New England Highway upgrade between Belford and the Golden Highway

Review of environmental factors

June 2017

Prepared by Arup and Roads and Maritime Services
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Executive summary

The proposal

Roads and Maritime Services (Roads and Maritime) proposes to upgrade the New England Highway between Belford and the Golden Highway (the proposal). The upgrade would improve traffic flow, travel times and safety for motorists along a busy section of the New England Highway.

The proposal includes:
- widening the New England Highway for around 3.2 kilometres to provide a divided road with two travel lanes in each direction between Belford and the Golden Highway
- replacing the existing right turn movement from the Golden Highway to the New England Highway with a right turn flyover
- removing the Whittingham rest area near the New England Highway and Golden Highway intersection.

The proposal forms part of the New England Highway Draft Corridor Strategy to provide an efficient and sustainable corridor that caters for increasing growth and improves safety along the New England Highway corridor. The New England Highway and the Golden Highway are both crucial connection corridors and are used extensively by local industries in the Hunter Valley and Central West region.

The NSW Government has announced $85 million funding for the proposal under the Rebuilding NSW Plan.

If the project is approved, construction of the proposal could start in 2019 and is expected to take around two years to complete.

Need for the proposal

Around 22,000 vehicles travel along the New England Highway between Belford and the Golden Highway every day and congestion is a common issue. The proposal is needed to meet current and predicted increases in freight and travel demand.

The existing three travel lanes on the New England Highway in the proposal area would not meet these traffic increases, leading to longer travel times, reduced travel reliability, crashes and higher vehicle operating costs.

The existing New England Highway and Golden Highway intersection experiences heavy traffic and limited turning opportunities during peak periods. This has resulted in safety and reliability issues, increased travel times and more greenhouse gas emissions due to slower car speeds.

The proposal would:
- increase the capacity and connectivity of the New England Highway and Golden Highway for the efficient and reliable movement of freight
- improve safety at the New England Highway and Golden Highway intersection by reducing the risk of crashes
- increase capacity at the New England Highway and Golden Highway intersection to cater for the predicted increase in traffic movements as a result of future growth in the Hunter.
Proposal objectives and development criteria

The objectives of the proposal are to:

- reduce peak period delays at the New England Highway and Golden Highway intersection, especially for traffic turning right from the Golden Highway
- improve road safety along the New England Highway between Belford and the Golden Highway, especially at the intersection with the Golden Highway
- maintain average peak hour travel times on the New England Highway
- identify all existing and future accesses, develop an access management strategy through the area and minimise direct access to the New England Highway corridor.

Options considered

Seven road design options, as well as a ‘do nothing’ option, were assessed to decide on a preferred upgrade solution. These options included installing traffic control systems at the New England Highway and Golden Highway intersection, duplicating the New England Highway and constructing a flyover from the Golden Highway over the existing New England Highway carriageway.

Each option was assessed in terms of traffic performance and economic viability. The preferred option would offer the greatest improvement to traffic congestion and road safety. It would also be the most cost effective option.

Statutory and planning framework

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

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) also applies to the proposal. Clause 94 of ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent. Formal consultation for the proposal is not triggered by any of the clauses under ISEPP, however consultation has been carried out with Singleton Council and other government agencies as part of the proposal development.

A strategic assessment under Roads and Maritime’s Environment Protection and Biodiversity Conservation Act 1999 – Strategic Assessment policy also applies to the proposal. This REF has been prepared to meet the requirements of the EPBC Act strategic assessment approval for Roads and Maritime Part 5 road activities. Therefore a referral to the Australian Department of the Environment is not required.

Community and stakeholder consultation

Roads and Maritime has consulted with a range of community members, government and non-government stakeholders as part of the proposal, including:

- local residents and affected landholders
- local council, emergency services and community centres
- Member of Parliament
- utility companies
- Office of Environment and Heritage (OEH)
- Wanurruah Local Aboriginal Land Council (LALC)
- Plains Clans of the Wonnarua People and the broader Aboriginal community.
Community feedback on the preferred project option was sought in May 2015 and feedback was accepted until 22 June 2015. All suggestions were considered as part of the development of the concept design for the preferred option.

This REF outlines ongoing and future consultation activities if the proposal is approved to proceed, including project updates, web updates, stakeholder briefings, media releases, advertisements and other consultation tools where relevant.

**Environmental impacts**

Detailed technical investigations have been carried out to assess, manage and minimise the proposal’s potential impacts.

The following outlines the proposal’s key environmental impacts to the environment and surrounding community. The safeguards and mitigation measures identified in this REF would help minimise the expected adverse impacts.

**Traffic, transport and access**

There would be some increased travel times along sections of the New England Highway and Golden Highway during construction of the proposal. Road users would be notified of any changes to traffic throughout construction and traffic management would be in place to reduce impacts.

When finalised, the completed proposal would reduce delays during peak periods at the New England Highway and the Golden Highway intersection, especially for traffic turning right from the Golden Highway. It would also improve average peak hour travel times on the New England Highway and improve road safety between Belford and the Golden Highway.

**Property and access**

The proposal would result in a loss of agricultural land and permanently change the property access arrangements of one private property on the western side of the New England Highway. Early and ongoing consultation with affected property owners, businesses and communities has been carried out. Environmental management and monitoring would also be carried out to minimise impacts to property during and after construction of the proposal.

**Biodiversity**

Construction of the proposal would result in a loss of around 11.23 ha of threatened vegetation under the NSW Threatened Species Conservation Act 1995 (TSC Act) and 8.20 ha of threatened vegetation under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). This would result in a reduction of habitat, including hollow-bearing trees, for a range of birds and mammals including threatened species, and loss of fauna habitat connectivity. An aerial fauna crossing over the New England Highway would be provided to help reduce potential impacts. A biodiversity offset strategy has also been developed to compensate for this loss and help achieve long-term conservation outcomes.

**Aboriginal heritage**

The proposal would impact two identified Aboriginal archaeological site clusters of moderate scientific significance. Construction of the proposal would result in a loss of scientific value at these sites. A methodology to salvage artefacts from these sites before construction has been developed in consultation with the local Aboriginal community. The archaeological salvage program would be carried out under the provision of an Aboriginal Heritage Impact Permit (AHIP).

**Noise**

Noise may be experienced at some properties within 600 metres of the site during construction. Where possible, work would be carried out during standard working hours. To minimise disruption to traffic and reduce construction timeframes, some work would take place outside of these hours.
Mitigation measures would include limiting noise related work to standard construction hours and minimising machinery noise wherever possible.

**Visual impacts**
The proposal would increase the scale and dominance of the road corridor in the area with the introduction of a flyover. A design and landscape strategy has been developed to help reduce this impact.

**Justification and conclusion**
The proposal is recommended as it would best address the objectives for the New England Highway between Belford and the Golden Highway. It would also be the most cost effective option.

The proposal would result in some adverse impacts to the local environment and community. The minimisation measures provided in this REF would help reduce these expected impacts.

The proposal is justified because it would help reduce existing congestion and delays experienced at the New England Highway and Golden Highway intersection, improve road safety and meet future traffic needs.

**Display of the review of environmental factors**
This REF is on display for comment until Friday, 28 July 2017. You can access the documents in the following ways:

**Internet**
The documents will be available as pdf files on the Roads and Maritime website at rms.work/B2G.

**Display**
The documents will be on display between 9am and 4.30pm from Monday to Friday at the Singleton Service NSW Centre at 158 John Street, Singleton.

**Purchase**
The documents are available for purchase in hard copy ($25) or CD/USB ($10) by contacting Roads and Maritime Senior Project Development Officer, Andrew Thompson, on (02) 4908 7630.

**How can I make a submission?**
To make a submission on the proposal, please send your written comments to Andrew.J.Thompson@rms.nsw.gov.au, or:

Roads and Maritime Services
Senior Project Development Officer
Andrew Thompson
Locked Bag 2030
Newcastle NSW 2300

Submissions must be received by 2pm on Friday, 28 July 2017.

**Privacy information**
All information included in submissions is collected for the sole purpose of assisting in the assessment of this proposal. The information may be used during the environmental impact assessment process by relevant Roads and Maritime Services staff and its contractors.
Where the respondent indicates at the time of supply of information that their submission should be kept confidential, Roads and Maritime will attempt to keep it confidential. However there may be legislative or legal justification for the release of the information, for example under the Government Information (Public Access) Act 2009 or under subpoena or statutory instrument.

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

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

The information will be held by the Roads and Maritime Services, Newcastle office.

**What happens next?**

Roads and Maritime will collate submissions after the submission period has closed. Acknowledgements will be sent to each respondent. Details of submission authors will be kept and authors will be advised when project information is released.

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

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

If you have any queries, please contact Senior Project Development Officer, Andrew Thompson, on (02) 4908 7630.
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1 Introduction

1.1 Proposal identification

Roads and Maritime Services (Roads and Maritime) proposes to upgrade the New England Highway between Belford and the Golden Highway. The upgrade would improve traffic flow, travel times and safety for motorists along a busy section of the New England Highway.

The proposal is located within the Singleton local government area (LGA) and the Hunter region of the Roads and Maritime network. The location of the proposal is shown in Figure 1-1.

Key features of the proposal include:

- Widening the New England Highway for around 3.2 kilometres to provide a divided road with two travel lanes in each direction between Belford and the Golden Highway
- Replacing the existing right turn movement from the Golden Highway to the New England Highway with a right turn flyover
- Removing the Whittingham rest area near the New England Highway and Golden Highway intersection.

Major benefits of the proposal include:

- Increased capacity and connectivity of the New England Highway and Golden Highway for the efficient and reliable movement of freight
- Improved safety at the New England Highway and Golden Highway intersection by reducing the risk of crashes, particularly for motorists turning right from the Golden Highway
- Increased capacity at the New England Highway and Golden Highway intersection to cater for the predicted increase in traffic movements as a result of future growth in the Hunter
- Compatibility with existing and future adjoining land use access.

The proposal forms part of the New England Highway Draft Corridor Strategy to provide an efficient and sustainable corridor that caters for increasing growth and optimises safety along the New England Highway corridor. The New England Highway and the Golden Highway are both crucial connection corridors and are used extensively by local industries in the Hunter Valley and Central West region. The NSW Government has announced $85 million funding for the upgrade under the Rebuilding NSW Plan.

The proposal is located in an area mostly rural in nature with primary production and the EC Throsby abattoir being the major industries currently present in the proposal area. The proposal is located within the traditional boundaries of the Wanaruah language group and the area contains a number of Aboriginal archaeological sites. The area also contains a number of endangered ecological communities, species and habitat, with one prominent vegetation community listed as Critically Endangered under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Five unnamed watercourses or drainage lines cross the proposal, two of which currently flow under the New England Highway via culverts. Section 6 of this REF describes in more detail the existing environmental conditions in the area.

The proposal is being designed to meet a number of guidelines, standards and criteria, as listed in Section 3.2.1 of this REF. Some of the design features include a number of proposed culverts or culvert extensions to manage water drainage, and an aerial fauna crossing to retain wildlife connectivity.

One main construction and one auxiliary construction compound would be required during construction work.

Construction of the proposal would be staged to minimise disruption to local traffic flows. Construction staging would be further investigated as the project is developed. It is anticipated work would first be carried out at the Golden Highway, followed by construction of the flyover.
duplication of the New England Highway to provide the new eastbound lanes and then reconfiguration of the New England Highway westbound lanes.

An overview of the proposal, including the construction footprint, is shown in Figure 1-2. Design and construction of the proposal is further described in Section 3.
Figure 1-1: Location of the proposal
Possible main construction compound 2

Possible auxiliary construction compound

Whittingham rest area

U-turn facility

Possible main construction compound 1

Golden Highway

Main North Railway Line

New England Highway duplication

Proposal / construction boundary

Concept design

Construction compounds

Figure 1-2: The proposal
1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by Arup on behalf of Roads and Maritime. For the purposes of this work, Roads and Maritime is the proponent and the determining authority under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

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

The description of the proposed work and associated environmental impacts have been undertaken 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 Environmental Planning and Assessment Act 1979* (DUAP, 1995/1996), the *Threatened Species Conservation Act 1995* (TSC Act), the *Fisheries Management Act 1994* (FM Act), and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

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

- Section 111 of the EP&A Act that Roads and Maritime examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity
- The strategic assessment approval granted by the Federal Government under the EPBC Act in September 2015, with respect to the impacts of Roads and Maritime's road activities on nationally listed threatened species, populations, ecological communities and migratory species.

The findings of the REF would be considered when assessing:

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

2.1 Strategic need for the proposal

2.1.1 Operational need

The New England Highway is part of the inland route of the Sydney to Brisbane National Land Transport Network and the primary route connecting the Upper Hunter with Maitland and Newcastle. The Golden Highway connects the New England Highway at Whittingham with Dubbo.

The New England Highway and Golden Highway road corridors are designated B-Double routes and are used extensively by heavy vehicles servicing coal mining, grain production and other industries in the Hunter Valley and the Central West to access the port of Newcastle.

The New England Highway is a critical connection between the urban and employment centres of Maitland and Singleton, which are planned future growth areas for the Hunter region. The section of the New England Highway between Belford and the Golden Highway is recognised as a major freight and commuter route between Newcastle and Upper Hunter. Around 22,000 vehicles travel along the New England Highway between Belford and the Golden Highway every day, with heavy vehicles making up about 17 per cent.

The proposal is needed to address the following issues:

1. Insufficient capacity eastbound on the New England Highway

East of the Golden Highway intersection, the New England Highway currently accommodates two lanes of traffic in each direction for around one kilometre. The carriageway then narrows to three lanes, with one lane eastbound and two lanes westbound up to the start of a separated carriageway just west of Bell Road. Here it widens again to two lanes in each direction.

With the increased freight and travel demand primarily coming from the Hunter Valley mining industry, the single eastbound travel lane along most of the New England Highway carriageway between Belford and the Golden Highway is expected to be inadequate and inevitably lead to:

- Longer traveling times
- Reduced travel reliability
- More frequent accidents because of merge conditions and ‘stop-start’ congestion
- Higher vehicle operating costs.

The growing economy and population in the Hunter and New England regions is expected to worsen these problems.

Current eastbound congestion issues on the New England Highway include the convergence of traffic turning right from the Golden Highway with the eastbound through traffic and the merging of two lanes of eastbound traffic into one lane. This is particularly an issue during the afternoon (PM) peak traffic. At this time, eastbound traffic on the Golden Highway turning right onto the New England Highway is currently around 435 vehicles per hour. Through traffic travelling eastbound on the New England Highway prior to the Golden Highway intersection is currently around 909 vehicles per hour. The merge of these 1344 vehicles per hour from two lanes into one single eastbound lane, without the provision of an overtaking lane, is reducing travel speeds with slower moving heavy vehicles also having the potential to hold back other vehicles. The current average travel speed eastbound on the New England Highway in the proposal area is 84 kilometres per hour during the PM peak, which is 16 kilometres per hour under the current posted speed of 100 kilometres per hour.
Future eastbound traffic volumes on the New England Highway for three time periods were modelled by Hyder in 2014. These are shown in Table 2-1 and Table 2-2. In general, traffic volumes on the New England Highway are forecast to grow at a rate of two per cent per annum.

Table 2-1: Predicted eastbound traffic on the New England Highway during the morning (AM) peak

<table>
<thead>
<tr>
<th>Movement</th>
<th>Predicted traffic during the AM peak (vehicles/hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year</td>
</tr>
<tr>
<td></td>
<td>2019</td>
</tr>
<tr>
<td>Eastbound traffic on the New England Highway before the Golden Highway intersection</td>
<td>470</td>
</tr>
<tr>
<td>Eastbound traffic on the New England Highway after the Golden Highway intersection</td>
<td>700</td>
</tr>
</tbody>
</table>

Table 2-2: Predicted eastbound traffic on the New England Highway during the afternoon (PM) peak

<table>
<thead>
<tr>
<th>Movement</th>
<th>Predicted traffic during the PM peak (vehicles/hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year</td>
</tr>
<tr>
<td></td>
<td>2019</td>
</tr>
<tr>
<td>Eastbound traffic on the New England Highway before the Golden Highway intersection</td>
<td>1000</td>
</tr>
<tr>
<td>Eastbound traffic on the New England Highway after the Golden Highway intersection</td>
<td>1480</td>
</tr>
</tbody>
</table>

The one eastbound lane section of the New England Highway can currently accommodate around 1,400 to 1,500 vehicles per hour. The predicted traffic volumes suggest that duplication of the New England Highway between Belford and Golden Highway is required before 2029.

2. Level of service at the New England Highway and Golden Highway intersection

Currently in the study area, the morning (AM) peak traffic starts at 5.30 am and mainly comprises vehicles heading west to mining sites (commonly referred to as the mining peak). The mining peak is followed by general commuter peak between 6.30 - 7.30 am, with the majority of traffic heading westbound.

PM peak traffic flows are heavy in the eastbound direction with vehicles heading back towards Maitland and Newcastle.

In the AM peak, eastbound traffic turning right from the Golden Highway onto the New England Highway is relatively low (counts show around 207 vehicles per hour). However, these vehicles have to negotiate substantial volumes of vehicles travelling westbound on the New England Highway towards Singleton (counts show over 750 vehicles per hour).
In the PM peak, eastbound traffic on the Golden Highway turning right onto the New England Highway is high (around 435 vehicles per hour), while conflicting traffic travelling westbound on the New England Highway is relatively low compared to the AM peak (around 448 vehicles per hour).

In June 2014, a queue length survey was undertaken at the New England Highway and Golden Highway intersection for vehicles turning right onto the New England Highway during the peak traffic times of 05.30 – 09.00 (AM) and 15.00 – 18.00 (PM). The results of this survey are provided in Table 2-3.

### Table 2-3: Queue length data at New England Highway and Golden Highway intersection

<table>
<thead>
<tr>
<th>Time period</th>
<th>Queue length in metres¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>05.30 – 06.30</td>
<td>40</td>
</tr>
<tr>
<td>06.30 – 07.30</td>
<td>90</td>
</tr>
<tr>
<td>07.30 – 08.30</td>
<td>100</td>
</tr>
<tr>
<td>15.00 – 16.00</td>
<td>240</td>
</tr>
<tr>
<td>16.00 – 17.00</td>
<td>130</td>
</tr>
<tr>
<td>17.00 – 18.00</td>
<td>130</td>
</tr>
</tbody>
</table>

¹ an average vehicle length of nine metres was assumed to convert vehicle numbers in metres

As shown, queues for vehicles turning right onto the New England Highway from the Golden Highway are low during the AM mining peak but significantly longer during the PM peak periods.

In accordance with Roads and Maritime guidelines, the performance of an intersection is measured by the average delay per vehicle at the intersection, which provides a ‘level of service’ measure. The Roads and Maritime level of service measures are:

- Level of Service A – average delay per vehicle is less than 14 seconds. Good operation
- Level of Service B – average delay per vehicle is between 15 and 28 seconds. Good operation with acceptable delays and spare capacity
- Level of Service C – average delay per vehicle is between 29 and 42 seconds. Satisfactory operation
- Level of Service D – average delay per vehicle is between 43 and 56 seconds. Operating near capacity
- Level of Service E – average delay per vehicle is between 57 and 70 seconds. Operating at capacity; incidents at signals will cause excessive delays
- Level of Service F – average delay per vehicle is more than 70 seconds. Extra capacity required.

A level of service study for the New England Highway and Golden Highway intersection was completed in June 2014. The level of service was determined for each hour between 5:30 and 8:30 (AM peak) and 15:00 and 18:00 (PM peak).

In the AM peak, the level of service for the eastbound right turn from the Golden Highway onto the New England Highway varied between B and E. Although small, the eastbound right turn from the New England Highway onto the Golden Highway also experienced delays with a level of service measured between B and F. In the PM peak, the level of service for the eastbound right turn from the Golden Highway onto the New England Highway varied between C and E.
By 2039, traffic modelling shows that the PM peak right turn movement out of Golden Highway will increase by over 230 vehicles per hour. During the same period, through traffic on the New England Highway is also set to substantially increase (see Table 2-2). This would result in less gaps for traffic to safely complete the right turn movement out of the Golden Highway, with queues on the Golden Highway predicted to be more than 1.3 kilometres long in peak periods.

3. Safety and vehicle conflict at New England Highway and Golden Highway intersection

The intersection of the New England Highway and the Golden Highway is currently an at-grade, all movements junction, laid out as a ‘sea gull’ type intersection. Heavy traffic and limited turning opportunities during peak periods have resulted in safety issues. These safety and vehicle conflict issues exacerbate travel times and reliability issues, increase the likelihood of crashes, and emit more greenhouse gases due to slower car speeds.

Between October 2008 and February 2014, 45 crashes were reported on the New England Highway or Golden Highway within the proposal area. Of these crashes, one crash resulted in a fatality and 22 crashes resulted in injuries. The remaining 22 were classified as non-casualty (damage only). Fourteen of the 45 crashes occurred when a vehicle was turning right out of an intersection and collided with another vehicle. The majority of these right turn crashes occurred at the New England Highway and Golden Highway intersection.

The proposal provides the opportunity to:
- Increase capacity and connectivity of the New England Highway and Golden Highway for the efficient and reliable movement of freight
- Improve safety at the New England Highway and Golden Highway intersection by reducing the risk of crashes, particularly for motorists turning right from the Golden Highway
- Increase capacity at the New England Highway and Golden Highway intersection to cater for the predicted increase in traffic movements as a result of future growth in the Hunter.

2.1.2 Strategic setting

NSW State priorities

In 2015, the NSW Premier announced a new set of State Priorities targeting growth and economic development (NSW Government, 2015). Under the banner of “Building Infrastructure”, improving road travel reliability was listed as a key priority. This includes ensuring journey times on key roads continues to improve to enable businesses and the community to move around with greater ease and boost productivity. To do this, the State Government are committed to making better use of existing road infrastructure.

A primary aim of the proposal is to increase the capacity and connectivity of the New England Highway and Golden Highway for the efficient and reliable traffic movements in the Hunter region, thereby reducing current traffic congestion and catering for forecast growth. To this extent the proposal supports the growth and economic goals and the State’s commitment to making better use of existing infrastructure.

NSW Long Term Transport Master Plan

The NSW Long Term Transport Master Plan (the LTTMP) (Transport for NSW, 2012) presents the State’s 20-year vision for the delivery of a world-class public transport, road and freight network. The LTTMP identifies road safety, congestion and reliability issues, and growing traffic volumes as major challenges for rural roads. The LTTMP also identifies actions required to address these challenges, specifically including improving regional road safety as part of the new Road Safety
Strategy for NSW, providing rural highway upgrades to address safety issues, and delivering new arterial roads and upgrades to meet growth in the Hunter region.

The proposal would support the LTTMP by providing the necessary upgrades to address the current safety issues and alleviate congestion at the New England Highway and Golden Highway intersection and improve the capacity along the New England Highway.

Hunter Regional Transport Plan

The Hunter Regional Transport Plan (the Hunter RTP) (Transport for NSW, 2014) complements the LTTMP and outlines more specific actions to address the transport challenges faced in the Hunter region. The Hunter RTP recognises the importance of the New England Highway in catering for major commodity movements to the Port of Newcastle and passenger movements between Newcastle and the New England region. The Hunter RTP also identifies the Golden Highway as a future critical freight corridor, with freight flows forecast to exceed the levels currently seen on the New England Highway by 2031. The Hunter RPT commits the State to upgrades along the New England Highway to address safety and congestion issues and identifies the duplication of the New England Highway between Belford and the Golden Highway as a road network investment action.

The proposal would deliver the State’s commitment to duplicate the New England Highway between Belford and the Golden Highway and address safety and congestion issues along the New England Highway.

State Infrastructure Strategy

The NSW Government’s Rebuilding NSW: State Infrastructure Strategy 2014 (Rebuilding NSW) (NSW Government, 2014) sets out and commits to the State’s infrastructure delivery and reform priorities. Rebuilding NSW identifies the importance of regional roads in contributing to the State and local economies and identifies the New England Highway and the Golden Highway road corridors as investment priorities.

The proposal would support Rebuilding NSW by helping to realise the investment commitment to the New England Highway and the Golden Highway road corridors.

Hunter Regional Plan 2036

The Hunter Regional Plan 2036 (the Hunter Regional Plan) (NSW Government, 2016b) provides an overarching framework to guide subsequent and more detailed land use plans, development proposals and infrastructure funding decisions in the Hunter region over the next 20 years.

The Hunter Regional Plan recognises the Hunter Region as the largest and most productive regional economy in Australia and highlights the importance of the transport linkages between the Hunter region and the Port of Newcastle and Newcastle Airport for economic growth and diversification in NSW.

The Hunter Regional Plan comprises four goals with a total of 27 directions supporting these goals. Direction 4 – Enhance inter-regional linkages to support economic growth supports Goal 1 – The leading regional economy in Australia and identifies that improvements are needed to maintain and enhance efficiencies across the inter-regional transport networks, particularly for freight, and to allow for future growth.

The proposal would support the Hunter Regional Plan by providing the necessary improvements to help maintain efficiency of the New England Highway and Golden Highway road corridors which form part of the strategically important inter-regional transport networks.
New England Highway Draft Corridor Strategy

The New England Highway Draft Corridor Strategy (NSW Government, 2016c) was developed by Roads and Maritime together with Transport for NSW to set out the NSW Government’s 20 year plan for the management and development of the New England Highway in accordance with the NSW Long Term Transport Master Plan and Regional Transport Plans and State and National plans. The vision for the New England Highway corridor is an efficient, safe and durable corridor that caters for increasing growth and provides for Higher Productivity Vehicles (HPV) with intra-regional, inter-regional and interstate linkages to support rural industries.

The New England Highway Draft Corridor Strategy identifies the New England Highway upgrade between Belford and the Golden Highway as a short-term priority to address the challenges on the New England Highway over the next 20 years.

The proposal would help to achieve the vision for the New England Highway corridor by delivering one of the identified short-term priorities, improving road safety along the New England Highway between Belford and the Golden Highway, especially at the intersection with the Golden Highway and improving regional freight movements.

Golden Highway Corridor Strategy

The Golden Highway Corridor Strategy (NSW Government, 2016a) was a joint Transport for NSW and Roads and Maritime deliverable with the purpose of identifying, amongst other things, objectives specific to the Golden Highway that support the NSW Long Term Transport Master Plan and Regional Transport Plans. The vision for the Golden Highway over the next 20 years is to support the development of agricultural and mining activities in the area and operate as a critical freight route, provide safe and efficient travel for all road users, and improve road network reliability and access by reducing the impact of flooding.

The Golden Highway Corridor Strategy identifies the New England Highway upgrade between Belford and the Golden Highway as a key initiative in the Hunter RTP, and crucial to meeting the objectives for the corridor.

The proposal would help to achieve the vision for the Golden Highway corridor by increasing capacity and improving safety at the Golden Highway and New England Highway intersection.

New England Highway Urban Design Framework

The New England Highway Urban Design Framework (Roads and Maritime, 2016) values the New England Highway as a scenic, country hinterland road and was developed to ensure a consistent urban design approach is applied to any current or future road upgrades along the New England Highway corridor. The New England Highway Urban Design Framework seeks to retain and enhance the distinct character of the New England Highway and its surrounds by listing a number of design objectives and principles.

The proposal has been developed in accordance with the New England Highway Urban Design Framework and the urban design objectives for the proposal have been outlined Section 2.3.2 of this REF.
2.2 Existing infrastructure

2.2.1 Overview

The New England Highway (A15) is part of the inland route between Sydney and Brisbane and it is
the primary route connecting the Upper Hunter with Maitland and Newcastle. The New England
Highway provides an alternative route to the coastal Pacific Highway. The Golden Highway (B84)
covers the New England Highway at Whittingham with Dubbo. These designated B-double route
corridors are used extensively to service coal mining, grain production and other industries in the
Hunter Valley and the Central West to provide access to the Port of Newcastle. Residents also use
these road corridors to access the local population and employment centres of Maitland and
Singleton.

2.2.2 New England Highway

The New England Highway is a 770 kilometres National Highway which extends from Hexham
near Newcastle in the south to Yarraman near Toowoomba in the north. In the locality of the
proposal, the New England Highway currently accommodates four lanes of traffic, two lanes in
each direction for approximately one kilometre east of the Golden Highway. Following this, the
New England Highway carriageway narrows to three lanes, with one lane eastbound and two lanes
westbound up to the start of the New England Highway separated carriageway just west of Bell
Road, where it widens again to two lanes in each direction.

Between Belford and the Golden Highway, the road shoulders along the New England Highway
vary in width, however the shoulder is generally wider on the westbound side. Drainage channels
are installed along some parts of the highway. The landform next to the road varies between
vegetation, rockface and grass coverage on flat and undulating land.

There have been a number of improvements made to the New England Highway in recent years.
In March 2014, Roads and Maritime completed a $5 million upgrade between Belford and the
Golden Highway to improve traffic flow and safety prior to the opening of the Hunter Expressway.
The project involved adding an additional westbound lane by road widening and changing the two
eastbound lanes to a single lane.

Safety improvements were also carried out at the Golden Highway intersection including line-
marking, installation of wire rope barrier and the provision of additional signage. Further, the left-
turn lane onto the Golden Highway was extended as part of work to improve traffic efficiency and
safety for road users travelling on the New England Highway. The right-turn lane from the Golden
Highway onto the New England Highway was retained to ensure vehicles can merge safely onto
the New England Highway.

The speed limit on the New England Highway in the proposal area is posted at 100 kilometres per
hour from Bell Road to just before the Golden Highway intersection, where the speed limit is
reduced to 80 kilometres per hour.

The New England Highway contains a mixture of steel W-beam safety barriers, wire rope safety
barriers and white timber guideposts. Heading westbound along the New England Highway, gantry
and roadside signage is provided prior to the Golden Highway intersection to direct drivers along
their journey. Some signage is also provided in the eastbound direction. Lighting is provided at the
New England Highway and Golden Highway intersection.

There are a number of existing pipes and culverts under the New England Highway carriageway
between Belford and the Golden Highway providing for drainage and stormwater management.
However, flood modelling results indicate that two of these culverts currently overtop on the New
England Highway, one in the 20 year average recurrence interval event and one in the 10 year
annual recurrence interval event.
The surface of the New England Highway is currently made up of flexible pavement.

The New England Highway carriageway is shown in Figure 2-1.

![Figure 2-1: Existing New England Highway carriageway between Belford and the Golden Highway, looking westbound (Source: Google Maps, 2017)](image)

### 2.2.3 Golden Highway

The Golden Highway is part of the Mitchell Line of Road and is a 310 kilometre section of the State road network connecting the New England Highway at Whittingham (about eight kilometres west of Branxton) to Dubbo and the Newell and Mitchell highways. The Golden Highway is a two-lane unseparated road with one lane in each direction. The existing intersection between the Golden Highway and the New England is an at-grade, all movements junction, laid out as a ‘sea gull’ type intersection. There is a right-turn lane heading westbound just after the intersection with the New England Highway to turn into the Whittingham rest area. There is a wide shoulder on the westbound side allowing for oversized vehicles to turn left onto the abattoir access road.

The speed limit on the Golden Highway in the proposal area is 70 kilometres per hour. W-beam safety barriers are provided on both sides of the Golden Highway for a short distance of up to 150...
metres, east of the railway crossing. Directional signage is provided at the intersection of the Golden Highway to help direct drivers.

The surface of the Golden Highway is currently made up of flexible pavement.

The intersection of the Golden Highway and the New England Highway is shown in Figure 2-2.

Figure 2-2: Existing Golden Highway and New England Highway intersection

2.2.4 Rail routes and services

Passenger rail services between Branxton and Singleton use the Main North Railway Line which crosses beneath the Golden Highway just west of the proposal area.

The Hunter Valley rail network uses the same rail line which is leased by the Australian Rail Track Corporation (ARTC) and services the coal mines in the Upper Hunter. The Hunter Valley rail network runs between Newcastle and Muswellbrook, where it then branches out into two lines: the Ulan line and the Gunnedah basin line. All but a very small portion of the Hunter Valley coal shipped from Newcastle is transported by this rail network. The network supports an average of around 60 loaded trains each day (ARTC, 2015).

The Golden Highway crosses the Main North Railway Line via an overbridge, and therefore does not disrupt road traffic from operation of the rail line.

2.2.5 Bus routes and services

A number of bus services travel through the proposal area.

Hunter Valley Buses run a public bus service along the New England Highway. The Singleton Heights to Stockland Green Hills via Maitland service (route 180) stops at the corner of the New England Highway and Bell Road (stop 233554). Hunter Valley Buses also provide school bus services with school routes 6318 and 6312 operating along the New England Highway and Golden Highway in the vicinity of the proposal area (CDCBus, 2016). School bus stopping warning signage is provided on the New England Highway.

A number of long distance coach services also use this section of the New England Highway, including Greyhound Australia, Hunter Valley Coaches, Port Stephens Coaches and Sid Fogg’s Coachlines.
2.2.6 Pedestrian and cyclist facilities

There are no formal cycleways in the proposal area and provision for cyclists is generally on-road via the existing road shoulders. The recent line-marking and safety upgrades of the New England Highway between Belford and the Golden Highway have resulted in variable shoulder widths on either side of this section of road. There is also a bicycle crossing on the westbound side of the New England Highway, just to the south of the Golden Highway intersection.

There is currently no provision for pedestrians on the New England Highway between Belford and the Golden Highway.

2.2.7 Light vehicle rest area

The Whittingham light vehicle rest area (known as the Whittingham rest area) is located on the northern side of the Golden Highway west of the intersection with the New England Highway (see Figure 2-3). The Whittingham rest area provides facilities for travellers to stop and break their journey. The Whittingham rest area comprises an accessible toilet, a picnic table, a sheltered picnic table and litter collection facilities. The next closest light vehicle rest area is located around 10 kilometres to the north on the New England Highway just outside of Singleton. Further north, the Rixs Creek rest area caters for both heavy and light vehicles. A heavy vehicle rest area is also located 10 kilometres to the south at Branxton.

2.2.8 Utilities

There are a number of above ground and underground utilities in the proposal area, including:

- Telecommunications – AAPT and Telstra
- Overhead and underground power lines – Ausgrid
- High pressure gas main – Jemena

The location of the utilities is shown in Figure 2-3.
Figure 2-3: Existing infrastructure in the proposal area
2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives

The objectives of the proposal include:
- Reduce peak period delays at the New England Highway and Golden Highway intersection, especially for traffic turning right from the Golden Highway
- Improve road safety along the New England Highway between Belford and the Golden Highway, especially at the intersection with the Golden Highway
- Maintain average peak hour travel times on the New England Highway for a period of 20 years
- Identify all existing and future accesses, develop an access management strategy through the area and minimise direct access to the New England Highway corridor.

2.3.2 Urban design objectives


The urban design objectives for the proposal include:

- **Objective 1: Design an experience in movement**
  Create a self-explaining road environment that recognises and reflects the interaction with the topography of the Great Dividing Range and the character and change of openness and enclosure of the road alignment.
  - Enhance and frame views from the road. Provide lower height plant species where views are available
  - Retain and enhance the progressive sequence of visual events such as the character of the Spotted Gum forest, flood plain and wooded edge landscape.

- **Objective 2: Fit with the landform**
  Respond to changes in landform as the New England Highway traverses the plains and plateaus.
  - Form a road in response to topography and landform
  - Minimise the physical footprint, including during the construction phase
  - Provide soft, feathered transitions at the top, bottom, and ends of earthworks
  - Grade out landform to match existing adjacent slopes but no steeper than 1(V) in 2(H), unless rock. In flatter areas, minimise embankments and mounding
  - Avoid the use of shotcrete.

- **Objective 3: Respond to natural vegetation patterns**
  Ensure the road design reflects the change in landscape character from enclosed forest to more open, scattered trees on pasture grasses and waterway crossings.
  - Integrate natural patterns and systems into the road design
  - Minimise the impact on native vegetation
  - Avoid the introduction of native weed species
  - Provide views out from the road
  - Provide distinctive trees at key points such as the propose flyover.

- **Objective 4: Achieve integrated and minimal maintenance design**
  - Use robust, durable materials fit for purpose and place
  - Provide a self-reliant and minimal maintenance natural landscape
  - Avoid opportunities for vandalism
  - Create a simple, coordinated and neat composition of road elements along a corridor
- Ensure signage does not block important views and avoid putting in highly scenic areas
- Locate fencing to minimise visual impact. Consider using dark coloured mesh where fencing cannot be screened by vegetation
- Consider the design quality of major road components and individual built elements.

### 2.4 Alternatives and options considered

#### 2.4.1 Introduction

Development of the proposal has included the investigation and selection of a preferred preliminary design option carried out in a number of stages.

The design assessed in this REF is based on the 80 per cent concept design for the proposal, which is a combination of the preferred preliminary design option (Option 5A- S2) and design refinements based on subsequent environmental investigations and community and stakeholder consultation. The alternatives and options considered are summarised in the following sections.

#### 2.4.2 Methodology for selection of preferred option

Following an initial workshop to develop, evaluate and refine various alternative options, seven short-listed options were chosen for further assessment to determine a preferred upgrade solution. These seven options represented the alternatives thought to be the least complex and most cost effective. The future traffic under each option was assessed for the years of 2019, 2029 and 2039 and compared against a do nothing scenario. An economic assessment was also undertaken to estimate and compare the net economic benefit of each option and estimate the benefit cost ratio (BCR) and net present value (NPV).

The traffic assessment and measures used to assess the seven options are listed in Table 2-4.

#### Table 2-4: Traffic assessment criteria

<table>
<thead>
<tr>
<th>Traffic assessment criteria</th>
<th>Key measures</th>
</tr>
</thead>
</table>
| 1. Performance of the New England Highway and Golden Highway intersection | • Level of service  
• Delays |
| 2. Improvements to travel time | Travel times along two key routes:  
• 4.6 kilometre route on the New England Highway between Golden Highway (north of the rail overbridge) and Bell Road (Route 1)  
• 9 kilometre route on the New England Highway between Range Road and Bell Road (Route 2) |
| 3. Flood modelling carried out for the proposal also indicates that two of the existing culverts currently overtop on the New England Highway, one in the 20 year average recurrence interval event and one in the 10 year annual recurrence interval event. | Eastbound traffic flows on the New England Highway and queues at the merge point |
The economic assessment was carried out in consideration of the following parameters:
- Capital costs
- Project maintenance costs
- Vehicle operating costs
- Road user travel time costs
- Crash costs
- External costs.

With application of the following key measures of economic performance:
- Net present value (NPV) – the difference between the present value of total incremental benefits and the present value of the total incremental costs in the improved options
- Benefit Cost Ratio (BCR) – ratio of the present value of total incremental benefits over the present value of total incremental costs.

### 2.4.3 Identified options

A brief description of the seven upgrade options with figures is provided below.

1. **Option 5 – S1**
   - Option 5 – S1 proposes grade separation of the right turn movement from the Golden Highway resulting free flow conditions for this movement only. All other movements would remain at-grade. In Option 5 – S1, a two lane flyover bridge over the New England Highway is proposed. Option 5 – S1 is illustrated in Figure 2-4.

   ![Figure 2-4: Option 5 – S1](image)

2. **Option 5A – S1**
   - Option 5A – S1 is a variation of Option 5 – S1. The main difference is the reduction in scope of the flyover bridge and approaches over the New England Highway (i.e. no provision for two lanes in the future). Refer to Figure 2-4 for Option 5 – S1.

3. **Option 5 – S2**
   - Option 5 – S2 proposes full duplication on the New England Highway in conjunction with Option 5 – S1 (i.e. grade separation of right turn movement). Option 5 – S2 proposes the full duplication (two lane dual carriageway) of the New England Highway between Belford (west of Bell Road) and Whittingham (east of the existing Golden Highway intersection). Option 5 – S1 is illustrated in Figure 2-5.
4. Option 5A – S2
   • Option 5A – S2 is a variation of Option 5 – S2. The main difference is the reduction in scope of the flyover bridge and approaches over the New England Highway (i.e. no provision for two lanes in the future). Refer to Figure 2-5 for Option 5 – S2.

5. Option 4 – S2
   • Option 4 – S2 proposes full grade separation of the existing intersection via the elevation of the New England Highway with a single bridge (one lane in each direction). Key accesses between New England Highway and Golden Highway are to be provided via a grade separated ramp system, with a section of the existing New England Highway to be utilised to provide the right turning movement from the Golden Highway to the New England Highway. Option 4 – S2 is illustrated in Figure 2-6.
6. Traffic Control System (TCS) Option
   - The TCS option involves the provision of an at-grade signalised T-junction replacing the existing priority control seagull intersection at New England Highway and Golden Highway. The eastbound through traffic on the New England Highway would remain as free flow as part of this option. The TCS option is shown in Figure 2-7.

![Figure 2-7: TCS Option](image)

7. Roundabout Option
   - The roundabout option involves the provision of an at grade roundabout intersection replacing the existing priority control seagull intersection at New England Highway and Golden Highway. The eastbound through traffic on the New England Highway would remain as free flow as part of this option. The roundabout option is shown in Figure 2-8.

![Figure 2-8: Roundabout Option](image)
2.4.4 Analysis of options

An assessment of the seven options and the ‘do nothing’ option on future traffic performance in the years 2019, 2029 and 2039 was carried out to understand the effect of each option on traffic flow and level of service. A summary of the key findings is provided below.

Do nothing

- Modelling shows that under a do nothing scenario the intersection of the Golden Highway and the New England Highway will operate at level of service D in the AM peak in 2019 and F in 2029 and 2039, and level of service F for all future years in the PM peak
- The current safety and vehicle conflict issues would remain and the option would fail to provide the capacity needed for future growth (see Section 2.1.1). Therefore this option is not considered viable.

Option 5 – S1

- Substantially improved level of service and delay times for traffic turning left or right from the Golden Highway onto the New England Highway
- Improved travel times on both the Golden Highway and New England Highway for Route 1 (A – B on Figure 2-4), primarily attributed to the proposed grade separation of the right turn movement from the Golden Highway (the flyover)
- Modelling does not suggest significant queuing at the merge point from the grade separated right turn movement (the flyover) to the New England Highway in the AM peak traffic for future years. However in the PM peak, it is predicted that travel time savings would decrease overtime due to congestion at the merge point, with queue lengths of up to 1150 metres in 2039
- On this basis, duplication of the New England Highway (to a two lane dual carriageway) from the Golden Highway to Belford would be required before 2029 and therefore this option alone is not viable.

Option 5A – S1

Option 5A – S1 is a variation of Option 5 – S1 and modelled traffic performance would produce a similar result as outlined above for Option 5 – S1. On the basis that duplication of the New England Highway (to a two lane dual carriageway) from the Golden Highway to Belford would be required before 2029, this option alone is not considered viable.

Option 5 – S2

- The traffic performance of Option 5 – S2 is similar to Option 5 – S1 in the AM peak, but significantly better for the PM peak
- Substantially improved level of service and delay times for traffic turning left or right from the Golden Highway onto the New England Highway
- Improved travel times on both the Golden Highway and New England Highway for Route 1 (A – B on Figure 2-5), primarily attributed to the proposed grade separation of the right turn movement from the Golden Highway (the flyover). The travel time of through traffic on the New England Highway for Route 2 (C – B on Figure 2-2) would also improve due to the proposed duplication of the New England Highway between Belford and the Golden Highway
- The merge from the grade separated right turn movement (the flyover) to the New England Highway would perform substantially better in Option 5 – S2 than Option 5 – S1 due to the proposed duplication of the New England Highway between Belford and the Golden Highway.

