Golden Highway Upgrade at Winery Hill

Review of Environmental Factors

Roads and Maritime Services | July 2018
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Executive summary

The proposal

Roads and Maritime Services (Roads and Maritime) proposes to widen about 6.8 kilometres of the Golden Highway between Coolmore Stud and 400 metres west of Saddlers Creek Bridge, at Winery Hill (the proposal). This section of the Golden Highway at Winery Hill is currently a single lane highway with narrow shoulders, non-compliant clear zones and limited overtaking opportunities. This results in heavy and oversize vehicles travelling slowly which impacts on average travel speeds and decreases the productivity of the highway.

The proposal forms part of the Golden Highway Corridor Strategy to provide an efficient and sustainable corridor that caters for increasing growth and improves safety along the Golden Highway corridor. The Golden Highway carries substantial freight volumes servicing the surrounding mining and agricultural activities. The main objective of the proposal is to provide overtaking lanes to improve road safety and freight efficiency.

Key features of the proposal are:

- Provision of a 1.3 kilometre long westbound overtaking lane
- Provision of a 1.3 kilometre long eastbound overtaking lane
- Road widening to provide 3.5 metre wide lanes and two metre shoulders
- Earthworks to allow for additional lanes and widening existing lanes
- Intersection improvement at two intersections, including the provision of:
  - A 120 metre long channelised right turn into Edderton Road and painted median islands on the approach and departure
  - A three metre wide shoulder on either side of the Golden Highway to facilitate eastbound and westbound turning movements at Woodlands Road
- Provision of three metre wide shoulders for 30 metres on either side of property accesses
- Provision of three metre wide shoulders for 85 metres for westbound and eastbound approaches to Hollydene Estate
- Culvert extension or replacement including scour protection
- Provision of new road surface along the length of the proposal
- Installation of safety barriers along the eastbound and westbound lanes where required
- Property acquisitions as required
- Four temporary construction ancillary facilities, including construction compounds, stockpile sites and erosion and sedimentation measures.

The construction of the proposal would be expected to start in late 2018, and would take about 12 months to complete.

Need for the proposal

This section of the Golden Highway is currently a single lane highway with narrow shoulders, non-compliant clear zones and limited overtaking opportunities. This results in heavy and oversize vehicles travelling slowly which impacts on average travel speeds and decreases productivity of the highway. The proposal would improve road safety and traffic and freight efficiency for oversized vehicles using the Golden Highway.
Proposal objectives
The proposal is part of a broader strategy to upgrade the Golden Highway. The objectives of the proposal include:

- Provide safe and efficient travel by providing overtaking lanes in each direction as well as wider paved shoulders
- Preserve and improve the condition of structures, cuttings and embankments
- Improve travel efficiency by providing a route with improved overtaking opportunities, signage and delineation
- Reduce fuel consumption and vehicle operating costs by providing consistent road conditions
- Cater for higher productivity vehicles including up to performance based standards (PBS) Class 2B of up to 30 metres in length
- Maintain and improve the ability to cater for over dimension and over mass loads.

Options considered
Three options were considered to address issues associated with a single lane highway with narrow shoulders, non-compliant clear zones and limited overtaking opportunities. The three options are as follows:

Option 1 – ‘Do Nothing’
The do nothing option would result in the Winery Hill section of the Golden Highway remaining in its current state with narrow shoulders, non-compliant clear zones and limited overtaking opportunities. Normal road maintenance would continue to be carried out.

Option 2 – Road widening with a one metre wide centre median
This option would include minor realignment of the road geometry through widening to accommodate overtaking lanes, two metre wide road shoulders and a one metre wide painted centre median.

The preferred option for the proposal is to progress Option 3 – Road widening with no median as it would:

- Provide safe and efficient travel by providing overtaking lanes in each direction as well as wider paved shoulders
- Preserve and improve the condition of structures, cuttings and embankments
- Improve travel efficiency by providing a route with improved overtaking opportunities, signage and delineation
- Reduce fuel consumption and vehicle operating costs by providing consistent road conditions
- Cater for higher productivity vehicles including up to PBS Class 2B of up to 30 metre in length
- Maintain and improve the ability to cater for over dimension and over mass loads
- Minimise impacts to Aboriginal heritage and vegetation due to a smaller proposal footprint.
Statutory and planning framework

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

As the proposal meets the definitions of ‘road infrastructure facilities’ provided for by clauses 93 and 94(2) of the ISEPP, and is being carried out by Roads and Maritime, it is permissible without consent under ISEPP. As a result, it can be assessed under Part 5.1 of the Environmental Planning and Assessment Act 1979 (EP&A Act). Development consent is not required.

A review of environmental factors (REF) has been prepared as part of the assessment process.

Community and stakeholder consultation

Local consultation has been managed as part of the community and stakeholder engagement strategy for the wider program to upgrade the Golden Highway corridor which connects the Hunter region with the Central West region.

A Communications Engagement Plan (CEP) (Roads and Maritime, 2016) was prepared and implemented for the both Ogilvies Hill and Winery Hill (the proposal) projects, which is part of the Golden Highway Corridor Strategy package of work. The CEP describes the communication and consultation approach and activities for the proposal and the proposed communications approach and to keep key stakeholders and the community informed during the work.

Roads and Maritime have consulted with property owners directly impacted by the proposal in relation to the project including property acquisitions and access arrangements.

Notifications would be placed in local print media before the start of construction. Directly affected (including adjacent) property owners would be advised by mail.

Environmental impacts

The proposal would have some adverse impacts during construction and operation which would be managed by the implementation of mitigation measures and safeguards as described in Section 7 and are summarised below.

Traffic and access

The proposal would cause temporary disruptions to traffic, including reduced speed limits, potential changes to property accesses and increased heavy vehicle movements on the existing road network during construction.

As the proposal is part of a wider program of work to upgrade the Golden Highway, the construction of the proposal would overlapping with the construction of a number of other projects along the Golden Highway. The potential highest average cumulative delay along the Golden Highway between the New England Highway and Dubbo, due to multiple construction works sites being operational at the same time would be in the order of up to 31 minutes at peak construction time (about August 2019).

The proposal would improve road safety and travel efficiently along the corridor by providing overtaking lanes, minimum two metre wide road shoulders and new road pavement.

Aboriginal Heritage

The study area contains evidence of past Aboriginal occupation and behaviour in the form of low and high density artefact scatters, potential archaeological deposits and isolated artefacts. The proposal area has been identified by Aboriginal knowledge holders as significant part of a wider cultural landscape.
Without mitigation the proposal would have the potential to indirectly impact on eight Aboriginal cultural heritage sites which were identified during sites surveys.

**Biodiversity**

The proposal would remove about 1.38 hectares of native vegetation. This would include the removal of about 1.34 hectares of vegetation meeting the description of the endangered *Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions* ecological community listed as endangered under the *Threatened Species Conservation 1995* (TSC Act).

An assessment of significance was carried out for threatened species and ecological communities that would be likely to occur in the proposal. With appropriate safeguards, the proposal would be unlikely to have a significant impact on any listed threatened species, populations or ecological communities.

**Noise and vibration**

During construction, noise management levels (NMLs) would be exceeded at about five receivers near the proposal. Where the NMLs have been predicted to exceed acceptable levels, construction noise would be mitigated through the safeguards and management measures outlined in this REF.

The proposal is not expected to result in road noise levels increasing by more than 2 dB(A) relative to existing road operations at surrounding receivers. Therefore, no specific operational mitigation measures would be necessary.

**Landscape, visual amenity and urban design**

Visual and landscape impacts would occur during construction and operation. Construction impacts would include a changed visual environment from construction plant, equipment and temporary ancillary facilities. Local landscapes would also be altered by earthworks and vegetation clearing creating a wider road corridor, potentially changing sight lines and the relationship between the road corridor and surrounding land.

Once the proposal is built, there would be permanent visual and landscape changes throughout the proposal area. The main visual changes would be due to the widening of the Golden Highway and associated vegetation removal.

**Socio-economic and property issues**

During construction, the community would experience temporary traffic delays, and noise and visual amenity impacts. The proposal would also require partial acquisitions from four private properties.

The proposal has the potential for both wider regional and local positive benefits in the medium to long term through improved road safety and freight efficiency.

**Justification and conclusion**

The proposal is consistent with national, state and local strategies and plans to improve the efficiency and safety of the Golden Highway for road users including the freight industry.

While there would be some environmental impacts as a consequence of the proposal, they have been avoided or minimised wherever possible through design and site specific safeguards. The beneficial effects are considered to outweigh the mostly temporary adverse impacts and risks associated with the proposal.

The proposal is subject to assessment under Part 5.1 of the EP&A Act. This REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.
The proposal would be unlikely to cause a significant impact on the environment. Therefore, it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Part 5.2 of the EP&A Act. A Species Impact Statement is not required. The proposal is subject to assessment under Part 5.1 of the EP&A Act. Consent from Council is not required. In addition, the proposal is not likely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the Environment Protection and Biodiversity Conservation Act 1999. A referral to the Australian Department of the Environment and Energy is not required.
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Appendices

Appendix A Consideration of clause 228(2) factors and matters of national environmental significance
1. Introduction

This chapter introduces the proposal and provides the context of the environmental assessment. In introducing the proposal, the objectives and project development history are detailed and the purpose of the report provided.

1.1 Proposal identification

Roads and Maritime Services (Roads and Maritime) proposes to widen about 6.8 kilometres of the Golden Highway between Coolmore Stud and 400 metres west of Saddlers Creek Bridge, at Winery Hill (the proposal). This section of the Golden Highway at Winery Hill is currently a single lane highway with narrow shoulders, non-compliant clear zones and limited overtaking opportunities. This results in heavy and oversize vehicles travelling slowly which impacts on average travel speeds and decreases the productivity of the highway.

The proposal forms part of the Golden Highway Corridor Strategy to provide an efficient and sustainable corridor that caters for increasing growth and improves safety along the Golden Highway corridor. The Golden Highway carries substantial freight volumes servicing the surrounding mining and agricultural activities. The main objective of the proposal is to provide overtaking lanes to improve road safety and freight efficiency.

The location of the proposal is shown in Figure 1-1 and an overview of the proposal is provided in Figure 1-2. The proposal is described in more detail in Section 3.

Key features of the proposal are:

- Road widening to provide 3.5 metre wide lanes and two metre shoulders
- Provision of a 1.3 kilometre long westbound overtaking lane
- Provision of a 1.3 kilometre long eastbound overtaking lane
- Earth works to allow for additional lanes and widening existing lanes
- Intersection improvement at two intersections, including the provision of;
  - A 120 metre long channelised right turn into Edderton Road and islands on the approach
  - A three metre wide shoulder on either side of the Golden Highway and eastbound and westbound turning movements at Woodlands Road
- Provision of three metre wide shoulders for 30 metres on either side of property accesses
- Provision of three metre wide shoulders for westbound and eastbound approaches to Hollydene Estate
- Culvert extension or replacement including scour protection
- Provision of new road surface along the length of the proposal
- Installation of safety barriers along the eastbound and westbound lanes where required
- Property acquisitions as required
- Four temporary construction ancillary facilities, including construction compounds, stockpile sites and erosion and sedimentation measures.

The construction of the proposal would be expected to start in 2018, and would take about 12 months to complete. The proposal must be completed by June 2019 due to funding requirements.

The proposal would require the use of up to four temporary construction ancillary facilities during construction. These sites would be used for stockpiling materials, storing plant and equipment, site offices and erosion and sedimentation measures. Further details about ancillary sites are provided in Section 3.4.

Construction of the proposal would be carried in sections and staged to enable work to be completed safely while maintaining traffic flows at all times. Construction would generally involve building one lane at a time,
and moving traffic between the lanes to keep the traffic flows for the duration of work. Further details on the sections and construction staging are provided in Section 3.1 and Section 3.3 respectively.

**Definitions**

For the purposes of this review of environmental factors (REF) the following definitions have been used:

- The ‘proposal’ refers to all the activities and ancillary sites associated with the widening of the 6.8 kilometre section of the Golden Highway at Winery Hill
- ‘Overtaking lane’ and ‘climbing lane’ are interchangeable terms for a lane which allows traffic to pass slower moving vehicles
- The ‘proposal area’ refers to the area that would be directly and indirectly impacted by construction activities. It also includes the areas of property acquisitions, ancillary site, and any other areas that would be temporarily disturbed. Not all vegetation within in this footprint would be removed as plant and machinery would manoeuvre around native vegetation where possible. The proposal area is shown in [Figure 1-2](#).
- The ‘construction footprint’ refers to maximum area that would potentially be directly impacted by the proposal and includes all areas of construction access tracks and boundary fencing realignments. It includes the 100 per cent concept design with a 10 metre buffer, and includes ancillary sites and any other areas that would temporarily be disturbed. The construction footprint is shown in [Figure 1-2](#).
- The ‘study area’ refers to the proposal area and the wider area that may be indirectly impacted by the proposal and varies for specialist studies
- ‘The locality’ encompasses the area in a 10 kilometre radius of the study area.
Figure 1-1 | Location of the proposal
Legend
- Proposal area
- Construction footprint
- Chainage point
- Cadastre
- Noise sensitive receiver

Figure 1-2a | The proposal
Figure 1-2e  |  The proposal
Legend

- Proposal area
- Construction footprint
- Concept design
- Chainage point
- Cadastre
- Culvert

Figure 1-2f | The proposal
Figure 1-2g | The proposal
Legend

- Proposal area
- Construction footprint
- Culvert
- Concept design
- Chainage point
- Cadastre

Figure 1-2h | The proposal
Figure 1-2i | The proposal

Legend

- Proposal area
- Construction footprint
- Concept design
- Cadastre
- Chainage point

GOLDEN HIGHWAY
Legend

- Proposal area
- Construction footprint
- Concept design
- Cadastre
- Chainage point

Figure 1-2k | The proposal
1.1.1 Surrounding land

As shown in Figure 1-1, the proposal is located about 14 kilometres east of Denman within the Muswellbrook local government area (LGA). The proposal is surrounded by predominantly cleared agricultural land which is used for vineyards, grazing and horse studs. Rural residential properties are scattered along the highway.

There are several small areas of native vegetation that are consistent with the definition of an endangered ecological community listed under the Threatened Species Conservation Act 1995 (TSC Act), (Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions).

Twenty-five Aboriginal heritage archaeological sites are located near to the proposal area. This includes 21 sites recorded on the Aboriginal Heritage Information Management system (AHIMS) and four potential archaeological deposit (PAD).

1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by Jacobs on behalf of Roads and Maritime. For the purposes of this proposal, Roads and Maritime is the proponent and the determining authority under Division 5.1 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

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

The description of the proposed work and assessment of associated environmental impacts has been carried out in the context of clause 228 of the Environmental Planning and Assessment Regulation 2000, the factors in Is an EIS Required? Best Practice Guidelines for Part 5 of the EP&A Act (Is an EIS required? guidelines) (DUAP, 1995/1996), Roads and Related Facilities EIS Guideline (DUAP 1996), the 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 5.5 of the EP&A Act including that Roads and Maritime examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

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 Division 5.2 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 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report
- The significance of any impact on nationally listed biodiversity matters under the EPBC Act, including whether there is a real possibility that the activity may threaten long-term survival of these matters, and whether offsets are required and able to be secured
- The potential for the proposal to significantly impact any other matters of national environmental significance or Commonwealth land and the need, to make a referral to the Australian Government Department of the Environment for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.
2. Need and options considered

This chapter describes the need for the proposal in terms of its strategic setting and operational need. It identifies the various options considered and the selection of the preferred option for the proposal.

2.1 Strategic need for the proposal

2.1.1 Strategic need for the proposal

The Golden Highway is the subject of a program of improvements for which funding of $133 million was announced in 2015. Overtaking lanes at Winery Hill are part of an integrated package of works under the RFPPSP and Heavy Vehicle Safety and Productivity Program (HSSVP) respectively.

The Golden Highway provides for regional freight distribution linking the Port of Newcastle to the Upper Hunter, Dubbo, central western and far western NSW. There are currently only a limited number of overtaking lanes along the length of the Golden Highway. Excluding four lane sections in Dubbo, there are only four westbound overtaking lanes and five eastbound overtaking lanes along the highway.

This section of the Golden Highway at Winery Hill is currently a single lane highway with narrow shoulders, non-compliant clear zones and limited overtaking opportunities. This results in heavy and oversize vehicles travelling slowly which impacts on average travel speeds and decreases productivity of the highway. Within this context, the proposal is required to improve road safety and traffic and freight efficiency for oversized vehicles using the highway.

2.1.2 Strategic planning and policy framework

A number of Commonwealth and State strategic plans refer to the need for improving safety and efficiency in roads in the State, including the Golden Highway. The proposal is consistent with these strategic plans, which are discussed below.

Golden Highway Corridor Strategy

The Golden Highway Corridor Strategy (Transport for NSW, 2016) outlines a 20 year vision for the Golden Highway corridor. The strategy sets out the vision, objectives, current performance, current and future challenges and the NSW Government’s strategic response to managing the Golden Highway corridor over the long term.

The vision for the Golden Highway has been developed to explain what actions should be achieved over the next 20 years in order to improve the performance of the highway and meet the specific corridor objectives. The vision includes:

- Boost productivity, support the development of agricultural and mining activities and operate as a critical freight route by enabling access for Performance Based Standards (PBS) Class 2B high productivity vehicles (up to 30 metres in length) across the Great Dividing Range from western NSW to the Hunter region and the Port of Newcastle
- Provide safe and efficient travel for all road users by providing a “2+1” lane arrangement east of Denman Road, and two lanes each way with an increased number of overtaking/climbing lanes west of Denman Road, and by addressing high risk crash locations
- Improve road network reliability and access by reducing the impact of flooding.
To address some of the challenges associated with road safety, freight productivity and sustainable asset management, a number of short term priorities (zero to five years) have been identified for the Jerrys Plains to Denman Road corridor along the Golden Highway. The short term priorities relevant to the proposal include:

- Road widening with clear zone works proposed to address run-off road crashes east of Denman, Gungal and west of the Castlereagh Highway (east) intersection
- Measures to enable safe access for higher productivity vehicles and improve safety at level crossings
- Overtaking lanes at more highly trafficked locations to improve traffic efficiency and reliability
- Improved safety for motorists, and supporting the productive movement of freight
- Carry out accelerated road rebuilding.

The Golden Highway Corridor Strategy has been divided into 11 sections which include:

- Section 1: Belford to Mt Thorley
- Section 2: Mt Thorley to Jerrys Plains
- Section 3: Jerrys Plains
- Section 4: Jerrys Plains to Denman
- Section 5: Denman (township)
- Section 6: Denman to Merriwa
- Section 7: Merriwa (township)
- Section 8: Merriwa to Dunedoo
- Section 9: Dunedoo (township)
- Section 10: Dunedoo to Dubbo
- Section 11: Dubbo (urban area).

The proposal forms part of Section 4: Jerrys Plains to Denman to improve safety, traffic and efficiency, network reliability and freight access and funded through the RFPPSP and HSSVP as part of a four year package of upgrades.

**NSW State Plan 2021: The Plan to Make NSW Number One**

The *NSW State Plan 2021: A Plan to Make NSW Number One* (Department of Premier and Cabinet, 2011) identifies priorities and targets for delivering services for NSW. The Hunter Regional Action Plan supports the NSW State Plan 2021 with regional specific priorities including investing in critical infrastructure and integrated transport. Where the regions existing infrastructure including the port, airport, and road and rail transport network would be strengthened, as well as, the links between mining and broader infrastructure needs would be considered for coal community towns including Scone, Muswellbrook, Singleton and Maitland.

The priority of investing in critical infrastructure and integrated transport aims to support future population and employment growth, improve access to services hubs, increase the share of commuter trips made by public transport and to improve travel efficiency and road safety. The proposal would support these aims as it would improve traffic /freight efficiency and improve road safety.

**Infrastructure NSW State Infrastructure Strategy 2012 (Update 2014)**

The *NSW State Infrastructure Update 2014* (Infrastructure NSW, 2014) is a strategy to plan and fund the infrastructure that the NSW Government delivers. For regional transport the strategic objective is to improve regional producer’s access to markets through investments supporting freight productivity. The key challenges for meeting the strategic objectives include:

- Managing a growing regional freight task efficiently
• Improving road freight productivity, particularly on major road freight corridors
• Tackling constraints and ‘pinch points’ on the local road network
• Making passenger transport investments that match the needs of a growing regional population.

The NSW Government’s strategic priorities for regional and interstate transport that are relevant to the Golden Highway Strategy include:

• Safer, more efficient road freight corridors
• Remove constraints on the local road network
• Keep pace with regional population growth.

The strategy recognises the Golden Highway as a priority corridor under the Regional Road Freight Corridor Program. It also identifies the need to improve the connectivity of the Hunter Valley to the Central West. The proposal would assist in meeting the key challenges of the infrastructure priorities of the State Infrastructure Strategy by improving road access into the region to support the growing NSW economy as well as improve the connectivity between the Hunter Valley and central west.

**NSW Long Term Transport Master Plan**

The *NSW Long Term Transport Master Plan* (LTTMP) (Transport for NSW 2012) was released by the NSW Government in December 2012. It is a 20 year plan which responds to key transport challenges and identifies the priorities needed to create a transport system that meets a range of needs. It also sets the framework for the NSW Government to deliver an integrated, modern transport system that puts the road user first.

The LTTMP has two themes that specifically reference upgrades to the Golden Highway, which is identified as servicing key mining, industry and agricultural centres in the Hunter. These themes include:

• Providing essential access for Regional NSW
• Supporting an efficient and productive freight industry.

The LTTMP also identifies significant investment to address pinch points on the Golden Highway. The proposal would support these themes by improving connectivity and travel time reliability, thereby reducing operating costs for heavy vehicles on the Golden Highway.

On a regional basis, a key aim of the LTTMP is to provide essential access for regional NSW. It outlines its commitment to provide accessibility and equity to people in the Western region by supporting good transport access to Broken Hill, Dubbo, Sydney and Newcastle for goods and services. The proposal supports this objective by planning for the improvement of the highway, addressing asset condition, road safety, traffic efficiency and freight access.

**Hunter Regional Transport Plan**

The *Hunter Regional Transport Plan* (Transport for NSW, 2015) supports the LTTMP and identifies specific transport actions for the Hunter region. The plan looks at population changes in the Hunter region and considers the fact that it has the largest regional workforce in NSW, with more than 80 per cent of the population living in the towns and cities of the Lower Hunter.

The broad actions identified in this plan, are under three themes:

• Better transport services
• Ensuring effective regulation
• Improving transport infrastructure.

To support these actions, the plan targets opportunities to invest in the road network to improve transport connections and efficiency. The plan specifically references the Golden Highway which is expected to
become a critical freight corridor, with inbound mining freight flows forecast to exceed the levels currently seen on the New England Highway by 2031.

The plan identifies two potential future improvements for the Golden Highway including regrading or realignment of Ogilvies Hill (around 2.5 kilometres east of Dalswinton Road, Denman) and Winery Hill (at Edderton Road, Jerrys Plains).

The proposal would assist in fulfilling the requirements of the plan, as it would improve transport infrastructure on the Golden Highway at Winery Hill.

The NSW Freight and Ports Strategy

The aim of the NSW Freight and Ports Strategy (Transport for NSW, 2015) is to provide a transport network that allows the efficient flow of goods to their market. The strategy outlines freight specific objectives which reflect the importance of the freight transport network for a competitive and productive NSW economy, as well as the need to integrate freight transport with other productive and non-productive activities and land uses. The strategies objectives include:

- Delivery of a freight network that efficiently supports the projected growth of the NSW economy
- Balancing of freight needs with those of the broader community and the environment.

The proposal would assist in fulfilling the requirements of the strategy as it would provide a safer and more reliable road freight network on the Golden Highway.

The NSW Road Safety Strategy 2012-2021

The NSW Road Safety Strategy 2012-2021 sets the direction of road safety in NSW. The NSW State Government committed to reducing fatalities to at least 4.3 per 100,000 population by 2016 together with at least a 30 per cent reduction in fatalities and serious injuries by 2021.

This strategy is underpinned by the safe system approach to improving road safety. This takes a holistic view of the road transport system and interactions among the key components of that system – the road user, the roads and roadides, the vehicle and travel speeds. It recognises that all these components have a role to play in helping to keep road users safe.

This strategy supports road safety infrastructure improvements such as overtaking lanes, wider clear zones, wider sealed shoulders and lanes, as well as, behavioural campaigns to reduce the number and severity of crashes along the corridor; in particular crashes relating to speed and driver fatigue. The proposal would assist in meeting the requirements of the strategy by helping provide safe and efficient travel for road users along the Golden Highway.

2.2 Existing infrastructure

Road infrastructure

The Golden Highway extends for a distance of about 313 kilometres between the New England Highway south of Singleton and Dubbo. The Golden Highway is also a vital connection between mines, surrounding towns and villages, the Lower Hunter and Newcastle (via the New England Highway and the Hunter Expressway). The Golden Highway within the proposal area consists of a single lane in each direction with noncompliant clear zones and limited overtaking opportunities. The posted speed limit is 100 kilometres per hour. The horizontal and vertical geometry do not meet current Austroads guidelines due to substandard curve radius with poor sight distances and clear zones. The existing road pavement is in poor condition.

The existing lane widths of the Golden Highway within the proposal area are about 3.5 metres with narrow shoulders on both sides of the highway. Refer to Photo 2-1 and Photo 2-2.
The Golden Highway though the proposal area has a steep grade which causes heavy vehicles to travel slowly. There are also limited overtaking opportunities and no existing formal pedestrian or cyclist facilities within the proposal area.

Intersections and property access

The Golden Highway intersects with the entry to Hollydene Estate, two council roads (Edderton Road and Woodlands Road) and five private property accesses. None of the intersections in the proposal area have traffic signals or dedicated turning lanes, and all turning movements are permitted. No formal refuges or turning lanes for cars are provided along the Golden Highway.

Hollydene Estate access is located on the southern side of the Golden Highway and provides access to the Hollydene Estate Winery. Refer to Photo 2-3.

The Edderton Road intersection is located on the northern side of the Golden Highway and meets the highway about 150 metres to the west of a crest and blind corner. Edderton Road is the shortest route to Muswellbrook and coal mining operations north of the Golden Highway. Refer to Photo 2-4.

The Woodlands Road intersection is located on the southern side of the Golden Highway and provides access to Darley’s Woodlands Stud Farm. The Golden Highway has a left turning lane into Woodlands Road but does not have a right hand turning lane. Refer to Photo 2-5.

Property accesses along both sides of the Golden Highway within the proposal include from formal driveways to access residential buildings, as well as sheds and gates through the roadside fences for access to rural holdings.

Photo 2-1 Golden Highway looking west showing poor curve alignment

Photo 2-2 Golden Highway looking east showing narrow road shoulders

Photo 2-3 Hollydene Estate intersection with the Golden Highway looking west

Photo 2-4 Edderton Road intersection with the Golden Highway looking east (google, 2016)
Bus facilities

The Golden Highway is an existing bus route. The Edderton Road intersection with the Golden Highway and along the Golden Highway near Woodlands Road are informal bus stops. The Edderton Road intersection is a key bus location with a pick up and drop off point for buses and cars exchanging passengers for onward journeys. Peak activity times at Edderton Road are between 7.40 - 8.00 am and 3.20 - 3.45 pm when three buses arrive and depart and private cars are parked to drop off and pick up passengers. Buses also stop near Woodlands Road.

Drainage

The existing drainage network includes 15 culverts (eleven single and four multi cell), and a mix of open channels and swales that discharge untreated stormwater into the Hunter River catchment. Refer to Photo 2-6 and Photo 2-7. The existing culverts along the highway within the proposal area are listed in Section 3.2.3. Culvert location and type is summarised in Table 3-3.
2.3 Proposal objectives

2.3.1 Proposal objectives

The proposal is part of a broader strategy to upgrade the Golden Highway. The objectives of the proposal include:

- Provide safe and efficient travel by providing overtaking lanes in each direction as well as wider paved shoulders
- Preserve and improve the condition of structures, cuttings and embankments
- Improve travel efficiency by providing a route with improved overtaking opportunities, signage and delineation
- Reduce fuel consumption and vehicle operating costs by providing consistent road conditions
- Cater for higher productivity vehicles including up to performance based standards (PBS) Class 2B of up to 30 metres in length
- Maintain and improve the ability to cater for over dimension and over mass loads.

2.4 Alternatives and options considered

Roads and Maritime considered a number of strategic design options for the implementation of overtaking lanes (both eastbound and westbound) through Winery Hill. Several of these contained substantial improvement to the geometry but resulted in large earthworks quantities and high cost, and were ultimately rejected as offering poor value for money. The preferred option uses the existing alignment and comprises of an overtaking lane for each direction.

2.4.1 Methodology for selection of preferred option

Following the identification of the need and objectives for the proposal, and the preferred strategic option, three options were considered to address issues associated with a single lane highway with narrow shoulders, non-compliant clear zones and limited overtaking opportunities.

As part of the Roads and Maritime planning process, a Value Management and Risk Management (VMRM) workshop for the 20 per cent concept design was held on 20 October 2016. The objectives of the workshop were to:

- Obtain a common understanding of the project and its current position
- Review the design options at each location and recommend a preferred direction for the median width as well as highlighting issues, concerns and potential improvements associated with various aspects of the project
- Highlight the key hazards and risks associated with the design and activities in developing the project and for those determined as critical, identify solutions or steps to address them
- Identify a way forward to make the design robust as it is progressed.

Suggested improvements and recommendations for consideration as the proposal is progressed were also considered.

The VMRM workshop resulted in a preferred option which best meets the proposal objectives as listed in Section 2.3.1 was selected and suggested improvements for consideration to meet the intent and maintain functionality and reducing cost as the design is progressed.
2.4.2 Identified options

Three options were considered for the proposal as follows:

**Option 1 – ‘Do Nothing’**

The do nothing option would result in the Winery Hill section of the Golden Highway remaining in its current state without any road widening. Normal road maintenance would continue to be carried out.

**Option 2 – Road widening with a one metre wide centre median**

This option would include minor realignment of the road geometry through widening to include an overtaking lane, two metre wide road shoulders and a one metre wide painted centre median.

**Option 3 - Road widening with no centre median**

Option 3 would include minor realignment of the road geometry through widening to include an overtaking lane, two metre wide road shoulders within no centre median.

2.4.3 Analysis of options

**Option 1 - Do Nothing Option**

When considering the Do Nothing option against the proposal objectives, it was found that this option would not:

- Provide safe and efficient travel by providing overtaking lanes in each direction as well as wider paved shoulders
- Improve the condition of structures, cuttings and embankments
- Improve travel efficiency by providing a route with improved overtaking opportunities, signage and delineation
- Cater for higher productivity vehicles including up to PBS Class 2B of up to 30 metre in length
- Maintain and improve the ability to cater for over dimension and over mass loads
- Impact the area’s natural environment, heritage and local communities.

This option would not meet the proposal objectives outlined in Section 2.3.1 and it does not present a solution to the strategic need. Accordingly, this option was rejected.

**Option 2 - One Metre Median and Option 3 - No Median**

Table 2-1 and Table 2-2 outline the advantages and disadvantages of Option 2 and Option 3 respectively as developed in the VMRM workshop.

**Table 2-1: Option 2 - One metre median**

<table>
<thead>
<tr>
<th>Potential benefits</th>
<th>Disadvantages/ implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improves safety due to increased separation between eastbound and westbound lanes</td>
<td>Larger footprint potentially increases environmental impacts compared to Option 3</td>
</tr>
<tr>
<td>Improves safety due to wider shoulders</td>
<td></td>
</tr>
</tbody>
</table>
Table 2-2: Option 3 - No median option

<table>
<thead>
<tr>
<th>Potential benefits</th>
<th>Disadvantages/ implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides overtaking lanes in both directions</td>
<td>Larger footprint potentially increases impact on heritage sites including PADs</td>
</tr>
<tr>
<td>Allows more flexibility, safer/easier staging during construction phase</td>
<td>Increased road surface area generates higher ongoing maintenance costs compared to Option 3</td>
</tr>
<tr>
<td>Caters for higher productivity vehicles including up to PBS Class 2B of up to 30 metre in length</td>
<td>Potentially more difficult to mitigate impacts next to telecommunication cables</td>
</tr>
<tr>
<td>Maintains and improves the ability to cater for over dimension and over mass loads</td>
<td>Greater land acquisition requirements</td>
</tr>
<tr>
<td>Improves the cuttings and embankments.</td>
<td>Potential impact to utilities near entrance to the Hollydene Estate</td>
</tr>
<tr>
<td></td>
<td>Increased cost due to slightly larger footprint than Option 3, property acquisitions, road surface and earthworks.</td>
</tr>
</tbody>
</table>

2.5 Preferred option

The preferred option for the proposal is Option 3 – Road widening with no median as it would:

- Provide safe and efficient travel by providing overtaking lanes in each direction as well as wider paved shoulders
- Preserve and improve the condition of structures, cuttings and embankments
- Improve travel efficiency by providing a route with improved overtaking opportunities, signage and delineation
- Reduce fuel consumption and vehicle operating costs by providing consistent road conditions
- Cater for higher productivity vehicles including up to PBS Class 2B of up to 30 metre in length
- Maintain and improve the ability to cater for over dimension and over mass loads
- Minimise impacts to Aboriginal heritage and biodiversity.
2.6 Design refinements

The strategic design anticipated utilisation of the existing horizontal and vertical alignment, retention of the existing road crown and use of existing crossfall. Review of the 20 per cent concept design identified opportunities for improvement, and critically, the Aboriginal heritage survey identified artefacts and PAD’s that should be avoided.

Road pavement investigations found existing pavement to be in poor condition and in need of reconstruction. The preferred pavement where vertical alignment grades lines are less than seven per cent would involve a heavily bound pavement constructed over the top of the existing pavement. The new grade line for the heavily bound pavement would be about 350 millimetres above the existing pavement compared with the target of 190 millimetres used in the 20 per cent concept design. Where grades are greater than seven per cent, an asphalt overlay is preferred with a grade line 195 millimetres above the existing road. All pavements have an asphalt wearing course with high friction aggregate.

As a result, the horizontal alignment of the proposal was completely revised to move the proposal footprint away from the PADs and crown land, to lift the grade further above the existing pavement and to shift new pavement construction to one side of the existing alignment where feasible.

Several other improvements and refinements have been made for the 80 per cent concept design. These include:

- Remove broken back curves between chainage 59280 and 59740 and move alignment slightly to the north to minimise property impacts
- Shift the alignment right to minimise impact on property between chainage 59800 to chainage 60540
- Replace deceleration lane for left hand turn into Hollydene Estate with a widened shoulder
- Channelised Edderton Road intersection with widening on the south shoulder
- Shorten westbound overtaking lane to diverge at a modelled heavy vehicle speed of 70 kilometres per hour (chainage 60200) and merge at chainage prior to climb over second short uphill gradient
- Alignment to be shifted to the south from Edderton Road to chainage 62860 to avoid impact on a PAD and keep construction to one side of the highway
- Alignment to be shifted to the south from chainage 62200 to chainage 63040 to avoid PAD impact
- Combine curves and short straight between chainage 62220 to chainage 62850
- Shift alignment to allow construction on one side of the highway between chainage 63320 to chainage Ch63540
- Realign to the south to minimise property acquisition between chainage 63540 to chainage 63800
- Shift alignment to the south to minimise property acquisition at chainage 64140 and set up for removal of broken back curves between chainage 64425 to 65693
- Shorten eastbound overtaking lane by moving diverge taper from chainage 64900 to chainage 64700
- Woodlands Road to be retained in current intersection form
- Lift design line to a target of 350 millimetres above existing pavement to allow for additional pavement thickness to meet design requirements.

The design refinements above collectively influenced the alignment for the 80 per cent concept design. The 80 per cent design has been modified to avoid impact on Crown Land, PADs and to move construction to predominantly one side of the current road alignment.

The alignment and grade of proposal was refined during preparation of the 100 per cent concept design. Changes include:

- Shifting the alignment right between chainage 60020 to chainage 60800 to minimise impact on high agricultural value vineyards
• Extending the diverge for the Edderton Road right turn lane eastwards to provide improved visibility of the intersection
• Refining the alignment to improve constructability by shifting the proposed alignment to one side of the existing pavement, limiting earthworks and new pavement construction to one side of the existing highway as far as practicable
• Refining the grade line to match the preferred pavement following the completion of pavement investigations and analysis
• Breaking the full project length into three sections (Sections 1A, 2 and 3) with Sections 2 and 3 built to match existing alignment and grade.
3. Description of the proposal

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

3.1 The proposal

Roads and Maritime proposes to widen about 6.8 kilometres of the Golden Highway between Coolmore Stud and 400 metres west of Saddlers Creek Bridge, at Winery Hill (the proposal). This section of the Golden Highway at Winery Hill is currently a single lane highway with narrow shoulders, non-compliant clear zones and limited overtaking opportunities. This results in heavy and oversize vehicles travelling slowly which impacts on average travel speeds and decreases the productivity of the highway. The proposal is shown in Figure 1-2.

Key features of the proposal are:

- Provision of a 1.3 kilometre long westbound overtaking lane
- Provision of a 1.3 kilometre long eastbound overtaking lane
- Road widening to provide 3.5 metre wide lanes and two metre shoulders
- Earth works to allow for additional lanes and widening of existing lanes
- Intersection improvement at two intersections, including the provision of:
  - A 120 metre long channelised right turn into Edderton Road and painted median islands on the approach and departure
  - A three metre wide shoulder on either side of the Golden Highway to facilitate eastbound and westbound turning movements at Woodlands Road
- Provision of three metre wide shoulders for 30 metres on either side of property accesses
- Provision of three metre wide shoulders for westbound and eastbound approaches to Hollydene Estate
- Culvert extension or replacement including scour protection
- Provision of new road surface along the length of the proposal
- Installation of safety barriers along the eastbound and westbound lanes where required
- Provision of three metre shoulders for 30 metres at formal property accesses
- Property acquisitions as required
- Four temporary construction ancillary facilities, including construction compounds, stockpile sites and erosion and sedimentation measures.

Construction of the proposal would be expected to start in late 2018, and would take about 12 months to complete.

The proposal has been developed to a concept design phase and would be further refined during the detailed design phase. The concept design of the proposal is described in HW27 Golden Highway –Winery Hill 100% Concept Design Report (Jacobs, 2017) and the following has been summarised from that report.

The proposal would require the temporary use of up to four ancillary sites during construction and these are outlined in Section 3.4.

About $23 to $26 million has been allocated for the construction of the proposal, with another $5 million potentially available. As the proposal would potentially cost more than the allocated funds to complete, the proposal has been considered as four sections for construction purposes. A description of each section is provided in Table 3-1. Section IA is the core section which addresses the proposal objectives. Sections IB, Section 2 and Section 3 are additional sections that may be constructed concurrently with IA or at a later date if or when funding becomes available. This REF has considered the aspects and impact of the four sections of the proposal. However, only Section 1A and Section 1B have progressed to detail design.
Table 3-1 Proposal sections

<table>
<thead>
<tr>
<th>Section</th>
<th>Chainage</th>
<th>Description of activities to be completed</th>
</tr>
</thead>
</table>
| Section IA| Between 60500 to 64460 (about 4000 metres*) | • East and westbound overtaking lanes  
• Pavement reconstruction  
• Two metre wide road shoulders  
• Edderton Road intersection upgrade. |
| Section IB| Between 62300 to 62980 (about 680 metres*) | • Pavement reconstruction  
• Two metre wide road shoulders. |
| Section 2 | Between 59255 to 60500 (about 1250 metres) | • Pavement reconstruction  
• Two metre wide road shoulders. |
| Section 3 | Between 64460 to 66008 (about 1550 metres) | • Pavement reconstruction  
• Two metre wide road shoulders (except over Saddlers Creek bridge)  
• Woodlands Road intersection improvements. |

*Note: Section 1B overlaps section 1A due to ties ins.

