (criteria A and C)

Site	Item	Location	Significance
CRSH 13	Dump	13650	Local (criterion A)
CRSH 15	Culvert	13270	Local (criterion A)
CRSH 17	Concrete and sandstone agglomeration	13170	Local (criterion A)
CRSH 18	Dry rubble sandstone wall	13200	Local (criterion A)
CRC 19	Concrete pad	5980	Local (criterion A)
CRC 21	Cutting and mound	5950	Local (criteria A and E)
CRC 23	Sandstone culvert	5360	Local (criteria A, C, E, F and G)
CRC 25	Clarence siding no.2	6280	Local (criterion A)
CRC 26	1869 railway alignment cutting	5560 to 5660	Local (criterion A)



Source:
Archaeological sites from Cosmos Archaeology.
Proposed road upgrade data and aerial imagery from NSW Roads and Maritime Services.
Project features digitised by Coffey.
WHA from DSEWPC (data currency 2007). National Parks from OEH.
State forests from GEODATA250k (optimum scale 1:250,000).

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NSW Roads and Maritime Services

Bells Line of Road – Chifley Road upgrade

Transport Roads & Maritime Services

Non Aboriginal heritage sites

Figure No: 6.7

MXD Reference: 3119AB_01_GIS012_v0_5

Plate 6.8 Sandstone culvert at Dargans Creek (CRC 2)

Plate 6.9 Stone gutter at Scenic Hill (CRSH 4)

Plate 6.10 Concrete pad (CRC 19)

Plate 6.11 Sandstone culvert (CRC 23) which runs under Chifley Road at southern end of Clarence road over rail bridge section

Much of the study area is covered in dense vegetation, and/or is located on steep slopes. The archaeological potential of steep slopes is low although in densely vegetated areas further archaeological sites could occur. Potential sites are likely to relate to twentieth century road construction activities (low significance scatters of construction waste) or building sites or dumps associated with the school at Clarence.

6.8.3 Policy setting

Legislation and plans relevant to non-Aboriginal heritage management are summarised in Appendix D.

6.8.4 Potential impacts

Potential impacts on non-Aboriginal sites, objects and places are discussed in this section. The assessment focuses on items in the vicinity of the study area listed on statutory registers, and items of local significance identified during investigations for this proposal.

Impacts on statutory register sites

Table 6.20 summarises the potential impacts on sites in the vicinity of the proposal area that are recorded on statutory registers.

Table 6.20 Potential impacts on non-Aboriginal heritage sites on statutory registers

Site name	Listing	Potential impact
Greater Blue Mountains Area	World Heritage List, National Heritage List	The Greater Blue Mountains Area is 0.5km from the proposal area at its closest point. No direct impact to the values of this listing are expected. The proposal involves upgrade of an existing road alignment and activities will not change the view or significantly increase access to the area. The Greater Blue Mountains Area will not be visible to, or from, the proposal area due to surrounding vegetation.
Great Zig Zag Railway and Tunnels	State Heritage Register 00542 (Great Zig Zag Railway and Reserves), State Heritage Register 01037 (Great Zig Zag Railway deviation tunnels), s.170 NSW Trains (Bell to Zig Zag Ten Tunnel Railway Deviation)	The railway and all associated sites are located over 1.5km from the proposal area and there would be no impact on these sites. The Ten Tunnel railway deviation passes underneath Chifley Road and the Clarence road over rail bridge. This section of the deviation is not within the heritage curtilage of the listing and is not protected. There would be no direct impact on the values of the Ten Tunnel railway deviation listing. Potential indirect impacts could include altered views or increased traffic to the site. As the proposal involves upgrade of an existing road alignment, activities would not change the view or significantly increase access to the site. The Ten Tunnel railway deviation will not be visible to or from the proposal area.
Lithgow Heavy Anti-aircraft Gun Stations and Dummy Station	State Heritage Register 01862 (Lithgow Heavy Anti-aircraft Gun Stations and Dummy Station) and Lithgow Local Environmental Plan A176 (Gun Emplacements – Archaeological Site	The gun emplacements site, Lithgow Anti-aircraft Gun Battery B is located next to Chifley Road about 25m from ancillary site 4. This site was chosen as an ancillary site due to previous use as a compound. No direct impacts on the values of this site are expected, although use of ancillary site 4 may temporarily restrict access. Potential indirect impacts could include altered views or increased traffic to the site. The proposal involves upgrade of an existing road alignment, and activities will not change the view or significantly increase access to the site. The Lithgow Anti-aircraft Gun Battery B will not be visible to, or from, the proposal area.

Impacts on sites of local significance

Table 6.21 below summarises the potential impacts on sites of local significance recorded in the vicinity of the proposal area. Sites are of local importance and the significance of potential impacts is assessed as being low, particularly after the application of safeguards and management measures discussed in Section 6.8.5. The location of the sites is shown on Figure 6.7.

Table 6.21 Potential impacts on non-Aboriginal heritage sites of local significance

Site name	Item	Potential impact
CRC 01	Clarence road over rail bridge	Demolish existing bridge and replace
CRC 02	Sandstone culvert at Dargans Creek	Outlet will be extended by 12-14 m. Current outlet will be buried
CRC 03	Formation	Burial of eastern end
CRSH 04	Stone lined gutter	Road realigned over feature
CRSH 05	Culvert	Road realigned over feature
CRSH 06	Benched track	Road realigned over feature
CRSH 08	Culvert	Road realigned over feature
CRSH 09	Stone lined gutter	Road realigned over feature
CRSH 13	Dump	Road realigned over feature
CRSH 15	Culvert	Road realigned over feature
CRSH 17	Concrete/sandstone agglomeration	Burial of all or part of feature
CRSH 18	Dry rubble sandstone wall	Burial of all or part of feature
CRC 19	Concrete pad	Removal of 4m or 20 per cent of the item with potential impact from heavy machinery during construction to the surviving portion
CRC 21	Cutting and mound	Potential impact from heavy machinery during construction
CRC 23	Sandstone culvert	Potential impact from heavy machinery during construction
CRC 25	Clarence siding no.2	Close to proposed work depot
CRC 26	1869 railway alignment cutting	Some excavation into side of cutting

Other sites

Although not assessed as a heritage item, a roadside memorial is located on the southern side of Chifley Road at Scenic Hill. Roads and Maritime policy for moving roadside tributes states efforts will be made to contact the family, if known, and work with them to safely store the tribute until the work is complete. If the tribute's owner cannot be located, Roads and Maritime would store the tribute off-site for an appropriate length of time.

6.8.5 Safeguards and management measures

Safeguards and management measures proposed to avoid, reduce or manage impacts on non-Aboriginal heritage are discussed in Table 6.22.

Table 6.22 Safeguards and management measures relating to non-Aboriginal heritage

Impact	Environmental safeguards	Responsibility	Timing
Impact on non-Aboriginal heritage items from the work	• Impact to the outlet of site CRC 02 will be minimised through deployment of sufficient and suitable separation fabric, plumbers sand or other similar method at the interface of the outlet.	Contractor	Detailed design/ pre-construction/ construction
Impact on non-Aboriginal heritage items from the work	• Damage to the unburied portion of site CRC 03 will be avoided where practical.	Contractor	Detailed design/ pre-construction/ construction
Impact on non-Aboriginal heritage items from the work	A Non-Aboriginal Heritage Management Plan will be prepared and implemented as part of the CEMP and will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to Non-Aboriginal heritage. The Plan will include, but not be limited to: Details of investigations completed or planned to be undertaken and any associated approvals required Mapping of areas of non-Aboriginal heritage value and identification of protection measures to be applied during construction Procedures to be implemented if previously unidentified non-Aboriginal relics or heritage items are discovered during construction, in accordance with the Roads and Maritime Standard Management Procedure - Unexpected Archaeological Finds Procedures to be followed in the management of sites CRSH 06, CRSH 17 and CRSH 18 An induction program for construction personnel on the management of non-Aboriginal heritage values.	Contractor	Pre-construction
Impact on non-Aboriginal heritage items from the work	• An archival recording will be prepared for all identified sites including CRC 01 and CRC 02 prior to demolition and removal. The recording will be prepared in accordance with guidelines published by the Office of Environment and Heritage.	Contractor	Pre-construction/ construction

Impact	Environmental safeguards	Responsibility	Timing
Impact on non-Aboriginal heritage items from the work	• A detailed archival recording will be prepared of sites CRSH 06, CRSH 17 and CRSH 18 prior to any works being undertaken that affects the item. The recording will be prepared in accordance with guidelines published by the Office of Environment and Heritage. These sites should be re-inspected and recorded by an archaeologist and after the area has been cleared of vegetation. Care should be taken during clearance minimise the amount of ground disturbance in this area.	Contractor	Pre-construction/ construction
Unexpected find of non-Aboriginal heritage artefact or site	• All personnel working on site will receive training to ensure awareness of requirements of the Non-Aboriginal Heritage Management Plan and relevant statutory responsibilities. Site-specific training will be given to personnel when working in the vicinity of identified Non-Aboriginal heritage items.	Contractor	Pre-construction/ Construction
Impact on non-Aboriginal heritage items from the work	• Exclusion zones will be established around sites CRC 19, CRC 21, CRC 23 and CRC 25 to prohibit vehicle movement and minimise impact when clearing vegetation.	Contractor	Pre-construction/ construction
Unexpected find of non-Aboriginal heritage artefact or site	• Should any heritage items, archaeological remains or potential relics of Non-Aboriginal origin be encountered, then construction work that might affect or damage the material will cease and notification provided to the relevant Roads and Maritime officer identified in the Roads and Maritime Standard Management Procedure - Unexpected Archaeological Finds. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Construction

6.9 Landscape character and visual impacts

This section describes the existing environment, potential impacts and proposed safeguards and management measures in relation to landscape character and visual amenity in the proposal area. It draws on the urban design concept, landscape character and visual impact assessment report completed by Spackman Mossop and Michaels (2016) (Appendix I).

The assessment involved review of relevant literature, aerial photographs and topographic maps, the engineering concept design and an initial site visit and field investigation. The landscape character of the proposal area was defined with specific landscape character zones identified. Sensitive viewpoints in the study area were identified and the magnitude assessed of potential impacts from the proposal on views from these sites.

6.9.1 Existing environment

The landform within the proposal area ranges from steep to undulating slopes. From Clarence, ridges rise over 1140m above sea level and consist of some of the more elevated landscapes in the area. At Scenic Hill, the landform descends steeply to Lithgow. A number of water bodies and water courses are located within the proposal area and surrounds including creeks and drainage lines.

The landscape within and surrounding the proposal area is semi-rural. Small holdings and settlements are scattered along Chifley Road and the connecting Bells Line of Road. Lithgow, located around 3km east of Scenic Hill, is the main urban settlement close to the proposal area. The city sits within a valley with small scale industry and industrial artefacts providing evidence of its industrial past (Spackman Mossop and Michaels, 2016).

The proposal area is also located in proximity to the Blue Mountains National Park and State and regionally managed parks and reserves such as Newnes State Forest and Lithgow Nature Reserve. These areas provide motorists travelling along the meandering Chifley Road with views of densely vegetated peaks with opening and closing views through the vegetation (Spackman Mossop and Michaels, 2016). These areas are valued for their native vegetation, picturesque views and cultural heritage values and contribute to the landscape character of the region.

The natural landscape is intercepted by arterial and local roads and the Main Western Railway Line which connect the small settlements as well as the city of Sydney to various regional centres. Overhead services and utilities such as transmission lines are also visible within parts of the proposal area.

Four landscape character zones (LCZ) have been defined in the proposal area (Spackman Mossop and Michaels, 2016). Each zone is based on characteristics of the urban form, topography, vegetation and land use. These zones are:

- LCZ1: Scenic Hill – this zone comprises residences and sensitive roadside vegetation along Scenic Hill, in an area of steep slopes and rocky outcrops. The Ex-POW memorial is located in this zone.
- LCZ2: Scenic Hill approach road – this zone transitions from the steep gradients of LCZ1 into a mildly graded crest. This zone comprises open woodland and rocky outcrops with little anthropogenic influence other than the road corridor.
- LCZ3: Clarence road west – this zone consists of gently undulating slopes and open woodland including the Clarence road over rail bridge. There is little infrastructure aside from the road corridor and the rail bridge. The bridge and cutting are relatively minor in elevation in a landscape of well vegetated and steeply undulating hill and valleys
- LCZ4: Clarence road east – this zone comprises steep to undulating slopes with dense forests and rocky outcrops.

6.9.2 Policy setting

The landscape character and visual impact assessment was informed by several Roads and Maritime guidelines including:

- EIA N04 Practice Note: Guideline for Landscape Character and Visual Impact Assessment V2.0 (RMS, 2013)
- Beyond the Pavement (RMS, 2014b)
- Bridge Aesthetics Design Guidelines (RMS, 2012b)
- Noise Wall Guidelines (RTA, 2006)
- Landscape Guideline (RTA, 2008)
- Shotcrete Design Guidelines (RTA, 2005).

6.9.3 Potential impacts

The nature and extent of potential impacts from the proposal on landscape character and visual amenity are summarised in this section. A full assessment of the impacts of the proposal on the identified LCZs and selected key viewpoints is presented in Appendix I.