Option 5A – S2

Option 5A – S2 is a variation of Option 5 – S2 and modelled traffic performance would produce a result as outlined above for Option 5 – S2.
Option 4 – S2

- Similar to Option 5 – S2, Option 4 – S2 would substantially improve travel times on both the Golden Highway and New England Highway
- The travel time savings on the Golden Highway and New England Highway for Option 4 – S2 would be similar to Option 5 – S2.

Traffic Control System (TCS) Option

- Modelling shows that introduction of at-grade traffic signals at the Golden Highway and New England Highway intersection would result in delays to westbound through traffic on the New England Highway of between 18 and 165 seconds per vehicle in the AM peak and 28 seconds in the PM peak
- The signals would also contribute to additional delays to the right turn movement out of the Golden Highway, with delays predicted around 67 seconds per vehicle in 2019 and 504 seconds per vehicle in 2039 in the AM peak and 108 seconds per vehicle in 2019 and 280 seconds per vehicle in 2039 in the PM peak
- The traffic signals would not improve travel times on the Golden Highway and New England Highway
- Modelling predicts that with the introduction of traffic signals the intersection will operate at level of service C in the AM peak and D in the PM peak 10 years after opening and result in a 36 second increase in delay compared to a do nothing scenario for the right turn movement out of the Golden Highway
- The intersection is predicted to operate at a level of service F in both the AM and PM peaks 20 years after opening, with traffic on both the Golden Highway and New England Highway experiencing substantial delays. As such, this option is not considered viable.

Roundabout Option

- Modelling shows that the roundabout would introduce delays to westbound through traffic on the New England Highway of between 12 and 20 seconds per vehicle in 2019 and 2029 and 280 seconds in 2039 in the AM peak and 7 and 8 seconds per vehicle in 2019 and 2039 in the PM peak
- The roundabout would also contribute to additional delays to the right turn movement out of the Golden Highway, with delays predicted between 95 seconds per vehicle in 2019 and 940 seconds per vehicle in 2039 in the AM peak and 253 seconds per vehicle in 2029 and 283 seconds per vehicle in 2039 in the PM peak
- The roundabout would not improve travel times on the Golden Highway and New England Highway in the eastbound and westbound directions and overall would adversely impact network performance compared to a do-nothing scenario. Therefore this option is not considered viable.

Summary of traffic performance

The do nothing option along with Option 5 – S1, Option 5A – S1, the TCS option and the Roundabout option are not considered viable from a traffic performance point of view. The remaining options, Option 5 – S2, Option 5A – S2, and Option 4 – S2, would address current and future traffic problems associated with delays and travel times on the New England Highway and vehicle conflicts at the intersection of the New England Highway and the Golden Highway. These options were further assessed on their economic costs and benefits in order to establish a preferred option.

An overview of the key costs and benefits for the seven upgrade options is shown in Table 2-5.
Table 2-5: Cost comparison (in 2014 dollars)

<table>
<thead>
<tr>
<th>Economic measure</th>
<th>Option 5 – S1</th>
<th>Option 5A – S1</th>
<th>Option 5 – S2</th>
<th>Option 5A – S2</th>
<th>Option 4 –S2</th>
<th>TCS option</th>
<th>Roundabout option</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCR</td>
<td>1.5</td>
<td>2.3</td>
<td>2.1</td>
<td>2.4</td>
<td>1.5</td>
<td>-2.3</td>
<td>-11.6</td>
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<tr>
<td>NPV</td>
<td>$15.6 m</td>
<td>$26.2 m</td>
<td>$54.7 m</td>
<td>$59.8 m</td>
<td>$38.5 m</td>
<td>- $27.8 m</td>
<td>- $57.6 m</td>
</tr>
</tbody>
</table>

Summary of economic performance

The TCS option and the Roundabout option were found to be not economically viable. The remaining seven options all had a BCR greater than 1.0, and therefore would be economically viable. The highest performing option economically was Option 5A – S2 as it has the highest BCR and NPV, meaning it produces the highest returns to road users in comparison with the money spent on capital work and maintenance.

2.5 Preferred option

Option 5A – S2 is the preferred preliminary design option. This option proposes grade separation of the right turn movement from the Golden Highway in the form of a two lane flyover bridge over the New England Highway. All other movements would remain at-grade. This option also proposes full duplication (a new two lane carriageway) of the New England Highway between Belford (west of Bell Road) and Whittingham (east of the existing Golden Highway intersection) to provide two eastbound and two westbound traffic lanes in this location.

2.6 Design refinements

Some design refinements to the preliminary design option (Option 5A – S2) have been proposed during development of the 80 per cent concept design for the proposal.

Addition of a u-turn facility on the Golden Highway

The main difference between the preliminary design option and the proposed concept design is the addition of a u-turn facility / property access on the northern side of the Golden Highway. As the right turn from the Golden Highway to the New England Highway would be grade separated, it was decided that a formal provision for vehicles egressing from the abattoir access road wanting to head eastbound along the New England Highway is required to ensure safety. Additionally, this feature would service a small number of properties on the southern side of the New England Highway whose access would be restricted to left-in / left-out as a result of the proposal.

The u-turn facility and the egress arrangements from the abattoir access road have been developed in consultation with EC Throsby (owners of the abattoir), Singleton Council and other stakeholders. This consultation has been summarised in Section 5.5 of this REF. The design of the u-turn facility is further discussed below in Section 3.2.4.
3 Description of the proposal

3.1 The proposal

Key features of the proposal include:

1. Widening the New England Highway for around 3.2 kilometres to provide a divided road with two travel lanes in each direction between Belford and the Golden Highway, comprising:
   - Modification of the New England Highway existing single three lane carriageway to a dedicated two lane westbound carriageway
   - Construction of a new two lane eastbound carriageway
   - Provision of a median separating the two carriageways.

2. Replacing the existing right turn movement from the Golden Highway to the New England Highway with a right turn flyover, comprising:
   - Construction of a two lane flyover bridge over the New England Highway alignment
   - Modification of the existing at grade intersection to remove the right turn.

3. Modifications / additions to existing accesses, including:
   - Provision of a u-turn facility on the northern side of the Golden Highway for vehicles wanting to head eastbound along the New England Highway
   - Realigning and widening of the Golden Highway to allow for right turn lanes into the abattoir access road and into the u-turn facility
   - Removal of the access from the Golden Highway into the existing rest area
   - Restriction of movements from the Golden Highway to the New England Highway to a left-turn only (right-turns would be via the flyover)
   - Minor work to the existing road surface at the intersection of the New England Highway and Bell Road to preserve the existing turning movements following duplication of the New England Highway.

4. Removing the Whittingham rest area adjacent to the New England Highway and Golden Highway intersection
   - Removal of the existing road furniture and rest facilities to accommodate the flyover.

5. Utility adjustments, including:
   - Removal of overhead power lines at the New England Highway and Golden Highway intersection
   - Protection of the underground critical gas main that runs along the northern side of the New England Highway
   - Relocation of underground telecommunication conduits in the location of the proposed flyover.

6. Provision of road drainage, including:
   - Extension of existing pipes and culverts under the New England Highway eastbound carriageway to provide the necessary continuity of drainage flows
   - Provision of grassed lined open channels next to the New England Highway eastbound carriageway for drainage and water quality treatment.
7. **Provision of landscaping and street furniture, including:**

- Provision of new signposting, relocation of existing signposting and removal of signs no longer required
- Installation of a permanent Variable Message Sign (VMS) adjacent to the westbound carriageway at Belford (west of Bell Road)
- Provision of a CCTV camera at the New England Highway and Golden Highway intersection
- Provision of lighting at the New England Highway and Golden Highway intersection, along the flyover, and at the u-turn facility
- Installation of safety barriers and guideposts along the New England Highway, flyover and Golden Highway
- Replacement tree planting and grassed lined open channels next to the New England Highway.

Key features of the proposal are shown in Figure 3-1, with further illustrations provided in Section 3.2.4.

If the project is approved, construction of the proposal could start in 2019 and is expected to take around two years to complete. Construction of the proposal would be staged to minimise disruption to local traffic flows. Staging would be further investigated in future stages of the project, however it is anticipated that work would first be carried out at the Golden Highway, followed by construction of the flyover, duplication of the New England Highway to provide the new eastbound lanes and then reconfiguration of the New England Highway westbound lanes.
Figure 3-1: Key features of the proposal
### 3.2 Design

#### 3.2.1 Design criteria

The design criteria that formed the basis of the concept design are set out in Table 3-1.

#### Table 3-1: Key design criteria

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Design speed</td>
<td>110 kilometres per hour for horizontal alignment</td>
<td>100 kilometres per hour</td>
<td>80 kilometres per hour (70 kilometres per hour adopted for section between New England Highway and flyover entry ramp)</td>
<td>80 kilometres per hour</td>
</tr>
<tr>
<td>Posted speed</td>
<td>100 kilometres per hour</td>
<td>100 kilometres per hour</td>
<td>70 kilometres per hour</td>
<td>70 kilometres per hour</td>
</tr>
<tr>
<td>Minimum grade</td>
<td>2.55 %</td>
<td>1.6 %</td>
<td>2.6 %</td>
<td>2.5 %</td>
</tr>
<tr>
<td>Maximum grade</td>
<td>4.03 %</td>
<td>4.7 %</td>
<td>5.1 %</td>
<td>5.5 %</td>
</tr>
<tr>
<td>Vertical clearance</td>
<td>6.5 metres ¹</td>
<td>6.5 metres ¹</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Lane width</td>
<td>3.5 metres</td>
<td>3.5 metres</td>
<td>3.5 metres</td>
<td>3.5 metres</td>
</tr>
<tr>
<td>Design vehicle</td>
<td>30 metre long B-double and A-double</td>
<td>30 metre long B-double and A-double</td>
<td>30 metre long B-double and A-double</td>
<td>30 metre long B-double and A-double</td>
</tr>
<tr>
<td>Road surface type</td>
<td>Flexible pavement</td>
<td>Flexible pavement</td>
<td>Flexible pavement</td>
<td>Flexible pavement</td>
</tr>
<tr>
<td>Hydraulic standard</td>
<td>10 years</td>
<td>10 years</td>
<td>10 years</td>
<td>10 years</td>
</tr>
</tbody>
</table>

¹ to match the vertical clearance on the Hunter Expressway and oversized vehicle route on the Golden Highway
3.2.2 Engineering constraints

During the concept design phase, several engineering constraints were identified. The major constraints are summarised below:

- The narrow road corridor along the New England Highway in the proposal area, bounded on either side by the existing carriageway and property boundaries provides limited opportunity to change the road alignment and access the site during construction.
- Potential for softer geology and soils at minor creek crossings.
- Variation in strength and excavation ability in sandstones and siltstones at proposed cutting locations.
- High erosion hazard and instability of soils at proposed cutting locations.
- Areas of dryland salinity and potential for salty soils washing into waterways.
- Localised mining related subsidence.
- Existing underground utilities, particularly the critical gas main located near proposed cutting locations.
- Flooding and potential for overtopping of stormwater runoff onto the New England Highway.
- The requirement for intersections to cater for turning movements of heavy / oversized vehicles.

3.2.3 Environmental constraints

There are a number of endangered ecological communities (EECs), species and habitat in the proposal area, including:

- Central Hunter Ironbark - Spotted Gum - Grey Box Forest (Endangered - TSC Act).
- Central Hunter Valley eucalypt forest and woodland (Critically Endangered - EPBC Act).
- Small remnants of Swamp Oak Floodplain Forest (Endangered - TSC Act).
- Two individual Squirrel Gliders (V – TSC Act), some Grey-crowned Babblers (V – TSC Act), some Speckled Warblers (V- TSC Act) and Grey-headed Flying Fox (V – TSC Act and V – EPBC Act).
- Vulnerable (TSC Act) bats including the Eastern Freetail-bat, Eastern Bent-wing Bat and Eastern Horseshoe Bat as well as a number of other probable / possible species.
- Habitat considered potential for the migratory species’ Regent Honeyeater and Swift Parrot.
- Hollow-bearing trees.

Biodiversity is further discussed in Section 6.1 of this REF.

The proposal area also contains a number of previously recorded Aboriginal heritage sites as well as newly identified sites, with higher densities of artefacts present in the areas next to watercourses. The Aboriginal heritage sites in the proposal area were assessed to be of moderate scientific significance. Aboriginal heritage is further discussed in Section 6.2 of this REF.

3.2.4 Major design features

The major design features for the proposal have been outlined in Section 3.1. Further details and illustrations have been provided below.

New England Highway duplication

A new two lane eastbound carriageway would be built from Bell Road to the Golden Highway. The existing eastbound lane of the New England Highway and the eastbound lane from the flyover would merge to form the start of the new two lane eastbound carriageway. The new carriageway would tie in with the existing separated New England Highway carriageway near the Bell Road intersection.
The new carriageway would be around 10.5 metres wide, with two 3.5 metre wide traffic lanes, a 2.5 metre wide paved shoulder on the outside, and a 1 metre wide paved shoulder on the inside (next to the median).

Existing pipes and culverts would be extended under the New England Highway eastbound carriageway to provide the necessary continuity of drainage flows. The intent is to retain the existing stormwater quality approach with no permanent basins proposed for the new works. Grassed lined open channels would be installed next to the road for drainage and water quality treatment. The stormwater runoff would flow off the road and down the embankments into grass lined open channels before being discharged into the natural environment or drainage system.

Wire rope safety barriers would be provided in areas where there are embankments. Safety barriers along other sections of the road would include a mix of type ‘F’ single sided concrete barriers and W-beam safety barriers.

The road has been designed to accommodate 30 metre long B-doubles and would have a posted speed limit of 100 kilometres per hour.

An indicative visualisation of the New England Highway eastbound carriageway is provided in Figure 3-2.

Figure 3-2: Indicative visualisation of the New England Highway eastbound carriageway

Flyover

Design of the flyover has been an iterative process during the concept design phase with consideration given to the following three aspects:
- Bridge type
- Span length
- Deck thickness.

The flyover would be a three span bridge with a total carriageway width of 11 metres. This would consist of two 3.5 metre wide lanes, with 2 metre shoulders on either side of the carriageway. The two lanes would become one lane before the merge with existing New England Highway eastbound lane. The length of the three spans are anticipated to be 20 metres, 28 metres and 20 metres, however this would be confirmed during detailed design.
Bridge abutments and piers on either side of the New England Highway would support the flyover structure. The piers would consist of two concrete columns, with the final dimensions and form of the piers to be determined during the detailed design phase. The embankments would be formed using fill material to an anticipated gradient of 1 to 1.5 metres. This would be confirmed during detailed design.

Bridge barriers would be provided along the flyover structure. Safety barriers along other sections of the road would include a mix of type ‘F’ single sided concrete barriers and W-beam safety barriers. A crash cushion would be provided between the start of the flyover ramp and the existing Golden Highway. Maintenance bays would be provided, to allow vehicles to access the bridge for maintenance.

A cross section and indicative visualisation of the flyover is shown in Figure 3-3 and Figure 3-4 respectively.

**Figure 3-3: Flyover structure concept design**

**Figure 3-4: Indicative visualisation of flyover structure**

**Golden Highway, abattoir access and u-turn facility**

The Golden Highway would be realigned and widened to allow for:
- A dedicated right turn lane from the Golden Highway onto the abattoir access road
- An eastbound through lane onto the right turn flyover
- A westbound through lane
- A diverging lane to the right of the flyover for traffic turning left onto the New England Highway
- Access to the u-turn facility
Removal of the access to the existing Whittingham rest area
- A raised central median between the u-turn facility and the abattoir access road
- Providing a larger horizontal curve for vehicles turning left onto the abattoir access road
- A 2-3 metre wide shoulder.

The design vehicles adopted for the u-turn facility and the abattoir access road turning movements are a 30 metre long B-double and a 26 metre long B-double respectively.

The new u-turn facility and the arrangements at the abattoir access road are shown in Figure 3-5.

![Figure 3-5: U-turn facility and access to the abattoir](image)

**New England Highway and Golden Highway intersection**

 Movements from the Golden Highway to the New England Highway would be restricted to left turns only. This would be configured with the use of raised medians on the New England Highway and by modifying the existing raised median on the Golden Highway to suit left turn only movements. The design vehicle adopted for the manoeuvres to and from the Golden Highway and New England Highway is a 30 metre long A-double. The proposed arrangements at the New England Highway and Golden Highway intersection are shown in Figure 3-6.

Existing bicycle pavement marking on the New England Highway would be extended across the Golden Highway and additional bicycle pavement marking would be provided on the outside of the New England Highway westbound lane, as shown in Figure 3-6.
New England Highway and Bell Road intersection

The existing conditions and turning movements at the New England Highway and Bell Road intersection would be maintained without any physical upgrade work. The left turn lane from the New England Highway eastbound carriageway onto Bell Road would be extended within the existing road surface area and the intersection remarked to suit the New England Highway duplication.

The New England Highway and Bell Road intersection is shown in Figure 3-7.
3.2.5 Other design features

- An aerial biodiversity crossing would be provided to retain fauna connectivity, particularly for the Squirrel Gliders recorded in the area. The location, type and design of the crossing would be determined during detailed design, however an indicative location is shown on Figure 3-1.

- Provisions for cyclists have been incorporated into the proposal, including a 1.3 metre high safety barrier on the flyover, green coloured pavement along the westbound shoulder of the New England Highway before the Golden Highway intersection, extension of the green coloured pavement across the Golden Highway at the intersection with the New England Highway and cyclist crossing on the eastbound flyover entry ramp.

3.3 Construction activities

A constructability assessment has been carried out for the 80 per cent concept design. The proposal would be built using conventional methods applied on most major road and bridge construction projects. These methods may be modified to address the site-specific environmental or engineering constraints.

Staging

Construction of the proposal would be staged to minimise disruption to local traffic flows and adjacent residents and businesses. Construction staging would be further investigated as the project is developed, however it is anticipated that work would first be carried out at the Golden Highway, followed by construction of the flyover, duplication of the New England Highway to provide the new eastbound lanes and then reconfiguration of the New England Highway westbound lanes.

Drainage and water quality

During construction, temporary sediment control measures would be used to improve the quality of discharged water. This would include using temporary sediment basins in conjunction with localised treatments such as sediment fences and earth bunds/channels to separate on-site and off-site water. Additionally, any existing stormwater pits would be protected using drop inlet pits, sand bags, geotextile covers or sediment fences.

The proposed locations for the temporary sediment basins are shown in Figure 3-1. It has also been assumed that the project boundary would be bunded to limit the flow of water from external catchments into the project area and subsequently into the basins.

Controls for dryland salinity

Areas of dryland salinity have been mapped in the proposal area. There is a risk of impact to water quality if salts wash into waterways. This risk can be reduced through use of the sediment control measures mentioned above, and is further outlined in Section 7 of this REF.

3.3.1 Work methodology

The typical construction sequence and activities, as shown in Table 3-2, are based on standard construction practices, but are also informed by the concept design for the project.
<table>
<thead>
<tr>
<th>Component</th>
<th>Typical activity</th>
<th>Typical plant and equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preliminary activities and site establishment</td>
<td>• Property acquisition and adjustments, including property access changes</td>
<td>• Trucks</td>
</tr>
<tr>
<td></td>
<td>• Salvage of Aboriginal artefacts</td>
<td>• Generators</td>
</tr>
<tr>
<td></td>
<td>• Clearing and removal of vegetation</td>
<td>• Light vehicles</td>
</tr>
<tr>
<td></td>
<td>• General site clearance, site establishment work and installation of fencing and</td>
<td>• Excavators</td>
</tr>
<tr>
<td></td>
<td>signage</td>
<td>• Chainsaws</td>
</tr>
<tr>
<td></td>
<td>• Removal of the roadside furniture and facilities at the Whittingham rest area</td>
<td>• Mulchers</td>
</tr>
<tr>
<td></td>
<td>• Establishment of construction site compounds, equipment laydown areas,</td>
<td>• Water carts</td>
</tr>
<tr>
<td></td>
<td>stockpile sites and temporary amenities</td>
<td>• Cranes</td>
</tr>
<tr>
<td></td>
<td>• Delivery of plant and equipment to the site</td>
<td>• Hand tools</td>
</tr>
<tr>
<td></td>
<td>• Establishment of construction site entry and exit points</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Progressive establishment of temporary traffic management arrangements</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Haulage of construction materials</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Progressive installation of environmental controls including temporary or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>permanent fencing, and erosion and sediment control measures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Construction of temporary drainage controls</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Relocation and protection of existing utilities and services</td>
<td></td>
</tr>
<tr>
<td>General site activities — daily</td>
<td>• Inspection of environmental and safety controls</td>
<td>• Traffic management controls</td>
</tr>
<tr>
<td></td>
<td>• Traffic management, as required</td>
<td>• Road sweepers</td>
</tr>
<tr>
<td></td>
<td>• Removal of waste and site clean-up, including road sweeping</td>
<td></td>
</tr>
<tr>
<td>Work associated with the flyover</td>
<td>• Haulage of construction materials</td>
<td>• Batching plant</td>
</tr>
<tr>
<td></td>
<td>• Earthworks involving excavation and fill</td>
<td>• Piling rigs</td>
</tr>
<tr>
<td></td>
<td>• Preparation of bridge work areas including temporary piling pads, access</td>
<td>• Concrete pumps</td>
</tr>
<tr>
<td></td>
<td>platforms</td>
<td>• Concrete trucks</td>
</tr>
<tr>
<td></td>
<td>• Installation of bridge foundations (driven or bored piles, pile caps and</td>
<td>• Cranes</td>
</tr>
<tr>
<td></td>
<td>footings</td>
<td>• Excavators</td>
</tr>
<tr>
<td></td>
<td>• Construction of flyover superstructure and piers</td>
<td>• Trucks</td>
</tr>
<tr>
<td></td>
<td>• Construction of flyover deck and road surface work (cast in-situ or pre-cast</td>
<td>• Small equipment</td>
</tr>
<tr>
<td></td>
<td>bridge elements)</td>
<td>• Lighting towers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Concrete saw</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Wacker plate compactor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Screen boards (petrol driven)</td>
</tr>
<tr>
<td>Component</td>
<td>Typical activity</td>
<td>Typical plant and equipment</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------</td>
<td>-----------------------------</td>
</tr>
</tbody>
</table>
| **Work associated with the New England Highway duplication (new eastbound carriageway)** | • Stripping of topsoil and removal of residual vegetation  
• Haulage of construction materials  
• Earthworks involving excavation and fill  
• Stockpiling  
• Placement and compaction of earthworks  
• Construction of new road, including construction of kerbs and medians and subsurface drainage  
• Construction of road surface  
• Installation of, roadside furniture, lighting and signage  
• Final surfacing and line marking  
• Progressive landscaping and tree planting | • Chainsaw  
• Graders  
• Backhoes  
• Trucks  
• Bulldozers  
• Excavators  
• Water carts  
• Vibratory compactors  
• Bitumen sprayers  
• Vibratory rollers  
• Rubber tyred rollers  
• Lighting towers  
• Concrete saw  
• Wacker plate compactor  
• Screen boards (petrol driven) |
| **Work associated with the New England Highway existing/modified westbound carriageway** | • Stripping of topsoil and removal of residual vegetation  
• Haulage of construction materials  
• Widening of road surface (temporary and new)  
• Reconstruction of existing road surface  
• Final surfacing and restorations  
• Installation of, roadside furniture, lighting and signage  
• Final surfacing and line marking  
• Progressive landscaping and tree planting | • Chainsaw  
• Graders  
• Backhoes  
• Trucks  
• Water carts  
• Vibratory compactors  
• Bitumen sprayers  
• Vibratory rollers  
• Rubber tyred rollers  
• Lighting towers  
• Concrete saw  
• Wacker plate compactor  
• Screen boards (petrol driven) |
| **Drainage** | • Haulage of construction materials  
• Construction of drainage, including kerb and gutter (where required)  
• Installation of new drainage, including culverts | • Trucks  
• Bulldozers  
• Excavators  
• Concrete pumps  
• Concrete trucks  
• Compactors |
| **Finishing work** | • Transport stockpiled waste and spoil to a licenced facility  
• Clean up and decommissioning of the construction site compounds, temporary equipment laydown areas and stockpile sites  
• Restoration and landscaping of temporary sites  
• Demobilisation of plant and equipment from site  
• Removal of construction environmental controls  
• Reinstatement of the site, roadways and all property accesses | • Trucks  
• Generators  
• Light vehicles  
• Cranes |
This list of activities and typical construction plant and equipment provides enough detail to allow an assessment of the likely nature and extent of environmental and community impacts during construction. The construction contractor would refine the construction methodology during detailed design and it is possible that activities would not occur in the precise order listed.

### 3.3.2 Construction hours and duration

If the project is approved, construction of the proposal could start in 2019 and is expected to take around two years to complete.

Where possible, work would be limited to the recommended standard hours for construction work outlined in the *Interim Construction Noise Guideline* (DECC, 2009) (ICNG) which are:

- 7.00am – 6.00pm Monday to Friday
- 8.00am – 1.00 pm Saturdays
- No work on Sundays or public holidays.

To minimise disruption to traffic and to reduce the duration of construction, some work would be undertaken outside of these hours. This would include work from 1.00pm – 6.00pm on Saturdays and some night-time works. Work planned outside of standard hours may include but not be limited to the relocation of existing utilities and services under the road, some road surfacing work and construction of the flyover. Reasonable and feasible work practices to minimise noise nuisance (nominally set at 5 dBA above background noise levels) would be implemented through a noise management plan (NMP). This would include notifying potentially affected residents and businesses.

Any other major noise generating work required outside standard construction hours would require justification in accordance with the ICNG and should follow the out-of-hours work and assessment procedure in the Roads and Maritime Construction Noise and Vibration Guideline. For further details refer to Section 6.7 of this REF.

### 3.3.3 Plant and equipment

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

- Batching plant
- Bulldozers
- Chainsaws
- Concrete pumps
- Concrete trucks, including bitumen sprayers and aggregate spreaders
- Concrete saw
- Cranes
- Drills
- Excavators and backhoes
- Generators
- Graders
- Hand tools
- Jackhammers and compressors
- Lighting towers
- Mulchers
- Piling rigs
- Road sweepers
- Rollers
- Scrapers
- Screen boards (petrol driven)
- Staff vehicles and light vehicles for transporting materials
- Tip trucks
- Traffic management controls
- Trucks for material and equipment deliveries
- Wacker plate compactor
- Water carts.
3.3.4 Earthworks

Earthworks for the proposal would include excavation for widening of the Golden Highway, duplication of the New England Highway and construction of the flyover embankments.

It is expected that the total cut volume for the proposal would be around 68,000 cubic metres and the total fill volume would be around 218,000 cubic metres.

It is expected that there would be a shortage of 150,000 cubic metres of fill over cut and therefore fill materials will need to be imported. Any excess materials following construction would be removed from site for either re-use and recycling or disposal at an approved disposal site.

3.3.5 Source and quantity of materials

Construction of the proposal would require, but is not limited to, the following materials:

- Earthworks materials, such as topsoil, mulch, general fill and select fill
- Aggregates for drainage construction, concrete and asphalt production and spray seals
- Sand for drainage construction and concrete and asphalt production
- Concrete for drainage construction, road surface construction, bridgeworks and miscellaneous work such as barrier kerbs, kerbs and gutters, paving and signpost footings
- Bitumen for spray seals and asphalt production
- Cement and fly ash for concrete production
- Concrete and girders, planks, precast concrete abutments for the flyover
- Road base for the construction of a flexible road surface
- Precast concrete elements for drainage construction (culverts, pits and headwalls) and miscellaneous work
- Steel for barrier railings and reinforcement in concrete
- Lighting, signage and street furniture
- Hard and soft landscaping materials.

Excess fill left over from other Roads and Maritime projects would be used for this proposal where suitable. All other materials would be purchased from Roads and Maritime registered suppliers where possible.

The relocation of existing utilities and services may require conduits, pits, cables and pipes. It is expected that these materials would be sourced and provided by the utility companies, who would carry out this work.

Water would be required during construction for earthworks and dust control. The volume of water required is currently unknown and would be determined by the construction contractor at a later stage. Water would be sourced from the farm dams acquired by Roads and Maritime or from authorised off-site sources. Water saving practices would include recycling and reusing water where possible. Water from the temporary sediment basins would also be used, where practicable.

3.3.6 Traffic management and access

Construction of the proposal would generate light vehicle, truck and heavy equipment movements to and from the site. The typical traffic generating activities would include construction staff travelling to and from site, delivery of plant, equipment and construction materials, and collection and disposal of waste not appropriate for reuse on-site.

It is expected that up to 100 combined light and heavy vehicle movements would occur each day during a typical working day. This is expected to increase to up to 400 per day during the peak construction period. This would include an estimated 10,000 truck movements for delivery of the imported fill.
Parking for construction staff would be provided at the construction compound sites. Where possible, the transport of heavy machinery to and from site would be avoided during peak hours to minimise road user delays.

The majority of work, and hence vehicle movements, would be on the northern side of the existing New England Highway. It is not feasible to use only left-in/ left-out accesses, and therefore provision would need to be made for safe right-in and right-out movements (i.e. all movements). There would also be some work and vehicle movements on the northern side of the Golden Highway, west of the New England Highway. Any expected traffic impacts would be managed in accordance with a project specific traffic management plan (TMP) and any road occupancy approvals.

The proposed main site access points during construction are listed in Table 3-3 and shown in Figure 3-8.

Table 3-3: Proposed site accesses

<table>
<thead>
<tr>
<th>Label</th>
<th>Location of access</th>
<th>Details</th>
<th>Movements</th>
</tr>
</thead>
<tbody>
<tr>
<td>GH1</td>
<td>Golden Highway / abattoir access road</td>
<td>For works on the northern side of the Golden Highway</td>
<td>All movements</td>
</tr>
<tr>
<td>GH2</td>
<td>Golden Highway (location of proposed u-turn facility)</td>
<td>For works on the northern side of the Golden Highway (including the flyover). Access to auxiliary construction compound</td>
<td>All movements</td>
</tr>
<tr>
<td>NEH 1</td>
<td>New England Highway</td>
<td>Access to main construction compound and flyover/ ramp areas. Import point for large quantities of fill material</td>
<td>All movements</td>
</tr>
<tr>
<td>NEH 2</td>
<td>New England Highway</td>
<td>Access to rock cutting/ blasting work zones, west of the access</td>
<td>All movements</td>
</tr>
<tr>
<td>NEH 3</td>
<td>New England Highway</td>
<td>Access to rock cutting/ blasting work zones east of the access</td>
<td>All movements</td>
</tr>
<tr>
<td>NEH 4</td>
<td>New England Highway</td>
<td>Exit from site</td>
<td>Eastbound only</td>
</tr>
</tbody>
</table>

Note: The above access points are indicative only. Construction accesses and associated traffic impacts would be managed for each stage of construction through the project Traffic Management Plan (TMP) and in accordance with AS1742 3 – 2009 and any Road Occupancy Licences issued by Roads and Maritime.

It is expected that temporary speed limits and lane closures would be required during the construction phase. Final construction methods would be refined to minimise traffic and transport impacts, however traffic restrictions would be unavoidable during some construction activities, such as piling work, foundation and road surfacing work and construction of the flyover.

Where possible, the most disruptive work would be undertaken as night work. This, combined with temporary effective traffic management, would minimise impacts to traffic and transport using both the New England Highway and Golden Highway.

The normal access arrangements at the abattoir access road may be temporarily disrupted, however access would be maintained at all times to ensure there is no impact to the day-to-day operations of the abattoir. Access to all private property would be maintained at all times. Details of all required access arrangements and traffic restrictions would be detailed in the TMP.
The Hunter Valley Buses Singleton Heights to Stockland Green Hills via Maitland (route 180) bus stops, as shown in Figure 2-3, may need to be relocated temporarily during construction. Areas for relocation would need to be arranged in consultation with Hunter Valley Buses prior to construction in order to minimise disruption to the service and customers.

There would be no direct impact to the Hunter Valley rail network or the Main North Railway Line, however access to land owned by ARTC and one private property would be affected by the construction of the u-turn facility and siting of the construction compound. As agreed with ARTC, access between the Golden Highway and the rail hardstand would be provided at all times. Similarly, access to the private property would also be maintained. This may require temporary works during construction to ensure the safe access and egress between these properties and the public roads.

3.4 Ancillary facilities

3.4.1 Compound sites

One main construction compound and one auxiliary construction compound would be required during construction work. The main construction compound would be located on the northern side of the New England Highway and the auxiliary construction compound would likely be located on the northern side of the Golden Highway, west of the New England Highway and Golden Highway intersection (see Figure 3-8).

The main construction compound would be of sufficient size to accommodate:
- Stockpiles and material laydown areas
- On-site construction buildings and worker facilities
- Temporary car parking.

The construction compound would be secured with construction fencing and gates for security and provided with power for lighting and communications. Erosion control provisions and any other contractual requirements would be provided to ensure that the site is maintained in a reasonable condition.

The auxiliary construction compound would provide for additional material handling, stockpiling and facilities. Temporary ancillary facilities, such as amenities and clean-up sites, may also be established along the New England Highway as work progresses.

Establishment of the main and auxiliary construction compound sites may require the clearing of some native vegetation. However this would be minimised as much as possible and has been addressed in Section 6.1 of this REF. Stockpile sites would be managed in accordance with the Roads and Maritime Stockpile Site Management Procedure and the QA Specification R44 – Earthworks.

Should additional compound sites and/or stockpile sites be required during construction, locations would be selected using the following criteria where practicable as set out in the Roads and Maritime Stockpile Site Management Procedures:
- Located within the proposal boundary, as shown in Figure 1-2 of this REF
- Located in areas previously disturbed that do not require the removal of native vegetation
- Located away from EECs, Aboriginal heritage sites and non-Aboriginal heritage items
- Located in areas not prone to flash flooding and more than 50 metres from a watercourse
- Located in areas of plain view to deter theft and illegal dumping
- Located more than 100 metres from residential receivers
- Stockpiles sites would be located outside the drip line of trees and be on level ground.
Figure 3-8: Proposed location of ancillary facilities
3.5 Public utility adjustment

Some of the existing utilities or services would require relocation or protection to accommodate the proposal, including:

- Removal of the Ausgrid overhead power lines at the New England Highway and Golden Highway intersection
- Protection of the Jemena underground critical gas main that runs parallel to the New England Highway
- Relocation of the Telstra underground telecommunication conduits at the location of the flyover.

Further consultation with these service providers would be carried out closer to construction.

3.6 Property acquisition

Partial property acquisitions would be required to accommodate construction and operation of the proposal. Details of the required property adjustments are provided in Table 3-4, and are illustrated on Figure 3-9.


Table 3-4: Property adjustments associated with the proposal

<table>
<thead>
<tr>
<th>Current land use</th>
<th>Lot</th>
<th>DP</th>
<th>Full/ partial acquisition</th>
<th>Area to be acquired</th>
<th>Portion of total lot area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private property</td>
<td>4</td>
<td>DP 621020</td>
<td>Partial</td>
<td>11.41 ha</td>
<td>9.7 %</td>
</tr>
<tr>
<td>Private property</td>
<td>1</td>
<td>DP 653039</td>
<td>Partial</td>
<td>28.50 ha</td>
<td>33.4 %</td>
</tr>
<tr>
<td>Private property</td>
<td>11</td>
<td>DP 825903</td>
<td>Partial</td>
<td>0.52 ha</td>
<td>1.3 %</td>
</tr>
</tbody>
</table>
Lot 1/DP653039
Lot 11/DP825903
Lot 4/DP621020

New England Highway
Golden Highway

Proposal boundary
Cadastre
Property to be acquired

Figure 3-9: Proposed property acquisition
4 Statutory and planning framework

4.1 Environmental Planning and Assessment Act 1979

The Environmental Planning and Assessment Act 1979 (EP&A Act), Environmental Planning and Assessment Regulation 2000 (EP&A Regulation) and associated environmental planning instruments (including SEPPs and LEPs) provide the framework for the assessment of environmental impacts and approval of development in NSW.

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 road and is to be carried by Roads and Maritime, it can be assessed under Part 5 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 Section 5 of this REF.

State Environmental Planning Policy No 44 – Koala Habitat Protection (SEPP 44)

State Environmental Planning Policy 44 Koala Habitat Protection (SEPP 44) aims to ‘encourage the conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline’.

Singleton is listed under Schedule 1 of SEPP 44, which lists the LGAs to which the SEPP applies.

SEPP 44 requires that before granting consent for development on land over one hectare in area, a consent authority must be satisfied as to whether or not the land is ‘potential’ and ‘core’ habitat for Koalas, where the habitat types are:

- **Potential koala habitat** - areas of native vegetation where feed trees listed in Schedule 2 constitute at least 15 per cent of the total number of trees in the canopy in the upper or lower strata of the tree component
- **Core Koala habitat** - areas of land with a resident population of koalas, which includes evidence of breeding females and/or recent sighting of koalas.

Under SEPP 44, where core koala habitat is found to occur, a site-specific Koala Plan of Management must be prepared, unless a local Koala Plan of Management already exists.
A Biodiversity Assessment was carried out by Environmental Property Services (EPS) in September 2016 as part of this REF. No koalas were recorded within the proposal area despite targeted nocturnal surveys and koala searches, and further no scats or scratches of this species were recorded. One supplementary Koala feed tree *Eucalyptus tereticornis* was recorded within the proposal area. This tree species comprises less than 15 per cent of the total trees and therefore does not constitute core or potential koala habitat within the proposal area. The proposal is not expected to have an adverse impact on the lifecycle of the koala such that a viable local population will be placed at risk of extinction. Therefore SEPP 44 has not been considered further.

### 4.1.2 Local Environmental Plans

**Singleton Local Environment Plan**

The *Singleton Local Environment Plan 2013* (Singleton LEP) sets out the framework for the planning and development of land within the Singleton LGA. The Singleton LEP is administered by Singleton Council who are the approving authority for local development subject to the Singleton LEP. However as outlined in Section 4.1.1, for this proposal, Clause 94 of ISEPP overrides the requirement for development consent from local councils. Nevertheless, the land uses prescribed by the Singleton LEP have been considered in development of the proposal and are discussed below.

In accordance with Clause 10 of the Singleton LEP, Roads and Maritime, as the determining authority, have the responsibility to ensure that essential services are available throughout the proposed work. This includes the provision of water supply, electricity supply, sewage disposal and management, stormwater drainage (or on-site conservation) and suitable vehicular access.

Under the Singleton LEP, and as shown in Figure 4-1, land directly affected by the proposal is zoned:

- SP2 – Infrastructure
- IN3 – Heavy Industrial
- E2 – Environmental Conservation
- RU1 – Primary Production.

**SP2 – Infrastructure**

Most of the proposal is located on land zoned as Infrastructure. This land is already owned by Roads and Maritime for the purpose of road development. The objectives of this zone under the Singleton LEP include:

- To provide for infrastructure and related uses
- To prevent development that is not compatible with or that may detract from the provision of infrastructure.

The proposal would meet the objectives of this zone.

**IN3 – Heavy Industrial**

Parts of the proposed road duplication and flyover would be located within land zoned as Heavy Industrial. The objectives of this zone under the Singleton LEP include:

- To provide suitable areas for those industries that need to be separated from other land uses
- To encourage employment opportunities
- To minimise any adverse effect of heavy industry on other land uses
- To support and protect industrial land for industrial uses.

Roads and Maritime proposes to acquire land affected by the proposal, as discussed in Section 3.6 of this REF. The acquired land would be rezoned as SP2 – Infrastructure.
The proposal would support future proposed industrial development in the area.

**E2 – Environmental Conservation**

Construction of the proposal may encroach onto land zoned as Environmental Conservation. This would be near the unnamed creek in the middle of the proposal area. Some vegetation to accommodate the proposed work may also be cleared within this area. The objectives of this zone under the Singleton LEP include:

- To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values
- To prevent development that could destroy, damage or otherwise have an adverse effect on those values.

The proposal would not support the objectives of this zone, however impacts within this area would be minimised where possible. Work at this location would be managed to preserve the environmental values of the area as much as practicable.

**RU1 – Primary Production**

Some work at the intersection of the Golden Highway and access to the abattoir would be located on land zoned Primary production. The objectives of this zone under the Singleton LEP include:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base
- To encourage diversity in primary industry enterprises and systems appropriate for the area
- To minimise the fragmentation and alienation of resource lands
- To minimise conflict between land uses within this zone and land uses within adjoining zones.

The proposal would temporarily affect this small portion of land zoned RU1 – Primary Production during construction, however would not impact production in the area. During operation, this area would be upheld as RU1 – Primary Production.
Figure 4-1: Land zoning
4.2 Other relevant NSW legislation

4.2.1 Roads Act 1993

The *Roads Act 1993* (Roads Act) aims to set out guidelines for the use, development and maintenance of roads throughout NSW. The Roads Act also confers the functions of Road and Maritime.

Under Section 143 of the Roads Act, a roads authority can use a public road in the exercise of a function conferred by the Roads Act, so long as the function is exercised in a way that will not unduly interfere with the rights of passage and access that exist with respect to the public road.

As outlined in Section 6.6 of this REF, there would be short term impacts to traffic movements as a result of the proposal, however safe access would be maintained throughout construction period.

4.2.2 Threatened Species Conservation Act 1995

The NSW *Threatened Species Conservation Act 1995* (TSC Act) aims to promote biodiversity and ecologically sustainable development throughout the State. If a proposal is likely to impact on threatened species, populations or ecological communities listed under the TSC Act, an assessment is required. Specifically, if a proposal is likely to occur in an area where threatened species, population or ecological communities are present then a Seven Part Test needs to be carried out to determine if there would be any significant impacts as a result of the proposal. If significant impacts are likely to occur, then a Species Impact Statement (SIS) may be required and the Director-General of the Department of Premier and Cabinet’s – Office of Environment (OEH) must provide approval for the proposal. In some cases, the Commonwealth Minister for the Environment may also need to be consulted.

As identified in Section 6.1 of this REF, two communities listed as endangered under the TSC Act were recorded in the proposal area during field work undertaken by Environmental Property Services (EPS) for this REF. These were:
1. Central Hunter Ironbark – Spotted Gum Grey Box Forest
2. Swamp Oak Floodplain Forest

The proposal would remove 10.40 ha of Central Hunter Ironbark – Spotted Gum – Grey Box Forest and 0.83 ha of Swamp Oak Floodplain Forest. Impact assessments carried out under the TSC Act for the Central Hunter Ironbark – Spotted Gum Grey Box Forest and Swamp Oak Floodplain Forest concluded that the proposal was unlikely to result in a significant impact to these ecological communities.

Six threatened fauna species listed under the TSC Act were recorded within the proposal area during field work for this REF. These were:
1. Squirrel Glider
2. Speckled Warbler
3. Grey-crowned Babbler
4. Grey-headed Flying Fox
5. Eastern Bent-wing Bat

A further 29 threatened fauna species have potential habitat within the proposal area though were not recorded during field work. Significance assessments carried out for these recorded and potential threatened fauna species were undertaken and no significant impacts were considered likely.

No threatened flora listed under the TSC Act was recorded in the proposal area during field work.
The Assessments of Significance (seven-part test) undertaken for the proposal did not identify potentially significant impacts to any threatened species, populations or ecological communities listed under the TSC Act. Therefore an SIS is not considered necessary for this proposal.

4.2.3 **National Parks and Wildlife Act 1974**

The National Parks and Wildlife Act 1974 (NPW Act) provides for the control and management of national parks, nature reserves, wetlands, reserves, historic sites and other state reserves in NSW. The NPW Act also outlines the approval requirements for work in the vicinity of Aboriginal heritage and provides for the protection of flora and fauna.