3.2 Design

The following sections provide a description of the design criteria, major design features and engineering constraints of the proposal. These features have been based on the concept design and would be subject to refinement during detailed design.

3.2.1 Design criteria

The road design has been carried out in accordance with the following guidelines and standards:

- *Austroads Guide to Road Design* (Austroads, 2009) and Roads and Maritime supplements to the Austroads Guide

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

Table 3-2 Design Criteria

<table>
<thead>
<tr>
<th>Specification</th>
<th>Criteria</th>
<th>Design criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Design</td>
<td>Design speed</td>
<td>100 kilometres per hour (a)</td>
</tr>
<tr>
<td></td>
<td>Posted speed</td>
<td>100 kilometres per hour</td>
</tr>
<tr>
<td></td>
<td>Design vehicle</td>
<td>30 metre B-Double</td>
</tr>
<tr>
<td></td>
<td>Checking vehicle</td>
<td>30 metre B-Double</td>
</tr>
<tr>
<td></td>
<td>Lane widths</td>
<td>3.5 metres</td>
</tr>
<tr>
<td></td>
<td>Auxiliary lane widths</td>
<td>3.5 metres</td>
</tr>
</tbody>
</table>
### Specification and Criteria

<table>
<thead>
<tr>
<th>Specification</th>
<th>Criteria</th>
<th>Design criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage</td>
<td>Shoulder width</td>
<td>- 2 metres</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 1 metre next to SO kerb (shallow v shaped wide drains)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 1 metre next to SO kerb at overtaking lanes</td>
</tr>
<tr>
<td></td>
<td>Channels and open drains</td>
<td>Minimum annual recurrence interval (ARI) 5 years</td>
</tr>
<tr>
<td></td>
<td>Culverts where surcharge is allowable</td>
<td>Minimum ARI 50 years</td>
</tr>
<tr>
<td></td>
<td>Nil width of flow spread onto traffic lanes</td>
<td>Minimum ARI 10 years</td>
</tr>
<tr>
<td></td>
<td>Major storm event check for no property damage</td>
<td>Minimum ARI 100 years</td>
</tr>
<tr>
<td>Road pavement</td>
<td>Design life</td>
<td>20 years</td>
</tr>
</tbody>
</table>

Note (a): The current vertical and horizontal alignment for the proposal does not meet the design speed of 100 km/h.

### 3.2.2 Engineering constraints

The design and construction of the proposal needs to consider a number of issues and constraints. The main issues and constraints include:

- **Existing alignment**: Tie-ins to the existing road and steep topography
- **Access**: Private property owners and residents would need to access their premises during construction
- **Utilities**: Underground utilities would be protected
- **Existing road connections**: Woodlands Road and Edderton Road intersects with the Golden Highway. These intersections would need to be adjusted to tie in with the proposal
- **Staging of the proposal**: The proposal would generally be constructed on the same alignment as the existing highway. This would pose staging challenges to maintain traffic flows (including oversized vehicles and over mass floats moving thought the proposal area) in both directions and access to local roads and properties. The proposal would most likely be constructed concurrently with a number of other upgrades along the Golden Highway
- **Availability of funds**: The final cost and availability of funds would determine if the full proposal made up of all four sections would be constructed or if would be a reduced version of a combination of sections.

### 3.2.3 Major design features

The major design features include the centreline shift associated with road widening and increased shoulder and verge widths. The intersections, road pavement design and drainage features are described below.

**Major design feature 1: Golden Highway cross section**

The cross section for the proposal was adopted with lanes 3.5 metres wide separated by a one metre painted median with two metre road shoulders. The shoulders would be two metres wide in fill locations and at table drains. In cut locations, next to SO kerbs, the shoulder would be reduced to 1.5 metres and further reduced to one metre next to SO kerb and the overtaking lane. The road shoulder is widened to three metres at entry points to private property for a distance of 30 metres on the approach side of the entry. The road verge is typically one metre wide. The typical cross sections are shown in [Figure 3-1](#).
Major design feature 2: Intersection with Edderton Road

Sight distances for westbound vehicles are limited by the existing crest and cutting just east of the Edderton Road intersection. To help improve road user awareness, the intersection with the Golden Highway and Edderton Road would include a 120 metre long channelised right turn into Edderton Road a painted median island starting 260 metres before the intersection as shown on Figure 3-2. A basic left turn for eastbound vehicles turning into Edderton Road would also be provided.
Major design feature 3: Intersection with Woodlands Road

The intersection between Woodlands Road and the Golden Highway would include three metre wide shoulder on either side of the Golden Highway to facilitate turning movements at Woodlands Road, as shown in Figure 3-3.

Figure 3-3 Golden Highway and Woodlands Road

Major design feature 4: Pavement design

The road pavement would be a combination of four profiles over the length of the proposal. In the steeper sections (where the grades are greater than seven per cent) the pavement would be an asphalt overlay over the existing pavement and for areas of road widening the pavement would consist of a layer of select material, which would be over laid with asphalt.

Where road grades are less than seven per cent, the pavements would consist of a full depth asphalt for road widening and over the existing pavements, the pavement would be an asphalt overlay.

Pavement wearing surface asphalt would contain high friction aggregate in steeper sections.

Major design feature 5: Drainage

Mainly concrete dish drains (SO kerbs) with some open channels have been proposed and would be included at the base of the cut batters to control and direct surface water. The SO kerb reduces the proposal area and protects the edge of shoulder.

The culverts within the proposal area were generally found to be in good condition and most of the cross culverts within the proposal area would be retained, although extension of culverts would generally be required for the wider road formation. The proposal would require the following changes to the culverts:

- Six new culverts would be required (five are for property access)
- Six culverts would require demolition and replacement
- Eight culverts would be to be retained and extended
- One culvert would be retained without modification
- All culverts would be upgrade to include scour protection.

The culvert location, type and proposed modification is summarised in Table 3-3.
<table>
<thead>
<tr>
<th>Culvert ID</th>
<th>Chainage</th>
<th>Culvert size and type (mm diameter)</th>
<th>Proposed modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>318108</td>
<td>59860</td>
<td>600 diameter precast concrete culvert</td>
<td>Remove and reinstall</td>
</tr>
<tr>
<td>318109</td>
<td>60110</td>
<td>Three x 750 diameter precast concrete culverts</td>
<td>Retain and extend</td>
</tr>
<tr>
<td>318110</td>
<td>60500</td>
<td>450 diameter precast concrete culvert</td>
<td>Remove and reinstall</td>
</tr>
<tr>
<td>318111</td>
<td>60640</td>
<td>Three x 450 diameter precast concrete culverts</td>
<td>Remove and reinstall</td>
</tr>
<tr>
<td>318111a</td>
<td>60770</td>
<td>450 diameter precast culvert</td>
<td>Remove/demolish</td>
</tr>
<tr>
<td>318112</td>
<td>61560</td>
<td>450 diameter precast concrete culvert</td>
<td>Retain and extend</td>
</tr>
<tr>
<td>318113</td>
<td>61760</td>
<td>450 diameter precast concrete culvert</td>
<td>Remove and reinstall</td>
</tr>
<tr>
<td>318114</td>
<td>62060</td>
<td>450 diameter precast concrete culvert</td>
<td>Retain and extend</td>
</tr>
<tr>
<td>318115</td>
<td>62195</td>
<td>Two x 1050 diameter precast concrete culverts</td>
<td>Remove and reinstall</td>
</tr>
<tr>
<td>318116</td>
<td>62325</td>
<td>Two x 1200 diameter precast culverts</td>
<td>Retain and extend</td>
</tr>
<tr>
<td>318117</td>
<td>62690</td>
<td>375 diameter precast concrete culvert</td>
<td>Retain and extend</td>
</tr>
<tr>
<td>318118</td>
<td>62970</td>
<td>750 diameter precast concrete culvert</td>
<td>Remove and reinstall</td>
</tr>
<tr>
<td>318119</td>
<td>63435</td>
<td>525 diameter precast concrete culvert</td>
<td>Retain and extend</td>
</tr>
<tr>
<td>318120</td>
<td>63975</td>
<td>600 diameter precast concrete culvert</td>
<td>Retain and extend</td>
</tr>
<tr>
<td>TBC</td>
<td>65860</td>
<td>525 diameter precast culvert pipe culvert</td>
<td>Retain</td>
</tr>
<tr>
<td>TBC</td>
<td>66115</td>
<td>Reinforced concrete box culvert</td>
<td>Retain and extend</td>
</tr>
</tbody>
</table>
3.3 Construction activities

This section provides a summary of the likely construction methodology, work hours, plant and equipment and associated activities that would be used to construct the proposal. For the purpose of this REF, an indicative construction plan and methodology are provided. Detailed construction plans and methods would be confirmed following completion of the detailed design.

The actual construction method may vary from the description in this chapter as a result of factors such as identification of on-site conditions during pre-construction activities, ongoing refinement of the design, consultation with property owners and availability of funding.

3.3.1 Work methodology

Construction activities would be guided by a Construction Environmental Management Plan (CEMP) to ensure work is carried out to Roads and Maritime specifications within the specified work area. Detailed work methodologies would be identified by the construction contractor.

The staging of construction would be sequenced so as to complete construction within the minimum possible timeframe, while maintaining traffic flow through the work zones at all times. The general approach would be to begin preliminary and enabling works as an early priority, before the main roadwork would begin.

**Early work**

The proposed scope of early work includes:

- Identification and delineation of sensitive areas as identified in this REF and the CEMP
- Establishment of temporary fencing and exclusion zone fencing, and clear demarcation of clearing limits
- Installation of temporary environmental controls including erosion, sediment and water quality controls
- Installation of drainage infrastructure to divert clean water through the site prior to ground disturbance
- Establishment of ancillary sites including main site compounds and stockpile areas
- Property and property access adjustment work
- Installation of traffic management measures, such as safety barriers in accordance with the traffic control plan
- Vegetation clearing and grubbing including tree removal where necessary
- Relocation or protection of utilities as required.

**Construction of the main proposal**

The construction of overtaking lanes would be constructed offline with a reduction in speed (40 kilometres) through the work area. The road rebuilding and shoulder widening would be carried out on half the road at a time. The Golden Highway would operate with a single lane available using temporary traffic control signals to manage traffic. Work would be carried out in 500 metre sections, with generally four sections carried out at each stage. This would result in five stages, of about two months duration each.

It is likely that widening would be constructed in the three main stages however the construction contractor may elect to vary this. The three stages are as follows:

- Stage one would involve the construction of as much of the widened new road as possible refer to Figure 1-2. Stage one would most likely be carried out during standard work hours, without any lane closures. However, traffic on the Golden Highway would be reduced to a speed of 40 kilometres per hour during any construction work adjacent to the highway
Stage two would involve the construction of 400 to 800 metre sections in two halves of 400 metres each. The contractor would potential work from both ends (east and west) of the proposal at one time using two teams. Stage two would most likely be carried out during standard work hours with the occasional night and/ or weekends work. In the section of the proposal being worked on traffic speeds would be reduced to 40 kilometres per hour and one traffic lane would be closed. Traffic would be switched between lanes to preserve traffic flows for the duration of work.

Stage three would involve tie in works at either end of the proposal. The work would be carried out during standard work hours with the occasional night and weekend work. Traffic would be switched while the road is rebuilt to tie into existing road levels.

The typical sequence of work during these stages would involve the following tasks:

- Delineate of the work area from traffic on the Golden Highway
- Install traffic management controls
- Stripping, stockpiling and managing of topsoil and unsuitable material
- Culvert extension or replacement
- Carrying out bulk earthworks
- Import and compact select material
- Construction of road pavement (this would include demolition of existing road pavement where required; and compaction of select fill, imported road base, insitu stabilisation of the base material)
- Install kerbs and gutters where required
- Asphalt road resurfacing
- Replace topsoil and stabilise embankments
- Carrying out finishing work (this would include installation of safety barriers, fencing, line marking, signposting, road furniture and street lights)
- Restore ancillary sites
- Site clean-up.

### 3.3.2 Construction workforce

The construction workforce would be expected to fluctuate, depending on the stage of construction and associated activities. The workforce would be expected to be between about 35 and 40 personnel at any given time during the construction period. The final number of construction workers would be determined by the construction contractor.

### 3.3.3 Construction hours and duration

As detailed in Section 1.1, construction work is expected to start towards the end of 2018 and take about 12 months to build.

The majority of construction work would generally be carried out during standard work hours, as follows:

- Monday to Friday 7am to 6pm
- Saturday 8am to 1pm
- Sunday and Public Holidays, no work.

To minimise disruption to traffic along the Golden Highway, it is anticipated that some out of hours work would be required (night and weekends). For example, Saturday work would most likely be between 7am and 5pm or as allowable in accordance with road occupancy licence (ROL) requirements. During scheduled night work, potentially impacted sensitive receivers would be consulted and kept informed of construction progress to minimise any impacts. In addition, management and mitigation measured detailed within the CEMP would be implemented as required to further mitigate any construction impacts. This
includes the development of an out-of-hours work protocol which would govern the management of works outside standard work hours.

The work would be carried out in accordance with the *Noise Criteria Guidelines* (Roads and Maritime, 2015) and *Construction Noise and Vibration Guideline* (Roads and Maritime 2016). Prior advice would be given to the community regarding work hours, and any planned construction work that is proposed to be carried out outside standard work hours.

### 3.3.4 Plant and equipment

An indicative list of plant and equipment that would typically be required is provided below. Additional equipment that is likely to be used would be identified during detailed design by the construction contractor.

- Excavator
- Scrapers
- Water carts
- Pulvi-mixers (Stabilisers)
- Bobcats
- Bitumen-sprayer Trucks
- Truck-mounted Lime Spreaders
- Bitumen-sprayer Trucks
- Bulldozers.
- Rollers
- Trucks (Tippers)
- Graders
- Loaders
- Backhoes
- Aggregate Spreader Trucks
- Light vehicles
- Aggregate Spreader Trucks

### 3.3.5 Earthworks

The proposal would involve earthworks, with the overall aim of maximising the re-use of material on site or between projects along the Golden Highway. The area of largest earthworks would be associated with:

- Widening the existing road to provide the overtaking lanes
- Widening of a low cutting near the top of the first ridge, west of Hollydene Estate.

The estimated quantities of materials associated with earthworks are provided in **Table 3-4**. The estimates may change depending on the actual quality of material, the depth to bedrock, and the suitability of the material for re-use in construction. Earthwork requirements would be confirmed during detailed design. It is expected that there would be about 4,000 cubic metres of cut over fill and therefore cut materials would need to be disposed of. There would be the potential to transfer the additional fill to Ogilvies Hill upgrade where or other construction projects along the Golden Highway.

**Table 3-4 Indicative earthworks quantities**

<table>
<thead>
<tr>
<th>Material</th>
<th>Volume (m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavation (cut) volume</td>
<td>42,000</td>
</tr>
<tr>
<td>Fill volume</td>
<td>46,000</td>
</tr>
</tbody>
</table>

### 3.3.6 Source and quantity of materials

About 10,000 cubic metres of asphalt would be required for the proposal. For earthworks, about 45,000 cubic metres of material is proposed to be imported during construction including about 25,800 cubic
Metres of heavy bound road base (blended with cement like stabiliser) and about 20,000 cubic metres of select material zone (SMZ) would be imported during construction.

Materials would be sourced from other project along the Golden Highway and/or appropriately licensed facilities. Wherever possible, materials would be sourced from commercial suppliers in nearby areas or other viable sources such as other nearby infrastructure projects. None of the materials proposed to be used are considered to be in short supply.

If additional fill material is required that cannot be sourced from the proposal area or other projects along the Golden Highway would be imported from a suitably licensed nearby quarry.

The amount of water that would be required during construction is unknown at this stage. The amount would depend on material sources and methodologies applied by the contractor. Water for the work would be sourced from authorised off site sources, including recycled or reused water. Water would also potentially be extracted from the Hunter River.

3.3.7 Traffic management and access

As described in Section 3.3.1, construction would be sequenced in four stages to allow the Golden Highway to remain open to traffic during construction with a reduction in speed to 40 kilometres per hour and managed oversize and over mass movements. Traffic would be moved between the lanes to preserve traffic flows for the duration of work. There would be temporary lane closures or stoppages as traffic as moved between lanes. Road traffic would be impacted throughout all four stages of construction. The worst case delay in moving though the proposal area is about 208 seconds eastbound and 178 seconds westbound (GHD, 2018). Traffic would temporarily be redirected along two alternative routes during construction activities along the Golden Highway as described below.

Vehicle movements

During construction a number of construction vehicles and machinery would require access to the proposal area. Ancillary sites would be established at up to eight locations along the Golden Highway (including both Winery Hill and Ogilvies Hill upgrade sections). All ancillary sites would be accessed from the Golden Highway, except for the one located at the Dalswinton Road intersection which would be accessed from Dalswinton Road west of Ogilvies Hill. The majority of construction plant and machinery would be located at these sites (refer to Figure 3-5 for location of ancillary sites).

Construction vehicles would access the proposal from the Golden Highway, resulting in a temporary increase in heavy vehicle movements on the highway. Construction traffic would include passenger vehicles, light and heavy trucks and would be greatest during the main earthworks and civil construction with vehicles transporting equipment, materials and spoil, and construction workers accessing the work site.

During normal working days about 10 to 15 heavy vehicle and 20 to 25 light vehicle movements would be required per day on and off-site. Between 40 to 45 heavy vehicle movements would potentially be required per day during construction. Should the staging of the proposal have two construction fronts occurring simultaneously, there could be over 100 heavy vehicle movements per day. Heavy vehicles would be used to deliver construction material and to transfer construction materials to ancillary sites.

During construction it would be necessary to move a large amount of onsite excavated materials from cuttings to fill areas. Any haulage movement across or along the Golden Highway would be in accordance with an approved Traffic Management Plan (TMP), refer further to mitigation measures included in Section 6.1.

As a proportion of the required fill material would be sourced from outside of the proposal area, truck haulage routes would be required between the proposal area and the material source using the existing highway and main road network. This would be detailed in the TMP.
Traffic management, control and signage

Where possible, construction would be programmed to minimise impact on traffic using the Golden Highway. Short traffic delays may occur as a result of construction and would be managed via the TMP (refer to Section 6.1).

Standard traffic management measures would be employed to minimise short term traffic impacts that could be expected during construction (refer to Section 6.1.3). These measures would be identified in the TMP. The TMP would also require management measures for oversize and over mass floats moving though the construction site and along Golden Highway. These management measure would most likely be address in an overarching Golden Highway TMP for all the Golden Highway upgrades that would be occurring concurrently. The TMP would be developed and carried out in accordance with Roads and Maritime’s Traffic Control at Works Sites Manual (RTA 2010) and Roads and Maritime G10 Specification for Traffic Management (Roads and Maritime 2011).

The TMP would detail traffic management requirements during construction, to ensure that traffic flow (including over-size and over mass floats) along the Golden Highway is maintained throughout construction. Further details on the management of vehicles during construction are provided in Section 6.1.

Access

There are several direct property accesses within the proposal area. Access to affected properties would be maintained during construction and temporary property access would be provided if required. The management of property access would be considered by the construction contractor and detailed as part of the final staging plan for the proposal.

The Golden Highway is a school bus route. School buses stop at the Edderton Road intersection and near Woodlands Road within the proposal area. The bus stops may require relocation or modification during construction and this would be carried out in consultation with the bus operators and patrons.

Temporary traffic diversions

Some construction activities associated with the proposal would require that traffic is temporarily redirected onto other nearby roads.

Traffic would temporarily be redirected along two alternative routes during construction activities at Ogilvies Hill and Winery Hill along the Golden Highway. Details of the temporary bypass routes are summarised in Table 3-5 and shown in Figure 3-4. It is expected that temporary bypass 01 would reduce traffic along the Golden Highway between the New England Highway and Denman Road, such that it is expected that a smaller volume mainly comprising of local traffic would use the Edderton Road segment of temporary bypass 02.

Table 3-5 Details of temporary bypass routes

<table>
<thead>
<tr>
<th>Temporary bypass ID</th>
<th>Bypassed road segment</th>
<th>Alternative road(s)</th>
</tr>
</thead>
</table>
| 01                  | Golden Highway between New England Highway and Denman Road | • New England Highway from Golden Highway to Thomas Mitchell Drive  
|                     |                       | • Thomas Mitchell Drive  
|                     |                       | • Denman Road between Thomas Mitchell Drive and the Golden Highway |
| 02                  | Golden Highway between Edderton Road and Denman Road | • Edderton Road  
|                     |                       | • Denman Road between Edderton Road and the Golden Highway |
Figure 3-4 Schematic of temporary bypass routes (Image: Google Earth)
3.4 Ancillary facilities

Roads and Maritime identified eight potential ancillary sites that would potentially be used both for this proposal and the road widening works at Ogilvies Hill. The eastern four sites (WH1, WH2 A&B and WH3) are assessed as part of this REF, while the western three (OH1, OH2A, OH2B and the existing Roads and Maritime maintenance stockpile) are assessed as part of the Ogilvies Hill project. The proposal would potentially use a combination of these eight sites as material is moved between the projects, that would be constructed concurrently. The Winery Hill and Ogilvies Hill projects are expected to be constructed concurrently. The locations of the eight ancillary sites are shown on Figure 3-5. The closest sensitive receiver is about 250 metres away from WH1.

Most ancillary sites would be used as stockpile and laydown areas, while one main site compound and one satellite compound would accommodate worker facilities, site offices, construction parking and plant. Table 3-6 provides the general arrangement of each ancillary site and its use. All ancillary facilities would be required for the duration of construction of the proposal.

The exact location and proposed use of ancillary sites would be confirmed by the construction contractor before the start of construction.

Table 3-6 Ancillary site details

<table>
<thead>
<tr>
<th>Site ID</th>
<th>Location</th>
<th>Size (square metres)</th>
<th>Proposed activities</th>
</tr>
</thead>
</table>
| WH1     | Bowmans crossing, located to the east of the Hunter River. This site is located within the road corridor. Access would be from the Golden Highway | 3,202 | • Stockpile areas  
• Plant and equipment parking area  
• Material laydown and storage area  
• Site office, parking, first aid post, daytime deliveries  
• Plant storage and construction parking  
• Chemical storage and equipment refuelling  
• Delivery of excavated material from site by tipper trucks  
• General stockpile management and loading of final product into tipper trucks for delivery to site  
• General delivery of other construction materials for storage  
• The site is located within an area known to flood |
| WH2A &B | Located to the south of the Golden Highway, opposite the Edderton Road Intersection. This site would be located on private property. Access would be from the Golden Highway | WHA: 17,646  
WHB: 21,012 | • Stockpile areas  
• Plant and equipment parking area  
• Material laydown and storage area  
• Site office, parking, first aid post, daytime deliveries  
• Chemical storage and equipment refuelling  
• Arrival and departure of office staff, workforce and daytime deliveries to compound  
• Plant storage and construction parking  
• Delivery of excavated material from site by tipper trucks |
### Site ID | Location | Size (square metres) | Proposed activities
---|---|---|---
| | | | • General stockpile management and loading of final product into tipper trucks for delivery to site
• General delivery of other construction materials for storage
• Site is outside of 1 in 10 ARI.

**WH3**

- Located to the north of the Golden Highway between chainage 62980 and 63160. This site would be located within the road corridor. Access would be from the Golden Highway
- Plant storage, construction parking, stockpiling, materials laydown and storage
- The site is outside of 1 in 10 ARI.

Ancillary facilities would predominantly be used during standard work hours however in some instances these facilities may need to be used outside of standard work hours to facilitate construction activities. In these instances, appropriate management measures would be implemented in accordance with the Construction Environmental Management Plan (CEMP) and consultation would occur with potentially impacted receivers to minimise impacts.

The stockpile areas would be established and managed in accordance with the *Stockpile Site Management Guideline* (Roads and Maritime, 2015). They would be located:

- In areas not prone to flash flooding and more than 40 metres from a watercourse
- More than 50 metres from the nearest dwelling
- In previously disturbed areas that do not require the clearing of native vegetation
- In plain view of the public to deter theft and illegal dumping
- Outside the drip line of trees and on level ground wherever possible.

All four proposed ancillary sites (WH1, WH2 A&B and WH3) are located in previously disturbed areas. Some limited clearing and vegetation may be required around the entry points of the ancillary sites to allow access to the sites. The proposal’s potential impacts on native vegetation, including for ancillary sites, is assessed in **Section 6.3**.

Ancillary facilities would be established as detailed in **Table 3-6**. Where amendments or additional ancillary facilities are identified during construction, the contractor would consult with Roads and Maritime’s lead environmental advisor to confirm the suitability of the proposed amendment or additional facility, and whether any additional environmental assessment is required.

Sites would be securely fenced with temporary fencing. Signs would be erected advising the general public of access restrictions and contact details in the event of emergency or incident. Upon completion of construction, the temporary site compound, work areas and stockpiles would be removed, and the sites would be cleared of all rubbish and materials and resorted.
3.5 Public utility adjustment

The utilities present within the proposal include:

- Ausgrid Overhead power lines and poles
- Telstra underground utilities.

No major utility relocations would be required as part of this proposal, however:

- Two power poles would be required to be relocated at chainage 59335 and chainage 61180
- Three communication cables and pits and cables routes (between chainage 59415 to 59500, 59600 to 60800 and at chainage 65135) associated with the Telstra underground telecommunications cables would potentially require adjustment or relocation
- The rest of the Telstra underground utilities near the proposal would need to be protected.

Any utility relocation requirements outside of the proposal area would be subject to further environmental assessment. Further consultation with these service providers would be carried out closer to construction.

3.6 Property acquisition

The property acquisitions described here reflect that only Section 1A and Section 1B have currently progressed to detail design, refer to Section 3.1. The property acquisitions required would need to be adjusted for the other two sections (Section 2 and Section 3) if and when the sections progress to detail design and ultimately construction.

The proposal would require partial acquisition of land from four properties which all share a boundary with the existing road reserve of the Golden Highway. The proposal requires acquisition of only a narrow strip of land from each property to accommodate the proposed widening of the road corridor. Properties impacted by partial acquisition are listed in Table 3-7.

The extent of property impacts would be refined and confirmed during detailed design in consultation with property owners. Partial acquisitions would require the development of property adjustment plans, which would be prepared in consultation with the property owner.

The land acquisitions would be subject to negotiation between each landholder and Roads and Maritime in accordance with Roads and Maritime’s Land Acquisitions Guide (Roads and Maritime, 2014) and the requirements of the Land Acquisition (Just Terms Compensation) Act 1991.

Table 3-7 Proposed property acquisition for Section 1A and Section 1B

<table>
<thead>
<tr>
<th>Area ID</th>
<th>Description</th>
<th>Total area (m²)</th>
<th>Acquisition type</th>
<th>Current owner</th>
<th>Lot and DP</th>
<th>Land use zone (LEP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Golden Highway</td>
<td>13,159</td>
<td>Partial acquisition</td>
<td>Private</td>
<td>Lot 12 DP861359</td>
<td>RU1</td>
</tr>
<tr>
<td>3</td>
<td>Golden Highway</td>
<td>7,543</td>
<td>Partial acquisition</td>
<td>Private</td>
<td>Lot 2 DP1004725</td>
<td>RU1</td>
</tr>
<tr>
<td>4</td>
<td>Golden Highway</td>
<td>14,410</td>
<td>Partial acquisition</td>
<td>Private</td>
<td>Lot 3 DP1004725</td>
<td>RU1</td>
</tr>
</tbody>
</table>

Total acquisition: 35,405
Roads and Maritime would also require a part lease of land from one property which would be used for ancillary sites (WH2 & B on Lot 12 DP861359). The need for lease arrangements would be confirmed by the contractor and consultation regarding agreements would be carried out with the identified landowners and Roads and Maritime before the start of work.
Legend
- Proposal area
- Construction footprint
- Culvert
- Property acquisition
- Affected property
- Watercourse
- Cadastre

Figure 3-6 | Property acquisition
4. Statutory and planning framework

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

4.1 Environmental Planning and Assessment Act 1979

4.1.1 State Environmental Planning Policies

**State Environmental Planning Policy (Infrastructure) 2007**

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

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

As the proposal is for the purposes of a road and associated road infrastructure facilities and is to be carried out on behalf of Roads and Maritime, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979*. 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 (Major Development) 2005.

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

**State Environmental Planning Policy No 44 – Koala Habitat Protection**

The Muswellbrook LGA is identified under Schedule 1 of *State Environmental Planning Policy No 44 – Koala Habitat Protection* (SEPP 44). The SEPP encourages the conservation and management of natural vegetation areas that provide habitat for koalas to ensure that permanent free living populations would be maintained over their present range.

Roads and Maritime is not bound by the provisions of SEPP 44 for Part 5.1 assessments. However, SEPP 44 is applicable to the Muswellbrook LGA and the principles of conservation would be adopted for the proposal where applicable.

The Biodiversity assessment carried out by Jacobs (Jacobs, 2018b) identified that the Koala would be unlikely to inhabit the proposal area due to no evidence of Koala habitation or population and the proposal being unlikely to contain suitable habitat, refer to Section 6.3.

4.1.2 Local Environmental Plans

**Muswellbrook Local Environmental Plan 2009**

The Muswellbrook Local Environmental Plan 2009 (the Muswellbrook LEP) applies to land within the Muswellbrook LGA. The proposal area is located within the RU1 Primary Production zone. The land use
objectives for the RU1 zone under the LEP and the proposal’s consistency with those objectives is detailed in Table 4-1.

Table 4-1: Relevant zone objectives

<table>
<thead>
<tr>
<th>Zone</th>
<th>Objective</th>
<th>Consistency of the proposal with the zone objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>RU1 Primary Production</td>
<td>- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base &lt;br&gt; - To encourage diversity in primary industry enterprises and systems appropriate for the area &lt;br&gt; - To minimise the fragmentation and alienation of resource lands &lt;br&gt; - To minimise conflict between land uses within this zone and land uses within adjoining zones &lt;br&gt; - To protect the agricultural potential of rural land not identified for alternative land use, and to minimise the cost to the community of providing, extending and maintaining public amenities and services &lt;br&gt; - To maintain the rural landscape character of the land in the long term &lt;br&gt; - To ensure that development for the purpose of extractive industries, underground mines (other than surface works associated with underground mines) or open cut mines (other than open cut mines from the surface of the flood plain), will not: &lt;br&gt;   a. Destroy or impair the agricultural production potential of the land or, in the case of underground mining, unreasonably restrict or otherwise affect any other development on the surface, or &lt;br&gt;   b. Detrimentally affect in any way the quantity, flow and quality of water in either subterranean or surface water systems, or &lt;br&gt;   c. Visually intrude into its surroundings, except by way of suitable screening. &lt;br&gt; - To protect or conserve (or both): &lt;br&gt;   a. Soil stability by controlling development in accordance with land capability, and &lt;br&gt;   b. Trees and other vegetation, and &lt;br&gt;   c. Water resources, water quality and wetland areas, ad their catchments and buffer areas, and &lt;br&gt;   d. Valuable deposits of minerals and extractive materials by restricting development that would compromise the efficient extraction of those deposits.</td>
<td>The proposal does not conflict with these objectives as it would encourage diversity in primary industry enterprises and systems by providing a more efficient freight network, while minimising the fragmentation of land, protecting agricultural potential of rural land and maintaining the rural landscape character of the land in the long term.</td>
</tr>
</tbody>
</table>

The zone provisions provide that the proposal would be permitted with consent in the RU1 zone. However, as outlined in Section 4.1.1 of this REF, under Clause 94 of ISEPP the proposal is permitted without the
consent of council. Therefore, the consent requirements of the LEP do not apply and the proposal may be determined under Part 5.1 of the EP&A Act.

One heritage item, ‘Arrowfield Estate’ listed as locally significant on the Singleton Local Environmental Plan 2013 was identified about 400 metres to the southeast of the proposal. This heritage item would not be impacted by the proposal.

4.2 Other relevant NSW legislation

4.2.1 Protection of the Environment Operations Act 1997

The Protection of the Environment Operations Act 1997 (POEO Act) provides the legal framework for the management of air, noise, water and waste pollution. Under section 48 of the POEO Act, scheduled activities (as defined in Schedule 1 of the Act) require an Environment Protection Licence (EPL).

Schedule 1 lists scheduled activities, including road construction on classified roads. The scheduled activities set out in Schedule 1 that are most relevant to Roads and Maritime include:

- Concrete works (clause 13)
- Crushing, grinding or separating materials (clause 16)
- Land-based or water-based extractive activities, such as extraction, dredging, quarrying, processing or storage (clause 19)
- Dealing with certain types of waste (see below)
- Road construction, widening or re-routing (but not maintenance or operation) where this results in four or more traffic lanes. To activate this clause, the road must be at least one kilometre to five kilometres in length depending on whether it is in a metropolitan or non-metropolitan area and on a freeway, tollway or main road (clause 35).

The proposal involves extractive activities, crushing, grinding or separating waste processing or storage. Therefore, based on the concept design, the proposal is considered a scheduled activity for the purposes of clause 19 under Schedule 1 of the POEO Act and an EPL would be required.

In addition, the POEO Act and the Protection of the Environment (Waste) Regulation 2005 are the key pieces of legislation that regulate waste in NSW. They contain the requirements for managing, storing, transporting, processing, recovering and disposing of waste. Applying waste to land in NSW (including temporary storage and reusing materials back into the construction of a road for example) may trigger various regulatory requirements such as the need to hold an environment protection licence or pay the waste and environment levy. However, a ‘resource recovery exemption’ may be applicable for the land application if it is a genuine, fit for purpose, reuse of the waste rather than another path to waste disposal.

An exemption facilitates the use of specific waste materials outside of certain requirements of the waste regulatory framework. For each exemption there is a corresponding ‘resource recovery order’ that specifies the requirements that must be met by suppliers of the material. The EPA has issued general resource recovery orders and exemptions for many materials including:

- Excavated natural material
- Excavated public road material
- Mulch
- Reclaimed asphalt road pavement
- Recovered aggregate.

These orders and exemptions may be used for the proposal without seeking approval from the EPA.
4.2.2 Roads Act 1993
The Roads Act 1993 (Roads Act) provides for the classification of roads. It also provides for the declaration of Roads and Maritime and other public authorities as roads authorities for both classified and unclassified roads. It also regulates the carrying out of various activities in, on and over public roads.

Under section 138(1) of the Roads Act, consent from the road authority is required for carrying out various activities in, on and over public roads. The proposal requires construction work through a classified road 14 kilometres east of Denman within the Muswellbrook LGA, and temporary interruption to traffic on the Golden Highway. Consent to carry out works on classified roads is not required as per Schedule 2 clause 5(1) of the Roads Act. However, a Road Occupancy Permit would need to be obtained as necessary prior to construction starting.

4.2.3 Biodiversity Conservation Act 2016

The BC Act sets out the environmental impact assessment framework for threatened species, threatened ecological communities and Areas of Outstanding Biodiversity Value (formerly critical habitat) for Part 5 activities (amongst other types of development).

However, the transitional provisions of the Biodiversity Conservation (Savings and Transitional) Regulation 2017 apply to the proposal because the environmental impact assessment of the activity began under Part 5 of the EP&A Act before the commencement of the new Act and is pending assessment under Part 5 (clause 29(1b)). Consequently, the biodiversity assessment for the proposal has been assessed in accordance with the TSC Act.

The biodiversity assessment conducted for this proposal is documented in Section 6.3. The proposal would not have a significant impact on threatened species or ecological communities or critical habitat and therefore a SIS has not been prepared.

4.2.4 National Parks and Wildlife Act 1974
The National Parks and Wildlife Act 1974 (NPW Act) is the primary legislation dealing with Aboriginal cultural heritage in NSW. Items of Aboriginal cultural heritage (Aboriginal objects) or Aboriginal places (declared under section 84) are protected and regulated under the NPW Act. Aboriginal objects are protected under section 86 of the Act. Under section 90(1) of the Act the Director-General may issue an Aboriginal heritage impact permit (AHIP) for an activity which would harm an Aboriginal object. An assessment of the potential impacts on Aboriginal cultural heritage is provided in the Archaeological Survey Report – Winery Hill Stage 2 PACHCI (Jacobs, 2018) included as Appendix C and summarised in Section 6.2. There are 19 known objects, PADs or places of Aboriginal cultural heritage located within the study area which may potentially be impacted by the proposal. If the proposal design is unable to avoid these areas, an AHIP would be required in respect of the proposal prior to construction.

4.2.5 Fisheries Management Act 1994
The Fisheries Management Act 1994 (FM Act) aims to conserve, develop and share the fisheries resources of the State for the benefit of present and future generations, including conserving fish stocks and key fish habitats and promoting ecologically sustainable development. The FM Act applies to all waters within the limits of the State, except where Commonwealth legislation applies.

Part 7A Division 4 of the Act prohibits the carrying out, without a licence, of activities that damage habitats or harm threatened species, populations or ecological communities. In determining the significance of impacts, the determining authority must consider the matters listed in section 5A of the EP&A Act.
The proposal would not directly impact aquatic habitat or block the passage of fish, therefore notice to the Minister is not required.

4.2.6 Land Acquisition (Just Terms Compensation) Act 1991

The proposal would require Roads and Maritime to acquire strips of private and publicly owned land in the study area to accommodate the proposal. All land acquisitions would be carried out in accordance with the Land Acquisition (Just Terms Compensation) Act 1991. Property requirements for the proposal, and the process that Roads and Maritime would follow in its dealings with affected landowners, are discussed in Chapter 3 in Section 3.6.

4.2.7 Waste Avoidance and Resource Recovery Act 2001

The purpose of the Waste Avoidance and Resource Recovery Act 2001 (WARR Act) is to develop and support the implementation of regional and local programs to meet the outcomes of a State-wide strategy for waste avoidance and resource recovery. It also aims to ‘minimise the consumption of natural resources and final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste’.

Waste generation and disposal reporting would be carried out during construction and operation of the proposal. Procedures would be implemented during construction in an attempt to promote the objectives of the Act (refer to Section 6.9).

4.2.8 Water Management Act

The Water Management Act 2000 (Water Management Act) controls the extraction of water, the use of water, the construction of infrastructure such as dams and weirs, and any activities in or near water sources in NSW. Water use approval, water management work approval and activity approvals are required under sections 89, 90 and 91 of the Act.


**Licensing**

Activity approvals under section 91 of the Water Management Act are required when a certain activity is likely to affect waterfront land or interfere with an aquifer. The proposal is not expected to impact on groundwater from geotechnical investigations. However, clause 38 of the Water Management (General) Regulation 2011 provides that Roads and Maritime, as a roads authority, is exempt from requiring controlled activity approval for all controlled activities that it carries out in, on or under waterfront land.

Section 56 of the Water Management Act 2000 establishes access licences for the taking of water within a particular water management area within a water sharing plan. Under section 18(1) of the Water Management (General) Regulation 2011 (Water Management Regulation), Roads and Maritime, as a roads authority, is exempt from the need to obtain an access licence in relation to water required for road construction and road maintenance. However, notification to the water owner would be required.

Section 92 of the Water Management Act 2000 sets approval requirements for water supply work. The proposed extracting water from the Hunter River (if needed) fall under the definition of water supply work and would require approval under section 92 of the Water Management Act 2000.

4.2.9 Biosecurity Act 2015

The Biosecurity Act 2015 and its subordinate legislation commenced on 1 July 2017. The Biosecurity Act 2015 replaces wholly or in part 14 separate pieces of biosecurity related legislation including the Noxious Weeds Act 1993. Under the Biosecurity Act 2015, all plants, including weeds are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who
deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

The Biosecurity Act 2015 and Regulations provide specific legal requirements for high risk activities and State level priority weeds. The State level priority weeds and associated legal requirements relevant to the region are outlined in the Greater Sydney Regional Strategic Weed Management Plan 2017 - 2022 (Local Land Services, 2017) together with the high risk priority weeds from the regional prioritisation process. As such, the three priority weeds on the site would be assessed and controlled to fulfil the General Biosecurity Duty and minimise biosecurity risks. Refer to Section 6.3.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

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

Potential impacts to these biodiversity matters are also considered as part of Section 6.3 of the REF and Appendix A.