Potential impacts on each LCZ in the proposal area are summarised below:

- LCZ1: Scenic Hill – bulk earthworks and vegetation removal would occur in this zone. The retaining wall on the eastern side of the Ex-POW Memorial would also increase the visibility of the road alignment for residents of Lithgow and sections of the work (such as the cut face treatment and retaining wall) would be visually prominent. Over time the magnitude of the impact would reduce as newly planted trees mature.
- LCZ2: Scenic Hill approach road – the proposal would require clearance of areas of roadside vegetation to widen of the existing alignment. Bulk earthworks would be required for the curve improvements. Reinstatement of vegetation over time would reduce the magnitude of impacts during operation.
- LCZ3: Clarence road west – the proposal would require cut and fill embankments on both sides of the road corridor and associated vegetation clearance. Dense vegetation retained in this zone would limit impacts, and over time, reinstated areas would reduce the magnitude of impacts further. The removal of the existing bridge structure and construction of the new bridge would require removal of some vegetation which will open up views to existing road users and train passengers on the railway.
- LCZ4: Clarence road east – the existing road alignment would be widened with some clearance of trees around the southern side of the road. Reinstatement of vegetation over time would reduce the magnitude of impacts during operation.

The work has the potential to cause an adverse impact within LCZ1 (Scenic Hill) due to the scale of the works and high sensitivity of this setting, particularly the view from Lithgow. Over time, the magnitude of these impacts will reduce as the reinstated areas of vegetation mature.

No significant adverse impacts on landscape character or views are expected in the other three LCZs. The proposed work largely follows the existing road alignment and the landscape character and native vegetation within these zones would be able to absorb changes arising from the proposal. Where the proposal deviates from the existing alignment at the Clarence road over rail bridge (LCZ3), the replacement of the bridge in the new location will not alter the character of this zone.

6.9.4 Safeguards and management measures

The engineering and urban design process has sought to optimise the integration of road elements into the landscape. Urban design objectives and principles are detailed in Section 4 of Appendix I. A landscape strategy and urban design and landscape concept plan for the proposal are presented in Section 5 of Appendix I.

Further safeguards and management measures proposed to avoid, reduce or manage impacts on landscape character are discussed in Table 6.23.

Table 6.23 Safeguards and management measures relating to landscape character and visual impacts

Impact	Environmental safeguards	Responsibility	Timing
Quality of structures	• Design the proposed Clarence road over rail bridge according to the Roads and Maritime – Bridge Aesthetics Design Guidelines.	Roads and Maritime	Detailed design

Impact	Environmental safeguards	Responsibility	Timing
Integration of earthworks design with existing landform	• Minimise visual impact of earthworks and associated structures through rounding off top of cut batters, tailing off cut batters and flattening of grades at the ends of fill embankments where feasible.	Roads and Maritime	Detailed design
Integration of earthworks design with existing landform	• Design retaining walls to utilise visually recessive materials and colours. The design should minimise the construction footprint and extent of vegetation clearance.	Contractor	Detailed design
Integration of earthworks design with existing landform	• Use screen planting to minimise visual dominance of retaining walls and use sculpted shotcrete finishes to blend the structure with surrounding rock cuttings where possible.	Contractor	Construction
Minimisation of road furniture and signage	• Coordinate signage locations with other roadside elements including structures, furniture, fencing and landscape treatment.	Roads and Maritime	Detailed design
Use of soft engineering	• Avoid the use of concrete-lined drainage channels where practical, and utilise vegetated or rock lined channels where possible. If concrete lined channels are used, ensure the concrete is coloured and/or heavily roughened.	Contractor	Detailed design
Use of soft engineering	• Maintain drainage structures where required, noting that revegetation and darkening are emphasised as a positive outcome from an urban design perspective.	Roads and Maritime	Operation
Retention of vistas	• Prepare and implement a landscape and revegetation plan for the proposal.	Contractor	Detailed design
Retention of vistas	• Maintain important vistas during maintenance regimes. Do not remove vegetation in revegetation areas associated with screening unless within clear zones.	Roads and Maritime	Operation

6.10 Socio-economic and land use

This section describes the existing environment, potential impacts and proposed safeguards and management measures in relation to the socio-economic values and land use of the proposal area.

6.10.1 Existing environment

The proposal is located the Lithgow Statistical Local Area. The surrounding area is semi-rural context. Small settlements are scattered along Chifley Road and the connecting Bells Line of Road. Lithgow is the main urban settlement close to the proposal area.

Table 6.24 summarises key demographic characteristics of the Lithgow Statistical Local Area and compares it to Greater Sydney, from the 2011 Census (ABS, 2011).

Table 6.24 Key demographic characteristics for the Lithgow Statistical Local Area (2011)

Characteristics	Lithgow	Greater Sydney
Population		
Total population	20,160	4,391,674
Median age	42	36
14 years and below	18.7%	19.2%
65 years and above	18.1%	12.7%
Households and families		
Couple families with children	38.5%	48.9%
Couple families without children	41.6%	33.5%
One parent families	18.2%	15.7%
Cultural Diversity		
Speak only English at home	90.7%	62.2%
Households where two or more languages are spoken	4.8%	35.5%
Aboriginal and Torres Strait Islander population	4.5%	1.2%
Income and employment		
Medium household income per week	$896	$1,447
Unemployed	7.2%	5.6%
Travel to work		
Travel to work by car as driver	67.4%	53.7%
Travel to work by car as passenger	5.4%	4.5%
Travel to work by public transport	1.5%	20%

In 2011, approximately 5.8 per cent of the population of the City of Lithgow reported a need for help in day-to-day life due to a disability (Lithgow City Council Community Profile, 2011).

Social characteristics

The Lithgow Statistical Local Area has an ageing population with just over 18 per cent of the aged over 65 years, compared to 12.7 per cent within Greater Sydney. Over 90 per cent of the population speak only English at home (90.7 per cent) compared to 62.2 per cent across Greater Sydney. Top languages other than English spoken at home in Lithgow include Italian (0.3 per cent), German (0.3 per cent) and Cantonese (0.2 per cent).

The majority of Lithgow residents travel to work by car as the driver or passenger (72.8 per cent).

Social infrastructure

Key social infrastructure and services located in Lithgow and the surrounding area include:

- Education facilities and childcare centres such as the Zig Zag Public School, Lithgow High School, First Grammar Lithgow, Lithgow College, Jack and Jill Preschool and Gumnut House Child Care Centre

- Aged care facilities such as Cooinda Homes and Three Tree Lodge
- Emergency and medical services such as the Lithgow Medical Clinic, Lithgow Police Station and NSW Rural Fire Service
- Religious institutions including Lithgow Uniting Church, Coast Spiritualist Church and St Patrick's Catholic Presbytery
- Recreation facilities such as Glanmire Oval, Majorie Jackson Oval.

The majority of this infrastructure is located over 1km from the proposed work at Scenic Hill and over 5km from the proposed work at Clarence road over rail bridge. The exception is Zig Zag Public School which is located around 500m north of the proposed work on Scenic Hill and on the opposite side of the Main Western Railway.

Recreation areas

A number of parks and reserves are located nearby to the proposed work, including Lithgow Valley Reserve, Blue Mountains National Park, State Mine Railway Heritage Park and Lake Pillans Wetlands. The current road provides access to these and other attractions within Lithgow and the surrounding area.

Environment and conservation

The Blue Mountains National Park is located to the east of the study area and is part of the Greater Blue Mountains Area, listed on the National Heritage List and the World Heritage List under the EPBC Act. At its closest point, the Blue Mountains National Park is approximately 500m to the south east of the Clarence road over rail bridge upgrade works along the current road alignment.

Dargan Creek Reserve is located immediately to the south of the Clarence road over rail bridge section of the proposal.

These parks and reserves are shown on Figure 6.2.

Community values

The community within the proposal area and surrounds are understood to value the area for its natural assets, leisure opportunities, heritage and attractive rural-residential lifestyle (Lithgow Community Strategic Plan 2013-2016, Lithgow City Council).

Lithgow has also been recognised as a tourism destination, heritage centre and a well-thought-of residential area.

Residential

Residential use in the study area comprises very low density rural development. No residences are visible along the majority of the Scenic Hill section of the work. Several properties are visible at the western end of the Scenic Hill section. One residence is located near the top curve on Scenic Hill and is screened from the road by native vegetation. No residences are located on the rural-residential area located on the eastern side of Chifley Road on Scenic Hill.

At Clarence road over rail bridge, a property is located to the north of the road, set back from the current alignment just to the east of the existing bridge. The other area of rural-residential development close to the Clarence road over rail bridge section is at the western end of the proposal area. Only one property has direct access to Chifley Road.

Economic characteristics

Medium household income (per week) in Lithgow is about 38 per cent lower than that in the Greater Sydney area. The top industry for employment is coal mining (11.9 per cent), followed by school education (4.2 per cent) and cafes, restaurants and takeaway food services (3.8 per cent). Clarence Colliery mine, located around 900m north of the Clarence road over rail bridge and accessed via Clarence Colliery Road off Chifley Road, is the main commercial industry in the area. Other businesses accessible from Chifley Road include Hanson Quarry on Clarence Colliery Road

and the Clarence Siding Sawmill, located on Old Bells Line of Road north of Chifley Road at Clarence.

Transport facilities and access

The Blue Mountains Line travels from Lithgow along the Main Western Railway Line to the north of the Scenic Hill section of the work, and crosses under the Clarence road over rail bridge section of Chifley Road. There are stops at Bell (approximately 4.5km south east of the proposed works at Clarence), Zig Zag (approximately 700m east of the proposed works at Scenic Hill) and Lithgow (approximately 2.5km south east of the proposed works at Scenic Hill). A railway maintenance yard is located to the north of the proposal area, at the western end of the Scenic Hill section.

There are no footpaths or bike paths on the sections of Chifley Road subject to the proposed work. The narrow width of the shoulder on both sides of Chifley Road was raised as a concern for cyclists as a part of stakeholder consultation conducted for the proposal (see section 5.2).

Four landowners access their properties directly from Chifley Road within the proposal area, two within the Scenic Hill section and two within the Clarence Road over rail bridge section of work (see Figure 6.5).

Services and utilities

Chifley Road is bisected by utility installations including water pipelines, electricity transmission lines and telecommunication cables. These services are mainly sited in the eastern section of the proposal area where the Main Western Railway crosses under Chifley Road at Clarence. Underground optic fibre and rail communications are located within the rail corridor.

Memorial

An ex-prisoner of war memorial is located on Scenic Hill, just off the current road alignment.

Lithgow City Council Local Environment Plan 2013

The Chifley Road corridor is zoned as a Special Purpose Zone SP2 (Infrastructure) under the Lithgow City Council Local Environment Plan. The proposal is consistent with this designation as a classified road.

Areas surrounding the road corridor are zoned as Environmental Protection Zone E3 (Environmental Management) (LCC, 2013). Objectives of this zone are to:

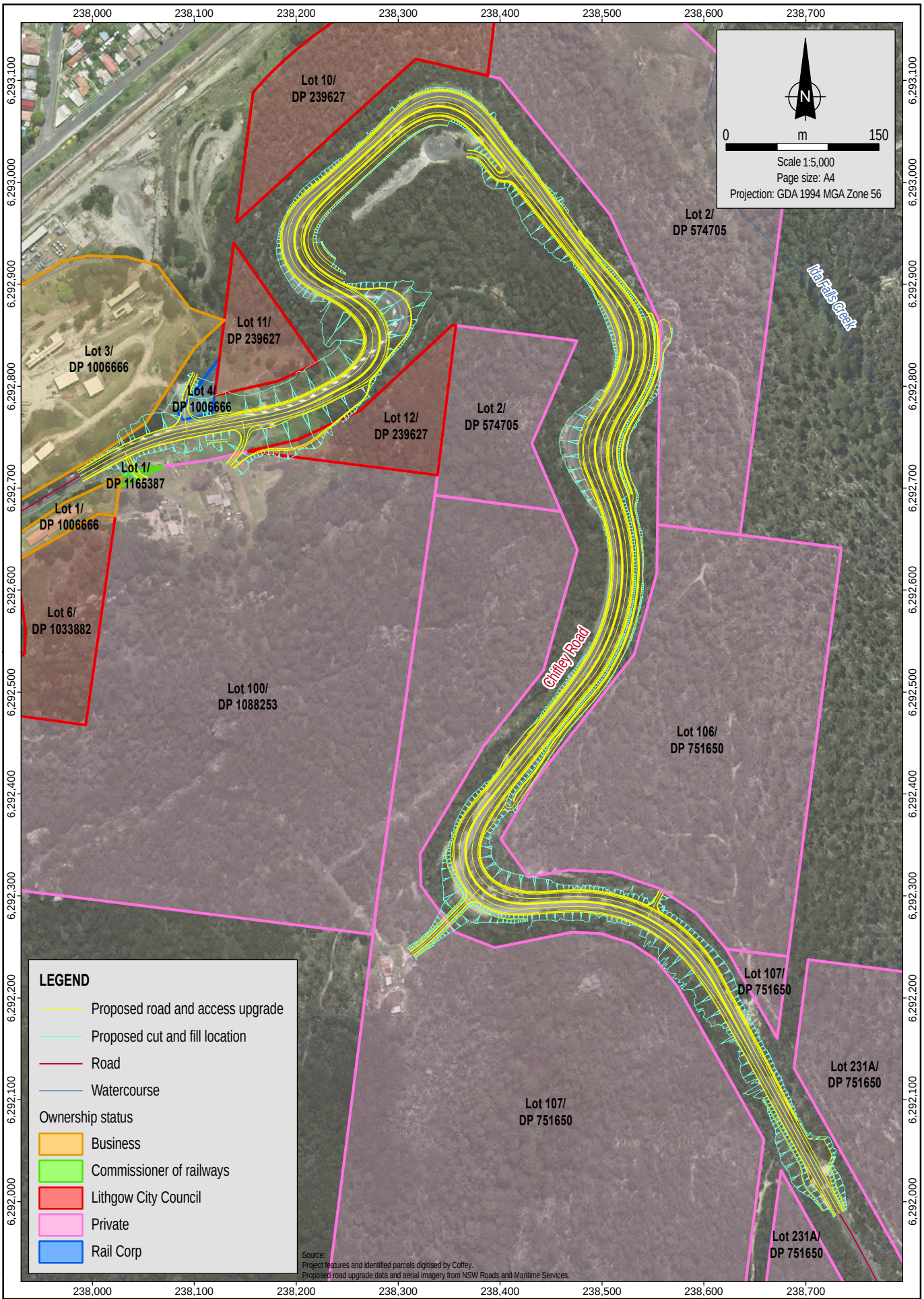
- Protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values.
- Provide for a limited range of development that does not have an adverse effect on those values.
- Facilitate the management of environmentally sensitive lands and riparian areas within the zone.
- Protect and conserve the vegetation and escarpment landscape surrounding the Lithgow Valley.
- Maintain or improve the water quality of receiving water catchments in accordance with the NSW water quality objectives.