The NPW Act aims to conserve nature, habitat, ecosystems, ecosystem processes and biological diversity at the community, species and genetic levels. All native fauna is protected, threatened or otherwise, under the NPW Act. Schedule 13 lists protected plants which shall not be harmed or picked on any land either on or off a National Park estate.

The NPW Act also provides legislative protection for Aboriginal heritage in NSW. Part 6 of the NPW Act prevents persons from impacting on an Aboriginal place or relic without consent or a permit. Under the NPW Act, an Aboriginal heritage impact permit (AHIP) is required prior to the harm of any Aboriginal objects.

Potential impacts to Aboriginal heritage in the proposal area have been assessed in accordance with the Roads and Maritime Procedure for Aboriginal cultural heritage consultation and investigation (the PACHCI). A Stage 2 PACHCI assessment carried out by Artefact Heritage identified Aboriginal archaeological sites within the proposal recommended that further investigation (including archaeological test excavation) and consultation with Aboriginal stakeholders be carried out in accordance with the Stage 3 of the PACHCI. Further investigation carried out by Kelleher Nightingale Consulting (KNC) in accordance with Stage 3 of the PACHCI, confirmed that Aboriginal sites and objects of moderate scientific significance would be impacted by the proposal.

A cultural heritage assessment report (CHAR) has been prepared for the proposal. The CHAR will accompany an AHIP for the proposal to impact Aboriginal heritage sites during construction. This process has further been summarised in Section 6.2 of this REF.

Consultation with the Aboriginal community about the proposal has been carried out in accordance with the OEH Aboriginal cultural heritage consultation requirements for proponents 2010 and the PACHCI and is detailed in Section 5.3 of this REF.

4.2.4 **Heritage Act 1977**

The Heritage Act 1977 (Heritage Act) provides for the conservation of non-Aboriginal heritage in NSW. The Heritage Act provides for protection of items of local, regional and State heritage significance and it is used to regulate development that may impact on the State’s heritage assets. Development or activities cannot be carried out which may affect an item listed on the State Heritage Register without approval under Section 60 of the Heritage Act.

As identified in Section 6.8 of this REF, there are no listed local, regional or State non-Aboriginal heritage items in the proposal area.

Under Section 170 of the Heritage Act, all government agencies must maintain a Heritage and Conservation Register that lists all heritage assets under their management and includes an assessment of the significance of each asset. Each agency must ensure that all items included in the Register are maintained with due diligence.

As identified in Section 6.8 of this REF, there are no Section 170 items near to the proposal area.
Under Section 139 of the Heritage Act, approval is also required prior to the disturbance or excavation of land if it would, or is likely to, result in a relic being discovered, exposed or damaged.

As discussed in Section 6.8 of this REF, the proposal area contains parts of two road alignments that were in existence by the mid-1830s which could be considered to be of local heritage significance as major regional thoroughfares. However these remains are expected to be defined as works rather than relics and therefore not protected by the Heritage Act.

Additional historic fabric relating to earlier phases of the construction and use of Jerry's Plains Road / Great North Road / New England Highway may also be present. However, any such fabric is likely to have been impacted by previous road work and would be fragmentary in nature. Therefore these remains are not considered to have local heritage significance.

4.2.5 Contaminated Land Management Act 1997

The Contaminated Land Management Act 1997 (CLM Act) outlines the process for investigating and where appropriate remediating land that has been significantly contaminated as well as outlining the roles of the NSW Environmental Protection Authority (EPA) and site auditors in supervision and quality assurance. Section 60 of the CLM Act imposes a duty on landowners to notify OEH, and potentially investigate and remediate land if contamination is above EPA guideline levels.

The proposal area has not been declared as significantly contaminated under the CLM Act and as discussed in Section 6.5 of this REF, a Stage 1 Preliminary Site Investigation carried out by Environmental Earth Sciences in June 2016 found that there is a low risk of potential contamination within the proposal area. A previous study undertaken by Hills Environmental in 2014 identified a former timber post and a rail cattle yard on the northern side of the New England Highway about 350 metres east of the Golden Highway intersection as having potential for contamination. While no remaining physical evidence was observed during a field investigation, there could still be the potential for organochlorine pesticide and arsenic contamination in this area. Should contaminants be identified on the site, an assessment would be carried out to determine if notification of the contamination under Section 60 of the CLM Act to the EPA is required. All remediation would be carried out in accordance with the CLM Act.

4.2.6 Water Management Act 2000

The Water Management Act 2000 (WM Act) provides for the management of surface water and groundwater in NSW. The WM Act repealed the Water Act 1912 and certain provisions of the Rivers and Foreshores Improvement Act 1948. Water use approval, water management work approval and activity approvals are required under Sections 89, 90 and 91 of the Act.

The proposal is located within the area of the Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009. The groundwater level in the proposal area is expected to be high, meaning there is a chance groundwater will be intercepted during work. A water supply work approval in accordance with Section 92 of the WM Act may be required if groundwater needs to be extracted for dewatering purposes during construction of the proposal.

Water would be sourced from the farm dams acquired by Roads and Maritime during construction of the proposal. To determine whether a licence is required for this activity, preliminary consultation with NSW Water was carried out in February 2017. NSW Water advised that the online maximum harvestable right calculator¹ should be used to determine how much water from the dam is within Roads and Maritime’s harvestable rights.

¹ NSW Water Maximum harvestable right calculator can be found at http://www.water.nsw.gov.au/water-licensing/basic-water-rights/harvesting-runoff/calculator
Preliminary calculations indicate that Roads and Maritime could withdraw 0.8 mega litres per year without a licence. However this should be verified before the construction period begins and a licence obtained for the intended use of any water outside the amount within the harvestable right.

4.2.7  **Soil Conservation Act 1938**

The *Soil Conservation Act 1938* (SC Act) is primarily concerned with the conservation of soil and prevention of soil erosion.

As outlined in Section 6.4 of this REF, soil protection and conservation practices will be followed throughout the proposal and no approval is required under this SC Act.

4.2.8  **Protection of the Environment Operations Act 1997**

The *Protection of the Environment Operations Act 1997* (POEO Act) is the key piece of legislation for environmental protection in NSW. The POEO Act also clearly outlines pollution offences relating to land, water, air and noise pollution and includes a duty to report pollution incidents. There is a broad allocation of responsibilities under the POEO Act between the NSW Environment Protection Authority (EPA), local councils and other public authorities. Relevant to the proposal, the EPA is the regulatory authority for:

- Activities listed in Schedule 1 to the Act and the premises where they are carried out on
- Activities carried out by a State or public authority
- Other activities in relation to which a licence regulating water pollution is issued
- Instances where the proposal is a scheduled activity under the POEO Act and an Environment Protection Licence is required.

Scheduled activities of relevance to the proposal comprise:

- Road construction activities, defined under Schedule 1(35) as the construction, widening or re-routing of roads
- Land-based extractive activities, defined under Schedule 1(19) as the extraction, processing or storage of extractive materials, either for sale or re-use, by means of excavation, blasting, tunnelling, quarrying or other such land-based methods. Extractive materials are defined as clay, sand, soil, stone, gravel, rock, sandstone or similar substances that are not minerals within the meaning of the *Mining Act 1992*.

Under Schedule 1(35) of the POEO Act, an environment protection licence (EPL) is required for any road construction activities that result in the establishment of four or more traffic lanes, over a distance of at least five kilometres (in non-metropolitan areas). Considering this and the scope of work outlined in Section 3.1 of this REF, the proposal is unlikely to be a scheduled activity under Schedule 1(35) of the POEO Act and is unlikely to need an EPL under this provision.

Under Schedule 1(19) of the POEO Act, an environment protection licence is required for any land-based extraction activities that involve the extraction, processing or storage of more than 30,000 tonnes per year of extractive materials. As outlined in Section 3.3.4, 68,000 cubic metres of material is anticipated to be excavated during construction of the proposal. This would require an EPL.

In accordance with Part 5.7 of the POEO Act, the contractor would be required to notify the EPA, and each ‘relevant authority’ when a pollution incident occurs that causes or threatens material harm to the environment during construction. Potential pollution impacts from the proposal and the proposed management measures are discussed in Section 6 of this REF.
4.2.9  Waste Avoidance and Resource Recovery Act 2001

The Waste Avoidance and Resource Recovery Act 2001 (WARR Act) promotes resource recovery and waste avoidance to continually reduce waste generation through the efficient use of resources and implementation of the waste hierarchy. Specifically the WARR Act outlines the resource management hierarchy principles of priority as:

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

The WARR Act also assists in the achievement of the POEO Act and associated regulations and introduces a scheme to promote extended producer responsibility for the life-cycle of a product.

By adopting the principles of the WARR Act, Roads and Maritime encourages the most efficient use of resources and reduces cost and environmental harm in accordance with the principles of ecologically sustainable development (ESD). Resource and waste management is further discussed in Section 6.13 of this REF.

4.2.10  Land Acquisition (Just Terms Compensation) Act 1991

The Land Acquisition (Just Terms Compensation) Act 1991 (Land Acquisition Act), applies to the acquisition of land (by agreement or compulsory process) by an authority of the State which is authorised to acquire the land by compulsory process.

Under the powers of the Roads Act, Roads and Maritime has the authority to acquire property that is directly impacted by a proposal either by negotiation and agreed sale or through a compulsory acquisition process. A property is described as being ‘directly affected’ by a proposal when Roads and Maritime needs to acquire part or all of it to deliver the proposal.

Roads and Maritime proposes to acquire land affected by the proposal, as discussed in Section 3.6 of this REF. Property acquisition required for the proposal would be confirmed through detailed design and in consultation with landowners. All property valuations and acquisitions would be carried out in accordance with the RMS Land Acquisition Information Guide (RMS 2012) and the Land Acquisition Act.

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. Potential impacts to these matters are considered in Section 6 of this REF and Appendix A, and are summarised below.

Findings – matters of national environmental significance (other than biodiversity matters)

An 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 under the EPBC Act.
Findings – nationally listed biodiversity matters

An assessment of the proposal’s impact on nationally listed threatened species, populations, endangered ecological communities and migratory species found that there would be a significant impact on relevant matters of national environmental significance. However, a referral to the Australian Government Department of the Environment is not required for proposed road activities that may affect nationally listed threatened species, populations, endangered ecological communities and migratory species. This is because in September 2015, the Australian Government entered into an agreement with Roads and Maritime and the requirements for considering these impacts are now the subject of a strategic assessment which can be carried out by Roads and Maritime and granted under the EPBC Act.

As part of the strategic assessment, Roads and Maritime is responsible for ensuring that potential impacts are avoided as a first priority and then minimised, mitigated and offset where there are significant residual impacts. The procedures for the strategic assessment are built-into the Roads and Maritime REF process, which includes assessing the significance of impacts on Commonwealth listed biodiversity matters in accordance with the Department of Environment and Energy’s Significant Impact Guidelines 1.1 - Matters of National Environmental Significance and documenting the steps taken to avoid, minimise and mitigate impacts. The safeguards and management measures to be applied are outlined in Section 6.1 of this REF.

4.3.2 Native Title Act 1993

The proposal is located within an area subject to a registered claim made by the Plains Clans of the Wonnarua People under the Commonwealth Native Title Act 1993 (Native Title Act).

Consultation with the Plains Clans of the Wonnarua People has been undertaken during development of the proposal, in accordance with the Roads and Maritime Procedure for Aboriginal cultural heritage consultation and investigation (PACHCI).

To-date, this has included a participation by a representative of the Plains Clans of the Wonnarua People in a site walkover, invitation to the Plains Clans of the Wonnarua People to attend the Aboriginal Focus Group (AFG) meetings for the proposal, and the opportunity to provide:

- Comment on the proposed Aboriginal heritage assessment methodology
- Information on the cultural values to Aboriginal people in the area
- Comment on the draft CHAR.

This is further summarised in Section 5.3 of this REF.

4.4 Confirmation of statutory position

All relevant statutory planning instruments have been examined for the proposal. 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. Therefore, under clause 94 of the ISEPP the proposal is permissible without consent under Part 5 of the EP&A Act. The proponent and determining authority for the proposal is Roads and Maritime.

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

Under the NPW Act, an AHIP for the proposal will need to be prepared and submitted to OEH for review and assessment. All work carried out for the proposal must abide by the conditions of this AHIP.
5 Consultation

5.1 Consultation strategy

Roads and Maritime has undertaken stakeholder and community consultation throughout the development of the proposal.

A community and stakeholder engagement strategy has been developed to:

- Inform the community and stakeholders of the proposal and make them aware of any potential impacts
- Seek feedback from the community and stakeholders for consideration in developing the concept design and environmental assessment
- Build a database of relevant and interested stakeholders and community members for ongoing consultation and engagement.

This section of the REF details consultation that has been carried out with stakeholders and the community to date. If Roads and Maritime proceeds with the proposal, ongoing and future consultation are also outlined.

5.2 Community involvement

Community consultation on the proposal commenced in May 2015, with the following consultation tools used:

- Project web page, offering a phone number, email and postal address
- Project updates
- Static project displays
- Media releases
- Email distribution to registered stakeholders
- Advertisements.

When the project was announced in May 2015, consultation tools included:

- Project update announcing the project and inviting local residents, businesses, roads users and the community to comment on the preferred project option. Community members and stakeholders were encouraged to provide their feedback via mail, email or phone. The project update was delivered to around 1800 households in Whittingham, Belford, Lower Belford, Branxton and Branxton East, as well as key stakeholders, emergency services, Singleton Council and the local MP
- Project web page (updated 20 May 2015) containing latest project information, next steps, project contact details and May 2015 project update
- Media release announcing the public display and inviting comments from the community, followed by a second media release (11 June 2015) reminding the community to provide feedback
- Newspaper advertisements (29 May 2016) in the Maitland Mercury and Singleton Argus
- Static display at Singleton Motor Registry, Singleton Council and Branxton Post Office
- Stakeholder briefings with Singleton Council, the Member for Upper Hunter and impacted property owners.

Comments on the preferred option closed on 22 June 2015 and 32 submissions were received over the consultation period. A range of issues were raised by individual community members, including potentially affected property owners and businesses in the project area. The feedback was generally supportive of the proposal with key concerns relating to safety, project design, property access and timing for construction.
A summary of the issues raised and Roads and Maritime’s response is included in the *New England Highway upgrade between Belford and the Golden Highway - Community Consultation Report*, August 2015 and presented in Table 5-1. The report can be viewed in full in Appendix B or at rms.work/B2G.

Roads and Maritime then provided the community and key stakeholders with an update on the proposal in September 2016. Consultation tools included:

- Project update outlining work in progress, next steps and contact details for the project. The update was delivered to around 1800 residents in the suburbs of Whittingham, Belford, Lower Belford, Branxton and Branxton East, as well as key stakeholders, emergency services and the local MP
- Project web page (updated September 2016) outlining latest project information, including the September 2016 project update
- Media release announcing the details of the update
- Static display at five key community sites, including Singleton Service New South Wales, Singleton Council, Branxton Post Office, Muswellbrook Shire Council and Denman Community Centre
- Handouts at an Aboriginal Focus Group meeting held in Singleton on 15 September 2016.

Additional comments raised following the September 2016 project update are presented in Table 5-2.
Table 5-1: Summary of issues raised by the community

<table>
<thead>
<tr>
<th>Issue category (number of comments)</th>
<th>Issues raised</th>
<th>Roads and Maritime response (August 15)</th>
<th>Additional comments</th>
<th>Section of this REF where addressed (if relevant)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety (12)</td>
<td>Safety solutions are needed to address the very dangerous existing section of the New England Highway, including changing the eastbound merge line markings, installing wire rope safety barriers and signage and reducing the speed limit.</td>
<td>In June 2015 a safety review was completed at the eastbound merge lane on the New England Highway south of the Golden Highway intersection, near Belford. Safety improvements have been carried out to relocate the eastbound merge north of the crest on the New England Highway to improve visibility of the merge and slow moving traffic which occurs at this location during peak times. A reduced 80 kilometres per hour speed limit has been installed along with queue warning signage to improve safety at the new merge location. Line marking improvements were carried out to provide a wider median and increased clearance between opposing traffic near the merge.</td>
<td>This specific safety issue has previously been addressed. Safety has also been a key consideration in the design of this proposal.</td>
<td>-</td>
</tr>
<tr>
<td>The proposed exit road from the abattoir is very close to the crest on the Golden Highway, which would make it difficult to see vehicles travelling west along the highway.</td>
<td>The project is currently in the early planning and design phase. Provisions for current and future access, including safety and visibility for motorists will be considered in greater detail during the concept design phase, which is expected to be displayed for community comment in late 2016.</td>
<td></td>
<td>In consultation with EC Throsby (owners of the abattoir), the proposed design provides a u-turn facility on the northern side of the Golden Highway for safe egress from abattoir</td>
<td>2.6</td>
</tr>
<tr>
<td>Issue category (number of comments)</td>
<td>Issues raised</td>
<td>Roads and Maritime response (August 15)</td>
<td>Additional comments</td>
<td>Section of this REF where addressed (if relevant)</td>
</tr>
<tr>
<td>------------------------------------</td>
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<td>----------------------------------------</td>
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<td>-----------------------------------------------</td>
</tr>
<tr>
<td>The dual carriageway will make exiting and entering the roads along the Belford straight, including the Bell Road intersection, more difficult and dangerous.</td>
<td>Community concerns have been noted regarding the existing New England Highway and Bell Road intersection. However, as the Belford section of dual carriageway including the Bell Road intersection is not part of the current proposal and outside the project boundary, these concerns have been passed onto the Roads and Maritime Network Safety Management team for consideration.</td>
<td>The existing turning movements at the Bell Road and New England Highway would be preserved. The existing road surface at Bell Road would be extended to connect to both the existing New England Highway carriageway (new westbound only carriageway) and the New England Highway duplication (new eastbound carriageway). A 12 metre median would separate the two carriageways providing safe turning arrangements from Bell Road for right-in/ right-out turns.</td>
<td>3.1</td>
<td></td>
</tr>
<tr>
<td>Consideration should be given to the existing intersections on the New England Highway from Bell Road to Standen Drive at Belford. These intersections have differing merging lane configurations and directional signage, which can be very confusing and dangerous for road users.</td>
<td>Community concerns have been noted regarding the existing Belford section of dual carriageway on the New England Highway, including the various intersection arrangements. However, as the Belford section of dual carriageway is not part of the current proposal and outside of the project boundary, these concerns have been passed onto the Roads and Maritime Network Safety Management team for consideration.</td>
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<tr>
<td>Issue category (number of comments)</td>
<td>Issues raised</td>
<td>Roads and Maritime response (August 15)</td>
<td>Additional comments</td>
<td>Section of this REF where addressed (if relevant)</td>
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<td>The decision to retain the right turn from the New England Highway and the left turn from the Golden Highway is not the safest option for motorists.</td>
<td>Many design options were investigated during the strategic design phase of the project, resulting in the preferred option outlined in the May 2015 community update. The right turn movement from the Golden Highway onto the New England Highway has been the cause of the majority of crashes at the intersection. Safety is a major consideration in road designs and this is why the right turn movement out of the Golden Highway is proposed to be upgraded to a flyover. Due to the current and predicted low usage of the right turn from the New England Highway onto the Golden Highway, the current arrangement will be retained.</td>
<td>The options and alternatives for the proposal have been detailed in Section 2.4 of this REF. The preferred option retains the right turn from the New England Highway onto the Golden Highway and the left turn from the Golden Highway onto the New England Highway.</td>
<td>2.4</td>
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<tr>
<td>Issue category (number of comments)</td>
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<td>Roads and Maritime response (August 15)</td>
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<tr>
<td>Suggestion for an additional flyover for the right turn from the New England Highway to the Golden Highway.</td>
<td>Grade separation of the right turn from the New England Highway to the Golden Highway is not warranted due to the low volume of traffic predicted to complete this movement.</td>
<td>The options and alternatives for the proposal have been detailed in Section 2.4 of this REF. The preferred option retains the at grade right turn from the New England Highway onto the Golden Highway.</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td>Calls for at grade solutions at the intersection, such as a roundabout or traffic lights.</td>
<td>At grade solutions have been considered, but were ultimately rejected due to the high speed environment and high traffic volumes at the intersection between the New England and Golden highways. At grade solutions would also have poor economic viability compared with the preferred option.</td>
<td>The options and alternatives for the proposal have been detailed in Section 2.4 of this REF. At grade solutions were assessed, however would not deliver the desired traffic improvements and level of service, and would not provide economic benefits.</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td>Suggestion to use fencing and median solutions to improve the intersection.</td>
<td>Feedback on improving the intersection on the basis of safety, engineering feasibility and cost will be considered. These options will be further investigated in the concept design and environmental assessment phase, which is expected to be displayed for community comment in late 2016.</td>
<td>The options and alternatives for the proposal have been detailed in Section 2.4 of this REF. Road furniture and landscaping has been considered as part of the design development and is detailed in Section 3.1.</td>
<td>2.4, 3.1</td>
<td></td>
</tr>
<tr>
<td>Issue category (number of comments)</td>
<td>Issues raised</td>
<td>Roads and Maritime response (August 15)</td>
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<tr>
<td>Concerns the proposed lane configurations at the intersection will create more confusion.</td>
<td>We will consider feedback for lane configurations on the basis of safety, engineering feasibility and cost. These options will be further investigated in the concept design and environmental assessment phase, which is expected to be displayed for community comment in late 2016.</td>
<td>The options and alternatives for the proposal have been detailed in Section 2.4 of this REF. The preferred design would provide for clear demarcation of lanes. Road markings and wayfinding signage and would also be employed to ensure a user-friendly experience.</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td>The new intersection design should include two westbound lanes on the Golden Highway to allow eastbound vehicles turning right onto the Golden Highway from the New England Highway and westbound vehicles turning left onto the Golden Highway to enter simultaneously.</td>
<td>We will consider feedback about the intersection design on the basis of safety, engineering feasibility and cost. These options will be further investigated in the concept design and environmental assessment phase, which is expected to be displayed for community comment in late 2016.</td>
<td>The options and alternatives for the proposal have been detailed in Section 2.4 of this REF. The options and alternatives considered the forecast traffic numbers and the level of service at the New England Highway and Golden Highway intersection for three future time periods (2019, 2029 and 2039). The preferred option would result in improved travel times on both the Golden Highway and New England Highway and a desired level of service at the intersection.</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td>Issue category (number of comments)</td>
<td>Issues raised</td>
<td>Roads and Maritime response (August 15)</td>
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<tr>
<td>Property access (8)</td>
<td>Suggestion to realign the left turn from the New England Highway onto the Golden Highway. This would make the movement easier for all vehicles, especially heavy vehicles that need to slow down considerably and could conceivably drift into traffic queuing at the end of the Golden Highway.</td>
<td>Feedback about the intersection design will be considered during the concept design and environmental assessment phase, which is expected to be displayed for community comment in late 2016.</td>
<td>The left turn arrangement into the Golden Highway from the New England would be retained by the proposed design. It was not considered to be a safety issue.</td>
<td>-</td>
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<tr>
<td></td>
<td>Concerns about the possible impact the project will have on accessing properties in the project area in a safe and convenient manner.</td>
<td>Provisions for current and future property access will be considered in greater detail during the concept design phase, which is expected to be displayed for community comment in late 2016.</td>
<td>The proposed design has considered the impact on property access. The proposed changes to access have been detailed in Section 3.1 of this REF. Further, temporary works may be required to ensure safe access to and from land owned by ARTC and a private property north of the Golden Highway to the public roads.</td>
<td>3.1</td>
</tr>
<tr>
<td>Issue category (number of comments)</td>
<td>Issues raised</td>
<td>Roads and Maritime response (August 15)</td>
<td>Additional comments</td>
<td>Section of this REF where addressed (if relevant)</td>
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<td></td>
<td>Suggestions for changes to the access and exit roads proposed for abattoir access road.</td>
<td>Provisions for current and future access will be considered in greater detail during the concept design phase, which is expected to be displayed for community comment in late 2016. More detailed information has been requested from the property/business owner about the number and size of vehicles entering and exiting abattoir access road. This information will assist in further consultation with the potentially affected property/business owner as the concept design progresses.</td>
<td>In consultation with EC Throsby (owners of the abattoir), the proposed design provides a u-turn facility on the northern side of the Golden Highway for safe egress from the abattoir access road. This was considered the safest and best solution for a range of light and heavy vehicles accessing the abattoir.</td>
<td>2.6</td>
</tr>
</tbody>
</table>

New England Highway upgrade between Belford and the Golden Highway
Review of Environmental Factors
<table>
<thead>
<tr>
<th>Issue category (number of comments)</th>
<th>Issues raised</th>
<th>Roads and Maritime response (August 15)</th>
<th>Additional comments</th>
<th>Section of this REF where addressed (if relevant)</th>
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<tbody>
<tr>
<td></td>
<td>The proposal for a dual carriageway will result in one property on the New England Highway losing the right turn movement from its driveway, therefore only allowing a left turn in and out which will cause problems for large trucks entering the property.</td>
<td>Provisions for current and future access will be considered in greater detail during the concept design phase and Roads and Maritime will consult as necessary with potentially affected property owners.</td>
<td>The proposed design would result in one property on the southern side of the New England Highway being restricted to left-in/ left-out movements only. The right-turn movement from the New England Highway into the property would be replaced with a U-turn movement at the Bell Road intersection, followed by a left-turn movement into the property. The right-turn movement out of the property onto the New England Highway traveling towards Newcastle would be replaced by a left-out movement, a left-turn onto the Golden Highway, a u-turn using the new u-turn facility and then a right-turn onto the New England Highway using the flyover.</td>
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<tr>
<td>Issue category (number of comments)</td>
<td>Issues raised</td>
<td>Roads and Maritime response (August 15)</td>
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<tr>
<td>Timing for construction (8)</td>
<td>The proposed upgrade is fully supported and Roads and Maritime is encouraged to start construction as soon as possible.</td>
<td>Roads and Maritime thanks community members who provided support and interest in the New England Highway upgrade project between Belford and the Golden Highway. The project is currently in the early planning and design phase and there are a number of steps to be completed before the project will be ready to go out for construction. More information about the project and the expected delivery timing is available on the Roads and Maritime website. The project web page is the best way to check on progress and obtain the latest updates regarding the project.</td>
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<tr>
<td>Concerns the design is too complex and will take too long to construct.</td>
<td>Many design options were investigated and modelled during the strategic design phase. However, these were ultimately rejected due to poor traffic performance and economic viability compared with the preferred option.</td>
<td>The options and alternatives for the proposal have been detailed in Section 2.4 of this REF. The preferred option was selected as it would result as it would not only provide improved travel times on both the Golden Highway and New England Highway and a desired level of service at the intersection, but also has the BCR and NPV, meaning it would provide the highest economic returns in comparison with the money spent on capital work and maintenance.</td>
<td>2.4</td>
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<tr>
<td>Issue category (number of comments)</td>
<td>Issues raised</td>
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<tr>
<td>Proposed road corridor (5)</td>
<td>Concerns the proposed reserved road corridor as shown on the project map suggests the Golden Highway route option for the Singleton Bypass has been excluded without community consultation.</td>
<td>Community concerns have been noted regarding the proposed establishment of a road corridor for future development of the New England Highway towards Singleton. All bypass options currently under consideration for the Singleton Bypass will have a long-term requirement for four lanes between the Golden Highway and Singleton based on future traffic projections. Community concerns have been passed on to the Singleton Bypass project team for consideration. More information about the Singleton Bypass project is available on the Roads and Maritime website.</td>
<td>Separate to this proposal, a preferred option report for the Singleton Bypass was made available in December 2016 on the Roads and Maritime website. More information can about the Singleton Bypass road reserve can be found on the Roads and Maritime website.</td>
<td></td>
</tr>
<tr>
<td>Environmental impacts (5)</td>
<td>Concerns about erosion due to water runoff from the existing highway, and the potential that it could worsen with the construction of a dual carriageway.</td>
<td>Hydrology and hydraulic investigations will be carried out as part of the concept design and environmental assessment phase to consider drainage and erosion impacts. The environmental assessment is expected to be displayed for community comment in late 2016.</td>
<td>Hydrology and drainage has been considered as part of the proposed design. The existing pipes and culverts would be extended under the new carriageway to provide the necessary continuity of drainage flows, and to meet design standards. Scour protection would be provided where required to prevent erosion.</td>
<td>6.4</td>
</tr>
<tr>
<td>Consideration needs to be given to drainage for nearby properties.</td>
<td>Hydrology and hydraulic investigations will be carried out as part of the concept design and environmental assessment phase to consider drainage and erosion impacts. The environmental assessment is expected to be displayed for community comment in late 2016.</td>
<td>Hydrology and drainage has been considered as part of the proposed design. The existing pipes and culverts would be extended under the new carriageway to provide the necessary continuity of drainage flows, and to meet design standards.</td>
<td>Hydrology and drainage has been considered as part of the proposed design. The existing pipes and culverts would be extended under the new carriageway to provide the necessary continuity of drainage flows, and to meet design standards.</td>
<td>6.4</td>
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<tr>
<td>Issue category (number of comments)</td>
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<tr>
<td>Kangaroos are a major problem along the first 10 kilometres of the Golden Highway, mainly because of the large numbers within the Army Range Land. The upgrade needs to consider keeping wildlife off the roads.</td>
<td>Community concerns have been noted regarding the number of crashes involving kangaroos along the Golden Highway, near the Army Range Land. However, as this section of Golden Highway is not part of the current proposal and outside of the project boundary, these concerns have been passed onto the Roads and Maritime Network Safety Management team for consideration. It is further noted that Roads and Maritime has no jurisdiction regarding Defence Force land. A flora and fauna study will be completed as part of the environmental assessment phase to consider impacts to local wildlife. Mitigation activities will be considered if required to minimise the impact to local wildlife and improve safety for motorists within the project area.</td>
<td>Day and night biodiversity field studies were carried out to help inform this REF. The Eastern Grey Kangaroo was recorded during these investigations. Section 6.1 contains a summary of the management measures recommended to for the protection of species potentially impacted by the proposal. At present this does not include provisions for kangaroos, as they were not seen to be an issue within the proposal area.</td>
<td>6.1</td>
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</tr>
<tr>
<td>Property acquisition (4)</td>
<td>Property owners have requested to meet with Roads and Maritime to discuss potential property acquisition.</td>
<td>Roads and Maritime will work closely with potentially affected property owners on identified property impacts. Roads and Maritime has directly contacted the potentially affected property owners to discuss the specific impact on each property and will continue working closely with these property owners as the project progresses and more detail is known during the planning process.</td>
<td>Partial property acquisitions would be required as part of the proposal Roads and Maritime has and will continue to liaise directly with affected property owners.</td>
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<tr>
<td>Issue category (number of comments)</td>
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<td>Roads and Maritime response (August 15)</td>
<td>Additional comments</td>
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<tr>
<td>Rest areas (3)</td>
<td>Concerns that the right turn flyover will impact on the Whittingham rest area.</td>
<td>The existing rest area is unable to be retained in the current proposal. New and redeveloped rest areas are designed to meet the needs of both heavy vehicle drivers and ordinary motorists. This includes high quality toilets, shade shelters, rubbish bins, tables and chairs. Rest areas have been recently built at Rixs Creek Road north of Singleton and on the Hunter Expressway at both Branxton and Buchanan. The new rest areas have been designed and positioned to provide for the needs along this route.</td>
<td>The Whittingham rest area would be removed as part of the proposal. The next closest light vehicle rest area is located around 10 kilometres to the north on the New England Highway just outside of Singleton. Further north, the Rixs Creek rest area caters for both heavy and light vehicles. A heavy vehicle rest area is also located 10 kilometres to the south at Branxton. Given the proximity of these other rest areas, the Whittingham rest area would not be replaced as part of this proposal.</td>
<td>2.2.7, 3.1</td>
</tr>
<tr>
<td>Noise impacts (1)</td>
<td>A property owner enquired about whether the proposal would include noise reduction measures and whether consideration had been given to the installation of noise barriers along the New England Highway to reduce noise impacts on surrounding properties.</td>
<td>The next phase of the project is the concept design and environmental assessment. During this phase noise impact assessments will be carried out to determine if noise treatments are warranted. Properties that would be potentially impacted by traffic noise would be identified and specific individual noise treatments if warranted for properties would be discussed with relevant property owners. The concept design and environmental assessment is expected to commence in late 2015 and will be displayed for community comment in late 2016.</td>
<td>A noise and vibration impact assessment has been carried out as part of this proposal (see Section 6.7). The assessment found that the Roads and Maritime Noise Criteria Guideline would not be exceeded at any residences located within the proposal area as a result of the upgrade. Therefore noise barriers would not be installed as part of the proposal.</td>
<td>6.7</td>
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<tr>
<td>Issue category (number of comments)</td>
<td>Issues raised</td>
<td>Roads and Maritime response (August 15)</td>
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<tr>
<td>Construction (1)</td>
<td>A local heavy vehicle business expressed interest in discussing the construction requirements of the project.</td>
<td>The project is currently in the early planning phase and there are a number of steps to be completed before the project will be ready to go out for construction. More information about the project and the expected delivery timing is available on the Roads and Maritime website. The project webpage is the best way for to check on progress and obtain the latest updates regarding the project.</td>
<td>There are still a number of steps to be completed before the project will be ready to go out for construction. More information about the project and the expected delivery timing is available on the Roads and Maritime website. The website will continually be updated as the project progresses.</td>
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</table>
Additional submissions and correspondence with the community following distribution of the September 2016 Project Update have been documented in Table 5-2.

Table 5-2: Additional correspondence with the community

<table>
<thead>
<tr>
<th>Issue</th>
<th>Issues raised</th>
<th>Response / how addressed</th>
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</thead>
<tbody>
<tr>
<td>Design (3)</td>
<td>Concerns raised about the left hand turn out of the Golden Highway and proposal to upgrade to a wider radius curve</td>
<td>The main objective of the New England Highway upgrade between Belford and the Golden Highway is to improve safety related to vehicles turning right from the Golden Highway towards Maitland and Newcastle. At this stage, the existing New England Highway left turn lane onto the Golden Highway will continue to be controlled by a ‘Give Way’ sign as it is currently deemed necessary from a safety and functionality perspective.</td>
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<tr>
<td></td>
<td>Concern over nothing being done to the right hand turn off the New England Highway into the Golden Highway</td>
<td>Due to the current and predicted low usage of the right turn from the New England Highway onto the Golden Highway, the current arrangement will be retained.</td>
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<td></td>
<td>Concern the proposed design does not cater for future land use, commercial and industrial</td>
<td>Roads and Maritime is currently in consultation with landowners regarding future development on adjacent properties.</td>
</tr>
<tr>
<td>Construction / timing (4)</td>
<td>Enquiry about project construction timeframes</td>
<td>There are still a number of steps to be completed before the project will be ready to go out for construction. More information about the project and the expected delivery timing is available on the Roads and Maritime website. The website will continually be updated as the project progresses.</td>
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<tr>
<td></td>
<td>Enquiry about future work opportunities</td>
<td>There are still a number of steps to be completed before the project will be ready to go out for construction. More information about the project and the expected delivery timing is available on the Roads and Maritime website. The website will continually be updated as the project progresses.</td>
</tr>
<tr>
<td></td>
<td>Happy to receive the update and looking forward to the project being completed</td>
<td>Roads and Maritime thanks the community and stakeholders for its support and interest in the New England Highway upgrade between Belford and the Golden Highway.</td>
</tr>
</tbody>
</table>

5.3 Aboriginal community involvement

Aboriginal community consultation is an integral part of the assessment of Aboriginal cultural heritage significance, as outlined in the OEH *Aboriginal cultural heritage consultation requirements for proponents* (2010). Consultation with registered Aboriginal parties is currently being carried out in accordance with the PACHCI.
Aboriginal community consultation carried out to date is summarised in Table 5-3. Appendix C contains the consultation materials prepared for consultation with the Aboriginal community and minutes from the Aboriginal focus group (AFG) meetings.

Table 5-3: Summary of Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td>Initial Roads and Maritime assessment  &lt;br&gt; <em>No Aboriginal community consultation is required to be carried out during this stage.</em></td>
</tr>
<tr>
<td>Stage 2</td>
<td>Site survey and further assessment  &lt;br&gt; The Wanaruah Local Aboriginal Land Council (LALC) and Native Title claimants the Plains Clans of the Wonnarua People were invited to participate in a site walkover undertaken as part of the Stage 2 Assessment. Reports submitted by the Wanaruah LALC and the Plains Clans of the Wonnarua People following the walkover are provided in Appendix D.</td>
</tr>
<tr>
<td>Stage 3</td>
<td>Formal consultation and preparation of a cultural heritage assessment report  &lt;br&gt; To-date, Aboriginal community consultation undertaken in accordance with Stage 3 of the PACHCI has included:  &lt;br&gt; • Notification and advertisement of the proposal  &lt;br&gt; • Registration of Aboriginal stakeholders interest in the proposal and provision of project information  &lt;br&gt; • Consultation on the proposed Aboriginal heritage assessment methodology (28 day review period)  &lt;br&gt; • Aboriginal Focus Group (AFG) meeting to discuss the proposed methodology  &lt;br&gt; • Invitation for Aboriginal cultural knowledge holders and stakeholders to provide information on the cultural values to Aboriginal people in the area  &lt;br&gt; • Participation in test excavation field work carried out for the proposal (limited to eight chosen Aboriginal site officers).  &lt;br&gt; • A second AFG meeting to discuss the results of the archaeological and cultural heritage assessments and consultation on the draft cultural heritage assessment report (CHAR) prepared for the proposal (28 day review period).  &lt;br&gt; Issues raised by the Aboriginal community during consultation have been summarised in the CHAR (see Appendix F).</td>
</tr>
<tr>
<td>Stage 4</td>
<td>Implement environmental impact assessment recommendations  &lt;br&gt; The Aboriginal community would be engaged in any post-approval programs recommended in the AHIP, including the completion of archaeological salvage. The details of any such programs would be determined as part of the CHAR.</td>
</tr>
</tbody>
</table>

### 5.4 ISEPP consultation

Part 2 of ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Table 5-4 provides a list of the consultation requirements under Clauses 13 – 16 of ISEPP.
Table 5-4: ISEPP consultation requirements

<table>
<thead>
<tr>
<th>Clause</th>
<th>Issue</th>
<th>Potential impact</th>
<th>Authority</th>
<th>Consultation required</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Council related infrastructure and services</td>
<td></td>
<td></td>
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<tr>
<td>13(1)a</td>
<td>Stormwater</td>
<td>Substantial impact on the stormwater management services provided by council</td>
<td>Singleton Council</td>
<td>No</td>
</tr>
<tr>
<td>13(1)b</td>
<td>Traffic</td>
<td>Traffic generation to an extent that will strain the existing road</td>
<td>Singleton Council</td>
<td>No</td>
</tr>
<tr>
<td>13(1)c</td>
<td>Sewerage system</td>
<td>Connection to, or substantial impact on the capacity of, any part of a sewerage system</td>
<td>Singleton Council</td>
<td>No</td>
</tr>
<tr>
<td>13(1)d</td>
<td>Water usage</td>
<td>Connection to, or use of a substantial volume of water from, any part of a water supply system</td>
<td>Singleton Council</td>
<td>No</td>
</tr>
<tr>
<td>13(1)e</td>
<td>Temporary structures</td>
<td>Installation of a temporary structure on, or the enclosing of, a public place that is under a council’s management or control that is likely to cause a disruption to pedestrian or vehicular traffic that is not minor or inconsequential</td>
<td>Singleton Council</td>
<td>No</td>
</tr>
<tr>
<td>13(1)f</td>
<td>Road and footpath excavation</td>
<td>Excavation that is not minor or inconsequential of the surface of, or a footpath adjacent to, a road for which a council is the roads authority under the Roads Act 1993 (if the public authority that is carrying out the development, or on whose behalf it is being carried out, is not responsible for the maintenance of the road or footpath)</td>
<td>Singleton Council</td>
<td>No</td>
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<tr>
<td></td>
<td>Local heritage items</td>
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<tr>
<td>14</td>
<td>Local heritage items</td>
<td>Impact that is not minor or inconsequential on a local heritage item (other than a local heritage item that is also a State heritage item) or a heritage conservation area</td>
<td>Singleton Council</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Flood liable land</td>
<td></td>
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<tr>
<td>15</td>
<td>Flood liable land</td>
<td>Development on flood liable land that will change flood patterns other than to a minor extent</td>
<td>Singleton Council</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Public authorities other than councils</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16(2)a</td>
<td>National parks and reserves</td>
<td>Development adjacent to land reserved under the National Parks and Wildlife Act 1974</td>
<td>Office of Environment and Heritage</td>
<td>No</td>
</tr>
<tr>
<td>Clause</td>
<td>Issue</td>
<td>Potential impact</td>
<td>Authority</td>
<td>Consultation required</td>
</tr>
<tr>
<td>--------</td>
<td>-------</td>
<td>------------------</td>
<td>-----------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>16(2)b</td>
<td>Marine parks</td>
<td>Development adjacent to a marine park declared under the <em>Marine Parks Act 1997</em></td>
<td>Marine Parks Authority</td>
<td>No</td>
</tr>
<tr>
<td>16(2)c</td>
<td>Aquatic reserves</td>
<td>Development adjacent to an aquatic reserve declared under the <em>Fisheries Management Act 1994</em></td>
<td>Department of Primary Industries (Fisheries)</td>
<td>No</td>
</tr>
<tr>
<td>16(2)d</td>
<td>Sydney Harbour foreshore</td>
<td>Development in the foreshore area within the meaning of the <em>Sydney Harbour Foreshore Authority Act 1998</em></td>
<td>Sydney Harbour Foreshore Authority</td>
<td>No</td>
</tr>
<tr>
<td>16(2)e</td>
<td>Navigable waters</td>
<td>Development comprising a fixed or floating structure in or over navigable waters</td>
<td>Roads and Maritime</td>
<td>No</td>
</tr>
<tr>
<td>16(2)F</td>
<td>Bushfire prone land</td>
<td>Development for the purposes of an educational establishment, health services facility, correctional centre or group home, or for residential purposes, in an area that is bush fire prone land (as defined by the Act)</td>
<td>Rural Fire Service</td>
<td>No</td>
</tr>
</tbody>
</table>

Consultation for the proposal is not triggered by any of the Clauses under ISEPP. Therefore formal consultation in accordance with ISEPP has not been carried out. However, consultation that has been carried out with Singleton Council and other government agencies as part of the proposal development is detailed in Section 5.5 of this REF.

### 5.5 Government agency and stakeholder involvement

A range of government agencies and stakeholders have been consulted about the proposal, including:
- Singleton Council
- EC Throsby (abattoir)
- Tillegra Investments
- Office of Environment and Heritage (OEH)
- Hunter Wine Country Private Irrigation District (PID)
- Jemena
- AAPT
- Ausgrid
- Telstra
- Hunter Water Corporation
- Australian Rail Track Corporation (ARTC).