Findings – matters of national environmental significance
The assessment of the proposal’s impact on matters of national environmental significance and the environment of Commonwealth land found that there is unlikely to be a significant impact on relevant matters of national environmental significance or on Commonwealth land. Accordingly, the proposal has not been referred to the Australian Government Department of the Environment and Energy under the EPBC Act.

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

4.4 Confirmation of statutory position

The proposal is categorised as development for the purpose of a road and is being carried out by or on behalf of a public authority. Under clause 94 of the ISEPP the proposal is permissible without consent. The proposal is not State significant infrastructure or State significant development. The proposal can be assessed under Division 5.1 of the EP&A Act.

Roads and Maritime is the determining authority for the proposal. This REF fulfils Roads and Maritime’s obligation under section 5.5 of the EP&A Act including to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

Roads and Maritime has formed the view that the proposal is not likely to significantly affect the environment and would not require the preparation of an Environmental Impact Statement (EIS).
5. Consultation

5.1 Golden Highway Corridor Strategy

As described in Section 2.1.2, the Golden Highway Corridor Strategy is a NSW Government initiative that aims to set a planning framework for how the government will manage road transport on the Golden Highway corridor in line with the NSW Long Term Transport Master Plan (LTTMP), Hunter and Central West Regional Transport Plans, the NSW Freight and Ports Strategy and other relevant state planning frameworks.

The Golden Highway Draft Corridor Strategy was released for public comment between the 30 March and 9 May 2016. Community members were encouraged to provide their feedback, leave comments and make submissions at information sessions or via mail, email or phone contact with the project team.


5.2 Consultation strategy

A Communications Engagement Plan (CEP) was prepared and implemented for the both Winery Hill (the proposal) and Ogilvies Hill projects, which are part of the Golden Highway Corridor Strategy package of work. The CEP describes the communication and consultation approach and activities for the proposal and the proposed communications approach and to keep key stakeholders and the community informed during the work. The consultation objectives were to:

- To keep the local community and other key stakeholders regularly informed of progress
- To provide the local community and stakeholders with regular and targeted information to build awareness about the Winery Hill and Ogilvies Hill project
- To provide clear information about what we are seeking feedback on, when and why
- To ensure feedback from the local community and key stakeholders is continuously fed into communication and engagement
- To be transparent in all that we do
- To encourage participation from local community members 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 increase stakeholder understanding of the Golden Highway program of work and its objectives
- To ensure that community and stakeholder enquiries about the project are managed and resolved effectively
- To ensure that project information is distributed in an effective and timely manner.

A range of engagement tools and activities would be utilised prior to and throughout the proposal to provide information to, and receive feedback from stakeholders and the local community.

5.3 Community involvement

The communication approach will focus on targeted communication with local property owners and key stakeholders including Muswellbrook Shire Council, the freight industry, Wanaruah Local Aboriginal Land Council (LALC), Tocomwall Pty Ltd, and emergency services.
Roads and Maritime has encouraged community feedback to the proposal through a combination of notifications and consultation with key stakeholders and affected property owners and residents. A summary of the community involvement activities carried out to date is provided in Table 5-1.

<table>
<thead>
<tr>
<th>Date</th>
<th>Community involvement activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>August 2016</strong></td>
<td>Notification of investigation work required for the detailed design.</td>
</tr>
<tr>
<td><strong>October 2016</strong></td>
<td>Notification of investigation work required for the detailed design.</td>
</tr>
<tr>
<td><strong>November 2016</strong></td>
<td>Notification of investigation work required for the preparation of the REF</td>
</tr>
<tr>
<td><strong>December 2016</strong></td>
<td>CEP prepared.</td>
</tr>
<tr>
<td><strong>December 2016 to January 2017</strong></td>
<td>Targeted communication was carried out with local property owners and key stakeholders including Muswellbrook Shire Council, the freight industry, Wanaruah LALC and emergency services.</td>
</tr>
<tr>
<td><strong>March 2018 to April 2018</strong></td>
<td>A project update seeking feedback and views on the proposal was delivered via mail and email to eight residents and property owners around the proposal (refer to Appendix B). The letters were also direct emailed to the freight network, businesses located in Mount Thorley industrial estate, emergency services and Muswellbrook Shire Council.</td>
</tr>
<tr>
<td><strong>18 April 2018</strong></td>
<td>- A media release was distributed on Wednesday 18 April by Upper Hunter MP Michael Johnsen to local media outlets (refer to Appendix B)</td>
</tr>
<tr>
<td></td>
<td>- The project webpage updated on Wednesday 18 April with the latest proposal information including the project update</td>
</tr>
<tr>
<td></td>
<td>- A Facebook post inviting comment was published on the NSW Roads Facebook. The post linked to the webpage and encouraged readers to complete the online feedback form.</td>
</tr>
<tr>
<td><strong>Prior to construction commencing</strong></td>
<td>Doorknocking and targeted consultation with adjacent residents and landholders prior to construction. Start of construction notification letter box drop a minimum of five business days prior to construction work starting.</td>
</tr>
</tbody>
</table>

Roads and Maritime consulted with the community during April and May 2018 on the concept designs for the Ogilvies Hill and Winery Hill overtaking lanes. Community members were encouraged to provide their feedback and leave comments via mail, email, online feedback form or phone contact with the project team. The consultation period closed on Wednesday 9 May 2018. A Community Consultation Report (CCR) (Roads and Maritime, 2018) was prepared to document the feedback received from the community for both the Ogilvies Hill (the proposal) and Winery Hill projects.

Roads and Maritime received 11 submissions about a range of issues. Some submissions included multiple comments and raised multiple issues. The feedback received was generally supportive of the proposed upgrades. The key concerns or issues included:

- Design of the proposed upgrades, including intersection treatments, road alignment, safety barriers, and wider road shoulders
- Location and grade of overtaking lanes
- Timing of construction

Other issues raised included suggestions for other road improvements along the Golden Highway. Some of these suggestions are being addressed by other projects in the Golden Highway package of work.
The Facebook post raised awareness of the project with 23,888 people reached during the consultation period. The post received 464 reactions, comments and shares and 4,440 post clicks, including the webpage link. Of the reactions (eg. like/love/dislike) on the post, 100 per cent were positive. The commentary was mixed with some supportive of the proposal and others saying the priority should be given to the Golden Highway and New England Highway intersection at Belford.

Key issues about the proposed upgrades raised in the comments on the Facebook post included:

- Support for overtaking lanes at Ogilvies Hill and Winery Hill
- Support for the proposed upgrades and a request that work be completed soon.

Other issues raised but not specific to this section of work included:

- Support for overtaking lanes at Whittingham
- Building a flyover at the Golden Highway and New England Highway intersection should be the priority
- Suggestion that building the Singleton Bypass would ease congestion at Whittingham
- Concerns about congestion at Maitland roundabouts
- Concerns about quality of roadwork in other areas – New England Highway at Muswellbrook and Aberdeen
- Suggestions for upgrades needed at other intersections on the Golden Highway.

A summary of the issues and responses documented in the CCR are included in Table 5-2. The CCR is attached as Appendix B.
<table>
<thead>
<tr>
<th>Issue category</th>
<th>Number of submissions</th>
<th>Issues raised</th>
<th>Roads and Maritime response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support for the proposed upgrades</td>
<td>3</td>
<td>Support for the concept designs for the proposed upgrades on the Golden Highway at Ogilvies Hill and Winery Hill</td>
<td>Support for the proposed upgrades has been noted.</td>
</tr>
<tr>
<td>Design of proposed upgrades</td>
<td>2</td>
<td>Request for right turning lane into Hollydene Estate Winery</td>
<td>The proposed upgrade provides for a three metre widened shoulder to allow vehicles to pass by a turning vehicle.</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Clarification as to whether the road is being realigned and if any improvements will be made to the grade of the eastern side of the hill</td>
<td>Roads and Maritime are maintaining existing alignments and grades.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Improvements include widening road shoulders, providing a widened painted median at Ogilvies Hill, improved roadside safety barriers and clear zones.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Query as to whether dividing barriers will be provided and whether they will be wire rope or concrete for motorcyclist safety</td>
<td>Median safety barriers are not included in the proposal.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Improvements include widening road shoulders, providing a widened painted median at Ogilvies Hill, improved roadside safety barriers and clear zones.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The proposed safety barriers are standard complying barriers in accordance with relevant standards. There are no specific provisions for motorcyclists.</td>
</tr>
<tr>
<td>Overtaking lanes</td>
<td>1</td>
<td>Request for wider shoulders for wide loads</td>
<td>The proposal includes widening the road shoulders generally to two metres at Ogilvies Hill and Winery Hill.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Overtaking lanes are needed on both sides of the Gap between Denman and Hollydene</td>
<td>Overtaking lanes are being constructed in both directions at Ogilvies Hill and Winery Hill.</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Suggestion for eastbound overtaking lanes at Ogilvies Hill, Daley Stud Hill and near Jerry Plains</td>
<td>Overtaking lanes are being constructed at Ogilvies Hill and Winery Hill as these were identified in the Golden Highway Corridor Strategy as priorities. For more information on the Golden Highway Corridor Strategy please visit our website at rms.nsw.gov.au.</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Request for better grade of climbing lanes</td>
<td>We are maintaining existing grades for the new overtaking lanes due to the existing road alignment.</td>
</tr>
<tr>
<td>Issue category</td>
<td>Number of submissions</td>
<td>Issues raised</td>
<td>Roads and Maritime response</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------------</td>
<td>---------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Improvements include widening road shoulders, providing a widened painted median at Ogilvies Hill, improved roadside safety barriers and clear zones.</td>
</tr>
<tr>
<td>Timing of construction</td>
<td>1</td>
<td>Concerned about delay in starting construction. Would like the proposed upgrades to start.</td>
<td>The proposal is on track to start in late 2018.</td>
</tr>
</tbody>
</table>
| Suggestions for other road improvements (outside the proposal area) | 1 | Improvements need to be made to the Golden Highway and Denman Road intersection as this is a dangerous location. | Work to upgrade the Golden Highway and Denman Road intersection started on Monday 14 May. Work involves:  
- Building a left turn and acceleration lane for westbound motorists  
- Providing a right turning lane for southbound motorists. This will allow eastbound motorists travelling through to Muswellbrook to safely pass by motorists waiting to turn right  
- Widening the road shoulder from the intersection to the bridge across the Hunter River.  
New lighting will be installed at the intersection to improve safety for all road users. |
| 1 | Request for extra truck stopping bays | A program of improvements to heavy vehicle stopping bays is being delivered along the Golden Highway. Seven new stopping bays are being built and three existing stopping bays are also being upgraded. Work involves resurfacing, line marking and sign posting, and installation of new picnic shelters and bins. |
| 1 | Concerns about safety at Collaroy Bridge over Krui River. Request to widen the bridge. | The Golden Highway package of works includes a program of improvements to bridge signage between Whittingham and Dubbo, including the Collaroy Bridge over Krui River.  
At the Collaroy Bridge Road and Maritime will be installing additional signage including vehicle activated signs with flashing lights. These types of signs are more visible than traditional signage and will warn motorists of the narrow bridge and to reduce speed on their approach. |
<p>| 1 | Request to widen the culvert on the western side of Ogilvies Hill on the curve towards the bottom of the hill | This culvert is located outside the proposal area. The comment has been noted and would need to be considered for future funding. |</p>
<table>
<thead>
<tr>
<th>Issue category</th>
<th>Number of submissions</th>
<th>Issues raised</th>
<th>Roads and Maritime response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Request to raise and straighten a corner on the western side of Ogilvies Hill</td>
<td>The corner on the western side of Ogilvies Hill is outside the proposal. The comment has been noted and would need to be considered for future funding.</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Request to extend the proposal to provide turning lanes at the Dalswinton Road intersection</td>
<td>The Dalswinton Road intersection is outside the proposal. The comments have been noted and would need to be considered for future funding.</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>Suggestion for westbound overtaking lanes at Winery Hill, Ogilvies Hill &amp; Collaroy Hill &amp; Cassilis Hill</td>
<td>Overtaking lanes are being constructed over Ogilvies Hill and Winery Hill as these were identified in the Golden Highway Corridor Strategy as priorities. For more information on the Golden Highway Corridor Strategy please visit our website at rms.nsw.gov.au.</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>Concerns the overtaking lanes on Ogilvies Hill will make safety worse at the Dalswinton Road intersection</td>
<td>The highway will remain as one lane in each direction past the Dalswinton Road intersection.</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>Consider access to a motorcycle track on the eastern side of Ogilvies Hill</td>
<td>This entrance to the motorcycle track is outside the proposal area.</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>Request to reintroduce broken lines on the long straight east of Ogilvies Hill, near the stock pile site to allow overtaking</td>
<td>This location is outside the proposal area and has been forwarded to our Network and Safety team for consideration. The new overtaking lanes at Ogilvies Hill will provide additional opportunities for light vehicles to pass heavy vehicles in this area.</td>
</tr>
</tbody>
</table>
The issues and comments outside the scope of work have been noted and would need to be considered for future funding. Based on the feedback, Roads and Maritime will be proceeding with further development of the proposal.

Roads and Maritime has considered all submissions and will ensure the project team is aware of concerns raised by the community. Roads and Maritime will ensure that issues highlighted by stakeholders and the community are appropriately addressed when finalising the detailed design. Roads and Maritime will continue to keep the community informed of the project progress.

5.4 Aboriginal community involvement

Roads and Maritime is committed to effective consultation with Aboriginal communities about its activities and the potential for impact on Aboriginal cultural heritage. Roads and Maritime’s Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) was developed to provide a consistent means of effective consultation with Aboriginal communities about activities which may impact on Aboriginal cultural heritage, and a consistent assessment process for Roads and Maritime activities across NSW. A summary of the four stages of the PACHCI procedure is provided in Table 5-3.

Table 5-3: Summary of PACHCI Procedure

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td>Initial desktop assessment to identify whether the project is likely to harm Aboriginal cultural heritage.</td>
</tr>
<tr>
<td>Stage 2</td>
<td>Further assessment and site survey with Aboriginal stakeholders to assess a project’s potential to harm Aboriginal cultural heritage and to identify whether formal Aboriginal community consultation and an Aboriginal cultural heritage assessment report (ACHAR) is required.</td>
</tr>
<tr>
<td>Stage 3</td>
<td>Where Stages 1 and 2 have let to the preliminary view that harm to Aboriginal objects or places will occur or is likely to occur, formal consultation and preparation of a CHAR must be completed. This stage may also involve archaeological test excavations.</td>
</tr>
<tr>
<td>Stage 4</td>
<td>Implementation of assessment recommendations.</td>
</tr>
</tbody>
</table>

Aboriginal community consultation carried out to date has involved:

- A site assessment was carried on multiple days August 2016 and September 2017 in consultation with the identified Aboriginal stakeholders under Stage 2 of PACHCI. The findings from the site assessment have been documented in the Aboriginal Archaeological Survey Report Stage 2 PACHCI completed by Jacobs Pty Ltd (2017). This report details an additional seven Aboriginal archaeological sites were identified near the proposal area (refer to Section 6.2 and Appendix C).

- In accordance with the PACHCI, the Roads and Maritime’s Aboriginal Cultural Heritage Officer provided Resource 7 (Aboriginal stakeholder cultural heritage survey report) to the Aboriginal stakeholders for completion (Aboriginal stakeholder completion of Resource 7 is optional). The purpose of Resource 7 is to determine whether any features of Aboriginal cultural significance occur within the study area, and whether they would be affected by the proposal. Information provided in Resource 7 was used to assist Roads and Maritime to determine whether further assessment and consultation is required.

- A Cultural Heritage Values Assessment (CVA) (Jacobs, 2018b) under PACHCI stage 2 was prepared to facilitate an understanding of the wider cultural values of the Golden Highway.

- Roads and Maritime conducted formal notification of the proposed CVA and proposal through advertisements placed in the Koori Mail and Singleton Argus on Wednesday 5 April 2017 and in the
Muswellbrook Chronicle on 7 April 2017. These notices informed the community of meetings to be held at the Singleton Civic Centre on Wednesday 26 April 2017 and Denman Community Technology Centre on Friday 28 April 2017 in an attempt to identify people with cultural knowledge of the Golden Highway. These meetings provided the opportunity for local Aboriginal people to formally register their interest in the proposal and other upgrades along the Golden Highway.

- As part of the CVA, Roads and Maritime has presented information on the proposed Golden Highway Corridor upgrades to the Wanaruah LALC at these meetings. As these meetings were poorly attended it was decided by Roads and Maritime and Jacobs to carry out direct contact with knowledge holders known to them in consultation with the Wanaruah LALC staff in attendance at these meetings. The CVA was prepared after interviews with the knowledge holders.

Refer to Section 6.2 and Appendix C for further details and the results of the consultation carried out with Aboriginal stakeholders.

5.5 ISEPP consultation

Clauses 13 to 16 of the State Environmental Planning Policy (Infrastructure) (ISEPP) specify the requirements for consultation with councils and other public authorities for infrastructure development carried out by or on behalf of a public authority. Appendix B contains an ISEPP consultation checklist that documents how ISEPP consultation requirements have been considered.

As the proposal would impact on two local roads that intersect with the Golden Highway (refer to Section 2.2), consultation was carried out with Muswellbrook Shire Council under clause 13 (1)(f). A letter was sent to council on 14 December 2016. The letter provided information on the proposal and requested input in terms of any issues or concerns. No response was received from Council.

5.5.1 Government agency and stakeholder involvement

Roads and Maritime has consulted on an ongoing basis with key State and local government agencies as well as utility providers, bus operators, local property owners and businesses in the proposal area. This consultation was designed to ensure issues and concerns were understood, documented and addressed, and that stakeholders had an opportunity to discuss any aspect of the proposed upgrade. Consultation has included phone calls, emails, letters and face-to-face meetings. Details of the consultation carried out are provided below. No specific issues have been raised.

Consultation with the school bus operators was also carried out in 2016 and 2017. (Roads and Maritime has discussed potential impacts during construction with this operator, including ensuring temporary bus stop relocation if required. Potential impacts on bus operators are discussed further in Section 6.1.)

5.6 Ongoing or future consultation

Ongoing consultation would be required by the construction contractor and Roads and Maritime to update local property owners, road users and councils of the proposal. Consultation activities would include:

- Consultation with Muswellbrook Shire Council, the freight industry and local bus companies would be ongoing in relation to staging plans, traffic management, and temporary road shut-downs
- Property owners identified would continue to be consulted about property acquisition and adjustment requirements
- All directly affected property owners and freight providers / industry using the highway would be consulted before the start of construction and changes to access for private properties (if required)
- Start of construction notification would be delivered via letter box drop to a number of residents around the proposal a minimum of five business days prior to the start of construction. Start of construction notification would also be provided to the local council and emergency services.
- Advertisements would be placed in local print media before the start of works detailing the likely timing of the proposal, potential changes to traffic conditions and project management contact details to open communication channels to provide further details or address complaints.
- Variable message signs (VMS) would be used along the Golden Highway to inform motorists using this road of the work and potential disruption to the road. The VMS’s would be deployed a minimum of five business days prior to the start of construction.
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 Traffic and transport

A summary of the potential impacts on traffic and transport are provided in this section, together with identification of measures to avoid, manage or mitigate these impacts. The potential cumulative impacts of the proposal on traffic and transport are assessed in the **Golden Highway Road User Delay Traffic Management Summary Report** (GHD, 2018), provided in Appendix D and summarised below.

6.1.1 Existing environment

The Golden Highway extends for a distance of about 313 kilometres between the New England Highway south of Singleton and Dubbo. The Golden Highway is a State road with a posted speed limit of 100 kilometres per hour in open areas and speed limited to 60 kilometres per hour through townships along its route. The Golden Highway carries about 2,800 vehicles per day (total in both directions) on week days based on 2015 data collected at Denman. The exceptions to this are the regional urban centres around Mount Thorley and Dubbo, which cater for more than 10,000 or 20,000 vehicles per day respectively (Cardno, 2015).

The Golden Highway provides:

- Connection for local communities between Singleton, Muswellbrook, Denman, Merriwa, Dunedoo and Dubbo
- Connection between mines, surrounding towns and villages, the Lower Hunter and Newcastle (via the New England Highway and the Hunter Expressway)
- Freight connection for goods moving west from Newcastle including supplies to mines in the east and fertiliser along the length of the corridor
- Connection for livestock and agricultural (including grain) between Dubbo, Dunedoo, Merriwa, Denman and Newcastle including the Port of Newcastle (via the New England Highway)
- Access to the Upper Hunter vineyards
- Connection to the M1 Pacific Motorway and Sydney via the New England Highway and Hunter Expressway
- Connection to southwest Queensland and central-north Victoria (via the Newell Highway) and to South Australia (via the Mitchell and Barrier highways).

The Golden Highway is an approved Higher Mass Limit (HML) B-Double route. It is one of only three east-west B-Double routes north of Sydney over the Great Dividing Range. The other routes are the New England Highway and the Gwydir Highway. The Golden Highway crosses the Great Dividing Range at an
The Golden Highway at Winery Hill is narrow and winding with narrow shoulders, non-compliant clear zones and limited overtaking opportunities. There are limited overtaking opportunities and no dedicated overtaking lanes in either direction. The road surface is tar sealed asphalt and there are no medians, footpaths, longitudinal drainage, street lights or any other traffic management features. The speed limit along Golden Highway is 100 kilometres per hour in either direction.

The Golden Highway intersects with the entry to Hollydene Estate, two council roads (Edderton Road and Woodlands Road) and five privately properties. The school bus stops at the Edderton Road intersection and near Woodlands Road within the proposal area.

### Crash history
Transport for NSW Summary Crash Report (2016) data for this area indicates that there have been a total of nine crashes within the proposal area between 2011 and 2016. Of these, six were non casualty crashes, two were uncategorised and one is listed as causing serious injury. Nothing is highlighted by the crash record in terms of vehicle types, crash types, speeds or conditions that is considered out of the ordinary for a rural highway. It is noted that crashes were located at the curve slightly east of the entry to Hollydene Estate.

### 6.1.2 Potential impacts

#### Construction
Construction is planned to occur over a 12 month period (weather permitting) from late 2018. Construction traffic (comprising light vehicles, haulage trucks, concrete trucks and delivery trucks) would lead to a temporary increase in traffic on the Golden Highway. This is increase construction traffic is not expected to be substantial in relation to existing traffic conditions.

Construction would be programmed to minimise impacts on traffic. Standard traffic management measures would be used to minimise short-term traffic impacts, and ensure that traffic flow (including oversize and over mass floats) and along the Golden Highway is maintained throughout construction. These measures would be documented in a TMP for the proposal and developed in accordance with Roads and Maritime’s Traffic Control at Works Sites Manual (RTA, 2010) and Specification G10 – Control of Traffic. Roads and Maritime would review the TMP before implementation.

#### Transport of excavated material and fill
The majority of construction truck movements for the proposal would be expected to be tipper trucks, which would be either single trucks (bogies) or ‘truck and dog’ trailers. Vehicles that are over-height, oversize or over-mass would not be expected to be required to construct the proposal. During normal working days about 10 to 15 heavy vehicles would be required per day on and off-site. Between 40 to 45 heavy vehicle movements would potentially be required per day during construction. If the staging of the proposal has two construction fronts occurring simultaneously, there could be over 100 heavy vehicle movements per day. These additional movements are not expected to impact on the existing traffic conditions and numbers. Heavy vehicles would be used to deliver construction material and to transfer construction materials to ancillary sites. Haulage would be in accordance with the TMP.

#### Local access
Access to properties would be maintained for the duration of construction. However, there may be a need to temporarily change access to some properties and the bus stops at Edderton Road and near Woodlands
Road, to establish safe construction working areas while maintaining local through traffic. These temporary changes to local access would include:

- Changes to access arrangements for vehicles using the Golden Highway, and for property access (including Hollydene Estate) located within the proposal area
- Disruption to the unsigned bus stops within the proposal area
- Short-term lane closures may be required, which could disrupt traffic on Golden Highway.

Where temporary disruptions are required, alternative access would be identified in consultation with property owners. The need for temporary access requirements would be identified during detailed design and construction stage planning.

**Increased travel times**

During construction, the speed limit would be reduced to 40 kilometres per hour where required through the site. This would delay travel time across the proposal when lane closures are in place (GDH, 2017). There may also be additional delays due to traffic control to allow construction vehicles to travel through the proposal and carry out works. This would be monitored throughout construction to ensure traffic flow is maintained on the highway. There would also be increased travel times due to traffic been temporarily redirected onto other nearby roads, this would also increase the volume of traffic along these roads.

The implementation of TMP, would minimise delays to road users. The cumulative traffic impacts of other upgrade work occurring concurrently on the Golden Highway are considered in Section 6.11.

**Road user delay modelling**

Road user delay modelling was carried out for the Golden Highway between the intersection with the New England Highway to about 11 kilometres west of Merriwa.

The proposed construction work across 10 sections of the Golden Highway would occur between August 2017 and the June 2020. The program of works as part of the Golden Highway Corridor Strategy and planned construction dates is provided in Table 6-1.

<table>
<thead>
<tr>
<th>Project name</th>
<th>Planned start date</th>
<th>Planned finish date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mudies Creek</td>
<td>November 2019</td>
<td>December 2020</td>
</tr>
<tr>
<td>HW9 to Putty Road Segments</td>
<td>August 2018</td>
<td>December 2020</td>
</tr>
<tr>
<td>Winery Hill Climbing lane (Segments 10 – 70)</td>
<td>November 2019</td>
<td>February 2020</td>
</tr>
<tr>
<td>Ogilvies Hill Climbing Lane (Segments 110 – 130)</td>
<td>November 2018</td>
<td>February 20520</td>
</tr>
<tr>
<td>Denman Road Intersection &amp; Segment 170</td>
<td>May 2018</td>
<td>September 2018</td>
</tr>
<tr>
<td>Segments 190 and 200</td>
<td>March 2018</td>
<td>July 2018</td>
</tr>
<tr>
<td>Rosemount Road intersection, Segments 240 – 260 and HV Parking areas</td>
<td>August 2017</td>
<td>February 2018</td>
</tr>
<tr>
<td>Segment 107</td>
<td>February 2018</td>
<td>June 2018</td>
</tr>
<tr>
<td>Willy Wally rest area westbound</td>
<td>April 2018</td>
<td>June 2018</td>
</tr>
<tr>
<td>Mt Thorley HV inspection</td>
<td>June 2018</td>
<td>May 2019</td>
</tr>
</tbody>
</table>

Each section would have a reduced speed limit for the duration of the works, and some sections would require single lane operation, creating cumulative delays.
The *Golden Highway Road User Delay Traffic Management Summary Report* (GHD, 2018), assessed the potential road user delay on the Golden Highway as a result of all the proposed construction works along the Golden Highway between the New England Highway to Dubbo (refer to Appendix D).

As part of this assessment road user delay calculations were carried out in order to understand the individual and cumulative impacts on travel times, of the multiple construction projects on the Golden Highway. The delay was calculated for each project based on the difference in travel time between the construction and base scenarios.

The key findings of this assessment included:

- The highest average cumulative delay per trip would be 31 minutes, which would be experienced by eastbound traffic in the afternoon peak hour. This is equivalent to about a 15 per cent increase in travel time between the New England Highway and Dubbo (about 309 kilometres). The cumulative delay would be greatest in August 2019, due to multiple projects under construction at the same time. The highest worst case cumulative delay per trip would be 42 minutes, which would be experienced by eastbound traffic in the afternoon peak hour.

- Potential diversion routes via Wybong Road and Denman Road offer potential travel time savings by allowing through traffic to bypass several worksites when travelling the length of the Golden Highway. This a route that traffic may choose to avoid the proposal as well as several other works sites that are been construction concurrently.

- Some potential diversion routes are not suitable for heavy vehicles, and longer routes may need to be used by these vehicles.

- **Figure 6-1** shows a graph of the cumulative average delay per trip from New England Highway to Dubbo at various times during the construction program, noting that not all projects would be under construction at once. The peak cumulative delay is expected for about one month around August 2019, with lower delays for much of the works program.

![Figure 6-1 Golden Highway average delay (GHD, 2018)](image)

**Potential diversion routes**

Six potential diversion routes between the New England Highway to Dubbo were identified in the *Golden Highway Road User Delay Traffic Management Summary Report* (GHD, 2017). These are options for traffic, they would not be used as detour routes as part of the proposal. The routes include:

- Ranger Road
Only the diversion route via Denman Road would be established as a detours for the proposal (refer to Section 3.3.7). The other routes are alternative options that traffic may choose to use to avoid multiple construction projects on the Golden Highway including the proposal.

These diversion routes are applicable for through traffic only, whereas local traffic may experience longer travel times if using these routes. The majority of diversion routes would offer limited travel time savings. This is due to the additional length and reduced speeds on some of the local roads along the diversion routes:

- The Wybong Road diversion route via Thomas Mitchell Drive and the New England Highway enables vehicles to bypass eight of the construction projects, giving a travel time saving of eight minutes
- The Denman Road diversion routes via Thomas Mitchell Drive or via Muswellbrook enables vehicles to bypass five of the construction projects, giving a travel time saving of up to eight minutes
- The Range Road, Putty Road and Lemington Road routes take marginally longer than the expected travel time during construction, but may also be worth considering.

The alternative routes would need to be assessed to ensure that they are suitable for the class of vehicles and have the capacity to cope with the increased demand associated with diverted traffic. B-doubles are not currently approved for some of the diversion routes.

**Accommodation of Over Size Over Mass (OSOM) movements**

Restrictions for heavy vehicles were identified for the five potential diversion routes according to the Roads and Maritime Restricted Access Vehicles Map. Restricted access vehicles include 19 metre B-double Routes (over 50 tonnes), 23 metre B-doubles and 25/26 metre B-doubles. Vehicles outside of these categories require a permit. The potential diversions routes and applicability to OSOM movements is as follows:

- Range Road, Wybong Road and Lemington Road are local roads and are not suitable for OSOM movements
- Putty Road is a regional Road. Putty Road between Mitchell Line of Road and Heuston Lane is approved for up to 25 metre B-double vehicle types. Putty Road between Heuston Lane and Campbell Street is restricted for 25-26 m B-Doubles, to northbound only between 3 am and 5 am, Monday to Friday. No restricted access vehicle travel is permitted on Campbell Street during 8:30-9:00 am and 3:00-4:00 pm on school days
- Denman Road is a state road and is approved for up to 25 m B-double vehicle types, however Thomas Mitchell Drive is unsuitable for B-doubles so heavy vehicles would need to travel via Muswellbrook
- Scone/Bunnan Roads are regional roads and are approved route for up to 25 m B-double vehicle types, however the following conditions apply: Travel not permitted 7:30 am to 9:00 am and 3:30 pm to 5:00 pm on school days.

All diversion routes use part of the New England Highway which is a National Highway and is approved for up to 25 metre B-double vehicle types.

The Denman Road diversion route via Muswellbrook would be most suitable for accommodating OSOM movements as it is approved with no conditions for heavy vehicles and offers the greatest travel time savings during construction.
Operation

The proposal would help provide safe and efficient travel for road users along the Golden Highway by providing two metre road shoulder, an east and westbound overtaking lane, improved road surface and condition of structures, cutting and embankments within the proposal area.

6.1.3 Safeguards and management measures

Safeguards and management measures for traffic and transport are presented in Table 6-2.

Table 6-2 Safeguards and management measures – traffic and transport

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Reference</th>
</tr>
</thead>
</table>
| Traffic and transport           | A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Roads and Maritime Traffic Control at Work Sites Manual (RTA, 2010) and QA Specification G10 Control of Traffic (Roads and Maritime, 2008). The TMP will include:  
|                                 | • Confirmation of oversize haulage routes and/ or detours  
|                                 | • Measures to maintain access to local roads and properties  
|                                 | • Site specific traffic control measures (including signage) to manage and regulate traffic movement  
|                                 | • Requirements and methods to consult and inform the local community of impacts on the local road network  
|                                 | • Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads  
|                                 | • A response plan for any traffic incidents within the construction zone.  
|                                 | • 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  
<p>|                                 | • Monitoring, review and amendment mechanisms.                                                                                                                                                                           | Contractor             | Detailed design / Pre-construction        | Section 4.8 of QA G36 Environment Protection |
| Property access - pre-construction | Requirements for any changes to local access arrangements will be confirmed during detailed design in consultation with the local road authority and any affected landowners.                                                   | Roads and Maritime     | Pre construction / detailed design   | Additional standard safeguard TT3              |
| Notifications to landowners     | Disruptions to property access and traffic will be notified to landowners at least five business days in accordance with the                                                                                                                                 | Roads and Maritime and | Pre construction / Construction        | Additional standard                            |</p>
<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property access - during construction</td>
<td>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 and the relevant local road authority.</td>
<td>Roads and Maritime and Construction Contractor</td>
<td>Construction</td>
<td>Additional standard safeguard TT4</td>
</tr>
<tr>
<td>Reduce speeds, traffic delays and disruptions during construction</td>
<td>Road users, local communities and the freight industry will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.</td>
<td>Roads and Maritime and Construction Contractor</td>
<td>Construction</td>
<td>Additional standard safeguard TT5</td>
</tr>
<tr>
<td>Disruption to public transport, including school bus services</td>
<td>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.</td>
<td>Roads and Maritime and Construction Contractor</td>
<td>Construction</td>
<td>Additional standard safeguard TT9</td>
</tr>
<tr>
<td>Impacts of the regional road network</td>
<td>Where possible, the most disruption work (such as work that requires lane closures) will be carried out at night to minimise potential impacts on the regional road network.</td>
<td>Roads and Maritime and Construction Contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
</tbody>
</table>
| Impact to oversize loads                   | • The ability to provide passage for oversize loads must be maintained during construction  
• The TMP will provide details on the strategy for informing oversized vehicles of the construction work and any temporary reduction in lane and/or shoulder widths or lane closures. | Construction contractor          | Pre-construction | Additional safeguard                                                                                                           |
6.2 Aboriginal heritage

The potential impacts on Aboriginal heritage during construction and operation of the proposal have been assessed as part of the Archaeological Survey Report – Winery Hill (Stage 2 PACHCI) (Jacobs, 2018) and Cultural Heritage Values Assessment (CVA) (Jacobs, 2018a), provided in Appendix C. The potential impacts, and safeguards to mitigate them, are summarised in this section.

6.2.1 Methodology

The Archaeological Survey Report and CVA were prepared in accordance with the:

- Stage 2 requirements of the Roads and Maritime PACHCI
- Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (OEH, 2010)

The study area for the Stage 2 PACHCI is defined as the existing Golden Highway within the proposal area within a 250 metre buffer either side of the highway, as shown in Figure 6-2. The assessment comprised of:

- An overview of the Aboriginal history of the study area
- A search of the AHIMS Register maintained by the OEH
- Identification of Aboriginal sites and areas of archaeological potential within the study area
- A site survey with local LALCs
- Assessment of the significance of identified Aboriginal sites
- Assessment of the potential for unidentified Aboriginal sites
- Recommendations and mitigation measures.

The CVA was prepared for a 45 kilometre section of the Golden Highway between Whitingham and Willy Wally Road (about 20 kilometres west of Merriwa) in the Singleton, Muswellbrook and Upper Hunter LGAs’ as part of the Golden Highway Corridor Strategy.

6.2.2 Existing environment

*Aboriginal background*

Difficulties exist in determining tribal boundaries within the study area, largely due to 200 years of dislocation caused by European settlement. The study area is thought to be within the boundary of the Wonnarua Nation. Commentators describe the fluidity of social organisation amongst the local tribal groups and commonalities in belief systems, language and modes of subsistence. Kinship relationships were likewise an integral and shared component of traditional Aboriginal society and governed the individuals and groups interaction with the environment. Trade was another social phenomena that bound local groups together and involved access routes throughout the landscape traversed by many and varied groups. Similarly, common behaviour was observable in the choices of campsite location, requiring common access to water and seasonal resources.

Aboriginal people of the Upper Hunter region traditionally used a wide variety of natural resources present within this fertile landscape. Ethno-historical accounts list some of the methods through which Aboriginal people harvested these resources. While there are gaps in the ethno-historical account, such as the lack of descriptions regarding stone artefact manufacture and use, it does provide a basis that can be used to understand how Aboriginal people used the landscape prior to non-Aboriginal colonisation.
Modification of the landscape by Aboriginal people took place through the use of fire farming and reed planting/weir development, however little evidence of such activities is likely to have been preserved in the archaeological record due to the perishable nature of the materials used and the historical alteration of the landscape. Evidence of campsites, with deposits of stone artefacts, hearths or middens are, in contrast, likely to be found where the landscape has not suffered severe ground disturbance. Ethno-historical accounts aid in developing a predictive model for the location of Aboriginal sites.

Similarities existed amongst regional tribal groups in their use of traditional material culture. Wood, stone, shell and bone comprised the raw materials of this world, most of which have little chance of being preserved in the archaeological record. Scarred trees, which were used in the production of items such as canoes, containers, shelters and bowls have the potential to be present within the region as do carved trees associated with ceremonial sites. However, the prevalence of logging in the Hunter region has severely reduced remaining scarred and carved tree numbers. Other sites, such as grinding grooves, stone quarries, burials and ceremonial grounds (bora rings, stone arrangements), while rarer, are discussed in the ethno historical records and have potential to be present within the study area.

The spiritual world of the Wonnarua was, and is, rich and diverse. Many important cultural sites are the central components of their traditions, and a number exist as focal points in the landscape. For example, Roads and Maritime have been informed by Aboriginal knowledge holders that the Golden Highway follows the path of a songline. Songlines trace the stories of the landscape, connecting the past, people and culture to the pathways taken to travel across country. Many pathways that Aboriginal people used to walk are now integrated with modern roads and highways.

**Database searches**

A search of the OEH’s AHIMS was carried out on 15 June 2017 as part of the Stage 2 PACHCI. Fourteen records were identified within 250 metres of the proposal. The AHIMS sites consisted of:

- Nine artefact scatters/open camp sites
- Four isolated artefacts
- One artefact scatter with associated grinding grooves.

As shown in **Table 6-3** and **Figure 6-2**, four of the 14 registered Aboriginal sites are located within 20 metres of the proposal.

**Table 6-3: AHIMS sites within 250 metres of the proposal**

<table>
<thead>
<tr>
<th>Site ID</th>
<th>Site name</th>
<th>Site type</th>
<th>Site status</th>
<th>Distance from the existing highway (metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>37-2-4422</td>
<td>SSD-1A1-12</td>
<td>Isolated Artefact</td>
<td>Valid</td>
<td>200</td>
</tr>
<tr>
<td>37-2-4423</td>
<td>SSD-1A2-12</td>
<td>Isolated Artefact</td>
<td>Valid</td>
<td>250</td>
</tr>
<tr>
<td>37-2-5029</td>
<td>DS-IF76-13</td>
<td>Artefact Scatter</td>
<td>Valid</td>
<td>150</td>
</tr>
<tr>
<td>37-2-0452</td>
<td>MAS 99; Mt Arthur South</td>
<td>Artefact Scatter and Grinding Grooves and PAD</td>
<td>Valid</td>
<td>10</td>
</tr>
<tr>
<td>37-2-0478</td>
<td>MAS 95; Mt Arthur South</td>
<td>Artefact Scatter</td>
<td>Valid</td>
<td>200</td>
</tr>
<tr>
<td>37-2-0426</td>
<td>MAS 51; Mt Arthur South</td>
<td>Artefact Scatter</td>
<td>Valid</td>
<td>20</td>
</tr>
<tr>
<td>37-2-4237</td>
<td>DS AS14 11</td>
<td>Artefact Scatter</td>
<td>Valid</td>
<td>20</td>
</tr>
<tr>
<td>37-2-0072</td>
<td>Saddler's Creek</td>
<td>Artefact Scatter</td>
<td>Valid</td>
<td>250</td>
</tr>
</tbody>
</table>
Site survey

As a result of the desktop assessment, predictive modelling was used to determine the archaeological sensitivity of particular landforms within the study area. The predictive model was used to identify areas of potential archaeological sensitivity based on known patterns of site distribution in similar landscape regions or archaeological landscapes. For example, a high sensitivity rating indicated that these areas have specific landscape characteristic are predicted to have a high potential for the discovery of archaeological sites and these sites are more likely to be of higher significance.