Road construction is not listed as a permitted activity within this zone. Any activities agreed within this area with the Lithgow City Council must be consistent with the objectives of this zone.

Land ownership

Land surrounding the proposal area is predominantly in forest. The land has various owners including private individuals, the Crown, Lithgow City Council, and Sydney Trains (Rail Corp). The proposal area is predominantly rural. The closest large settlement is the city of Lithgow, to the west of Scenic Hill. Clarence is a scattered residential development across a hillside to the west of the Clarence road over rail bridge upgrade.

Land ownership in the vicinity of Scenic Hill is shown on Figure 6.8. Land ownership in the vicinity of the Clarence road over rail bridge is shown on Figure 6.9.



MXD Reference: 3119AB_01_GIS014_v0_3

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Date: 26.07.2016
Project: ENAURHOD03119AB
File Name: 3119AB_01_F06.08_GIS

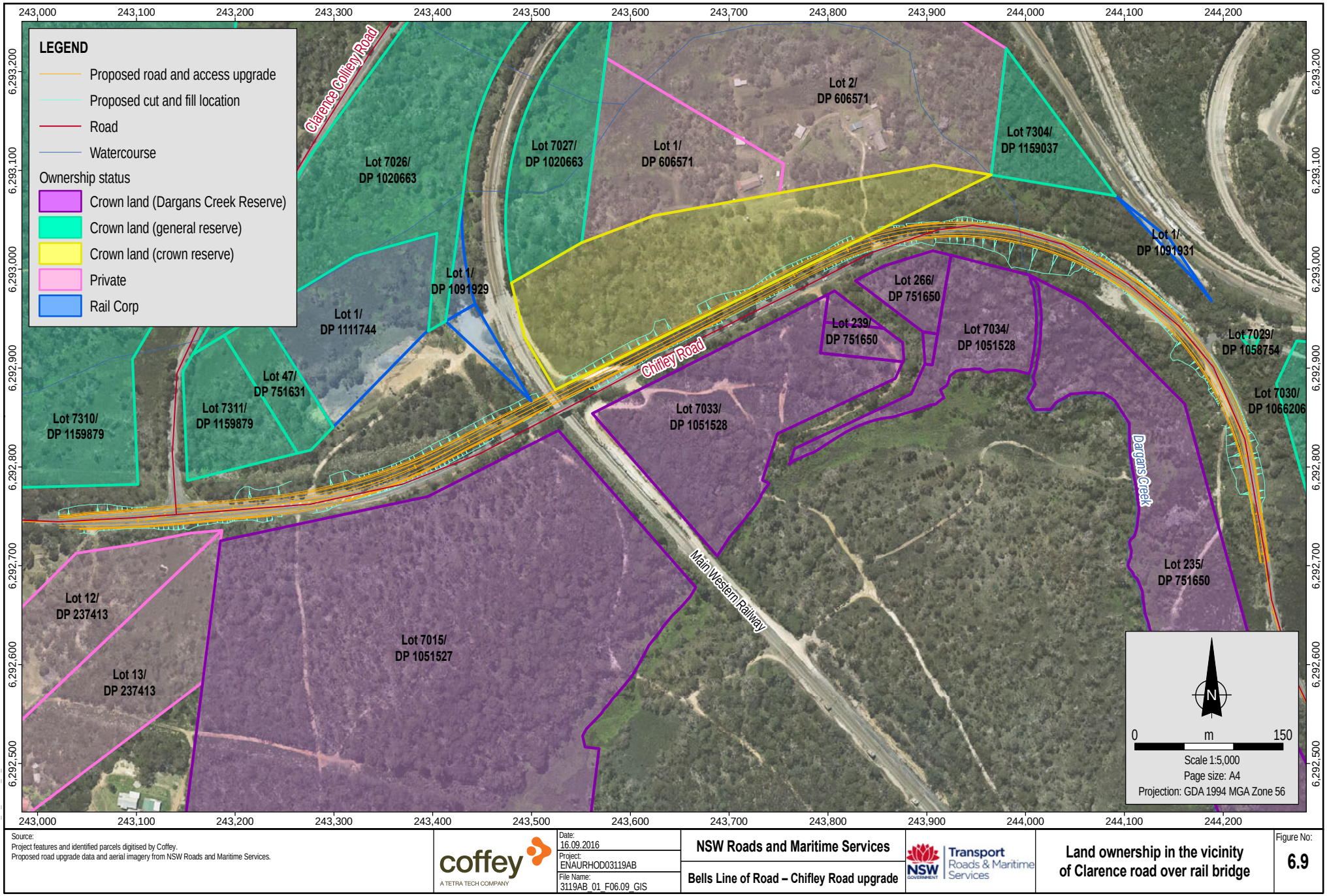
NSW Roads and Maritime Services

Bells Line of Road – Chifley Road upgrade

Transport Roads & Maritime Services

Land ownership in the vicinity of Scenic Hill

Figure No: 6.8



Source:
Project features and identified parcels digitised by Coffey.
Proposed road upgrade data and aerial imagery from NSW Roads and Maritime Services.

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Date: 16.09.2016
Project: ENAURHOD03119AB
File Name: 3119AB_01_F06.09_GIS

NSW Roads and Maritime Services

Bells Line of Road – Chifley Road upgrade

Transport Roads & Maritime Services

Land ownership in the vicinity of Clarence road over rail bridge

Figure No: 6.9

MXD Reference: 3119AB_01_GIS015_v0_4

6.10.2 Potential impacts

The nature and extent of potential impacts from the proposal on aspects of the social and economic environment and land use values of the proposal area are described in this section. Potential impacts on landscape character and visual amenity are discussed in Section 6.9 and on amenity (in respect to noise and vibration and air quality in (sections 6.6 and 6.11 respectively).

Construction

Social infrastructure

Indirect impacts may be experienced from reduced access to social infrastructure during the proposed work associated with the temporary changes to traffic conditions. The ageing population of the area has the potential to be particularly vulnerable to such changes given that they are likely to be particularly reliant on social infrastructure and services. The impact has been assessed as minor given that access along Chifley Road will be maintained throughout the work and changes to traffic conditions will be short-term and notified well in advance.

Transport facilities and access

Section 6.5 describes potential impacts on road users, local businesses and property owners associated with temporary changes to traffic conditions during construction and operation of the project. Temporary closure of the access to the Ex-POW memorial may be needed at some stages of the work for technical reasons and to ensure safety of the public and work personnel. Such closures would be notified well in advance to the community.

Utilities and services

During the work, water, electricity and telecommunications services along the road corridor may be affected by temporary disruptions to some services. The impact of this disruption would be minor, as it will be short-term in nature and affected individuals and organisations will be notified in advance.

Local businesses

Local businesses, especially in Lithgow would benefit from increased patronage of cafes, restaurants and other food service industries as well as increased occupancy of accommodation facilities. Other suppliers in the local area may also benefit from increased sales of fuel and materials. The significance of this beneficial impact will be dependent on where the contractor sources personnel to support the project, and associated employment, lodging and transport arrangements.

Property acquisition

Eight properties will require partial acquisition as a part of the Scenic Hill upgrade. Table 3.7 lists the properties that would be partially acquired as part of the proposal. No property acquisition is proposed for Clarence road over rail bridge section.

Of the eight properties to be partially acquired, four are privately owned. The acquisitions will be conducted in accordance with the safeguards and management measures outlined in Section 6.10.3. The impact on these property owners would be moderate given the scale of land to be acquired (between 830m^2 and 2,130m^2 per property). The impact on public authorities who own the remaining four properties would be minor due to the current use of this land.

Roads and Maritime has consulted with affected landowners informing them of the area of acquisition that would be required. These areas would be finalised during detailed design. All property acquisition would be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and Roads and Maritime's Land Acquisition Information Guide February 2012 (RMS, 2012c).

Some additional land may need to be leased by Roads and Maritime during the work for use as ancillary sites. Areas leased by Roads and Maritime will be returned to the landowner following the

completion of work. The impact on these property owners would be minor due to the temporary nature of these arrangements and the relatively small areas of land to be leased.

Property access

Access to properties and businesses along the road would be maintained during the work. Temporary property access would be provided to residences where required. The management of property access would be considered by the contractor and detailed in the final staging plan.

Access to the Ex-POW memorial at Scenic Hill would also be maintained where possible.

Operations

Road users including locals and tourists, pedestrians and cyclists will benefit from improved safety, access and reduced travel times along Chifley Road once the proposed work is complete. Users and operators of the passenger services and freight trains that travel under the Clarence Road over rail bridge will also benefit from the improved safety provided by the new bridge.

Local businesses such as Clarence Colliery mine and Hanson Quarry will benefit from access improvements through the upgrade of the Clarence Road – Chifley Road intersection.

Improvements to the access road to the Ex-POW Memorial will also provide enhanced access by visitors of this memorial.

The proposal does not have any impact on the viability of land identified for future development in the Lithgow Environmental Plan (LCC, 2013).

Finally, access to social infrastructure is expected to improve during operation of the proposal through reduced travel times and improved traffic flows along Chifley Road.

6.10.3 Safeguards and management measures

Safeguards and management measures proposed to avoid, reduce or manage impacts on socio-economic and land-use values are discussed below in Table 6.25. These measures should be read in conjunction with the safeguards and management measures outlined in sections 6.5, 6.6, 6.7 and 6.10, many of which will also help to avoid, reduce or manage impacts on socio-economic values.

Table 6.25 Safeguards and management measures relating to socio-economic and land-use values

Impact	Environmental safeguards	Responsibility	Timing
Property acquisition	• All property acquisition will be carried out in accordance with the Land Acquisition Information Guide (RMS, 2012c) and the *Land Acquisition (Just Terms Compensation) Act 1991*.	Roads and Maritime	Detailed design/ Pre-construction
Changes to road access and/or conditions during the work	• Consultation will occur with Clarence Colliery mine and Hanson Quarry to identify appropriate management strategies to avoid or minimise impacts on access and operations. This will include consideration of measures such as additional signage and alternative access arrangements.	Roads and Maritime/ Contractor	Detailed design/ Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
Changes to road access and/or conditions during the work	• A Communication Plan (CP) will be prepared and implemented as part of the CEMP to ensure provision of 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. The CP will be prepared in accordance with the Roads and Maritime *Community Involvement and Communications Resource Manual*.	Contractor	Pre-construction/ construction
Management of community inquiries or complaints	• A complaints handling procedure and register will be included in the CEMP.	Contractor	Construction
Emergency access	• Access for emergency vehicles will be maintained at all times during construction. Any site-specific requirements will be determined in consultation with the relevant emergency services agency.	Contractor	Construction
Disruption to utilities and services	• Persons and organisations likely to be affected by utility related work (eg disruption to services) will be notified at least five days prior to commencement of any such work. In the notification include details of: the project; work period and work hours; period of utility service disruption; contact information for project management staff; complaint and incident reporting; and how to obtain further information.	Contractor	Construction (prior to any utility works)

6.11 Air quality

This section describes the existing air environment, relevant air quality criteria, potential impacts on air quality from the proposal, as well as proposed safeguards and management measures.

6.11.1 Existing environment

Air quality overall in NSW is good by international standards (EPA, 2016) and locally depends on nearby sources of pollutants. A search of the National Pollution Inventory (NPI) database (2013/2014) for Lithgow LGA identified 10 facilities which could potential emit pollutants and affect local air quality. Existing air quality in the study area is likely to be influenced by nearby mining activities, power station emissions, transport corridors and wood-fired heaters in winter.

Monitoring data show that ambient concentrations in NSW of common pollutants such as carbon monoxide (CO), lead, nitrogen dioxide (NO_2), and sulphur dioxide (SO_2) are all consistently below the respective national standards in most areas. Concentrations of some pollutants, including particulate matter (PM_{10}) can exceed national standards, in both rural and urban areas (EPA, 2016).