A summary of the issues raised by these agencies and stakeholders is provided in Table 5-5 below. Roads and Maritime will continue to consult with all stakeholders and affected landowners as required.
<table>
<thead>
<tr>
<th>Agency</th>
<th>Issue raised</th>
<th>Response / where addressed in REF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singleton Council</td>
<td>Provision for attachment of a water main on the side or underside of the flyover to assist with future water services in the area.</td>
<td>Roads and Maritime will consider Council’s request for a water main to be attached to the flyover.</td>
</tr>
<tr>
<td>EC Throsby (abattoir)</td>
<td>Concern around the right turn into the u-turn facility from the Golden Highway during the 3-4pm peak traffic period and the potential for queuing in the right hand turn lane. Also B-doubles coming out of the u-turn facility being able to get up to speed in time to safely merge with traffic on route to the flyover.</td>
<td>Storage available at the right turn into the u-turn facility would be checked in consideration of B-doubles.</td>
</tr>
<tr>
<td>EC Throsby (abattoir)</td>
<td>Consideration of the approach speed leading up to the flyover, whether a roundabout had been investigated at the intersection of the Golden Highway and New England Highway, and the potential for a grade separated entrance to the abattoir, east of the Golden Highway.</td>
<td>Roads and Maritime has undertaken an options assessment for the proposal which considers installation of a roundabout at the intersection of the New England Highway and Golden Highway (see Section 2.4 of this REF). The roundabout option was discounted as it would adversely impact traffic performance.</td>
</tr>
<tr>
<td>Tillegra Investments</td>
<td>Access to the former Tinkler property off the proposed flyover.</td>
<td>At this stage, the design does not include provisions for access to the former Tinkler property from the flyover.</td>
</tr>
<tr>
<td>Hunter Wine Country PID</td>
<td>Impact to the Hunter Wine Country PID water main which runs through the proposal area and services local vineyards.</td>
<td>If required, protection measures would be installed during construction to prevent damage to the main.</td>
</tr>
<tr>
<td>Jemena</td>
<td>Impact to the critical gas main.</td>
<td>The construction methodology would be tailored to consider impacts to the critical gas main and the necessary protection measures implemented to ensure there are no conflicts.</td>
</tr>
<tr>
<td>Ausgrid</td>
<td>Protection and access to all Ausgrid overhead mains and structures.</td>
<td>24 hour access would be provided to all Ausgrid assets during construction and operation of the proposal.</td>
</tr>
<tr>
<td>ARTC</td>
<td>Ongoing access to the rail corridor on both sides of the Golden Highway for maintenance purposes.</td>
<td>Access between the Golden Highway and the rail hardstand would be provided at all times. This may require temporary works during construction to ensure the safe access and egress between these properties and the public roads (see Section 3.3.6 of this REF).</td>
</tr>
</tbody>
</table>
Consideration of the proposal’s impacts on water flow into the rail corridor and on both downstream and upstream properties.

It is not anticipated that the proposal would have an impact on the rail corridor or surrounding land during operation, however this would be further investigated during detailed design. Management measures recommended during construction of the proposal are provided in Section 6.4 of this REF.

5.6 **Ongoing or future consultation**

Rocks and Maritime will continue to keep the community and key stakeholders informed as the project progresses via project updates, web updates, stakeholder briefings, media releases, advertisements and other consultation tools where relevant.

This REF will be placed on display until Friday, 28 July 2017 for the community and stakeholders to review and provide feedback. The community will be notified about the display period via local media and other Roads and Maritime communications channels.

Following public display of the REF, all comments received will be recorded and addressed in a Submissions Report detailing how each issue raised would be considered in finalising the proposal design. The Submissions Report will be made available to the public on the project webpage on the Roads and Maritime website.

The community will be informed of any further changes to the proposal resulting from the Submissions Report or any future consultation.
6 Environmental assessment

6.1 Biodiversity

A Biodiversity assessment report for the proposal was prepared by Environmental Property Services in November 2016. The Biodiversity assessment report is summarised below and provided in Appendix E.

6.1.1 Methodology

Database searches were undertaken to identify the potential for threatened species to occur within the proposal area. Preliminary searches were undertaken on 12 and 19 October 2015, with updated searches undertaken on 11 April 2016. The databases searches included:

- Commonwealth Department of the Environment Protected Matters search tool
- Review of Weeds of National Significance
- NSW BioNet, 20 kilometre search
- PlantNet 25 kilometre buffer around Branxton
- OEH Critical habitat register
- Department of Primary Industries aquatic records viewer for Singleton LGA

The study area identified for the biodiversity assessment generally comprised a 50 metre buffer around the proposed road upgrade alignment, with some variations to account for land reserved for construction compounds and site access arrangements. For the purpose of the survey, the study area is shown in Figure 6-1. The database searches were undertaken for the study area, unless stated otherwise above.

The following information and reports were also reviewed to identify the main biodiversity considerations:

- Department of Primary Industries Noxious Weeds for Upper Hunter Control Area
- Threatened Species, Populations, and Ecological Communities of NSW
- SIX Spatial Information Exchange
- The Vegetation of the Central Hunter Valley (Peake 2006)
- OEH Vegetation Information System: Classification database
- New England Highway upgrade Belford to Golden Highway – Preliminary Environmental Investigation (Roads and Maritime Services 2014)

A flora and fauna field survey of the study area was conducted between January and February 2016. The field survey involved the following effort:

- Opportunistic surveys throughout the study area
- Fauna habitat assessment and herpetofauna searches throughout the study area
- Diurnal Bird census – more than one bird survey conducted each day
- Elliott B arboreal trapping – four trap transects, 20 traps set for four nights
- Cage traps – six cages set for four nights
- Spotlighting throughout study area
- Call playback
- Green and Golden Bell Frog and general frog surveys
- Mobile and stationary Anabat surveys
- Hollow-bearing tree surveys and opportunistic surveys
- Aquatic habitat assessment at ten riparian sites
- Culvert inspections
- Targeted Swift Parrot and Regent Honeyeater winter bird surveys and opportunistic surveys
Searches for threatened flora species via random meander surveys covering the entire study area.

The field survey was primarily conducted over the following periods:

- 4 January to 13 January 2016 (mainly vegetation and flora)
- 25 January to 27 January 2016 (mainly fauna)
- 2 February to 12 February 2016 (mainly fauna trapping)
- June to August (weekly winter bird surveys).

The survey locations are shown in Figure 6-1.
Figure 6-1: Biodiversity study area and survey locations

- Study area
- Bird survey
- Winter bird survey
- Call playback
- Elliot & Cage Trap Line
- Anabat survey
- Green & Golden Bell Frog survey
- Aquatic survey
- BioBank & floristic plot

Legend:
6.1.2 Existing environment

The proposal occurs within the following landscapes:
- Sydney Basin Bioregion
- Hunter Land Services Hunter Region (formerly Hunter Catchment Management Authority);
- Hunter / Central Rivers CMA sub region
- North Coast Botanical sub region
- Central Hunter Foothills Mitchell Landscape
- Upper Hunter Noxious Weed Control Area.

The majority of the surrounding land uses consist of agricultural uses such as cattle grazing and cropping. There is a large expanse of native remnant vegetation to the north which provides connectivity to the Hunter River. A large expanse of native vegetation also occurs to the south east and extends to a distance of approximately 20 kilometres south to Wollemi National Park.

Vegetation communities

Two native vegetation communities and two non-native vegetation communities were identified within the study area during the field surveys. These included:

**Spotted Gum – Narrow-leaved Ironbark – Red Ironbark Shrub – Grass Open Forest of the Central Hunter and Lower Hunter**

This community has an open forest to woodland structure canopy layer with an absent shrub layer and a grassy ground layer. The extent of the community within the study area is approximately 24.4 ha and is shown in Figure 6-2. This community is listed as endangered on the TSC Act and critically endangered on the EPBC Act. The quality of this community was assessed in accordance with the OEH BioBanking Assessment Methodology. Overall this community was considered to be in a moderate to good condition, however some patches were rated as moderate to good (poor) as they contained a high percentage of exotic species.

**Swamp Oak Weeping Grass Grassy Riparian Forest of the Hunter Valley**

This community is riparian vegetation that is associated with creek lines. The canopy of this community contains native species with the understory and ground layer dominated by exotic species. The extent of the community within the study area is approximately 1.9 ha and is shown in Figure 6-2. This community is commensurate with EEC Swamp Oak Floodplain Forest as listed on the TSC Act. The quality of this community was assessed in accordance with the OEH BioBanking Assessment Methodology. Overall this community was considered to be in a moderate to good condition.

**Farm dams and cleared riparian**

There are three farm dams within the study area, all of which are considered to be in poor condition. The dams encompass 0.5 ha of the study. Together with cleared riparian vegetation, these areas provide potential habitat for a number of commonly occurring and threatened fauna species.

The cleared riparian zones within the study area contain creek lines but have no overstorey or understorey vegetation. The creek lines consist of exotic aquatic species and exotic pasture weeds. The cleared riparian areas encompass 1.0 ha of the study area.

**Cleared land**

The remainder of the study area consist of cleared paddocks, occasional paddock trees and grazed vegetation. The paddock trees comprise native species, some of which are hollow-bearing
and contain habitat for a number of arboreal mammals and birds. The dominant understorey is comprised of exotic grasses, herbs and shrubs.

**Flora species**

During the field surveys, 184 flora species from 50 families were recorded in the study area. Of these species, 71 were exotic. The most common family was *Poaceae* and *Asteraceae*. No threatened flora species were recorded.

Three of the exotic species recorded are listed as noxious on the *Noxious Weed Act 1993* (NW Act) for the Upper Hunter Control Area. These include, *Opuntia aurantiaca* (Tiger Pear), *Opuntia stricta* (Prickly Pear) and *Senecio madagascariensis* (Fireweed). All of these weeds are categorised as Class 4, a locally controlled weed under the NW Act which states that “The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread”. All of these weeds are also listed as a Weed of National Significance. Two further weeds recorded within the study area are also listed as a Weed of National Significance, being *Anredera cordifolia* (Madeira Vine) and *Lantana camara* (Lantana).

The African Olive, an invasive weed, was recorded in high density in the understorey of vegetation within the study area. This weeds degrades the habitat of native biodiversity recorded within the study area.

**Fauna species**

During the field surveys, 77 species of fauna were recorded within the study area. This comprised birds (53), mammals (18), frogs (4) and reptiles (2).

Six species of threatened fauna were recorded, including:
- Speckled Warbler
- Grey-crowned Babbler
- Squirrel Glider
- Eastern Bent-wing Bat
- Eastern Freetail-bat
- Grey-headed Flying Fox.

All of these species are listed on the TSC Act, with the Grey-headed Flying Fox also listed on the EPBC Act.

The location of threatened fauna recorded in the study area is shown in Figure 6-3.

Three invasive species were also recorded being the Black Rat, Fox and Indian Myna.

**Migratory species**

Migratory species are those which migrate to Australia (or its external territories), or pass through or over Australian waters during their annual migrations. Migratory species listed under international agreements are protected under the EPBC Act.

The White-throated Needletail migratory species was recorded in the study area.

**Hollow-bearing trees**

During the field surveys, 40 hollow-bearing trees with a total of 151 hollows were recorded in the study area. This comprised 90 small hollows, 55 medium hollows and five large hollows. These hollows would be used by a variety of fauna including mammals (e.g. Squirrel Gliders), birds and...
microchiropteran bats. The high percentage of small hollows indicates that the hollow resources within the study area are an important resource for small mammals, birds and bats.

The location of hollow-bearing trees recorded within the study area are shown in Figure 6-3.

**Fauna habitat**

Three main fauna habitats were identified as occurring the study area. These three habitats provide a range of roosting, breeding and foraging habitat for commonly occurring and threatened species of fauna. The three fauna habitats are:

- Open Forest/Woodland habitat
- Cleared land
- Aquatic habitat.

**Open Forest/Woodland habitat**

The open forest/woodland habitat within the study area includes the Spotted Gum – Narrow-leaved Ironbark – Red Ironbark Shrub – Grass Open Forest of the Central Hunter and Lower Hunter and the Swamp Oak Weeping Grass Grassy Riparian Forest of the Hunter Valley vegetation communities.

This habitat type contains a number of fauna habitat features that provides habitat for a number of fauna species due to the high number of hollow-bearing trees and the presence of a wide range of microhabitat features. The condition of the habitat is considered to be in moderate to good condition and has fragmented connectivity to greater regional vegetation patches to the south and north of the study area.

Species recorded in open forest/woodland habitat within the study area included Eastern Brown Snake, Brown Thornbill, Eastern Yellow Robin, Yellow-faced Honeyeater, Squirrel Glider, Grey-headed Flying Fox, Grey-crowned Babbler, Common Brush-tailed Possum, Speckled Warbler, Rainbow Lorikeet and Grey Butcherbird.

**Aquatic**

The aquatic habitat within the study area includes the three farm dams, ditches on road verges and freshwater creeks and drainage lines. The farm dams provide potential habitat for a range of amphibians and waterbirds. The creeks and drainage lines are both ephemeral and permanent pools. The drainage lines are considered to be in poor to moderate condition. The creek line to the north of the study area contains native vegetation along the banks, while the creek line in the south of the study area is in a highly degraded condition as all native vegetation has been removed.

Fauna species recorded in the aquatic habitat in the study area included Dusky Moorhen, Common Eastern Froglet, Striped Marsh Frog and Eastern Water Skink.

**Grassland**

The grassland habitat within the study area is defined as the cleared land vegetation community. The hollow-bearing trees provide potential breeding and roosting habitat for a variety of mammals and birds, and the grassland provides foraging habitat particularly for insectivorous micro bats, small mammals and birds of prey, such as the Nankeen Kestrel and the Wedge-tailed Eagle. The cleared land is generally devoid of essential micro habitat features such as leaf litter, fallen timber and understorey shrubs. Commonly occurring species recorded in this habitat included Eastern Grey Kangaroo, Australian Raven, Welcome Swallow, Australian Magpie-lark, Willie Wagtail, Crested Pigeon and Masked Lapwing. Pest species recorded in this habitat included the Black Rat and European Fox.
Riparian and aquatic features

The study area consists of five creek / drainage lines and three dams (see Figure 6-2). The creek lines are tributaries of the Hunter River.

The creek line in the north west of the study area contains permanent water with slow water flow, while the creek and drainage lines contain ephemeral pools. Barriers to fish passage in the creek and drainage lines include culverts and vehicle tracks. The water quality is considered to be poor as the water colour was brown indicating high dissolved sediment and algae. Evidence of fox burrows and tracks were observed in the banks of the creek line located in the centre of the study area.

Nine culvert inspections were undertaken as part of the field survey, with one of the culverts containing water at the time of survey. Two of the culverts contained Swallow nests and provide potential roosting habitat for micro bats, although none were observed.
Figure 6-2: Biodiversity vegetation features in the study area

- **Study area**
- **Cleared riparian area**
- **Riparian area**
- **Drainage line**
- **Creeklines**
- **Dam vegetation**

**Vegetation Types**

- **Swamp Oak Floodplain Forest**
  - Endangered TSC Act
- **Grey Box Forest - Narrow-leaved Ironbark**
- **Red Ironbark Shrub - Grass open forest of the central & lower Hunter**
  - Endangered TSC Act
- **Central Hunter Valley Eucalypt Forest / Woodland**
  - Critically Endangered EPBC Act
- **Central Hunter Ironbark - Spotted Gum**
- **Weeping Grass grassy riparian forest of the Hunter Valley**
  - Moderate to Good
- **EPBC Category Class A High Quality (>5 ha)**
- **EPBC Category Class B High Quality**
- **EPBC Category Class C Moderate Quality**

**Qualities**

- **Moderate to Good**
- **Moderate to Poor**
Figure 6-3: Biodiversity fauna features in the study area
Biodiversity considerations

Potential species

It is important to note, that even though they were not recorded during the field surveys, the study area contains potential for habitat for the following species listed under both the TSC Act and EPBC Act:

- Green and Golden Bell Frog
- Spotted-tailed Quoll
- Koala
- Regent Honeyeater
- Swift Parrot
- Australian Painted Snipe
- Painted Honeyeater.

And these species listed under just the TSC Act:

- Black-necked Stork
- Little Lorikeet
- Black-chinned Honeyeater
- Brown Treecreeper
- Diamond Firetail
- Hooded Robin
- Scarlet Robin
- Turquoise Parrot
- Varied Sittella
- Black Falcon
- Little Eagle
- Square-tailed Kite
- Powerful Owl
- Masked Owl
- Barking Owl
- Brush-tailed Phascogale
- Eastern False Pipistrelle
- Yellow-bellied Sheathtail Bat
- Greater Broad-nosed Bat
- Large-eared Pied Bat
- Little Bent-wing Bat
- Eastern Cave Bat
- Southern Myotis.

Migratory species with potential habitat within the study area include:

- Rainbow Bee-eater
- Fork-tailed Swift
- Cattle Egret.

Connectivity

Wildlife connectivity corridors provide linkages between native vegetation within fragmented landscapes. This connectivity provides fauna species with access to foraging, breeding and roosting habitat. Connectivity corridors may also provide refuge from fire, avoidance of predators and retention of population levels through genetic linkages.

The riparian vegetation and roadside vegetation to the north of the New England Highway provides connectivity to Belford National Park to the east and fragmented connectivity to the Hunter River to the north.

The vegetation to the south west of the New England Highway is linked to fragmented vegetation which extends to Pokolbin State Forest and the Howes Valley.
### 6.1.3 Potential impacts

#### Vegetation loss

The proposal would result in the clearing of around 27.73 ha of vegetation, including areas containing vegetation communities listed under the TSC Act and EPBC Act. The breakdown of this clearing is detailed in Table 6-1.

**Table 6-1: Impacts to vegetation**

<table>
<thead>
<tr>
<th>Vegetation community</th>
<th>TSC Act status/name</th>
<th>EPBC Act status/name</th>
<th>Proposed area of removal (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spotted Gum – Narrow-leaved Ironbark – Red Ironbark Shrub – Grass Open Forest of the Central Hunter and Lower Hunter</td>
<td>Endangered Central Hunter Ironbark – Spotted Gum Grey Box Forest</td>
<td>-</td>
<td>10.40</td>
</tr>
<tr>
<td>Spotted Gum – Narrow-leaved Ironbark – Red Ironbark Shrub – Grass Open Forest of the Central Hunter and Lower Hunter (in part)</td>
<td>-</td>
<td>Critically Endangered Central Hunter Valley Eucalypt Forest and Woodland</td>
<td>Class A – 3.94 Class B – 3.27 Class C – 0.99</td>
</tr>
<tr>
<td>Swamp Oak Weeping Grass Grassy Riparian Forest of the Hunter Valley</td>
<td>Endangered Swamp Oak Floodplain Forest</td>
<td>-</td>
<td>0.83</td>
</tr>
<tr>
<td>Farm dams and cleared riparian</td>
<td>-</td>
<td>-</td>
<td>0.30</td>
</tr>
<tr>
<td>Land that is already cleared</td>
<td>-</td>
<td>-</td>
<td>16.20</td>
</tr>
<tr>
<td><strong>Total vegetation</strong></td>
<td>27.73³</td>
<td><strong>Total TSC Act threatened community</strong></td>
<td>11.23</td>
</tr>
<tr>
<td><strong>Total EPBC Act threatened community</strong></td>
<td>8.20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Not all of the patches mapped as Spotted Gum – Narrow-leaved Ironbark – Red Ironbark Shrub – Grass Open Forest of the Central Hunter and Lower Hunter meet the criteria for listing under the EPBC Act

2. No removal of farm dams is proposed, only removal of cleared riparian vegetation

3. Does not include 16.20 ha of land that is already cleared.

**Impacts to Critically Endangered Central Hunter Valley Eucalypt Forest/Woodland**

The Central Hunter Valley Eucalypt Forest and Woodland community is listed as critically endangered under the EPBC Act because of a decline in extent, a restricted distribution, being highly fragmented, and a reduction in community integrity.

The proposal would reduce the extent of this community by 8.20 ha. One of the patches to be impacted is 7.1 ha in size, which is in the high range for remaining patch size for this community. This patch size is classified as high quality class A in accordance with the criteria set out by the Commonwealth Threatened Species Scientific Committee. The proposal would decrease the size...
of this patch to 3.9 ha which equates to 54 per cent of the current patch size. Furthermore, any area of the EPBC Act listed community that meets the criteria for moderate or higher quality is defined as habitat that is critical to the survival of the community.

The impact assessment undertaken for this community (see Appendix E) determined that the proposal would result in a significant impact upon this community.

The conservation advice for this community states that the minimum threshold for a patch to be the subject of a referral under the EPBC Act is moderate or higher condition. Two of the patches within the study area do not meet this, however the remaining seven patches are all in a moderate to high condition. As such, a strategic assessment for this community is required under Roads and Maritime’s Environment Protection and Biodiversity Conservation Act 1999 – Strategic Assessment policy.

**Impacts to Central Hunter Spotted Gum Ironbark Forest**

The Central Hunter Spotted Gum Ironbark Forest is listed as endangered on the TSC Act. This community within the study area has been modified due to previous land uses and is already fragmented. The proposal would remove 10.40 ha of this community, which equates to 0.06 per cent removal in the locality and 0.07 per cent of the extent of this community in the Central Hunter. Therefore, it is considered that the removal of a comparatively minor area of this community is not likely to place the local occurrence of this community at risk of extinction.

The impact assessment undertaken for this community (see Appendix E) determined that the proposal is unlikely to have a significant impact upon this community.

**Impacts to Swamp Oak Floodplain Forest**

The Swamp Oak Floodplain Forest is listed as endangered on the TSC Act. The proposal proposes to remove 0.8 ha, representing a small area of degraded extent of this community. This would result a reduction of 0.07 per cent of the extent of this community within the locality and 0.06 per cent of the extent of this community in the Central Hunter.

The impact assessment undertaken for this community (see Appendix E) determined that the proposal is unlikely to have a significant impact upon this community.

**Fauna habitat loss**

The proposal would result in a loss across all habitats, as detailed in Table 6-2.

Table 6-2: Impacts to habitat

<table>
<thead>
<tr>
<th>Fauna habitat</th>
<th>Corresponding vegetation community</th>
<th>Proposed area of removal (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Forest/Woodland</td>
<td>Spotted Gum – Narrow-leaved Ironbark – Red Ironbark Shrub – Grass Open Forest of the Central Hunter and Lower Hunter, Swamp Oak Weeping Grass Riparian Forest of the Hunter Valley</td>
<td>11.23</td>
</tr>
<tr>
<td>Aquatic²</td>
<td>Farm dams and cleared riparian</td>
<td>0.30</td>
</tr>
<tr>
<td>Grassland</td>
<td>Cleared land</td>
<td>16.20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>27.73</strong></td>
</tr>
</tbody>
</table>

1. Aquatic habitat removal is of cleared riparian areas only, not the farm dams.
Removal of hollow-bearing trees

The proposal would remove 18 hollow-bearing trees within the study area, retaining 22.

Removal of hollow-bearing trees would be reduce habitat for a range of birds and mammals, including the Squirrel Glider which was recorded along the north of the New England Highway and utilises small hollows for roosting and breeding.

Impact to threatened species

An assessment of potential impacts on the six threatened species recorded in the study area is provided in Table 6-3. It is considered that none of the species would be significantly impacted by the proposal. The full assessment can be found in Appendix E.

Table 6-3: Impacts to threatened species

<table>
<thead>
<tr>
<th>Species and listing</th>
<th>Impact assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speckled Warbler TSC Act</td>
<td>The Speckled Warbler was recorded at seven locations on both sides of the New England Highway. The proposal would remove or modify a maximum of 11.23 ha of habitat for this species within the study area. This would include a large expanse of higher quality habitat to the north of the New England Highway which provides foraging, breeding and roosting habitat. Whilst the proposal would remove habitat for this species, it is considered unlikely to have an adverse effect on the lifecycle of the Speckled Warbler such that a viable local population is placed at risk of extinction. The local population of this species is highly likely to extend in all directions immediately outside of the study area.</td>
</tr>
<tr>
<td>Grey-crowned Babbler TSC Act</td>
<td>The Grey-crowned Babbler was recorded at five locations on both sides of the New England Highway. The proposal would remove a large expanse of high quality habitat to the north of the New England Highway which provides contiguous foraging, breeding and roosting habitat for this species. Whilst the proposal would remove habitat for this species, it is considered unlikely to have an adverse effect on the lifecycle of the Grey-crowned Babbler such that a viable local population is placed at risk of extinction. Extensive habitat for this species will remain in the immediate locality.</td>
</tr>
</tbody>
</table>
| Grey-headed Flying Fox TSC Act and EPBC Act | The Grey-headed Flying Fox was recorded at one location on the southern side of the New England Highway. Two deceased Grey-headed Flying Fox were also observed at the junction of Lot 21 DP 1014307 and Lot 4 DP 621020 entangled on barbed wire strung across a farm dam.

The proposal would remove a large expanse of high quality habitat to the north of the New England Highway which provides foraging habitat for this species. No breeding or roosting habitat such as camps were recorded in the study area. Whilst the proposal would remove habitat for this species, it is considered unlikely to have an adverse effect on the lifecycle of the Grey-headed Flying Fox such that a viable local population is placed at risk of extinction. |
Species and listing | Impact assessment
---|---
Squirrel Glider | The Squirrel Glider was recorded at two locations on the northern side of the New England Highway. The proposal would remove a large expanse of high quality habitat that occurs to the north of the New England Highway which provides foraging, breeding and roosting habitat for this species. The proposal would also remove hollow-bearing trees reducing the breeding habitat for this species.

Duplication of the New England Highway would widen the barrier for this species to access foraging and breeding habitat on the south side of New England Highway. Connectivity for the Squirrel Glider, which is currently as close as 15 metres across the existing New England Highway (a distance over which the species can glide), would be widened to over 50 metres.

However, the proposal is considered unlikely to result in an adverse effect on the lifecycle of the Squirrel Glider such that a viable local population is placed at risk of extinction. This is primarily due to the extensive habitat that extends to the north and south of the study area. Connection structures, such as glider poles or arboreal rope crossings, would help mitigate any impacts to the lifecycle of the Squirrel Glider.

Eastern Bent-wing Bat | The Eastern Bent-wing Bat was recorded within the study by Anabat. The proposal would remove a large expanse of high quality habitat to the north of the New England Highway which provides foraging habitat for this species. However, the Eastern Bent-wing Bat is insectivorous and the reduction of a small amount of foraging habitat is unlikely to impact on the availability of foraging resources. Therefore the proposal is unlikely to impact on the lifecycle of the Eastern Bent-wing Bat such that a viable local population is placed at risk of extinction.

Eastern Freetail-Bat | The Eastern Freetail-Bat was recorded within the study by Anabat. The proposal would remove a large expanse of high quality habitat to the north of the New England Highway which provides foraging habitat for this species. The proposal would also remove 18 hollow-bearing trees which would reduce roosting sites for this species. However the Eastern Freetail-Bat is insectivorous and the reduction of a small amount of foraging habitat is unlikely to impact on the availability of foraging resources. Therefore the proposal is unlikely to impact on the lifecycle of the Eastern Freetail-Bat such that a viable local population is placed at risk of extinction.

**Impact to aquatic habitat**

The proposal would remove a small area of riparian vegetation and the exposure of soil during the construction phase may result in additional sedimentation and erosion of the aquatic habitat. However this is expected to be managed by the measures outlined in Section 7 of this REF.

Existing obstructions to fish passage in the study area include upstream dams, culverts and vehicle tracks. The proposal would widen the existing culverts, although this is considered unlikely to substantially impact upon the aquatic habitat within the study area.
Habitat fragmentation and barrier effects

The project would remove 27.73 ha of vegetation, including vegetation along the existing New England Highway road verges. The vegetation to the north of the New England Highway contains much larger areas of vegetation and while these patches are fragmented to a certain degree, overall they are well connected over an expansive area.

It is expected that the proposal could affect connectivity for the Squirrel Glider narrowing the gap between habitats for this species. Squirrel Gliders have a maximum gliding distance of approximately 70 metres. The current distance between the remnant vegetation areas either side of the New England Highway is approximately 15-30 metres. Duplication of the New England Highway would increase the distance from one side of the highway to the other to a conservative maximum distance of about 75 to 80 metres. This could create a barrier to the movement of the Squirrel Glider population.

The widening of the New England Highway is unlikely to create a barrier for flora species pollinators more than already exists.

Fauna injury and mortality

Fauna injury and mortality is currently occurring as a result of the existing New England Highway. However, an increase in mortality may occur during construction of the proposal, through collision with construction equipment and plant and light vehicles. Species that roost in hollows and are nocturnal are likely to have difficulty moving in time to avoid direct impact. These species are most likely to sustain injury or mortality as a result of construction works.

The mitigation measures outlined in Section 6.1.5 would help to limit the injury and mortality of fauna during construction of the proposal.

Spreading of weeds

During construction, the proposal has the potential to spread weeds through the movements of construction equipment, plant vehicles across the site. This includes the three species recorded listed on the NW Act for the Upper Hunter Control Area and the African Olive invasive species was recorded in high density in the understorey of vegetation within the study area.

The mitigation measures outlined in Section 6.1.5 would help to limit the spread of weeds during construction of the proposal.

Noise impacts to fauna

Fauna species use sound for communication, navigation, foraging and detecting prey species or danger. Changes in noise from human induced noise sources, such as vehicle traffic, can affect the ability of fauna species to function normally.

Construction equipment, plant and vehicles would increase noise levels in the study which may impact the ability of local fauna to function normally in their environment. Construction noises may also startle animals such as birds and mammals and frogs may stop calling. However this would only be a temporary impact and fauna within the locality is not known to be substantially affected by the currently noises from high traffic volumes on New England Highway.

Impacts to key threatening processes

Forty key threatening processes are currently listed on the TSC Act and/or the EPBC Act. Ten of these have been assessed as having the potential to being increased by the proposal. These are listed in Table 6-4.
Table 6-4: Impacts to key threatening processes

<table>
<thead>
<tr>
<th>Key threatening processes</th>
<th>Potential impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthropogenic climate change</td>
<td>The proposal would result in a minor incremental contribution to greenhouse gas (see Section 6.14)</td>
</tr>
<tr>
<td>Clearing of native vegetation</td>
<td>The proposal would contribute to an incremental loss in native vegetation and biodiversity offsets would be required (see Section 6.1.4)</td>
</tr>
<tr>
<td>Infection of frogs by <em>amphibian chytrid</em> causing the disease <em>chytridiomycosis</em></td>
<td>The proposal has the potential to spread this disease through the movement of construction equipment, plant and vehicles around the site.</td>
</tr>
<tr>
<td>Infection of native plants by <em>Phytophthora cinnamomi</em></td>
<td>No evidence of <em>Phytophthora cinnamomi</em> was recorded on any plant species during the field surveys, however the proposal may facilitate the transmission of this disease through the movement of construction equipment, plant and vehicles around the site.</td>
</tr>
<tr>
<td>Introduction and establishment of Exotic Rust Fungi of the order <em>Pucciniales</em> pathogenic on the family <em>Myrtaceae</em></td>
<td>No evidence of myrtle rust was recorded on any <em>Myrtaceaeous</em> species during the field surveys, however the proposal may facilitate the transmission of this disease through the movement of construction equipment, plant and vehicles around the site.</td>
</tr>
<tr>
<td>Invasion and establishment of exotic vines and scramblers</td>
<td>The proposal has the potential to further spread exotic vines and scramblers through the movement of construction equipment, plant and vehicles around the site.</td>
</tr>
<tr>
<td>Invasion of native plant communities by the African Olive invasive weed species</td>
<td>The proposal has the potential to further spread African Olive through the movement of construction equipment, plant and vehicles around the site.</td>
</tr>
<tr>
<td>Loss of hollow-bearing trees</td>
<td>The proposal would result in the removal of 18 hollow bearing trees. Impact assessment have been carried out for fauna species that utilise hollows.</td>
</tr>
<tr>
<td>Removal of dead wood and trees</td>
<td>Fallen timber and dead trees were recorded throughout the study area. The proposal is likely to remove these during construction.</td>
</tr>
<tr>
<td>Removal of bushrock</td>
<td>Minor areas of bushrock were recorded within the study area. The proposal is likely to remove a small amount of bushrock during construction.</td>
</tr>
</tbody>
</table>

**Conclusion on significance of impacts**

The proposal **is not** likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the *Threatened Species Conservation Act 1995* or *Fisheries Management Act 1994* and therefore a Species Impact Statement is not required.

The proposal **is** likely to significantly impact threatened species, populations, ecological communities or migratory species, within the meaning of the EPBC Act. As such, a strategic assessment for this community is required under Roads and Maritime's *Environment Protection and Biodiversity Conservation Act 1999 – Strategic Assessment* policy. The procedures for the
strategic assessment are built-into the Roads and Maritime REF process, which includes assessing the significance of impacts on Commonwealth listed biodiversity matters in accordance with the Department of Environment and Energy’s Significant Impact Guidelines 1.1 - Matters of National Environmental Significance and documenting the steps taken to avoid, minimise and mitigate impacts.

6.1.4 Biodiversity offsets

Roads and Maritime requires the consideration of biodiversity offsets when remnant vegetation is to be impacted. Given the proposal would impact upon areas of Commonwealth and State-listed threatened ecological communities, it is considered that biodiversity offsets would be required via a Biodiversity Offset Strategy.

In accordance with the Roads and Maritime Guideline for Biodiversity Offsets (2011), offsets are only required for the 10.4 ha of Spotted Gum – Narrow-leaved Ironbark – Red Ironbark Shrub – Grass Open Forest of the Central Hunter and Lower Hunter to be removed, as this community is listed as an EEC on the TSC Act and more than one hectare is to be cleared. Offsetting this vegetation would also compensate for the impacts to threatened species habitat for the ecosystem credit species recorded or considered likely to occur within the study area.

Other native vegetation to be removed includes 0.83 ha of Swamp Oak Floodplain Forest, which is also listed as an EEC on the TSC Act. However the small amount to be removed does not meet the thresholds for requiring offsets.

As no species credit species were recorded in the study area, no species-specific offsets are required.

A preliminary calculation to determine the required ecosystem credits to offset the likely impacts of the proposal has been completed. The full report can be found in Appendix E. The calculation was carried out using the linear assessment option of the Major Project module (Framework for Biodiversity Assessment or FBA methodology) as although this proposal is not a Major Project, the linear assessment option was considered to best suit the proposal design. Data collected from the BioBanking plots was used in the calculation.

A preliminary credit requirement of 520 credits of Spotted Gum – Narrow-leaved Ironbark – Red Ironbark Shrub – Grass Open Forest of the Central Hunter and Lower Hunter (HU815) is required to be retired to offset the impacts of the project.

Roads and Maritime’s Environment Protection and Biodiversity Conservation Act 1999 – Strategic Assessment policy states that biodiversity offsets are required when a significant impact is determined to threatened biodiversity listed under the EPBC Act.

The proposal is subject to a strategic assessment, and it is expected that a significant impact upon the critically endangered community listed under the EPBC Act of Central Hunter Valley Eucalypt Forest and Woodland Complex would be determined. Therefore, biodiversity offsets for this community would also be required.

The proposal would impact upon 8.2 ha of this Commonwealth listed community and proportionally this means 410 credits of the total 520 credits have been calculated to be required to offset this community. With the Spotted Gum – Narrow-leaved Ironbark – Red Ironbark Shrub – Grass Open Forest of the Central Hunter and Lower Hunter (HU815) being the like for like community that is required to offset residual impacts from the proposal.

A Biodiversity Offset Strategy would be prepared in later stages of the proposal, which would outline the methodology for finalising biodiversity offsets for the proposal, including refining credit requirements if the proposal design is altered enough to change the impacts of the proposal.
6.1.5 Safeguards and management measures
The recommended safeguards and management measures to minimise impacts to biodiversity are outlined in Table 6-5.
Table 6-5: Biodiversity safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
</table>
| General biodiversity impacts        | B1 A Flora and Fauna Management Plan (FFMP) is to be prepared and implemented as part of the CEMP. The FFMP should include, but not be limited to:  
- Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas  
- 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. | Project Manager and Site Manager | Pre-construction | Standard safeguard                  |
<p>| Vegetation Clearing                  | B2 Protocols for the clearing of vegetation, such as a pre-clearing check, are to be developed and implemented in accordance with the Roads and Maritime Biodiversity Guidelines (Guide 4: Clearing of vegetation and removal of bushrock). | Project Manager and Site Manager | Pre-construction and construction | Standard safeguard                  |
| Unexpected threatened species        | B3 An unexpected finds procedure is to be implemented in the event that a threatened species or ecological community that has not been identified and assessed by the REF is unexpectedly encountered during the construction process. | Site Manager | Pre-construction and construction | Standard safeguard                  |
| Hollow-bearing tree removal          | B4 A nest box strategy is to be developed and implemented in accordance with the Roads and Maritime Services Biodiversity Guidelines 2011 – Guide 8 (nest boxes). | Project Manager and Site Manager | Pre-construction and construction | Additional safeguard                |</p>
<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>Wildlife Connectivity</td>
<td><strong>B5</strong> An aerial crossing to retain fauna connectivity is to be installed in the vicinity of the Squirrel Gliders recorded. (An indicative location has been provided in Figure 3-1 of this REF, however the final location, design and type of aerial crossing is to be determined during detailed design).</td>
<td>Project Manager and Site Manager</td>
<td>Pre-construction and construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td></td>
<td><strong>B6</strong> Protocols for preventing the introduction and/or spread of disease causing agents such as bacteria and fungi are to be developed and implemented in accordance with the Roads and Maritime Biodiversity Guidelines – Guide 7 (Pathogen Management).</td>
<td>Project Manager and Site Manager</td>
<td>Pre-construction and Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td></td>
<td><strong>B7</strong> Declared noxious weeds are to be managed according to requirements under the <em>Noxious Weeds Act 1993</em> and the Roads and Maritime Biodiversity Guidelines – Guide 6 (Weed Management).</td>
<td>Site Manager</td>
<td>Pre-construction and Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td></td>
<td><strong>B8</strong> A Biodiversity Offset Strategy is to be developed and implemented in accordance with Roads and Maritimes Guidelines for Biodiversity Offsets.</td>
<td>Project Manager</td>
<td>Pre-construction or Construction</td>
<td>Additional safeguard</td>
</tr>
</tbody>
</table>
6.2 Aboriginal heritage

The Roads and Maritime PACHCI outlines a four stage process for investigating potential impacts to Aboriginal cultural heritage as a result of Roads and Maritime road planning, development, construction and maintenance activities. The PACHCI includes a process for community consultation that aims to ensure that the role, function and views of Aboriginal people are properly considered and respected in the assessment process. The PACHCI process has been followed in the assessment of potential impacts to Aboriginal culture and heritage as a result of the proposal.

6.2.1 Methodology

A Stage 2 PACHCI assessment was carried out by Artefact Heritage in April 2016.

The Stage 2 Aboriginal archaeological survey report was prepared in accordance with the OEH Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales 2010 and Stage 2 of the Roads and Maritime PACHCI. The Stage 2 PACHCI assessment consisted of:

- Desktop investigation, including Native Title and Aboriginal Heritage Information System (AHIMS) database searches, as well as consideration of previous archaeological survey reports within and adjacent to the study area
- Detailed site walkover across the study area on 16 December 2015 and 13 January 2016.

The Wanaruah LALC and Native Title claimants the Plains Clans of the Wonnarua People were invited to participate in the site walkover. Reports submitted by the Wanaruah LALC and the Plains Clans of the Wonnarua People following the walkover are provided in Appendix D.

The Stage 2 PACHCI assessment recommended that further investigation (including archaeological test excavation) and consultation with Aboriginal stakeholders be undertaken in accordance with the Stage 3 of the PACHCI.

In March 2017, an archaeological test excavation program was carried out in accordance with the OEH Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales. Test excavations were performed within two areas. Thirty 0.5 m² test units were excavated in total with the primary aim to assess the nature and extent of identified archaeological sites. The program was designed to determine the spatial boundaries of the known sites and the degree of intactness or disturbance to inform a future mitigation program. Further details about the test excavations are provided in Section 6.2.2. Following the test excavations, a draft CHAR was prepared for the proposal. The CHAR will accompany an AHIP for the proposal to impact Aboriginal heritage sites during construction. A draft version of the CHAR has been attached in Appendix F and is summarised in the sections below.

The study area for the Aboriginal heritage assessment is shown in Figure 6-4.

Consultation with the Aboriginal community about the proposal has been carried out in accordance with the OEH Aboriginal cultural heritage consultation requirements for proponents 2010 and the PACHCI and is detailed in Section 5.3 of this REF.

The cultural significance of the proposal area was assessed using both primary and secondary sources, including consultation with Aboriginal cultural knowledge holders who were identified as having specific knowledge about objects, places or cultural features. The knowledge holders did not identify any specific cultural values within the study area. However, it is recognised that the project sits within a broader cultural landscape that holds significance. There are a number of key areas surrounding the proposal boundary that have been noted as holding cultural significance and the values lying within this cultural landscape include resource areas, gathering places, songlines, a women's business place, burials, and associated visual lines of sight.
Figure 6-4: Aboriginal heritage study area
6.2.2 Existing environment

The study area is located within the traditional boundaries of the Wanaruah language group, which extends from the Hunter River in the north, down to the south of Lake Macquarie and west as far out as the Sugarloaf ranges. Land within the study area is subject to a registered claim made by the Plains Clans of the Wonnarua People under the *Native Title Act 1993* (Commonwealth).

The existing archaeological record is limited to certain materials and objects that are able to withstand degradation and decay. As a result, the most common type of Aboriginal objects remaining in the archaeological record are stone artefacts.

As a general rule, Aboriginal artefacts are likely to be present in association with the following landscape features:
- Within 200 metres of waterways
- Within a sand dune system
- On a ridge top, ridge line or headland
- Within 200 metres below or above a cliff face
- Within 20 metres of or in a cave, rock shelter or a cave mouth.

Of these, waterways and low ridges are present within the study area.

OEH maintains the Aboriginal Heritage Information Management System (AHIMS) database, a register of Aboriginal archaeological sites that have been recorded in NSW. Following on from the Stage 2 assessment, the Stage 3 assessment identified a number of Aboriginal archaeological sites within the study area, four sites already recorded in AHIMS and two additional sites. The site areas were defined by topography and contours and are located near the creek lines. The number of artefacts within the sites was reported as being highest along the creek lines, and decreasing rapidly when moving away from the water source.

Table 6-6 contains a summary of the Aboriginal archaeological sites located within the study area. These sites are shown in Figure 6-5.

Table 6-6: Aboriginal archaeological sites within the study area

<table>
<thead>
<tr>
<th>Site name</th>
<th>Registered name</th>
<th>AHIMS identification</th>
<th>Site type</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP 6 (Bulga)</td>
<td>WP 6 (Bulga)</td>
<td>37-6-0818</td>
<td>Artefact</td>
</tr>
<tr>
<td>USR 33</td>
<td>USR 33</td>
<td>37-6-1594</td>
<td>Artefact</td>
</tr>
<tr>
<td>USR 35</td>
<td>USR 35</td>
<td>37-6-1596</td>
<td>Artefact</td>
</tr>
<tr>
<td>USR 39</td>
<td>USR 39</td>
<td>37-6-1600</td>
<td>Artefact</td>
</tr>
<tr>
<td>NEH AFT 2</td>
<td>NEH AFT 2</td>
<td>37-6-3691</td>
<td>Artefact</td>
</tr>
<tr>
<td>NEH IF 03</td>
<td>NEH IF 03</td>
<td>37-6-3720</td>
<td>Artefact</td>
</tr>
<tr>
<td>USR 10</td>
<td>USR 10</td>
<td>37-6-1567</td>
<td>Artefact</td>
</tr>
</tbody>
</table>
Figure 6-5: removed due to cultural sensitivity -
The two areas of test excavations included:

- **Test Area 1** - comprising previously identified site USR 39, the less disturbed northern portions of WP 6 (Bulga) located within the project area, and the slope landform between the two sites
- **Test Area 2** – comprising previously identified site NEH AFT 2.

The results of the test excavations are provided below.