Landforms with high sensitivity were identified for further investigation as part of the site survey. For the site survey the study area was divided up into four survey areas (SA1, SA2, SA3 and SA4). The survey area locations and features are summarised in Table 6-4 and shown on Figure 6-2.

As part of the Stage 2 PACHCI investigations, an archaeological survey of the study area was carried on the 11 August 2016, 22 September 2016 and 11 October 2016, 26 May 2017 and 7 September 2017. The survey team was comprised of the Roads and Maritime Aboriginal Cultural Heritage Officer, archaeologists from Jacobs and members from the Wanaruah LALC, Tocumwal Pty Ltd (Tocumwal) and Gomicon.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Valid</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>37-2-4331</td>
<td>DS IF6 11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37-2-0371</td>
<td>MAS 25; Mt Arthur South</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37-2-0372</td>
<td>MAS 26; Mt Arthur South</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37-2-0373</td>
<td>MAS 27; Mt Arthur South</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37-2-0374</td>
<td>MAS 28; Mt Arthur South</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37-2-4332</td>
<td>DS IF7 11</td>
<td></td>
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</tr>
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<td></td>
<td>Isolated Artefact</td>
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<tr>
<td></td>
<td>Artefact Scatter</td>
<td></td>
<td></td>
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<td></td>
<td>Artfact Scatter</td>
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<tr>
<td></td>
<td>Site Destroyed</td>
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<td></td>
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<td>250</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survey area</td>
<td>Landscape/ Section</td>
<td>Summary of desktop assessment</td>
<td>Site survey result</td>
</tr>
<tr>
<td>-------------</td>
<td>---------------------</td>
<td>-------------------------------</td>
<td>-------------------</td>
</tr>
</tbody>
</table>
| SA1 - Hunter River Floodplain | Eastern end of the proposal to the interface between Bowmans Crossing and the Hunter River Floodplain landscapes. SA1 includes the Bowmans Crossing stockpile area. | - No known Aboriginal heritage sites identified within the survey area  
- Western portion of the survey area slopes toward Hunter River  
- Undisturbed portions of the survey area are likely to be of low potential archaeological sensitivity. | The site survey identified two isolated artefacts (refer to Figure 6-2):  
- Winery Hill 6 (AHIMS 37-2-5490)  
- Winery Hill 7 (AHIMS 37-2-5490). |
| SA2 - Edderton Road | Includes the proposal area between the Hunter River Floodplain landscapes, past Hollydene Estate Winery and incline up to Edderton Road section. SA2 includes the Edderton Road stockpile area. | - Eight AHIMS records identified within the survey area (37-2-0371, 37-2-0372, 37-2-0373, 37-2-0374, 37-2-4332, 37-2-433, 37-2-4237, 37-2-0426)  
- Edderton Road portion of the survey area has been heavily disturbed by road corridor and the Golden Highway  
- Undisturbed portions of the survey area are likely to be of moderate-high potential archaeological sensitivity, especially near ephemeral waterways  
- Steeply sloped areas are of low potential archaeological sensitivity  
- One site (AHIMS 37-2-0373) has been destroyed. | The site survey identified (refer to Figure 6-2):  
- A low density artefact scatter and PAD (Winery Hill 1 (AHIMS 37-2-5469)) extending 200 metres either side of ephemeral creek directly west of Edderton Road  
- One artefact scatter and PAD (Winery Hill 2 (AHIMS 37-2-5470)) 200 metres either side of ephemeral creek 1100 metres west of Edderton Road  
- PAD (Winery Hill 3 (AHIMS 37-2-5490)) located south of Highway 100 metres to west of Edderton Road. |
| SA3 - Winery Hill | Includes the proposal area between the Edderton Road section and the sloped area toward Saddlers Creek and Woodlands Road (east of the Saddlers Creek) | - One known Aboriginal heritage site identified within the survey area (AHIMS. 37-2-0426)  
- Portions of the survey area are heavily disturbed by the existing Golden Highway  
- Areas near ephemeral waterways are likely to be of moderate to high potential archaeological sensitivity  
- Other undisturbed portions of the survey area are likely to be of low-moderate potential archaeological sensitivity PAS. | The site survey identified (refer to Figure 6-2):  
- One artefact scatter and PAD (Winery Hill 2 (AHIMS 37-2-5470)) which also extends into this survey area  
- One artefact scatter (Winery Hill 4 (AHIMS 37-2-5488))  
- One isolated artefact (Winery Hill 5 (AHIMS 37-2-5489)). |
<table>
<thead>
<tr>
<th>Survey area</th>
<th>Landscape/ Section</th>
<th>Summary of desktop assessment</th>
<th>Site survey result</th>
</tr>
</thead>
</table>
| SA4         | Saddlers Creek/Woodlands Road | - Five Aboriginal AHIMS records identified within the survey area (37-2-0478, 37-2-0452, 37-2-5029, 37-2-4422, 37-2-4423)  
- Woodlands road shoulder has been heavily disturbed by the existing Golden Highway  
- Undisturbed, elevated portions of the survey area near Saddlers Creek are likely to be of moderate-high potential archaeological sensitivity. | The site survey identified one area of PAD (AHIMS 37-2-0452) previously identified as an artefact scatter with grinding grooves located on the alluvial terraces of Saddlers Creek (refer to Figure 6-2). |
The survey identified seven previously unrecorded Aboriginal cultural heritage sites consisting of three isolated artefacts (Winery Hill 5, 6 and 7) and a low density artefact scatter (Winery Hill 4) all located close to the study area. Additionally, three areas of PAD (Winery Hill 1, 2 & 3), two of these with surface artefacts were located during the surveys. A further PAD (Saddlers Creek PAD) was identified in the location of an extensive artefact scatter and grinding grooves first located in 1984 (Koettig and Hughes 1985). All seven new sites have since been registered on the AHIMS.

All of these seven archaeological sites are located outside of the proposal area (refer to Figure 6-2) and would not be impacted. These Aboriginal archaeological sites are described in Table 6-5.

### Table 6-5: Archaeological sites identified during the site survey

<table>
<thead>
<tr>
<th>Site Name (AHIMS ID)</th>
<th>Site Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winery Hill 1 37-2-5469</td>
<td>Surface artefact and PAD</td>
<td>A low density artefact scatter located along a property boundary directly north of the road corridor. Artefacts comprise indurated mudstone angular fragments and flakes. This site was within an area identified as a PAD.</td>
</tr>
<tr>
<td>Winery Hill 2 37-2-5470/37-2-0426</td>
<td>Isolated surface and PAD</td>
<td>The isolated artefact is located about ten metres from the current road corridor on private land adjacent to the study area. The isolated artefact is located on a lower slope in a disturbed area on private property close to an eroding boundary track. The site is within an area identified as a PAD incorporating AHIMS site # 37-2-0426 recorded by Koettig and Hughes in 1984 (now disturbed by roadbuilding/fencing). Winery Hill 2 PAD extends from this location to the west and east delineating areas 200 metres either side of ephemeral tributary of Saddlers Creek across survey area 1 and 2.</td>
</tr>
<tr>
<td>Winery Hill 4 37-2-5488</td>
<td>Artefact scatter</td>
<td>Winery Hill 4 is a low density artefact scatter located on a lower slope near an unnamed ephemeral creek that flows to the north of the road corridor. Two artefact are located about ten metres from the current road corridor on private land.</td>
</tr>
<tr>
<td>Winery Hill 5 37-2-5489</td>
<td>Isolated artefact</td>
<td>Winery Hill 5 is an isolated artefact on a mid-slope. The artefact is located about five metres south of a fence bordering the Golden Highway.</td>
</tr>
<tr>
<td>Winery Hill 6 37-2-5490</td>
<td>Isolated artefact</td>
<td>Winery Hill 6 is an isolated artefact on a mid-slope comprising of indurated mudstone core. The artefact is located 12 metres from a fence line bordering the Golden Highway.</td>
</tr>
<tr>
<td>Winery Hill 7 37-2-5491</td>
<td>Isolated artefact</td>
<td>Winery Hill 7 is an isolated artefact located on a midslope in a disturbed context on an erosion swale about 15 metres from the proposal. The artefact is comprised of banded chert.</td>
</tr>
</tbody>
</table>
| Saddlers Creek PAD 37-2-0452 | Artefact scatter, grinding grooves and PAD | AHIMS site 37-2-0452 is a low density artefact scatter (with an unspecified number of grinding grooves located nearby and a total of 30 artefacts. The scatter is located on tributary of Saddlers Creek that flows to the Hunter River. The site was first recorded in 1984 by Koettig and Hughes (Koettig and Hughes 1985). The site is within an area identified as a PAD incorporating the scatter and extending 200 metres either side of the
<table>
<thead>
<tr>
<th>Site Name (AHIMS ID)</th>
<th>Site Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>scatter recorded by Koettig and Hughes. Consultation with the Aboriginal representatives at this location confirmed it as an area of PAD and of cultural significance.</td>
</tr>
</tbody>
</table>
Summary of Significance Assessment

A significance assessment is made up of several significance criteria that attempt to define why a site is important. The assessment of Aboriginal cultural heritage was based upon the four criteria of the Australia ICOMOS Burra Charter (Australia ICOMOS 2013) which include:

- Social values
- Historical values
- Scientific values
- Aesthetic values.

Each of the newly identified Aboriginal cultural heritage sites was assessed against the above criteria and an overall significance is assigned based on an average across the values. The summary of the significance assessment of Aboriginal cultural heritage sites located within 20 metres of the existing highway is presented below in **Table 6-6**.

**Table 6-6 Summary of the significance assessment for known sites within 20 metres of the road corridor**

<table>
<thead>
<tr>
<th>Name (AHIMS ID)</th>
<th>Social</th>
<th>Historical</th>
<th>Scientific</th>
<th>Aesthetic</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winery Hill 1 (37-2-5469)</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Winery Hill 2 (37-2-5470 &amp; 37-2-0426)</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Winery Hill 3 (37-2-5483)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Winery Hill 4 (37-2-5488)</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Winery Hill 5 (37-2-5489)</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Winery Hill 6 (37-2-5490)</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Winery Hill 7 (37-2-5491)</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Cultural assessment

A CVA was prepared by Jacobs (2018) and included consultation with Aboriginal knowledge holders (refer to **Appendix C**). The CVA investigated cultural values along the Golden Highway between Willy Wally Road (about 20 kilometres west of Merriwa) and Whittingham (including the proposal area).
Consultation with stakeholders and on-site discussions with Aboriginal knowledge holders have however identified the following cultural heritage values with the landscape which are applicable to the Golden Highway:

- Resource gathering locations and techniques
- Campsites
- Scarred trees
- Transit routes/pathways through the landscape
- Water courses, water holes or springs
- Plants and animals
- Burial sites
- Songlines
- Post-contact sites
- Massacre sites
- Cultural knowledge.

Within the range of the cultural heritage values above, three Aboriginal cultural places along the Golden Highway which are not gazetted Aboriginal Places under S86(4) of the National Parks and Wildlife Act, but rather are places of local significance identified during this CVA. Knowledge holders expressed a strong ongoing cultural knowledge of customary lore specific to three cultural sites along the Golden Highway which have significant cultural values to the local Aboriginal community. These areas have both tangible and intangible values. There are three corresponding proposed upgrade works along Golden Highway which are within or near to these three cultural sites. These upgrades include:

- Ogilvies Hill – rebuilding about two kilometre section of the highway to provide climbing lanes in both directions
- Winery Hill – Provide climbing lanes in both directions. Also, road widening and reconstruction of prioritised sections between Bowmans Crossing and Saddlers Creek (this proposal)
- New Heavy Vehicle Inspection Stations for both directions between Putty Road intersection and Mount Thorley interchange.

Saddlers Creek which includes the proposal area was identified as an Aboriginal cultural place due to the following:

- It is an area known to contain a large number of sites recorded on the AHIMS site register associated with the waterways of Saddlers Creek
- Sites containing Bondi points with suggested antiquity
- Reported by knowledge holders to be a significant campground
- It is a significant part of a wider cultural landscape.

The significance of Saddlers Creek Aboriginal cultural places is summarised in Table 6-7.

**Table 6-7 Assessment of significance of Saddlers Creek Aboriginal cultural site**

<table>
<thead>
<tr>
<th>Aboriginal Cultural significance</th>
<th>Scientific Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate to High</td>
<td>Moderately Significant</td>
</tr>
<tr>
<td>Saddlers Creek is considered to have moderate to high significance to the local Aboriginal community in terms of its: Historic value:</td>
<td>Saddlers Creek has demonstrable potential to yield information that will contribute to an understanding of the</td>
</tr>
</tbody>
</table>
### Aboriginal Cultural significance

- Significant in the evolution or pattern of the history of a locality, region, state, nation or people
- Importance for the density or diversity of cultural features illustrating the human occupation and evolution of the locality, region, state or nation
- Known to have significant archaeological sites containing Bondi points that left the ‘tool kit’ in the last few hundred years.

**Social value:**

- Importance in contributing to a community’s sense of place and/or identity
- It is recognised as having been a significant camp site for Aboriginal people prior to European contact
- “Everything is important because it’s all got lore! It all got lore, the whole lot of it” (Jacobs, 2018a)
- “They pathways all them creeks and rivers, they all trails” (Jacobs, 2018a)
- As soon as you get to those river junctions you will find a concentrated amount of stuff [archaeological material] on either side (Jacobs, 2018a).

Saddlers Creek is considered to be representative in these contexts.

### Scientific Significance

- natural or cultural history of the region.
- The large number of archaeological sites, the diversity of stone tools types and raw materials demonstrate its archaeological potential.

The cultural values expressed by the participants within the context of the CVA indicate there are strong ongoing connections to the Golden Highway as well as strong interests in the manner in which cultural places are managed. It was also noted that the cultural values expressed by the participants in the CVA and previous assessments have been consistent in voicing an over-arching concern for the wider cultural landscape and criticism of the negative cumulative impacts of mining and development on that landscape.

No specific cultural value mitigation measures were suggested or recommended by Aboriginal knowledge holders regarding the proposal. Avoiding the cultural sites in the vicinity of Saddlers Creek would achieved satisfactory mitigation of both the tangible and intangible cultural values in the proposal area of these areas.

### 6.2.3 Potential impacts

#### Construction

The proposal would avoid all 14 previously recorded AHIMS registered archaeological sites as they are outside of the proposal area. However, without mitigation the proposal would have the potential to indirectly impact:

- Eight sites which were identified during sites surveys between August 2016 and September 2017
- The two previously recorded open sites which were re-examined and included in the site area of newly identified PADs (AHIMS 37-2-0426 and Saddlers Creek MAS 99).

Table 6-8 summarises the proposal’s potential to impact on Aboriginal cultural heritage sites without mitigation.
Table 6-8 Potential impacts to Aboriginal cultural heritage without mitigation

<table>
<thead>
<tr>
<th>Site/PAD name (AHIMS ID)</th>
<th>Site type</th>
<th>Overall significance</th>
<th>Type of impact*</th>
<th>Degree of impact*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winery Hill 1 37-2-5469</td>
<td>Artefact Scatter</td>
<td>Low</td>
<td>Indirect</td>
<td>Partial</td>
</tr>
<tr>
<td>Winery Hill 2 37-2-5470 / 37-2-0426</td>
<td>Isolated artefact, PAD, and artefact scatter</td>
<td>Low</td>
<td>Indirect</td>
<td>Partial</td>
</tr>
<tr>
<td>Winery Hill 3 37-2-5483</td>
<td>PAD</td>
<td>Unconfirmed</td>
<td>Indirect</td>
<td>Partial</td>
</tr>
<tr>
<td>Winery Hill 4 37-2-5488</td>
<td>Artefact Scatter</td>
<td>Low</td>
<td>Indirect</td>
<td>Partial</td>
</tr>
<tr>
<td>Winery Hill 5 37-2-5489</td>
<td>Isolated Artefact</td>
<td>Low</td>
<td>Indirect</td>
<td>Partial</td>
</tr>
<tr>
<td>Winery Hill 6 37-2-5490</td>
<td>Isolated Artefact</td>
<td>Low</td>
<td>Indirect</td>
<td>Partial</td>
</tr>
<tr>
<td>Winery Hill 7 37-2-5491</td>
<td>Isolated Artefact</td>
<td>Low</td>
<td>Indirect</td>
<td>Partial</td>
</tr>
<tr>
<td>Saddlers Creek PAD MAS 99 37-2-0452</td>
<td>PAD with artefact scatter and grinding grooves</td>
<td>Moderate</td>
<td>Indirect</td>
<td>Partial</td>
</tr>
</tbody>
</table>

*If mitigation measures not implemented

The concept design was modified to avoid impact to these sites so all eight newly recorded sites and all previously recorded sites would be avoided provided management measures below are implemented.

The avoidance of cultural sites in the vicinity of Saddlers Creek would achieved satisfactory mitigation of both the tangible and intangible cultural values of this area.

**Operation**

The operation of the proposal would not adversely impact Aboriginal heritage significance or archaeological potential along the Golden Highway.

6.2.4 Safeguards and management measures

Safeguards and management measures for Aboriginal heritage are presented in Table 6-9. No specific cultural value mitigation measures were suggested or recommended by Aboriginal knowledge holders.

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aboriginal heritage</td>
<td>An Aboriginal Heritage Management Plan (AHMP) will be prepared in accordance with the G36 Environment Protection. It will provide specific safeguards and mitigation measures including the installation of limits to construction fencing and sensitive area exclusion zones prior to start of construction.</td>
<td>Contractor</td>
<td>Detailed design / pre-construction</td>
<td>Section 4.9 of QA G36 Environment Protection</td>
</tr>
<tr>
<td>Aboriginal heritage – unexpected finds</td>
<td>The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime, 2015) will be followed in the event that an unknown or potential</td>
<td>Contractor</td>
<td>Detailed design / pre-construction</td>
<td>Core standard safeguard AH2</td>
</tr>
<tr>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Reference</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
<td>--------------------</td>
<td>---------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Minimise risks to Aboriginal cultural heritage during construction</td>
<td>Aboriginal object/s, including skeletal remains, is found during construction. Work will only re-commence once the requirements of that Procedure have been satisfied.</td>
<td>Contractor</td>
<td>Detailed design / pre-construction</td>
<td>Section 4.9 of QA G36 Environment Protection</td>
</tr>
<tr>
<td>Impacts to Winery Hill 1, 2, 3, 4, 5, 6, 7 and Saddlers Creek PAD MAS 99 37-2-0452</td>
<td>Winery Hill 1, 2, 3, 4, 5, 6, 7 and Saddlers Creek PAD MAS 99 37-2-0452 are in the vicinity of proposal will be flagged or fenced prior to construction so as to provide an exclusion zone for the duration of the proposal.</td>
<td>Roads and Maritime</td>
<td>Detailed design / pre-construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Unavoidable impacts to archaeological sites</td>
<td>If the detailed design is unable to avoid archaeological sites referred to above then a Stage 3 assessment in accordance with Roads and Maritime (2011) PACHCI will be required, including formal consultation with the Aboriginal community, the preparation of a cultural heritage assessment report and AHIP (PACHCI Stage 3). This assessment would be expected to take at least four months.</td>
<td>Roads and Maritime</td>
<td>Detailed design</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Additional Aboriginal heritage impacts</td>
<td>Any further impacts proposed beyond those assessed in this REF or beyond the boundary of the assessed areas would be subject to further assessment including consultation with Aboriginal stakeholders.</td>
<td>Roads and Maritime</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
</tbody>
</table>
6.3 Biodiversity

The potential impacts of the proposal on biodiversity are assessed in the *Golden Highway - Winery Hill Biodiversity Assessment Report* (BAR) (Jacobs, 2018b) provided in Appendix E. The potential impacts, and safeguards to mitigate them, are summarised in this section.

6.3.1 Methodology

A detailed methodology for the biodiversity assessment is provided in the BAR in Appendix E. The following provides a summary of the methodology used.

The assessment areas referenced throughout this section are defined as:

- Proposal area: this area comprises the limits of the proposal as outlined in Figure 1-2
- Study area: includes the proposal area with a surrounding 20 metre buffer. Boundaries of the study area are displayed in Figure 6-3
- Construction footprint: As per the definition provided in Section 1.1. The potential loss of vegetation associated with the proposal has been quantified by overlaying the 100 per cent concept design onto the vegetation community map, with a 10 metre buffer to allow for a for construction activities.

The methodology for the biodiversity assessment involved:

- A desktop review of relevant database records and previous studies within the locality to identify Commonwealth and State listed threatened species, populations and ecological communities
- The mapping of vegetation communities and flora through aerial photograph interpretation, regional spatial data, and elevation data to stratify vegetation and habitats in the investigation area
- Targeted terrestrial flora and fauna surveys carried out on 26 July 2016 and 10 August 2016. Species targeted during surveys included Weeping Myall (*Acacia pendula*), Tiger Orchid (*Cymbidium canaliculatum*), River Red Gum (*Eucalyptus camaldulensis*), Slaty Red Gum (*Eucalyptus glaucina*), and Wollemi Mint-bush (*Prostanthera cryptandroides* subsp. *cryptandroides*). Due to the small areas of suitable habitat and conspicuous nature of the target species, survey technique included visual searches during site traverses and vegetation plots
- Vegetation and habitat condition assessment consistent with *Framework for Biodiversity Assessment* (OEH 2014) and *Biobanking Assessment Methodology* (BBAM 2014). The flora survey aimed to provide baseline data for the presence of threatened plant species, populations and ecological communities to provide a basis for the prediction of impacts
- Field surveys were carried out on the 26 July 2016 and 10 August 2016 by ecologists from Jacobs. The field survey included flora and fauna field surveys. The fauna survey method included rapid habitat assessment at multiple sites, searches for evidence of threatened fauna, and opportunistically recording fauna species active at the time of the survey. No targeted fauna survey techniques such as mammal trapping, bat (anabat) surveys, spotlighting, frog surveys or call playback, were carried out
- An assessment of threatened species to identify the likely occurrence of State and nationally listed threatened species; these were identified from background reviews based on their habitat requirements
- An assessment of significance for threatened species and ecological communities positively identified during surveys and inspections or that are considered to have a moderate or high likelihood of occurring in the investigation area
- Identification of impacts and associated mitigation measures to reduce and manage impacts.
Database review

Database searches were carried out in August 2016 and updated in February 2018. The databases searched included the following:

- OEH vegetation information system (VIS) database (Office of Environment and Heritage 2015)
- The Federal Bureau of Meteorology’s Atlas of Groundwater Dependent Ecosystems (Bureau of Meteorology 2016)
- Department of Primary Industries (DP) database for aquatic species and ecological communities (Department of Primary Industries 2016a)
- Atlas of NSW Wildlife maintained by the OEH (Office of Environment and Heritage 2016)
- EPBC Act protected matters search tool (Department of the Environment 2016)
- DPI’s Records Viewer Application (Department of Primary Industries 2016b)
- Available regional vegetation mapping including The Vegetation of the Central Hunter Valley, New South Wales (Peake, 2006)
- Hunter Coalfield Regional 1:100 000 Geology Map (Glen and Beckett 1993)
- Soil Landscapes of the Singleton 1:250,000 (Kovac and Lawrie 1991)
- DPI Noxious Weed listings (Department of Primary Industries 2016c)

The database search findings and a review of vegetation spatial data were used to identify a list of ‘subject species, populations and ecological communities’ for targeted survey during the field surveys.

6.3.2 Existing environment

The locality is located within the Hunter sub-region of the Sydney Basin Bioregion as defined by Thackway and Cresswell (1995) and within the Hunter-central Rivers Catchment Management Area in the Hunter sub-region.

Due to the historical land use in the locality, there are no large stands of remnant vegetation remaining along road corridor and mapping of the region (Peak, 2006) does not show any natural vegetation communities within the road corridor at Winery’s Hill. The largest patches of vegetation within the study area are predominately planted indigenous and non-indigenous native trees along the edge of properties. There are patches of remnant trees and shrubs scattered along the sides of the road, however the majority of vegetation is dominated by exotic shrubs, grasses and groundcover species due to a history of mowing and/or grazing regimes and disturbance to the soil. There are about 1.4 hectares of low poor condition native vegetation within the study area, with remaining areas comprising regrowth shrubland and rows of planted wind-breaks.

A list of plants and animals recorded during the field surveys is provided in the Biodiversity Assessment in Appendix E. The surveys recorded 61 plant species (of which 21 species, or 34 per cent were exotic), 38 vertebrate fauna species (including 32 bird species, one mammal, three frog species and two reptile species) and three priority weeds for the Hunter Region. These weeds include:

- African boxthorn (Lycium ferocissimum)
- Prickly pear (Opuntia stricta)
- Fireweed (Senecio madagascariensis).

Plant community types

The largest patches of vegetation within the corridor are predominately planted indigenous and non-indigenous native trees along the edge of properties. There are patches of remnant trees and shrubs
scattered along the sides of the road, however the majority of vegetation is dominated by exotic shrubs, grasses and groundcover species.

Three Plant Community Types (PCTs) as described by the NSW Vegetation Information System (VIS) database PCTs described by the NSW VIS were identified within the study area:

- Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (PCT 1691)
- Bull Oak grassy woodland of the central Hunter Valley (PCT 1692)
- River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion) (PCT 485).

The most abundant PCT within the study is Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (PCT 1691). This PCT is an eucalypt woodland to forest with a shrubby understorey that historically would have covered much of the study area. It exists in the study area as a low density of scattered remnant trees with a regenerating understorey. The distribution of the PCTs are shown on Figure 6-3.

Due to the extent of historical land clearing within the study area, the patch size of vegetation is small, with average patch sizes for PCTs ranging from 0.01 to 0.1 hectares.
Threatened Ecological Communities

Vegetation within the study area belonging to Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (PCT 1691) and Bull Oak grassy woodland of the central Hunter Valley (PCT 1692) and areas of Regrowth Acacia salicina shrubland meet the requirements of the BC Act listed EEC referred to as Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions. The vegetation does not meet the condition thresholds required for identifying as the Critically Endangered Ecological Community listed under the EPBC Act and referred to as Central Hunter Valley eucalypt forest and woodland. The distribution of this EEC is outlined in Figure 6-3.

As Central Hunter Grey Box-Ironbark Woodland is flagged in the Bull Oak grassy woodland (PCT 1692) classification profile, a precautionary approach has been taken and the EEC has been included in this assessment.

Threatened flora

Twenty one threatened flora species and four endangered populations have been previously recorded or modelled as having potential to occur in the locality. However, the study area is considered unlikely to provide suitable habitat for threatened flora species with none recorded within the survey area during the field investigations. Threatened flora species are considered to have a low likelihood of occurrence or are unlikely to occur. Refer to the Biodiversity Assessment provide in Appendix E, in for the full list of threatened flora and their likelihood of occurrence.

Threatened fauna

Based on regional records and the presence of suitable habitat, 39 threatened fauna species have been identified in the locality. This includes 14 mammal species, 21 bird species, two reptiles species and two frog species. However, the study area is unlikely to provide suitable habitat for a number of these species as there are no sandstone ridge tops or gullies, no wet or rainforest habitat. In addition, the habitats within the study area are generally poor quality and generally do not possess the features required for the threatened species to complete their life cycles. In addition, there is no suitable habitat for threatened fish is present in the study area. No threatened fauna species were recorded during the field survey.

A number of threatened species have been recorded close to the study area during the Drayton South Coal Project Environmental Impact Statement (EIS) (Cumberland Ecology, 2011). Some of these records do not show up in OEH Atlas data for the study area, including a Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) recorded in planted vegetation at the Edderton Road intersection, refer to Figure 6-3. This planted vegetation may provide part of a larger area of suitable habitat for the Grey-crowned Babbler (vulnerable BC Act) which is capable of moving across patchy landscapes. However, this vegetation would not be impacted by the proposal. Many of the threatened bird species in the locality may intermittently use the vegetation in the study area, however it is not considered important habitat for any of them. The removal of roadside regrowth shrubs and some isolated trees is not considered likely to impact these species.

The sandstone escarpments several kilometres to the west would likely provide roosting habitat for cave-roosting microbats including the Eastern Cave Bat (*Vespaduelus troughtoni*), Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), Large-eared Pied Bat (*Chalinolobus dwyeri*) and Southern Myotis (*Myotis macropus*) (all listed as vulnerable under the BC Act) and the study area is within the foraging range of bats roosting on the escarpment.

The study area would potentially provide foraging habitat for threatened microbat. In addition, hollow-bearing *Eucalyptus moluccana* (Grey Box) in the locality would potentially provide roosting habitat for hollow roosting microbats which includes the Eastern Freetail-bat (*Mormopterus norfolkensis*), Corben’s Long-eared Bat (*Nyctophilus corbeni*) and Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*).
The culverts underneath the highway may provide a suitable roost site for cave roosting species. While these species were not found roosting in the culverts (nor was any evidence of use identified) during the survey, these species may utilise the culverts seasonally or may use the culverts as a component of a larger collection of roosting resource in the locality. Some of these would potentially be suitable as roosting habitat for bats such as the Southern Myotis (Myotis macropus) and/or the Eastern Bentwing-bat (Miniopterus schreibersii oceanensis) that are known from the locality. The small size of the culverts made them very hard to inspect for bats and evidence of use, however in general many of the culverts at Winery Hill exhibited overgrown vegetation at the entrance and did not appear to provide much roosting opportunities. Considering this, the potential for bats in all culverts is low. The bridge over the Saddler’s Creek may also provide roosting opportunities, including old swallow mud nests.

In summary the fauna habitat in the study area is disturbed and largely unsuitable for the threatened species that were identified during database searches. However, the vegetation to be impacted does provide some habitat for highly mobile species. Therefore, the threatened fauna species considered to have a moderate likelihood of occurring in the habitat across the study area include:

- Corben’s Long-eared Bat (Nyctophilus corbeni)
- Large-eared Pied Bat (Chalinolobus dwyeri)
- Eastern Bentwing-bat (Miniopterus schreibersii oceanensis)
- Eastern Cave Bat (Vespadelus troughtoni)
- Large-eared Pied Bat (Chalinolobus dwyeri)
- Southern Myotis (Myotis macropus)
- Eastern Freetail-bat (Mormopterus norfolkensis)
- Greater Broad-nosed Bat (Scoteanax rueppellii)
- Yellow-bellied Sheathtail-bat (Saccolaimus flaviventris)
- Grey-crowned Babbler (Pomatostomus temporalis temporalis).

Refer to the Biodiversity Assessment provided in Appendix E, for the full list of threatened fauna and their likelihood of occurrence.

**Fauna habitat and condition**

No aquatic habitat in the study area was identified during the site surveys and no critical habitat as listed in the Register of Critical Habitat kept by the NSW Office of Environment and Heritage (OEH) is present within the study area.

Natural fauna habitats in the locality have been largely removed and/or modified for agricultural actives and road infrastructure. Although somewhat isolated and fragmented, habitat in the study area includes:

- Remnant or regrowth grassy and shrubby woodland
- Riparian and small areas of freshwater aquatic habitats
- Planted native species mix
- Cleared and modified agricultural landscapes.

The habitat values for fauna in the study area are generally limited. Remnant vegetation, where present, exists as isolated trees in a fragmented and regenerating landscape. The predominantly young age of the vegetation, altered vegetation structure with absent midstorey, and the heavily grazed or mown ground layer significantly limits the value of the habitats.

A large proportion of the vegetation in the study area is planted indigenous and non-indigenous native trees. These areas provide some fauna habitat value, albeit limited and were observed during site visits being used by a range of common bird species. However due to their small patch size and modified
understorey, they do not provide high habitat value. Riparian vegetation around Saddlers Creek also provides shelter for a range of small woodland birds and would potentially be used by microbats for foraging. Many mud nests of swallows were seen underneath the bridge at Saddlers Creek which may also be used by microbats for roosting, refer to Photo 6-4.

Photo 6-4 Mud nests of swallows under the bridge at Saddler’s Creek and within a culvert

The habitats in the study area provide shelter, breeding and foraging resources for several common frog, reptile and bird species.

Small fragments of remnant and regrowth vegetation are dispersed among a matrix of predominantly cleared land containing areas of Acacia regrowth and rows of planted Eucalyptus species. Where the ground layer vegetation is not mown, it is often dense and generally dominated by exotic grasses. In some areas the regrowth midstorey is likely to provide suitable habitat for small birds that require dense cover. There is a general absence of structural maturity and few logs, reducing the value of the habitat as sheltering or refuge areas. The overall habitat for fauna condition was considered poor, and limited for threatened fauna.

The middle section of the Winery’s Hill study area is dominated by scattered remnant *Eucalyptus moluccana* (Grey Box), which exhibit many hollows, many at the end of branches, refer to Photo 6-5. Most of these hollows are outside the proposal area within private property. The hollows are likely to provide nesting and roosting habitat for hollow dependant birds and microbats. It is unlikely that the hollows provide and habitat for large mammals and the hollows observed are not suitable for nest or roost site for large forest owl.
Photo 6-5 Grey Box with hollows within the study area
Legend

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Proposal area</td>
</tr>
<tr>
<td></td>
<td>Construction footprint</td>
</tr>
<tr>
<td></td>
<td>Ancillary site</td>
</tr>
<tr>
<td></td>
<td>Biodiversity study area</td>
</tr>
<tr>
<td></td>
<td>Cadastre</td>
</tr>
<tr>
<td></td>
<td>ATLAS record (OEH)</td>
</tr>
<tr>
<td></td>
<td>Rainbow Bee-eater (fauna)</td>
</tr>
<tr>
<td></td>
<td><em>Acacia pendula</em> (flora)</td>
</tr>
</tbody>
</table>

Vegetation communities

- *Acacia salicina* regrowth
- Bull Oak grassy woodland of the central Hunter Valley
- *Casuarina cunninghamiana* wind break
- Eucalypt wind break
- Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter

Threatened ecological communities

- Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions (BC Act)

Figure 6-3a | Biodiversity values
Legend
- Proposal area
- Construction footprint
- Ancillary site
- Biodiversity study area
- Cadastre

Vegetation communities
- Acacia salicina regrowth
- Bull Oak grassy woodland of the central Hunter Valley
- Casuarina cunninghamiana wind break
- Eucalypt wind break
- Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter

Threatened ecological communities
- Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions (BC Act)
Figure 6-3c | Biodiversity values

Legend
- Concept design
- Proposal area
- Construction footprint
- Ancillary site
- Biodiversity study area
- Cadastre
- Hollow-bearing tree

Vegetation communities
- Acacia salicina regrowth
- Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter

Threatened ecological communities
- Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions (BC Act)
Figure 6-3d | Biodiversity values

Legend
- Proposal area
- Construction footprint
- Biodiversity study area
- Cadastre
- Hollow-bearing tree

Vegetation communities
- Acacia salicina regrowth
- Casuarina cunninghamiana wind break
- Eucalypt wind break
- Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter
- River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)

Threatened ecological communities
- Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions (BC Act)
6.3.3 Potential impacts

**Construction**

Removal of native vegetation

The potential loss of vegetation associated with the proposal has been quantified by overlaying the 100 per cent concept design onto the vegetation community map, with a 10 metre buffer (construction footprint) to allow for a small contingency surrounding the proposal for construction activities. The results are summarised in Table 6-10. Currently there is around 1.97 hectares of fragmented vegetation within the construction footprint, which would potentially be removed as part of the proposal. This vegetation removal would include about 1.38 hectares of remnant and regrowth vegetation and about 0.59 hectares of planted vegetation. Outside of the construction footprint within proposal area, the plant and machinery would manoeuvre around native vegetation within the proposal area.

Table 6-10: Condition of native vegetation in study area and predicted loss during from the proposal.

<table>
<thead>
<tr>
<th>Plant Community Type</th>
<th>Condition</th>
<th>Potential Impact (ha)*</th>
<th>Impact in the context of the locality (within 10 km) – Peak (2006)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (PCT 1691)</td>
<td>Poor</td>
<td>0.25</td>
<td>&gt;0.0 1% (3,063 ha of MU 10 mapped in the locality)</td>
</tr>
<tr>
<td>Bull Oak grassy woodland of the central Hunter Valley(PCT 1692)</td>
<td>Poor</td>
<td>0.08</td>
<td>&gt;0.01% (1,531 ha of MU 32 mapped in the locality)</td>
</tr>
<tr>
<td>River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion) (PCT 485)</td>
<td>Poor</td>
<td>0.04</td>
<td>&gt;0.01% (4,097 ha of MU 30 mapped in the locality)</td>
</tr>
<tr>
<td>Acacia salicina regrowth</td>
<td>Poor</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>1.38 ha</strong></td>
<td><strong>&gt;0.01%</strong></td>
</tr>
</tbody>
</table>

As can be seen from Table 6-10, the proposal would remove about 1.38 hectares of native vegetation. The process of clearing vegetation would also result in additional impacts including:

- Loss of hollow-bearing trees
- Removal of dead-wood and dead trees
- Bushrock removal.

Although the proposal would not result in large amounts of any of these additional impacts, they must be considered in the clearing process. Only two hollow-bearing trees were identified within the study area. Grey Box appears to readily form hollows in this area and some trees were observed to contain up to five hollows each. These would be suitable for many hollow-roosting bat species. However, these hollow-bearing trees are on the outskirts of the construction footprint and are likely able to be avoided. The removal of dead wood/trees and bushrock may reduce habitat availability for some fauna species. However, as the areas to be impacted are in the disturbed road corridor, there are few occurrences of these habitat features and the impact would be minimal.
Safeguards and mitigation measures designed to reduce the impact on vegetation are provided in Section 6.3.4.

**Threatened biodiversity**

The proposal would not be expected to impact on any threatened flora species, as none were recorded during the field surveys and the proposal area is not considered optimal for any of the threatened flora species.

The proposal’s predicted impacts on the EEC are outlined in **Table 6-11**.

**Table 6-11 Proposals impact EECs (TSC Act)**

<table>
<thead>
<tr>
<th>Threatened ecological community</th>
<th>Formation</th>
<th>Potential impact (ha)</th>
<th>Impact in the context of the locality (within 10 km)*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions</strong> (endangered)</td>
<td>Woodland (PCT 1691 and 1692)</td>
<td>0.4</td>
<td>&gt;0.001% (4,594 ha mapped in the locality)</td>
</tr>
<tr>
<td></td>
<td>Regrowth <em>Acacia salicina</em> shrubland</td>
<td>0.94</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>1.34 ha</strong></td>
<td></td>
</tr>
</tbody>
</table>

As shown in **Table 6-11**, the proposal would remove about 1.34 hectares of *Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions* EEC. The local occurrence of this EEC is estimated at about 2.39 hectares. The removal of the 1.34 hectares represents about 56 per cent of the occurrence of this EEC within the study area. When considered in the context of the locality where is 4,594 hectares mapped, the proportional impact is low at around 0.001 per cent. This impact has been quantified based on 10 metre buffer on the 100 per cent concept design (construction footprint).

Fauna habitat in the study area is disturbed and largely unsuitable for the threatened species that were identified during database searches. However, the vegetation to be impacted does provide some habitat for highly mobile species such as cave and hollow-roosting microbats, and some woodland birds that can move across a patchy landscape. This is generally limited to foraging habitat though hollow-roosting species such as the Eastern Freetail-bat and Southern Myotis may roost in the hollow-bearing trees in and around the study area. Both these species have been found in caves, mine shafts, hollow-bearing trees, storm-water channels, buildings, under bridges.