The closest OEH air quality monitoring station to the proposal area is at Richmond, about 50km east of the proposal area. Data for Richmond from 2011 to 2015 was reviewed and showed that

there were no exceedances recorded for nitrogen dioxide (NO_2), carbon monoxide (CO) and sulphur dioxide (SO_2).

Criteria for visibility were exceeded on 133 days in 2013, 14 days in 2014 and 17 days in 2015. Particulate emissions (measured as PM_{10} and often associated with dust) were exceeded less than five times between 2011 and 2013.

A few instances each year of the PM_{10} criteria being exceeded is not uncommon at OEH monitoring stations, caused typically by events such as dust storms, bushfires and hazard reduction burns.

Sensitive receivers close to the study area are detailed in Section 6.6.

6.11.2 Policy setting

Further to the statutory and planning framework relevant to air quality discussed in Section 4, the following policy document is also relevant.

National Environment Protection (Ambient Air Quality) Measure
This measure includes national ambient air quality standards for Australia. It sets standards for six key air pollutants (carbon monoxide, ozone, sulphur dioxide, nitrogen dioxide, lead and particulates. This measure requires jurisdictions to monitor air quality and helps identify air quality issues.

The NSW EPA reports on these pollutants and provides assessment criteria for these pollutants as part of the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC, 2005).

6.11.3 Potential impacts

Air emission sources during the building of the proposal include dust (airborne particulate matter) and vehicle emissions.

Dust is generated when the ground surface is disturbed, exposing the surface to wind erosion. Activities that can cause dust include clearing of vegetation and/or topsoil, earthworks, and trafficking of unpaved roads/tracks as well as the transport of construction materials.

Dust can cause nuisance impacts if activities are located close to sensitive receptors, such as residences. At Scenic Hill the closest sensitive receivers are located from around 75m south of the work areas. At Clarence the closest sensitive receivers are located from around 85m north of the work areas. Nearby sensitive receivers are also located southwest of the work in Clarence (see Figure 6.5).

These properties may be impacted by dust during the work. The extent of impact associated with dust generation would be short term and minor and influenced by soil types, amount and duration of ground disturbance, local weather conditions (particularly wind speed and direction), vehicle speeds and frequency of water spraying. Progressive rehabilitation of disturbed areas would also help to reduce the extent of exposed soils. Impacts on sensitive receivers as a result of dust are expected to be confined within the area of the immediate works and would be short term and minor.

Vehicle (exhaust) emissions include those from petrol and diesel-fuelled vehicles and operation of on-site plant and machinery. The emission rates and impact potential would depend on the power output of combustion engines, quality of fuel and condition of combustion engines. The work contractor would be expected to operate and maintain all vehicles and equipment to required standards. Emissions from these sources are unlikely to result in local decreases in air quality during the work.

The aim of the proposal is to improve safety along Chifley Road. No increase in vehicle movements is anticipated. No adverse air quality impacts would be expected from the proposal during operation.

6.11.4 Safeguards and management measures

Safeguards and management measures proposed to avoid, reduce or manage impacts on air quality are discussed in Table 6.26.

Table 6.26 Safeguards and management measures relating to air quality

Impact	Environmental safeguards	Responsibility	Timing
Particulate matter and emissions	• Air quality management measures will be prepared and implemented as part of the CEMP. The measures will include: Mitigation and suppression measures to be implemented, such as spraying or covering exposed surfaces, provision of vehicle clean down areas, covering of loads, street cleaning, use of dust screens, maintenance of plant in accordance with manufacturer's instructions Methods to manage work during strong winds or other adverse weather conditions.	Contractor	Pre-construction /construction

6.12 Waste

This section describes the existing environment, potential impacts and proposed safeguards and management measures in relation to waste. Construction activities associated with the project will generate various waste streams, including spoil. Inappropriate management, disposal or reuse of these waste materials may lead to environmental, health and safety impacts.

6.12.1 Existing environment

The existing road and its use generates little waste. Waste may be generated from pruning or cutting of roadside vegetation to maintain a cleared highway, and from any maintenance activities on the road. Litter from passing motorists is evident along the road corridor. No waste disposal facilities are located within the proposal area. Green waste is left in situ, and any waste from maintenance activities is removed for disposal in Lithgow.

6.12.2 Policy setting

The following policy is applicable to the management of waste in relation to this proposal.

Waste Avoidance and Resource Recovery Strategy 2014 – 2021
The NSW Government releases a Waste Avoidance and Resource Recovery Strategy every five years associated with the *Waste Avoidance and Resource Recovery Act 2001* (NSW). The Strategy has been adopted by Roads and Maritime in seeking to minimise waste and maximise use of recycled materials where possible.

Roads and Maritime report annually on the implementation of their Waste Reduction and Purchasing Policy and every two years, a progress report is submitted to the federal Department of Environment. Roads and Maritime contractors are also required to propose recycled-content materials where they are cost and performance competitive.

6.12.3 Potential impacts

Various waste streams would be generated during construction of the proposal including spoil from excavations. The construction crew would also generate domestic and sewage waste. The following waste streams are anticipated to be generated:

- Cleared vegetation (green waste)
- General construction waste
- Old road material (eg concrete/asphalt)
- Roadside material (eg rail guards, signs)
- Liquid waste from construction equipment maintenance
- Domestic waste from site compounds
- Packaging materials (eg pallets, crates, drums)
- Scrap metal
- Sewage and greywater
- Spoil from earthworks.

Waste would be a combination of general and hazardous waste, and require disposal appropriate to this classification. Management of waste is discussed below and would be according to the procedure Management of Wastes on Roads and Maritime Services Land (RMS, 2014c).

Earthworks may encounter buried or partially buried asbestos material that has been illegally dumped on the site (eg fibrous cement sheeting potentially containing asbestos). Asbestos poses a risk to human health when asbestos fibres are breathed in. Any asbestos material in the soil with potential to create airborne fibres is a potential risk to human health. Such materials, if encountered, would need to be handled and disposed of as outlined in the measures contained in Table 6.27.

Potential impacts from waste relate to contamination of the surrounding environment (such as pollution of waterways, attracting pest fauna) through improper waste handling, storage and transport practices. The significance of these impacts is predicted to be low, as proposed safeguards and management measures would manage potential impact pathways into the surrounding environment.

Wastes during operation would be similar to existing wastes that currently occur along the road. Long term waste impacts are not anticipated.

6.12.4 Safeguards and management measures

Roads and Maritime will employ the waste management hierarchy principles of the Waste Avoidance and Resource Recovery Strategy 2014 – 2021, and its Management of Wastes on Roads and Maritime Services Land Procedure as follows:

- Waste avoidance - minimise the amount of material excavated or products used initially through detailed design
- Reuse waste - where possible re-use excavated material for fill, to reduce need to import materials and need for disposal locations to be identified. Reduce associated materials handling and transport issues, reduces fuel use and minimises footprint. Material can also be used offsite through finding sites that are approved by the relevant planning consent authority to accept the material (eg virgin excavated natural material to a building development site that has development consent from the local council to accept such material for use as engineered fill
- Recycle waste - material that cannot be reused on or offsite but can be processed at a third party facility (eg waste transfer facility in Lithgow) to be recycled (eg glass, plastic, metals)
- Dispose of waste - the least preferred management option. If materials must be disposed of, they must be transported to a facility that is licensed by the EPA to accept the specific material that requires disposal.

Following the principles set out above, surplus materials that cannot be used on site as part of the proposal would be re-used or disposed of in the following order of priority:

- Transfer to other nearby Roads and Maritime projects for immediate use
- Transfer to an approved Roads and Maritime temporary stockpile site for future use during projects or routine maintenance
- Transfer to a Roads and Maritime approved site for reuse on concurrent private/local government projects (with appropriate approvals as required)
- Disposal at an approved materials recycling or waste disposal facility
- As otherwise provided for by the relevant waste legislation including relevant resource recovery exemptions under the Protection of Environment Operations (Waste) Regulation 2014.

The process for managing excess materials would be detailed in a Waste Management Plan that would form part of the CEMP. This plan would include estimates of the total volume of waste streams to be generated by the proposal and identify how it would be managed in accordance with the waste hierarchy. The plan would include specific details for each permanent reuse and disposal site as well as all temporary material storage sites, including:

- Site locations. In the interim, four ancillary sites have been identified where waste would be stored, prior to processing either onsite or at a third party facility (likely to be located in Lithgow)
- Type and volume of waste
- Whether waste would be placed on the site permanently or temporarily
- Details on the beneficial reuse of the waste, if applicable (eg noise mound, visual barrier, engineered fill).

The estimates of materials generated would take a precautionary approach to allow for the possibility of additional material being generated. For example, soils may not be able to be reused during construction if too wet or unsuitable in composition, and may require alternative offsite disposal. The design of the ancillary facilities would allow for such contingency, and in some cases, alternative uses for the material would be identified (eg alternative beneficial use scenario, alternative on-site storage areas).

Safeguards and management measures proposed to avoid, reduce or manage impacts relating to waste are discussed below in Table 6.27.

Table 6.27 Safeguards and management measures relating to waste

Impact	Environmental safeguards	Responsibility	Timing
Generation of construction waste	• Prior to land being used for ancillary construction purposes (compounds, storage, parking, etc) a pre-construction land assessment will be undertaken to identify the presence of any pre-existing wastes. The assessment will be prepared in accordance with the Roads and Maritime *Environmental Procedure - Management of Wastes on Roads and Maritime Services Land*. Where the land is privately owned, a copy of the assessment will be provided to the landowner.	Roads and Maritime/ Contractor	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
Generation of construction waste	• A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The Plan will be prepared taking into account the Roads and Maritime Environmental Procedure - Management of Wastes on Roads and Maritime Services Land and relevant Roads and Maritime Waste Fact Sheets. It will include, but not be limited to: Measures to avoid and minimise waste associated with the project Measures to identify potential asbestos on site Classification of wastes and management options (re-use, recycle, stockpile, disposal) including for asbestos containing material Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions Procedures for handling, storage, transport and disposal of waste Monitoring, record keeping and reporting requirements.	Contractor	Design/ pre-construction/ construction
Generation of construction waste	• Waste materials (such as soils and aggregates) obtained from the project and to be exported to a non-road construction site or project will be sampled and managed in accordance with relevant Roads and Maritime *Waste Fact Sheets*.	Contractor	Construction
Generation of construction waste	• No burning of timber or other materials will occur, other than vegetation debris that is unsuitable for any other purpose, and subject to any necessary approval of the local council and/or EPA, and provision of any required notification to the Rural Fire Service. No burns will be undertaken during total fire bans.	Contractor	Construction
Generation of construction waste	• Any trees to be removed will be reused as millable timber wherever practicable. Other vegetated material from native species will be mulched and re-use on-site for landscaping or rehabilitation purposes if consistent with the approved Flora and Fauna Management Plan for the project. Weed species, or vegetation not considered appropriate for re-use on-site, will be removed and disposed of to an appropriately licenced facility.	Contractor	Construction
Generation of construction waste	• Asbestos waste will be removed from the site and disposed of to an appropriately licenced facility and in accordance with the Waste Management Plan for the project.	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
Generation of construction waste	• A post-construction land assessment will be undertaken of land that was used for ancillary construction purposes (compounds, storage, parking, etc) to determine the suitability for hand-back to the landowner. The assessment will be prepared in accordance with the Roads and Maritime *Environmental Procedure - Management of Wastes on Roads and Maritime Services Land*. Where the land is privately owned, a copy of the assessment will be provided to the landowner.	Contractor	Construction
Generation of construction waste	• Appropriate housekeeping will be undertaken at the construction site and project sites will be maintained free of litter at all times.	Contractor	Construction

6.13 Climate change

The Lithgow area is characterised by mild to warm summers and cold winters. The mean maximum temperature ranges from 10.4 degrees Celsius in July to 25.5 degrees in January. The mean minimum temperature ranges from 0.7 degrees in July to 12.1 degrees in February.

January is the wettest month with mean rainfall of 94mm and September is the driest month with mean rainfall of 59mm. Rainfall is generally spread over the year with the mean number of days with rain greater than 1mm being between 7 days in April to 8.8 days in June.

Extreme climatic events such as floods and bushfires may also occur in the Lithgow region. Areas of Lithgow between Good Luck Hollow and Ida Falls Creek are known to have flooded in the past, mostly between January and March or June and August. Major floods occurred in Lithgow in 1928, 1963, 1964, 1978, 1981, 1986 and 1990, mostly in the town area itself (Lithgow City Council, 2011). The proposal area is traversed by a number of minor drainage lines and culverts and is not on flood prone land.

Hot summers and prolonged drought can increase the risk of bush fires. The proposal area is surrounded by large tracts of vegetation, much of it on slopes. Higher hazard bushfire areas tend to be associated with sclerophyll forests on steeper slopes and ridgelines.

6.13.1 Existing environment

The global climate is changing including increases in global air and ocean temperatures, melting of snow and ice and rising sea levels. The global air temperature has risen around 0.8ºC since 1880 and in Australia around 0.9ºC since 1910. This rise is widely attributed to the observed increases in human activities that generate greenhouse gas emissions such as burning of fossil fuels, agriculture and land clearance. In NSW, temperatures have been steadily rising since the 1960s and the decade from 2001 to 2010 was the hottest on record (DEH, 2016).