### Test Area 1

Test excavations within Test Area 1 confirmed the presence of intact subsurface archaeological deposits and showed that the boundaries of the site were limited to the creek terrace. Of the 20 test squares, eight were found to contain artefacts on terrace landforms and raised areas, with no artefacts occurring on the lower slopes. The most frequent artefact raw material was silcrete. Artefact types were predominantly flakes and flaked fragments with one multidirectional core also recorded. The recovery of a single core and limited range of materials suggests that the area was primarily used to maintain and utilise artefacts. However, the presence of several artefacts also suggests that some tool creation also occurred. This finding is in agreement with the extensive surface exposures exhibiting a more selective artefact array indicative of more specialised activities.

### Test Area 2

No Aboriginal archaeological objects or deposits were identified within the 10 test squares located within Test Area 2. The deposit within the test squares was heavily disturbed and consisted of introduced fill on top of reworked basal clays. The disturbance is likely associated with the previous alignment and construction of an embankment for the existing New England Highway.

### Archaeological significance

**WP 6 (Bulga)**

The test excavations demonstrated that an intact archaeological deposit is present at the site within the proposed impact area. The archaeological deposit was not found across large portions of the previously defined site area, including areas where surface artefacts had been identified due to disturbance from natural process such as erosion and fluvial activities. The site area was redefined to exclude areas without surface or subsurface archaeology (see Figure 6-6) and was assessed as having **moderate** archaeological potential due to intact archaeological deposit and topographic location.

**USR 39**

The results from the test excavations demonstrated that a very low density subsurface archaeological deposit is present at the site. Of the six test squares excavated across the area, three contained one artefact each and a fourth square contained two artefacts. The site was assessed as having **low** archaeological potential due to shallow deposit, dispersed nature of the retrieved artefacts and very low artefact density.

**NEH AFT 2**

The results from the test excavations demonstrated that site NEH AFT 2 has been extensively disturbed by past land use practices, including the construction of an embankment for the New England Highway and the installation of underground services. The presence of low density artefact scatter within exposure surfaces reflected the past subsurface disturbance of the site and not subsurface archaeological deposit. Test excavations confirmed that artefacts were limited to the disturbed surface scatter. The site was assessed as having **low** archaeological potential due to the high level of subsurface disturbance.
**NEH IF03**

Site NEH IF 03 is an isolated surface artefact comprising a single silcrete flake that was identified in a disturbed context on a dirt track. The site was assessed as having **low** archaeological potential due to the high level of subsurface disturbance.

**USR 10**

Site USR 10 is a highly disturbed surface artefact scatter comprising 29 artefacts of mudstone/tuff and 24 artefacts of silcrete which were identified on ground surface exposures across the embankment of a dam. The artefacts are predominantly flakes, flaked pieces and flaked fragments with one multiplatform core and one flake with useware also found. The site had been extensively disturbed by the construction of the dam and was assessed as having **low** archaeological potential.
Figure 6-6: removed due to cultural sensitivity -
Cultural significance

It has been identified during the consultation process that the local area has cultural heritage value (social value) to the local Aboriginal community. However regarding the Aboriginal sites identified within the project area, no specific cultural or social values expressed by these sites have been identified to date.

6.2.3 Potential impacts

Construction

Avoidance and minimisation of harm to Aboriginal objects during the design stage is the best and most important management strategy. The proposed design would result in impact to all sites listed in Table 6-6. The degree of impacts are listed in Table 6-7.

Table 6-7: Degree of impact to Aboriginal archaeological sites

<table>
<thead>
<tr>
<th>Site name</th>
<th>Registered name</th>
<th>AHIMS identification</th>
<th>Significance</th>
<th>Degree of impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP 6 (Bulga)</td>
<td>WP 6 (Bulga)</td>
<td>37-6-0818</td>
<td>Moderate</td>
<td>Partial loss of value</td>
</tr>
<tr>
<td></td>
<td>USR 33</td>
<td>37-6-1594</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>USR 35</td>
<td>37-6-1596</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USR 39</td>
<td>USR 39</td>
<td>37-6-1600</td>
<td>Low</td>
<td>Total loss of value</td>
</tr>
<tr>
<td>NEH AFT 2</td>
<td>NEH AFT 2</td>
<td>37-6-3691</td>
<td>Low</td>
<td>Total loss of value</td>
</tr>
<tr>
<td>NEH IF 03</td>
<td>NEH IF 03</td>
<td>37-6-3720</td>
<td>Low</td>
<td>Total loss of value</td>
</tr>
<tr>
<td>USR 10</td>
<td>USR 10</td>
<td>37-6-1567</td>
<td>Low</td>
<td>Total loss of value</td>
</tr>
</tbody>
</table>

The scientific value of archaeological sites is linked to the physical information the sites contain. The proposal would result in a loss of scientific value to the identified sites within the proposal boundary. However, the test excavations showed that the bulk of the archaeological resource likely exists to the north of the proposal boundary. Therefore, a pre-construction salvage program would help increase the understanding of the potential resource, strengthen interpretations and improve ongoing and future management of Aboriginal heritage in the surrounding area.

Suitable recommendations for the identified impacts to the sites have been developed based on the environmental context and condition, background research, and consultation with stakeholders. An AHIP is required for impacts to the identified sites/objects prior to the commencement of pre-construction or construction activities associated with the proposal. Management strategies for mitigating harm to the sites are outlined in below and further listed in Section 6.2.4.
Table 6-8: Management strategies for impacted Aboriginal sites

<table>
<thead>
<tr>
<th>Site name</th>
<th>Registered name</th>
<th>AHIMS identification</th>
<th>Management strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP 6 (Bulga)</td>
<td>WP 6 (Bulga)</td>
<td>37-6-0818</td>
<td>• Given the moderate significance of the site and degree of proposed impact, salvage excavation of a representative sample of the site is required prior to impact</td>
</tr>
<tr>
<td></td>
<td>USR 33</td>
<td>37-6-1594</td>
<td>• An AHIP is required for the impacted portion of the site</td>
</tr>
<tr>
<td></td>
<td>USR 35</td>
<td>37-6-1596</td>
<td>• Management measures to be implemented to ensure the non-impacted portion of site is avoided by construction activities could include protective fencing, identification in the CEMP, toolbox talks, etc.</td>
</tr>
<tr>
<td>USR 39</td>
<td>USR 39</td>
<td>37-6-1600</td>
<td>• Archaeological salvage not required</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• An AHIP is required for the impacted portion of the site.</td>
</tr>
<tr>
<td>NEH AFT 2</td>
<td>NEH AFT 2</td>
<td>37-6-3691</td>
<td>• Archaeological salvage not required</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• An AHIP is required for the impacted portion of the site.</td>
</tr>
<tr>
<td>NEH IF 03</td>
<td>NEH IF 03</td>
<td>37-6-3720</td>
<td>• Archaeological salvage not required</td>
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<td>• Archaeological salvage not required</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• An AHIP is required for the impacted portion of the site.</td>
</tr>
</tbody>
</table>

As there have been no specific cultural values identified within the proposal boundary, the proposed is not expected to impact on the cultural significance of the area.

**Operation**

Operation of the proposal is not expected to have any impact on Aboriginal heritage

6.2.4 Safeguards and management measures

The recommended safeguards and management measures to minimise impacts to Aboriginal heritage objects are outlined in Table 6-9.
## Table 6-9: Aboriginal heritage safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts to known Aboriginal heritage sites</td>
<td>AH1 An Aboriginal Heritage Management Plan (AHMP) is to be prepared in accordance with the Procedure for Aboriginal cultural heritage consultation and investigation and implemented as part of the CEMP. The AHMP should provide specific guidance on measures and controls to be implemented for managing impacts on Aboriginal heritage and culture. The AHMP should be prepared in consultation with all relevant Aboriginal groups.</td>
<td>Project Manager/ Site Manager</td>
<td>Pre-construction and construction</td>
<td>Standard safeguard</td>
</tr>
<tr>
<td>Impacts to known Aboriginal heritage sites</td>
<td>AH2 An AHIP for the project area would be obtained prior to construction and any salvage would be undertaken in accordance with the proposed salvage methodology and any conditions of approval (if granted).</td>
<td>Project Manager/ Site Manager</td>
<td>Pre-construction and construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Possible impacts to known Aboriginal heritage sites</td>
<td>AH3 Archaeological sites in close proximity to construction works should be fenced off prior to the commencement of construction to ensure that they are not inadvertently affected as a result of construction work. Fencing should be maintained throughout the duration of works.</td>
<td>Site Manager</td>
<td>Pre-construction and construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Possible disturbance to unknown Aboriginal heritage sites</td>
<td>AH4 The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime, 2015) is to be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. Work should only re-commence once the requirements of that Procedure have been satisfied.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Standard safeguard</td>
</tr>
</tbody>
</table>
6.3 Soils and geology

6.3.1 Methodology
Arup conducted a geotechnical site investigation from late July through early August of 2016 and produced a *Geotechnical Factual Report* for the proposal. It should be noted that at the time of preparation of this REF, the geotechnical reporting was only at an interim stage. Any additional findings would be incorporated into the detailed design for the proposal.

The proposal's impact on soil and geology has been considered against the construction activities outlined in Section 3.3 of this REF.

6.3.2 Existing environment

Overview

The Kovac and Lawrie (1991) - Soil landscapes of the Singleton 1:250,000 sheet identifies that soils in the locality belong to the 'Rothbury' landscape. Soils typical of this landform consist of the following characteristics:

- Red podzolic soils on upper slopes
- Yellow Podzolic soils on mid slopes
- Yellow solodic soils and Brown Soloths on lower slopes
- Prairie soils in the drainage lines.

The geotechnical site investigation confirmed that the proposal area is generally underlain by one meter of residual soil, becoming thicker towards the base of hill slopes and thinner towards the hill crests. Whilst no alluvium was encountered during geotechnical investigations, alluvial deposits are expected along creek and drainage lines. The Branxton and Rothbury soil landscapes are present in the proposal area and are for the most part moderately erodible, however represent a high (and in some cases very high) erosion hazard.

The underlying bedrock can be typically described as siltstone and sandstone of the Maitland Group. Rock strength is expected to vary across the proposal area, however high strength rock was encountered at relatively shallow depths in the areas of proposed cuttings.

**Acid sulphate soils**

A search of the Singleton LEP (2013) undertaken on 17 January 2016 found that the proposal area does not lie in an area requiring management for potential acid sulphate soils (PASS). This was confirmed through the Department of Land and Water Conservation acid sulphate soil risk map for Singleton which indicates a low likelihood for PASS occurrence in the vicinity of the proposal area and the geotechnical investigations, which did not encounter PASS materials.

**Salinity**

Areas of dryland salinity have been mapped in the proposal area. There is a risk of impact to water quality if salts wash into waterways. This risk can be reduced through use of the sediment control measures mentioned above, and is further outlined in Section 7 of this REF.

**Groundwater**

Groundwater level monitoring indicated the groundwater table in the proposal area ranges between four to eight metres below ground level at the proposed cuttings, and around three to five metres below ground level in the vicinity of the proposed flyover.
6.3.3 Potential impacts

Construction

Geology and soils

As outlined in Section 3.3, construction of the proposal would involve excavation, piling activities and the clearing of vegetation.

As the soils in the proposal area have been deemed to be moderate to highly erodible, batter slopes would be used to stabilise the sidewalls of excavations greater than 1.5 metres. The proposed depths for the excavation works greater than 1.5 metres and the associated batter slopes are listed in Table 6-10 and shown in Figure 6-7.

Table 6-10: Proposed excavation depths and batter slope angles

<table>
<thead>
<tr>
<th>Maximum excavation depth</th>
<th>Proposed batter slope angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.0 metres</td>
<td>0.75H:1V*</td>
</tr>
<tr>
<td>3.4 metres</td>
<td>0.75H:1V*</td>
</tr>
<tr>
<td>7.9 metres</td>
<td>0.75H:1V*</td>
</tr>
<tr>
<td>1.7 metres</td>
<td>4H:1V</td>
</tr>
<tr>
<td>3.9 metres</td>
<td>2H:1V</td>
</tr>
<tr>
<td>2.8 metres</td>
<td>2H:1V</td>
</tr>
</tbody>
</table>

* Note: A provisional slope of 0.75H:1V has been adopted based on preliminary geotechnical information. Further slope stability analysis would be carried out prior to detailed design.

It is expected that piles would be founded within the bedrock and account for constraints such as variability in the size and strength of material encountered.

Appropriate safeguard measures would be outlined to manage potential impacts from excavation and piling. As such, excavation activities would have a minor impact on the subsurface profile of soils and geology.

Other construction activities that may impact on soils and geology include ground disturbance associated with the clearing of vegetation and stripping of topsoils, movement of vehicles across soft or stripped ground and stockpiling activities at construction compounds. These activities have the potential to result in the erosion of exposed soils. It is expected that these activities would be controlled through appropriate safeguard measures and would therefore have a minor impact on soils and geology.
Figure 6-7: Excavation works greater than 1.5 metres deep
Salinity

Excavation within the proposal area would areas of mapped dryland salinity. Excessive concentrations of salt can affect soil chemistry and plant growth. There is also risk of impact to water quality if salts wash into waterways. These risks can be reduced through use of the sediment control measures as outlined in Section 6.3.4 and further considered in Section 6.4.

Construction of the proposal would have a minor impact on salinity.

Groundwater

Groundwater level monitoring indicated the groundwater table in the proposal area ranges between four to eight metres below ground level at the proposed cuttings, and around three to five metres below ground level in the vicinity of the proposed flyover.

Given the high water table (three to five metres below the existing ground levels) and the proposed depth of excavation required for works related to the flyover, there is the potential for groundwater ingress during construction. While excavation in this area would be minimised to avoid ingress where possible, it is expected that excavation and piling (specifically the pile sockets which are to be founded in the bedrock) would encounter some groundwater seepage. As such, dewatering activities are likely to be required. These would need to be carried out in accordance with the provisions of the WM Act, including obtaining the relevant licences/permits.

Construction of the proposal would therefore have a minor impact on groundwater.

Operation

Geology and soils

During operation (following completion of the ground stabilisation and revegetation), the proposal would not have an impact geology and soils.

Soil chemistry is an important consideration for assessment of the durability of structures containing steel and concrete. There is no existing data on soil chemistry in the proposal area. Soil aggressivity would be investigated prior to detailed design of the proposal.

Landform

The proposal would require the installation of embankments at the flyover on ramps on the Golden Highway and eastbound entry ramps at one the New England Highway. The embankments would have a maximum height of 11 metres with the typical gradient being 2H: 1V. See Figure 3-4 for an indication of the embankments at the flyover.

Therefore, the proposal would have moderate impact on the landform in the proposal area.

Salinity

Salinity has the potential to cause damage to the foundations of infrastructure including roads and bridges. Operational maintenance regimes would need to consider this risk.

Therefore, salinity may have a minor impact on the proposal.

Groundwater

Operation of the proposal is not expected to have an impact on groundwater.
### 6.3.4 Safeguards and management measures

The recommended safeguards and management measures to minimise impacts to soils and geology are outlined in Table 6-11.

#### Table 6-11: Soil and geology safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil impacts</td>
<td>SG1 A Soil Management Plan (SMP) is to be prepared in accordance with QA Specification G38 and implemented as part of the CEMP. The SMP should identify all reasonably foreseeable risks relating to subsurface impacts and pollution associated with construction of the proposal, and describe how these risks would be managed and minimised. This should include arrangements for managing pollution risks associated with spillage or soil contamination on the site and adjoining areas, and monitoring during and post-construction.</td>
<td>Project Manager / Site Manager</td>
<td>Pre-construction and construction</td>
<td>Standard safeguard</td>
</tr>
<tr>
<td>Spoil and stockpile management</td>
<td>SG2 A Spoil and Fill Management Plan (SFMP) is to be prepared and implemented as part of the CEMP. The SFMP should identify the locations of spoil and fill stockpiles, sources of imported fill, and methods to re-use or dispose of excess or unsuitable spoil material including estimated volumes and disposal sites.</td>
<td>Project Manager / Site Manager</td>
<td>Pre-construction and construction</td>
<td>Standard safeguard</td>
</tr>
<tr>
<td>Groundwater impacts</td>
<td>SG3 In addition to the implementation of general erosion, sediment and water quality control safeguards, sediment basins, stockpiles, washdowns, batch plants, refuelling and chemical storage sites are to be lined and/or bunded if they are located within 50 metres of a shallow groundwater source.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Standard / additional safeguard</td>
</tr>
<tr>
<td>--------</td>
<td>--------------------------</td>
<td>----------------</td>
<td>--------</td>
<td>--------------------------------</td>
</tr>
</tbody>
</table>
| Groundwater interaction | **SG4** Any groundwater intercepted during construction works, such as around the flyover, is to be treated, disposed or reused appropriately. Prior to any dewatering activities being carried out, an approval must first be obtained in accordance with Section 92 of the WM Act and dewatering is to be carried out in accordance with the requirements of the EPL. Management measures to minimise potential adverse impacts are to be implemented in accordance with the RTA *Technical Guideline: Environmental management of construction site dewatering*. These may include, but not necessarily be limited to:  
• Options to collect and store groundwater to enable recharge of the water table (such as via grassed lined channels  
• Where recharge is not appropriate or feasible, discharging groundwater to the surface water drainage system following  
• Appropriate treatment to ensure discharged water is of sufficient quality. | Site Manager | Construction | Additional safeguard |
<p>| Management of topsoil | <strong>SG5</strong> Topsoil should be stockpiled in cleared or disturbed areas and managed in accordance with the RTA <em>Stockpile Site Management Guideline</em> until it is removed from the construction site and disposed of an appropriately licensed facility. | Site Manager | Construction | Additional safeguard |</p>
<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
</table>
| Soil stabilisation           | SG6 The rehabilitation of disturbed areas is to be carried out progressively as construction stages are completed, and in accordance with:  
                              | Site Manager                                                                 | Construction   | Additional safeguard            |
|                              | - Landcom’s Managing Urban Stormwater: Soils and Construction series                     |                |              |                                 |
|                              | - RTA Landscape Guideline                                                                 |                |              |                                 |
| Construction of batter during excavation | SG7 Batters are to be designed and constructed to minimise risk or exposure, instability and erosion, and to support long-term, on-going best practice management, in accordance with the Roads and Maritime Guideline for Batter Stabilisation Using Vegetation. | Site Manager   | Construction | Additional safeguard            |
| Saline soils                 | SG8 A pre-construction preliminary salinity field investigation is to be considered with locations, profile descriptions, soil tests and laboratory analyses planned with reference to the Department of Land and Water Conservation (2002) – Site Investigations for Urban Salinity (DLWC, 2002). | Project Manager | Pre-construction | Additional safeguard            |

6.4 Water quality, hydrology and flooding

6.4.1 Methodology

Issues relating to water quality, hydrology and flooding were identified by reviewing publicly available sources such as government and council documents, aerial photographs and topographical information, as well as the concept design report and flood modelling carried out for the proposal.

6.4.2 Existing environment

Overview

The proposal area ranges from around 86 metres above Australia Height Datum (mAHD) just west of the Whittingham rest area, to around 62 mAHD just south of the New England Highway and Golden Highway intersection. The locality generally comprises undulating to rolling hills with
elevations ranging with average slopes of 6 – 10 per cent with some slopes up to 12 per cent. Slope lengths are about 800 – 1000 metres and with reliefs of 60 – 80 metres. Drainage lines are common throughout the area and occur at intervals between 200 – 1000 metres.

The proposal is located within the Hunter River catchment, with the Hunter River itself located about two kilometres to the north. There are two unnamed creek lines and about three other minor drainage lines which traverse the proposal area (see Figure 6-2). The two creek lines flow under the New England Highway via culverts. The creek lines are tributaries of the Hunter River and service very small-localised catchments extending between 0.5 – 1 kilometre beyond the proposal area. The creek line in the north west of the study area contains permanent water with slow water flow, while the other creek and drainage lines contain ephemeral pools. The creek line running through the centre of the proposal area is zoned as E2 – Environmental Conservation under the Singleton LEP. There are also three farm dams and minor water storage areas in the private properties within the proposal area. Other waterways in the locality include Mudies Creek which lies to the west of the proposal around 700 metres north of the Golden Highway, and Jump Up Creek which lies around 800 metres to the east of the proposal.

Water quality

Water quality in the creek / drainage lines and farm dams is considered to directly correlate to adjacent land uses which include farming, rail, road, a service station and an abattoir. During the biodiversity field surveys in January – February 2016, the water quality was considered to be poor as the water colour was brown indicating high dissolved sediment and algae. However there is still some potential for the waterways to provide habitat for a range of amphibians and waterbirds.

Hydrology and flooding

The existing transverse drainage system and stormwater management system in the proposal area comprises a number of pipes, culverts and headwalls under the New England Highway carriageway between Belford and the Golden Highway. Heavy rainfall in the proposal area is expected to result in overland flow which is managed by the existing transverse drainage system.

While the proposal area does not fall within the Flood Planning Areas mapped within the Singleton LEP, there is evidence of consistent and prolonged inundation with the prevalence of various rush and swamp vegetation species within the drainage lines and flats, particularly around the culverts. Flood modelling carried out for the proposal also indicates that two of the existing culverts currently overtop on the New England Highway, one in the 20 year average recurrence interval event and one in the 10 year annual recurrence interval event.

6.4.3 Potential impacts

Construction

Water quality

Construction of the proposal has the potential to impact on water quality due to erosion and sediment runoff. Proposed earthworks would primarily include excavation, piling and vegetation clearing. During earthworks the topsoil would be stripped back and soil material exposed, creating the potential for erosion, runoff and sedimentation particularly during heavy rainfall events. Erosion from stockpiles of excavated spoil, fill and other erodible materials could also result in sediment runoff. Another potential source of water pollution includes accidental spills or leakage of fuels, oils or other potentially harmful substances, which could result in localised contamination of soils and pollution of downstream waterways.

During construction, temporary sediment control measures would be used to improve the quality of discharged water. This would include using temporary sediment basins in conjunction with
localised treatments such as sediment fences and earth bunds/channels to separate on-site and off-site water. Additionally, any existing stormwater pits would be protected using drop inlet pits, sand bags, geotextile covers or sediment fences.

The proposed locations for the temporary sediment basins are shown in Figure 3-1. It has also been assumed that the project boundary would be bunded to limit the flow of water from external catchments into the project area and subsequently into the basins.

As such, the impact of the proposal on water quality would be **minor** during construction.

**Hydrology and flooding**

Construction of the proposal is not expected to impact the capacity of the current transverse drainage and stormwater management system within the proposal area. However, the existing overland flow paths may be temporarily impacted by construction works. Where this is the case, it is expected that appropriate safeguard measures, such as diversions, would be implemented.

As such, the impact of the proposal on water quality would be **minor** during construction.

**Operation**

**Water quality**

Risks to water quality during operation include untreated stormwater runoff and oils and leaked fuels, oils or other potentially harmful substances entering the natural environment or drainage system. The existing water quality measures would be adopted which would be supported by grassed lined open channels installed next to the road for additional drainage and water quality treatment. The stormwater runoff would flow off the road and down the embankments into grass lined open channels before being discharged into the natural environment or drainage system.

As such, the impact of the proposal on water quality is expected to be **negligible** during operation.

**Hydrology and flooding**

The proposal would increase the impervious surface area, and the new eastbound carriageway of the New England Highway would cross over the existing creek and drainage lines. The existing pipes and culverts would be extended under the new eastbound carriageway to provide the necessary continuity of drainage flows. Figure 3-1 shows the locations where the existing culverts would be extended.

Currently all existing drainage structures do not overtop in up to and including one in 100 year flood events, except for two culverts, one which overtops during one in 20 year flood events and the other which overtops during one in 10 year flood events.

Flood modelling carried out for the proposed design shows that the culvert that currently overtops during one in 20 year flood events would no longer overtop in flood events up to and including one in 100 year event. The culvert that currently overtops during one in 10 year flood events would now only overtop during one in 20 year flood events.

As such, the proposal is expected to have a **beneficial** impact on hydrology during operation.

**6.4.4 Safeguards and management measures**

The recommended safeguards and management measures to minimise impacts to water quality and hydrology during construction of the proposal are outlined in Table 6-12.
### Table 6-12: Water quality, hydrology and flooding safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water quality impacts during construction</td>
<td><strong>W1</strong> A site specific Erosion and Sediment Control Plan (ESCP) is to be prepared and included in the CEMP. The ESCP should identify detailed measures and controls to be applied to minimise erosion and sediment control risks including, but not necessarily limited to runoff, diversion and drainage points, sediment basins and sumps, scour protection, stabilising disturbed areas as soon as possible, and dam checks. The ESCP should also include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.</td>
<td>Project Manager / Site Manager</td>
<td>Pre-construction and construction</td>
<td>Standard safeguard</td>
</tr>
</tbody>
</table>
| Minimise risks to water quality during construction | **W2** Consistent with any specific requirements of the approved ESCP and the SMP, control measures should be implemented to minimise risks associated with erosion and sedimentation and entry of materials into the creek / drainage lines. This may include, but not necessarily be limited to:  
  - Sediment management devices, such as sediment fencing, straw bales or sand bags  
  - Installation of measures at work entry and exit points to minimise movement of material onto adjoining roads, such as rumble grids or wheel wash bays  
  - Appropriate location and storage of construction materials, fuels and chemicals, including bunding where appropriate. | Site Manager          | Construction            | Additional safeguard          |
6.5 Contamination

A Stage 1 Preliminary Site Investigation was undertaken by Environmental Earth Sciences in June 2016. The Stage 1 Preliminary Site Investigation is summarised below and provided in Appendix G.

6.5.1 Methodology

The Stage 1 Preliminary Site Investigation included:

- A review of the following sources:
  - Geology, soil, acid sulphate soils, hydrology and meteorology maps and databases (carried out on 17 January 2016)
  - Section 149 (1) and (5) council planning certificate for the United Petrol service station adjacent to the proposal (carried out on 30 October 2015)
  - SafeWork NSW dangerous goods information for the United Petrol service station (carried out on 11 February 2016)
  - Historic aerial photography
  - NSW Environment Protection Authority (EPA) search of register of notified properties under the Contaminated Land Management Act 1997 (CLM Act) subject to investigation / remediation orders (carried out on 17 January 2016)
  - Inspection of the proposal area on 21 January 2016 to ascertain land use features and assess locations of potential contamination
  - Preparation of a conceptual site model considering the likelihood of pathways between any source(s) of contamination on-site and potential receptors.

The proposal's impact on land contamination has been considered against the construction activities outlined in Section 3.3 of this REF.

6.5.2 Existing environment

A study undertaken by Hills Environmental in 2014 identified a former timber post and a rail cattle yard on the northern side of the New England Highway about 350 metres east of the Golden Highway intersection as having potential for contamination. While no remaining physical evidence was observed during the Environmental Earth Sciences field investigation, there is still thought to be the potential for organochlorine pesticide and arsenic contamination in this area. The proposed works are expected to be located just outside of this area.

A United Petrol service station is also located about 250 metres to the north-west of the Golden Highway intersection. Again, while there was no physical evidence of contamination observed during the Environmental Earth Sciences field investigation, there still remains the potential for hydrocarbon contamination in this area. The proposed works would be located over 100 metres away from this site.

Other potential sources of contamination in the locality include:

- The EC Throsby abattoir, located around 700 metres from the proposal area
- A former construction compound located 100 metres from the proposal area
- Agricultural practices, such as irrigation spraying, at adjacent properties
- A former works compound (at Lot 24 in DP1128978) used during upgrade of the Golden Highway vehicular bridge over the Main North Railway Line between 2009 – 2013.

The proposal area contains the following sensitive receptors:

- On-site humans
  - Residents, visitors and employees of rural properties
  - Construction workers during construction of the proposal
  - Maintenance workers (roads and utilities)
- Offsite humans
  - Residents, visitors and employees of rural properties and the United Petrol service station
Recreational users of the Hunter River and Jump Up Creek

- On-site ecological
  - Surface water (the creek / drainage lines and farm dams)
  - Groundwater
- Offsite ecological
  - Surface water (Mudies Creek to the west, Jump Up Creek to the east and the Hunter River to the north)
  - Groundwater.

6.5.3 Potential impacts

Construction

Based on the findings of the desktop assessment, site inspection and conceptual site model developed by Environmental Earth Sciences, the following was concluded:

- No potential sources of contamination or observations of contamination were noted in the proposal area which would pose an unacceptable risk to human health or the environment
- Potential risks posed from the current operations of the EC Throsby abattoir or agricultural practices in lots adjacent to the proposal area were evaluated as posing a low risk
- Potential risks posed by operation of the United Petrol service station were evaluated as posing a low risk pending that operations comply with the UPSS regulations
- Potential risks posed from residual contamination at the former works compound (at Lot 24 in DP1128978) were evaluated as posing a low risk.

Small quantities of fuels or other hazardous substances may be stored at the site during construction to serve construction machinery. As a result there is the potential for spills of contaminants, resulting in localised contamination within the proposal area or the contamination of nearby creeks / drainage lines and soils. Bunding and other appropriate mitigation measures would reduce the risk of accidental spillages and/or discharge during construction.

Based on the above, the proposal is expected to have a negligible impact on contamination during construction and no investigations are deemed necessary given implementation of the general management measures listed in Section 6.5.4.

Operation

There are minor contamination risks associated with the operation of proposal which would be limited to:

- Spills from industrial heavy vehicles such as oil tankers etc
- Accidents from general motorists causing oil and petrol spills.

However spills and other potential contamination sources during operational are expected to be managed by implementation of standard emergency spill environmental safeguards. As such, the potential impact of the proposal on contamination during operation would be negligible.

6.5.4 Safeguards and management measures

The recommended safeguards and management measures to minimise impacts to land contamination are outlined in Table 6-13.
### Table 6-13: Land contamination safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contaminant exposure during construction</td>
<td>C1</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Standard safeguard</td>
</tr>
<tr>
<td></td>
<td>If contaminated areas are encountered during construction, appropriate control measures are to be implemented to manage the immediate risks of contamination, such as the diversion of surface runoff, capture of any contaminated runoff or temporary capping. All other work that may impact on the contaminated area should cease until the nature of the contamination has been confirmed and any necessary site-specific controls or further actions are identified in consultation with the Environment Manager and/or EPA.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency spills</td>
<td>C2</td>
<td>Project Manager / Site Manager</td>
<td>Pre-construction and construction</td>
<td>Standard safeguard</td>
</tr>
<tr>
<td></td>
<td>A site specific emergency spill plan is to be developed and implemented. The plan should be prepared in accordance with the Roads and Maritime Code of Practice for Water Management and relevant EPA guidelines. The plan should include measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 6.6 Traffic, transport and access

#### 6.6.1 Methodology

An assessment of the proposal’s impact on traffic and transport was carried out as part of the *New England Highway Duplication - Belford to Golden Highway Traffic Modelling Report* (Hyder, 2014a). A summary of this is provided in the sections below.

The purpose of this traffic assessment is to evaluate the following elements:

- Operational performance at the New England Highway and Golden Highway intersection
- Operational network performance in the proposal area the future years of 2019, 2029 and 2039
- Operational safety impacts
- Operational impacts to property access, public transport, pedestrians and cyclists
- Preliminary construction traffic impacts.
As part of the *New England Highway Duplication - Belford to Golden Highway Traffic Modelling Report* (Hyder, 2014a) a road based micro-simulation traffic model was developed to assess the performance of the proposal from a traffic network point of view.

Construction impacts have been assessed using preliminary staging details and vehicle volumes.

### 6.6.2 Existing environment

**General overview**

Section 2.2 provides a good overview of the existing transport infrastructure in the proposal area.

In summary, the New England Highway and the Golden Highway are designated B-double corridors that service the coal mining, grain production and other industries in the Hunter Valley and the Central West and provide access to the Port of Newcastle. These roads are also used by residents to access the local population and employment centres of Maitland and Singleton, and by through traffic accessing Newcastle and the Hunter, Central West and New England regions.

The speed limit on the New England Highway in the proposal area is currently posted at 100 kilometres per hour from Bell Road to just before the Golden Highway intersection, where the speed limit is reduced to 80 kilometres per hour. The speed limit on the Golden Highway in the proposal area is 70 kilometres per hour.

A number of bus services travel through the proposal area including local bus services and long distance coach services.

There are no formal cycleways in the proposal area and provision for cyclists is generally on-road via the existing road shoulders. Although, there is a bicycle crossing on the westbound side of the New England Highway, just to the south of the Golden Highway intersection.

There is currently no provision for pedestrians on the New England Highway between Belford and the Golden Highway.

The Whittingham rest area, located on the northern side of the Golden Highway west of the intersection with the New England Highway, provides facilities for travellers to stop and break their journey.

**Current traffic volumes and network performance**

Currently about 22,000 vehicles travel along the New England Highway between Belford and the Golden Highway every day.

The AM peak traffic starts at 5.30 am and mainly comprises vehicles heading to mining sites. This is followed by general commuter peak between 6.30 - 7.30 am. In the AM peak, eastbound traffic turning right from the Golden Highway onto the New England Highway is relatively low (counts show around 207 vehicles per hour). However, these vehicles have to negotiate substantial volumes of vehicles travelling westbound on the New England Highway towards Singleton (counts show over 750 vehicles per hour).

PM peak traffic flows are heavy in the eastbound direction towards Maitland and Newcastle. At this time, eastbound traffic on the Golden Highway turning right onto the New England Highway is high (around 435 vehicles per hour), while conflicting traffic travelling westbound on the New England Highway is relatively low compared to the AM peak (around 448 vehicles per hour).
As shown in Table 2-3, queues for vehicles turning right onto the New England Highway from the Golden Highway are low during the AM mining peak but significantly longer during the PM peak periods.

In the AM peak, the current level of service for the eastbound right turn from the Golden Highway onto the New England Highway varies between B and E. Although small, the eastbound right turn from the New England Highway onto the Golden Highway also experiences delays with a level of service measured between B and F. In the PM peak, the level of service for the eastbound right turn from the Golden Highway onto the New England Highway varies between C and E.

Section 2.1.1 provides a more detailed overview of the current traffic volumes and level of service in the proposal area.

Current safety implications

Between October 2008 and February 2014, 45 crashes were reported on the New England Highway or Golden Highway within the study area. Of these crashes, one crash resulted in a fatality and 22 crashes resulted in injuries. The remaining 22 were classified as non-casualty (damage only). Fourteen of the 45 crashes occurred when a vehicle was turning right out of an intersection and collided with another vehicle. The majority of these right turn crashes occurred at the New England Highway and Golden Highway intersection.

Current access arrangements

There are seven privately owned properties along the southern side of the New England Highway. Six of these properties are used for residential and/or grazing purposes, and the other property is the EC Throsby abattoir. Five of the private properties have access off Bell Road while one has direct access from the New England Highway. The EC Throsby abattoir can be accessed via a road from the Golden Highway.

There are three large rural properties along the northern side of the New England Highway. There are no formal accesses to these properties from the New England Highway, but it is noted that informal accesses to the New England Highway (gates with no driveways) exist. The formal access for these properties is provided via New Freugh Lane off the New England Highway to the north and via Bell Road to the east.

There are two properties on the southern side of the Golden Highway, one is owned by Transport for NSW and the other is owned by Roads and Maritime. These properties have direct access from the Golden Highway.

There are two privately owned properties on the northern side of the Golden Highway which currently have access via the Whittingham rest area to the old section of the Golden Highway. Access to the Main North Railway Line is also located on the northern side of the Golden Highway.

6.6.3 Potential impacts

Construction

Traffic and transport

It is expected that up to 200 light vehicle and 200 heavy vehicle movements would occur each day during the peak construction period (during a typical working day). Parking for construction staff would be provided at the construction compound sites. Heavy machinery would be transported to and from site predominantly during off peak hours where possible to minimise road user delays due to turning movements.
The majority of work, and hence vehicle movements, would be on the northern side of the existing New England Highway. It is not feasible to use only left-in/ left-out accesses, and therefore provision would need to be made for safe right-in and right-out movements (i.e. all movements). In order to provide safe right-turn movements during construction, the New England Highway would be restricted to a single traffic lane in each direction for around 1.5 kilometres (from around 1.3 kilometres west of Bell Road to 2.8 kilometres west of Bell Road) i.e one westbound lane would be closed along this section of the road. There would also be some work and vehicle movements on the northern side of the Golden Highway, west of the New England Highway.

The proposed main site access points during construction are listed in Table 3-3 and shown in Figure 3-8 in Section 3.6 above.

As well as the temporary lane closure on the New England Highway, it is expected that temporary speed limits would also be required during the construction phase. Final construction methods would be refined to minimise traffic and transport impacts, however traffic restrictions would be unavoidable during some construction activities, such as piling work, foundation and road surfacing work and construction of the flyover.

Traffic modelling was carried out to understand the potential impacts of the temporary westbound lane closure for 1.5 kilometres along the New England Highway. The modelling assumed a reduced speed limit of 60 kilometres per hour in both directions for this section of the road. The construction traffic volumes were based on the predicted 2021 opening year traffic volumes and the arrangement was compared to the existing configuration with two continuous westbound traffic lanes. The assessment focussed on the morning and evening peak traffic hours of:

- 5:30–8:30 am
- 3:00-7:00 pm.

The results are shown in Table 6-14.

Table 6-14: Construction travel times on the New England Highway

<table>
<thead>
<tr>
<th>Year</th>
<th>Existing road configuration</th>
<th>Road configuration during construction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Travel time (seconds)</td>
<td>Average speed (kilometres per hour)</td>
</tr>
<tr>
<td>New England Highway (eastbound)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2021 AM</td>
<td>376</td>
<td>91</td>
</tr>
<tr>
<td>2021 PM</td>
<td>451</td>
<td>76</td>
</tr>
<tr>
<td>New England Highway (westbound)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2021 AM</td>
<td>403</td>
<td>85</td>
</tr>
<tr>
<td>2021 PM</td>
<td>370</td>
<td>92</td>
</tr>
</tbody>
</table>

The most significant impacts are anticipated to occur during the AM peak hours of 5.30-6.30 am in the westbound direction, where average travel speeds are forecast to fall from 85 kilometres per hour to 55 kilometres per hour.
It should be noted however that this presents a ‘worst case’ scenario where the annual traffic growth rates used are based on previously forecast growth in nearby mining activities. It should also be noted that the westbound travel speeds would only be significantly reduced between the hours of 5.30 am and 6.30 am, where more than 2,000 vehicles per hour are forecast to use this section of road. After 6.30 am on a typical day, westbound traffic volumes are significantly reduced (less than 1,500 vehicles per hour) and therefore the proposed construction road configuration could accommodate this level of traffic.

The Hunter Valley Buses Singleton Heights to Stockland Green Hills via Maitland (route 180) bus stops, as shown in Figure 2-3, may need to be relocated temporarily during construction. Areas for relocation would be arranged in consultation with Hunter Valley Buses prior to construction in order to minimise disruption to the service and customers.

Impacts to other local and regional bus services would be limited to reduced speeds due to construction works. Safe stopping locations would be maintained at all times for the existing bus services. Cyclists may also experience delays during construction.

Effective consultation and traffic management would help to minimise impacts to traffic and transport using both the New England Highway and Golden Highway. Some of these measures may include:
- Construction finish times to be planned for minimal impact to the afternoon peak traffic flows
- Consultation with EC Throsby regarding their scheduled truck movements
- Installing, maintaining and monitoring advisory and directional signage, line marking and pavement markings to direct motorists via the safest and most convenient route
- Delivering plant and equipment to the site outside of peak traffic flow.

Safe access for emergency vehicles would be provided at all times during the construction period.

In summary, the potential impacts during construction would include:
- Increased travel times due to reduced speed limits around construction sites, truck and construction machinery movements and temporary partial or complete closure of roads
- Temporary delays to local and regional bus services through reduced speeds
- Temporary switching of traffic on the Golden Highway and between existing and new sections of the New England Highway. Construction staging would consider minimising the number of traffic switches from one carriageway of the New England Highway to the other to help minimise traffic disruption.

A TMP for the project would be developed prior to construction as part of the CEMP. The TMP would include the guidelines, general requirements and procedures to be used when activities or areas of work have a potential impact on existing traffic arrangements and flow.

As such, it is expected there would be a moderate impact on traffic and network performance during construction.

**Property access**

The normal access arrangements at the abattoir access road may be temporarily disrupted, however access would be maintained at all times to ensure there is no impact to the day-to-day operations of the abattoir. Access to all private property would be maintained at all times.

There would be no direct impact to the Hunter Valley rail network or the Main North Railway Line, however there is an access to land owned by ARTC that would be affected by the construction of the u-turn facility and siting of the construction compound. This would be coordinated in consultation with ARTC prior to construction.

As such, it is expected there would be a minor impact on property access during construction.
**Operation**

**Traffic performance**

Section 2.4 shows that a number of options were modelled against future traffic performance in the years 2019, 2029 and 2039 to determine a solution that would provide an acceptable, long-term level of service.

As Option 5A-S2 (the preferred option) and the proposal presented in this REF are largely similar, it is expected that any traffic modelling would produce similar results in terms of network performance and level of service.

Notwithstanding, there are some minor differences between the proposal design and Option 5A-S2. These are outlined in Section 2.6 of this REF and include the addition of a u-turn facility for vehicles egressing from the EC Throsby abattoir wanting to travel eastbound on the New England Highway. The traffic performance for the proposal, as derived from the initial traffic modelling for Option 5A-S2, is shown in Table 6-15 and Table 6-16 below.

Table 6-15: Traffic performance in the AM peak

<table>
<thead>
<tr>
<th>Movement</th>
<th>2019</th>
<th>2029</th>
<th>2039</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Delay (s)</td>
<td>Level of service</td>
<td>Delay (s)</td>
</tr>
<tr>
<td>Right-turn from the Golden Highway onto the New England Highway</td>
<td>No delays due to free flow movement via the flyover</td>
<td>No delays due to free flow movement via the flyover</td>
<td>No delays due to free flow movement via the flyover</td>
</tr>
<tr>
<td>Left-turn from the Golden Highway onto the New England Highway</td>
<td>32</td>
<td>C</td>
<td>51</td>
</tr>
<tr>
<td>Right-turn from the New England Highway onto the Golden Highway</td>
<td>48</td>
<td>D</td>
<td>76</td>
</tr>
<tr>
<td>Eastbound traffic on the New England Highway</td>
<td>0</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>Westbound traffic on the New England Highway</td>
<td>0</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>Left-turn from the New England Highway onto the Golden Highway</td>
<td>10</td>
<td>A</td>
<td>11</td>
</tr>
</tbody>
</table>
**Table 6-16: Traffic performance in the PM peak**

<table>
<thead>
<tr>
<th>Movement</th>
<th>2019</th>
<th>2029</th>
<th>2039</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Delay (s)</td>
<td>Level of service</td>
<td>Delay (s)</td>
</tr>
<tr>
<td>Right-turn from the Golden Highway onto the New England Highway</td>
<td>No delays due to free flow movement via the flyover</td>
<td>No delays due to free flow movement via the flyover</td>
<td>No delays due to free flow movement via the flyover</td>
</tr>
<tr>
<td>Left-turn from the Golden Highway onto the New England Highway</td>
<td>10</td>
<td>A</td>
<td>16</td>
</tr>
<tr>
<td>Right-turn from the New England Highway onto the Golden Highway</td>
<td>21</td>
<td>B</td>
<td>23</td>
</tr>
<tr>
<td>Eastbound traffic on the New England Highway</td>
<td>0</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>Westbound traffic on the New England Highway</td>
<td>0</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>Left-turn from the New England Highway onto the Golden Highway</td>
<td>0</td>
<td>A</td>
<td>7</td>
</tr>
</tbody>
</table>

The traffic model predicts travel time savings eastbound on the New England Highway between the Golden Highway intersection and Bell Road of around 1.3 minutes in the AM peak and 1.7 minutes in the PM peak on opening in 2019.