Vegetation in the study area exists as small isolated patches, which is not suitable for many bird species. However, the Grey-crowned Babbler is able to persist in such areas and much of the study area is suitable foraging and nesting habitat for this species.

The predicted impacts to habitat for threatened species are outlined in **Table 6-12**. All vegetation to be impacted by the proposal (refer **Figure 6-3**) is considered potential foraging habitat for these threatened species. The overall impact to foraging habitat is predicted at about 1.97 hectares. The amount of habitat to be impacted as a result of the proposal is dominated by *Acacia* regrowth and planted vegetation. Impact to native vegetation communities constitutes about 1.38 hectares (70 per cent) of the overall impact. When considered in the context of the locality (the area within 10 kilometres of the proposal) the proportional impact is low at about 0.009 per cent.
Table 6-12 Predicted loss of threatened species habitat from the proposal

<table>
<thead>
<tr>
<th>Threatened species</th>
<th>BC Act</th>
<th>EPBC Act</th>
<th>Potential occurrence</th>
<th>Extent of potential impact (hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern Bentwing-bat (<em>Miniopterus schreibersii oceanensis</em>)</td>
<td>V</td>
<td>–</td>
<td>Moderate</td>
<td>1.97 May forage in all vegetation in the study area (cannot define specific areas). Potential use of culverts for roosting is low.</td>
</tr>
<tr>
<td>Eastern Cave Bat (<em>Vespadelus troutoni</em>)</td>
<td>V</td>
<td>–</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>Large-eared Pied Bat (<em>Chalinolobus dwyeri</em>)</td>
<td>V</td>
<td>V</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>Southern Myotis (<em>Myotis macropus</em>)</td>
<td>V</td>
<td>–</td>
<td>Moderate</td>
<td>1.97 Foraging and potential roosting habitat only. No impact to breeding habitat. May forage in all vegetation in the study area (cannot define specific areas)</td>
</tr>
<tr>
<td>Corben’s Long-eared Bat (<em>Nyctophilus corbeni</em>)</td>
<td>V</td>
<td>V</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>Eastern Freetail-bat (<em>Mormopterus norfolkensis</em>)</td>
<td>V</td>
<td>–</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>Greater Broad-nosed Bat (<em>Scoteanax rueppelli</em>)</td>
<td>V</td>
<td>–</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>Yellow-bellied Sheathtail-bat (<em>Saccolaimus flaviventris</em>)</td>
<td>V</td>
<td>–</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>Grey-crowned Babbler (<em>Pomatostomus temporalis temporalis</em>)</td>
<td>V</td>
<td>–</td>
<td>Moderate</td>
<td>1.97 Foraging and nesting habitat. Family groups of this species utilise large areas of fragmented habitat</td>
</tr>
</tbody>
</table>

Fauna Habitat

Two hollow bearing trees could potentially be removed by the proposal. However, as they are on the outskirts of the proposal there would potentially be avoided. These trees provide important habitat for many fauna species, particularly for roosting and nesting activities and as dens sites. The loss of these hollows has the potential to impact on the breeding habitat for microbat species such as the Eastern Freetail-bat. There are number of small culverts within the proposal area that would be upgraded as part of the proposal. These have potential to provide roosting habitat for cave-roosting microbat species. This potential is low as all pipes are small diameter and many of the entrances are overgrown with grass.

Injury and mortality

Fauna injury or death has the greatest potential to occur during the vegetation clearing and the extent of this impact would be proportionate to the extent of vegetation cleared. Some mobile species, such as birds, may be able to move away from the path of clearing and may not be greatly affected unless they are nesting. Although no nests were observed during the field surveys, nests may be built in trees to be impacted prior to the start of clearing activities. However, other species that are less mobile (e.g. ground dwelling reptiles and mammals), or those that are nocturnal and nest or roost in trees during the day (such as arboreal mammals and microchiropteran bat species), may find it difficult to move rapidly when disturbed. Common fauna species such as possums, reptiles, birds (particularly fledglings) and frogs would likely be affected.
Entrapment of wildlife in trenches dug during construction would be a possibility if the trenches are deep and steep sided. Wildlife may also become trapped in machinery stored in the proposal area overnight which could result in injury or death.

**Wildlife connectivity and habitat fragmentation**

While the proposal would not divide any new areas of continuous habitat, the vegetation clearing required would contribute to increasing isolation of habitats to a small degree. Some small ‘islands’ of habitat along the western road reserve would be removed resulting in an increased distance between habitats on the northern and southern side of the highway.

**Impacts to hydrology and aquatic habitat**

The construction and operation of the proposal has low potential to impact aquatic ecosystems downstream from the study area due to changes in water quality. Saddlers Creek is the only aquatic habitat present in the study area with the potential for impact, however the scope of works at this location is limited and the potential for impacts to the creek and downstream aquatic habitat would be low. Culvert extension works would have some potential to impact aquatic ecosystems downstream of the project, however the unnamed drainage lines at these locations are highly ephemeral and no aquatic habitat was observed during field surveys. Overall, potential impacts on aquatic habitat are considered minor and manageable with the application of standard mitigation measures.

**Proliferation of weeds**

During the construction of the proposal there would be the potential to disperse weed seeds and plant material into adjoining areas of high quality native vegetation where weed species do not currently occur in high density. The most likely causes of weed dispersal would be associated with clearing of vegetation and stockpile of contaminated mulch and topsoil during earthworks, and movement of soil and attachment of seed (and other propagules) to construction vehicles and machinery.

**Pathogens**

While pathogens were not observed or tested for in the study area the potential for pathogens to occur should be treated as a risk during construction. Safeguards and mitigation measures for the potential introduction and spread of pathogens are provided in Section 6.3.4.

**Operation**

The operational impact of the proposal would relate to the cumulative impacts associated with clearing native vegetation and the loss of habitat for flora and fauna species.

The potential biodiversity impacts of a project must be considered as a consequence of the construction and operation of the proposal within the existing environment. The proposal would not act alone in causing impacts to biodiversity, as very large areas of vegetation within the locality have already been removed, predominately for mining and agriculture in the recent past. The incremental effects of multiple sources of impact (past, present and future) are referred to as cumulative impacts and provide an opportunity to consider the proposal within a strategic context.

The accumulating impacts of historic vegetation clearing for agriculture, mining, rural development and maintenance of infrastructure would likely include continued loss of biodiversity in the Hunter Catchment. While data from all recent projects in the locality is not freely available, some information as presented in Table 6-13. The total cumulative impact of the two projects listed and this proposal would result in about 1.3 per cent reduction in the mapped area of the Central Hunter Grey Box – Ironbark Woodland EEC (TSC Act).
Table 6-13 Cumulative impacts within Central Hunter Valley

<table>
<thead>
<tr>
<th>Project</th>
<th>Total impact</th>
<th>TEC</th>
<th>This project</th>
<th>Cumulative impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drayton South Coal Project (approx. 10 km north-east of the proposal)</td>
<td>A loss of 1,439 ha of native vegetation, including five threatened ecological communities (269.5 ha) and habitat for four threatened flora species and 21 threatened and/or migratory fauna species.</td>
<td>151 ha of Central Hunter Grey Box – Ironbark Woodland (TSC Act)</td>
<td>1.34 ha of Central Hunter Grey Box – Ironbark Woodland (TSC Act)</td>
<td>&lt;0.001% (14,818 ha total area mapped in Central Hunter Valley)</td>
</tr>
<tr>
<td>Mt Arthur open cut coal mine (approx. 10 km north of the proposal)</td>
<td>Loss of 235 hectares of native vegetation</td>
<td>41 hectares of Central Hunter Grey Box – Ironbark Woodland (TSC Act)</td>
<td></td>
<td>1.3% (14,818 ha total area mapped in Central Hunter Valley)</td>
</tr>
</tbody>
</table>

The proposal is one of 10 proposed upgrades along the Golden Highway. The total length of all 10 sites is about 32.45 kilometres. The proposed works in these sections includes the widening of the entire length by about four metres and addition of 3.5 metre wide overtaking lanes in some areas. Although all these areas would not contain vegetation, the cumulative impact of the whole project needs to be considered as each site would be assessed individually.

**Conclusion on significance of impacts**

An assessment of significance has been carried out for threatened species and ecological communities that have been positively identified or that were considered to have a moderate or high likelihood of occurring in the investigation area (refer to Appendix E). The follow threatened species and EECs species were assessed for significance under the BC Act:

- Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions
- Cave-roosting microbats:
  - Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)
  - Eastern Cave Bat (*Vespadelus troughtoni*)
  - Large-eared Pied Bat (*Chalinolobus dwyeri*)
  - Southern Myotis (*Myotis macropus*)
- Hollow-roosting microbats:
  - Eastern Freetail-bat (*Mormopterus norfolkensis*)
  - Corben’s Long-eared Bat (*Nyctophilus corbeni*)
  - Greater Broad-nosed Bat (*Scoteanax rueppelli*)
  - Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)
- Grey-crowned Babbler (*Pomatostomus temporalis subsp. temporalis*)
The assessments of significance found that the proposal would not likely significantly impact threatened species, populations or ecological communities or their habitats, as defined by BC Act or FM Act meaning a Species Impact Statement is not required.

No threatened species listed under the EPBC Act were identified in the study area during field surveys. However, several species have a moderate likelihood of occurring within the study area based on nearby records and the presence of suitable habitat. Therefore, the following threatened species and EEC were assessed for significance under the EPBC Act:

- Corben’s Long-eared Bat (*Nyctophilus corbeni*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*).

The assessments of significance found that the proposal would not be likely to significantly impact threatened species, populations, ecological communities or migratory species, within the meaning of the EPBC Act.

### 6.3.4 Safeguards and management measures

Safeguards and management measures for biodiversity are presented in **Table 6-14**.

**Table 6-14 Safeguards and management measures – biodiversity**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
</table>
| Biodiversity | 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 implemented as part of the CEMP. It will include, but not be limited to:  
- Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features (including hollow-bearing trees) and revegetation areas  
- Requirements set out in the Landscape Guideline (RTA, 2008)  
- Pre-clearing survey requirements  
- Procedures for unexpected threatened species finds and fauna handling  
- Procedures addressing relevant matters specified in the Policy and guidelines for fish habitat conservation and management (DPI Fisheries, 2013)  
- Protocols to manage weeds and pathogens. | Contractor | Detailed design / pre-construction | Core standard safeguard B1  
Section 4.8 of QA G36 Environment Protection |
<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biodiversity</td>
<td>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.</td>
<td>Contractor</td>
<td>Detailed design / pre-construction</td>
<td>Core standard safeguard B3</td>
</tr>
<tr>
<td>Protect native flora and fauna, minimise edge effects and avoid inadvertent impacts</td>
<td>All personnel working on site will receive training to ensure awareness of requirements of the Flora and Fauna Management Plan and relevant statutory responsibilities. Site-specific training will be given to personnel when working in the vicinity of areas of identified biodiversity value that are to be protected.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard B4</td>
</tr>
<tr>
<td>Stockpiles, plant and ancillary sites</td>
<td>Vehicle parking, machinery, construction compounds, material stockpiles and the like, will be located in cleared or disturbed areas, not within the drip-zone of vegetation to be retained or within other protected or exclusion zones identified in the Flora and Fauna Management Plan.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional standard safeguard B10</td>
</tr>
<tr>
<td>Fauna handling</td>
<td>Consistent with the Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects, and any specific requirements of the approved Flora and Fauna Management Plan, management arrangements will be implemented to ensure safe fauna handling. As a minimum that will include:</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional safeguard B11</td>
</tr>
<tr>
<td></td>
<td>- Fauna handling being carried out by appropriately licenced ecologists or wildlife carers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Liaison with local animal rescue agency, wildlife carer group or vet to establish agreed arrangements for fauna rescue or injured animal assistance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Induction information for construction staff.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 6.3.5 Biodiversity offsets

The BAR (Appendix D) identified that the proposal would not be likely to have a significant impact on any threatened biodiversity listed under the TSC Act or EPBC Act.

The Roads and Maritime *Guideline for Biodiversity Offsets* (2011) states that biodiversity offsets are to be provided where more than one hectare of high conservation value vegetation is cleared and/or more than five hectares of habitat for threatened species is cleared.

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitat management - minimising impacts</td>
<td>Consistent with the Biodiversity Guidelines - <em>Protecting and managing biodiversity on RTA projects</em>. As a minimum that will include:</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional standard B12</td>
</tr>
<tr>
<td></td>
<td>• No vegetation clearing or bushrock removal beyond limits identified in this REF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Avoiding identified exclusion zones and protected habitat features</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Avoiding mixing of topsoil with woody debris materials</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Separation of woody vegetation suitable for re-use during construction and rehabilitation or revegetation works</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Implementation of staged clearing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Trimming and pruning to be carried out in accordance with relevant Australian Standards</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• In riparian zones: avoiding clearing during likely flood periods; ensuring cleared vegetation does not enter the waterway; retaining roots and stumps to maintain bank stability; applying the hierarchy for snag management set out in the Guidelines.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weed, Pest Species and Pathogen Management</td>
<td>Consistent with the Biodiversity Guidelines - <em>Protecting and managing biodiversity on RTA projects</em>. As a minimum that will include:</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional standard B13</td>
</tr>
<tr>
<td></td>
<td>• Implementation of appropriate weed control methods and weed disposal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Implementation of appropriate hygiene protocols where there are potential or known pathogen risks.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The area of EEC in the study area has been identified as poor condition, and no threatened species were identified that are considered unable to withstand a loss.
6.4 Noise and vibration

The potential noise and vibration impacts on sensitive receivers during construction and operation of the proposal have been assessed as part of the Golden Highway - Winery Hill Noise and Vibration Assessment Report (Jacobs, 2018c) and HW27 - Golden Highway Upgrades Diversion Construction noise review (Jacobs, 2018d) provided in Appendix F. The main findings of the report are summarised below.

6.4.1 Methodology

The Noise and Vibration Assessment provided in Appendix F has been prepared in accordance with the following:

- Road Noise Policy, NSW EPA, 2011 (RNP)
- Noise Criteria Guideline, Roads and Maritime Services, April 2015 (NCG)
- Noise Policy for Industry, NSW Environment Protection Authority, 2017 (NPI)
- Calculation of Road Traffic Noise, UK Department of Transport, 1988 (CoRTN)
- Construction Noise and Vibration Guideline, Transport (Roads and Maritime), April 2016 (CNVG)
- Interim Construction Noise Guideline, Department of Environment and Climate Change NSW, July 2009 (ICNG)

In summary, the methodology for the noise and vibration assessment included the following:

- Identifying noise and vibration sensitive receivers and defining the study area
- Undertaking noise monitoring to determine the existing noise environment
- Establishing noise and vibration assessment criteria
- Prediction of construction and operational noise levels. This would include noise impact from the temporary traffic diversions
- Assessing predicted noise and vibration levels against the relevant criteria to identify potential impacts
- Identify safeguards and management measures to be implemented to minimise impacts.

Study area

The study area noise and vibration assessment has been defined as sensitive receivers located within 1,500 metres of the proposal. Receivers were identified using aerial photography, GIS databases and information gathered from site visits.

Noise monitoring

Unattended noise monitoring to identify background noise levels for the proposal was carried out from 24 to 30 November 2016 at representative locations (refer to Section 6.4.2 and Figure 6-4) using automatic unattended noise monitoring equipment (Type 1 Ngara noise loggers). The loggers continuously measured the level of ambient noise over 15-minute periods for the duration of the monitoring period at each location.
Short-term attended noise monitoring was carried out to identify ambient noise sources (such as traffic) at the same monitoring locations using a SVAN Type 1 sound level meter.

6.4.2 Existing environment

Sensitive receivers
About 16 rural residential properties are located within the study area, with the nearest receiver located about 130 metres from the proposal. The receivers around the proposal are shown in Figure 6-4 and presented in Table 6-15.

The existing noise environment around the proposal is primarily influenced by road traffic noise, No vibration-sensitive commercial or other land uses (such as medical imaging or electronics facilities) have been identified within the study area.

Table 6-15 Summary of nearby residential receivers

<table>
<thead>
<tr>
<th>Receiver ID</th>
<th>Receiver type</th>
<th>Distance from the proposal</th>
<th>Distance from nearest ancillary facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>R01</td>
<td>Residential</td>
<td>970 metres</td>
<td>3800 metres</td>
</tr>
<tr>
<td>R02</td>
<td>Residential</td>
<td>730 metres</td>
<td>3450 metres</td>
</tr>
<tr>
<td>R03</td>
<td>Residential</td>
<td>1150 metres</td>
<td>2300 metres</td>
</tr>
<tr>
<td>R04</td>
<td>Residential</td>
<td>1190 metres</td>
<td>2350 metres</td>
</tr>
<tr>
<td>R05</td>
<td>Residential</td>
<td>1220 metres</td>
<td>2400 metres</td>
</tr>
<tr>
<td>R06</td>
<td>Residential</td>
<td>1290 metres</td>
<td>2400 metres</td>
</tr>
<tr>
<td>R07</td>
<td>Residential</td>
<td>130 metres</td>
<td>450 metres</td>
</tr>
<tr>
<td>R08</td>
<td>Residential</td>
<td>170 metres</td>
<td>450 metres</td>
</tr>
<tr>
<td>R09</td>
<td>Residential</td>
<td>220 metres</td>
<td>450 metres</td>
</tr>
<tr>
<td>R10</td>
<td>Residential</td>
<td>970 metres</td>
<td>1150 metres</td>
</tr>
<tr>
<td>R11</td>
<td>Residential</td>
<td>1000 metres</td>
<td>1250 metres</td>
</tr>
<tr>
<td>R12</td>
<td>Residential</td>
<td>960 metres</td>
<td>1300 metres</td>
</tr>
<tr>
<td>R13</td>
<td>Residential</td>
<td>920 metres</td>
<td>1400 metres</td>
</tr>
<tr>
<td>R14</td>
<td>Residential</td>
<td>870 metres</td>
<td>1500 metres</td>
</tr>
<tr>
<td>R15</td>
<td>Residential</td>
<td>170 metres</td>
<td>750 metres</td>
</tr>
<tr>
<td>R16</td>
<td>Residential</td>
<td>200 metres</td>
<td>650 metres</td>
</tr>
<tr>
<td>C01</td>
<td>Commercial</td>
<td>1400 metres</td>
<td>2800 metres</td>
</tr>
<tr>
<td>C02</td>
<td>Commercial</td>
<td>270 metres</td>
<td>750 metres</td>
</tr>
<tr>
<td>C03</td>
<td>Commercial</td>
<td>260 metres</td>
<td>250 metres</td>
</tr>
</tbody>
</table>
**Existing noise environment**

The existing noise environment has been determined based on the results of attended and unattended noise monitoring carried out at representative locations within the study area. Unattended monitoring was carried out at R01 and R07 and attended measurements was carried at N01 and N02 and around receivers R03 to R06, as well as attended measurements at these two locations and around receivers R03 to R06, and receivers R10 to R14. Attended measurements at R01 and R07 were carried out for quality assurance purposes, and to assist with the characterisation of key features of the noise environment around both monitoring locations. Attended monitoring at the additional locations (near R03 to R06, and near R10 to R14) was carried out to confirm whether factors contributing to background noise levels were the same as at the nearest unattended monitoring location, noting differences in separation distance from the loudest local noise source (i.e. Golden Highway). The monitoring locations are shown in Figure 6-4.

Noise results were post-processed to eliminate inconsistent features (including wind speed great that five metres per second, rain and seasonal insect noise) and develop the data into the relevant metrics for assessment.

Low pass filtered noise monitoring metrics applicable for the assessment of road and construction noise assessment are presented for both noise monitoring locations below in Table 6-16 respectively. The rating background level (RBL) refers to the median value of monitored background noise levels measured over each period. ‘LAeq’ is the equivalent continuous sound level or energy-time average for the relevant period of monitoring.

<table>
<thead>
<tr>
<th>Location</th>
<th>Road noise results LAeq dB(A)</th>
<th>Construction noise measured RBLs dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day (15 hour), 7am to 10pm</td>
<td>Night (9 hour), 10pm to 7am</td>
</tr>
<tr>
<td></td>
<td>Night (9 hour), 10pm to 7am</td>
<td>Day (11 hour), 7am to 6pm</td>
</tr>
<tr>
<td></td>
<td>Evening (4 hour), 6pm to 10pm</td>
<td>Night (9 hour), 10pm to 7am</td>
</tr>
<tr>
<td>N01</td>
<td>48.3</td>
<td>44.1</td>
</tr>
<tr>
<td>N02</td>
<td>51.3</td>
<td>47.1</td>
</tr>
</tbody>
</table>

Where evening and night RBLs were measured as being less than 30 dB(A), they have been adjusted to 30 dB(A) for the purpose of setting noise management levels. Similarly, for day time RBLs recorded to be less than 35 dB(A) these were also adjusted to 35 dB(A), consistent with guidance as per guidance presented in the NPI (Refer to Section 6.4.3).
Figure 6-4 | Noise monitoring locations and noise sensitive receivers
Existing traffic noise along the proposed traffic diversion route

Roads and Maritime’ Construction Noise Estimator (CNE) was used to predict the noise levels of existing traffic flows along the affected bypass routes at nearby residential receivers. The traffic volumes and composition data that was used in the CNE are detailed in *HW27 - Golden Highway Upgrades Diversion Construction noise review* (Jacobs, 2018c) (Appendix F) and summarised in Table 6-17. The locations of where traffic data was collected along the temporary bypass routes is shown in Figure 6-5.

Table 6-17 Estimated existing traffic flows

<table>
<thead>
<tr>
<th>Road segment</th>
<th>Year</th>
<th>Direction 1 (Northbound / Westbound)</th>
<th>Direction 2 (Southbound/Eastbound)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Day (7am to 10pm)</td>
<td>Night (10pm to 7am)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>LV</td>
<td>HV</td>
<td>LV</td>
</tr>
<tr>
<td>01</td>
<td>2019</td>
<td>7105</td>
<td>488</td>
<td>2542</td>
</tr>
<tr>
<td>02</td>
<td>2019</td>
<td>3488</td>
<td>1280</td>
<td>1601</td>
</tr>
<tr>
<td>03</td>
<td>2019</td>
<td>1486</td>
<td>314</td>
<td>372</td>
</tr>
<tr>
<td>04</td>
<td>2019</td>
<td>2525</td>
<td>348</td>
<td>631</td>
</tr>
<tr>
<td>05</td>
<td>2019</td>
<td>1925</td>
<td>358</td>
<td>481</td>
</tr>
<tr>
<td>06</td>
<td>2019</td>
<td>1860</td>
<td>347</td>
<td>465</td>
</tr>
<tr>
<td>07</td>
<td>2019</td>
<td>427</td>
<td>58</td>
<td>107</td>
</tr>
</tbody>
</table>

Day (\(L_{A\text{eq} 15 \text{ hr}}\)) and night (\(L_{A\text{eq} 9 \text{ hr}}\)) noise levels predictions using the CNE at the nearest sensitive receiver location along each segment are summarised in Table 6-18. The high levels predicted for segments 01 and 02 along the New England Highway, and 05 and 06 along Denman Road are a result of residential receivers being located in close proximity to the road at these locations.

Table 6-18 Predicted existing traffic noise levels

<table>
<thead>
<tr>
<th>Bypass road segment</th>
<th>(L_{A\text{eq} 15 \text{ hr}}) (Day)</th>
<th>(L_{A\text{eq} 9 \text{ hr}}) (Night)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>79.2</td>
<td>74.6</td>
</tr>
<tr>
<td>02</td>
<td>69.7</td>
<td>66.2</td>
</tr>
<tr>
<td>03</td>
<td>57.2</td>
<td>53.5</td>
</tr>
<tr>
<td>04</td>
<td>58.5</td>
<td>54.7</td>
</tr>
<tr>
<td>05</td>
<td>65.9</td>
<td>62.1</td>
</tr>
<tr>
<td>06</td>
<td>65.8</td>
<td>62.0</td>
</tr>
<tr>
<td>07</td>
<td>45.3</td>
<td>41.7</td>
</tr>
</tbody>
</table>
6.4.3 Criteria

**Construction noise criteria**

Construction noise criteria have been established for the proposal in accordance with the ICNG, in the form of construction Noise Management Levels (NMLs).

The NMLs for residential receivers were derived from the existing background noise levels, or rating background levels (RBL), with the relevant criteria applied in accordance with the ICNG for works during recommended standard hours and works outside these hours. Table 6-19 identifies the methodology applied in the development of NMLs for residential receivers.
Table 6-19 Development of construction noise management levels (NML)

<table>
<thead>
<tr>
<th>Time of day</th>
<th>NML LAeq (15 min)</th>
<th>How to apply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended standard hours</td>
<td>Noise affected (RBL + 10 dB)</td>
<td>The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and the duration, as well as contact details.</td>
</tr>
<tr>
<td>Monday to Friday 7.00am to 6.00pm</td>
<td>Highly noise affected (75 dB(A))</td>
<td>The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences 2. If the community is prepared to accept longer construction periods of higher noise activities over a shorter overall duration, in exchange for respite periods extending the length of time it takes for these works to be performed (for guidance on negotiating agreements see Section 7.2.2 of the ICNG (DECC, 2009).</td>
</tr>
<tr>
<td>Saturday 8.00am to 1.00pm</td>
<td>Highly noise affected (75 dB(A))</td>
<td>A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see Section 7.2.2 of the ICNG (DECC, 2009).</td>
</tr>
<tr>
<td>No work on Sundays or public holidays</td>
<td>Noise affected (RBL + 5 dB)</td>
<td>Where evening and night RBLs measured are less than 30 dB(A), they have been set to 30 dB(A) for the purpose of developing NMLs. Similarly, for day time RBLs recorded to be less than 35 dB(A) these were also adjusted to 35 dB(A) for the for the purpose of developing day time NMLs.</td>
</tr>
</tbody>
</table>

Source: *Interim Construction Noise Guideline (DECC, 2009)*

Based on the results, background noise statistics (low pass filtered) presented in Table 6-16 and the application of the criteria presented in Table 6-19, the following construction NMLs have been established as outlined in Table 6-20. Where evening and night RBLs measured are less than 30 dB(A), they have been set to 30 dB(A) for the purpose of developing NMLs. Similarly, for day time RBLs recorded to be less than 35 dB(A) these were also adjusted to 35 dB(A) for the for the purpose of developing day time NMLs.

Table 6-20 Construction noise management levels

<table>
<thead>
<tr>
<th>Noise monitoring location</th>
<th>Noise management level (NML) LAeq 15 minute dB(A)</th>
<th>Outside recommended standard hours of construction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard hours of construction</td>
<td>Day (1 pm to 6 pm Saturday and 8 am to 6 pm Sunday)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evening (6pm to 10 pm)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Night (10 pm to 7 am [8 am on Weekends])</td>
</tr>
<tr>
<td>N01</td>
<td>40</td>
<td>39</td>
</tr>
</tbody>
</table>
Levels measured around N01 are considered to be applicable to residential receivers R01 to R06, with levels measured at N02 applicable at residential receivers R07 to R16.

The ICNG also provides an external NML of 70 dB(A) for commercial receivers which is applicable to C01, C02 and C03.

Sleep disturbance criteria

The sleep disturbance awakening guidance value is the threshold at which an awakening reaction is likely to occur. Research discussed in the RNP identified this threshold to be an internal bedroom noise level of around 50 to 55 dB(A). A value of 55 dB(A) internally translates to an external level of 65 dB(A) when conservatively allowing 10 dB(A) noise based guidance presented for an ‘open window’ in AS2436-2010. Conservatively applying a -10 dB(A) correction to convert between from the $L_{A1\text{ minute}}$ to $L_{AEq\ 15\text{ minute}}$ metric realises a value of 55 dB(A) which was applied in this assessment.

Construction vibration criteria

Construction vibration criteria are separated into two categories being vibration effects on humans, and vibration impacts on building structures.

Human comfort criteria

The NSW EPA classifies vibration as one of three types:

- Continuous – where vibration occurs uninterrupted and can include sources such as machinery and constant road traffic
- Impulsive – where vibration occurs over a short duration (i.e. less than 2 seconds) and occurs less than three times during the assessment period, which is not defined. This may include activities such as occasional dropping of heavy equipment or loading / unloading activities
- Intermittent – occurs where continuous vibration activities are regularly interrupted, or where impulsive activities recur. This may include activities such as rock hammering, drilling, pile driving and heavy vehicle or train pass-bys.

Construction vibration is typically classed as intermittent and is assessed using the vibration dose value (VDVs). Relevant assessment criteria expressed as preferred and maximum VDVs are provided in Table 6-21.
Table 6-21 Preferred and maximum values for continuous and impulsive vibration acceleration (m/s²) 1-80 Hz (DECC, 2006)

<table>
<thead>
<tr>
<th>Locations</th>
<th>Assessment period</th>
<th>Preferred values</th>
<th>Maximum values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>z-axis</td>
<td>X and y axis</td>
</tr>
<tr>
<td>Continuous vibration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical areas*</td>
<td>Day or night</td>
<td>0.0050</td>
<td>0.0036</td>
</tr>
<tr>
<td>Residences</td>
<td>Day</td>
<td>0.010</td>
<td>0.0071</td>
</tr>
<tr>
<td></td>
<td>Night</td>
<td>0.007</td>
<td>0.005</td>
</tr>
<tr>
<td>Offices, schools, educational institutions and places of worship</td>
<td>Day or night</td>
<td>0.020</td>
<td>0.014</td>
</tr>
<tr>
<td>Workshops</td>
<td>Day or night</td>
<td>0.04</td>
<td>0.029</td>
</tr>
</tbody>
</table>

**Impulsive vibration**

<table>
<thead>
<tr>
<th>Locations</th>
<th>Assessment period</th>
<th>Preferred values</th>
<th>Maximum values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>z-axis</td>
<td>X and y axis</td>
</tr>
<tr>
<td>Critical areas²</td>
<td>Day or night</td>
<td>0.0050</td>
<td>0.0036</td>
</tr>
<tr>
<td>Residences</td>
<td>Day</td>
<td>0.30</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>Night</td>
<td>0.10</td>
<td>0.071</td>
</tr>
<tr>
<td>Offices, schools, educational institutions and places of worship</td>
<td>Day or night</td>
<td>0.64</td>
<td>0.46</td>
</tr>
<tr>
<td>Workshops</td>
<td>Day or night</td>
<td>0.64</td>
<td>0.46</td>
</tr>
</tbody>
</table>

¹ Daytime is 7am to 10pm. Night-time is 10pm to 7am
² Includes hospital operating theatres or precision laboratories.

Intermittent vibration is assessed differently; using vibration does values (VDV). Preferred and maximum VDVs are also provided in Assessing Vibration: a technical guideline, (DECC, February 2006) and have been reproduced in **Table 6-22**.

### Table 6-22 Preferred and maximum VDVs for intermittent vibration (ms⁻¹.⁷⁵), (DECC, 2006)

<table>
<thead>
<tr>
<th>Location</th>
<th>Day time (7 am to 10 pm)</th>
<th>Night time (10 pm to 7 am)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preferred VDV</td>
<td>Maximum VDV</td>
</tr>
<tr>
<td>Critical areas¹</td>
<td>0.10</td>
<td>0.20</td>
</tr>
<tr>
<td>Residences</td>
<td>0.20</td>
<td>0.40</td>
</tr>
<tr>
<td>Offices, schools, educational institutions and places of worship</td>
<td>0.40</td>
<td>0.80</td>
</tr>
<tr>
<td>Workshops</td>
<td>0.80</td>
<td>1.60</td>
</tr>
</tbody>
</table>

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

The British Standard 7385 is used as a guide to assess the likelihood of building damage from ground vibration such as that caused by piling, compaction, construction equipment and road and rail traffic. The standard recommends levels at which ‘cosmetic’, ‘minor’ and ‘major’ categories of damage might occur based on the type of structure affected, using the peak particle velocity (PPV) parameter. The criteria are presented in Table 6-23.

Table 6-23 Structural damage criteria for cosmetic building damage, (BS7385-2: 1993)

<table>
<thead>
<tr>
<th>Group</th>
<th>Type of structure</th>
<th>Peak particle velocity (PPV) - mm/s</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4Hz to 15Hz</td>
</tr>
<tr>
<td>1</td>
<td>Reinforced or framed structures Industrial and heavy commercial buildings</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>Un-reinforced or light framed structures Residential or light commercial type buildings</td>
<td>15 to 20</td>
</tr>
</tbody>
</table>

Section 7 of the CNVG (Roads and Maritime, 2016) recommends safe working distances for achieving human comfort (Assessing Vibration: a technical guideline, (DECC, February 2006)) 2006) and cosmetic building damage (BS7385-2:1993) criteria for a range of different plant and equipment. Although it is noted that these distances are indicative and vary depending on local geotechnical conditions; these offsets have been considered for the initial assessment of potential vibration impacts during the construction of the proposal. These have been reproduced in Table 6-24.

Table 6-24 Recommended safe working distances for vibration-intensive plant and equipment, (CNVG, Roads and Maritime 2016)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibratory Roller</td>
<td>&lt;50 kN (typically 1-2 tonne)</td>
<td>5</td>
<td>15 to 20</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>&lt;100 kN (typically 2-4 tonne)</td>
<td>6</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>&lt;200 kN (typically 4-6 tonne)</td>
<td>12</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>&lt;300 kN (typically 7-13 tonne)</td>
<td>15</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>&gt;300 kN (typically 13-18 tonne)</td>
<td>20</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>&gt;300 kN (&gt; 18 tonne)</td>
<td>25</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Small hydraulic hammer</td>
<td>300 kg – 5 to 12 tonne excavator</td>
<td>2</td>
<td>15 to 20</td>
<td>20</td>
</tr>
<tr>
<td>Medium hydraulic hammer</td>
<td>900 kg – 12 to 18 tonne excavator</td>
<td>7</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>Large hydraulic hammer</td>
<td>1600 kg – 18 to 34 tonne excavator</td>
<td>22</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Vibratory pile driver</td>
<td>Sheet piles</td>
<td>2</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Pile boring</td>
<td>≤800 mm</td>
<td>2 (nominal)</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>
Buried services

DIN 4150-3:1999-02 provides guidance for evaluating the effects of short-term vibration on buried services. This guidance has been reproduced in **Table 6-25**.

**Table 6-25** DIN 4150-3: 1999-02 guidance for evaluating effects of short-term vibration on buried services

<table>
<thead>
<tr>
<th>Pipe material</th>
<th>Guideline value for velocity measured on the pipe (mm/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel (including welded pipes)</td>
<td>100</td>
</tr>
<tr>
<td>Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)</td>
<td>80</td>
</tr>
<tr>
<td>Masonry, plastic</td>
<td>50</td>
</tr>
</tbody>
</table>

**Construction traffic**

Operational road traffic criteria adopted from the RNP is also considered to be applicable to construction traffic noise, therefore a relative increase criteria of 2 dB(A) has been adopted for the assessment of construction traffic impacts associated with the proposal.

**Temporary traffic diversions during construction works.**

Section 9 of the CNVG outlines the method of assessment required for temporary traffic re-routing during construction works. This first involves evaluating whether traffic noise along the re-routed roads would increase noise levels at the nearest residential receivers by more than 2 dB(A) (i.e. 2.1 dB(A)) relative to existing conditions. Where this is the case, day and night time equivalent noise levels are to be compared against the fixed road category-based criteria in the NSW Road Noise Policy (RNP), (DECC, 2011), with adjustments made where the re-routing results in a temporary change in road category.

If both criteria are found to be triggered, compliance is to be reviewed at all nearby residential receivers and mitigation measures in the Noise Mitigation Guideline (NMG), (Roads and Maritime, 2014) are to be considered in consultation with Roads and Maritime as to the extent that the measures would be both reasonable and feasible given the temporal nature of impacts.

**Operational traffic noise**

Where a proposal has the potential to generate a new source of noise for residential receivers due to changes in road alignment or where a proposal would result in a change to the volume or mix of vehicles, an operational traffic noise assessment is carried out in accordance with the RNP, (DECC, 2011). Where the changes of an existing road alignment are only minor, such as relating to safety projects, where the...
project is not intended to increase traffic carrying capacity or traffic mix, activities are classified as ‘minor works’ and a less intensive assessment of traffic noise impacts is required.

In accordance with the NCG the minor works requirement for criteria of noise levels not to result in an increase of more than 2 dB(A) (ie 2.1 dB(A) or more) relative to existing noise levels at the worst affected receiver apply. As such, the primary operational noise requirement considered for this assessment is whether the proposal would result in a traffic noise increase of more than 2.1 dB(A) at any nearby receiver. Although not considered applicable to a proposal of this nature, it is nevertheless noted that the measured day and night time equivalent noise levels at N01 and N02 were below applicable criteria for the redevelopment of the relevant road type (‘existing freeway/arterial/sub-arterial roads’), when corrected, to account for facade reflections.

6.4.4 Potential impacts

Construction

It is expected that the proposal would be constructed over a 18 month period starting late 2018. The Roads and Maritime’s Construction Noise Estimator (2016) (CNE) was used to estimate whether the proposal has the potential to affect ‘many receivers, few receivers or no receivers’. The criteria established in Section 6.4.3 was applied, with the following default construction scenarios considered from the CNE:

- 01 – Site establishment
- 02 – Utility adjustments
- 03 – Corridor clearing
- 04 – Bulk earthworks
- 05 – Drainage infrastructure
- 06 – Paving / asphalting
- 07 – Re-surfacing works
- 08 – Road furniture installation.
- 09 – Compound site establishment
- 10 – Compound site operations.

The final construction methodology and staging would be refined during the detailed design phase of the proposal, and associated noise and vibration impacts and mitigation measures re-assessed as required. Proposed plant and equipment to be used during each stage of construction are provided in Section 3.3.4 and have been factored into the assessment of construction noise and vibration impacts during each stage of construction.

Predicted construction noise impacts

Predicted $L_{Aeq\text{ 15 minute}}$ dB(A) sound pressure levels (SPLs) at each receiver for each scenario listed above are listed below in Table 6-26. For ease of interpretation, noise levels exceeding the different day, evening and night time NMLs of construction have been shaded in different colours. The term ‘-’ in Table 6-26 indicates where noise levels less than 20 dB(A) were predicted. The results presented are considered to be conservative noting that they consider the worst-case separation distance, whereas in reality noise sources would move owing to the linear nature of the proposal.
Table 6-26 Predicted noise levels using CNE

<table>
<thead>
<tr>
<th>Rec.</th>
<th>NML LAeq 15 minute dB(A)</th>
<th>Sleep dist.</th>
<th>Predicted SPL LAeq 15 minute dB(A) for each construction scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day</td>
<td>Eve.</td>
<td>Night</td>
</tr>
<tr>
<td>R01</td>
<td>45</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>R02</td>
<td>45</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>R03</td>
<td>45</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>R04</td>
<td>45</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>R05</td>
<td>45</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>R06</td>
<td>45</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>R07</td>
<td>45</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>R08</td>
<td>45</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>R09</td>
<td>45</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>R10</td>
<td>45</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>R11</td>
<td>45</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>R12</td>
<td>45</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>R13</td>
<td>45</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>R14</td>
<td>45</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>R15</td>
<td>45</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>R16</td>
<td>45</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>C01</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>C02</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
</tbody>
</table>
As shown in Table 6-26, the predictions using the CNE indicate that five nearby receivers (R07, R08, R09, R15 and R16) may experience noise levels exceeding NMLs during standard hours of construction. The same five receivers are predicted to experience noise levels above night time NMLs should some activities be required to be carried out outside standard hours of construction. Of these locations, noise levels exceeding the sleep disturbance guidance value was only predicted at receiver R07 during construction phases 03 (Corridor clearing) and 04 (Bulk earthworks) should these activities be completed at night. For construction phases 06 (asphalting), 07 (re-surfacing) and 10 (compound operations) which would be likely to be require some out of hours works, levels exceeding the night time NMLs were predicted at receivers R07 to R09, R15 and R16 for scenarios 06 and 07, but not at levels greater than the sleep disturbance guidance value.