Climate change projections are available for the Lithgow region (Central West and Orana region) for the year 2039 and 2079 from NSW and ACT Regional Climate Modelling (NARCliM) Project. In this region, maximum temperatures are projected to rise by 0.7 degrees by 2030 and continue to rise by 2.1 degrees by 2070. The greatest increase is during the summer months. The region is projected to experience an extra nine days per annum above 35 degrees by 2030, and an extra 27

days per annum by 2070, mainly in summer. Severe fire weather is projected to increase in the west during spring and summer. Rainfall is predicted to increase in summer, autumn and winter and decrease in spring. Small increases in rainfall are projected along the Blue Mountains.

The projected changes to future climatic conditions described above will have an effect on existing and proposed projects and infrastructure. Climate change is expected to exacerbate natural variability in the region. Climate change adaption strategies may be required for the design, construction and operation of projects, such as this proposal.

6.13.2 Policy setting

Legislation relevant to climate change includes the *Climate Change Authority Act 2011* (Cwlth). At a State level, NSW 2021: A Plan to make NSW number one, includes a target to minimise the impact of climate change in the State. The plan assists businesses and communities to manage the risks associated with climate change and take action to adapt to climate changes.

6.13.3 Potential impacts

Emissions from the combustion of fossil fuels from construction vehicles, machinery and equipment in the form of greenhouse gases may affect climate. While the proposal is not expected to significantly add to these emissions, safeguards would be implemented to minimise these impacts. Impacts would be negligible in the context of overall NSW and Australian emissions.

During operation, overall emissions along the road are expected to reduce as travel times on Chifley Road are reduced.

6.13.4 Safeguards and management measures

Safeguards and management measures proposed to avoid, reduce or manage impacts on air quality and reduce vegetation clearance areas would contribute to reducing greenhouse gas emissions from the proposal (see sections 6.7 and 6.4 respectively).

6.14 Cumulative impacts

In accordance with Clause 82 of the EP&A Regulation, any cumulative environmental effects of the proposal associated with other existing and likely future activities must be taken into account in determining the potential impacts of the proposal.

The cumulative environmental effect is a combination of the direct impacts discussed in sections 6.1 to 6.13 that would occur as a result of the construction and operation of the proposal, along with any direct impacts from other projects within the general area.

6.14.1 Existing environment

Roads and Maritime has consulted with the nearby Hanson Quarry and Clarence Colliery mine and no activity is occurring or planned that could interact significantly with this proposal.

A search of the Department of Planning and Environment major project register showed one known local development (planned or current) planned to occur in the same geographic area as the proposal.

A sand quarry is proposed to be located at Newnes Junction (Newnes Kaolin Mine) and was approved by the NSW Department of Planning and Environment. Development of the site is expected to commence in late 2016 or 2017. The site is located between the existing Clarence Colliery mine and Rocla Quarry.

No road transport for processing is proposed (would utilise rail) although some road access would be required off Clarence Colliery Road during construction.

Additional potential cumulative impacts are restricted to ongoing Roads and Maritime work in the Lithgow region, namely the Great Western Highway upgrade program, and additional work along the Bells Line of Road.

Upgrades to the Great Western Highway between Katoomba and Lithgow are ongoing and include widening of the highway, pavement improvements, corridor realignment and pedestrian and road safety improvements. Roads and Maritime are delivering the following projects as part of the Great Western Highway upgrade:

- Road safety improvements between Hartley Valley and Forty Bends – in construction and will be completed in 2017, weather permitting.
- Mount Victoria village road safety upgrade – in construction and will be completed in 2017, weather permitting
- Katoomba to Mount Victoria road safety upgrades – in development.

The Bells Line of Road corridor improvement program is a $48 million program to improve road safety and traffic flow along the Bells Line of Road between Lithgow and Kurrajong Heights, including overtaking lanes, wider sealed shoulders and improved clear zones. This proposal is part of the overall corridor improvement program.

The sections of Bells Line of Road being upgraded all occur between Bell and Kurrajong Heights and comprise ten sites. One of these sites is completed and work is underway on four of the other sites. The remaining sites will be completed over the next four years, and further proposals from North Richmond to Lithgow will be developed. Work will comprise seven overtaking lane stretches between Kurrajong Hills and Mount Tomah and safety improvements to three sites between Mount Tomah and Bell (RMS, 2016b).

6.14.2 Potential impacts

Potential cumulative impacts could occur as a result of the simultaneous construction of the Great Western Highway upgrade and Bells Line of Road corridor improvement projects in the vicinity of the proposal, as well as construction activities for the proposed Newnes Kaolin Mine.

Upgrades to the Great Western Highway and Bells Line of Road would likely occur at the same time as the schedule for this proposal but are unlikely to result in significant cumulative impacts due to the distances between upgrade locations and the proposal. The Newnes Kaolin Mine would largely utilise rail transport for movement of materials to and from the site. Some construction traffic is anticipated along Clarence Colliery Road.

Construction

Traffic and transport

Multiple construction projects occurring on the highway and surrounding roads may increase travel times as a result of lane closures and traffic management. These impacts are anticipated to be effectively managed through coordination of the construction timetable, and phasing of construction activities to avoid peak hours where possible. Traffic impacts are likely to be short-term and minor due to implementation of the safeguards mitigation measures discussed in Section 6.5.

Noise and air quality

Each individual proposal would manage noise and air emissions on a project level and due to the distance between proposals, no cumulative impacts are expected.

Biodiversity

Multiple proposals occurring in the same geographic region have the potential to cause a cumulative ecological impact. All of the disturbance areas are small and within or adjacent to the existing road corridor. No significant cumulative impact on flora or fauna values is expected.

The area of vegetation clearance required for this proposal is small (approximately 13ha). About 0.03ha of this clearance is identified as a threatened ecological community (PCT HN633 *Baeckea linifolia - Grevillea acanthifolia* subsp. *acanthifolia* shrub/sedge swamp on sandstone, Sydney Basin Bioregion). This PCT is consistent with the Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion EEC, listed under the TSC Act and Temperate Highland Peat Swamps on Sandstone EEC, listed under the EPBC Act.

These EECs were not identified in the EPBC Act Referral for the Bells Line of Road upgrade proposed nearby (Roads and Maritime, 2014). No cumulative impacts on these EECs, nor significant impacts on listed protected species, were predicted.

Operation

During operation of the proposal, cumulative impacts would be negligible. The implemented road upgrade as part of the broader program of upgrades would have positive cumulative effects in terms of improved road safety and reduced traffic delays. The upgrade program will reduce crash numbers, improve access for visitors, overall traffic conditions, reduce travel times and generate increased employment during the work. Overall access to services and facilities would also be improved.

A minor increase in road kill of fauna could occur along the Scenic Hill section at the new overtaking lanes. The potential impact of the widening on the viability at a population scale of threatened flora and fauna species would be relatively minor and negligible.

6.14.3 Safeguards and management measures

The contribution of the proposal to cumulative impacts would be reduced through implementation of the safeguards and management measures identified in sections 6.1 to 6.14. The additional safeguards and management measures relating to cumulative impacts are identified below in Table 6.28.

Table 6.28 Safeguards and management measures relating to cumulative impacts.

Impact	Environmental safeguards	Responsibility	Timing
Changed traffic conditions	• The construction timetable, and phasing of major construction activities associated with the proposal and other developments including the upgrades to the Great Western Highway and Bells Line of Road will be coordinated and managed to avoid peak travel periods.	Roads and Maritime/ Contractor	Construction

7 Environmental management

This chapter describes how the proposal would be managed to reduce potential environmental impacts throughout detailed design, construction and operation. A framework for managing the potential impacts has been provided with reference to environmental management plans and relevant Roads and Maritime Services QA specifications. A summary of site-specific environmental safeguards, as well as the licence and/or approval requirements required prior to construction, are provided below.

7.1 Environmental management plans

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 would be incorporated into the detailed design and applied during the construction and operation of the proposal.

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

The CEMP would be prepared prior to construction of the proposal and would be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in accordance with the specifications set out in Roads and Maritime's QA Specification G36 – Environmental Protection (Management System), QA Specification G38 – Soil and Water Management (Soil and Water Plan), QA Specification G40 – Clearing and Grubbing and QA Specification G10 - Traffic Management.

7.2 Summary of safeguards and management measures

Environmental safeguards outlined in this document would be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards would 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. Safeguards and management measures may apply to more than one aspect (eg hydrology and topography) but are included just once in Table 7.1 under the most relevant aspect. Further management measures relating to specific technical studies that are captured in Table 7.1 under another area, are included in the appendices.

Table 7.1: Summary of site specific environmental safeguards

No.	Impact	Environmental safeguards	Responsibility	Timing
General				
G-1	General	• All environmental safeguards must be incorporated within the following: Detailed design stage Contract specifications for the proposal Contractor's Environmental Management Plan	Roads and Maritime/ Contractor	Detailed design
G-2	General	• A risk assessment must be carried out on the proposal in accordance with the Roads and Maritime Services Project Pack and PMS risk assessment procedures to determine an audit and inspection program for the work. The recommendations of the risk assessment are to be implemented • A review of the risk assessment must be undertaken after the initial audit or inspection to evaluate is the level of risk chosen for the project is appropriate • Any work resulting from the proposal and as covered by the REF may be subject to environmental audit(s) and/or inspection(s) at any time during their duration.	Roads and Maritime	Pre-construction
G-3	General	• The environmental contract specification must be forwarded to the Roads and Maritime Services Environment Manager in the Greater Sydney Program office for review at least ten working days prior to the tender stage • A contractual hold point must be maintained until the CEMP is reviewed by the Roads and Maritime Services Senior Environment Officer in the Greater Sydney region.	Roads and Maritime	Pre-construction
G-4	General	• The Roads and Maritime Services Environment Manager in the Greater Sydney Program office will be notified at least five working days prior to work commencing.	Roads and Maritime	Pre-construction

General (cont'd)				
G-5	General	• All businesses and residences likely to be affected by the proposed work must be notified at least five working days prior to the commencement of the proposed activities.	Roads and Maritime/Contractor	Pre-construction
G-6	General	• Environmental awareness training must be provided, by the contractor, to all field personnel and subcontractors.	Contractor	Pre-construction/construction
Hydrology and drainage				
HY-1	Changes to hydrology	• Prior to construction commencing, final hydrology and drainage assessments will be undertaken to inform detail design measures to minimise risks to the environment, properties and the project. This will include selection of appropriate scour protection treatments, energy dissipation and retention structures. Consultation will be undertaken with Water NSW on the final design measures.	Roads and Maritime/ Contractor	Detailed design/ pre-construction
HY-2	Culvert extension within Dargans Creek	• The culvert extension and re-alignment of Dargans Creek will be designed to maintain downstream bed stability, minimise changes to existing waterway length, and maintain existing flow velocity.	Contractor	Detailed design
HY-3	Blocking or diverting drainage channels	• Duration and length of any temporary drainage channel diversions will be minimised where reasonable and feasible.	Contractor	Construction
HY-4	Blocking or diverting drainage channels	• Temporary drainage channel diversions will include appropriate scour protection and energy dissipation measures, such as check dams.	Contractor	Construction
HY-5	Hydrology and flow regime	• Any dewatering activities will be undertaken in accordance with the RTA Technical Guideline: Environmental management of construction site dewatering in a manner that prevents pollution of waters and scouring of drainage channels or waterways.	Contractor	Construction

Water quality				
WQ-1	Sedimentation/ decreased water quality	• Batters will be designed and constructed to minimise risk or exposure, instability and erosion, and to support long-term, on-going best practice management, in accordance with the Roads and Maritime *Guideline for Batter Stabilisation Using Vegetation* (RMS, 2015a).	Contractor	Detailed design
WQ-2	Sedimentation / decreased water quality	• A site specific erosion and sediment control plan will be prepared and implemented and included in the construction environmental management plan (CEMP). The plan will identify detailed measures and controls to be applied to minimise erosion and sediment control risks including, but not necessarily limited to: runoff, diversion and drainage points; sediment basins and sumps; scour protection; stabilising disturbed areas as soon as possible, check dams, fencing and swales; and staged implementation arrangements. The plan will also include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather. Prior to commencement of the activity, the Soil and Water Management Plan will be reviewed by a soil conservationist on the RMS list of Registered Contractors for Erosion, Sedimentation and Soil Conservation Consultancy Services. The review will assess the adequacy of measures in the Plan and recommend any revisions or additional measures required. The Soil and Water Management Plan will then be revised to address the outcomes of the review.	Contractor	Pre-construction/ construction