Additional modelling was carried out by Arup to assess the performance of the u-turn facility and egress from the abattoir access road at the Golden Highway. The assessment tested the performance of the proposed configuration for future years 2021 and 2031, with the same forecast traffic growth rates used to assess the proposal options (see Section 2.4) and traffic performance presented in Table 6-14 and Table 6-15 above. An additional “worst-case” assessment was also tested where traffic from the EC Throsby abattoir was doubled (in addition to the forecast traffic growth). The assessment focussed on the morning and evening peak traffic hours of:

- 5:30–6:30 am
- 3:00-4:00 pm.

The traffic modelling indicated that the proposed u-turn facility and abattoir egress configuration would perform with an overall Level of Service of A (‘good operation’) for all scenarios, including the “worst-case” scenario (where abattoir traffic is doubled in addition to the forecast traffic growth). The modelling indicated all key movements would perform with spare capacity and in particular, observations from the modelling included:

- Vehicles would be able to turn left from the abattoir access road onto the Golden Highway with an average delay of 24 seconds (Level of Service B)
- Maximum queue lengths would be approximately 25 metres (two vehicles) for vehicles turning right into the u-turn facility, even under the “worst-case” scenario
- Vehicles would be able to turn left from the u-turn facility onto the Golden Highway with an average delay of 12 seconds (Level of service A).

In summary, the proposal would reduce congestion and peak period delays at the New England Highway and Golden Highway intersection, and improve travel times in both directions along the New England Highway.
The proposal would have a positive impact on traffic and network performance during operation.

**Safety**

As Option 5A-S2 and the proposal design are largely similar and contain similar potential vehicle conflict points, similar safety modelling results are expected. The crash reduction performance of Option 5A-S2, as derived from the initial traffic modelling, is presented in Table 6-17.

Table 6-17: Crash reduction rates in the proposal area

<table>
<thead>
<tr>
<th>Vehicles</th>
<th>Crash type</th>
<th>Current total</th>
<th>Predicted reduction rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-vehicle accidents</td>
<td>Intersection, adjacent approaches</td>
<td>15</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Head-on</td>
<td>2</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>U-turn</td>
<td>1</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Rear-end</td>
<td>11</td>
<td>40%</td>
</tr>
<tr>
<td>Single vehicle accidents</td>
<td>Off carriageway, straight</td>
<td>4</td>
<td>45%</td>
</tr>
<tr>
<td></td>
<td>Off straight section of road, hit object</td>
<td>3</td>
<td>45%</td>
</tr>
<tr>
<td></td>
<td>Off curved section of road, hit object</td>
<td>7</td>
<td>60%</td>
</tr>
</tbody>
</table>

As shown, separation of the eastbound and westbound carriageways of the New England Highway and introduction of a flyover for right-turn movements from the Golden Highway onto the New England Highway is expected to eliminate intersection-based, U-turn and head-on crashes in the proposal area.

The proposal would have a positive impact on road safety during operation.

**Property access**

Some of the existing property access arrangements would be modified to accommodate the proposal and ensure safety.

The main change would be experienced by vehicles egressing from the abattoir access road wanting to head eastbound along the New England Highway. These vehicles would need to access the flyover by using the u-turn facility provided on the northern side of the Golden Highway, as shown in Figure 3-5. The u-turn facility and the proposed egress arrangements from abattoir access road have been developed in consultation with EC Throsby (owners of the abattoir), Singleton Council and other stakeholders.

The proposal would result in the one private property on the southern side of the New England Highway being restricted to left-in/ left-out movements only. The current right-turn movement from the New England Highway into the property would be replaced with a U-turn movement at the Bell Road intersection, followed by a left-turn movement into the property. The right-turn movement out of the property onto the New England Highway traveling towards Newcastle would be replaced by a left-out movement, a left-turn onto the Golden Highway, a U-turn using the u-turn facility and then a right-turn onto the New England Highway using the flyover.

All other formal property accesses would be maintained by the proposal.
Access to the Whittingham rest area would be removed by the new flyover. Access to the two privately owned properties and the rail corridor on the northern side of the Golden Highway, who currently use the rest area for informal access, will be via the new u-turn facility. Consultation about alternative access arrangements to these properties is currently being carried out with the property owners.

There would be no change to the current turning movements at the intersection of the New England Highway and Bell Road.

The proposal would have a **minor adverse** impact on property access during operation.

**Walking and cycling**

The existing bicycle crossing at the New England Highway (see Figure 2-3) would be maintained and the following new cycle infrastructure would be provided:

- A 1.3 metre high safety barrier on the proposed bridge to cater for cyclists
- Green coloured pavement along the westbound shoulder of the New England Highway in advance of the Golden Highway intersection
- Green coloured pavement extended across the Golden Highway at the intersection with the New England Highway
- A cyclist crossing on the New England Highway eastbound entry ramp.

No provisions for pedestrian would be provided as part of the proposal.

The proposal would have a **positive** impact for cyclists and a **negligible** impact on pedestrians during operation.

**Public transport**

There would be no impact to the local and regional bus services operating in the area. If anything, these services would benefit from the improved travel times as a result of the proposal.

The proposal is anticipated to have a **positive** impact on bus services during operation.

**6.6.4 Safeguards and management measures**

The recommended safeguards and management measures to minimise impacts to traffic and access during construction of the proposal are outlined in Table 6-18.
### Table 6-18: Traffic and access safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
</table>
| Disruptions to traffic and transport | T1  A TMP is to be prepared and implemented as part of the project CEMP. The TMP should be prepared in accordance with the Roads and Maritime *Traffic control at worksites manual* (Version 4), Australian Standard 1742.3 Manual of uniform traffic control devices, and instruction from the Transport Management Centre. The TMP should include, but not be limited to:  
- Confirmation of haulage routes and site access points  
- Site specific traffic control measures (including signage) to manage and regulate traffic movements  
- Measures to maintain access to properties  
- Requirements and methods to inform the local community of impacts on the local road network  
- A response plan for any construction traffic related incidents. | Project Manager and Site Manager | Pre-construction | Standard |
| Changed transport and access conditions | T2  Road users, local residents, and local businesses are to be informed in advance of changed conditions, including any likely disruptions to access. | Project Manager and consultation team | Pre-construction and construction | Standard |
| Changed transport and access conditions | T3  Consultation is to be carried out with Hunter Valley Buses should the existing Singleton Heights to Stockland Green Hills via Maitland (route 180) bus stops within the project area need to be temporarily relocated. Appropriate temporary stop locations should be agreed and implemented for the defined period. | Project Manager | Pre-construction and construction | Additional |
### 6.7 Noise and vibration

A construction and operational noise and vibration assessment was carried out for the proposal as part of this REF. The assessment report is attached as Appendix H and is summarised below.

#### 6.7.1 Methodology

The noise and vibration assessment was carried out in accordance with:

- NSW Road Noise Policy (RNP)
- Roads and Maritime Noise Criteria Guideline (NCG)
- Roads and Maritime Noise Mitigation Guideline (NMG)
- Roads and Traffic Authority Environmental Noise Management Manual (ENMM)
- Roads and Maritime Construction Noise and Vibration Guideline (CNVG)
- NSW Interim Construction Noise Guideline (ICNG)
- Assessing Vibration: A Technical Guideline
- NSW Industrial Noise Policy (INP).

Unattended noise monitoring was conducted by Arup for seven consecutive days from 4 December to 11 December 2015. Noise loggers were set up at the locations listed in Table 6-19 and shown in Figure 6-8.

Unattended noise measurements were supplemented by a 15-minute attended noise level measurement at each noise logger location at commencement and completion of the logging period for the purposes of verification.
<table>
<thead>
<tr>
<th>ID</th>
<th>Location</th>
<th>Distance to nearest road kerb</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>R4 - Lot 42, DP1128981</td>
<td>458 metres</td>
<td>Logger located in the free-field on the northern side of the property. Ambient $L_{Aeq}$ noise levels influenced by freight rail noise.</td>
</tr>
<tr>
<td>L2</td>
<td>R5 - Lot 106, DP1141521</td>
<td>185 metres</td>
<td>Logger located in the free-field on the northern side of the property. Ambient $L_{Aeq}$ noise levels dominated by road traffic along the New England Highway.</td>
</tr>
<tr>
<td>L3</td>
<td>R10 - Lot 11, DP1125000</td>
<td>30 metres</td>
<td>Logger located in the free-field on the southern side of the property. Ambient $L_{Aeq}$ noise levels dominated by road traffic along the New England Highway.</td>
</tr>
</tbody>
</table>
Figure 6-8: Noise logging locations
In accordance with Roads and Maritime guidelines, all receivers within 600 metres from the centre line of the outermost traffic lane on each side of the subject roads have been identified for the construction noise assessment. These are identified in Table 6-20 and shown in Figure 6-9.

Table 6-20: Receiver locations

<table>
<thead>
<tr>
<th>ID</th>
<th>Address</th>
<th>Lot</th>
<th>Distance from proposal¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>98 Mitchell Line Road</td>
<td>351/DP1053417</td>
<td>410 metres</td>
</tr>
<tr>
<td>R2</td>
<td>96 Mitchell Line Road</td>
<td>27/DP1128978</td>
<td>260 metres</td>
</tr>
<tr>
<td>R3</td>
<td>3193 New England Highway, Belford</td>
<td>10/DP703050</td>
<td>450 metres</td>
</tr>
<tr>
<td>R4</td>
<td>3193 New England Highway, Belford</td>
<td>42/DP1128981</td>
<td>470 metres</td>
</tr>
<tr>
<td>R5</td>
<td>3193 New England Highway, Belford</td>
<td>106/DP1141521</td>
<td>220 metres</td>
</tr>
<tr>
<td>R6</td>
<td>3193 New England Highway, Belford</td>
<td>107/DP1141521</td>
<td>485 metres</td>
</tr>
<tr>
<td>R7</td>
<td>3193 New England Highway, Belford</td>
<td>108/DP1141521</td>
<td>325 metres</td>
</tr>
<tr>
<td>R9</td>
<td>2 Lindsay Street, Belford</td>
<td>A/DP400750</td>
<td>430 metres</td>
</tr>
<tr>
<td>R10</td>
<td>2 Lindsay Street, Belford</td>
<td>11/DP1125000</td>
<td>460 metres</td>
</tr>
<tr>
<td>R11</td>
<td>10 Lovell Street, Belford</td>
<td>3/14/DP758078</td>
<td>575 metres</td>
</tr>
<tr>
<td>R12</td>
<td>Lindsay Street, Belford</td>
<td>69/DP755209</td>
<td>585 metres</td>
</tr>
<tr>
<td>C1</td>
<td>United Petrol service station</td>
<td>21/DP1014307</td>
<td>180 metres</td>
</tr>
</tbody>
</table>

¹ Approximate distance from centre line of outermost carriageway to façade of receiver building.
Figure 6-9: Potential receiver locations
However, for the operational noise assessment only the receivers at R3 through R7 have been considered as they are within 600 metres of the new eastbound New England Highway carriageway.

C1 has also not been considered as part of the operational noise assessment as it is not classified as a noise sensitive receiver.

Potential noise and vibration impacts have been predicted based on the indicative construction methodology and equipment, as detailed in Section 3 of this REF and the traffic forecasts from the *New England Highway Duplication - Belford to Golden Highway Traffic Modelling Report* (Hyder, 2014a).

### 6.7.2 Existing environment

The existing noise environment around the proposal area is mainly characterised by road traffic noise, including heavy vehicles, along the New England Highway, rail movements along the Main North Railway Line, rural industry and machinery and local insect and animal noise.

A summary of existing ambient and road traffic noise levels is provided in Table 6-21.

**Table 6-21: Existing ambient and road traffic noise levels**

<table>
<thead>
<tr>
<th>ID</th>
<th>Location</th>
<th>Rating background noise levels (RBL)¹</th>
<th>LAeq road traffic noise levels² (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Day</td>
<td>Evening</td>
</tr>
<tr>
<td>L1</td>
<td>R4 - Lot 42, DP1128981</td>
<td>43</td>
<td>42</td>
</tr>
<tr>
<td>L2</td>
<td>R5 - Lot 106, DP1141521</td>
<td>46</td>
<td>47</td>
</tr>
<tr>
<td>L3</td>
<td>R10 - Lot 11, DP1125000</td>
<td>54</td>
<td>49</td>
</tr>
</tbody>
</table>

1. See NSW Industrial Noise Policy (INP) for a detailed description.
   Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays
   Evening: 18:00-22:00 Monday to Sunday & Public Holidays
   Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays
2. Traffic results as measured in the free field
3. Due to distance from the carriageway and relative low traffic flows during the night-time period, road traffic noise was not considered the dominant noise source measured at this location.

### 6.7.3 Criteria

**Residences**

The ICNG establishes a “noise affected” and “highly noise affected” criteria to determine the noise management requirements necessary to minimise construction noise impacts on residential receivers. The construction noise criteria for residential receivers is summarised in Table 6-22.
### Table 6-22: Construction noise criteria for residential receivers

<table>
<thead>
<tr>
<th>Period</th>
<th>Management level criteria $L_{Aeq, 15\text{ min}}$</th>
<th>Management requirements</th>
</tr>
</thead>
</table>
| Recommended standard hours: Monday to Friday (7am to 6pm) Saturday (8am to 1pm) | Noise affected RBL + 10 dB | • The noise affected level represents the point above which there may be some community reaction to noise  
• Where the predicted or measured $L_{Aeq, 15\text{ min}}$ is greater than the noise affected level, all feasible and reasonable work practices should be applied to meet the noise affected level  
• All potentially impacted residents should be informed of the nature of works to be carried out, the expected noise levels and duration, as well as contact details. |
| Highly noise affected 75 dB(A) | • The highly noise affected level represents the point above which there may be strong community reaction to noise  
• Where noise is above this level, respite periods may be required by restricting the hours that the very noisy activities can occur, taking into account:  
  - 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  
  - if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times. |
| Outside recommended standard hours | Noise affected RBL + 5 dB | • A strong justification would typically be required for works outside the recommended standard hours  
• All feasible and reasonable work practices should be applied to meet the noise affected level  
• Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, negotiation should be carried out with the community. |

### Other sensitive land uses

The ICNG also provides recommended noise levels for sensitive land uses other than residential receivers. These recommended limits are summarised in Table 6-23.

Table 6-23: Recommended construction noise limits for non-residential sensitive receivers

<table>
<thead>
<tr>
<th>Sensitive Land Use</th>
<th>Management level, $L_{Aeq, 15\text{ min}}$ (applies when properties are being used)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classrooms at schools and other educational institutions</td>
<td>Internal noise level 45 dB(A)</td>
</tr>
<tr>
<td>Sensitive Land Use</td>
<td>Management level, $L_{Aeq,15min}$ (applies when properties are being used)</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)</td>
<td>External noise level 65 dB(A)</td>
</tr>
<tr>
<td>Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)</td>
<td>External noise level 60 dB(A)</td>
</tr>
<tr>
<td>Community centres</td>
<td>Internal noise levels 45 dB(A) (based on the Maximum internal noise level for Reading Areas in public libraries in AS2107)</td>
</tr>
</tbody>
</table>

**Commercial and industrial premises**

The ICNG also gives recommended management measures for commercial (e.g. offices, retail outlets) and industrial premises:
- Commercial premises: $L_{Aeq,15minute}$ 70 dB(A)
- Industrial premises: $L_{Aeq,15minute}$ 75 dB(A).

**Construction noise management levels**

Construction noise management levels for residential receivers are established from the prevailing background noise level. The data measured at the noise logger location most representative of each residential receiver has been used to derive appropriate noise management levels for the proposal. These are presented in Table 6-24. It should be noted that the results from logger L2 has been conservatively excluded due to the higher measured background noise levels.

**Table 6-24: Construction noise management levels (NMLs) for the proposal**

<table>
<thead>
<tr>
<th>Receiver location (s)</th>
<th>Logger ID</th>
<th>Noise management levels (NML) dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Standard hours¹</td>
</tr>
<tr>
<td>R1-R8 &amp; R11-R12</td>
<td>L1</td>
<td>53 db(A)</td>
</tr>
<tr>
<td>R9 &amp; R10</td>
<td>L3</td>
<td>64 db(A)</td>
</tr>
<tr>
<td>C1 - United Petrol service station</td>
<td>N/A</td>
<td>75 db(A) (when in use)</td>
</tr>
</tbody>
</table>

1. 07:00-18:00 Monday to Friday, 08:00-13:00 Saturday
2. Outside Standard hours – Day 13:00-18:00 Saturday, 08:00-18:00 Sunday
3. Outside Standard hours – Evening: 18:00-22:00 Monday to Saturday
4. Outside Standard hours – Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays
**Operational noise**

The noise criteria for residential and non-residential receivers is established in Roads and Maritime’s Noise Criteria Guideline (NCG). The relevant noise criteria for the proposal is shown in Table 6-25.

Table 6-25: Road traffic noise assessment criteria for residential and non-residential land uses

<table>
<thead>
<tr>
<th>Type of project/ land use</th>
<th>Assessment Criteria – dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day (7am-10pm)</td>
</tr>
<tr>
<td></td>
<td>Night (10pm-7am)</td>
</tr>
<tr>
<td>Existing residences affected by noise from redevelopment of existing freeways/ arterial/ sub-arterial roads</td>
<td>$L_{A_{eq}}$ (15 hour) 60 (external)</td>
</tr>
<tr>
<td>Open space (active use¹)</td>
<td>$L_{A_{eq}}$ (15 hour) 60 (external) when in use</td>
</tr>
<tr>
<td>Open space (passive use²)</td>
<td>$L_{A_{eq}}$ (15 hour) 55 (external) when in use</td>
</tr>
</tbody>
</table>

1. Active recreation is characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion.
2. Passive recreation is characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, e.g. playing chess, reading.

**Vibration**

**Human comfort and amenity**

The Assessing Vibration guideline (DEC, 2006) provides vibration criteria for maintaining human comfort within different uses. The guideline recommends ‘preferred’ and ‘maximum’ weighted vibration levels for both continuous vibration sources, such as steady road traffic and continuous construction activity, and for impulsive vibration sources. The weighting curves are obtained from British Standard BS 6472 – Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz).

For intermittent sources (e.g. passing heavy vehicles, impact pile driving, intermittent construction), the guideline uses the vibration dose value (VDV) metric to assess human comfort effects of vibration. VDV takes into account both the magnitude of vibration events and the number of instances of the vibration event. Intermittent events that occur less than three times in an assessment period (either day, 7am to 10pm, or night, 10 pm to 7am) are counted as ‘impulsive’ sources for the purposes of assessment.

The recommended vibration limits for maintaining human comfort in residences and other relevant receiver types for continuous/impulsive and intermittent vibration are provided in Table 6-26 and Table 6-27.
Table 6-26: Preferred and maximum weighted root-mean-square (rms) values for continuous and impulsive vibration acceleration (m/s²) 1-80 Hz

<table>
<thead>
<tr>
<th>Location</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- axes</td>
</tr>
<tr>
<td><strong>Continuous Vibration</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical areas</td>
<td>Daytime or night-time</td>
<td>0.005</td>
<td>0.0036</td>
</tr>
<tr>
<td>Residences</td>
<td>Daytime 0700-2200</td>
<td>0.010</td>
<td>0.0071</td>
</tr>
<tr>
<td></td>
<td>Night-time 2200-0700</td>
<td>0.007</td>
<td>0.005</td>
</tr>
<tr>
<td>Offices, schools, educational institutions and places of worship</td>
<td>Daytime or night-time</td>
<td>0.020</td>
<td>0.014</td>
</tr>
<tr>
<td>Workshops</td>
<td>Daytime or night-time</td>
<td>0.04</td>
<td>0.029</td>
</tr>
<tr>
<td><strong>Impulsive Vibration</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical areas</td>
<td>Daytime or night-time</td>
<td>0.005</td>
<td>0.0036</td>
</tr>
<tr>
<td>Residences</td>
<td>Daytime 0700-2200</td>
<td>0.30</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>Night-time 2200-0700</td>
<td>0.10</td>
<td>0.071</td>
</tr>
<tr>
<td>Offices, schools, educational institutions and places of worship</td>
<td>Daytime or night-time</td>
<td>0.64</td>
<td>0.46</td>
</tr>
<tr>
<td>Workshops</td>
<td>Daytime or night-time</td>
<td>0.64</td>
<td>0.46</td>
</tr>
</tbody>
</table>

1. Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am
2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specified above. Alternative criteria is outside the scope of the policy and other guidance documents should be referred to.
Table 6-27: Acceptable vibration dose values for intermittent vibration (m/s^{1.75})

<table>
<thead>
<tr>
<th>Location</th>
<th>Daytime 0700-2200</th>
<th>Night-time 2200-0700</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preferred value</td>
<td>Maximum value</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical areas</td>
<td>0.10</td>
<td>0.20</td>
</tr>
<tr>
<td></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></td>
<td>0.13</td>
<td>0.26</td>
</tr>
<tr>
<td>Offices, schools, educational institutions and places of worship</td>
<td>0.40</td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td>0.40</td>
<td>0.80</td>
</tr>
<tr>
<td>Workshops</td>
<td>0.80</td>
<td>1.60</td>
</tr>
<tr>
<td></td>
<td>0.80</td>
<td>1.60</td>
</tr>
</tbody>
</table>

1. Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am
2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas.

**Building damage**

Part 2 of British Standard BS 7385:2 – Evaluation and measurement for vibration in buildings-Part 2: Guide to damage levels from groundborne vibration gives specific guidance on the levels of vibration below which building structures are considered to be at minimal risk. Limits to the acceptable levels of vibration on the foundations of a building as proposed in the standard are listed in Table 6-28.

Table 6-28: Transient vibration guide values for cosmetic damage

<table>
<thead>
<tr>
<th>Category</th>
<th>Peak component particle velocity in frequency range of predominant pulse</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4 Hz to 15 Hz</td>
</tr>
<tr>
<td>1) Reinforced or framed structures</td>
<td>50 mm/s</td>
</tr>
<tr>
<td>Industrial and heavy commercial buildings</td>
<td>50 mm/s</td>
</tr>
<tr>
<td>2) Unreinforced or light framed structures</td>
<td>15 mm/s @ 4 Hz increasing to 20 mm/s @ 15 Hz</td>
</tr>
<tr>
<td>Residential or light commercial type buildings</td>
<td>20 mm/s @ 15 Hz increasing to 50 mm/s @ 40 Hz and above</td>
</tr>
</tbody>
</table>

Table 6-29: Guideline values of vibration velocity for evaluating the effects of short-term vibration

<table>
<thead>
<tr>
<th>Structural type</th>
<th>Vibration Velocity, ( v_i ), in mm/s</th>
<th>Foundation</th>
<th>Plane of floor of uppermost full storey</th>
<th>Frequency mixture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Hz to 10 Hz</td>
<td>10 to 50 Hz</td>
<td>50 to 100 Hz</td>
<td></td>
</tr>
<tr>
<td>Buildings used for commercial purposes, industrial buildings and buildings of similar design</td>
<td>20</td>
<td>20 to 40</td>
<td>40 to 50</td>
<td>40</td>
</tr>
<tr>
<td>Dwellings and buildings of similar design and/or use</td>
<td>5</td>
<td>5 to 15</td>
<td>15 to 20</td>
<td>15</td>
</tr>
<tr>
<td>Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Group 1 or 2 and have intrinsic value (e.g., buildings under a preservation order)</td>
<td>3</td>
<td>3 to 8</td>
<td>8 to 10</td>
<td>8</td>
</tr>
</tbody>
</table>

The guidelines state that:

"Experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur. If damage nevertheless occurs, it is to be assumed that other causes are responsible. Exceeding the values in table [17] does not necessarily lead to damage; should they be significantly exceeded; however, further investigations are necessary."

The most stringent limit recommended in the German Standard is 3 mm/s. This criterion is applicable to particularly sensitive constructions such as heritage structures.

**Buried services**

The German Standard also sets out guideline values for vibration effects on buried pipework. These are reproduced in Table 6-30 below.

Table 6-30: Guideline values for short-term vibration impacts on buried pipework

<table>
<thead>
<tr>
<th>Pipe material</th>
<th>Guideline values for vibration velocity measured on the pipe, mm/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Steel (including welded pipes)</td>
<td>100</td>
</tr>
<tr>
<td>2. Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)</td>
<td>80</td>
</tr>
<tr>
<td>3. Masonry, plastic</td>
<td>50</td>
</tr>
</tbody>
</table>
In addition, specific limits for vibration affecting high-pressure gas pipelines is provided in the UK National Grid’s Specification for Safe Working in the Vicinity of National Grid High Pressure Gas Pipelines and Associated Installations – Requirements for Third Parties (report T/SP/SSW/22, UK National Grid, Rev 10/06, October 2006). This specification states that no piling is allowed within 15 metres of a pipeline without an assessment of the vibration levels at the pipeline. The PPV at the pipeline is limited to a maximum level of 75 mm/s, and where PPV is predicted to exceed 50 mm/sec the ground vibration is required to be monitored.

Other services that may be encountered include electrical cables and telecommunication services such as fibre optic cables. While these may sustain vibration velocity levels from between 50 mm/s and 100 mm/s, the connected services such as transformers and switchgear, may not. Where encountered, site specific vibration assessment in consultation with the utility provider should be carried out.

6.7.4 Potential impacts

Construction noise

Noise impacts from construction activities were modelled based on the typical construction equipment (see Section 3.3.3) and the derived sound power levels for each activity (see Appendix H).

Construction noise predictions have been carried out for a selection of the worst case scenarios, as it is unclear at this stage which activities may be undertaken outside of the standard working hours.

Table 6-31 provides a summary of the predicted noise levels at each receiver for different activities.

Table 6-31: Construction noise predictions

<table>
<thead>
<tr>
<th>ID</th>
<th>Address</th>
<th>Lot</th>
<th>Corridor clearing db(A)</th>
<th>Bulk earthworks db(A)</th>
<th>Paving db(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>98 Mitchell Line Road</td>
<td>351//DP1053417</td>
<td>51</td>
<td>53</td>
<td>48</td>
</tr>
<tr>
<td>R2</td>
<td>96 Mitchell Line Road</td>
<td>27//DP1128978</td>
<td>57</td>
<td>59</td>
<td>54</td>
</tr>
<tr>
<td>R3</td>
<td>3193 New England Highway, Belford</td>
<td>10//DP703050</td>
<td>49</td>
<td>51</td>
<td>46</td>
</tr>
<tr>
<td>R4</td>
<td>3193 New England Highway, Belford</td>
<td>42//DP1128981</td>
<td>49</td>
<td>51</td>
<td>46</td>
</tr>
<tr>
<td>R5</td>
<td>3193 New England Highway, Belford</td>
<td>106//DP1141521</td>
<td>59</td>
<td>61</td>
<td>56</td>
</tr>
<tr>
<td>R6</td>
<td>3193 New England Highway, Belford</td>
<td>107//DP1141521</td>
<td>48</td>
<td>50</td>
<td>45</td>
</tr>
<tr>
<td>R7</td>
<td>3193 New England Highway, Belford</td>
<td>108//DP1141521</td>
<td>54</td>
<td>56</td>
<td>51</td>
</tr>
<tr>
<td>R8</td>
<td>3193 New England Highway, Belford</td>
<td>3/4/DP758078</td>
<td>47</td>
<td>49</td>
<td>44</td>
</tr>
</tbody>
</table>
The assessment indicates that works have the potential to exceed the NMLs at locations R1 to R8 and R11 to R12, even when carried out during standard hours. At locations R9 and R10, works are predicted to exceed NMLs during the night time period only. The non-residential receiver (C1) is not predicted to exceed the noise management level.

**Construction vibration**

The Roads and Maritime CNVG provides recommended safe working distances for vibration intensive plant. These are based on International Standards and guidance and have been reproduced in Table 6-32. Based on the identified nearest receiver locations, proposed construction works are not expected to occur within the safe working distances with respect to nearby sensitive receivers.

Table 6-32: Roads and Maritime recommended safe working distances for vibration intensive plant

<table>
<thead>
<tr>
<th>Plant item</th>
<th>Rating/ description</th>
<th>Safe working distance</th>
<th>Human response (NSW Assessing vibration)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cosmetic damage</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(BS 7385)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 metres</td>
<td>15 metres to 20 metres</td>
</tr>
<tr>
<td>Vibratory roller</td>
<td>&lt; 50 kN (Typically 1-2 tonnes)</td>
<td>5 metres</td>
<td>15 metres to 20 metres</td>
</tr>
<tr>
<td></td>
<td>&lt; 100 kN (Typically 2-4 tonnes)</td>
<td>6 metres</td>
<td>20 metres</td>
</tr>
<tr>
<td>Plant item</td>
<td>Rating/ description</td>
<td>Safe working distance</td>
<td>Human response (NSW Assessing vibration)</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>---------------------</td>
<td>-----------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Cosmetics damage</td>
<td>Human response</td>
<td></td>
</tr>
<tr>
<td>&lt; 200 kN (Typically 4-6 tonnes)</td>
<td>12 metres</td>
<td>40 metres</td>
<td></td>
</tr>
<tr>
<td>&lt; 300 kN (Typically 7-13 tonnes)</td>
<td>15 metres</td>
<td>100 metres</td>
<td></td>
</tr>
<tr>
<td>&gt; 300 kN (Typically 13-18 tonnes)</td>
<td>20 metres</td>
<td>100 metres</td>
<td></td>
</tr>
<tr>
<td>&gt; 300 kN (&gt; 18 tonnes)</td>
<td>25 metres</td>
<td>100 metres</td>
<td></td>
</tr>
<tr>
<td>Small hydraulic hammer</td>
<td>(300 kg - 5 to 12t excavator)</td>
<td>2 metres</td>
<td>7 metres</td>
</tr>
<tr>
<td>Medium hydraulic hammer</td>
<td>(900 kg – 12 to 18t excavator)</td>
<td>7 metres</td>
<td>23 metres</td>
</tr>
<tr>
<td>Large hydraulic hammer</td>
<td>(1600 kg – 18 to 34t excavator)</td>
<td>22 metres</td>
<td>73 metres</td>
</tr>
<tr>
<td>Vibratory pile driver</td>
<td>Sheet piles</td>
<td>2 metres to 20 metres</td>
<td>20 metres</td>
</tr>
<tr>
<td>Pile boring</td>
<td>≤ 800 mm</td>
<td>2 metres (nominal)</td>
<td>4 metres</td>
</tr>
<tr>
<td>Jackhammer</td>
<td>Hand held</td>
<td>1 metre (nominal)</td>
<td>2 metres</td>
</tr>
</tbody>
</table>

Potential vibration impacts from blasting should be reviewed by the contractor if required.

**Operational noise**

Using the noise model prepared for the proposal, road traffic noise levels have been predicted for residential receivers R3 through R7 for two future time periods:
- The year of opening (2019)
- 10 years after opening (2029 – the ‘design year’).

These time periods were based on the original project program, which has since been revised for an opening year of 2021.

It is not expected that traffic volumes from 2019 to 2021 would increase considerably, with the percentage of heavy vehicles also expected to be similar. A two per cent annual growth rate (as per the traffic modelling undertaken for the proposal) was applied across the study to obtain the 2019 and 2029 modelling scenarios. Applying this same growth rate means that the noise levels in 2021 would be similar to the 2019 noise levels presented below (an increase no more than 0.5 dB may occur which is considered to be negligible). Similarly, the difference between 2029 traffic volumes (used for the noise modelling) and 2031 traffic volumes is not expected to change significantly, with no considerable change to the number of heavy vehicles expected in that period either. Again, this would result in a negligible increase in noise levels (less than 0.5 dB) compared to the predicted 2029 noise levels. It is noted that with an increase of 0.5 dB, the assessment criterion of +2 dB will still not be exceeded. As such, the extent of noise mitigation suggested in accordance with the assessment below would not change with this negligible increase in noise levels. Noise levels for the opening and design years would be re-evaluated during the detailed design stage.
Two scenarios have also been considered:
- Without the proposal – termed the ‘no-build’ scenario
- With the proposal – termed the ‘build’ scenario.

The predicted noise levels at individual receivers are presented in Table 6-33.
Table 6-33: Predicted road traffic noise levels for the year of opening and the design year

<table>
<thead>
<tr>
<th>Receiver ID</th>
<th>Year of opening ‘No Build’ scenario dB(A)</th>
<th>Year of opening ‘Build’ scenario dB(A)</th>
<th>Design year ‘No Build’ scenario dB(A)</th>
<th>Design year ‘Build’ scenario dB(A)</th>
<th>NCG criteria, dB(A)</th>
<th>Is the NMG criteria exceeded?</th>
<th>Change in noise level dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R3</td>
<td>51.5</td>
<td>47.9</td>
<td>51.1</td>
<td>47.5</td>
<td>52.4</td>
<td>48.7</td>
<td>51.9</td>
</tr>
<tr>
<td>R4</td>
<td>52.0</td>
<td>48.4</td>
<td>51.7</td>
<td>48.1</td>
<td>52.9</td>
<td>49.3</td>
<td>52.5</td>
</tr>
<tr>
<td>R5</td>
<td>56.9</td>
<td>53.3</td>
<td>56.5</td>
<td>53.0</td>
<td>57.7</td>
<td>54.2</td>
<td>57.3</td>
</tr>
<tr>
<td>R6</td>
<td>53.8</td>
<td>50.1</td>
<td>53.6</td>
<td>50.0</td>
<td>54.6</td>
<td>51.0</td>
<td>54.5</td>
</tr>
<tr>
<td>R7</td>
<td>55.9</td>
<td>52.4</td>
<td>55.7</td>
<td>52.2</td>
<td>56.8</td>
<td>53.2</td>
<td>56.6</td>
</tr>
</tbody>
</table>

New England Highway upgrade between Belford and the Golden Highway
Review of Environmental Factors
Table 6-33 shows that the predicted operational road traffic noise levels for the ‘Build’ scenario are within 0.5 dBA of the ‘No-Build’ noise levels at all residential receivers. Further, road traffic noise levels at all receiver locations within the study area are predicted to be below the NCG criteria.

Roads and Maritime applies the criteria from the NCG if noise levels increase by more than 2.0 dBA at the worst affected receiver. As the predicted road traffic noise increases for the proposal are below 2.0 dBA at all receiver locations they therefore do not qualify for mitigation.

6.7.5 Safeguards and management measures
The recommended safeguards and management measures to minimise noise impacts during construction of the proposal are outlined in Table 6-34.
Table 6-34: Noise safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
</table>
| Construction noise and vibration | **NV1**
A Noise and Vibration Management Plan (NVMP) is to be prepared and implemented as part of the CEMP. The NVMP should generally follow the approach in ICNG and identify:
- All potential significant noise and vibration generating activities
- Measures to be implemented during construction to minimise noise and vibration impacts
- 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.
The CEMP should be regularly updated to account for changes in noise and vibration management strategies. | Project Manager/ Site Manager | Pre-construction and construction | Standard safeguard |
| Construction noise | **NV2**
All sensitive receivers likely to be affected by construction noise are to be notified at least 7 days prior to commencement of any works associated with the activity that may have an adverse impact. The notification will include details of: the project, the construction period and construction hours, contact information for project management staff, complaint and incident reporting, and how to obtain further information. | Site Manager | Pre-construction and construction | Standard safeguard |
<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction noise</td>
<td><strong>NV3</strong>&lt;br&gt;The majority of works are to be carried out during standard working hours (i.e. 7am – 6pm Monday to Friday, 8am –1pm Saturdays). Any work that is performed outside normal work hours or on a Sunday or public holiday is to minimise noise impacts in accordance with Roads and Maritime’s <em>Environmental Noise Management Manual Practice Note 7 – Roadworks Outside of Normal Working Hours</em> and the ICNG.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Standard safeguard</td>
</tr>
<tr>
<td>Construction noise</td>
<td><strong>NV4</strong>&lt;br&gt;Construction personnel are to be made familiar with the potential for noise and vibration impacts upon local residents and encouraged to take all practical and reasonable measures to minimise noise during the course of their activities.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Construction noise</td>
<td><strong>NV5</strong>&lt;br&gt;Where practical, the location of construction compounds and the layout and positioning of noise-producing plant and activities at each work site is to be optimised to minimise noise emission levels.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Construction noise</td>
<td><strong>NV6</strong>&lt;br&gt;Where practical, equipment should be selected to minimise noise emissions. Equipment should be fitted with appropriate noise control equipment and be in good working order.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Construction noise</td>
<td><strong>NV7</strong>&lt;br&gt;Where possible, non-&quot;beeper&quot; reversing movement alarms should be used such as broadband (non-tonal) alarms or ambient noise-sensing alarms. Work sites should also be designed to reduce the need for reversing, potentially minimising the use of reversing beepers.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Construction noise</td>
<td><strong>NV8</strong>&lt;br&gt;Vehicles, plant and equipment are to be regularly inspected and maintained to avoid increased noise levels from rattling hatches, loose fittings etc.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Standard / additional safeguard</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
<td>----------------</td>
<td>--------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Construction noise</td>
<td>NV9&lt;br&gt; All vehicles, plant and equipment are to be shut off when not in use.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Construction vibration</td>
<td>NV10&lt;br&gt; Where required, attended vibration measurements are to be undertaken at the commencement of vibration generating activities to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Construction vibration</td>
<td>NV11&lt;br&gt; Where required, the following should be considered to minimise the noise and vibration impacts of blasting:&lt;br&gt;  - Choosing the appropriate blast charge configurations&lt;br&gt;  - Ensuring appropriate blast-hole preparation&lt;br&gt;  - Optimising blast design, location, orientation and spacing&lt;br&gt;  - Selecting appropriate blast times, and&lt;br&gt;  - Utilising knowledge of prevailing meteorological conditions.&lt;br&gt;AS 2187.2 Explosives-Storage, transport and use, Part 2: Use of Explosives provides more detailed advice on ground vibration and airblast overpressure impact minimisation options.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
</tbody>
</table>
6.8 Non-Aboriginal heritage

A Non-Aboriginal heritage assessment report was prepared for the proposal by Artefact Heritage in June 2016. The Non-Aboriginal heritage assessment report is summarised below and provided in Appendix I.

6.8.1 Methodology

As part of the Non-Aboriginal heritage assessment report, a search of the following online statutory heritage registers was carried out:

- State Heritage Register
- Singleton LEP
- World Heritage List
- National Heritage List
- Commonwealth Heritage List
- Section 170 Heritage and Conservation registers.

The following non-statutory heritage lists were also searched:

- Hunter Region Heritage Study
- Register of the National Estate
- National Trust Register.

A field survey of the proposal area was also carried out by Artefact Heritage on 16 December 2015 and 13-14 January 2016 to verify the results of the online heritage searches.

The study area identified for the non-Aboriginal heritage assessment generally comprised a 20 metre buffer around the proposed road upgrade alignment, with some variations to account for land reserved for construction compounds and site access arrangements. For the purpose of the survey, the study area was divided into three sections as shown in Figure 6-10.
Figure 6-10 Non-Aboriginal heritage study area and survey sections
6.8.2 Existing environment

The New England Highway was first formed as a track from Newcastle to the prime wool growing areas of the New England region and was originally known as the Great Northern Road until 1928, when it became the Great Northern Highway (State Highway 9). In 1933, the Great Northern Highway was renamed the New England Highway and in 1954 the New England Highway was designated the national route number 15 (DesignInc, 2016).

Statutory listed Items

There are no listed heritage items or sites within or in close proximity to the study area.

Historic archaeological potential / remains

As mentioned in Section 2.1.1, development of the New England Highway was closely related to establishment of the Great Northern Road. The Golden Highway is part of an original route along the Hunter River (Jerrys Plains Road). The alignment of both roads has been modified and reformed on a number of occasions over the last century.

The section of the Golden Highway within the study area includes two paved road alignments – the current Golden Highway alignment and a former alignment. Two sections of the former New England Highway alignment were also identified during the field survey. These former alignments, as shaded in yellow on Figure 6-11, were still in use until substantial realignment of the New England Highway work took place in the late 1970s / early 1980s.

The western section of the former alignment is no longer in use and is overgrown with vegetation and weeds. The eastern section of the former alignment is currently used as an access road for properties on the southern side of the New England Highway. There is also an unsurfaced access track which presently runs in between the two sections of former alignment to the south of the New England Highway, which could also represent the pre-c1980 alignment. Although no actual road fabric relating to the earlier road was identified in this location during the field survey, a cutting alongside the track may be associated.

These former road alignments are not considered to be of heritage significance.

Figure 6-11 Former New England Highway road alignment
The study area may also include additional historic fabric relating to earlier phases of the construction and use of Jerrys Plains Road / Great Northern Road / New England Highway. However any such fabric is likely to have been impacted by earlier road works and will be fragmentary in nature. These potential remains are considered to be of local heritage significance, however as they are defined as works rather than relics they are not protected by the *Heritage Act 1977*.

**Landscape**

The rural landscape in the study area is characteristic of the local area and associated with its history. Although more recently, parts of the study area have been impacted by two previous realignments of the New England Highway at the intersection with the Golden Highway.

### 6.8.3 Potential impacts

#### Construction

**Listed items**

Construction of the proposal would not result in any impact to listed heritage items or sites.

**Non-listed items**

Construction of the proposal is likely to result in the complete removal of any archaeological remains within the proposal area. The known remains appear to be relatively late in date (from c.1934 onwards) and are well documented, however the potential also exists for removal of historic fabric relating to earlier phases of Jerrys Plains Road / Great Northern Road / New England Highway.

Construction of the flyover would involve encroachment into a section of the rural landscape characteristic of the local area and associated with its history.

An assessment of the above potential heritage impacts was carried out in accordance with the Heritage Division guidelines (Heritage Office & DUAP 2002) and the level of impact presented in Table 6-35.

**Table 6-35: Scale of heritage impact**

<table>
<thead>
<tr>
<th>Level of impact</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major</td>
<td>The proposed works would directly impact defining elements inherent to the item’s heritage significance such as built fabric, archaeological remains, defining landscape characteristics and/or associated aesthetic elements. This would permanently impact the integrity/intactness of the item and the heritage significance of the item would be lost.</td>
</tr>
<tr>
<td>Moderate</td>
<td>The proposed works would impact defining elements inherent to the item’s heritage significance such as built fabric, archaeological remains, defining landscape characteristics and/or associated aesthetic elements. Although the integrity/intactness of the item would be impacted, some defining elements of the item would be retained. Therefore, there is potential for the heritage significance of the item to be retained.</td>
</tr>
<tr>
<td>Level of impact</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Minor</td>
<td>The proposed works would impact defining elements inherent to the item’s heritage significance such as built fabric, archaeological remains, defining landscape characteristics and/or associated aesthetic elements. However, these impacts are not considered to detract from the heritage significance of the item.</td>
</tr>
<tr>
<td>Nil</td>
<td>The proposed works would not impact defining elements inherent to the item’s heritage significance such as built fabric, archaeological remains, defining landscape characteristics and associated aesthetic elements. The works are not considered to detract from the heritage significance of the item.</td>
</tr>
</tbody>
</table>

Based on this criteria, removal of any historic fabric relating to earlier phases of Jerrys Plains Road / Great Northern Road / New England Highway is considered to be a moderate heritage impact (note: this assessment is based on the assumption that remains relating to the nineteenth century roads are present within the study area, which may not be the case), and encroachment into the rural landscape for construction of the flyover is considered to be a minor heritage impact.