Noting these results it was concluded that the proposal may result in a ‘few receivers’ experiencing noise levels above NMLs.

Considering that the CNE assessment identified that the proposal has the potential to impact a ‘few receivers’, and that it has an overall duration of ‘greater than six weeks’ (about 12 months) Section 5.5.3 of the CNVG recommends the completion of a detailed noise assessment.
Significance of noise levels

The assessment predicted that receivers R07, R08, R09, R15 and R16 may experience noise levels exceeding day, evening and night time NMLs during construction. Predicted levels of exceedance of the NMLs for standard hours of construction are presented below in Table 6-27. Exceedances of less than 10 dB(A) above NMLs were generally predicted with a maximum exceedance of 17 dB(A) above the standard day time NML predicted at R07 during bulk earthworks activities. Levels exceeding the ICNG ‘highly noise affected’ criterion of 75 dB(A) were not predicted during any stage of works, and any of the receivers assessed.

As noted above, these exceedances are worst-case and would vary as activities progress along the proposal given its linear nature. The duration of these exceedances would generally expected to be short-term (i.e. less than three weeks), except during bulk earthworks where impacts may be longer in duration.

Table 6-27 Review of significance of noise exceedances

<table>
<thead>
<tr>
<th>Receiver</th>
<th>Level and indicative duration of exceedance for each construction scenario during standard hours of construction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>01</td>
</tr>
<tr>
<td>----------</td>
<td>----</td>
</tr>
<tr>
<td>R07</td>
<td>5</td>
</tr>
<tr>
<td>R08</td>
<td>1</td>
</tr>
<tr>
<td>R09</td>
<td>-</td>
</tr>
<tr>
<td>R15</td>
<td>-</td>
</tr>
<tr>
<td>R16</td>
<td>-</td>
</tr>
</tbody>
</table>

S = short duration (less than three weeks), M = moderate duration (three to six weeks), L = long duration (greater than six weeks)

Sleep disturbance impacts

Where works may take place over two or more consecutive nights, an assessment of maximum noise levels is required to evaluate potential sleep disturbance impacts. Works are generally expected to be completed during standard hours of construction. However, some works may occasionally be required to be carried out outside these hours due to road access and safety reasons. Such activities may include asphalting, road re-surfacing and compound operations.

Based on the results shown in Table 6-26, noise levels exceeding the sleep disturbance guidance value were only predicted at receiver R07 if construction phases 03 and 04 during the night. It is noted that only scenarios 06 and 07 (with support from scenario 09) may need to be completed during night time periods.

Mitigation and management measures

To manage potential impacts during the proposal, standard mitigation measures listed in Appendix B of the CNVG should be implemented as well as relevant additional measures from Appendix F. These additional measures are summarised in Section 6.4.5.

Construction vibration impacts

Some vibration-intensive equipment may be used during the proposal including compaction equipment. Relevant recommended safe setback distances to maintain building cosmetic and human comfort criteria for these types of plant are reproduced below in Table 6-28.
Table 6-28 Recommended safe setback distances for relevant vibration-generating plant

<table>
<thead>
<tr>
<th>Plant</th>
<th>Rating / description</th>
<th>Safe working distance (metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>5 metres</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 metres</td>
</tr>
<tr>
<td>Vibratory Roller</td>
<td>&lt;50 kN (typically 1-2 tonne)</td>
<td>12 metres</td>
</tr>
<tr>
<td></td>
<td>&lt;100 kN (typically 2-4 tonne)</td>
<td>15 metres</td>
</tr>
<tr>
<td></td>
<td>&lt;200 kN (typically 4-6 tonne)</td>
<td>20 metres</td>
</tr>
<tr>
<td></td>
<td>&lt;300 kN (typically 7-13 tonne)</td>
<td>25 metres</td>
</tr>
<tr>
<td></td>
<td>&gt;300 kN (typically 13-18 tonne)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;300 kN (&gt; 18 tonne)</td>
<td></td>
</tr>
</tbody>
</table>

Considering these safe working setback distances and the distance (refer to Table 6-28) and the distance to nearby structures and receivers (refer to Table 6-15), vibration levels are not expected to exceed relevant criteria described Section 6.4.3; and as such, vibration impacts are not expected to arise during the proposal.

To provide guidance for avoiding vibration-related impacts at nearby utilities, peak particle velocities at different setback distances from different sizes of vibratory rollers and operating settings (low and high amplitude) were predicted using the methods detailed in British Standard (BS 5228-1:2009).

This is presented in Table 6-29, with the lower value related to relating to operations in ‘low amplitude mode’ (i.e. lower vibratory setting for the drum) and the higher value relevant to operations completed in ‘high amplitude mode’.

Table 6-29 Guidance for avoiding vibration-related damage to surrounding utilities

<table>
<thead>
<tr>
<th>Vibratory roller details</th>
<th>DIN 4150-3:1999-02 criteria</th>
<th>Peak particle velocity (ppv) mm/s at specified distance (metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>Specifics</td>
<td>1</td>
</tr>
<tr>
<td>Small</td>
<td>4 tonne, 0.8 metre drum width</td>
<td>50 mm/s (Masonry, plastic)</td>
</tr>
<tr>
<td>Medium</td>
<td>11 tonne, 2.1 metre drum width</td>
<td>80 mm/s (Clay, concrete, reinforced concrete, pre-stressed concrete, metal)</td>
</tr>
<tr>
<td>Large</td>
<td>19 tonne, 2.1 metre drum width</td>
<td>100 mm/s (Steel)</td>
</tr>
</tbody>
</table>

As shown Table 6-29, the smallest practicable plant resulting in vibration levels well within the criteria should preferably be selected where feasible, to minimize any risk of damage. Where vibration levels for the selected plant are close to or above the criteria, then a review and assessment should be undertaken and alternative plant or construction techniques considered. This review and assessment should also consider concurrent vibration monitoring and inspection of the utility to ensure that no damage takes place where vibration levels are close to the criteria.

Construction traffic

The CNE was utilised to assess potential impacts arising from construction traffic. Existing traffic inputs were added as below with volumes extrapolated from observations made during attended monitoring at
N02, and additional traffic generated during construction was conservatively estimated based on the anticipated workforce. Based on these inputs in was found that additional noise arising from construction traffic would not result in changes of more than 2 dB(A) above existing noise levels. Based on these inputs it was found that additional noise arising from construction traffic would not result in changes of more than 2 dB(A) above existing day and night time traffic noise levels at the nearest receiver (R07).

Temporary diversion routes

As described in Section 3.3.7 and Section 6.1.2, some construction activities associated with the proposal would require that traffic is temporarily redirected onto other nearby roads. It is expected that this would increase the volume of traffic along these redirected roads which would temporarily increase road traffic-related noise levels at surrounding sensitive receivers.

Temporary bypass 01 would reduce traffic along the Golden Highway between the New England Highway and Denman Road, such that it is expected that a smaller volume mainly comprising of local traffic would utilise the Edderton Road section of temporary bypass 02. To estimate the residual traffic utilising the Edderton Road bypass route (segment 07), it was assumed that 20 per cent of the 2019 AADT volumes at Location C would be added. The incremental bypass volumes applied are summarised below in Table 6-30, with cumulative (i.e. existing and incremental bypass flows) values listed in Table 6-31. Results from the assessment are presented in Table 6-32.

Table 6-30 Redirected incremental traffic volumes (Roads and Maritime, 2011)

<table>
<thead>
<tr>
<th>Temporary bypass number</th>
<th>Year</th>
<th>Direction 1 (Northbound / Westbound)</th>
<th></th>
<th>Direction 2 (Southbound/Eastbound)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Day (7am to 10pm)</td>
<td>Night (10pm to 7am)</td>
<td>Day (7am to 10pm)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LV</td>
<td>HV</td>
<td>LV</td>
</tr>
<tr>
<td>01</td>
<td>2019</td>
<td>1030</td>
<td>114</td>
<td>140</td>
</tr>
<tr>
<td>02</td>
<td>2019</td>
<td>257</td>
<td>29</td>
<td>35</td>
</tr>
</tbody>
</table>

Table 6-31 Cumulative traffic along bypassed road segments

<table>
<thead>
<tr>
<th>Road segment</th>
<th>Year</th>
<th>Direction 1 (Northbound / Westbound)</th>
<th></th>
<th>Direction 2 (Southbound/Eastbound)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Day (7am to 10pm)</td>
<td>Night (10pm to 7am)</td>
<td>Day (7am to 10pm)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LV</td>
<td>HV</td>
<td>LV</td>
</tr>
<tr>
<td>01</td>
<td>2019</td>
<td>8135</td>
<td>602</td>
<td>2682</td>
</tr>
<tr>
<td>02</td>
<td>2019</td>
<td>4518</td>
<td>1394</td>
<td>1741</td>
</tr>
<tr>
<td>03</td>
<td>2019</td>
<td>2516</td>
<td>428</td>
<td>512</td>
</tr>
<tr>
<td>04</td>
<td>2019</td>
<td>3555</td>
<td>462</td>
<td>771</td>
</tr>
<tr>
<td>05</td>
<td>2019</td>
<td>2955</td>
<td>472</td>
<td>621</td>
</tr>
<tr>
<td>06</td>
<td>2019</td>
<td>2890</td>
<td>461</td>
<td>605</td>
</tr>
</tbody>
</table>
### Table 6-32 Predicted changes in noise levels resulting from the temporarily bypassed traffic

<table>
<thead>
<tr>
<th>Bypass segment</th>
<th>LAeq 15 hr (Day)</th>
<th>Change</th>
<th>LAeq 9 hr (Night)</th>
<th>RNP criteria</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Existing</td>
<td>During bypass</td>
<td></td>
<td>Existing</td>
<td>During bypass</td>
</tr>
<tr>
<td>01</td>
<td>79.2</td>
<td>79.9</td>
<td>+0.7</td>
<td>74.6</td>
<td>75.0</td>
</tr>
<tr>
<td>02</td>
<td>69.7</td>
<td>70.3</td>
<td>+0.6</td>
<td>66.2</td>
<td>66.5</td>
</tr>
<tr>
<td>03</td>
<td>57.2</td>
<td>59.0</td>
<td>+1.8</td>
<td>53.5</td>
<td>54.5</td>
</tr>
<tr>
<td>04</td>
<td>58.5</td>
<td>59.9</td>
<td>+1.4</td>
<td>54.7</td>
<td>55.4</td>
</tr>
<tr>
<td>05</td>
<td>65.9</td>
<td>67.5</td>
<td>+1.6</td>
<td>62.1</td>
<td>63.0</td>
</tr>
<tr>
<td>06</td>
<td>65.8</td>
<td>67.4</td>
<td>+1.6</td>
<td>62.0</td>
<td>62.9</td>
</tr>
<tr>
<td>07</td>
<td>45.3</td>
<td>47.2</td>
<td>+1.9</td>
<td>41.7</td>
<td>42.6</td>
</tr>
</tbody>
</table>

Given that increases of 2.1 dB(A) or more were not predicted at the nearest receivers along any of the temporary bypass road segments, no noise mitigation measures were determined to be necessary during both temporary bypasses.

**Operation**

There would be no increase in the volume of traffic, mix of traffic, or posted speed as a result of the proposal. At the nearest receiver (R07), the proposal would realign the nearest lane about half of one lane width (1.75 metres) closer to the dwelling compared to the existing arrangement.

An assessment was completed using the calculation method for road traffic noise presented in CoRTN, to determine whether noise levels would be likely to increase at nearby receivers by 2 dB(A) or more as a result of the proposal. The CoRTN assessment method considers several input variables including traffic flow, percentage heavy vehicles, traffic speed, road gradient, road surface type, propagation pathway from road source to receiver including, terrain barrier and shielding effects to identify noise levels arising from road traffic at receivers.

Considering traffic realignments, the resulting increase in traffic noise at the nearest receiver was identified to be of the order of about 0.1 dB(A).

The road surface type is another variable noted to affect noise generated from road operations. The proposal would change the road surface from spray sealed 10/14 millimetre aggregate to densely graded asphalt which would have the potential reduce wheel-generated noise.

Given these findings, the proposal would not result in road noise levels increasing by more than 2.1 dB(A) or more relative to existing road operations at surrounding receivers and no specific operational mitigation measures would be necessary.
Maximum noise level review

In general, it is expected that the new pavement would reduce noise levels associated with tyre and road interactions for light vehicles. Further, the proposal is intended to improve the flow of traffic over Winery Hill such that the frequency of some maximum noise events (i.e., deceleration and braking) from light vehicles would be reduced, though the frequency of maximum noise events from heavy vehicles is expected to remain largely the same.

6.4.5 Safeguards and management measures

Safeguards and management measures be implemented to mitigate and manage noise and vibration impacts are provided in Table 6-33.

Table 6-33 Safeguards and management measures – noise and vibration

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Reference</th>
</tr>
</thead>
</table>
| Noise and vibration     | A Noise and Vibration Management sub-plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will identify:  
|                         | • All potential significant noise and vibration generating activities associated with the activity  
|                         | • Feasible and reasonable mitigation measures to be implemented, taking into account Beyond the Pavement: urban design policy, process and principles (Roads and Maritime, 2014)  
|                         | • A monitoring program to assess performance against relevant noise and vibration criteria  
|                         | • Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures  
|                         | • Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria. | Contractor | Detailed design / pre-construction | Core standard safeguard NV1  
|                         | All sensitive receivers (e.g., local residents and Hollydene Estate) likely to be affected will be notified at least five working days prior to the start of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of:  
|                         | • The proposal  
|                         | • The construction period and construction hours  
|                         | • Contact information for project management staff  
<p>|                         | • Complaint and incident reporting | Contractor | | Section 4.6 of QA G36 Environment Protection |</p>
<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site induction</td>
<td>How to obtain further information.</td>
<td></td>
<td></td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Noise and vibration</td>
<td>All personnel working on site will receive training to ensure awareness of requirements of the NVMP. Site-specific training will be given to personnel when working in the vicinity of sensitive receivers.</td>
<td>Contractor</td>
<td>Pre-construction / construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td></td>
<td>Where possible, works outside of standard construction hours will be planned so that noisier works are carried out in the earlier part of the evening or night time.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Out of hours works construction          | - Where out-of-hours activities are required, high impact noise generating activities will be carried out prior to 11pm where possible  
- Where out-of-hours activities are required, respite periods (Respite Period 1 and Respite Period 2) in accordance with the CNVG would be implemented  
- Duration respite for out-of-hours (increase in number of nights per week but a reduced overall construction period) works will be considered in consultation with the affected sensitive receivers  
- During out of hours works, conduct monitoring to measure construction noise levels against NMLs and sleep disturbance criteria. The monitoring would be carried out at the nearest sensitive receiver where possible. Where required, implement additional control measures as detailed in the CNVG will be applied if noise levels noise levels require further mitigation. |
|                                          | Construction contractor                                                                                                                                                                                                   | Construction contractor | Construction          | Additional safeguard |
| Vibration impacts to underground utilities| The use of high intensity vibratory compaction equipment near underground services will be limited. If vibration-intensive plant and equipment change from that which has been in the Noise and Vibration Assessment (Jacobs, 2018c), a review will be carried out prior to commencing work. |                      |                       |                 |
6.5 Hydrology and flooding

The potential impacts of the proposal on water quality and hydrology are presented in this section, together with safeguards and management measures to mitigate any negative impacts.

6.5.1 Existing environment

The proposal is located within the Hunter River Catchment about 100 kilometres north of Sydney. It is bound by the Great Dividing Range in the west, Manning and Karuah catchments in the north, and by the Lake Macquarie and Hawkesbury-Nepean catchments in the south. The Hunter Catchment is the largest coastal catchment in NSW, with an area of about 21,500 square kilometres. Elevations across the catchment vary from over 1,500 metres in the high mountain ranges north of the catchment, to less than 50 metres on the floodplains of the lower valley. The Hunter River which supports a large population and a diverse range of important water users is located around 600 metre to the southeast of the eastern end of the proposal. The largest tributary of the Hunter River is the Goulburn River which joins the Hunter River about 10 kilometres to the west of the proposal area. The unnamed water ways around the proposal are shown on Figure 1-2.

**Surface water**

The Hunter River flows to the south of the proposal area and eventually crosses under the highway to the east of the proposal. Saddler’s Creek which is a tributary of the Hunter River crosses under the highway to the west of the proposal and joins up with the Hunter River about 1.5 kilometres to the south.

Saddlers Creek is an ephemeral flow regime which is highly disturbed from a history of grazing and agricultural activities. Ephemeral streams flow only in direct response to precipitation. The majority of watercourses and drainage lines around the proposal area are ephemeral and most flow events occur in direct response to major rainfall, with flow frequently of short duration (Jacobs, 2018b). The absence of macrophyte vegetation around them suggests they do not often contain water.

**Flooding**

Majority of the proposal is not located in flood prone land, however the very eastern end of the proposal including Ancillary Site 1 (WH1) is within a flood prone location. The Bureau of Meteorology (BOM) operates a flood forecasting system for the Hunter River. The system is similar to that implemented for most of the major river systems in Australia. The BOM issues Flood Watches in advance of possible floods, if forecasts indicate that flood producing rain is expected.

**Water quality monitoring data**

The Hunter region, and particularly the lower Hunter catchment, supports a high level of urban and industrial development which has affected water quality. In the upper catchment significant land clearing has resulted in erosion and salinity problems (Muswellbrook Council, 2016).

There is currently no publically available water quality data for Saddler’s Creek or any of the tributaries near the proposal. The waterways within the proposal area drain into the Hunter River for which there is some water quality data. The water quality of the Hunter River near Denman in April 2015 was found to be suitable for recreation, stock drinking but not for human drinking (Muswellbrook Council, 2016).

**Drainage and water quality elements**

Existing pavement drainage in the proposal area consists of swales and open channels and 15 culverts. There is no formal treatment of stormwater runoff from the existing Golden Highway and no containment infrastructure within the proposal area.
6.5.2 Potential impacts

Construction

Construction of the proposal would involve earthworks to widen the Golden Highway. The removal of vegetation and earthworks would disturb soils with the potential to transport sediment offsite into unnamed drainage lines within and near the project. Construction activities with the potential to impact on local water quality from sedimentation and contamination from the following activities include:

- Construction near waterways including the unnamed drainage lines within and near the proposal
- Removal of vegetation
- General earthworks, including stripping of topsoil, excavation or filling
- Stockpiling of topsoil and vegetation
- Transportation of cut and/or fill materials
- Movement of heavy vehicles across exposed earth
- Accidental spills of fuels, oils or other chemicals from construction vehicles or equipment
- Blocking or diverting local drainage lines may result in localised areas of flooding and scour during rainfall events.

As there are unnamed and named waterways throughout and at either end of the proposal coupled with the undulating and hilly nature of the topography, the risks to water quality from sediment runoff during construction would be moderate. They can, however, be readily mitigated with standard construction site management measures and with the implementation of the proposed safeguards and management measures, the risks to water quality would be minimal.

Construction does not involve deep excavation or drilling and would therefore be unlikely to impact groundwater. Construction activities are not expected to impact on regional flooding behaviour in the area. Aside from Ancillary Site 1, ancillary sites are not located in flood prone areas or near to drainage lines or waterway. Provided the safeguards and management measures are implemented for ancillary sites no major impacts would be expected to water.

Non potable water sources (including the potential for water extraction from the Hunter River) would be investigated during detailed design to minimise reliance on potable water where feasible. Any water extraction would occur only after consultation with the NSW Office of Water, and acquisition of associated permits and approvals.

Operation

As the proposal has been designed to accommodate stormwater volumes during a 100 year storm event, and the design has incorporate measures to protect in-stream water quality and prevent scour and erosion so as to protect aquatic ecosystems.

The risk of accidental spills of hazardous materials would always be present from accidents and incidents involving vehicles., Contaminants could flow into the highway drainage system and impact downstream ecosystems and waterways. The improved horizontal and vertical geometry and improved layout of the road would improve safety and therefore reduce the risk of accidental spills during operation.

Mitigation measures to reduce any additional impact to water quality as a result of the proposal have been provided in Table 6-34.
6.5.3 Safeguards and management measures

Safeguards and management measures for water quality and hydrology are presented in **Table 6-34**.

**Table 6-34 Summary of mitigation measures - water quality and hydrology**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil and water</td>
<td>A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction.</td>
<td>Contractor</td>
<td>Detailed design / pre-construction</td>
<td>Core standard safeguard SW1 Section 2.1 of QA G38 Soil and Water Management</td>
</tr>
<tr>
<td>Soil and water</td>
<td>1. A site specific Erosion and Sediment Control Plan/s (ESCP) will be prepared and implemented as part of the Soil and Water Management Plan 2. The plan will 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.</td>
<td>Contractor</td>
<td>Detailed design / Pre-construction</td>
<td>Core standard safeguard SW2 Section 2.2 of QA G38 Soil and Water Management</td>
</tr>
</tbody>
</table>

Contaminants entering receiving environments during construction

Control measures to minimise the risk of water pollution will be implemented including:

- All fuels, chemicals, and liquids will be stored at least 50 metres away from the existing stormwater drainage system and stored in an impervious bunded area within the compound site
- Plant and maintenance machinery will be refuelled in impervious bunded areas in the designated compound area
- Vehicle washdowns and/or concrete truck washouts would be carried out within a designated bunded area of an impervious surface or carried out off-site.

<p>| Extraction of water | Non potable water sources (including the potential for water extraction from the Hunter River) would be investigated during detailed design to minimise reliance on potable water where feasible. Any water extraction would occur only after consultation with the NSW Office of Water, and Roads and Maritime / Construction contractor | Construction contractor | Construction | Additional safeguard |</p>
<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Reference</th>
</tr>
</thead>
</table>
| Flood management for ancillary site WH1 | acquisition of associated permits and approvals. If ancillary site WH is used for the proposal, a Flood Management Plan will be prepared prior to the work starting. This plan will include:  
• Review and coordination with existing local flood plans and evacuation procedures  
• Flood emergency preparation, response, and recovery measures which will implemented during construction  
• Procedure for daily review of The Bureau of Meteorology website  
• Site protection measures to be implemented prior to and in the event of flooding  
• Procedure for monitoring and maintenance of protection measures during heavy rainfall events. | Construction contractor | Construction | Additional safeguard |

Other safeguards and management measures that would address hydrology and water quality are impacts are identified in Section 6.6.3.
Golden Highway Upgrade at Winery Hill
Review of Environmental Factors

6.6 Topography, geology, soils and contamination

This section outlines the local topography, drainage, geology and soils, the potential impacts of the proposal, and safeguards to mitigate them.

6.6.1 Existing environment

Topography and drainage
The landscape is predominantly rolling hills, wide valleys, with a meandering river system on a wide flood plain. River terraces are evident, the highest with silicified gravels and numerous small swamps are evident in the upper reaches of the catchment.

The elevation of the proposal area ranges from about 100 metres Australian Height Datum (AHD) at the western and eastern end of the proposal (at the location of the Saddlers Creek and Hunter River floodplains, respectively) up to about 180 metres AHD towards the central portion of the proposal area. Drainage is to the north across the central portion of the proposal area, to the west at the western end of the proposal towards Saddlers Creek, and to the east at the eastern end towards the Hunter River.

Geology and soils
Geology is dominated by permian sedimentary rocks, which include the Singleton Coal measures (divided into the Whittingham Coal Measures and Wollombi Coal Measures), shale, tuffs, sandstone and conglomerate, with some lava beds in the oldest portion of the sequence (1:100,000 Scale Geological Series Sheet 9033, Hunter Coalfield Regional Geology, 1993). Quaternary sediments are located along the channels and in the immediate surrounds of the Hunter and Goulburn rivers; and many other streams and rivers (Peake, 2006).

Soil landscapes are represented by a variety of harsh texture contrast soils on slopes and deep sandy loam alluvium on the valley floors. Within the gently undulating low hills that characterise the proposal area, residual red clays would be anticipated to predominate, with brown clays and possible yellow (orange) solodic soils on the lower slopes. Alluvial soils would be anticipated within drainage lines and particularly within the vicinity of Saddlers Creek and the Hunter River towards the east (Singleton Soil Landscape Map 1:250,000). The soil in the proposal is expected to be highly erodible and highly dispersible, and there is evidence of gully and sheet erosion around the proposal.

Acid sulfate soils
A review of the CSIRO Australian Soil Resource Information System was carried out on 17 October 2016. The search indicated that there is a low probability of encountering any acid sulphate soils within the proposal area.

Contamination
A search of official databases searches did not reveal any known contaminated sites within the proposal area. The following databases were searched on the 11 October 2016:

- OEH contaminated land records for Singleton Council and Muswellbrook Shire Council: These records showed there were no contaminated site records within 500 metres of the proposal area
- The POEO Act: This showed that there were no licences on record for near the proposal area. No other licences or notices are for properties or operations within and/or immediately next to the proposal area
- The review of contamination databases indicates low potential for contamination within the proposal area. However, agricultural practices around the proposal area may have used pesticides and
herbicides, and there would also be potential for the proposed compound site to have had illegal dumping of waste products

- Contamination is considered a low risk to the proposal due to the low intensity of development surrounding the proposal area. There may be contamination surrounding the proposal area associated with agricultural practices.

### 6.6.2 Potential impacts

**Construction**

Construction activities would have the following potential impacts on soils and contamination:

- **Topography:** The earthworks would result in a minor change to the topography of the proposal area. However, this change is consistent with the existing topography and would not be expected to be significant.

- **Soil erosion and loss of topsoil:** This could result from the removal of vegetation (clearing and grubbing) along both sides of the proposal area, and disturbance of the ground surface during site preparation, earthworks, excavation and other construction activities. Earthmoving activities have the potential to expose loose soils and mobilise these materials. Soil erosion and loss of top soil would be most likely to occur in areas of larger excavation such as where the cut and fill batters would be trimmed and excavated. Due to the undulating and hilly terrain through this section of the Golden Highway, the maximum cutting size is about five metres high. For this reason, the risk of erosion and sedimentation is anticipated to be moderate.

- **Disturbance of contaminated soil:** Contamination is considered a low risk due to the low intensity of development surrounding the proposal, however there may be contamination surrounding the proposal associated with agricultural practises and illegal dumping. If contamination is present in these areas, the proposal would have the potential to disperse contaminated materials. There is potential for construction activities to result in contamination of soil and/or water due to leaks and spills of potentially contaminating materials such as hydrocarbons and chemicals. These impacts would generally be temporary, and safeguards measures to reduce the impacts are summarised in Table 6-35.

- **Spills of contaminating materials:** There would be potential for construction activities to result in contamination of soil and/or water due to leaks and spills of potentially contaminating materials. Spill containment would be used at ancillary site to contain spills and spill response procedures would be followed. These impacts would generally be temporary, and mitigation measures to reduce the impacts are summarised in Table 6-35.

For the proposal area it was estimated that a contributing disturbed area exceeding 0.7 hectares would generate 150 cubic metres of annual soil loss. According to the Blue Book (Soils and Construction, 2004 and 2008 Volume 2D Main Road), where the sediment loss is less than 150 cubic metres per year, the building of a sediment retention basin can be considered unnecessary. Therefore, for catchments less than about 0.7 hectares would not require sediment basins however these catchments would still require adequate local erosion and sediment controls.

Taking into account the various stages of construction (refer to Section 3.3.1), as long as sufficient rehabilitation (such as hydro seeding) of batter areas is carried out as soon as the finished road levels have been completed, it has been determined that the catchment areas for each stage can be kept under 0.7 hectares, with the exception of one marginal catchment area of 0.76 hectares. However, as the construction staging may vary, it has been assumed that this 0.76 hectare catchment area can be reduced at construction stage to less than 0.7 hectares as a condition for the removal of this sediment basin. Therefore, no temporary sediment basins would be required and local erosion and sediment controls including sediment traps would be sufficient.
Operation

Once the proposal is operational, the surfaces disturbed during construction would have been re-surfaced or revegetated and, therefore, erosion and salinity risks would be minimal. There would be potential for indirect impacts on soils as a result of surface water run-off from the road corridor into the surrounding environment. This potential impact would be managed through stabilisation of disturbed areas, revegetation and scour protection along drainage lines and culvert inlets and outlets.

6.6.3 Safeguards and management measures

The proposed safeguards and management measures for soils are presented in Table 6-35.

Table 6-35 Summary of mitigation measures - soils and contamination

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contaminated land</td>
<td>If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA.</td>
<td>Contractor</td>
<td>Detailed design / Pre-construction</td>
<td>Core standard safeguard C2 Section 4.2 of QA G36 Environment Protection</td>
</tr>
<tr>
<td>Accidental spill</td>
<td>A site specific emergency spill plan will be developed, and include spill management measures in accordance with the Roads and Maritime Code of Practice for Water Management (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).</td>
<td>Contractor</td>
<td>Detailed design / Pre-construction</td>
<td>Core standard safeguard C3 Section 4.3 of QA G36 Environment Protection</td>
</tr>
<tr>
<td>Stockpile management</td>
<td>Stockpiles will be designed, established, operated and decommissioned in accordance with the Roads and Maritimes’ Stockpile Site Management Guideline 2015.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Additional standard safeguard SW9</td>
</tr>
<tr>
<td>Soil stabilisation and restoration</td>
<td>The rehabilitation of disturbed areas will be carried out progressively as construction stages are completed, and in accordance with:</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Additional standard safeguard SW15</td>
</tr>
<tr>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Standard / additional safeguard</td>
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<td>----------------------------</td>
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<tr>
<td>Erosion and sedimentation</td>
<td>The SWMP will be implemented throughout the construction period. It will include the following safeguards:</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
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<tr>
<td></td>
<td>• Designated exclusion zones will be identified for the storage and use of construction plant and equipment. These zones will delineate traffic areas and restrict entry and exit points to construction sites</td>
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<td></td>
<td>• Areas of risk near the proposal, such as steep areas or highly erodible soils, will be identified and appropriate management controls implemented</td>
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<td></td>
<td>• Temporary or permanent diversion drains will be used to divert off-site run-off around or through the construction site to minimise the volume of flow that mixes with on-site run-off</td>
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<td></td>
<td>• Physical controls will be developed in line with the ESCP, including sediment fences, sediment filters, rock check dams, level spreaders, and onsite diversion drains installed before construction and maintained during construction</td>
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<td></td>
<td>• Exposed batters will be lined, if required</td>
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<td></td>
<td>• A schedule for the ongoing maintenance and inspection of temporary erosion and sediment controls will be developed.</td>
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<tr>
<td>Pollution from run-off</td>
<td>The ancillary facilities will be managed within the ESCP. The following measures will be included to limit sediment and other contaminations entering receiving waterways:</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td></td>
<td>• Chemicals will be stored within a sealed or bunded area</td>
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<tr>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Standard / additional safeguard</td>
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<tr>
<td></td>
<td>• Appropriate controls will be in place where plant is stored</td>
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<td></td>
<td>• Run-off from ancillary sites will be controlled and treated before discharging into downstream waterways</td>
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<td></td>
<td>• Vehicle movements will be restricted to designated pathways where feasible</td>
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<td></td>
<td>• Areas that will be exposed for extended periods, such as car parks and main access roads, will be stabilised where feasible</td>
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</tbody>
</table>
6.7 Landscape character and visual impacts

An assessment was carried out to identify the extent and magnitude of potential visual impacts of the proposal. The assessment is documented in the *Golden Highway, Winery Hill Upgrade, - Visual Assessment Report* (Envisage, 2018), which is provided in Appendix G and summarised below.

6.7.1 Methodology

For the assessment of landscape character and visual impact, the study area includes the area covered by the proposal area, and distance views from northbound and southbound lanes as shown in Figure 6-6. The visual impact assessment was carried out in accordance with Roads and Maritime’s *Guidelines for Landscape Character and Visual Impact Assessment* (2013).

The study area for the landscape and visual impact assessment is the area from where the proposal would be potentially seen.

**Landscape character**

For the purpose of the landscape character assessment, the proposal area was divided into three landscape character units (LCU) which correspond to landscape character types in the area. These LCUs are shown on Figure 6-6a and include:

- Eastern foothills and plain landscape
- Central hilly landscape
- Saddlers Creek plain landscape.

The assessment of impact on landscape character is based on a combination of the sensitivity of the identified landscape character zones and the magnitude (physical size and scale) of the proposal in that zone. This is used to derive an impact assessment rating for the proposal within each landscape character zones (refer to Table 6-36).

**Table 6-36 Landscape character and visual impact matrix (source: Roads and Maritime 2013)**

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Moderate</td>
<td>Moderate / High</td>
</tr>
<tr>
<td>Low</td>
<td>Moderate / Low</td>
</tr>
<tr>
<td>Negligible</td>
<td>Negligible</td>
</tr>
</tbody>
</table>

**Visual impact assessment**

Visual impact assessment is carried out to understand the day-to-day visual effects of a proposal on people’s views. It is based on the assessment of a number of selected viewpoints that are rated according to the sensitivity of the view and the magnitude of the proposal within that view. The locations and directions of the chosen viewpoints are representative of the range of viewpoints both within and beyond the road corridor.
Four key viewpoints (KV) were identified within the proposal visual envelope, as shown on Figure 6-6. The KV are representative of the road users, residents, workers and visitors to the properties located within the proposal area, and consist of:

- Coolmore, a thoroughbred stud situated at the far eastern end of the proposal area
- Rural property, located at the eastern end of the proposal area on the northern side, and includes two houses, with the nearest some 175 metres from the Golden Highway
- Hollydene Estate, situated on the side of the first hill on the southern side of the Golden Highway, when travelling from the direction of Jerrys Plains
- Godolphin Stud, another thoroughbred stud located at the far western end of the proposal area.

The assessment of the visual impact on these viewpoints has considered the sensitivity of the view (that is, the quality of the view and how it would be affected by the proposal) and the magnitude of the proposal within that view (that is, the physical size and scale of the change and its proximity to the viewer). The combination of sensitivity and magnitude was then used to derive the visual impact rating (refer to Table 6-36).
Figure 6-6a Viewpoints within the proposal visual envelope - east section (Envisage, 2018)
Figure 6-6b Viewpoints within the proposal visual envelope – central section (Envisage, 2018)
Figure 6-6c Viewpoints within the proposal visual envelope – western section (Envisage, 2018)

NB: RECOMMENDATIONS SHOWN IN RED TEXT BOXES
6.7.2 Existing environment

**Landscape character**

The existing landscape character of the proposal area reflects its mostly rural nature, with rural land uses and large landholdings. The landscape has been extensively cleared of native trees, and supports thoroughbred studs, wineries, cattle grazing and some crops. The dominant vegetation in this rural landscape is pasture grasses. Trees and shrubs are primarily confined to watercourses and clustered around houses and other buildings.

The few residences with the proposal area are over 100 metres from the Golden Highway. The two horse studs and Hollydene Estate next to the proposal area are visually prominent with avenue trees and distinctive gateway features.

Within the proposal area there are many opportunities for wider views over the surrounding undulating wider plain, the vegetated ranges to the south such as Martindale Range and Doyles Range, and lower ranges to the west, east and north.

**General visibility**

The main viewers of the proposal would be users of the highway and residents, workers and visitors of nearby properties.

The central hilly section, which covers the majority of the proposal area, has a relatively low visibility as views beyond the highway corridor are limited by a combination of landform and vegetation. This central section is for the most part quite enclosed. From some elevated locations there are opportunities for regional views over the plains to the forested ranges to the south and north. However, there are no houses in close proximity from where clear views are possible.

In the far eastern section the visibility is slightly higher due to the presence of the Hollydene Estate winery which is frequented by tourists. This section is also on the edge of the plain and able to be viewed from a wider, although still limited catchment. Similarly, the far western section near Saddlers Creek is flatter and allows for wider regional views for motorists. Although visibility is still relatively low as there are no nearby houses and few elevated locations from which to view the highway.

The main natural landmarks are the forested ranges to the south, with the most recognisable peaks include Mount Neilson and Woodlands Hill to the west. The higher Mount Wambo is located to the far south-west. Hollydene Estate is a local cultural landmark which nestles on a hill close to the highway, displaying its vineyards, tree lined avenue and buildings. The gateways to the thoroughbred studs are also a feature along this section of highway.

6.7.3 Potential impacts

**Construction**

Short term visual impacts include earthworks, generation of waste, traffic barriers and temporary signage would result in a more cluttered streetscape.

Construction worksites would be restored following the completion of construction. Measures to ameliorate the impacts are summarised in Section 6.7.4.
Operation

Landscape character

The completed proposal would have impacts on landscape character, such as minor long term impacts on visual amenity from the clearing of vegetation and the road widening and additional climbing lanes. These are summarised in Table 6-37 for each LCU.

<table>
<thead>
<tr>
<th>LCU 1: Eastern foothills and plain landscape</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact</td>
</tr>
<tr>
<td>Sensitivity</td>
</tr>
<tr>
<td>Magnitude</td>
</tr>
<tr>
<td>Overall impact</td>
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<td></td>
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</tr>
</tbody>
</table>
The overall impact to this LCU would be Moderate to low.

LCU 2: Central hilly landscape

<table>
<thead>
<tr>
<th>Impact</th>
<th>Landscape character impact</th>
<th>LCU photo (Envisage, 2018)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>Magnitude</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Overall impact</td>
<td>Moderate to low</td>
<td></td>
</tr>
</tbody>
</table>

This rural, hilly landscape is a common one along the Golden Highway. It has no particular scenic or natural conservation values, however, it is part of a wider culturally important landscape frequented by tourists and has Moderate sensitivity to change. The magnitude of change to this LCU is considered Low. The main change to the landscape character in this section would be:

- Widened road shoulders and overtaking lane
- Widening of a low cutting near the top of the first ridge, west of Hollydene Estate, which would lead to the removal of some small native trees
- Road widening mostly on existing embankments or through low cuttings where there is limited vegetation and therefore the landscape change would still appear as a rural, hilly landscape.

The overall impact to this LCU is Moderate to low.

LCU 3: Saddlers Creek plain landscape

<table>
<thead>
<tr>
<th>Impact</th>
<th>Landscape character impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>Moderate</td>
</tr>
<tr>
<td>Magnitude</td>
<td>Low</td>
</tr>
</tbody>
</table>

As per LCU 2, LCU3 has no particular scenic or natural conservation values however it is part of a wider landscape, and has a moderate sensitivity to...
<table>
<thead>
<tr>
<th>Impact</th>
<th>Landscape character impact</th>
<th>LCU photo (Envisage, 2018)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall impact</td>
<td>Moderate to low change. The magnitude of change to this LCU is considered Low. The main change to the landscape character in this section would be:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Minimal change alongside Godolphin’s frontage. Although the main widening would occur along the closest, southern side of the horse stud, the landform change would be minimal and existing trees on the southern side would not be impacted</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- The existing bridge over Saddlers Creek would remain and there would be minimal change on either side of the creek, with limited vegetation impacted</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- The overall impact to this LCU is Moderate to low.</td>
<td></td>
</tr>
</tbody>
</table>

**Visual impacts**

The potential visual impacts of the proposal were assessed for four KVs in terms of the viewpoint’s sensitivity to change and the magnitude of the proposed changes that would be seen from the viewpoint. As outlined in **Section 6.7.2**, the KV represents the road users, residents, workers and visitors to the properties located within the proposal area. The visual impact on the KVs are summarised in **Table 6-38**.