Water quality (cont'd)				
WQ-3	Sedimentation/ decreased water quality of Dargans Creek	• A detailed environmental work method statement (EWMS) will be prepared and implemented for work activities within 100m of Dargans Creek, including the culvert extension and earthworks associated with the curve realignment. The EWMS will detail: measures to avoid or minimise risks from erosion and sedimentation to water quality and biodiversity maintain fish passage during construction monitoring requirements to assess the performance of implemented mitigation measures. The EWMS will be prepared in accordance with relevant guidelines including, but not limited to: RMS Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects NSW DPI (Fisheries) guidelines Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings.	Contractor	Pre-construction/ construction
WQ-4	Contamination of surface waters and groundwater related to accidental spills	• Spill management measures and procedures will be prepared and implemented as part of the CEMP to minimise the risk of pollution arising from spillage or contamination on the site and adjoining areas. The measures and procedures will address, but not necessarily be limited to: management and storage of chemicals and potentially polluting materials; any bunding requirements; refuelling requirements; maintenance of plant and equipment; and emergency management, including notification in accordance with Roads and Maritime guidelines, response and clean-up procedures.	Contractor	Pre-construction/ construction
WQ-5	Sedimentation/ decreased water quality	• The rehabilitation of disturbed areas will be undertaken progressively as construction stages are completed, and in accordance with: Landcom's Managing Urban Stormwater: Soils and Construction series Roads and Maritime Guideline for Batter Stabilisation Using Vegetation (RMS, 2015a)	Contractor	Construction
WQ-6	Disturbance of contaminated soil / contamination of environment	• Emergency spill kits will be kept at areas identified as having spill risk at all times.	Contractor	Construction

Water quality (cont'd)				
WQ-7	Contamination of surface waters and groundwater	• Refuelling will not take place within 50m of waterways, and will occur in a suitably located and bunded area.	Contractor	Construction
WQ-8	Contamination of surface waters and groundwater	• Washdown of plant, equipment and vehicles will occur in a designated bunded area away from waterways and drainage lines.	Contractor	Construction
Topography, geology, soils and contamination				
TGS-1	Acid sulfate rock	• Geotechnical testing will be carried out to assess the likelihood that cuttings will be through acid sulfate rock, and the potential this will have to generate acid leachate. If present, acid sulfate rock will be managed in accordance with the Guidelines for the Management of Acid Sulfate Materials: Acid Sulfate Soils, Acid Sulfate Rock and Monosulfidic Black Ooze (RTA, 2005).	Contractor	Detailed design
TGS-2	Management of excess or unsuitable material	• A Waste Management Plan will be prepared and implemented as part of the CEMP. The plan will identify the locations of spoil stockpiles, and methods to re-use or dispose of excess or unsuitable spoil material including estimated volumes and disposal sites.	Contractor	Pre-construction
TGS-3	Soil erosion	• Areas of high erosion risk, such as steep areas or highly erodible soils, will be identified during the development of the site specific erosion and sediment control plan and appropriate management controls implemented.	Contractor	Construction
TGS-4	Soil erosion	• A registered Soil Conservation Consultant will be engaged during construction to advise on the types of controls required in areas of high erosion risk. The Soil Conservation Consultant will undertake regular inspections and surveillance of the work to ensure that erosion and sediment controls are being implemented and maintained.	Contractor	Construction
TGS-5	Soil erosion	• Stockpiles will be designed, established, operated and decommissioned in accordance with the Roads and Maritime's Stockpile Site Management Guideline 2015 (RMS, 2015b).	Contractor	Construction

Topography, geology, soils and contamination (cont'd)				
TGS-6	Soil erosion	• Stockpile management will consider the following: On relatively level ground and up-slope of sediment control barriers Have ready access to the road network or direct access to the construction corridor Away from areas of ecological and heritage conservation value In areas previously disturbed within the proposal area that do not require the clearing of native vegetation Away from residential buildings At least 5m clear of all areas of possible concentrated water flow and at least 10m from a waterway (any Class 1 or Class 2 fish habitat waterways as described in the NSW Fisheries guidelines) Limit topsoil stockpile height to 2m where practical Cover or otherwise protect from erosion, stockpiles that will be in place for more than 20 days as well as any stockpiles that are susceptible to wind erosion, within 10 days of forming each stockpile.	Contractor	Construction
TGS-7	Soil erosion	• Activities will be planned and sequenced to minimise the length of time disturbed soil remains exposed, and limit the time of soil stockpile storage before the material is reused or removed from the site.	Contractor	Construction
TGS-8	Soil erosion	• Consistent with any specific requirements of the approved erosion and sediment control plan, a monitoring program will be implemented during construction to ensure effective implementation of all temporary and permanent soil, erosion and water pollution safeguards. The timing and frequency of monitoring inspections will be set out in the plan. The inspections will assess implementation and success of the controls, actions required to ensure on-going effective operation, and compliance with any statutory approvals. A register of inspections will be established.	Contractor	Construction
TGS-9	Disturbance of contaminated soil / contamination of environment	• Visual inspections will be undertaken during excavation activities to ensure no waste material from dumping is present. If encountered, stockpile separately from other spoil. An unexpected finds procedure will be developed as part of the Waste Management Plan.	Contractor	Construction

Topography, geology, soils and contamination (cont'd)				
TGS-10	Disturbance of contaminated soil / contamination of environment	• If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other work that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA.	Contractor	Construction
TGS-11	Disturbance of contaminated soil / contamination of environment	• Prior to the acceptance of any soil onsite (regardless of volume), the following actions must be taken to reduce the risk of receiving contaminated material: Ensure that all fill used is virgin excavated natural material (eg clay, gravel, sand, soil or rock) that is not mixed with any other waste Request the supplier provides formal certification that the fill material is clean VENM Request the supplier provide information on what activities previously occurred onsite where there fill was sourced Check for signs of contamination, such as odours (chemical/petrol), staining from chemicals, and rubbish such as bricks, timber, masonite, etc Supervise the delivery of the material to ensure the material received matches the material ordered Material from a known or potentially contaminated site must not be accepted without EPA approval Maintain all documents and records.	Contractor	Construction
TGS-12	Disturbance of contaminated soil / contamination of environment	• Hazardous materials such as fuel and chemicals will be stored in suitably located and bunded areas, in accordance with DECC's Storing and Handling Liquids: Environmental Protection Participants Manual (DECC, 2007).	Contractor	Construction
Biodiversity				
BI-1	Removal of vegetation / fauna habitat	• Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	Contractor	Detailed design

Biodiversity (cont'd)				
BI-2	Removal of vegetation / fauna habitat	• Pre-clearing surveys will be undertaken in accordance with Guide 1: Preclearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Pre-construction
BI-3	Biodiversity impacts	• A Flora and Fauna Management Plan will be prepared in accordance with Roads and Maritime's Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RTA, 2011) and the biodiversity and aquatic assessments prepared for the proposal (RPS, 2016) The Plan will be implemented as part of the CEMP,and will include an induction program for construction personnel on the management of biodiversity values.	Contractor	Pre-construction
BI-4	Removal of vegetation / fauna habitat	• Vegetation and habitat removal will be undertaken in accordance with Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Pre-construction/ construction
BI-5	Removal of vegetation / fauna habitat	• The unexpected species find procedure is to be followed under Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011) if threatened ecological communities or species, not assessed in the biodiversity assessment, are identified in the proposal site.	Contractor	Pre-construction/ construction
BI-6	Removal of vegetation / fauna habitat	• Exclusion zones will be set up at the limit of clearing in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Pre-construction/ construction
BI-7	Habitat loss and fauna mortality	• Fauna will be managed in accordance with Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Pre-construction/ construction
BI-8	Introduction of weeds and pests	• Weed species will be managed in accordance with Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Pre-construction/ construction
BI-9	Introduction of weeds and pests	• Pest species will be managed within the proposal site.	Contractor	Pre-construction/ construction

Biodiversity (cont'd)				
BI-10	Introduction of weeds and pests	• Pathogens will be managed in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Pre-construction/ construction
BI-11	Impacts on Dargans Creek	• Aquatic habitat will be protected in accordance with Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011) and Section 3.3.2 Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013 (DPI (Fisheries NSW) 2013).	Contractor	Pre-construction/ construction
BI-12	Removal of vegetation / fauna habitat	• Native vegetation and habitat will be re-established in accordance with Guide 3: Reestablishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011), Guide 5: Reuse of woody debris and bushrock and Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Operation
Traffic and access				
TR-1	Changes to local access arrangements	• Requirements for any changes to local access arrangements, including to the Ex-POW Memorial will be confirmed during detailed design.	Contractor	Detailed design

Traffic and access (cont'd)				
TR-2	Changes to traffic conditions	• A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP in accordance with the Roads and Maritime *Traffic Control at Work Sites Manual* and Roads and Maritime Specification G10. 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 Measures to maintain fire trail access 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	Pre-construction
TR-3	Changes to traffic conditions	• Consultation will be undertaken with potentially affected residences prior to the commencement of and during work in accordance with the RTA's *Community Involvement and Communications Resource Manual*. Consultation will include but not limited to door knocks, newsletters or letter box drops providing information on the proposed work working hours and a contact name and number for more information or to register complaints.	Roads and Maritime / Contractor	Pre-construction / construction
TR-4	Changes to traffic conditions	• Road users and local communities will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.	Contractor	Construction
TR-5	Disruption to school bus services	• Access for public transport services, including school bus services, will be maintained. The requirements for any temporary changes will be confirmed following consultation with local bus operators and the community.	Roads and Maritime/ Contractor	Construction

Traffic and access (cont'd)				
TR-6	Changes to property access during work	• Access to properties will be maintained during construction. Where that is not feasible or necessary, temporary alternative access arrangements will be provided following consultation with affected landowners.	Contractor	Construction
TR-7	Changes to maintenance access tracks during work	• Maintenance access tracks will be maintained during construction. Where this is not feasible or necessary, temporary alternative access arrangements will be provided following consultation with affected stakeholders.	Contractor	Construction
Noise and vibration				
NV-1	Construction noise and vibration	• A Noise and Vibration Management Plan will be prepared and implemented as part of the CEMP. The Plan will generally follow the approach in EPA's *Interim Construction Noise Guideline* (ICNG) and identify: All potential significant noise and vibration generating activities associated with the activity Feasible and reasonable mitigation measures to be implemented, taking into account the Roads and Maritime Beyond the Pavement urban design policy, process and principles and site specific mitigation options detailed in the noise assessment (Wilkinson Murray, 2016) A monitoring program to assess performance against relevant noise and vibration criteria Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.	Contractor	Pre-construction
NV-2	Construction noise and vibration	• All personnel working on site will receive training to ensure awareness of requirements of the Noise and Vibration Management Plan. Site-specific training will be given to personnel when working in the vicinity of sensitive receivers.	Contractor	Pre-construction / Construction
NV-3	Construction noise and vibration	• Any variations to the standard construction hours will follow the approach in Roads and Maritime Services Construction Noise and Vibration Guideline, including consultation with the affected local community.	Contractor	Construction

Noise and vibration (cont'd)				
NV-4	Construction noise and vibration	• All sensitive receivers (eg 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 include details of: the project; construction period and construction hours; contact information for project management staff; complaint and incident reporting; and how to obtain further information.	Contractor	Construction
NV-5	Construction blasting and vibration	• Specific measures to manage blasting, if required at Scenic Hill will be included in the Noise and Vibration Management Plan including: Recommended blast sizes consistent with that detailed in the noise assessment (Wilkinson Murray, 2016) An overpressure monitoring program to assess performance against relevant blasting criteria Exclusion zones for the section of Chifley Road within 500m of blasting activities Management of livestock close to blast sites.	Contractor	Construction
Aboriginal heritage				
AH-1	Unexpected find of Aboriginal heritage artefact or site	• The *Standard Management Procedure - Unexpected Heritage Items* will be followed in the event that a known 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.	Contractor	Pre-construction/ Construction
AH-2	Unexpected find of Aboriginal heritage artefact or site	• All personnel working on site will be provided with environmental training to achieve a level of competence and awareness of the environmentally issues associated with Aboriginal heritage, including the need to protect these areas. Training will include the application of the *Standard Management Procedure - Unexpected Heritage Items*.	Contractor	Pre-construction/ Construction

Non-Aboriginal heritage				
NA-1	Impact on non-Aboriginal heritage items from the work	• Impact to the outlet of site CRC 02 will be minimised through deployment of sufficient and suitable separation fabric, plumbers sand or other similar method at the interface of the outlet.	Contractor	Detailed design/ pre-construction/ construction
NA-2	Impact on non-Aboriginal heritage items from the work	• Damage to the unburied portion of site CRC 03 will be avoided where practical.	Contractor	Detailed design/ pre-construction/ construction
NA-3	Impact on non-Aboriginal heritage items from the work	A Non-Aboriginal Heritage Management Plan will be prepared and implemented as part of the CEMP and will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to Non-Aboriginal heritage. The Plan will include, but not be limited to: Details of investigations completed or planned to be undertaken and any associated approvals required Mapping of areas of non-Aboriginal heritage value and identification of protection measures to be applied during construction Procedures to be implemented if previously unidentified non-Aboriginal relics or heritage items are discovered during construction, in accordance with the Roads and Maritime Standard Management Procedure - Unexpected Archaeological Finds Procedures to be followed in the management of sites CRSH 06, CRSH 17 and CRSH 18 An induction program for construction personnel on the management of non-Aboriginal heritage values.	Contractor	Pre-construction
NA-4	Impact on non-Aboriginal heritage items from the work	• An archival recording will be prepared of sites CRC 01 and CRC 02 prior to demolition and removal. The recording will be prepared in accordance with guidelines published by the Office of Environment and Heritage.	Contractor	Pre-construction/ construction
NA-5	Impact on non-Aboriginal heritage items from the work	• An archival recording will be prepared of sites CRSH 06, CRSH 17 and CRSH 18 prior to any work being undertaken that affects the item. The recording will be prepared in accordance with guidelines published by the Office of Environment and Heritage. These sites should be re-inspected and recorded by an archaeologist and after the area has been cleared of vegetation. Care should be taken during clearance minimise the amount of ground disturbance in this area.	Contractor	Pre-construction/ construction