Safeguards to document any early historic fabric disturbed have been provided in Table 6-36.

As such, the proposal is expected to have a *minor adverse* impact to local heritage during construction.

**Operation**

There would be no impacts to non-Aboriginal heritage following construction of the proposed road upgrade.

As such, the proposal is expected to have a *negligible* impact to local heritage during operation.

### 6.8.4 Safeguards and management measures

The recommended safeguards and management measures to minimise impacts to heritage are outlined in Table 6-36.

Table 6-36: Non-Aboriginal heritage safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Aboriginal heritage</td>
<td>NAH 1 The <em>Standard Management Procedure - Unexpected Heritage Items</em> (Roads and Maritime, 2015) is to be followed in the event that any unexpected heritage items, archaeological remains or potential relics of non-Aboriginal origin are encountered during construction. Work should only re-commence once the requirements of the procedure have been satisfied.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Standard safeguard</td>
</tr>
</tbody>
</table>
### 6.9 Landscape character and visual impacts

A Landscape Character, Visual Impact Assessment and Urban Design Study was carried out for the proposal as part of this REF. The full report is attached as Appendix J and summarised below.

#### 6.9.1 Methodology

The methodology followed for the Landscape Character and Visual Impact Assessment was based on the Roads and Maritime *Environmental Impact Assessment Practice Note EIA - N04 (2013) Guidelines for Landscape Character and Visual Impact Assessment*. This involved identifying landscape character zones (LCZs) and distinct viewpoints for the study area. An assessment of the potential impacts during construction and operation of the proposal was then carried out by considering the sensitivity of each LCZ and viewpoint and the anticipated magnitude of change.

#### 6.9.2 Existing environment

The key features that contribute to landscape character and visual amenity in the vicinity of the proposal area are illustrated in Figure 6-12 and summarised below.
Landscape characteristics

- The topography is predominantly flat to the west of the New England Highway, becoming gently undulating further to the east
- Two drainage lines extend from north to south of the New England Highway, marked by Swamp Oak and River Oak Forest vegetation communities
- Open agricultural landscape to the west of the New England Highway with scattered trees
- Central Hunter Ironbark Grey Box Forest encloses the New England Highway corridor to the east with intermittent breaks in vegetation providing short distance views out from the road
- Stands of mature vegetation stretch along the existing New England Highway, filtering views out to the surrounding agricultural landscape
- Views of Mount Thorley can be seen when driving along the Golden Highway, westbound after crossing the rail bridge.

These key features have facilitated the establishment of three LCZs. Each LCZ has been defined to illustrate an area of distinct and consistent character within and around the proposal area. The LCZs are shown in Figure 6-13 and the contributing characteristics are summarised as follows:

**LCZ 1 – Wooded Edge**

This LCZ comprises Spotted Gum Forest on a locally undulating hill. It is situated between the existing United Petrol service station, near the intersection of the Golden Highway and the New England Highway, and the Whittingham rest area which includes facilities such as toilets, signage, historical interpretation and parking. This LCZ is considered to have a low sensitivity.
LCZ 2 – Floodplain

This LCZ is located in a floodplain with a series of creek lines and dammed ponds. The area is predominately cleared riparian vegetation. Within the floodplain there are isolated Aboriginal heritage sites that are of potential significance (see Section 6.2). This LCZ is considered to have a moderate sensitivity.

LCZ 3 – Spotted Gum Forest

This LCZ provides a forest edge of Spotted Gum trees along the New England Highway. Parts of the road corridor run through areas of rock cutting that are evident as the existing alignment traverses the gently undulating terrain. This LCZ is considered to have a moderate sensitivity.

Figure 6-13 Landscape character zones

Visual amenity

- The visual amenity of the road corridor varies from east to west. The west of the corridor at the Golden Highway and New England Highway intersection offers views out from the road corridor across a low lying agricultural landscape with scattered trees. Recent planting at the intersection and a gentle undulation in topography reduces distant views to the west.
- To the east, Ironbark Grey Box Forest encloses the road corridor, limiting views out across the landscape.

A visual envelope was identified to illustrate the visual catchment of the proposal area and generally describe where directional views towards the proposal are possible. The visual envelope and viewpoints are illustrated in Figure 6-14. The following five viewpoints were identified as...
having the potential for visual impacts:

- Viewpoint 1 - United Petroleum service station. This viewpoint has a low visual sensitivity due to the passing nature of the view from road users.
- Viewpoint 2 - EC Throsby (abattoir). This viewpoint has a low sensitivity due to the industrial nature of the business and its location in the landscape.
- Viewpoint 3 - Road users of the existing Golden Highway. This viewpoint has a low visual sensitivity due to the passing nature of the view from road users.
- Viewpoint 4 - Residential property 3193 New England Highway, Branxton. This viewpoint has a moderate sensitivity due to the residential use and visual interest in the surrounding landscape, however mature vegetation filters direct views of the road corridor.
- Viewpoint 5 - Road users of the existing New England Highway. This viewpoint has a low visual sensitivity due to the passing nature of the view from road users.

Figure 6-14 Visual envelope and viewpoints

6.9.3 Potential impacts

Construction

Landscape

Construction would have an adverse impact across all of the LCZs, the magnitude of which is influenced by the sensitivity of each LCZ. A description of impacts for each LCZ is provided in Table 6-37.

The landscape impacts range between low-moderate and moderate adverse during construction, reflecting the low and moderate sensitivity of the proposal area. More moderate impacts are evident around the more open agricultural areas.
<table>
<thead>
<tr>
<th>LCZ</th>
<th>Sensitivity</th>
<th>Temporary landscape changes</th>
<th>Magnitude of change</th>
<th>Impact</th>
</tr>
</thead>
</table>
| LCZ 1 – Wooded Edge | Low         | • Construction of new flyover and u-turn facility and associated civil works  
• Removal of the Whittingham rest stop  
• Works associated with installation of directional signage, lighting and CCTV cameras at the Golden Highway and New England Highway intersection  
• Vegetation removal  
• Auxiliary construction compound.                                                                                                                                                                                                                                                   | Moderate            | Low - moderate adverse      |
| LCZ 2 – Floodplain  | Moderate    | • Construction of new flyover and new road alignment Highway and associated civil works  
• Modification of the existing New England Highway carriageway  
• Works associated with installation of directional signage, lighting and CCTV cameras at the Golden Highway and New England Highway intersection  
• Vegetation removal  
• Main construction compound.                                                                                                                                                                                                                                                             | Moderate            | Moderate adverse            |
| LCZ 3 – Spotted Gum Forest | Moderate | • Construction of new road alignment and associated civil works  
• Modification of the existing New England Highway carriageway  
• Vegetation removal  
• Works associated with installation of directional signage and VMS.                                                                                                                                                                                                                      | Low                 | Moderate adverse            |
**Visual**

Construction would have an adverse impact across all of the viewpoints during construction, the magnitude of which is influenced by the sensitivity of each viewpoint. A description of impacts by viewpoint is provided in Table 6-38.

The visual impacts range between low-moderate and moderate adverse during construction, reflecting the low and moderate sensitivity of the viewpoints. More moderate impacts are evident where views would be more open and major works are being carried out.
<table>
<thead>
<tr>
<th>Viewpoint</th>
<th>Sensitivity</th>
<th>Potentially visual elements</th>
<th>Magnitude of change</th>
<th>Impact</th>
</tr>
</thead>
</table>
| Viewpoint 1 - United Petroleum service station | Low         | • Construction of new flyover and u-turn facility and associated civil works  
• Main construction compound. | Low | Low adverse |
| Viewpoint 2 - EC Throsby (abattoir) | Low         | • Construction of new flyover and u-turn facility and associated civil works  
• Works associated with at the Golden Highway and abattoir access road  
• Removal of the Whittingham rest stop  
• Works associated with installation of directional signage, lighting and CCTV cameras at the Golden Highway and New England Highway intersection  
• Vegetation removal  
• Auxiliary construction compound. | Moderate | Low-moderate adverse |
| Viewpoint 3 - Road users of the existing Golden Highway | Low         | • Construction of new flyover and u-turn facility and associated civil works  
• Works associated with at the Golden Highway and abattoir access road  
• Removal of the Whittingham rest stop  
• Works associated with installation of directional signage, lighting and CCTV cameras at the Golden Highway and New England Highway intersection  
• Vegetation removal  
• Auxiliary and main construction compounds. | Moderate | Moderate adverse |
| Viewpoint 4 - Residential property 3193 New England Highway, Branxton | Moderate | • Construction of new road alignment and modification of the existing New England Highway carriageway  
• Vegetation removal  
• Works associated with installation of directional signage and VMS. | Low | Low - moderate adverse |
<table>
<thead>
<tr>
<th>Viewpoint</th>
<th>Sensitivity</th>
<th>Potentially visual elements</th>
<th>Magnitude of change</th>
<th>Impact</th>
</tr>
</thead>
</table>
| Viewpoint 5 - Road users of the existing New England Highway | Low          | • Construction of new flyover, new road alignment and modification of the existing New England Highway carriageway and associated civil works  
• Vegetation removal  
• Main construction compound. | Moderate | Moderate adverse |
**Operation**

*Landscape*

During operation the proposal would have low-moderate to moderate impacts across the LCZs. A description of impacts by LCZ is provided in Table 6-39.
<table>
<thead>
<tr>
<th>LCZ</th>
<th>Sensitivity</th>
<th>Permanent landscape changes</th>
<th>Magnitude of change</th>
<th>Impact</th>
</tr>
</thead>
</table>
| LCZ 1 – Wooded Edge | Low         | • New flyover and u-turn facility  
• Removed Whittingham rest stop  
• New directional signage, lighting and CCTV cameras at the Golden Highway and New England Highway intersection  
• Vegetation removal. | Moderate  
The flyover structure would be incongruous with the existing topography and landform. | Low - moderate adverse |
| LCZ 2 – Floodplain | Moderate     | • New flyover and new road alignment  
• Modification of the existing New England Highway carriageway  
• New directional signage, lighting and CCTV cameras at the Golden Highway and New England Highway intersection  
• Vegetation removal. | Moderate  
The flyover structure would contrast with the low lying floodplain landscape and the localised vegetation removal along the northern edge of the New England Highway would result in an incremental enlargement of the road infrastructure in this character zone. | Moderate adverse |
| LCZ 3 – Spotted Gum Forest | Moderate | • New road alignment running  
• Modification of the existing New England Highway carriageway  
• Vegetation removal  
• New directional signage and VMS. | Low  
The localised vegetation removal would have localised impacts on the forest edge that lines the existing New England Highway. | Low - moderate adverse |
Visual

The proposal would change the existing views at each of the viewpoints during operation. A description of the changes and the potential impacts is provided in Table 6-40.
Table 6-40: Visual impacts during operation

<table>
<thead>
<tr>
<th>Viewpoint 1 - United Petroleum service station</th>
<th>Sensitivity</th>
<th>Potentially visual elements</th>
<th>Magnitude of change</th>
<th>Impact</th>
</tr>
</thead>
</table>
| Viewpoint 1 - United Petroleum service station | Low         | • New roadway from Golden Highway, including new flyover and earthworks  
• New directional signage, lighting and CCTV cameras at the Golden Highway and New England Highway intersection. | High | Moderate adverse |
| Viewpoint 2 - EC Throsby (abattoir) | Low         | • New roadway from Golden Highway, including new flyover and earthworks  
• Realigned Golden Highway and abattoir access road  
• New directional signage, lighting and CCTV cameras at the Golden Highway and New England Highway intersection. | Moderate | Low - moderate adverse |
| Viewpoint 3 - Road users of the existing Golden Highway | Low         | • New roadway from Golden Highway, including new flyover and earthworks  
• New directional signage, lighting and CCTV cameras at the Golden Highway and New England Highway intersection. | High | Moderate adverse |

The physical footprint introduced by the flyover, earthworks and roadside infrastructure, combined with the localised vegetation removal would add vertical elements visible during day and night time hours. Views from the entrance to the abattoir access road towards the flyover would be filtered by intervening vegetation. The physical footprint introduced by the flyover, earthworks and roadside infrastructure, combined with the localised vegetation removal would add vertical elements visible during day and night time hours. The physical footprint introduced by the flyover, earthworks and roadside infrastructure, combined with the localised vegetation removal would add vertical elements visible during day and night time hours.
<table>
<thead>
<tr>
<th>Viewpoint</th>
<th>Sensitivity</th>
<th>Potentially visual elements</th>
<th>Magnitude of change</th>
<th>Impact</th>
</tr>
</thead>
</table>
| Viewpoint 4 - Residential property 3193 New England Highway, Branxton | Moderate | • New road alignment and modified existing New England Highway carriageway  
• New directional signage and VMS. | Low  
Even with localised vegetation removal, it is anticipated new visible elements would be somewhat filtered from this viewpoint. | Low - moderate adverse |
| Viewpoint 5 - Road users of the existing New England Highway | Low | • New flyover, road alignment and modified existing New England Highway carriageway  
• New directional signage, lighting and CCTV cameras at the Golden Highway and New England Highway intersection and directional signage and VMS at the eastern end of the New England Highway. | High  
Road users will experience views towards the flyover with approaching roads to the east and west. The introduction of the flyover and associated infrastructure would impinge on the distant views to the north and contrast with the low lying landform. | Moderate adverse |
**Design strategy**

The proposed landscape strategy (see Appendix J) identifies a design response that integrates the proposal with the existing landscape and meets the objectives identified in Section 2.3.2 of this REF. It adopts the recommendations listed in Table 6-41, integrating them into a coherent landscape composition for the corridor. The landscape strategy would be further visited and refined during detailed design for the project.

Table 6-41: Recommended landscape strategy for each viewpoint

<table>
<thead>
<tr>
<th>Viewpoint</th>
<th>Recommended landscape strategy</th>
</tr>
</thead>
</table>
| Viewpoint 1 - United Petroleum service station | • Provide tree planting, taking into account requirements for clear zones, to filter views to and from the road corridor  
• Planting to earthworks surrounding bridge to soften impact on the horizon  
• Abutments to be sympathetic to existing environment and new flyover structure  
• Wetland planting to residual land around creek dams and along existing creek lines to increase vegetation cover and habitat opportunity. |
| Viewpoint 2 - EC Throsby (abattoir) | • Wetland planting to residual land around creek dams and along existing creek lines to increase vegetation cover and habitat opportunity  
• Opportunity to provide a soft landscape gateway feature that will assist with redefining the arrival and departure from New England Highway to Golden Highway. |
| Viewpoint 3 - Road users of the existing Golden Highway | • Provide replacement tree planting to re-establish the mature landscape boundary  
• Maximise elevated position in the landscape and views across landscape when passing over the flyover. |
| Viewpoint 4 - Residential property 3193 New England Highway, Branxton | • Screen planting to be provided to reduce views towards lighting columns in night time views. |
| Viewpoint 5 - Road users of the existing New England Highway | • Further develop urban design of the bridge design and framing views using the structure during detailed design  
• Planting to earthworks to integrate approach roads. |

**6.9.4 Safeguards and management measures**

The recommended safeguards and mitigation measures to minimise the impacts of the proposal on landscape and visual are listed in Table 6-42.
Table 6-42: Landscape and visual safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual impacts during construction</td>
<td>LV1 Project work sites, including construction areas and supporting facilities (such as storage compounds and offices) must be managed to minimise visual impacts, including appropriate storage of equipment, parking, stockpile screening and arrangements for the storage and removal of rubbish and waste materials.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Standard safeguard</td>
</tr>
<tr>
<td>Temporary lighting</td>
<td>LV2 Temporary site lighting must be installed and operated in accordance with AS4282:1997 Control of the Obtrusive Effect of Outdoor Lighting.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Standard safeguard</td>
</tr>
<tr>
<td>Landscape design strategy</td>
<td>LV3 The landscape design strategy for the proposal should be reviewed during the final detailed project design and implemented as part of the CEMP.</td>
<td>Project Manager and Site Manager</td>
<td>Detailed design and construction</td>
<td>Additional safeguard</td>
</tr>
</tbody>
</table>

6.10 Property and land use

6.10.1 Methodology

The proposal’s impact on property and land use has been considered through a high-level qualitative assessment referencing the Singleton LEP, land ownership details, the proposed design and property acquisition requirements.

6.10.2 Existing environment

The proposal is located in an area predominantly rural in nature, with the majority of the surrounding land uses consisting of agricultural uses such as cattle grazing and cropping. There is a large expanse of native remnant vegetation to the north which provides connectivity to the Hunter River and a large expanse of native vegetation to the south east connecting Wollemi National Park.

There are also a number of utility service corridors traversing the proposal area as discussed in Section 2.2.8.

As discussed in 4.1.2, the Singleton LEP outlines the designated land use zones within the LGA. The designated land use zones within the proposal area are:

- SP2 – Infrastructure
- IN3 – Heavy Industrial
- E2 – Environmental Conservation
- RU1 – Primary Production.
These are shown on Figure 4-1.

The dominant zones are SP2 – Infrastructure and IN3 – Heavy Industrial, with only small areas of land zoned E2 – Environmental Conservation and RU1 – Primary production being within the proposal area.

The SP2 – Infrastructure zone comprises segments of the existing New England Highway and Golden Highway and land owned by Roads and Maritime designated as road reserve.

The land zoned as IN3 – Heavy Industrial is currently used for cattle grazing, however forms part of the Whittingham Urban Release Area. This land was rezoned in December 2008 to enable the development of a major industrial estate (the Whittingham Industrial Estate).

6.10.3 Potential impacts

Construction

During construction, land would be required to accommodate the main construction compound and auxiliary construction compound sites and works associated with the flyover and New England Highway duplication. The potential location of the compound sites is shown on Figure 3-8. Land not owned by Roads and Maritime to be used in construction includes part of Lot 1 DP653039 and Lot 4 DP6210020. This land is currently vacant rural land that is being used for grazing.

The temporary use of this land would result in:
- Changes and reduction of land used for grazing.
- Removal of the Whittingham rest area for public use.

Additionally, the proposal may have an impact on utilities in the area including telecommunications, overhead and underground power lines, a high pressure gas main and a private irrigation pipeline. This may require adjustment of some existing service corridors and/or the implementation of protection measures at the commencement of construction. No impacts on infrastructure or utilities are expected outside of the proposal area and appropriate safeguard measures would be put in place.

The proposal is expected to have a minor adverse impact on land uses during construction.

Operation

The proposal would require some property acquisition in order to accommodate the widened road corridor (see Table 3-4 and Figure 3-9). As a result it is expected that this land would be rezoned to SP2 – Infrastructure under the Singleton LEP. This would result in a reduction of around 40 ha of land zoned IN3 – Heavy Industrial as part of the Whittingham Urban Release Area.

While this acquisition would slightly impact the potential magnitude of development, the proposal would not alter the opportunity for an industrial estate to be developed at this location. The proposal would also contribute to improved accessibility to this precinct.

6.10.4 Safeguards and management measures

The recommended safeguards and management measures to minimise impacts to property and land use are outlined in Table 6-43.
Table 6-43: Property and land use safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property acquisition</td>
<td><strong>LU1</strong> All property acquisition is to 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>Project manager</td>
<td>Pre-construction</td>
<td>Standard safeguard</td>
</tr>
<tr>
<td>Temporary leasing</td>
<td><strong>LU2</strong> The temporary leasing of any land is to be managed and setup at the earliest stage possible in the project and all land owners consulted with in accordance with the standard consultation measures.</td>
<td>Project Manager</td>
<td>Pre-construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Utility work</td>
<td><strong>LU3</strong> Prior to the commencement of utility work, consultation is to be carried out with the identified persons and organisations that may be adversely affected by service disruptions to determine any special requirements or alternative service arrangements.</td>
<td>Project Manager</td>
<td>Pre-construction</td>
<td>Additional safeguard</td>
</tr>
</tbody>
</table>

6.11 Air Quality

6.11.1 Methodology
The proposal's impact on air quality has been considered in a qualitative assessment referencing existing local air quality information, future traffic forecasts, and the likely extent of emissions during construction and operation.

6.11.2 Existing environment
The proposal is located in a predominantly rural environment, between the urban and industrial setting of Newcastle and the Hunter region's wine and coal mining industries.

The National Pollutant Inventory (NPI) contains data on 93 substances around Australia which have been identified by the Department of Environment as important due to their possible effect on human health and the environment. A review of the NPI database identified four facilities within a 10 kilometre radius of the proposal, being:
- Singleton Beef Processing Facility (the EC Throsby abattoir)
- Branxton Wastewater Treatment Works (WWTW)
- The Hunter Bottling Company
- Singleton Sewage Treatment Plant.
The 2014/2015 data for these facilities reports that collectively they emitted 10 different pollutants, including:

- Phosphorus
- Nitrogen
- Oxides of nitrogen (NOx)
- Carbon monoxide (CO)
- Particulate matter 10 μg (PM10)
- Particulate matter 2.5 μg (PM 2.5)
- Total Volatile Organic Compounds (TVOCs)
- Ammonia
- Sulfur dioxide (SO2)
- Polycyclic aromatic hydrocarbons (PAH).

This emissions data is provided in Appendix K.

Other sources of emissions in the area include the Ashton Coal and Rio Tinto Coal sites which operate less than 15 kilometres from Singleton. These sites are monitored closely in regards to emissions under planning approval and environment protection licence (EPL) requirements.

The local ambient air quality is also expected to be influenced by exhaust emissions from light and heavy vehicles travelling on the New England Highway and Golden Highway, as well as dust and vehicle movements from local agricultural and industrial practices. Operation of the Hunter Valley rail network within the area is also expected to have an influence on local air quality.

OEH has a number of air quality monitoring stations across NSW that gather measurements of atmospheric pollutants. Data gathered at the Singleton South monitoring station is the most representative for the proposal area, being located around 9 kilometres north of the New England Highway and Golden Highway intersection. A plot of the daily regional air quality index (RAQI) in the Singleton South catchment area for the last 12 months is shown in Figure 6-15.
Figure 6-15: Daily RAQI values recorded at the Singleton South monitoring station between 19/04/2016 and 19/04/2017

A health alert is issued when the RAQI is considered to be poor or worse, which is when the index value reaches 100 or above. There has only been one instance over the last 12 months when the air quality in the Singleton South catchment area has been rated as poor or worse.

The Singleton South monitoring station also measures PM$_{10}$ at hourly intervals. A plot of the daily averages of PM$_{10}$ for the last 12 months is shown in Figure 6-16.
Figure 6-16: PM$_{10}$ levels recorded at the Singleton South monitoring station between 19/04/2016 and 19/04/2017

Potentially sensitive receivers within and around the proposal area include:
- Residential properties located on the southern side of the New England Highway, northern side of the Golden Highway and Bell Road
- Employees of local businesses, including the abattoir and the United Petrol service station.

### 6.11.3 Criteria

The National Environment Protection (Ambient Air Quality) Measure (2016) sets the standards and goals for ambient levels of carbon monoxide (CO), nitrogen dioxide (NO$_2$), sulphur dioxide (SO$_2$), PM$_{10}$ and PM$_{2.5}$. These are listed in Table 6-44.

Table 6-44: National Environment Protection (Ambient Air Quality) Measure standards for pollutants

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Maximum concentration level</th>
<th>Averaging period</th>
<th>Maximum allowable exceedance period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon monoxide (CO)</td>
<td>9.0 ppm</td>
<td>8 hours</td>
<td>1 day per year</td>
</tr>
<tr>
<td>Nitrogen dioxide (NO$_2$)</td>
<td>0.12 ppm, 0.03 ppm</td>
<td>1 hour, 1 year</td>
<td>1 day per year, None</td>
</tr>
<tr>
<td>Sulphur dioxide (SO$_2$)</td>
<td>0.2 ppm, 0.08 ppm, 0.02 ppm</td>
<td>1 hour, 1 day, 1 year</td>
<td>1 day per year, None</td>
</tr>
<tr>
<td>Pollutant</td>
<td>Maximum concentration level</td>
<td>Averaging period</td>
<td>Maximum allowable exceedance period</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------</td>
<td>-----------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>PM$_{10}$</td>
<td>50 μg/m³ 25 μg/m³</td>
<td>1 day 1 year</td>
<td>None None</td>
</tr>
<tr>
<td>PM$_{2.5}$</td>
<td>25 μg/m³ 8 μg/m³</td>
<td>1 day 1 year</td>
<td>None None</td>
</tr>
</tbody>
</table>

The current approach to air quality management in Australia is focussed on reducing exceedances of the ambient air quality standards at specific locations. With the above standards designed to protect human health. Keeping in mind though that research has found that for Particulate Matter (PM), long-term exposure is more of an influence on adverse health outcomes as opposed to a particular threshold concentration level (PAEHolmes, 2013).

6.11.4 Potential impacts

Construction

Potential air quality impacts during construction would be associated with emissions from construction traffic and the generation of dust and emissions from the movement of plant and equipment on site.

Anticipated sources of gaseous emissions and suspended particulates include construction vehicle movements and the operation of plant and equipment. These sources would generate PM$_{10}$ and PM$_{2.5}$ from exhaust, road abrasion, tyre wear, brake wear and the resuspension of particles, and carbon monoxide (CO), carbon dioxide (CO$_2$), oxides of nitrogen (NOx), sulphur dioxide (SO$_2$), and trace levels of volatile organic compounds (VOCs) and non-combustible hydrocarbons from the combustion of fossil fuels during vehicle movement. It is expected that all construction vehicles, plant and machinery would be in good condition and operated in accordance with the manufacturer guidelines.

If the project is approved, construction of the proposal could start in 2019 and is expected to take around two years to complete. Based on this, and the scheduling of machinery (i.e. not all machinery would operate simultaneously), emissions affecting local air quality are likely to be minor in the context of existing vehicular movements in the area.

Sources of dust and dust generating activities are expected to include:

- Vehicle and plant movements around the site
- Vegetation clearing and stripping of topsoil
- Earthworks, such as excavation and fill activities
- Handling, transfer and stockpiling of soils and materials
- Erosion of stockpiles and exposed areas.

Earthworks for the proposal would include cutting around 68,000 cubic metres, filling around 218,000 cubic metres and importing around up to 150,000 cubic metres of soil and earth material (excavated spoil would be re-used on-site where possible). Around 27.73 ha of vegetation would also need to be cleared. This would be staged as outlined in Section 3.3 of this REF. These activities would leave areas temporarily exposed and would require the stockpiling of excavated and imported soils and materials, potentially generating dust. Dust generation can be exacerbated during dry and windy conditions, particularly on hot days.

During construction, dust levels would vary in relation to the type and extent of activities being carried out, the area of soil exposed, and the weather conditions. Potential impacts can be
minimised through implementation of standard safeguard measures (see Section 6.11.4). As such, dust generated during a typical work day is not expected to adversely affect the local air quality. The proposal is expected to have a minor adverse impact on air quality during construction.

**Operation**

The proposal would increase the capacity of the New England Highway to accommodate the forecast growth in traffic from the growing economy and population in the Hunter and New England regions. Predicted traffic volumes are provided in Section 6.6 of this REF.

Generally, the more vehicles on the road, the more emissions. However, even though the proposal would contribute to an increase in traffic volumes, potential impacts to local air quality could be offset by improvements to vehicle emission performance, with older, less efficient vehicles gradually being replaced by newer, more efficient vehicles, and perhaps even electric vehicles.

The proposal would also help to reduce emissions by allowing for more efficient travel movement. Non-exhaust PM emissions can be caused by brake wear, engine abrasion, tyre wear, etc. The potential for road traffic related PM emissions in the proposal area would be reduced by improved traffic flows and reduced congestion at the New England Highway and Golden Highway intersection.

As such, the proposal is expected to have a negligible impact on air quality during operation.

**6.11.5 Safeguards and management measures**

The recommended safeguards and management measures to minimise impacts on the local air quality during construction are outlined in Table 6-45.

There are no safeguards proposed for the operational phases of the proposal.
## Table 6-45: Air quality safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
</table>
| Air quality impacts during construction     | AQ1  
> An Air Quality Management Plan (AQMP) is to be prepared and implemented as part of the CEMP. The AQMP should identify:  
> • Potential sources of air pollution (such as dust, vehicles transporting waste, plant and equipment) during construction  
> • Air quality management objectives consistent with any relevant published EPA and/or OEH guidelines  
> • Mitigation and suppression measures to be implemented, such as spraying or covering exposed surfaces, provision of vehicle clean down areas, covering of loads, street cleaning, use of dust screens, maintenance of plant in accordance with manufacturer's instructions  
> • Methods to manage work during strong winds or other adverse weather conditions  
> • A progressive rehabilitation strategy for exposed surfaces  
> • A monitoring program to assess compliance with the identified objectives, and developed in accordance with any relevant published EPA and/or OEH guidelines  
> • Community notification and complaint handling procedures. | Project Manager and Site Manager | Pre-construction and construction | Standard safeguard |
|                                             | **AQ2**  
> All personnel working on-site are to receive training to ensure awareness of requirements of the AQMP. Site-specific training is to be given to personnel working in the vicinity of sensitive receivers. | Site Manager | Pre-construction | Standard safeguard |
|                                             | **AQ3**  
> Consistent with the approved AQMP, mitigation and suppression measures are to be implemented to protect local air quality. | Site Manager | Construction | Standard safeguard |
A socio-economic impact assessment was carried out for the proposal as part of this REF. The report is attached as Appendix L and is summarised below. The report has been prepared in accordance with the Roads and Maritime Environmental Impact Assessment Practice Note: Socio-economic assessment (EIA-N05).

### 6.12.1 Methodology

A number of data sources were used to inform the socio-economic assessment, including but not limited to:

- Discussions with landowners to gain access and local knowledge of the project site
- Roads and Maritime reports associated with the proposal, such as the *Belford to Golden Highway Community Consultation Report* (2015)
- Singleton Council planning documentation, such as the *Singleton Land Use Strategy, Singleton LEP*, online mapping tools and DA information
- Data from the Australian Bureau of Statistics (ABS), such as the 2011 census data.

The socio-economic assessment has considered the other environment assessments carried out for this REF, including traffic and access (Section 6.6), Aboriginal heritage (Sections 6.2), property and land use (Section 6.10) and amenity associated with noise and vibration, landscape and visual, biodiversity and air quality (Sections 6.7, 6.9, 6.1 and 6.11 respectively).

A number of geographic areas were considered during the assessment, including:

- Study area – defined by combining two Statistical Area Level 1 (SA1) areas (shown in blue in Figure 6-17). To provide more accurate population and dwelling data related to the proposal area, ABS Mesh Block areas were also used where relevant (shown in green in Figure 6-17)
- Singleton LGA – this area has been used for comparative purposes where relevant
- State of NSW – this area has been used for comparative purposes where relevant.
Figure 6-17: Socio-economic study areas
6.12.2 Existing environment

Demographics

In 2014, the population of the Singleton LGA was 23,884. This is expected to grow to 25,600 people by 2021. According to the 2011 census data, the population of the study area is around 906 people and within the ABS Mesh Block is around 106 people.

Some characteristics of the population within the study area include:
- Fourteen per cent of the population is aged 14 years or younger, which is relatively low compared to 22 per cent of the population in the Singleton LGA and 19 per cent of the population in NSW.
- Nine per cent of the population is aged 65 years or older, compared to 11 per cent of the population in the Singleton LGA and 15 per cent of the population in NSW.
- Two per cent of people in the study area identify as being of Aboriginal or Torres Strait Islander descent.
- Two per cent of people in the study area identify a need for assistance with daily living.

Travel behaviour

Both the New England Highway and the Golden Highway are designated B-double route corridors and are used extensively to service coal mining, grain production and other industries in the Hunter Valley and the Central West to provide access the Port of Newcastle. Residents also use these road corridors to access the local population and employment centres of Maitland and Singleton.

Some characteristics of travel within the study area include:
- Of those who travel to work, 48.4 per cent travel via car as the driver and 4.2 per cent as a passenger in a car. Other methods of travel to work include walking (17 per cent), bicycle (1.5 per cent), truck (1.7 per cent) and public transport (less than one per cent).
- On average there are 2.3 motor vehicles per dwelling.
- Between October 2008 and February 2014, 45 crashes were reported on the New England Highway or Golden Highway within the proposal area. Of these crashes, one crash resulted in a fatality and 22 crashes resulted in injuries. The remaining 22 were classified as non-casualty (damage only).

Economic profile

Some economic indicators for the study area from the 2011 census include:
- The median weekly household income was $1,383, compared to $1,692 in the Singleton LGA and $1,237 in NSW.
- The unemployment rate in the Singleton LGA was 3.3 per cent. (At 30 September 2015, this rate had risen to 7.0 per cent).
- Key employment industries for people who live in the study area include defence (34 per cent), coal mining (10 per cent) and accommodation (3 per cent).

Business and industry

The key businesses located in the study area are described below.

United Petrol service station

Located around 300 metres north of the Golden Highway and New England Highway intersection. The United Petrol service station provides fuel and convenience items. Passing trade is a major aspect of the viability of this local business with access being left-in, left-out from the New England Highway.
**EC Throsby (abattoir)**

Located around 700 metres south of the Golden Highway and New England Highway intersection. The abattoir processes 170,000 head of cattle annually, employs 220 people and sells 60 meat products within Australia and overseas. About 45 livestock trucks access the abattoir each day between the hours of 8:00am and 6:00pm. Up to 30 other deliveries also take place each day from a range of vehicles. Staff who work at the facility drive private vehicles and park on-site, with peak staff movement times being 4:00am to 6:30am, 2:45pm to 3:45pm and 12:15am to 1:30am during shift start and end times. Access to the abattoir is off the Golden Highway.

**Primary production**

The area located to the south and south-west of the study area is zoned primary production. It supports activities such as extensive agriculture, forestry, home occupations, intensive plant agriculture and other uses with consent.

**Future land development**

A number of lots in the vicinity of the Golden Highway and New England Highway intersection are part of an Urban Release Area designated in the Singleton LEP. The site, comprising Lot 1 DP 33992, Lot 4 DP 621020, Lot 1 DP 653039, Lot 23 DP1128978 and Lot 24 DP112897 are zoned as zoned Heavy Industrial (IN3) in the Singleton LEP and form part of the Whittingham Urban Release Area (see Figure 6-18).
Figure 6-18: Location of Whittingham Urban Release Area

- Golden Highway
- Main North Railway Line
- New England Highway
- Bell Road
- Proposal / construction boundary
- Whittingham Urban Release Area
**Regional businesses**

As the New England Highway and Golden Highway are designated B-double corridors that service the coal mining, grain production and other industries in the Hunter Valley and the Central West and provide access the Port of Newcastle, it is expected that a number of regional businesses would travel through the proposal area on a daily basis.

**Infrastructure and services**

The infrastructure and services listed below and shown on Figure 6-19 are also located within the study area:

- Mobile phone tower – located about 35 metres off the New England Highway (on Lot 10 DP703050) and is used by Telstra, Optus, Vodaphone and the NBN Co Limited
- Singleton Army Training Area – a 14,375 hectare firing range located just outside the proposal area
- Singleton Airport – located around 6 kilometres to the north-west of the proposal area and is used for sky diving and other general aviation activities
- Main North Railway Line – as discussed in Section 2.2.4
- Bus services – as discussed in Section 2.2.5
- Cycling provisions - formal bicycle crossing on the westbound side of the New England Highway, just to the south of the Golden Highway intersection
- Emergency services – emergency services, including police, ambulance, fire and rescue and the rural fire brigade, utilise the highways for emergency response and enforcement activities.
- Whittingham light vehicle rest area – as discussed in Section 2.2.7.

**Amenity**

The proposal is located in an area predominantly rural in nature, with the majority of the surrounding land uses consist of agricultural uses such as cattle grazing and cropping. There is a large expanse of native remnant vegetation to the north which provides connectivity to the Hunter River and a large expanse of native vegetation to the south east connecting Wolleni National Park.

The existing noise environment around the proposal area is mainly characterised by road traffic noise, including heavy vehicles, along the New England Highway, rail movements along the Main North Railway Line, rural industry and machinery and local insect and animal noise.

On an average day, the local air quality is expected to be good (see Section 6.11.2).
Figure 6-19: Additional infrastructure and services within the study area
6.12.3 Potential impacts

Construction

Demographics

The proposal is not expected to have a direct impact on the demographic profile of the study area. Any workers not from the Singleton region may temporarily take residence in the area, influencing the local demographics in the short term.

Travel behaviour

The proposal is not expected to have an impact on the travel behaviours listed in Section 6.12.2. However it is expected that at times there will need to be changes to local traffic conditions. These include:

- Speed limit reductions in the construction area
- Increased truck movements associated with construction activities
- Partial or complete stoppages of traffic for construction activities
- Changes to access arrangements which will include removal of right hand turn movements (left in, left out will be allowed) along the New England Highway.

Given the already congested nature of the New England Highway and Golden Highway interchange, it is likely that drivers will experience additional delay during construction because of these traffic management actions.

Final construction methods would be refined to minimise traffic and transport impacts, however traffic restrictions would be unavoidable during some construction activities, such as piling work, foundation and road surfacing work and construction of the flyover.

Where possible, the most disruptive work would be undertaken as night work. This, combined with temporary effective traffic management, would minimise impacts to traffic and transport using both the New England Highway and Golden Highway.

Section 6.6.3 of this REF also discusses impacts to traffic and transport during construction of the proposal.

Economic profile

Construction of the proposal is not expected to significantly influence the economic indicators for the study area as listed in Section 6.12.2. Any workers not from the Singleton region may temporarily take residence in the area. This may result in short-term economic benefits.

Business and industry

Impacts during construction to business and industry would be limited to impacts from changes to traffic conditions and access arrangements. The proposal’s impact on traffic and access is discussed in the sections above. These would be short-term and considered to be manageable. It is thought that any economic impacts as a result would be very minor / negligible in nature.

Infrastructure and services

There would be no direct impacts to the mobile phone tower, Singleton Army Training Area, the Singleton Airport or the Main North Railway Line during construction.
Impacts to local and regional bus services would be limited to reduced speeds due to construction works. Safe stopping locations would be maintained at all times at the existing bus stops.

Safe access for emergency vehicles would be provided at all times during the construction period.

The Whittingham light vehicle rest area may be used as an auxiliary construction compound site during construction, before it is permanently removed to accommodate the new flyover. This would mean motorists who normally use this area would need to use one of the alternate rest areas in the region. The next closest light vehicle rest area is located around 10 kilometres to the north on the New England Highway just outside of Singleton. Further north, the Rixs Creek rest area caters for both heavy and light vehicles. A heavy vehicle rest area is also located 10 kilometres to the south at Branxton.

Amenity

Construction of the proposal may impact the local amenity of the area temporarily. This would primarily relate to minor increases in noise and air emissions, additional traffic on local roads and visual amenity impacts. Amenity impacts would be minor, short-term and highly localised.

Impacts to the local air quality are likely to be minor and would be influenced by the extent and nature of the works being undertaken and the weather conditions (dust generation can be exacerbated during dry and windy conditions, particularly on hot days). Impacts to the local air quality would be minimised through implementation of standard management measures for the duration of the construction period (see Section 6.11.4).

The proposal would result in a temporarily altered visual environment as a result of construction works and the use of compound sites (see Section 6.9.3). Construction of the proposal would be staged and therefore impacts would be progressive along the upgrade route. The few sensitive receivers in the area combined with the passing nature of road users keeps these impacts fairly moderate.

A noise and vibration assessment carried out for the proposal found that depending on the proposed hours of construction, some residences along the New England Highway may be exposed to noise impacts during construction works. However mitigation measures applied during the construction period would reduce these temporary and low level impacts (see Section 6.7.3).

Summary of impacts

Table 6-46: Summary of socio-economic impacts during construction

<table>
<thead>
<tr>
<th>Impact</th>
<th>Stakeholder impacted</th>
<th>Duration and nature of impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased travel times</td>
<td>Local and regional users of the New England Highway and Golden Highway</td>
<td>Minor impacts throughout the construction period</td>
</tr>
<tr>
<td>Altered access arrangements</td>
<td>EC Throsby (abattoir) and some local residences</td>
<td>Minor impacts throughout the construction period</td>
</tr>
<tr>
<td>Changes to local amenity</td>
<td>Local residences and employees of local businesses, including the abattoir and the United Petrol service station</td>
<td>Moderate impacts throughout the construction period</td>
</tr>
</tbody>
</table>
Impact Stakeholder impacted Duration and nature of impact

Removal of the Whittingham Light Vehicle Rest Area Local and regional users of the New England Highway and Golden Highway Permanent, moderately adverse impact

Operation

Demographics

The proposal is not expected to have a direct impact on the demographic profile of the study area. However, increased road capacity and improved traffic flows and road user safety may influence residential and employment growth in the region.

Travel behaviour

The proposal is not expected to have an impact on the travel behaviours listed in Section 6.12.2. However, the proposal would provide improved traffic flows, travel times, and a safer environment for road users. Section 6.6.3 of this REF discusses impacts to traffic and transport during operation of the proposal.

Economic profile

Operation of the proposal is not expected to influence the economic indicators for the study area as listed in Section 6.12.2.

Business and industry

The proposal is expected to deliver positive outcomes for business and industry through improved road capacity travel times and safety.

Infrastructure and services

There would be no direct impacts to the mobile phone tower, Singleton Army Training Area, the Singleton Airport or the Main North Railway Line during operation. Local and regional bus services and emergency vehicles would benefit from the proposal through reduced congestion and improved travel times.

Additional infrastructure for cyclists would be provided by the proposal, including a 1.3 metre high safety barrier on the flyover, green coloured pavement along the westbound shoulder of the New England Highway before the Golden Highway intersection, extension of the green coloured pavement across the Golden Highway at the intersection with the New England Highway and cyclist crossing on the eastbound flyover entry ramp.

Removal of the Whittingham rest area means that motorists who normally use this area would need to use one of the alternate rest areas in the region. The next closest light vehicle rest area is located around 10 kilometres to the north on the New England Highway just outside of Singleton. Further north, the Rixs Creek rest area caters for both heavy and light vehicles. A heavy vehicle rest area is also located 10 kilometres to the south at Branxton.
Amenity

The proposal would result in some improvement to the local amenity through better traffic flow and reduced congestion.

However, the most significant change to the existing environment will be the permanent installation of the flyover. This change is considered a moderate impact at the most sensitive viewpoints (see Section 6.9.3).

From an acoustic perspective, the noise assessment carried out for the proposal found that no noise sensitive receivers would be adversely impacted by the proposal (see Section 6.7.3).