This section of the Golden Highway in which the proposal is located, fits well into the existing landscape, reflecting the undulating to hilly landform and winding through the local ridgelines. There are opportunities for regional views towards the higher forested hills, particularly the higher peaks seen to the west. Due to its role as a regional highway, viewpoints from the Golden Highway have been assessed as having a moderate sensitivity.
Table 6-38 Visual impact assessment

<table>
<thead>
<tr>
<th>Impact</th>
<th>Comment</th>
<th>Photo of KV (Envisage, 2018)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KV -1: Coolmore Stud</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Moderate</td>
<td>Coolmore Stud is situated at the far eastern end of the proposal, and although the property entry is just east beyond the proposal area, its close proximity presents key viewpoints to be considered. The closest building to the highway is the stud’s administration centre, set in manicured gardens with a treed avenue stretching from the imposing gateway on the highway. Alongside the front fence are a band of mature trees, with many of these trees deciduous, and therefore during winter months, when the trees have no leaves, there are clearer views to and from the property. Considering the land use and prominence of this business, and its proximity to the proposal, the visual sensitivity of this viewpoint would be considered Moderate. The magnitude of change seen from the closest part of the property would be Low. There are a number of large eucalypt trees located along the edge of the existing highway which would potentially be impacted by the small side fill embankment. The overall visual impact level is assessed as Moderate to low.</td>
</tr>
<tr>
<td>Magnitude</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Overall impact</td>
<td>Moderate to low</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KV-2: Rural property</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Moderate</td>
<td>Two residences are located at the eastern end of the proposal area on the northern side of the existing highway. There are separate driveways to each of the residences that are lined with native trees, as well as a band of large eucalypts along the front fence that are within the road corridor. The trees along the highway serve to screen views of the highway from the houses and other parts of the property. The trees add to the amenity of that view and that of the highway. Based on the proximity to the proposal and residential use, the visual sensitivity of this viewpoint is considered Moderate. The loss of the large Eucalypts along the front fence would reduce screening of the highway, although other substantial trees along the two driveways and around the houses would continue to provide a high degree of screening. The loss of these trees would be a negative outcome for the residents. If these Eucalypts are to be impacted suitable mitigation measures, such as replacing these trees, would be discussed and agreed with the landowner.</td>
</tr>
<tr>
<td>Magnitude</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>Overall impact</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>Impact</td>
<td>Comment</td>
<td>Photo of KV (Envisage, 2018)</td>
</tr>
<tr>
<td>--------</td>
<td>---------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td></td>
<td>However, taking into account the extent of other trees on the property, the magnitude of change seen from the residences has been assessed as being Moderate. The overall visual impact would be moderate.</td>
<td><img src="image" alt="Photo of KV (Envisage, 2018)" /></td>
</tr>
</tbody>
</table>

**KV- 3: Hollydene Estate**

| Sensitivity | Moderate | Hollydene Estate is situated on the side of the first hill on the southern side of the highway, when travelling for the direction of Jerry Plains: A cluster of main buildings can be seen from the highway set within a landscape of vineyards. The main buildings include a restaurant and cellar door surrounded by attractive gardens and car parking. These are linked to the highway by a treed avenue. At the highway entrance is a substantial gateway feature. Based on the proximity to the proposal and the tourist reliant land use, the visual sensitivity of this viewpoint is considered Moderate. The proposal would widen the road on the opposite side of the estate, and would not affect the gateway nor the nearby trees, and so the magnitude would be Low. The overall impact would be Moderate to low. |
| Magnitude | Low | ![Photo of KV (Envisage, 2018)](image) |
| Overall impact | Moderate to low | |

**VK - 4: Godolphin Stud**

| Sensitivity | Moderate | Godolphin is thoroughbred stud which is situated at the far western end of the proposal near Saddlers Creek. The main visual element as seen from the highway are the substantial gates, fence and trees at the entrance to the property. Visual presentation is an important component of the thoroughbred business, as such the visual sensitivity of this viewpoint is considered Moderate. The front fence, gateway and band of native mature trees along the highway would not be impacted by the proposal. The main visual change would be a wider highway which would remove several metres of existing grass. The magnitude of visual changes is Low and the overall impact is Moderate to low. |
| Magnitude | Low | ![Photo of KV (Envisage, 2018)](image) |
| Overall impact | Moderate to low | |
As shown in Table 6-37 and Table 6-38 the landscape character and visual impact of the proposal would be moderate to moderate to low. The main impact would be due to the loss of planted eucalypts within the road corridor in front of the rural property identified as KV-2 within LCU1 and in the far eastern section of the proposal. If these Eucalypts are to be impacted suitable mitigation measures, such as replacing these trees, would be discussed and agreed with the landowner.

Overall, the proposal is considered to be in keeping with the scale and bulk of existing road infrastructure in the locality. There are a limited number of visual receptors within the locality and the visual changes would have adverse impact on only a small number of properties due to increased road surface and vegetation clearing.

Overall there would be a relatively low magnitude of change to views seen from the Golden Highway due to the proposal, with maximum cuttings of five metres high and a slight increase to fill embankments in places. The highway would be slightly wider with wider road shoulders throughout and some turning lanes in certain locations such as Edderton Road and property access points. Road users would not be expected to notice a substantial visual change.

6.7.4 Safeguards and management measures

Safeguards and management measures for landscape character and visual impacts are presented in Table 6-39.

Table 6-39 Safeguards and management measures – Landscape character and visual impacts

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Reference</th>
</tr>
</thead>
</table>
| Landscape character and visual impact | A Landscape Plan and specification will be prepared as part of the detailed design stage and implemented as part of the CEMP. The plan and specification will include design treatments for:  
  - Location and identification of existing vegetation and proposed landscaped areas, including species to be used  
  - Details of the staging of landscape works taking account of related environmental controls such as erosion and sedimentation controls and drainage  
  - Procedures for monitoring and maintaining landscaped or rehabilitated areas. The Landscape Plan will be prepared in accordance with relevant guidelines, including:  
    - Landscape Guideline (RTA, 2008)  
    - Shotcrete Design Guideline (RTA, 2005). | Roads and Maritime and Contractor | Detailed design / pre-construction | Standard safeguard |
<p>| Visual impact of work sites           | Project work sites, including construction areas and supporting facilities (such as)    | Contractor          | Construction            | Core standard   |</p>
<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual impact of work sites</td>
<td>Storage compounds and offices will be managed to minimise visual impacts, including avoiding temporary light spill if required, rehabilitation of disturbed areas, appropriate storage of equipment, parking, stockpile screening and arrangements for the storage and removal of rubbish and waste materials. Compound and ancillary facilities will be decommissioned and the sites rehabilitated to their existing condition or as otherwise agreed with the landowner on completion of works.</td>
<td>Contractor</td>
<td>Construction</td>
<td>safeguard UD2</td>
</tr>
</tbody>
</table>
| Vegetation and landscaping     | The Landscape Plan will consider where feasible:  
  - Property frontages affected by the proposal: All trees within five metres of the outer edge of the proposal area will be assessed by an arborist. If possible these trees should be retained and managed during construction. If the trees will be impacted suitable mitigation measures, such as replacing these trees, would be discussed and agreed with the landowner  
  - Retaining open views and fill embankments: Low native plants or pasture grasses will be used as ground cover  
  - Cutting treatments to be stabilised with low vegetation where practical  
  - The majority of landscape planting will use plants that are locally native (endemic) to the site and surroundings. Cultural plantings (i.e. non – native trees) have been identified as appropriate near Hollydene Estate.     |                 |                 |                          |
| Maintenance of the highway     | Ongoing maintenance, repair and replacement of any damaged built elements or failed vegetation will be carried out as part of normal road maintenance.                                                                                                                                                                                                                                                                                                   | Roads and Maritime | Operation       | Additional safeguard     |
6.8 Socio-economic and land use

The potential impacts of the proposal on the socio-economic environment, property and land use are assessed in this section, together with identification of measures to avoid, manage or mitigate potential impacts. The cumulative socio-economic impacts for the wider program of work to upgrade the Golden Highway as part of the Golden Highway Corridor Strategy have been assessed as part of the *Golden Highway Upgrade Cumulative Socio-economic Assessment* (Jacobs, 2018e), which is provided in Appendix H.

6.8.1 Methodology

The socio-economic assessment was prepared in accordance with Roads and Maritime’s *Environmental Impact Assessment Practice Note N05 – Socio-economic assessment* (Roads and Maritime, July 2013). The methodology for the preparation of the socio-economic and land use assessment involved a four stage process, as follows:

- Identifying the scope of assessment and defining the study area based on the likely range of potential socio-economic and land use impacts and the communities most likely to be affected by the proposal
- Assessing the existing socio-economic and land use characteristics, values and conditions in the study area, to provide a baseline from which potential benefits and impacts of the proposal can be assessed
- Identifying and evaluating the proposal’s potential impacts on the socio-economic and land use conditions and values of the study area as a result of construction and operation of the proposal
- Identifying safeguards and management measures to avoid, minimise or mitigate potential socio-economic and land use impacts identified in the assessment.

The assessment of existing socio-economic conditions and land uses of the proposal area principally draws on information from the Australian Bureau of Statistics (ABS) *Census of Population and Housing 2011*, supplemented with information and data from:

- Government agencies such as the NSW Department of Planning and Environment
- State Government and Muswellbrook Shire Council publications, including the Muswellbrook Shire Community Strategic Plan 2013-2023
- Muswellbrook Local Environment Plan 2009
- A desktop survey of businesses and properties located near the proposal
- Community and stakeholder consultation carried out for the proposal.

Community and stakeholder consultation is documented in Section 5 of the REF, the outcome of which has informed this assessment.

The study area for the assessment includes those communities that are likely to be affected by the proposals construction and operation. The study area has been identified as including the ABS Statistical Area Level (SA1) 112701 which includes the proposal area.

6.8.2 Existing environment

The proposal is located within the Muswellbrook LGA of the Upper Hunter Valley region about 130 kilometres northwest of Newcastle. The LGA covers over 3,400 square kilometres, of which 40 per cent is national parks (Muswellbrook Shire Council, 2016).
The LGA consists of two larger towns, Muswellbrook and Denman, as well as a number of outlining rural communities. The region is regarded for its prominent vineyards and international horse studs. The Golden Highway traverses the study area and provides for regional freight distribution servicing the surrounding agricultural and mining industries as well as providing a link between the Hunter and the central west.

There are a small number of residential dwellings located at the southern end of the proposal, at Hollydene Estate and on Woodlands Road. There are several direct property accesses onto the Golden Highway within the in the proposal area.

**Population and demographics**

Data is primarily sourced from the 2011 ABS Census, supplemented from other sources including NSW government agencies and Muswellbrook Shire Council.

Key findings of the demographics of the community within the study area can be summarised as follows:

- The study area (i.e., communities located within the ABS SA1 112701) comprised a population of 320 people in 2011.
- In the 10 years from 2005 to 2015, the population of the LGA grew by about 1.1 per cent per annum to 17,201 as of 2015, which was slightly lower than the overall rate of population growth for NSW.
- The study area has a younger population compared with the LGA and NSW, with the median age being 31 years compared with the median ages of 34 and 38 for the LGA and NSW respectively.
- Communities in the study area generally display lower levels of cultural diversity compared with the LGA and NSW.
- There are lower levels of vulnerability in the study area, with lower levels of people requiring assistance compared with the LGA and NSW, reflecting the younger population.
- The study area and LGA have slightly higher median household incomes compared with NSW, with the median household income of the study area standing at $1,375 per week compared with $1,237 per week for NSW as a whole.
- The dominant industry of employment for residents in the study area is categorised as agriculture, forestry and fishing (49 percent), reflecting the importance of the agricultural industry in the area (LGA 7.1 and 2.2 for NSW).
- More people participate in the labour force in the study area (82.4 per cent) compared with NSW (59.7 per cent), which is reflective of the younger population.
- A high proportion of workers in the study area (14.5 per cent) walk to work compared with workers of the LGA (4.2 per cent) and NSW (4.1 per cent), suggesting many residents reside at their place of employment.

**Social infrastructure**

There are no community facilities or social infrastructure located in the proposal area. Residents of the study area would be required to travel to nearby towns of Denman or Muswellbrook for community facilities, social infrastructure, retail and commercial services.

**Business and industry**

There are a small number of business and industry located in or adjacent to the proposal area.

At the southern end of the proposal is Coolmore Stud Farm, a commercial thoroughbred racehorse breeding operation. Access to the farm is via Golden Highway.
Located between Edderton Road and Coolmore Stud Farm is Hollydene Estate. This estate is open to the general public seven days per week and includes a cellar door and tasting rooms as well as a fine dining restaurant. The vineyard is operated with some diversification with beef cattle, wheat and grapes (Hollydene Estate Wines, 2016). Hollydene Estate is one of a number of wineries comprising the Upper Hunter Wine Trail. The customer base also includes ‘passing trade’, that is customers who access the estate because they see it while they are driving past. Access to the estate is via the Golden Highway.

At the northern end of the proposal located on Woodlands Road is Godolphin Horse Stud Farm. The farm currently operates as a private breeding program.

**Community values**

The study areas rural uses and landscapes are important to the character and identity of the area, while the rural amenity and lifestyles are valued by the local communities. Residents of the LGA value the community in which they live and its rural atmosphere Generally residents feel the LGA is a safe and friendly place (Muswellbrook Shire Community Strategic Plan 2013-2023).

During consultation for the Muswellbrook Shire Community Strategic Plan, many residents identified improvements to the roads as being a key issue they would like to see addressed over the next 10 to 15 years.

**Property and land use**

The proposal area is surrounded by agricultural land which is predominately grazing land and cleared of native vegetation. Land use next to the proposal area is primary production (Muswellbrook Local Environment Plan, 2009). The land zoning is discussed in **Section 4.1.2.**

**The Golden Highway regional context**

The Golden Highway connects the Hunter region to the east with the Central West and Orana region to the west. The Hunter and Central West and Orana regions are characterised by wineries, coal mining, agricultural production and regional and rural communities. Reflecting this, the Golden Highway serves as an important transport network for rural and regional communities, business and industry, and tourism.

Locally, the Golden Highway serves as an important road network for communities between Belford and Dubbo. It traverses the townships of Denman, Merriwa and Dunedoo, and the rural communities of Belford, Jerrys Plains, Sandy Hollow, Cassilis, Elong and Ballimore.

**The Hunter Region Profile**

The Hunter region has traditionally been known for coal mining and horse breeding, although in recent times, the region has developed a reputation for food and wine production. Key regional towns near to the study corridor include Singleton and Muswellbrook. These are identified in the Hunter Regional Plan 2036 as important strategic centres in the region and as the focus for population and/or economic growth over the next 20 years.

Singleton and Muswellbrook have traditionally been centres of primary production, with beef cattle properties, dairy farms and vineyards, coal mining and related industries. The Singleton LGA is the largest producer of coal in NSW with approximately 20 coal mining operations (Singleton Council, 2017). Muswellbrook LGA accommodates a range of coal mining activities and important agricultural areas including 26 stud farms and five open cut mine operations.
The Hunter region has the largest economy in regional NSW. In 2013, it contributed $38.5 billion to Gross Regional Product (GRP), representing 28 per cent of regional NSW’s total GRP (Hunter Economic Profile, 2013). The top three industries by contribution to GRP in 2013 included: mining (14.7 per cent); manufacturing (9.5 per cent); and health care and social assistance (6.7 per cent) (Hunter Economic Profile, 2013). The Port of Newcastle is a vital hub for exporting agricultural produce and coal to new markets throughout Asia.

The Hunter region also has a significant tourism industry, receiving nearly 3.4 million domestic and international overnight visitors, and 6.6 million domestic daytrip visitors in the year to December 2016 (Destination NSW, 2016). Major tourist attractions include wineries, the Werakata and Wollemi National Parks and Lake Macquarie.

6.8.3 Potential impacts

Construction

The Golden Highway Upgrade would have beneficial impacts for regional and local communities through reduced traffic congestion, improved access and connectivity, and improved road safety. However, during construction there would be both temporary localised and regional cumulative impacts on the community, businesses and industry, due to construction of the project and concurrent construction works associated with the Golden Highway Upgrade. These are discussed in further detail below.

Property impacts

Property acquisition and land use

As discussed in Section 3.6 and outlined in Table 3-7, the proposal would require the partial acquisition or adjustment of four properties. The extent of partial property acquisition is about 35,405 square metres. Property adjustment impacts include relocating property boundary fencing, driveway adjustments and loss of roadside vegetation.

Some temporary leases of land would be required during construction to accommodate the ancillary sites.

Local impacts

Access and connectivity

During construction, potential impacts on access and connectivity in the study area would generally relate to:

- Traffic delays and disruptions for motorists and other road users along the Golden Highway due to the implementation of traffic management measures, such as temporary lane closures or stoppages and reductions in speed limits. These impacts would be temporary
- Increased construction traffic on the Golden Highway, including light and heavy vehicles used to deliver equipment, materials and spoil, and construction workers accessing the work site. These impacts would be temporary
- Changes to access arrangements for private property access for residents. Access to private properties would be maintained during construction. Where temporary changes are required, suitable access arrangements would be implemented in consultation with affected property owners
- Edderton Road is a key route to Muswellbrook. Construction activity and increased construction traffic may obstruct signage to Edderton Road for visitors to the area. Road signage would be maintained at all times to ensure ease of access
Temporary relocation or modification of informal bus stops at the Edderton Road intersection and near Woodlands Road within the proposal area, as well as temporary impacts to school bus services

Construction activity and increased construction traffic may obstruct signage to Hollydene Estate for visitors to the area. Access and signage to Hollydene Wine Estate would be maintained at all times to ensure customers ease of access to the business. Where temporary changes are required, these would be identified in consultation with Hollydene Estate to ensure that potential impacts are appropriately managed.

**Local business and industry**

During construction, potential impacts on local business and industry would arise from:

- Temporary impacts to freight efficiency and oversize freight scheduling
- Temporary traffic disruptions and construction activities reducing connectivity to Hollydene Wine Estate
- Increased noise, dust and construction traffic, impacting on amenity at businesses near the proposal
- An analysis of the monetary impact caused by delays to both heavy vehicle drivers and freight within the proposal area, indicates that construction would have an estimated delay cost of about $116,813
- Customers visiting Hollydene Wine Estate would expect to face amenity impacts associated with construction as they travel to the facilities including the restaurant, cellar door and carpark.

**Amenity**

Construction of the proposal may affect the local amenity for nearby sensitive receivers, such as noise impacts to residential dwellings to the east of the Edderton Road intersection and potentially the Hollydene Estate during standard construction hours and out-of-hours works (refer to Section 6.4.4). Amenity impacts may also be experienced by other residents located close to construction work and compounds due to increased noise and dust from construction activities and increased traffic, including heavy vehicles. Mitigation measures to minimise noise and dust impacts are provided in Sections 6.4.5 and Section 6.9 respectively.

**Regional impacts**

**Access and connectivity**

As described in Section 6.1.2, the construction of the proposal would affect access and connectivity in the region for motorists, business owners, bus services to Denman and surrounding areas including school bus services, regional freight and commercial traffic. The potential cumulative delay along the Golden Highway due to multiply project construction concurrently would be in the order of up to 31 minutes between the New England Highway and Dubbo. Traffic impacts and mitigation measures to minimise traffic impacts are discussed in Section 6.1.2 and Section 6.1.3 respectively.

**Business and industry**

During construction, potential impacts on business and industry in the region would arise from:

- Reduced access to employment (i.e. to coal mines, farms, wineries) due to some residents choosing to use alternative, and potentially longer routes, to avoid using the Golden Highway
- Reduce access to tourist destinations and small businesses in the region, including wineries, cafes, and retail in townships which may discourage some road users from making the journey
- Incur greater costs to business and industry in the region due to increase in travel times for freight and commercial traffic.

An analysis of the potential monetary impacts caused by cumulative delays to both heavy vehicle drivers and freight was carried out. Overall it was calculated that the costs of delays along the Golden Highway
would be up to about $353,693 (based on increased travel times) due to multiple projects being constructed concurrently.

As outlined above, potential cumulative delays to road users would be up to 31 minutes along the length of the Golden Highway. Notification of communities and road users about potential delays and disruptions would assist in helping people plan their journeys and minimise potential impacts on travel times, as discussed in Section 6.1.3.

Amenity

During construction, potential cumulative impacts on community values and safety in the region would generally relate to:

- ‘Construction fatigue’ for local residents and road users due to multiple construction activities being carried out over an extended period
- Disruptions and travel delays for motorists and freight due to changed traffic conditions
- Reduced perceptions of safety along the road corridor, with some road users choosing to use alternative routes along local, lower order roads which may be perceived to be more dangerous
- Increased costs to business and industry due to delays and disruptions to freight movements
- Reduced emergency response times for emergency services vehicles, including police, ambulance, and fire and rescue services utilising the Golden Highway
- Potential cumulative impacts on emergency service response times would affect service vehicles along the length of the Golden Highway. This may require changes to some emergency service operations during construction.

Operation

Access and connectivity

As discussed in Section 2.5 the proposal would generally improve access and connectivity to community services and facilities within or near the study area through improved travel times, freight efficiency and road safety. This would have beneficial impacts for local communities and workers as well as communities across the broader Muswellbrook Shire and Upper Hunter region.

Business and industry impacts

At a regional level, the proposal would have beneficial impacts on business and industry through improved access and connectivity. In particular, the proposal would improve travel times and reliability for freight and commercial vehicles, reducing transport costs.

Locally, the proposal would improve road safety and accessibility through the upgrade of intersections to Woodlands Road and to Hollydene Estate, supporting general improvements to local business and industry in the study area.

Amenity

The operation of the proposal would improve access and connectivity for freight and would improve amenity for local communities by providing safer and more efficient travel to the community, which in turn may encourage the wider use of regional facilities and community networks.
6.8.4 Safeguards and management measures

Safeguards and management measures for socio-economic and landuse impacts are presented in Table 6-40.

**Table 6-40 Safeguards and management measures – Socio-economic and land use**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socio-economic</td>
<td>A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum): • Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions • Contact name and number for complaints • Mechanisms to share issues raised by stakeholders with other Golden Highway Upgrade projects • The CP will be prepared in accordance with the <em>Community Involvement and Communications Resource Manual</em> (RTA, 2008). Coordination with other Golden Highway Upgrade projects’ CP will be carried out to ensure consistency in the information provided to the community during construction.</td>
<td>Contractor</td>
<td>Detailed design / pre-construction</td>
<td>Core standard safeguard SE1</td>
</tr>
<tr>
<td>Property acquisition</td>
<td>All property acquisition will be carried out in accordance with the <em>Land Acquisition Information Guide</em> (Roads and Maritime, 2012) and the <em>Land Acquisition (Just Terms Compensation) Act 1991</em>.</td>
<td>Roads and Maritime project manager</td>
<td>Pre construction / detailed design</td>
<td>Core standard safeguard PL1</td>
</tr>
<tr>
<td>Emergency vehicle access</td>
<td>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.</td>
<td>Roads and Maritime and Construction Contractor</td>
<td>Pre construction / detailed design</td>
<td>Additional safeguard SE2</td>
</tr>
<tr>
<td>Consultation - property owners</td>
<td>Consultation will be carried out with all affected property owners during detailed design and construction to develop and implement measures to mitigate impacts on their property.</td>
<td>Roads and Maritime and Construction Contractor</td>
<td>Pre construction / detailed design</td>
<td>Additional safeguard SE5</td>
</tr>
<tr>
<td>Complaints</td>
<td>A complaints handling procedure and register will be included in the CEMP.</td>
<td>Construction Contractor</td>
<td>Construction</td>
<td>Additional safeguard SE8</td>
</tr>
</tbody>
</table>
Other safeguards and management measures that would address socio-economic impacts are identified in Section 6.1 (Traffic and transport), Section 6.4 (Noise and vibration), Section 6.10 (Air quality) and Section 6.17 (Landscape character and visual amenity).
6.9 Waste

6.9.1 Policy setting

The WARR Act promotes waste avoidance and resource recovery by developing waste avoidance and resource recovery strategies and programs. Roads and Maritime endeavours to reduce and manage waste to conserve resources and reduce impacts associated with waste disposal through the implementation of the waste management hierarchy established under the WARR Act as follows:

- **Waste Avoidance** – Take action to avoid the generation of waste and to be more efficient in its use of resources. If unable to avoid generating waste, then reduce the amount of waste generated and reduce the toxicity or potential harm associated with its generation and management
- **Resource Recovery** – Maximise the reuse, reprocessing, recycling and recovery of energy from materials
- **Disposal** – Disposal is the least desirable option and must be carefully handled to minimise negative environmental outcomes.

6.9.2 Potential impacts

*Construction*

Construction would generate waste streams typical of road construction, including:

- Green waste from cleared vegetation
- Road construction materials from construction of the widened road
- Bitumen, concrete and asphalt from removal of any existing road surfaces
- Roadside materials (ie. guide posts, guard rails, traffic signage)
- Excess fill material from any excavation of soils and fill embankments during construction
- Construction wastes created from the demolition of old road pavement from the Golden Highway
- Oil, grease and other liquid wastes from the maintenance of construction plant and equipment
- General wastes and sewage from site compounds and offices
- Plant and equipment maintenance waste including liquid wastes from cleaning, repairing and maintenance
- Packaging materials from items delivered to site, such as pallets, crates, cartons, plastics and wrapping materials.

Any remaining surplus material would be stockpiled in a suitable location for use by Roads and Maritime on future projects, or disposed of to a licenced facility following validation assessment of the type of spoil waste classification. Allowance would be made at the proposed ancillary sites for initial stockpiling of surplus material, either for re-use elsewhere on the site, or prior to its disposal. Sufficient space exists across the proposed ancillary sites to accommodate material stockpiles, and these would be managed in accordance with the contractor’s construction management plan and environmental management plan. Surplus material that cannot be used within the proposal area would be reused on other projects along the Golden Highway or disposed of in the following order of priority:
- Transferred to other Roads and Maritime projects for reuse in accordance with the NSW Environmental Protection Authority (EPA) Excavated Public Road Material resource recovery exemption
- Transferred to an approved Roads and Maritime stockpile site for future re-use, only if a specific project has been identified before stockpiling and Protection of the Environment Operations Act 1997 (POEO Act) waste regulatory requirements have been met. If a project cannot be identified the material would not be stockpiled within the proposal
- Transported off site for reuse by a third party in accordance with a relevant EPA resource recovery exemption or planning approval
- Disposed of at an approved materials recycling or waste disposal facility.

As otherwise provided for by the relevant waste legislation.

The quantities of each type of waste would be defined during detailed design. In addition, as detailed in Section 4.2.1, an EPL may be required for the proposal.

### 6.9.3 Safeguards and management measures

Measures to manage the potential waste from the proposal are summarised in Table 6-41.

#### Table 6-41 Summary of mitigation measures - waste

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Reference</th>
</tr>
</thead>
</table>
| Waste  | - A Waste Management Plan will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to:  
  - Measures to avoid and minimise waste associated with the project  
  - Classification of wastes generated by the project and management options (re-use, recycle, stockpile, disposal)  
  - Classification of wastes received from off-site for use in the project and management options  
  - Identifying any statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions  
  - Procedures for storage, transport and disposal  
  - Monitoring, record keeping and reporting, including any documentation management obligations arising from resource recovery exemptions.  
  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, as well as the adopting the Resources | Contractor | Pre construction / detailed design | Section 4.2 of QA G36 Environment Protection |
<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Hierarchy principles of the WARR Act.</td>
<td></td>
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</tr>
<tr>
<td>Existing condition of ancillary sites</td>
<td>Prior to land being used for ancillary construction purposes (compounds, storage, parking, etc) a pre-construction land assessment will be carried out to identify the presence of any pre-existing wastes.</td>
<td>Contractor</td>
<td>Pre construction / detailed design</td>
<td>Core standard safeguard W2</td>
</tr>
<tr>
<td>Excavated material</td>
<td>Opportunity to reuse material between Golden Highway upgrades will be considered to minimise waste to landfill. This is should be viable where the is excessive cut material at Ogilvies Hill and a deficit of cut to fill material for the proposal.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Final condition of ancillary sites</td>
<td>A post-construction land assessment will be carried out of land that was used for ancillary construction purposes (compounds, storage, parking, etc) to determine the suitability for hand-back to the landowner.</td>
<td>Contractor</td>
<td>Post construction / operation</td>
<td>Additional standard W12</td>
</tr>
</tbody>
</table>
### 6.10 Other impacts

#### 6.10.1 Existing environment and potential impacts

<table>
<thead>
<tr>
<th>Environmental factor</th>
<th>Existing environment</th>
<th>Potential impacts</th>
</tr>
</thead>
</table>
| Non-Aboriginal Heritage | Searches of the following databases were conducted on 12 July 2016:  
- RTA section 170 register  
- NSW Heritage database  
- Commonwealth EPBC heritage list  
- Australian Heritage Places Inventory  
- Singleton Local Environmental Plan (LEP) 2013 and Muswellbrook (LEP) 2009.  
One heritage item, ‘Arrowfield Estate’ listed as locally significant on the Singleton LEP 2013 was identified about 400 metres to the southeast of the proposal. | Impacts to non-Aboriginal heritage as a result of construction and operation of the proposal would not be expected, as heritage items were not identified within the proposal area. |
| Air quality and greenhouse gas | Ambient air quality at the proposal are influenced by local sources including traffic along the Golden Highway, as well as regional influences arising from mining and extractive activities within the Upper Hunter. The main air pollutants from motor vehicles are carbon monoxide (CO), nitrogen dioxide (NO₂) and fine particles (PM₁₀, i.e. particulate matter with equivalent aerodynamic diameters of less than 10 microns), whereas deposited dust and particulate matter are the primary pollutants associated with regional influences. | During construction air quality impacts would potentially occur in the vicinity of the proposal and would be dependent upon atmospheric conditions. The proposal would have potential to generate dust earth works, stockpiles and the use of imported fill. Levels of air borne dust would be expected to below level and unlikely to cause concern to sensitive receivers (the nearest sensitive receive is located 100 metres from the proposal). Construction equipment and plant would emit exhaust fumes and would contribute to local air quality. However, in the context of the existing vehicular movements along the Golden Highway and given the short duration of the construction period, this was considered to be negligible. |
### 6.10.2 Safeguards and management measures

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</table>
| Air quality                   | An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to:  
  - Potential sources of air pollution  
  - Air quality management objectives consistent with any relevant published EPA and/or OEH guidelines  
  - Mitigation and suppression measures to be implemented  
  - Methods to manage work during strong winds or other adverse weather conditions  
  - A progressive rehabilitation strategy for disturbed areas.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Contractor    | Detailed design / pre-construction | Core standard safeguard AQ1  
  Section 4.4 of QA G36 Environment Protection                                                                                                           |               |                               |                                                                                                     |
| Utilities                     | Prior to the start of works:  
  - The location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners  
  - If the scope or location of proposed utility relocation works falls outside of the assessed proposal scope and footprint, further assessment will be carried out.                                                                                                                                                                                                                                                                                                                                                   | Contractor    | Detailed design / pre-construction | Core standard safeguard U1  
  Section 4.10 of QA G36 Environment Protection                                                                                                           |               |                               |                                                                                                     |
| Non-Aboriginal Heritage       | - The *Standard Management Procedure - Unexpected Heritage Items* (Roads and Maritime, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered  
  - Work will only re-commence once the requirements of that Procedure have been satisfied.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Contractor    | Detailed design / pre-construction | Core standard safeguard HAZ1  
  Section 4.10 of QA G36 Environment Protection                                                                                                           |               |                               |                                                                                                     |
| Hazards and risk management   | A Hazard and Risk Management Plan (HRMP) will be prepared and implemented as part of the CEMP. The HRMP will include, but not be limited to:  
  - Details of hazards and risks associated with the activity  
  - Measures to be implemented during construction to minimise these risks  
  - Record keeping arrangements, including information on the materials present on the site, material safety data sheets, and personnel trained and authorised to use such materials                                                                                                                                                                                                                                                                                                                                                                              | Contractor    | Detailed design / pre-construction | Core standard safeguard HAZ1  
  Section 4.10 of QA G36 Environment Protection                                                                                                           |               |                               |                                                                                                     |
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<tbody>
<tr>
<td></td>
<td>• A monitoring program to assess performance in managing the identified risks</td>
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<td></td>
<td>• Contingency measures to be implemented in the event of unexpected hazards or risks</td>
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<td></td>
<td>arising, including emergency situations</td>
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<td></td>
<td>• The HRMP will be prepared in accordance with relevant guidelines and standards,</td>
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<td></td>
<td>including relevant Safe Work Australia Codes of Practice, and EPA or OEH publications.</td>
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</table>
6.11 Cumulative impacts

Cumulative impacts have the potential to arise from the interaction of individual elements within the proposal and the additive effects of the proposal with other external projects. Roads and Maritime is required under clause 228(2) of the Environmental Planning and Assessment Regulation 2000, to take into account potential cumulative impacts as a result of the proposal.

6.11.1 Study area

The study area used for the assessment of cumulative impacts has been defined by identifying other developments or activities that are under way now within 20 kilometres of the proposal, or are likely to commence during the proposals scheduled construction timeframe. Construction of the proposal would begin in late 2018.

6.11.2 Broader program of work

As outlined in Section 2.1, the proposal originated as part of a wider program of work to upgrade the Golden as part Golden Highway Corridor Strategy. The closest project as part of this programme of work is Ogilvies Hill upgrade located about five kilometres to the west. The proposal and the Ogilvies Hill upgrade would be constructed concurrently.

Many of these projects would overlap with the construction timeframe of the proposal (refer to Table 6-42). As described in the Golden Highway Road User Delay Traffic Management Summary Report (GHD, 2017) the highest average cumulative delay per trip would be 31 minutes, which would be experienced by eastbound traffic in the afternoon peak hour. The cumulative delay would be the greatest in August 2019 when all the projects would be construction at the same time. The highest worst case cumulative delay per trip would be 42 minutes, which is experienced by eastbound traffic in the PM peak hour. Refer to Section 6.1.2.

6.11.3 Other projects and developments

Other approved developments around the proposal that have the potential to overlap include:

- Dolwendee Quarry Project: located about 15 kilometres west of the proposal
- Drayton South Coal Project: this projects boundary follows the Golden highway road corridor boundary within the study area. The current determination for his project is refused, However this could change in the near future
- Mount Arthur Coal: located about six kilometres from the proposal. Approval for the extension of this project has been granted with conditions.

6.11.4 Potential impacts

In terms of cumulative impact, this proposal would most likely be perceived as part of a larger, staged overall upgrade of the Golden Highway, with the effects from construction being similar for all receivers located near to the proposal. Property owners, residents, businesses local along the Golden Highway and road users would experience extended periods of disruptions related to road construction and likely to experience ‘construction fatigue’ due to extended periods of disruption caused by construction activities, construction traffic, noise and dust, interruptions to access, and occasional night-time construction work.
The likely cumulative impacts of the proposal, other projects and developments during construction and operation are summarised in Table 6-42.

### Table 6-42 Potential cumulative impacts

<table>
<thead>
<tr>
<th>Environmental factor</th>
<th>Construction</th>
<th>Construction</th>
<th>Operation</th>
</tr>
</thead>
</table>
| Traffic and transport | As a result of the proposal and other nearby proposals that form part of the Golden Highway Corridor Strategy within a similar time period. There is potential for impacts on traffic and transport to be greater than those that were identified for the proposal in isolation. Impacts would primarily be a result of road and lane closures and an increase in construction-related traffic. Potential cumulative impacts would include:  
  - Increased travelling time on the road network  
  - Reduced traffic speeds on the road network  
  - Increased construction traffic volumes along the highway  
  - Impacts to oversize freight scheduling. | | The proposal and other road upgrades along the Golden Highway would have a positive cumulative impact on travel times and road safety resulting in an improved transport corridor. |

| Biodiversity | Long-term plans for Golden Highway and other individual projects that would contribute to the loss of endangered species and EECs. The proposal would result the removal of about 1.34 hectares of Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions EEC. When considered in the context of the locality (the area within 10 kilometres of the proposal) the proportional impact is small. However, when considered in the context of other proposed developments within the study area, the cumulative impacts to endangered species and EECs would be potentially be larger than determined for the proposal, in terms of the already cleared nature of the region. | | No cumulative impact is anticipated during operation of the proposal. |

| Visual amenity | Multiple construction activities would have a cumulative impact on the visual amenity of the Golden Highway for the road user as they would pass multiple works sites. Earthworks, construction compounds, stockpile sites, and construction machinery would be highly visible. | | Overall, the proposal would be considered to be in keeping with the scale and bulk of existing road infrastructure. |

| Social impacts | Cumulative impacts would mainly be associated with changes to road conditions during construction across multiple projects resulting in temporary delays and disruptions, and subsequent impacts on people’s access to employment, services and facilities, and movement of freight. Multiple construction activities over an extended period would also likely result in ‘construction fatigue’ for local residents and road users. | | The proposal and other planned road upgrades as part of the Golden Highway Strategy would have a positive cumulative impact on travel times, freight efficiency and road safety. |
The proposal would involve earthworks, with the overall aim of maximising the re-use of material on site or between projects along the Golden Highway. There are opportunities to move material excavated material between projects to another projects for another for fill material. This would help reduce on material going to landfill.

No cumulative impact is anticipated during operation of the proposal

### 6.11.5 Safeguards and management measures

Measures to manage cumulative impacts are proved in Table 6-43.

Table 6-43 Summary of mitigation measures for cumulative impacts

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative impacts from construction of multiple projects</td>
<td>The CEMP will be updated as required to address cumulative impacts as other projects/activities begin. This will include a process to review and update mitigation measures as new work begins or if complaints are received.</td>
<td>Contractor</td>
<td>Pre-construction Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Cumulative traffic and access impacts</td>
<td>The TMP will be prepared in consultation with the Transport Management Centre and Muswellbrook Shire Council.</td>
<td>Contractor</td>
<td>Pre-construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Cumulative construction impacts</td>
<td>To minimise potential impacts during construction, construction of the proposal would be staged to enable work to be completed safely while maintaining traffic flows at all times. Construction would involve building one lane at a time, and moving the traffic between the lanes to keep the traffic flows for the duration of work. This approach will ensure that negative cumulative impacts on both the function of the Golden Highway and the surrounding environment will be minimised where possible.</td>
<td>Roads and Maritime</td>
<td>Detailed design, pre-construction</td>
<td>Additional safeguard</td>
</tr>
</tbody>
</table>
7. Environmental management

This chapter describes how the proposal will be managed to reduce potential environmental impacts throughout detailed design, construction and operation. A framework for managing the potential impacts is provided. A summary of site-specific environmental safeguards is provided and the licence and/or approval requirements required prior to construction are also listed.