Non-Aboriginal heritage (cont'd)				
NA-6	Unexpected find of non-Aboriginal heritage artefact or site	• All personnel working on site will receive training to ensure awareness of requirements of the Non-Aboriginal Heritage Management Plan and relevant statutory responsibilities. Site-specific training will be given to personnel when working in the vicinity of identified Non-Aboriginal heritage items.	Contractor	Pre-construction/ Construction
NA-7	Impact on non-Aboriginal heritage items from the work	• Exclusion zones will be established around sites CRC 19, CRC 21, CRC 23 and CRC 25 to prohibit vehicle movement and minimise impact when clearing vegetation.	Contractor	Pre-construction/ construction
NA-8	Unexpected find of non-Aboriginal heritage artefact or site	• Should any heritage items, archaeological remains or potential relics of Non-Aboriginal origin be encountered, then construction work that might affect or damage the material will cease and notification provided to the relevant Roads and Maritime officer identified in the Roads and Maritime Standard Management Procedure - Unexpected Archaeological Finds. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Construction
Landscape character and visual impacts				
LCV-1	Quality of structures	• Design the proposed Clarence road over rail bridge according to the Roads and Maritime – Bridge Aesthetics Design Guidelines.	Roads and Maritime	Detailed design
LCV-2	Integration of earthworks design with existing landform	• Minimise visual impact of earthworks and associated structures through rounding off top of cut batters, tailing off cut batters and flattening of grades at the ends of fill embankments where feasible.	Roads and Maritime	Detailed design
LCV-3	Integration of earthworks design with existing landform	• Design retaining walls to utilise visually recessive materials and colours. The design should aim to minimise the construction footprint and extent of vegetation clearance.	Contractor	Detailed design
LCV-4	Integration of earthworks design with existing landform	• Use screen planting to minimise visual dominance of retaining walls and use sculpted shotcrete finishes to blend the structure with surrounding rock cuttings where possible.	Contractor	Construction

Landscape character and visual impacts (cont'd)				
LCV-5	Minimisation of road furniture and signage	• Coordinate signage locations with other roadside elements including structures, furniture, fencing and landscape treatment.	Roads and Maritime	Detailed design
LCV-6	Use of soft engineering	• Avoid the use of concrete-lined drainage channels where practical, and utilise vegetated or rock lined channels where possible. If concrete lined channels are used, ensure the concrete is coloured and/or heavily roughened.	Contractor	Detailed design
LCV-7	Use of soft engineering	• Maintain drainage structures where required, noting that revegetation and darkening are emphasised as a positive outcome from an urban design perspective.	Roads and Maritime	Operation
LCV-8	Retention of vistas	• Prepare and implement a landscape and revegetation plan for the proposal.	Contractor	Detailed design
LCV-9	Retention of vistas	• Maintain important vistas during maintenance regimes. Do not remove vegetation in revegetation areas associated with screening unless within clear zones.	Roads and Maritime	Operation
Socio-economic and land-use				
SE-1	Property acquisition	• All property acquisition will be carried out in accordance with the Land Acquisition Information Guide (RMS, 2012c) and the *Land Acquisition (Just Terms Compensation) Act 1991*.	Roads and Maritime	Detailed design/ Pre-construction
SE-2	Changes to road access and/or conditions during the work	• Consultation will occur with Clarence Colliery mine and Hanson Quarry to identify appropriate management strategies to avoid or minimise impacts on access and operations. This will include consideration of measures such as additional signage and alternative access arrangements.	Roads and Maritime/ Contractor	Detailed design/ Pre-construction

Socio-economic and land-use (cont'd)				
SE-3	Changes to road access and/or conditions during the work	• A Communication Plan (CP) will be prepared and implemented as part of the CEMP to ensure provision of 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. The CP will be prepared in accordance with the Roads and Maritime *Community Involvement and Communications Resource Manual*.	Contractor	Pre-construction/ construction
SE-4	Management of community inquiries or complaints	• A complaints handling procedure and register will be included in the CEMP.	Contractor	Construction
SE-5	Emergency access	• Access for emergency vehicles will be maintained at all times during construction. Any site-specific requirements will be determined in consultation with the relevant emergency services agency.	Contractor	Construction
SE-6	Disruption to utilities and services	• Persons and organisations likely to be affected by utility related work (eg disruption to services) will be notified at least five days prior to commencement of any such work. In the notification include details of: the project; work period and work hours; period of utility service disruption; contact information for project management staff; complaint and incident reporting; and how to obtain further information.	Contractor	Construction (prior to any utility work)
Air quality				
AQ-1	Particulate matter and emissions	• Air quality management measures will be prepared and implemented as part of the CEMP. The measures will include: Mitigation and suppression measures to be implemented, such as spraying or covering exposed surfaces, provision of vehicle clean down areas, covering of loads, street cleaning, use of dust screens, maintenance of plant in accordance with manufacturer's instructions Methods to manage work during strong winds or other adverse weather conditions.	Contractor	Pre-construction /construction

Waste				
WA-1	Generation of construction waste	• Prior to land being used for ancillary construction purposes (compounds, storage, parking, etc) a pre-construction land assessment will be undertaken to identify the presence of any pre-existing wastes. The assessment will be prepared in accordance with the Roads and Maritime *Environmental Procedure - Management of Wastes on Roads and Maritime Services Land*. Where the land is privately owned, a copy of the assessment will be provided to the landowner.	Roads and Maritime/ Contractor	Pre-construction
WA-2	Generation of construction waste	• A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The Plan will be prepared taking into account the Roads and Maritime Environmental Procedure - Management of Wastes on Roads and Maritime Services Land and relevant Roads and Maritime Waste Fact Sheets. It will include, but not be limited to: Measures to avoid and minimise waste associated with the project Measures to identify potential asbestos on site Classification of wastes and management options (re-use, recycle, stockpile, disposal) including for asbestos containing material Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions Procedures for handling, storage, transport and disposal of waste Monitoring, record keeping and reporting requirements.	Contractor	Design/ pre-construction/ construction
WA-3	Generation of construction waste	• Waste materials (such as soils and aggregates) obtained from the project and to be exported to a non-road construction site or project will be sampled and managed in accordance with relevant Roads and Maritime *Waste Fact Sheets*.	Contractor	Construction
WA-4	Generation of construction waste	• No burning of timber or other materials will occur, other than vegetation debris that is unsuitable for any other purpose, and subject to any necessary approval of the local council and/or EPA, and provision of any required notification to the Rural Fire Service. No burns will be undertaken during total fire bans.	Contractor	Construction

Waste (cont'd)				
WA-5	Generation of construction waste	• Any trees to be removed will be reused as millable timber wherever practicable. Other vegetated material from native species will be mulched and re-use on-site for landscaping or rehabilitation purposes if consistent with the approved Flora and Fauna Management Plan for the project. Weed species, or vegetation not considered appropriate for re-use on-site, will be removed and disposed of to an appropriately licenced facility.	Contractor	Construction
WA-6	Generation of construction waste	• Asbestos waste will be removed from the site and disposed of to an appropriately licenced facility and in accordance with the Waste Management Plan for the project.	Contractor	Construction
WA-7	Generation of construction waste	• A post-construction land assessment will be undertaken of land that was used for ancillary construction purposes (compounds, storage, parking, etc) to determine the suitability for hand-back to the landowner. The assessment will be prepared in accordance with the Roads and Maritime *Environmental Procedure - Management of Wastes on Roads and Maritime Services Land*. Where the land is privately owned, a copy of the assessment will be provided to the landowner.	Contractor	Construction
WA-8	Generation of construction waste	• Appropriate housekeeping will be undertaken at the construction site and project sites will be maintained free of litter at all times.	Contractor	Construction
Cumulative impacts				
CI-1	Changed traffic conditions	• The construction timetable, and phasing of major construction activities associated with the proposal and other developments including the upgrades to the Great Western Highway and Bells Line of Road will be coordinated and managed to avoid peak travel periods.	Roads and Maritime/ Contractor	Construction

7.3 Licensing and approvals

The licences required for the proposal include those listed in Table 7.2. Roads and Maritime have numerous internal approvals procedures and guidance relating to road projects.

Table 7.2 Summary of licensing and approval required

Instrument	Requirement	Timing
Protection of the Environment Operations Act 1997 (s43)	Environment protection licence (EPL) for extractive activities from the EPA.	Prior to start of the activity.
Fisheries Management Act 1994 (s199)	Notification to the Minister for Primary Industries prior to any dredging or reclamation work.	A minimum of 28 days prior to the start of work.
Crown Lands Act 1989 (s6)	Licence to occupy areas of Crown land.	Prior to start of the activity
Mine Subsidence Compensation Act 1961 (s15)	Application for approval from the Mine Subsidence Board is required when carrying out work in the Lithgow Mine Subsidence District.	Prior to start of the activity

8 Conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*.

8.1 Justification

The Chifley Road corridor provides a secondary connection between the central west of NSW and Sydney, traversing the Blue Mountains. The road also provides a local connection to residents of Lithgow, Bell and the surrounding area.

The proposal seeks to implement improvements to Chifley Road to:

- Reduce the overall crash rate
- Reduce rail safety risks at Clarence road over rail bridge
- Improve light vehicle travel times
- Provide efficiency and consistency for traffic flows
- Minimise environmental impacts.

The proposed improvements assessed in this REF include minor realignments and straightening, overtaking lanes, increasing safety features such as land widths and shoulders, intersection upgrades, slope stabilisation, bridge safety and opportunities for enhanced amenity.

The concept design process has been instrumental in avoiding or reducing the severity of a number of potential environmental impacts from the proposal (eg avoidance of the stand of threatened *Acacia meiantha*). However, some negative environmental impacts would occur including:

- Increased levels of noise and vibration during construction
- Erosion of exposed soils during vegetation clearance and earthworks with potential for sediment-laden runoff from the steeper areas to enter watercourses with subsequent impacts on water quality (increased suspended sediments)
- Disturbance to Dargans Creek during the extension works for the culvert under Chifley Road and potential changes to flow, scouring and channelisation in the creek downstream and associated increases in turbidity
- Minor impacts on biodiversity, principally through clearance of about 13.1ha of remnant vegetation, although no significant impact is predicted on any threatened communities or species
- Disruption and delays to road users during particular phases of the works.

The majority of these impacts occur during the construction of the proposal, would be temporary, and restricted in their spatial extent. Environmental safeguards are proposed to minimise these impacts. With effective implementation of the measures, most impacts would be minor or negligible.

Some cumulative impacts are predicted as a result of other road and infrastructure projects in the region. These impacts can be effectively managed through coordination of the construction timetable, and phasing of construction activities to avoid peak hours where possible.

The proposal has several substantial benefits - principally improved road safety, more reliable travel times and improved freight access and efficiency. The proposal is consistent with the NSW and Australian governments' strategic priorities of improving the highway's safety performance and efficiency, and would help meet ongoing and future road network needs. These benefits would not

be realised if the proposal did not proceed, with subsequent implications for road safety along Chifley Road.

These benefits outweigh the potential negative environmental impacts from the proposal, which can be managed effectively with implementation of the safeguards proposed.

8.2 Objects of the EP&A Act

Table 8.1 identifies the objects of the EP&A Act and their relevance to the proposal.

Table 8.1 Objects of the EP&A Act

Object	Comment
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.	The proposed design, impact mitigation and management measures detailed in this REF allow for the proper management, development and conservation of natural and artificial resources. The proposal would not impact on any agricultural land, or any land used for extractive or resource industries. The replacement of the Clarence road over rail bridge would also improve the intersection of Chifley Road and the Clarence Colliery Road through the inclusion of an eastbound acceleration lane from the intersection. These improvements will support heavy vehicle movements from the neighbouring businesses at Clarence Colliery mine and Hanson Quarry.
5(a)(ii) To encourage the promotion and co-ordination of the orderly economic use and development of land.	The proposal would improve access to industrial and commercial land use in the local area, and between Sydney and the central west of NSW.
5(a)(iii) To encourage the protection, provision and co-ordination of communication and utility services.	Communication and utility services would be adjusted or relocated as required. Roads and Maritime has consulted with public utility authorities as part of the development of the concept design to identify and locate existing utilities and incorporate utility authority requirements for relocations and/or adjustments. Confirmation of the relocation of utilities and associated strategies would be carried out in consultation with utility authorities during detailed design.
5(a)(iv) To encourage the provision of land for public purposes.	The proposal would encourage use of the road for public purposes.
5(a)(v) To encourage the provision and co-ordination of community services and facilities.	The proposal would improve access to social infrastructure for road users, pedestrians and cyclists. The community is expected to benefit from improved safety, access and reduced travel times along Chifley Road. Users and operators of the passenger services and freight trains that travel under the Clarence Road over rail bridge would also benefit from the improved safety provided by the new bridge. Improvements to the access road to the Ex-POW Memorial would also provide enhanced access to visitors of this memorial.

Object	Comment
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.	This proposal has sought to minimise impacts on the environment, including threatened species, populations and ecological communities, and their habitats. Specifically, the stand of *Acacia meiantha* has been avoided through design development and the proposal has minimised impacts on the Newnes Plateau shrub swamp in the Sydney Basin bioregion EEC listed under the TSC Act, and the Temperate Highland Peat Swamps on Sandstone EEC listed under the EPBC Act. Management measures and safeguards are proposed to manage impacts during construction and operation.
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.	The proposal has incorporated consultation with directly and indirectly affected landowners, interested local and regional individuals as well as the wider community. Consultation has also included involvement of local interest groups, local businesses, Lithgow City Council and State Government agencies (see Section 5). This REF will be placed on public display for comment. Following the submissions period, Roads and Maritime will collate submissions. After consideration of community comments, Roads and Maritime will determine whether the proposal should proceed as proposed, or whether any alterations to the proposal are necessary. Roads and Maritime will also continue to update the project website (http://www.rms.nsw.gov.au/projects/sydney-west/bells-line-of-road/chifley-road-upgrade.html) and issue community update newsletters during the display of this REF and during construction.

8.3 Ecologically sustainable development

The principles of ecologically sustainable development (ESD) described below have been an integral consideration during the development of this proposal.

Ecologically sustainable development requires the effective integration of economic and environmental considerations in decision making processes. The principles of ESD, set out in Schedule 2 of the EP&A Regulation are:

- Precautionary principle
- Inter-generational equity
- Conservation of biological diversity and ecological integrity
- Improved valuation and pricing of environmental resources

Roads and Maritime is committed to conducting business in an environmentally sustainable manner. Details of how the principles of ESD have been incorporated into this proposal are described below.

8.3.1 The precautionary principle

The assessment of impacts in this REF is consistent with the precautionary principle. Environmental and social investigations have been consistent with accepted methodologies and, when considering the potential impacts associated with the proposal, have assumed that the impact may occur.

This REF has shown that the environmental impacts of the proposal are expected to be minimal, and do not pose a risk of serious or irreversible environmental damage. Management measures and safeguards to reduce impacts have been identified in this REF, and outlined in Section 7. Where possible, avoidance has been the first measure adopted. The management measures proposed have been applied on similar projects and found to be successful in managing the identified impact. They are feasible from both an economic and engineering perspective.

8.3.2 Intergenerational equity

The proposal will contribute towards regional strategic benefits for future generations, including improved public transport, increased road safety and increased access to facilities and services.

Minor impacts are predicted during construction through land acquisition and construction impacts including noise and vibration and traffic delays. These impacts will be short term in nature and managed through project staging and safeguards.

8.3.3 Conservation of biological diversity and ecological integrity

An assessment of the Clause 228 factors in this REF note the proposal is not likely to result in any significant loss of biodiversity or ecological integrity.

This proposal has sought to minimise impacts on the environment, including threatened species, populations and ecological communities, and their habitats. Specifically, the stand of *Acacia meiantha* has been avoided through design development and the proposal has minimised the impact on Newnes Plateau shrub swamp in the Sydney Basin bioregion EEC listed under the TSC Act, and the Temperate Highland Peat Swamps on Sandstone EEC listed under the EPBC Act.

Management measures and safeguards are proposed to manage impacts during construction and operation.

8.3.4 Improved valuation, pricing and incentive mechanisms

Roads and Maritime recognises the value of environmental resources and aims to minimise the impacts of its activities by ensuring that appropriate safeguards and management measures are implemented for all aspects of the proposal. Economic and social issues were considered in the rationale for the proposal and consideration of design options.

8.4 Conclusion

The proposed road upgrades along Chifley Road between Lithgow and Bell 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 assessment has included consideration of conservation agreements and plans of management under the NPW Act, joint management and biobanking agreements under the TSC Act, wilderness areas, critical habitat, impacts on threatened species, populations and ecological

communities and their habitats and other protected fauna and native plants. Potential impacts to matters of national environmental significance listed under the Federal EPBC Act have also been considered.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some impacts on hydrology, terrestrial biodiversity landscape and visual amenity and non-Aboriginal heritage.

Safeguards and mitigation measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also improve safety, improve driving conditions and reduce travel times in the local area and between Sydney and the central west of NSW and could provide local business and residents with increased income and employment. On balance the proposal is considered justified and the following conclusions are made:

1. **Significant impact to the environment**
   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 to be sought for the proposal from the Minister for Planning under Part 5.1 of the EP&A Act.

2. **Significant impact to NSW listed biodiversity matters**
   The proposal is not likely to significantly affect threatened species, populations or ecological communities or their habitats, within the meaning of the *Threatened Species Conservation Act 1995* or *Fisheries Management Act 1994* and therefore a Species Impact Statement is not required.

3. **Significant impact to nationally listed biodiversity matters**
   The proposal is not likely to significantly affect threatened species, ecological communities or migratory species, within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*

4. **Commonwealth land and other matters of national environmental significance**
   The proposal does not significantly affect Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999* and a referral to the Federal Department of the Environment is not required.

   The proposal is not likely to significantly affect other matters of national environmental significance, within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999* and a referral to the Federal Department of the Environment is not required.

9 Certification

This review of environmental factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.

Emma Waterhouse
Project Director
Coffey
Date: 23 August 2016

I have examined this review of environmental factors and the certification by Emma Waterhouse from Coffey and accept the review of environmental factors on behalf of Roads and Maritime Services.

Dylan Connell
Senior Project Development Manager
Greater Sydney Program Office | Infrastructure Development
Date: 23 August 2016

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Terms and acronyms used in this REF

Aboriginal	Inhabiting or existing in a land from the earliest times or from before the arrival of colonists; indigenous.
Acid sulphate soil	Acid sulfate soil is the common name for soils that contain metal sulfides. In an undisturbed and waterlogged state, these soils may pose no or low risk. However, when disturbed or exposed to oxygen, acid sulfate soils undergo a chemical reaction known as oxidation. Oxidation produces sulfuric acid which has led to these soils being called acid sulfate soils.
ACT	Australian Capital Territory.
AHIMS	Aboriginal Heritage Information Management System.
AMSL	Above mean sea level.
Ambient	Surrounding (eg surrounding air or water environment).
Ancillary site	Supporting site or laydown area.
Anthropogenic	Of humans.
Aquifer	A geological formation which holds water in sufficient quantity to provide a source of water that can be tapped by a bore.
ARI	Average recurrence interval.
Artefact	Object made by humans with a view to subsequent use – in the case of heritage items left in the environment by past inhabitants and an indicator of previous land use.
ASRIS	Australian Soil Research Information Service.
B-double	A prime mover pulling two semi-trailers.
Baffle arrangement	An arrangement to restrain the flow of water at a drainage outlet
Batter	The slope of embankments and cuttings, usually expressed as a ratio of horizontal distance unit to one vertical height unit.
BCR	Benefit cost ratio.
BHI	Bridge health index.
Biodiversity	The variety of species of plants, animals and microorganisms, their genes, and the ecosystems they comprise, often considered in relation to a particular area.
Bund	Any area protected by a low wall to prevent the spread of dangerous liquids being stored or processed.
Burra charter	The Australian ICOMOS Charter for the Conservation of Places of Cultural Significance (the Burra Charter 1979, most recently revised in 1999), is the standard adopted by most heritage practitioners in Australia when assessing significance of cultural values.
Catchment	A drainage area of a river.
CEMP	Construction environmental management plan.

Channel scouring	Removal of sediment through swiftly moving water, widening or deepening a channel.
Chert	A hard, siliceous rock of opaline or chalcedonic silica.
Class	Classification system used by Lithgow LGA to prioritise weeds.
CLM register	*Contaminated Land Management Act* 1997 register.
CO	Carbon monoxide.
Conglomerate	Rock consisting of rounded and waterworn pebbles, embedded in a finer cementing material.
Construction footprint	Area that would be affected by the construction of the proposal.
CP	Communication plan.
Culvert	A drain or channel crossing under a road.
Cutting	Excavation through higher ground.
dBA	A-weighted decibels.
Design speed	The design speed of a road is the maximum speed at which a motor vehicle can be operated safely on that road in perfect conditions.
DoE	Department of Environment (Commonwealth).
DUAP	Department of Urban Affairs and Planning.
Earthworks	The excavating and embanking of earth involved in engineering construction.
Edge effects	A change in species composition, physical conditions or other ecological factors at the boundary between two ecosystems or the ecological changes that occur at the boundaries of ecosystems (including changes in species composition, gradients of moisture, sunlight, soil and air temperature, wind speed and other factors).
EEC	Endangered ecological community.
EIS	Environmental impact statement.
EPA	Environment Protection Authority.
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW). Provides the legislative framework for land use planning and development assessment in NSW.
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
Ephemeral	Short lasting.
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased.
EWMS	Environmental work method statement.

Exotic species	An invasive species occurring, often as a result of human activities, beyond its accepted normal distribution and which threatens valued environmental, agricultural or other social resources by the damage it causes.
Fauna	Animals.
Flora	Plants.
FM Act	*Fisheries Management Act 1994* (NSW).
Grade	Inclination with the horizontal expressed by stating vertical rise as a percentage of the horizontal distance.
Greywater	Wastewater generated from sources without faecal contamination.
Grinding groove	Made from Aboriginal people sharpening their stone axe heads.
Ground-truthed	Verifying mapping or desktop information during a site visit (eg vegetation type).
HNCMA	Hawkesbury-Nepean Catchment Management Authority.
ha	Hectare.
Habitat	The native environment or kind of place where a given animal or plant naturally lives or grows.
Hydrology	The science of water.
ICNG	Interim Construction Noise Guideline.
ISEPP	State Environmental Planning Policy (Infrastructure).
Key threatening process	A threatening process is something that threatens, or could potentially threaten, the survival or evolutionary development of a species, population or ecological community. A threat can be listed under the *Threatened Species Conservation Act* 1995 (TSC Act) (NSW) or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Commonwealth) as a 'key threatening process' if it adversely affects threatened species, populations or ecological communities or if it could cause species, populations or ecological communities that are not threatened to become threatened.
km	kilometre.
L_{Aeq}	The equivalent continuous sound level is the average energy of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.
LALC	Local Aboriginal Land Council.
LCZ	Landscape character zone.
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
LGA	Local government area.
Macroinvertebrate	An invertebrate that is visible to the naked eye, as a crustacean, mollusc, worm, etc.
Macrophyte	An aquatic plant.

Masonite	Hardboard.
mg	milligram(s).
mm	millimetre.
Microhabitat	A habitat which is of small or limited extent and which differs in character from some surrounding more extensive habitat.
NARCliM	NSW and ACT Regional Climate Modelling project.
National Heritage List	The National Heritage List is Australia's list of natural, historic and Indigenous places of outstanding significance to the nation.
NES	Matters of national environmental significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
NO_2	Nitrogen dioxide.
Noise logger	Noise recording device.
NorBE	Neutral or Beneficial Effect assessment. In accordance with Clause 12 of the State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011, Roads and Maritime Services is required to consider whether or not an activity to which Part 5 of the Environmental Planning and Assessment Act applies will have a neutral or beneficial effect on water quality before carrying out the activity.
Noxious Weeds Act	*Noxious Weeds Act 1993* (NSW).
NPI	National Pollution Inventory.
NPW Act	*National Parks and Wildlife Act 1974* (NSW).
NSW	New South Wales.
OEH	Office of Environment and Heritage.
Pathogen	A pathogenic or disease-producing organism.
PCT	Native plant community type.
Perched water table	An accumulation of groundwater that is above the water table in the unsaturated zone.
Perennial	Lasting or continuing throughout the year (as a stream).
Permian	Relating to the latest Palaeozoic geological period or system.
Phase 1 investigation	Investigation to identify potential or existing environmental contamination liabilities.
Plateau	A flat surface of high elevation.
PM_{10}	Particulate matter.
POW	Prisoner of war.
RBL	Rating background level (an indicator of typical background noise levels).
Receiver	A person or premises potentially sensitive to noise or air quality impacts that may require attention.

REF	Review of Environmental Factors.
Riparian	Of, relating to, or situated or dwelling on the bank of a river or other body of water.
Rock shelter	Rock shelter sites include rock overhangs, shelters or caves, and generally occur on, or next to, moderate to steeply sloping ground characterised by cliff lines and escarpments. These naturally formed features may contain rock art, stone artefacts or midden deposits and may also be associated with grinding grooves.
RTA	Road and Traffic Authority (now Roads and Maritime).
Scarred tree	Trees which have previously had bark removed by Aboriginal Australians for the creation of bark canoes, shelters, shields and containers.
Sclerophyll	Various plants, typically found in low rainfall areas, having tough leaves which help to reduce water loss.
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
Stockpile	Large supply of essential materials, held in reserve for use during a period of shortage.
Study area	The area that encompasses the proposal and could potentially be indirectly affected by the proposal.
SO_2	Sulphur dioxide.
Spoil	Waste materials, as those cast up in mining, excavating, quarrying.
Threatened	As defined under the NSW *Threatened Species Conservation Act* 1995. A species, population or ecological community that is likely to become extinct or is in immediate danger of extinction.
TMP	Traffic management plan.
Torbanite	A dark brown oil shale rich in carbonaceous matter.
Triassic	Relating to the geological period or system that constitutes the earliest principal division of the Mesozoic era.
TSC Act	*Threatened Species Conservation Act 1995* (NSW).
Topographical mapping	Relief features or surface configuration of an area.
Turbidity	Not clear, opaque with suspended particles.
VENM	Virgin excavated natural material.
World Heritage List	World heritage sites that are nominated for World Heritage listing are inscribed on the list only after they have been carefully assessed as representing the best examples of the world's cultural and natural heritage.

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