7.1 Environmental management plans (or system)

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

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

The CEMP will be prepared prior to construction of the proposal and must be reviewed and certified by the Roads and Maritime Environment Officer, Hunter Region, prior to the start of any on-site works. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in accordance with the specifications set out in:

- QA Specification G36 – Environmental Protection (Management System)
- QA Specification G38 – Soil and Water Management (Soil and Water Plan)
- QA Specification G40 – Clearing and Grubbing
7.2 Summary of safeguards and management measures

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

Table 7-1: Summary of safeguards and management measures

<table>
<thead>
<tr>
<th>No.</th>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
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</table>
| GEN1| General - minimise environmental impacts during construction | A CEMP will be prepared and submitted for review and endorsement of the Roads and Maritime Environment Manager prior to commencement of the activity. As a minimum, the CEMP will address the following:  
  - Any requirements associated with statutory approvals  
  - Details of how the project will implement the identified safeguards outlined in the REF  
  - Issue-specific environmental management plans  
  - Roles and responsibilities  
  - Communication requirements  
  - Induction and training requirements  
  - Procedures for monitoring and evaluating environmental performance, and for corrective action  
  - Reporting requirements and record-keeping  
  - Procedures for emergency and incident management  
  - Procedures for audit and review.  
  The endorsed CEMP will be implemented during the undertaking of the activity. | Contractor / Roads and Maritime project manager | Pre-construction / detailed design | Core standard safeguard GEN1 |
<p>| GEN2| General - notification                      | All businesses, residential properties and other key stakeholders (e.g. schools, local councils) affected by the activity will be notified at least five business days prior to the start of the activity. | Contractor / Roads and Maritime project manager | Pre-construction | Core standard safeguard GEN2 |</p>
<table>
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<tr>
<th>No.</th>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
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</thead>
</table>
| GEN3  | General – environmental awareness | All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular "toolbox" style briefings. Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include:  
- Areas of Aboriginal heritage sensitivity  
- Aboriginal heritage management including unexpected finds procedures  
- Threatened species habitat and EEC.  
Records of training will be maintained by the contractor, including details of staff attending, dates, nature of training provided, and training provider(s) used. | Contractor / Roads and Maritime project manager | Pre-construction / detailed design | Core standard safeguard GEN3 |
| GEN4  | General – environmental awareness | Standard construction hours:  
- Monday to Friday 7.00 am to 6.00 pm  
- Saturdays 8.00 am to 1.00 pm  
- No construction on Sundays or Public Holidays.  
Works outside standard construction hours (including those detailed within this REF) will be carried out in accordance with the management and mitigation measures detailed within the Noise and Vibration Management Plan. | Contractor | Construction | Core standard safeguard GEN4 |
<p>| GEN5  | General – environmental awareness | The RMS Project Manager will notify the RMS Environment Manager at least five business days prior to the start of the activity. The notification will include a copy of any local community notification carried out (GEN2). | Contractor | Pre-construction / detailed design | Additional safeguard GEN7 |
|       | <strong>Traffic and transport</strong>       | <strong>A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Roads and Maritime <em>Traffic Control at Work Sites Manual</em> (RTA, 2010) and QA</strong> | Contractor | Detailed design / Pre-construction | Core standard |</p>
<table>
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<th>Responsibility</th>
<th>Timing</th>
<th>Reference</th>
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</thead>
<tbody>
<tr>
<td>TT-2</td>
<td>Property access - pre-construction</td>
<td>Requirements for any changes to local access arrangements will be confirmed during detailed design in consultation with the local road authority and any affected landowners.</td>
<td>Roads and Maritime</td>
<td>Pre construction / detailed design</td>
<td>Additional standard safeguard TT3</td>
</tr>
<tr>
<td>TT-3</td>
<td>Notifications to landowners</td>
<td>Disruptions to property access and traffic will be notified to landowners at least five business days in accordance with the relevant community consultation processes outlined in the TMP.</td>
<td>Roads and Maritime and Construction Contractor</td>
<td>Pre Construction / Construction</td>
<td>Additional standard safeguard TT4</td>
</tr>
<tr>
<td>TT-4</td>
<td>Property access - during construction</td>
<td>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 and the relevant local road authority.</td>
<td>Roads and Maritime and Construction Contractor</td>
<td>Construction</td>
<td>Additional standard safeguard TT5</td>
</tr>
</tbody>
</table>

*Specification G10 Control of Traffic* (Roads and Maritime, 2008). The TMP will include:
- Confirmation of oversize haulage routes and/or detours
- Measures to maintain access to local roads and properties
- Site specific traffic control measures (including signage) to manage and regulate traffic movement
- Requirements and methods to consult and inform the local community of impacts on the local road network
- Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads
- A response plan for any traffic incidents within the construction zone
- 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.
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<tbody>
<tr>
<td>TT-5</td>
<td>Reduce speeds, traffic delays and disruptions during construction</td>
<td>Road users, local communities and the freight industry will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.</td>
<td>Roads and Maritime and Construction Contractor</td>
<td>Construction</td>
<td>Additional standard safeguard TT5</td>
</tr>
<tr>
<td>TT-6</td>
<td>Disruption to public transport, including school bus services</td>
<td>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.</td>
<td>Roads and Maritime and Construction Contractor</td>
<td>Construction</td>
<td>Additional standard safeguard TT9</td>
</tr>
<tr>
<td>TT-7</td>
<td>Impacts of the regional road network</td>
<td>Where possible, the most disruption work (such as work that requires lane closures) will be carried out at night to minimise potential impacts on the regional road network.</td>
<td>Roads and Maritime and Construction Contractor</td>
<td>Construction</td>
<td>Additional safeguard TT9</td>
</tr>
</tbody>
</table>
| TT-8 | Impact to oversize loads                                              | - The ability to provide passage for oversize loads must be maintained during construction  
- The TMP will provide details on the strategy for informing oversized vehicles of the construction work and any temporary reduction in lane and/or shoulder widths or lane closures.                                                                                                                                                                                                                                                                                                                                                                      | Construction contractor                                | Pre-construction     | Additional safeguard                                                      |
<p>| | | | | | |
|      |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                         |                    |                                                                          |
| A-1  | Aboriginal heritage                                                    | An Aboriginal Heritage Management Plan (AHMP) will be prepared in accordance with the G36 Environment Protection. It will provide specific safeguards and mitigation measures including the installation of limits to construction fencing and sensitive area exclusion zones prior to the start of construction.                                                                                                                                                                                                                                                                                                                            | Contractor                                              | Detailed design / pre-construction | Core standard safeguard AH1 Section 4.9 of QA G36 Environment Protection |</p>
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</table>
| A-2 | Aboriginal heritage – unexpected finds                                 | • The *Standard Management Procedure - Unexpected Heritage Items* (Roads and Maritime, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction  
  • Work will only re-commence once the requirements of that Procedure have been satisfied.                                                                 | Contractor        | Detailed design / pre-construction | Core standard safeguard AH2 Section 4.9 of QA G36 Environment Protection |
<p>| A-3 | Minimise risks to Aboriginal cultural heritage during construction     | All personnel working on site will receive training to ensure awareness of requirements of the Aboriginal Heritage Management Plan and relevant statutory responsibilities. Site-specific training will be given to personnel when working in the vicinity of identified Aboriginal heritage items.                                                                 | Contractor        | Detailed design / pre-construction | Additional standard safeguard AH3                                        |
| A-4 | Impacts to Winery Hill 1, 2, 3, 4, 5, 6, 7 and Saddlers Creek PAD MAS 99 37-2-0452 | Winery Hill 1, 2, 3, 4, 5, 6, 7 and Saddlers Creek PAD MAS 99 37-2-0452 are in the vicinity of proposal will be flagged or fenced prior to construction so as to provide an exclusion zone for the duration of the proposal.                                                                 | Roads and Maritime | Detailed design / pre-construction | Additional safeguard                                                   |
| A-5 | Unavoidable impacts to archaeological sites                            | If the detailed design is unable to avoid archaeological sites referred to above then a Stage 3 assessment in accordance with Roads and Maritime (2011) PACHCI will be required, including formal consultation with the Aboriginal community, the preparation of a cultural heritage assessment report and AHIP (PACHCI Stage 3). This assessment would be expected to take at least four months. | Roads and Maritime | Detailed design               | Additional safeguard                                                   |
| A-6 | Additional Aboriginal heritage impacts                                  | Any further impacts proposed beyond those assessed in this REF or beyond the boundary of the assessed areas would be subject to further assessment including consultation with Aboriginal stakeholders.                                                                                                      | Roads and Maritime | Construction                | Additional safeguard                                                   |</p>
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</table>
| B-1 | Biodiversity                               | 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 implemented as part of the CEMP. It will include, but not be limited to:  
  - Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features (including hollow-bearing trees) and revegetation areas  
  - Requirements set out in the *Landscape Guideline* (RTA, 2008)  
  - Pre-clearing survey requirements  
  - Procedures for unexpected threatened species finds and fauna handling  
  - Procedures addressing relevant matters specified in the *Policy and guidelines for fish habitat conservation and management* (DPI Fisheries, 2013)  
  - Protocols to manage weeds and pathogens. | Contractor     | Detailed design / pre-construction | Core standard safeguard B1 Section 4.8 of QA G36 Environment Protection |
<p>| B-2 | Biodiversity                               | Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible. | Contractor     | Detailed design / pre-construction | Core standard safeguard B3                      |
| B-3 | Protect native flora and fauna, minimise edge effects and avoid inadvertent impacts | All personnel working on site will receive training to ensure awareness of requirements of the Flora and Fauna Management Plan and relevant statutory responsibilities. Site-specific training will be given to personnel when working in the vicinity of areas of identified biodiversity value that are to be protected. | Contractor     | Construction        | Core standard safeguard B4                      |
| B-4 | Stockpiles, plant and ancillary sites     | Vehicle parking, machinery, construction compounds, material stockpiles and the like, will be located in cleared or disturbed areas, not within the drip-zone of vegetation to be retained or within other protected or exclusion zones identified in the Flora and Fauna Management Plan. | Contractor     | Construction        | Additional standard safeguard B10              |</p>
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</table>
| B-5 | Fauna handling | Consistent with the Biodiversity Guidelines - *Protecting and managing biodiversity on RTA projects*, and any specific requirements of the approved Flora and Fauna Management Plan, management arrangements will be implemented to ensure safe fauna handling. As a minimum that will include:  
  - Fauna handling being carried out by appropriately licenced ecologists or wildlife carers  
  - Liaison with local animal rescue agency, wildlife carer group or vet to establish agreed arrangements for fauna rescue or injured animal assistance  
  - Induction information for construction staff. | Contractor | Construction | Additional safeguard B11 |
| B-6 | Habitat management - minimising impacts | Consistent with the Biodiversity Guidelines - *Protecting and managing biodiversity on RTA projects*. As a minimum that will include:  
  - No vegetation clearing or bushrock removal beyond limits identified in this REF  
  - Avoiding identified exclusion zones and protected habitat features  
  - Avoiding mixing of topsoil with woody debris materials  
  - Separation of woody vegetation suitable for re-use during construction and rehabilitation or revegetation works  
  - Implementation of staged clearing  
  - Trimming and pruning to be carried out in accordance with relevant Australian Standards  
  - In riparian zones: avoiding clearing during likely flood periods; ensuring cleared vegetation does not enter the waterway; retaining roots and stumps to maintain bank stability; applying the hierarchy for snag management set out in the Guidelines. | Contractor | Construction | Additional standard B12 |
| B-7 | Weed, Pest Species and Pathogen Management | Consistent with the *Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects*. As a minimum that will include:  
  - Implementation of appropriate weed control methods and weed disposal | Contractor | Construction | Additional standard safeguard B13 |
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<td></td>
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<td>· Implementation of appropriate hygiene protocols where there are potential or known pathogen risks.</td>
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<td></td>
<td><strong>Noise and vibration</strong></td>
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<tr>
<td>NV-1</td>
<td>Noise and vibration</td>
<td>A Noise and Vibration Management sub-plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will identify:</td>
<td>Contractor</td>
<td>Detailed design / pre-construction</td>
<td>Core standard safeguard NV1 Section 4.6 of QA G36 Environment Protection</td>
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<td></td>
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<td>· All potential significant noise and vibration generating activities associated with the activity</td>
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<td>· Feasible and reasonable mitigation measures to be implemented, taking into account <em>Beyond the Pavement: urban design policy, process and principles</em> (Roads and Maritime, 2014)</td>
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<td></td>
<td>· A monitoring program to assess performance against relevant noise and vibration criteria</td>
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<td>· Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures</td>
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<td></td>
<td>· Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.</td>
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<td>NV-2</td>
<td>Noise and vibration</td>
<td>All sensitive receivers (eg local residents and Hollydene Estate) likely to be affected will be notified at least five working days prior to the start of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of:</td>
<td>Contractor</td>
<td>Detailed design / pre-construction</td>
<td>Core standard safeguard NV2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· The proposal</td>
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<td>· The construction period and construction hours</td>
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<td>· Contact information for project management staff</td>
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<td>· Complaint and incident reporting</td>
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<td>· How to obtain further information</td>
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<td>NV-3</td>
<td>Site induction</td>
<td>All personnel working on site will receive training to ensure awareness of requirements of the NVMP. Site-specific training will be given to personnel when working in the vicinity of sensitive receivers.</td>
<td>Contractor</td>
<td>Pre-construction / construction</td>
<td>Additional standard safeguard NOISE2</td>
</tr>
<tr>
<td>NV-4</td>
<td>Noise and vibration</td>
<td>Where possible, works outside of standard construction hours will be planned so that noisier works are carried out in the earlier part of the evening or night time.</td>
<td>Contractor</td>
<td>Pre-construction / construction</td>
<td>Additional safeguard</td>
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</table>
| NV-5| Out of hours works construction| • Where out-of-hours activities are required, high impact noise generating activities will be carried out prior to 11pm where possible  
• Where out-of-hours activities are required, respite periods (Respite Period 1 and Respite Period 2) in accordance with the CNVG would be implemented  
• Duration respite for out-of-hours (increase in number of nights per week but a reduced overall construction period) works will be considered in consultation with the affected sensitive receivers  
• During out of hours works, conduct monitoring to measure construction noise levels against NMLs and sleep disturbance criteria. The monitoring would be carried out at the nearest sensitive receiver where possible. Where required, implement additional control measures as detailed in the CNVG will be applied if noise levels noise levels require further mitigation. |
| NV-6| Vibration impacts to underground utilities | The use of high intensity vibratory compaction equipment near underground services will be limited. If vibration-intensive plant and equipment change from that which has been in the Noise and Vibration Assessment (Jacobs, 2018c), a review will be carried out prior to commencing work. | Construction contractor | Construction                  | Additional safeguard           |
| W-1 | Soil and water                 | A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction. | Contractor              | Detailed design / pre-construction | Section 2.1 of QA G38 Soil and Water Management Plan |

**Golden Highway Upgrade at Winery Hill**

Review of Environmental Factors

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</table>
| W-2 | Soil and water                              | • A site specific Erosion and Sediment Control Plan/s (ESCP) will be prepared and implemented as part of the Soil and Water Management Plan  
• The plan will 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. | Contractor                      | Detailed design / Pre-construction | Core standard safeguard SW2, Section 2.2 of QA G38 Soil and Water Management |
| W-3 | Contaminants entering receiving environments during construction | Control measures to minimise the risk of water pollution will be implemented including:  
• All fuels, chemicals, and liquids will be stored at least 50 metres away from the existing stormwater drainage system and stored in an impervious bunded area within the compound site  
• Plant and maintenance machinery will be refuelled in impervious bunded areas in the designated compound area  
• Vehicle washdowns and/or concrete truck washouts would be carried out within a designated bunded area of an impervious surface or carried out off-site. | Construction contractor          | Construction                  | Additional safeguard                                                     |
<p>| WH-4| Extraction of water                         | Non potable water sources (including the potential for water extraction from the Hunter River) would be investigated during detailed design to minimise reliance on potable water where feasible. Any water extraction would occur only after consultation with the NSW Office of Water, and acquisition of associated permits and approvals. | Roads and Maritime / Construction contractor | Construction                  | Additional safeguard                                                     |</p>
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<tr>
<td>WH-5</td>
<td>Flood management for ancillary site WH1</td>
<td>If ancillary site WH is used for the proposal, a Flood Management Plan will be prepared prior to the work starting. This plan will include: • Review and coordination with existing local flood plans and evacuation procedures • Flood emergency preparation, response, and recovery measures which will be implemented during construction • Procedure for daily review of The Bureau of Meteorology website • Site protection measures to be implemented prior to and in the event of flooding • Procedure for monitoring and maintenance of protection measures during heavy rainfall events.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
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<tr>
<td>S-1</td>
<td>Contaminated land</td>
<td>If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA.</td>
<td>Contractor</td>
<td>Detailed design / Pre-construction</td>
<td>Core standard safeguard C2 Section 4.2 of QA G36 Environment Protection</td>
</tr>
<tr>
<td>S-2</td>
<td>Accidental spill</td>
<td>A site specific emergency spill plan will be developed, and include spill management measures in accordance with the Roads and Maritime <em>Code of Practice for Water Management</em> (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).</td>
<td>Contractor</td>
<td>Detailed design / Pre-construction</td>
<td>Core standard safeguard C3 Section 4.3 of QA G36 Environment Protection</td>
</tr>
<tr>
<td>S-3</td>
<td>Stockpile management</td>
<td>Stockpiles will be designed, established, operated and decommissioned in accordance with the Roads and Maritimes’ <em>Stockpile Site Management Guideline 2015</em>.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Additional standard</td>
</tr>
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| S-4 | Soil stabilisation and restoration | The rehabilitation of disturbed areas will be carried out progressively as construction stages are completed, and in accordance with:  
  - *Landcom’s Managing Urban Stormwater: Soils and Construction series*  
  - *RTA Landscape Guideline*  
| S-5 | Erosion and sedimentation | The SWMP will be implemented throughout the construction period. It will include the following safeguards:  
  - Designated exclusion zones will be identified for the storage and use of construction plant and equipment. These zones will delineate traffic areas and restrict entry and exit points to construction sites  
  - Areas of risk near the proposal, such as steep areas or highly erodible soils, will be identified and appropriate management controls implemented  
  - Temporary or permanent diversion drains will be used to divert off-site run-off around or through the construction site to minimise the volume of flow that mixes with on-site run-off  
  - Physical controls will be developed in line with the ESCP, including sediment fences, sediment filters, rock check dams, level spreaders, and onsite diversion drains installed before construction and maintained during construction  
  - Exposed batters will be lined, if required  
  - A schedule for the ongoing maintenance and inspection of temporary erosion and sediment controls will be developed. | Construction contractor  | Construction | Additional safeguard |
<table>
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</table>
| S-6 | Pollution from run-off | The ancillary facilities will be managed within the ESCP. The following measures will be included to limit sediment and other contaminations entering receiving waterways:  
- Chemicals will be stored within a sealed or bunded area  
- Appropriate controls will be in place where plant is stored  
- Run-off from ancillary sites will be controlled and treated before discharging into downstream waterways  
- Vehicle movements will be restricted to designated pathways where feasible  
- Areas that will be exposed for extended periods, such as car parks and main access roads, will be stabilised where feasible. | Construction contractor | Construction | Additional safeguard |

**Landscape character and visual impacts**

| LC-1 | Landscape character and visual impact | A Landscape Plan and specification will be prepared as part of the detailed design stage and implemented as part of the CEMP. The plan and specification will include design treatments for:  
- Location and identification of existing vegetation and proposed landscaped areas, including species to be used  
- Details of the staging of landscape works taking account of related environmental controls such as erosion and sedimentation controls and drainage  
- Procedures for monitoring and maintaining landscaped or rehabilitated areas.  
The Landscape Plan will be prepared in accordance with relevant guidelines, including:  
- *Landscape Guideline* (RTA, 2008)  
- *Shotcrete Design Guideline* (RTA, 2005). | Roads and Maritime Contractor | Detailed design / pre-construction | Core standard safeguard UD1 |
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<tr>
<td>LC-2</td>
<td>Visual impact of work sites</td>
<td>Project work sites, including construction areas and supporting facilities (such as storage compounds and offices) will be managed to minimise visual impacts, including avoiding temporary light spill if required, rehabilitation of disturbed areas, appropriate storage of equipment, parking, stockpile screening and arrangements for the storage and removal of rubbish and waste materials.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Core standard safeguard UD2</td>
</tr>
<tr>
<td>LC-3</td>
<td>Visual impact of work sites</td>
<td>Compound and ancillary facilities will be decommissioned and the sites rehabilitated to their existing condition or as otherwise agreed with the landowner on completion of works.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
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</table>
| LC-4 | Vegetation and landscaping     | The Landscape Plan will consider where feasible:  
1. Property frontages affected by the proposal: All trees within five metres of the outer edge of the proposal area will be assessed by an arborist. If possible these trees should be retained and managed during construction. If the trees will be impacted suitable mitigation measures, such as replacing these trees, would be discussed and agreed with the landowner  
2. Retaining open views and fill embankments: Low native plants or pasture grasses will to be used as ground cover  
3. Cutting treatments to be stabilised with low vegetation where practical  
4. Establish new planting west of Hollydene Estate’s entry to provide screening to nearby houses, and highlight the character of the vineyard and surrounding area  
5. The majority of landscape planting will use plants that are locally native (endemic) to the site and surroundings. Cultural plantings (i.e. non-native trees) have been identified as appropriate near Hollydene Estate. | Roads and Maritime and Contractor | Detailed design / pre-construction | Additional safeguard |
<p>| LC-5 | Maintenance of the highway     | Ongoing maintenance, repair and replacement of any damaged built elements or failed vegetation will be carried out as part of normal road maintenance.                                                                                                                                                                                                                                      | Roads and Maritime | Operation            |                                |</p>
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<td></td>
<td><strong>Socio-economic and land use</strong></td>
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</table>
| SE-1| Socio-economic | A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum):  
  - Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions  
  - Contact name and number for complaints  
  - Mechanisms to share issues raised by stakeholders with other Golden Highway Upgrade projects  
  - The CP will be prepared in accordance with the *Community Involvement and Communications Resource Manual* (RTA, 2008)  
  - Coordination with other Golden Highway Upgrade projects’ CP will be carried out to ensure consistency in the information provided to the community during construction. | Contractor                 | Detailed design / pre-construction | Core standard safeguard SE1 |
<p>| SE-2| Property acquisition | All property acquisition will be carried out in accordance with the <em>Land Acquisition Information Guide</em> (Roads and Maritime, 2012) and the <em>Land Acquisition (Just Terms Compensation) Act 1991</em>. | Roads and Maritime project manager | Pre construction / detailed design | Core standard safeguard PL1 |
| SE-3| Emergency vehicle 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. | Roads and Maritime and Construction Contractor | Pre construction / detailed design | Additional safeguard SE2 |
| SE-4| Consultation - property owners | Consultation will be carried out with all affected property owners during detailed design and construction to develop and implement measures to mitigate impacts on their property. | Roads and Maritime and Construction Contractor | Pre construction / detailed design | Additional safeguard SE5 |
| SE-5| Complaints | A complaints handling procedure and register will be included in the CEMP. | Construction Contractor | Construction | Additional safeguard SE8 |</p>
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<td>WR-1</td>
<td>Waste</td>
<td>A Waste Management Plan will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to: • Measures to avoid and minimise waste associated with the project • Classification of wastes generated by the project and management options (re-use, recycle, stockpile, disposal) • Classification of wastes received from off-site for use in the project and management options • Identifying any statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions • Procedures for storage, transport and disposal • Monitoring, record keeping and reporting, including any documentation management obligations arising from resource recovery exemptions • 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, as well as the adopting the Resources Management Hierarchy principles of the WARR Act.</td>
<td>Contractor</td>
<td>Pre construction / detailed design</td>
<td>Core standard safeguard W1 Section 4.2 of QA G36 Environment Protection</td>
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<tr>
<td>WR-2</td>
<td>Existing condition of ancillary sites</td>
<td>Prior to land being used for ancillary construction purposes (compounds, storage, parking, etc) a pre-construction land assessment will be carried out to identify the presence of any pre-existing wastes.</td>
<td>Contractor</td>
<td>Pre construction / detailed design</td>
<td>Core standard safeguard W2</td>
</tr>
<tr>
<td>WR-3</td>
<td>Excavated material</td>
<td>Opportunity to reuse material between Golden Highway upgrades will be considered to minimise waste to landfill. This is should be viable where the is excessive cut material at Ogilvies Hill and a deficit of cut to fill material for the proposal.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Additional safeguard</td>
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<tr>
<td>WR-4</td>
<td>Final condition of ancillary sites</td>
<td>A post-construction land assessment will be carried out of land that was used for ancillary construction purposes (compounds, storage, parking, etc) to determine the suitability for hand-back to the landowner.</td>
<td>Contractor</td>
<td>Post construction / operation</td>
<td>Additional standard W12</td>
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</tbody>
</table>
| A-1 | Air quality                    | An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to:  
- Potential sources of air pollution  
- Air quality management objectives consistent with any relevant published EPA and/or OEH guidelines  
- Mitigation and suppression measures to be implemented  
- Methods to manage work during strong winds or other adverse weather conditions  
- A progressive rehabilitation strategy for disturbed areas. | Contractor     | Detailed design / pre-construction | Core standard safeguard AQ1 Section 4.4 of QA G36 Environment Protection |
| U-1 | Utilities                      | Prior to the start of works:  
- The location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners  
- If the scope or location of proposed utility relocation works falls outside of the assessed proposal scope and footprint, further assessment will be carried out. | Contractor     | Detailed design / pre-construction | Core standard safeguard U1 |
| NAH-1 | Non-Aboriginal Heritage        | - The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered  
- Work will only re-commence once the requirements of that Procedure have been satisfied. | Contractor     | Detailed design / pre-construction | Core standard safeguard H2 Section 4.10 of QA G36 Environment Protection |
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<tr>
<td>C-1</td>
<td>Cumulative impacts from construction of multiple projects</td>
<td>The CEMP will be updated as required to address cumulative impacts as other projects/activities begin. This will include a process to review and update mitigation measures as new work begins or if complaints are received.</td>
<td>Contractor</td>
<td>Pre-construction, Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>C-2</td>
<td>Cumulative traffic and access impacts</td>
<td>The TMP will be prepared in consultation with the Transport Management Centre and Muswellbrook Shire Council.</td>
<td>Contractor</td>
<td>Pre-construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>C-3</td>
<td>Cumulative construction impacts</td>
<td>To minimise potential impacts during construction, construction of the proposal would be staged to enable work to be completed safely while maintaining traffic flows at all times. Construction would involve building one lane at a time, and moving the traffic between the lanes to keep the traffic flows for the duration of work. This approach will ensure that negative cumulative impacts on both the function of the Golden Highway and the surrounding environment will be minimised where possible.</td>
<td>Roads and Maritime</td>
<td>Detailed design, pre-construction</td>
<td>Additional safeguard</td>
</tr>
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</table>
7.3 Licensing and approvals

Licences and approvals required for the proposal are listed in **Table 7-2**.

**Table 7-2: Summary of licensing and approvals required**

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<tr>
<th>Instrument</th>
<th>Requirement</th>
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<tbody>
<tr>
<td><em>Protection of the Environment Operations Act 1997 (s43)</em></td>
<td>Environment protection licence (EPL) for scheduled activities (road construction) from the EPA.</td>
<td>Prior to start of the activity.</td>
</tr>
<tr>
<td><em>Roads Act 1993</em></td>
<td>Road Occupancy Permit would need to be obtained as necessary prior to construction commencing.</td>
<td>Prior to start of the activity.</td>
</tr>
<tr>
<td>Permission from private landowners and residents</td>
<td>Permission from private landowners and residents must be obtained to access proposal work sites. This would likely be obtained through temporary lease arrangements or land acquisition.</td>
<td>Before accessing any private property.</td>
</tr>
<tr>
<td><em>Water Act or Water Management Act</em></td>
<td>Licence/permit to extract water from waterway.</td>
<td>Prior to start of activity.</td>
</tr>
</tbody>
</table>
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 Golden Highway is one of only three east-west B-Double routes north of Sydney over the Great Dividing Range and is an important freight distribution route linking the Port of Newcastle to the Upper Hunter, Dubbo, central western and far western NSW.

This section of the Golden Highway at Winery Hill is currently a single lane highway with narrow shoulders, non-compliant clear zones and limited overtaking opportunities. This results in heavy and oversize vehicles travelling slowly which impacts on average travel speeds and decreases productivity of the highway. Within this context, the proposal is required to improve road safety and traffic and freight efficiency for oversized vehicles using the highway.

The proposal would:

- Provide safe and efficient travel by providing overtaking lanes in each direction as well as wider paved shoulders
- Preserve and improve the condition of structures, cuttings and embankments
- Improve travel efficiency by providing a route with improved overtaking opportunities
- Reduce fuel consumption and vehicle operating costs by providing consistent road conditions
- Cater for higher productivity vehicles including up to PBS Class 2B of up to 30 metre in length
- Maintain and improve the ability to cater for over dimension and over mass loads.

This is consistent with the NSW and Australian governments’ strategic priorities of improving the road’s safety performance and efficiency needs.

While there would be some environmental impacts as a consequence of the proposal such as temporary traffic delays, amenity impacts, vegetation clearing and property acquisitions, they have been avoided or minimised wherever possible through design and site-specific safeguards. The beneficial effects of through improvement safety and travel efficiency are considered to outweigh the mostly temporary adverse impacts and risks associated with the proposal.

8.1.1 Social factors

As documented in Section 6.8, the proposal would have some minor short-term negative social impacts as a result of the disturbance and change that would occur during construction. The combined effect of construction noise, dust, local access changes, and general disturbance caused by construction activity, construction traffic and machinery movements would result in a general loss of amenity for residents, motorists, workers and others who live near the proposal area and those who visit the proposal area on a regular basis during the construction period.

However, the long-term effect would be an overall social benefit, through improved safety and efficiency of the Golden Highway at Winery Hill.
8.1.2 Biophysical factors

The proposal involves widening the existing Golden Highway at Winery Hill along its existing alignment. The proposal would therefore minimise the amount of land required for its development and the consequential impact on adjoining land uses and ecosystems. The proposal would generally follow the existing topography and the existing alignment and would thereby minimise the need for major earthworks.

Some clearing of native vegetation would be required to construct the proposal. However, as discussed in Section 6.3, the overall area of vegetation clearing would be relatively minor. The proposal has also been designed to avoid impacting of the 19 archaeological sites located near to the proposal area.

As part of the design criteria presented in Section 3.2, the proposal has been designed to accommodate stormwater volumes during a 100 year storm event, and the proposed design would incorporate measures to protect in-stream water quality and prevent scour and erosion so as to protect aquatic ecosystems.

8.1.3 Economic factors

The proposal would be constructed largely within the existing road corridor, with minimal land acquisition required. The upgrade of an existing road corridor would minimise long-term disruption and economic impacts on residents, businesses and motorists.

The proposal would deliver long-term economic benefits on its own and as part of the broader Golden Highway Corridor Strategy. It would improve traffic conditions and reduce travel times for the Golden Highway road users.

8.1.4 Public interest

The public interest is best served through the equitable distribution of resources, and investment in public infrastructure that fulfils the needs of the majority. The proposal represents a cost-efficient investment in public infrastructure that would maximise the long-term social and economic benefits, while minimising the long-term negative impacts on communities and the environment. By improving local and regional transport facilities, the proposal would better enable the movement of people, goods and services.

Although the proposal, during the construction phase, would result in some short-term impacts on amenity, accessibility and transport efficiency, these impacts would be outweighed by the long-term benefits once the proposal is operational.

As a result, the proposal is considered to be in the public interest.
### 8.2 Objects of the EP&A Act

<table>
<thead>
<tr>
<th>Object</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State’s natural and other resources.</td>
<td>The proposal design, impact, safeguards and management measures detailed in this REF allow for the proper management, development and conservation of natural and artificial resources. The proposal would also improve the social and economic welfare of the community by improving the road safety on this section of the Golden Highway.</td>
</tr>
<tr>
<td>1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.</td>
<td>Ecologically sustainable development is considered in Sections 8.1.1 to Section 8.2.4 below.</td>
</tr>
<tr>
<td>1.3(c) To promote the orderly and economic use and development of land.</td>
<td>The proposal would not impact on the economic use of land. However, the proposal would improve the economic use of the road by improving freight efficiency for the local mines and freight industry.</td>
</tr>
<tr>
<td>1.3(d) To promote the delivery and maintenance of affordable housing.</td>
<td>Not relevant to the project.</td>
</tr>
<tr>
<td>1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.</td>
<td>Impacts to native animals and plants, including threatened species, populations and ecological communities and their habitats were considered in Section 6.3. The majority of the construction footprint is within road reserve and within areas that are already cleared, consequently vegetation clearing is minimised. However, the proposal would still remove about 1.34 hectares of the TSC Act listed Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions EEC. Assessments of significance carried out as part of the Biodiversity Impact Assessment (Jacobs, 2018b) (refer to Section 6.3) found that the proposal is unlikely to have a significant impact to any threatened species, population or ecological communities. Safeguards and management measures would be implemented to manage impacts to biodiversity and cleared areas would be appropriately revegetated at the completion of works.</td>
</tr>
<tr>
<td>1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).</td>
<td>The proposal has been designed to avoid the Twenty-five Aboriginal know heritage archaeological sites located near the Golden Highway at Winery Hill. Refer to Section 6.2.</td>
</tr>
<tr>
<td>1.3(g) To promote good design and amenity of the built environment.</td>
<td>Not relevant to the proposal.</td>
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<td>Object</td>
<td>Comment</td>
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<td>1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.</td>
<td>Not relevant to the proposal.</td>
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<tr>
<td>1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.</td>
<td>Not relevant to the proposal.</td>
</tr>
<tr>
<td>1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.</td>
<td>The proposal development process has involved consultation with relevant stakeholders. Consultation carried out and proposed is outlined in Chapter 5.</td>
</tr>
</tbody>
</table>

**8.2.1 The precautionary principle**

This principle states: “if there are threats of serious or irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation”.

The evaluation and assessment of alternative options within the proposal have also aimed to reduce the risk of serious and irreversible impact on the environment as a result of the proposal.

The proposal has sought to take a precautionary approach to minimising environmental impact. This has been applied through the development of a range of environmental safeguards, as summarised in Chapter 7. These safeguards would be implemented during construction and operation of the proposal.

No safeguards have been postponed as a result of lack of scientific certainty. The selected construction contractor would be required to prepare a CEMP before commencing construction. No mitigation measures or management mechanisms would be postponed as a result of a lack of information.

**8.2.2 Intergenerational equity**

The principle states: “the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations”.

The proposal would not result in any impacts that are likely to adversely impact on the health, diversity or productivity of the environment for future generations.

The proposal together with other planned road upgrades under the Golden Highway Corridor Strategy would cater for future traffic growth in the region. The proposal would benefit future generations by addressing the future increases in traffic volumes and traffic congestion associated with movement of traffic, including road freight between the Port of Newcastle to the Upper Hunter, Dubbo, central western and far western NSW. While the proposal would have some adverse impacts, they are not considered to be of a nature or extent that would result in disadvantage to any specific section of the community or to future generations.

Should the proposal not proceed, the principle of intergenerational equity may be compromised, as future generations would inherit a freight highway with heavy and oversize vehicles travelling slowly with impacts on average travel speeds and decreases productivity of the route.
8.2.3 Conservation of biological diversity and ecological integrity

This principle states: “the diversity of genes, species, populations and communities, as well as the ecosystems and habitats to which they belong, must be maintained and improved to ensure their survival”.

The proposal is located in an area that has previously been modified as a result of the construction of the existing Golden Highway and nearby agricultural activities. However, remnant areas of native vegetation and associated habitats remain next to the existing highway.

A key objective of the project is to minimise adverse impacts on the environmental values of the area. Conservation of biological diversity and ecological integrity has been considered during all stages of the proposal’s development. Potential impacts have been avoided where possible and safeguards and management measures have been included where necessary.

The biodiversity assessment (refer to Section 6.3 and Appendix E) concluded that the proposal would not have a significant impact on any existing flora or fauna species, biodiversity communities or the overall biological integrity of the proposal and nearby areas. The findings of the biodiversity assessment indicate that the potential impacts would be acceptable and minimised through the proposed safeguards (refer to Chapter 7).

8.2.4 Improved valuation, pricing and incentive mechanisms

This principle is defined as:

improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:

(i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,
(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,
(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

Environmental and social issues were considered in the strategic planning and establishment of the need for the proposal, and in consideration of various proposal options. The value placed on environmental resources is evident in the extent of the planning and environmental investigations, and in the design of the proposed mitigation measures and safeguards.

Implementation of these mitigation measures and safeguards would result in an economic cost to Roads and Maritime, which would be included in both the capital and operating cost of the proposal.

8.3 Conclusion

The proposed Golden Highway upgrade at Winery Hill is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and taken into account the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

This has included consideration (where relevant) of conservation agreements and plans of management under the NPW Act, biodiversity stewardship sites under the TSC Act, wilderness areas, areas of outstanding value, impacts on threatened species and ecological communities and their habitats and other
protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the Federal EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some impacts on traffic, amenity biodiversity and property acquisitions. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also improve safety and reduce travel times. On balance the proposal is considered justified and the following conclusions are made.

**Significance of impact under NSW legislation**

The proposal would be unlikely to cause a significant impact on the environment. Therefore, it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act. A Biodiversity Development Assessment Report or Species Impact Statement is not required. The proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from Council is not required.

**Significance of impact under Australian legislation**

The proposal is not likely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*. A referral to the Australian Department of the Environment and Energy 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.

Tina Donovan
Senior Environmental Scientist
Jacobs
Date: 16/07/2018

I have examined this review of environmental factors and accept it on behalf of Roads and Maritime Services.

Ryan De Carteret
Roads and Maritime Project Manager
Date: 16/07/2018
10. References


Department of Environment, Climate Change and Water 2010a, Aboriginal Cultural Heritage Consultation Requirements for Proponents, Sydney.


DECCW. 2010b. Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales. Sydney: Department of Environment, Climate Change and Water NSW.


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Jacobs 2018d, *Golden Highway Upgrades Diversion Construction noise review*

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Roads and Maritime 2010, Aboriginal cultural heritage consultation requirements for proponents.

Roads and Maritime 2011, Procedure for Aboriginal Cultural Heritage Consultation and Investigation, Sydney.


Roads and Maritime Services 2011b, Roads and Maritime Guideline for Biodiversity Offsets.


Roads and Traffic Authority NSW 2009a, Beyond the Pavement – Roads and Traffic Authority of NSW urban design policy, procedure and design principles, Sydney.


Transport for NSW 2012, NSW Long Term Transport Master Plan, Sydney.
## Terms and acronyms used in this REF

<table>
<thead>
<tr>
<th>Term / Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADT</td>
<td>Average Daily Traffic</td>
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<tr>
<td>AHD</td>
<td>Australian Height Datum</td>
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<tr>
<td>AHIMS</td>
<td>Aboriginal Heritage Information Management System</td>
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<td>AHIP</td>
<td>Aboriginal Heritage Impact Permit</td>
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<td>AHMP</td>
<td>Aboriginal Heritage Management Plan</td>
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<td>AQMP</td>
<td>Air Quality Management Plan</td>
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<tr>
<td>ARI</td>
<td>Annual Reoccurrence Interval</td>
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<tr>
<td>BAR</td>
<td>Biodiversity Assessment Report</td>
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<td>BC Act</td>
<td><em>Biodiversity Conservation Act 2016</em></td>
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<td>BBAM</td>
<td>BioBanking Assessment Methodology</td>
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<td>CEMP</td>
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<td>Environmental Protection License</td>
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<td>EP&amp;A Act</td>
<td><em>Environmental Planning and Assessment Act 1979</em> (NSW). Provides the legislative framework for land use planning and development assessment in NSW</td>
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<tr>
<td>ESD</td>
<td>Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased</td>
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<td>FM Act</td>
<td>Fisheries Management Act 1994 (NSW)</td>
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<td>HML</td>
<td>Higher Mass Limit</td>
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<td>HRMP</td>
<td>Hazard and Risk Management Plan</td>
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<td>HSSVP</td>
<td>Heavy Vehicle Safety and Productivity Program</td>
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<td>Term / Acronym</td>
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<td>HYS</td>
<td>Have your say</td>
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<td>State Environmental Planning Policy (Infrastructure) 2007</td>
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<td>LCU</td>
<td>Landscape character units</td>
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<td>Local government area</td>
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<td>Long Term Transport Master Plan</td>
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<td>National Parks and Wildlife</td>
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<td>Matters of national environmental significance under the Commonwealth <em>Environment Protection and Biodiversity Conservation Act 1999</em>.</td>
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<td>Office of Environment and Heritage</td>
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<td>PACHCI</td>
<td>Procedure for Aboriginal Heritage Consultation and Investigation</td>
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<td>vegetation information system</td>
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<td>VMRM</td>
<td>Value Management and Risk Management</td>
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<td>VMS</td>
<td>Variable Message Signs</td>
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<td>Waste Avoidance and Resource Recovery</td>
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<td>WMP</td>
<td>Waste Management Plan</td>
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