Summary of impacts

Table 6-47: Summary of socio-economic impacts during operation

<table>
<thead>
<tr>
<th>Impact</th>
<th>Stakeholder impacted</th>
<th>Duration and nature of impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquisition of 40 ha of land from an Urban Release Area</td>
<td>Private land owners</td>
<td>Permanent, moderately adverse impact</td>
</tr>
<tr>
<td>Altered access / egress arrangements</td>
<td>EC Throsby (abattoir) and some private properties</td>
<td>Permanent, minor adverse impact</td>
</tr>
<tr>
<td>Improved road safety</td>
<td>Local and regional users of the New England Highway and Golden Highway</td>
<td>Permanent, positive impact</td>
</tr>
<tr>
<td>Reduced congestion and improved travel times</td>
<td>Local and regional users of the Golden Highway</td>
<td>Permanent, positive impact</td>
</tr>
<tr>
<td>Changes to visual amenity</td>
<td>Local residences</td>
<td>Permanent, moderate adverse impact</td>
</tr>
<tr>
<td>Improved cycling infrastructure</td>
<td>Local and regional cyclists</td>
<td>Permanent, positive impact</td>
</tr>
<tr>
<td>Removal of the Whittingham Light Vehicle Rest Area</td>
<td>Local and regional users of the New England Highway and Golden Highway</td>
<td>Permanent, moderately adverse impact</td>
</tr>
</tbody>
</table>

6.12.4 Safeguards and management measures

Socio-economic impacts would be minimised through implementation of the safeguards and management measures provided in other sections of this REF. Additional recommended safeguards and management measures to minimise socio-economic impacts are outlined in Table 6-48.
<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
</table>
| General community            | **SE1** A Communication Plan (CP) is to 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  
  • A complaints handling procedure  
The CP will be prepared in accordance with the *Community Involvement and Communications Resource Manual* (RTA, 2008). | Project Manager and Site Manager | Pre-construction and construction | Standard safeguard                |
| Property impacts             | **SE2** Consultation is to be carried out with EC Throsby to identify appropriate management strategies to avoid or minimise impacts on access and operations. These details are to be included in the TMP. | Project Manager            | Pre-construction            | Additional safeguard              |
| Impacts to bus services      | **SE3** Operation of public and school bus services are to be maintained during construction of the project. Appropriate arrangements are to be made with the local school bus provider to ensure safe pick up and drop off points are maintained/established throughout the construction period. These details are to be included in the project TMP. | Project Manager and Site Manager | Pre-construction and construction | Additional safeguard              |
6.13 Resource use and waste management

6.13.1 Methodology
The proposal's impact on waste and resource use has been reviewed in a qualitative assessment considering the existing setting and the likely waste and resource streams during construction and operation.

6.13.2 Existing environment
Currently, there is expected to be limited waste generated by the road network within the proposal area, with waste sources limited to roadside litter and other waste material associated with roadside maintenance. The Whittingham rest area currently provides litter collection facilities.

6.13.3 Policy setting
The safe storage, handling, transport, recovery and disposal of waste is governed by the POEO Act and the Waste Regulation (see Section 4.2.10 of this REF). Generators of waste are responsible for the correct classification of the waste they produce in accordance with the EPA Waste Classification Guidelines Part 1: Classifying waste (the Waste Classification Guidelines). A waste register is required to ensure that legislative requirements are met.

The WARR Act provides a framework for considering resource management and is given effect by the NSW Waste Reduction and Purchasing Policy (WRAPP). Under the WRAPP Reporting Guidelines, agencies are required to give priority to buying materials with recycled content, when it is cost and performance competitive to do so. Their plans must set out how the agency would reduce waste and increase purchases of recycled products, with baseline and performance data on:
- Total quantities of wastes being generated and recycled
- Total quantities of recycled content materials being purchased.

Roads and Maritime contractors are required to propose recycled-content materials where they are cost and performance competitive and are the environmental equivalent (or better) than non-recycled alternatives. Specific materials that are targeted for reuse or recycling in the Roads and Maritime Environmental Sustainability Strategy that are specifically relevant to this proposal are included in Table 6-49.
### Table 6-49: Targeted wastes for reuse

<table>
<thead>
<tr>
<th>Targeted wastes</th>
<th>Recover target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt removal and replacement</td>
<td>Recover 95% of all asphalt for reuse</td>
</tr>
<tr>
<td>Concrete pavement and infill areas</td>
<td>Recover 76% of concrete for reuse</td>
</tr>
<tr>
<td>Waste steel from traffic control devices, including signage and electrical infrastructure</td>
<td>Recover 76% of steel for reuse</td>
</tr>
<tr>
<td>Waste aggregate</td>
<td>Recover 76% of aggregate for reuse</td>
</tr>
<tr>
<td>Virgin excavated natural materials (VENM)</td>
<td>Recover 95% of all VENM for reuse</td>
</tr>
</tbody>
</table>

The Roads and Maritime *Re-use of waste off-site: Waste Fact Sheet 9* outlines the potential off-site re-uses for typical wastes from Roads and Maritime construction projects. These re-use opportunities do not require environmental licensing from the EPA, provided that all conditions for off-site re-use are met.

The Roads and Maritime *Management of Wastes on Roads and Maritime Services Land* procedure was developed in 2014 to minimise the risks of construction wastes on Roads and Maritime land. The procedure includes best practice and contingency planning for construction wastes on sites, benchmark pre-construction site assessments to establish the condition of a Roads and Maritime owned site prior to hand over to a construction contractor, and a post-construction site condition assessment guide to verify that no unauthorised wastes remain on a site post-construction.

### 6.13.4 Potential impacts

#### Construction

Construction activities have the potential to generate waste, some of which would be able to be reused or recycled. The expected waste streams and activities likely to generate waste include:

- Road and other infrastructure materials from construction of the flyover and the New England Highway duplication
- Excess spoil (where excavated material cannot be used on site for fill or landscaping)
- Green waste from vegetation clearing (where green waste cannot be mulched and used on site for the landscaping works)
- Packaging materials associated with items delivered to the site, such as pallets, crates, cartons, plastics and other packaging materials
- Wastes such as oils and paints and synthetic materials from line markings
- Wastes produced from the maintenance of construction plant and equipment, including liquid wastes from cleaning, repairing and maintenance
- Wastes from installation of the VMS and CCTV
- Conduits and cables from protection and/or relocation of utilities
- Waste material resulting from any on-site spillage and subsequent clean-up of fuels/oils
- Sewage wastes generated through the use of worker’s facilities
- General office wastes, such as paper, cardboard, beverage containers and food wastes, generated by workers at construction facilities.

It is anticipated that waste would be removed from construction areas at the end of each day and disposed of at an appropriately licensed waste facility or temporarily stockpiled at the construction compound sites.
Construction waste could have potential impacts in terms of:
- Volumes of waste generated on-site
- Volumes of waste sent to landfill from the inadequate collection, classification and disposal of waste
- Contamination of soil, surface water and groundwater from inadequate waste handling
- Amenity impacts from odour and increases in vermin from inappropriate general waste storage and disposal.

Roads and Maritime adopts the principles of the waste management hierarchy to encourage the efficient use of resource, reuse and recycling where possible to reduce cost and environmental harm and divert waste from landfill in accordance with the principles of ESD.

It is expected that there would be a shortage of 150,000 cubic metres of fill over cut which presents the opportunity to reuse excavated spoil on-site. Excess fill left over from other Roads and Maritime projects would also be used for this proposal where suitable. All other materials would be purchased from Roads and Maritime registered suppliers, according to the Roads and Maritime specifications for the proposal.

Supply constraints are not expected and the proposal would not affect any resources in short supply. In sourcing materials, Roads and Maritime would use local suppliers as a priority, provided the materials sourced meet the specifications.

Any excess materials following construction would be removed from site for either re-use / recycling or disposal at an approved disposal site.

Through the implementation of mitigation measures and procedures to achieve the principles of the waste management hierarchy, it is expected that the proposal would have a minor adverse impact on resource use and waste during construction.

**Operation**

Operational aspects of the proposal would be similar to those currently in place with regards to resource use and waste management. There would be limited volumes of waste generated and minimal resources used and the primary source of waste would be from road users. The proposal would therefore have a negligible impact on resource use and waste management during operation.

**6.13.5 Safeguards and management measures**

The recommended safeguards and management measures minimise impacts to waste and resource use are outlined in Table 6-50.
# Table 6-50: Waste and resource use safeguards and management measures

<table>
<thead>
<tr>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction waste</td>
<td>WR1 A Waste Management Plan (WMP) is to be prepared and implemented as part of the CEMP. The WMP should provide specific guidance on measures and controls to be implemented to support minimising the amount of waste produced and appropriately handle and dispose of unavoidable waste. It would also address the importation of waste to the site for use in undertaking the project. The WMP would give effect to any management measures contained in any waste assessment carried out for the project and include, but not necessarily 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 WMP would be prepared taking into account the Roads and Maritime <em>Environmental Procedure – Management of Wastes on Roads and Maritime Services Land</em> and relevant Roads and Maritime Waste Fact Sheets.</td>
<td>Project Manager / Site Manager</td>
<td>Pre-construction and construction</td>
<td>Standard safeguard</td>
</tr>
<tr>
<td>Construction waste</td>
<td>WR2 Waste would be classified in accordance with the methods and specifications of the NSW EPA Waste Classification Guidelines 2014.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Standard / additional safeguard</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td>----------------</td>
<td>--------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Construction green waste</td>
<td>WR3 Any trees to be removed are to be reused as millable timber wherever practicable. Other vegetated material from native species shall be mulched and re-use on-site for landscaping or rehabilitation purposes if consistent with the approved FFMP for the project and the most current Mulch Exemption. Weed species, or vegetation not considered appropriate for re-use on-site, would be removed and disposed of to an appropriately licenced facility.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
</tbody>
</table>
6.14 Climate change

6.14.1 Introduction

There is a wide body of scientific evidence demonstrating that climate change is occurring at a steady rate. Studies, reports and evidence shows that over the past century, and in particular the last 50 years, our climate is warming. Along with increased temperatures, this warming is also leading to an increase in extreme weather conditions and hazards, such as longer dry spells, more intense storms and flash flooding. These events impact people, infrastructure and ecosystems.

It is now generally accepted that the release of certain gases into the atmosphere, most notably carbon dioxide, methane and nitrous oxide, exacerbates climate change. These gases are collectively referred to as greenhouse gases, or GHGs.

At the COP 21 climate talks in Paris (December 2015), the Australian Government announced a GHG emissions target of a 26-28% reduction by 2030 compared to 2005 levels.

To support the Australian Government target and provide a clear statement of their commitment to emissions reduction, in November 2016 the NSW Government released the draft NSW Climate Change Policy framework which aims to achieve zero net emissions by 2050. The accompanying Draft Climate Change Fund Strategic Plan outlines the potential cost-effective pathways and actions identified to reduce greenhouse gas emissions.

The NSW Government acknowledges that road transport is a big contributor to GHG emissions. To offset this, a primary focus will be the development of a NSW electric vehicles strategy to increase the uptake of low emission and electric vehicles by individuals and businesses.

In 2013, the Australian state road authorities (including Roads and Maritime) and New Zealand Transport Agency formed a Transport Authorities Greenhouse Group (TAGG) to share information around the estimation, reporting and minimisation of GHG emissions. In order to establish a common approach, the Greenhouse Gas Assessment Workbook for Road Projects (‘the Workbook’) was developed to provide road designers, builders, managers and operators with a consistent means of estimating GHG emissions at the key stages of construction, operation and maintenance. Through these estimation exercises, the Workbook also provides an understanding of how GHG emissions for projects can be reduced.

GHG emissions sources are usually categorised into different ‘scopes’. The scopes and sources of emissions for typical road projects, as Adapted from the Workbook, are presented in Table 6-51.

Table 6-51: Greenhouse gas sources by scope

<table>
<thead>
<tr>
<th>Scope of emissions</th>
<th>Description</th>
<th>GHG sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Direct GHG emissions associated with emissions generated on-site</td>
<td>Vegetation clearing: Vegetation absorbs carbon dioxide from the atmosphere (by photosynthesis), therefore where vegetation is removed the ability to act as a carbon sink is lost. Construction and maintenance equipment: Most construction and maintenance equipment is operated by the burning of fossil fuels, typically diesel, which creates greenhouse gas emissions.</td>
</tr>
<tr>
<td>Scope of emissions</td>
<td>Description</td>
<td>GHG sources</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Generator use:</strong> Some small equipment and lighting for out of hours works require the use of an on-site generator, typically powered by diesel, which creates greenhouse gas emissions.</td>
</tr>
<tr>
<td>2</td>
<td>Indirect GHG emissions associated with emissions generated elsewhere (i.e. at the source of electricity generation)</td>
<td><strong>Electricity:</strong> Electricity is generally consumed during construction for lighting during night works and by the site offices for lighting and security. Electricity is also consumed during operation of the project by street lights and traffic lights.</td>
</tr>
</tbody>
</table>
| 3                  | Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities and waste disposal | **Construction materials:** Different construction materials contain varying levels of embodied emissions for example; high-strength concrete contains a greater proportion of cement (which has a high level of embodied emissions), compared to concrete for lower-strength applications which contain fly-ash (which has a lower level of embodied emissions).  
**Construction waste:** Clearing of vegetation, disposal of contaminated soil and wood material from the demolition of acquired dwellings creates greenhouse gases, as the breakdown of organic matter as waste material directly releases stored carbon dioxide to the atmosphere.  
**Construction transport:** All construction-related transportation creates greenhouse gas emissions from the consumption and burning of fossil fuels. |

### 6.14.2 Methodology

Climate change has the potential to both impact on the proposal and be impacted by the proposal.

The proposal’s impact on climate change has been considered in a qualitative assessment guided by the emissions scopes presented in Table 6-51 and by considering the future traffic forecasts and trends and the likely construction methods, materials, and maintenance activities.

The impact of climate change on the proposal has been reviewed in consideration of the existing climate conditions and forecast climate projections.

### 6.14.3 Existing environment

The existing climate within the Singleton area is characterised by hot, humid summers and mild to cool winters with significantly more intense rainfall in the summer months, as illustrated in Table 6-52.
Table 6-52: Historic climate statistics for Singleton

<table>
<thead>
<tr>
<th>Climate effect</th>
<th>Period</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean maximum daily temperature</td>
<td>Annual</td>
<td>25.0 °C</td>
</tr>
<tr>
<td></td>
<td>Summer</td>
<td>30.5 °C</td>
</tr>
<tr>
<td></td>
<td>Autumn</td>
<td>24.8 °C</td>
</tr>
<tr>
<td></td>
<td>Winter</td>
<td>18.6 °C</td>
</tr>
<tr>
<td></td>
<td>Spring</td>
<td>26.2 °C</td>
</tr>
<tr>
<td>Highest maximum temperature</td>
<td>February 2017</td>
<td>47.2 °C</td>
</tr>
<tr>
<td>Mean number of days over 35 °C</td>
<td>Annual</td>
<td>23.7 p.a</td>
</tr>
<tr>
<td>Mean minimum daily temperature</td>
<td>Annual</td>
<td>10.8 °C</td>
</tr>
<tr>
<td></td>
<td>Summer</td>
<td>17.0 °C</td>
</tr>
<tr>
<td></td>
<td>Autumn</td>
<td>11.0 °C</td>
</tr>
<tr>
<td></td>
<td>Winter</td>
<td>4.8 °C</td>
</tr>
<tr>
<td></td>
<td>Spring</td>
<td>10.4 °C</td>
</tr>
<tr>
<td>Lowest temperature</td>
<td>August 2005</td>
<td>-4.0 °C</td>
</tr>
<tr>
<td>Mean total rainfall</td>
<td>Annual</td>
<td>676.0 mm</td>
</tr>
<tr>
<td></td>
<td>Summer</td>
<td>235.9 mm</td>
</tr>
<tr>
<td></td>
<td>Autumn</td>
<td>151.7 mm</td>
</tr>
<tr>
<td></td>
<td>Winter</td>
<td>128.1 mm</td>
</tr>
<tr>
<td></td>
<td>Spring</td>
<td>165.9 mm</td>
</tr>
<tr>
<td>Mean total number of rain days</td>
<td>Annual</td>
<td>104.3</td>
</tr>
<tr>
<td></td>
<td>Summer</td>
<td>28.1</td>
</tr>
<tr>
<td></td>
<td>Autumn</td>
<td>25.6</td>
</tr>
<tr>
<td></td>
<td>Winter</td>
<td>26.3</td>
</tr>
<tr>
<td></td>
<td>Spring</td>
<td>24.3</td>
</tr>
</tbody>
</table>

Source: Bureau of Metrology, 2017
Note: Historic data taken from Singleton STP weather station (station number 061397) for available period 2002 – 2016. Data presented is the mean data taken from this time period, unless otherwise stated.

The Hunter Valley region in general is known for its historic climate variability and extremes. Singleton Council note that major floods, droughts and bushfire events have had an impact on the LGA (Singleton Council, 2017).
6.14.4 Climate projections

To understand the future climate in the proposal area, climate projection data was sourced from the CSIRO’s Australian Climate Futures (hereafter referred to as Climate Futures). Climate Futures uses the four Representative Concentration Pathways (RCPs) adopted in the Fifth Assessment Report (AR5) of the United Nations Intergovernmental Panel on Climate Change (IPCC) based on varying greenhouse gas (GHG) trajectories. When applied, the RCPs describe four plausible climate futures, depending on greenhouse gases emissions in the years to come.

The RCPs are:
- RCP 2.6 – which assumes global annual GHG emissions (measured in CO2-equivalents) peak between 2010-2020, and the decline substantially thereafter
- RCP 4.5 – which assumes global annual GHG emissions peak around 2040, and then decline
- RCP 6 – which assumes global annual GHG emissions peak around 2080, and then decline
- RCP 8.5 – which assumes global annual GHG emissions continue to rise throughout the 21st century.

For the purpose of this assessment, RCP 8.5 was adopted for the chosen time period of 2050, allowing the forecast climate projections to depict the higher end impacts of climate change. This is a prudent risk management process and allows for a more precautionary approach to climate adaptation through the design process.

The climate projections are presented in Table 6-53 and can be found in Appendix M.
Table 6-53: Climate projections for Singleton for 2040

<table>
<thead>
<tr>
<th>Climate effect</th>
<th>Period</th>
<th>Baseline</th>
<th>Reported as</th>
<th>RCP 8.5 2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean maximum daily temperature</td>
<td>Annual</td>
<td>25.0 °C</td>
<td>Absolute change</td>
<td>+ 1.87 °C</td>
</tr>
<tr>
<td></td>
<td>Summer</td>
<td>30.5 °C</td>
<td>Absolute change</td>
<td>+ 1.78 °C</td>
</tr>
<tr>
<td></td>
<td>Autumn</td>
<td>24.8 °C</td>
<td>Absolute change</td>
<td>+ 1.72 °C</td>
</tr>
<tr>
<td></td>
<td>Winter</td>
<td>18.6 °C</td>
<td>Absolute change</td>
<td>+ 1.88 °C</td>
</tr>
<tr>
<td></td>
<td>Spring</td>
<td>26.2 °C</td>
<td>Absolute change</td>
<td>+ 2.03 °C</td>
</tr>
<tr>
<td>Highest maximum temperature</td>
<td>January 2006</td>
<td>45.9 °C</td>
<td>Expected measurement</td>
<td>47.7 °C</td>
</tr>
<tr>
<td>Mean minimum daily temperature</td>
<td>Annual</td>
<td>10.8 °C</td>
<td>Absolute change</td>
<td>+ 1.84 °C</td>
</tr>
<tr>
<td></td>
<td>Summer</td>
<td>17.0 °C</td>
<td>Absolute change</td>
<td>+ 1.91 °C</td>
</tr>
<tr>
<td></td>
<td>Autumn</td>
<td>11.0 °C</td>
<td>Absolute change</td>
<td>+ 2.02 °C</td>
</tr>
<tr>
<td></td>
<td>Winter</td>
<td>4.8 °C</td>
<td>Absolute change</td>
<td>+ 1.70 °C</td>
</tr>
<tr>
<td></td>
<td>Spring</td>
<td>10.4 °C</td>
<td>Absolute change</td>
<td>+ 1.72 °C</td>
</tr>
<tr>
<td>Lowest temperature</td>
<td>August 2005</td>
<td>-4.0 °C</td>
<td>Expected measurement</td>
<td>- 2.3 °C</td>
</tr>
<tr>
<td>Mean total rainfall</td>
<td>Annual</td>
<td>676.0 mm</td>
<td>Percentage change</td>
<td>- 7.0 %</td>
</tr>
<tr>
<td></td>
<td>Summer</td>
<td>235.9 mm</td>
<td>Percentage change</td>
<td>+ 6.8 %</td>
</tr>
<tr>
<td></td>
<td>Autumn</td>
<td>151.7 mm</td>
<td>Percentage change</td>
<td>- 1.3 %</td>
</tr>
<tr>
<td></td>
<td>Winter</td>
<td>128.1 mm</td>
<td>Percentage change</td>
<td>- 12.9 %</td>
</tr>
<tr>
<td></td>
<td>Spring</td>
<td>165.9 mm</td>
<td>Percentage change</td>
<td>- 24.4 %</td>
</tr>
<tr>
<td>Humidity</td>
<td>Annual</td>
<td></td>
<td>Percentage change</td>
<td>- 1.6 %</td>
</tr>
<tr>
<td>Solar radiation</td>
<td>Annual</td>
<td></td>
<td>Percentage change</td>
<td>+ 1.3 %</td>
</tr>
</tbody>
</table>

In general, the climate in Singleton is expected to become hotter and drier with more intense storms, floods, droughts and bushfire events.
6.14.5 Potential impacts

Construction

*Impacts of the proposal on climate change*

The likely sources of GHG emissions during construction of the proposal, as categorised by scope, are listed in Table 6-54.

Table 6-54: Likely GHG emissions by scope during construction

<table>
<thead>
<tr>
<th>Scope of emissions</th>
<th>GHG sources</th>
<th>Details</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Construction equipment</td>
<td>GHGs would be generated from fossil fuel combustion in plant, equipment and vehicles used for construction activities.</td>
<td>Construction activities would be planned to minimise movements on-site and use lower emission equipment, however GHG emissions related to construction activities would be largely unavoidable.</td>
</tr>
<tr>
<td></td>
<td>Generator use</td>
<td>Night works would require the use of a generator to power lights at construction sites. This would create GHG emissions through the combustion of diesel or other fossil fuels.</td>
<td>Construction activities would be planned to minimise disruption to traffic and to reduce the overall duration of construction. While night works would result in the generation of GHGs that may be avoidable during day time works, this could be offset by the reduced duration of the construction period overall, hence limiting other sources of emissions.</td>
</tr>
<tr>
<td>2</td>
<td>Electricity</td>
<td>It is expected that a small amount of electricity would be required during construction, which would be associated with power for the on-site construction buildings and worker facilities and possibly also the permanent VMS and CCTV if they are installed early and used during construction.</td>
<td>Electricity would be purchased from the grid, which largely comprises electricity generated from fossil fuels.</td>
</tr>
<tr>
<td>3</td>
<td>Construction materials</td>
<td>Extraction and production of materials used for construction of the proposal, such as concrete, steel, road base, pipes, cables, conduits, etc would result in GHG emissions.</td>
<td>Recycled materials or materials left over from other projects would be used where possible, however GHG emissions related to the production of materials would be largely unavoidable.</td>
</tr>
</tbody>
</table>
Scope of emissions | GHG sources | Details | Assessment
---|---|---|---
Construction waste | The mulching of cleared vegetation would result in increased GHG emissions, as the breakdown of organic matter to waste material directly releases stored carbon dioxide to the atmosphere. The processing of other waste materials may also result in GHG emissions. (Note: if these activities occur on-site, these would be considered as Scope 1 emissions). | GHG emissions related to the processing of construction waste would be largely unavoidable. |
Construction transport | GHGs would be generated by staff travelling to and from the construction site and by any transportation related to the movement of construction materials, equipment or plant in their delivery to the site. | Construction staging would be managed to minimise haulage and general vehicles trips to and from the construction sites, however GHG emissions related to construction transport would be largely unavoidable. |

Construction of the proposal would result in increased GHG emissions not only at the site, but also in a regional context. While measures would be carried out where possible to reduce GHG emissions, most of the emissions would be largely unavoidable.

Therefore, as with any activity that releases GHGs, construction of the proposal would contribute to climate change. However, as the volume of GHG emissions is expected to be fairly small, the proposal is expected to have a **negligible** impact on climate change during construction.

**Impacts of climate change on the proposal**

Climatic factors would not constrain construction of the proposal except during adverse or extreme weather conditions such as heatwaves, prolonged heavy rain, flooding, or very high winds. If the project is approved, construction of the proposal could start in 2019 and is expected to take around two years to complete. As such, the conditions are expected to be fairly similar to the present day climate and weather events.

The following potential impacts of climate change on construction of the proposal have been identified:

- Hot days (days over 35°C) would reduce work capacity and increase the risk of heat stress for site workers
- Heatwaves may delay construction, for example increased temperatures can interfere with the laying of concrete and road pavements. Prolonged hot, dry weather is also conducive to bushfires and the generation of dust
- Intense rainfall events would delay construction and increase the risk of erosion to exposed areas on-site
- Increased rainfall could create the potential for flash flooding.

The conditions of climate change are expected to have a **negligible** impact on construction of the proposal.
**Operation**

**Impacts of the proposal on climate change**

The likely sources of GHG emissions during operation of the proposal, as categorised by scope, are listed in Table 6-55.

Table 6-55: Likely GHG emissions by scope during operation

<table>
<thead>
<tr>
<th>Scope of emissions</th>
<th>GHG sources</th>
<th>Details</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vegetation clearing</td>
<td>Around 27.73 ha of vegetation would need to be cleared to accommodate the proposal. This includes pockets of dense vegetation and mature trees.</td>
<td>The proposal has been designed to minimise the amount of vegetation clearing as much as possible. However this loss of vegetation and the increase in pavement will contribute to an overall increase in the amount of carbon in the locality.</td>
</tr>
</tbody>
</table>
| 2                  | Electricity       | The following elements of the proposal would require electricity:  
|                    |                   | - Lighting at the New England Highway / Golden Highway intersection, along the flyover, and at the u-turn facility 
|                    |                   | - The VMS adjacent to the westbound carriageway of the New England Highway at Belford 
|                    |                   | - The CCTV camera at the New England Highway and Golden Highway intersection. | Electricity would be purchased from the grid, which largely comprises electricity generated from fossil fuels. |
| 3                  | Traffic           | The proposal would increase the capacity of the New England Highway to accommodate a growth in traffic. Generally speaking, the more vehicles on the road, the more emissions. | Even though the proposal would contribute to an increase in traffic volumes, potential increases in emissions could be offset by improvements to vehicle emission performance, with older, less efficient vehicles gradually being replaced by newer, more efficient vehicles, and perhaps even electric vehicles. |

The clearing of vegetation and the increase of vehicle traffic in the proposal area is expected to result in an increase GHGs and carbon in the locality. To understand the full effects of the proposal, a detailed GHG assessment would need to be carried out. However, given the existing conditions, the impact of the proposal on climate change is expected to be **minor** during operation.
Impacts of climate change on the proposal

Climate and weather can have an impact on the road surface and the safety of a road. The biggest influences on road surface are moisture and temperature, both of which can lead to faster rates of deterioration.

In theory, as rainfall decreases overall, the rate of moisture related road surface deterioration should slow (Austroads, 2004). However this could be offset by an increase in ambient temperatures, which may accelerate the rate of deterioration of any seal binders. Drier conditions may also cause pavements to age more quickly due to oxidation and embrittlement (Austroads, 2004). However, these effects are expected to be small over time and in combination with the Roads and Maritime maintenance regime are likely to have a negligible impact.

More intense rainfall and flooding events could put pressure on the culverts and open drainage channels which serve to keep the road dry. Overtopping could cause dangerous conditions for drivers. The proposal has been designed in accordance with the Australian Rainfall and Runoff Guideline to meet the 1 in 100 year flood levels.

Overall, the impact of climate change on the proposal is expected to be minor during operation.

6.14.6 Safeguards and management measures

The safeguards provided in the above sections are expected to minimise resource use and greenhouse gas emissions where possible, No further specific climate change related safeguards are recommended.

6.15 Cumulative impacts

Cumulative impacts could be experienced if construction or operation of the project coincided with construction or operation of other local development, such as other road upgrades, public work or private development.

A desktop review of the major project register on the Department of Planning and Environment’s website completed on 20 April 2017 identified major projects within the Singleton LGA which have the potential to contribute to cumulative impacts with the proposal. These projects are listed in Table 6-56.

Table 6-56: Major projects within the Singleton LGA which have the potential to contribute to cumulative impacts with the proposal

<table>
<thead>
<tr>
<th>Project</th>
<th>Brief description</th>
<th>Planning status</th>
<th>Distance from proposal</th>
</tr>
</thead>
</table>
| Mount Owen Continued Operations  | • Continuation of the extraction of coal at the Mount Owen mine site and on-site infrastructure upgrades  
                                  |                                   | Approved on 3 November 2016      | About 30 kilometres to the north |
|                                  | • Upgrade to Hebden Road, including construction of a road overpass over the Main Northern Railway Line and a new dual land bridge over Bowmans Creek  
                                  |                                   |                                  |                                |
|                                  | • Augmentation of the existing Mount Own rail line through construction of an additional rail line. |                                  |                                |
The Singleton Council website identifies Development Applications (DAs) recently determined within the LGA, including major developments and Council infrastructure maintenance work. A review of the website on 20 April 2017 identified a number recent approved DAs relating to upgrades at residential properties within the Singleton town centre, as well as construction of a water recycling and biosolids treatment facility at a property.

The Department of Planning and Environment’s major project register and Singleton Council’s website should be reviewed before commencement of construction to properly understand potential cumulative impacts.

A number of upgrades along the Golden Highway have been identified in the **Golden Highway Corridor Strategy** (for further information see Section 2.1.2 of this REF). In the near-term and in close proximity to the proposal, this is expected to include flood immunity works at Mudies Creek, Whittingham, and the regrading / realignment at Ogilvies Hill (around 2.5 kilometres east of Dalswinton Road, Denman) and Winery Hill (at Edderton Road, Jerrys Plains).

A New England Highway bypass of Singleton (also known as the Singleton Bypass), is also being developed and is currently in the route options phase. Roads and Maritime, together with the Australian Rail Track Corporation (ARTC), are also planning an upgrade of the New England Highway railway underpass at Gowrie, just west of Singleton.

### 6.15.1 Potential impacts

#### Construction

Cumulative impacts could occur during construction as a result of the proposal and other developments in the locality being carried out in parallel. However, this would be temporary and environmental safeguards and management measures would be implemented as appropriate.

The key cumulative impacts during construction could include:
- Increased construction vehicle traffic on local roads causing congestion and delays
- Cumulative air and noise impacts associated with multiple construction work
- Temporary changes to the visual amenity of the area.

The severity of potential cumulative impacts would vary between locations and would generally be dependent on the types of work being carried out, the timing and duration of the work relative to each other, the distance between the work and the receivers and the sensitivity of the receiver.

When combined with potential noise impacts of concurrent construction work in the area, cumulative noise levels in the proposal area may result in exceedance of the noise criteria (see Section 6.7) and result in reduced local amenity. During work, reasonable and feasible measures
to manage noise levels in exceedance of the criteria would be carried out where practicable to minimise all noise impacts.

For residents and motorists in the area, coinciding construction activities may also result in a lower visual amenity and air quality environment during work. These impacts would be short-term and can be justified by the long-term, positive impacts of the proposal. Further, the safeguards and management measures recommended are expected to effectively manage potential cumulative visual amenity and air quality impacts.

**Operation**

The proposal, combined with the wider road upgrade schemes, would result in cumulative benefits for the New England Highway and Golden Highway road corridors and to the locality through increased capacity of the road network, improved traffic flow and journey times, improved road safety, and improved cyclist facilities.

However, cumulatively the road upgrades may also result in localised increases in traffic noise and air pollution within the region. Noise impacts would be addressed during design on a project-by-project basis to minimise impacts on sensitive receivers and further managed through project noise management plans. Air quality would also be addressed on a project-by-project basis.

The road upgrades may also contribute to a larger loss of rural land cumulatively, however this is expected to be minor and be offset by the above mentioned benefits.

**6.15.2 Safeguards and management measures**

The safeguards and mitigation measures detailed in Table 6-57 would be implemented to minimise potential cumulative impacts of the proposal combined with other local development.

Table 6-57: Safeguards and management measures for cumulative impacts

<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>Cumulative impacts</td>
<td><strong>CU1</strong> Cumulative impacts would be incorporated into the traffic management plan and the noise management plan.</td>
<td>Project Manager</td>
<td>Pre-construction and construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>Cumulative impacts</td>
<td><strong>CU2</strong> Management measures within the CEMP would be reviewed in response to any complaints received.</td>
<td>Project Manager / Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
</tbody>
</table>
6.16 Summary of beneficial effects

The proposal would provide the following benefits during construction and operational phases:

**Construction**

- Potential to generate jobs.

**Operation**

- Reduction of peak period delays at the New England Highway and Golden Highway intersection, especially for traffic turning right from the Golden Highway
- Improved road safety along the New England Highway between Belford and the Golden Highway, especially at the intersection with the Golden Highway
- Improved average peak hour travel times on the New England Highway
- Increased capacity of two existing culverts under the New England Highway resulting in reduced flooding on the New England Highway
- Additional cycling infrastructure at the New England Highway and Golden Highway intersection and on the new flyover
- Support growth in the Hunter region through improved freight movements and road user connections.

6.17 Summary of adverse effects

The proposal would have the following adverse impacts during construction and operational phases:

**Construction**

- Impacts to Aboriginal archaeological sites of moderate scientific significance
- Increased travel times along sections of the New England Highway and Golden Highway
- Noise exceedances at properties within 600 metres of the proposal during some activities
- Changes to air quality and visual amenity.

**Operation**

- Loss of around 11.23 ha of threatened vegetation under the TSC Act and 8.20 ha of threatened vegetation under the EPBC Act (a biodiversity offset strategy would be developed to help offset this loss)
- Reduction of habitat, including hollow-bearing trees, for a range of birds and mammals including threatened species
- Loss of fauna habitat connectivity (although this would be offset by the provision of an aerial fauna crossing)
- Permanent change to property access, affecting one private property on the southern side of the New England Highway
- Loss of around 40 ha of land zoned IN3 – Heavy Industrial as part of the Whittingham Urban Release Area
- Increase of the scale and dominance of the road corridor through construction of the flyover.
7 Environmental management

7.1 Environmental management plans (or system)
A number of safeguards and management measures have been identified in this REF in order to minimise adverse environmental impacts, including social and cultural impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and management measures will need to be incorporated into the detailed design and applied during construction and operation of the proposal.

A Project Environmental Management Plan (PEMP) and a Construction Environmental Management Plan (CEMP) will need to be prepared to describe the safeguards and management measures identified. These plans should provide a framework for establishing how these measures are to be implemented and who is responsible for their implementation.

The PEMP and CEMP should 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 commencement 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 and PEMP 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, and QA Specification G10 - Traffic Management.

7.2 Summary of safeguards and management measures
Environmental safeguards and management measures outlined in this REF will need to be incorporated into the detailed design for the proposal and during construction and operation, should the proposal proceed. These safeguards and management measures will minimise any potential adverse impacts arising from the proposed works on the surrounding environment and community. 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>
<th>Timing</th>
<th>Standard / additional safeguard</th>
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</table>
| G1  | General - minimise environmental impacts during construction          | A CEMP is to be prepared and submitted for review and endorsement of the Roads and Maritime Environment Manager prior to commencement of any work. As a minimum, the CEMP should 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 is to be implemented during the pre-construction and construction stages of the project. | Project manager / Site Manager | Pre-construction and construction | Standard safeguard |
| G2  | General - notification                                                 | All businesses, residential properties and other key stakeholders likely to be affected by the activity are to be notified at least five days prior to the commencement of any work. | Project manager / Site Manager | Pre-construction and construction | Standard safeguard |
| G3  | General – environmental awareness                                      | Environmental awareness training must be provided, by the contractor, to all field personnel and subcontractors. This should include up-front site induction and regular "toolbox" style briefings. Site-specific training to be provided includes:  
  • Aboriginal heritage sensitivity  
  • Threatened species habitat. | Site Manager | Pre-construction and construction | Standard safeguard |
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<tr>
<th>No.</th>
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<tr>
<td>G4</td>
<td>General – ancillary facilities</td>
<td>Prior to establishment and use of any additional ancillary facilities such as compound sites and/or stockpile sites, consultation is to be undertaken with the Roads and Maritime Environment Officer, Hunter region to determine if any further environmental impact assessment is required.</td>
<td>Site Manager</td>
<td>Pre-construction and construction</td>
<td>Standard safeguard</td>
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</tbody>
</table>
| B1  | General biodiversity impacts                | A Flora and Fauna Management Plan (FFMP) is to be prepared and implemented as part of the CEMP. The FFMP should include, but not be limited to:  
  - Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas  
  - 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.                                                                                                                                                                                                                                                             | Project Manager and Site Manager | Pre-construction              | Standard safeguard              |
<p>| B2  | Vegetation Clearing                         | Protocols for the clearing of vegetation, such as a pre-clearing check, are to be developed and implemented in accordance with the Roads and Maritime Biodiversity Guidelines (Guide 4: Clearing of vegetation and removal of bushrock).                                                                                                                                                  | Project Manager and Site Manager | Pre-construction and construction | Standard safeguard              |
| B3  | Unexpected threatened species               | An unexpected finds procedure is to be implemented in the event that a threatened species or ecological community that has not been identified and assessed by the REF is unexpectedly encountered during the construction process.                                                                                                         | Site Manager              | Pre-construction and construction | Standard safeguard              |</p>
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<tr>
<th>No.</th>
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</thead>
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<tr>
<td>B4</td>
<td>Hollow-bearing tree removal</td>
<td>A nest box strategy is to be developed and implemented in accordance with the Roads and Maritime Services Biodiversity Guidelines 2011 – Guide 8 (nest boxes).</td>
<td>Project Manager and Site Manager</td>
<td>Pre-construction and construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>B5</td>
<td>Wildlife Connectivity</td>
<td>An aerial crossing to retain fauna connectivity is to be installed in the vicinity of the Squirrel Gliders recorded. (An indicative location has been provided in Figure 3-1 of this REF, however the final location, design and type of aerial crossing is to be determined during detailed design).</td>
<td>Project Manager and Site Manager</td>
<td>Pre-construction and construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>B6</td>
<td>Spread of pathogens</td>
<td>Protocols for preventing the introduction and/or spread of disease causing agents such as bacteria and fungi are to be developed and implemented in accordance with the Roads and Maritime Biodiversity Guidelines – Guide 7 (Pathogen Management).</td>
<td>Project Manager and Site Manager</td>
<td>Pre-construction and Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>B7</td>
<td>Spread of Noxious Weeds</td>
<td>Declared noxious weeds are to be managed according to requirements under the <em>Noxious Weeds Act 1993</em> and the Roads and Maritime Biodiversity Guidelines – Guide 6 (Weed Management).</td>
<td>Site Manager</td>
<td>Pre-construction and Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>B8</td>
<td>Biodiversity offsets</td>
<td>A Biodiversity Offset Strategy is to be developed and implemented in accordance with Roads and Maritimes Guidelines for Biodiversity Offsets.</td>
<td>Project Manager</td>
<td>Pre-construction or Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>AH1</td>
<td>Impacts to known Aboriginal heritage sites</td>
<td>An Aboriginal Heritage Management Plan (AHMP) is to be prepared in accordance with the <em>Procedure for Aboriginal cultural heritage consultation and investigation</em> and implemented as part of the CEMP. The AHMP should provide specific guidance on measures and controls to be implemented for managing impacts on Aboriginal heritage and culture. The AHMP should be prepared in consultation with all relevant Aboriginal groups.</td>
<td>Project Manager/ Site Manager</td>
<td>Pre-construction and construction</td>
<td>Standard safeguard</td>
</tr>
<tr>
<td>No.</td>
<td>Impact</td>
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<tr>
<td>AH2</td>
<td>Impacts to known Aboriginal heritage sites</td>
<td>An AHIP for the project area would be obtained prior to construction and any salvage would be undertaken in accordance with the proposed salvage methodology and any conditions of approval (if granted).</td>
<td>Project Manager/ Site Manager</td>
<td>Pre-construction and construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>AH3</td>
<td>Possible impacts to known Aboriginal heritage sites</td>
<td>AH3 Archaeological sites in close proximity to construction works should be fenced off prior to the commencement of construction to ensure that they are not inadvertently affected as a result of construction work. Fencing should be maintained throughout the duration of works.</td>
<td>Site Manager</td>
<td>Pre-construction and construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>AH4</td>
<td>Possible disturbance to unknown Aboriginal heritage sites</td>
<td>The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime, 2015) is to be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. Work should only re-commence once the requirements of that Procedure have been satisfied.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Standard safeguard</td>
</tr>
<tr>
<td>SG1</td>
<td>Soil impacts</td>
<td>A Soil Management Plan (SMP) is to be prepared in accordance with QA Specification G38 and implemented as part of the CEMP. The SMP should identify all reasonably foreseeable risks relating to subsurface impacts and pollution associated with construction of the proposal, and describe how these risks would be managed and minimised. This should include arrangements for managing pollution risks associated with spillage or soil contamination on the site and adjoining areas, and monitoring during and post-construction.</td>
<td>Project Manager / Site Manager</td>
<td>Pre-construction and construction</td>
<td>Standard safeguard</td>
</tr>
<tr>
<td>SG2</td>
<td>Spoil and stockpile management</td>
<td>A Spoil and Fill Management Plan (SFMP) is to be prepared and implemented as part of the CEMP. The SFMP should identify the locations of spoil and fill stockpiles, sources of imported fill, and methods to re-use or dispose of excess or unsuitable spoil material including estimated volumes and disposal sites.</td>
<td>Project Manager / Site Manager</td>
<td>Pre-construction and construction</td>
<td>Standard safeguard</td>
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<tr>
<td>No.</td>
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<td>SG3</td>
<td>Groundwater impacts</td>
<td>In addition to the implementation of general erosion, sediment and water quality control safeguards, sediment basins, stockpiles, washdowns, batch plants, refuelling and chemical storage sites would be lined and/or bunded if they are located within 50 metres of a shallow groundwater source.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>SG4</td>
<td>Groundwater interaction</td>
<td>Any groundwater intercepted during construction works, such as around the flyover, is to be treated, disposed or reused appropriately. Prior to any dewatering activities being carried out, an approval must first be obtained in accordance with Section 92 of the WM Act and dewatering is to be carried out in accordance with the requirements of the EPL. Management measures to minimise potential adverse impacts are to be implemented in accordance with the RTA Technical Guideline: Environmental management of construction site dewatering. These may include, but not necessarily be limited to: - Options to collect and store groundwater to enable recharge of the water table (such as via grassed lined channels - Where recharge is not appropriate or feasible, discharging groundwater to the surface water drainage system following - Appropriate treatment to ensure discharged water is of sufficient quality.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>SG5</td>
<td>Management of topsoil</td>
<td>Topsoil would be stockpiled in cleared or disturbed areas and managed in accordance with the RTA Stockpile Site Management Guideline until it is removed from the construction site and disposed of an appropriately licensed facility.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>No.</td>
<td>Impact</td>
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</table>
| SG6 | Soil stabilisation         | The rehabilitation of disturbed areas would 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  
- Roads and Maritime *Guideline for Batter Stabilisation Using Vegetation*. | Site Manager           | Construction         | Additional safeguard    |
<p>| SG7 | Construction of batter during excavation | Batters would be designed and constructed to minimise risk or exposure, instability and erosion, and to support long-term, on-going best practice management, in accordance with the Roads and Maritime <em>Guideline for Batter Stabilisation Using Vegetation</em>. | Site Manager           | Construction         | Additional safeguard    |
| SG8 | Saline soils               | A pre-construction preliminary salinity field investigation is to be considered with locations, profile descriptions, soil tests and laboratory analyses planned with reference to the Department of Land and Water Conservation (2002) – Site Investigations for Urban Salinity (DLWC, 2002). | Project Manager        | Pre-construction     | Additional safeguard    |
| W1  | Water quality impacts during construction | A site specific Erosion and Sediment Control Plan (ESCP) is to be prepared and included in the CEMP. The ESCP should identify detailed measures and controls to be applied to minimise erosion and sediment control risks including, but not necessarily limited to runoff, diversion and drainage points, sediment basins and sumps, scour protection, stabilising disturbed areas as soon as possible, and dam checks. The ESCP should also include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather. | Project Manager / Site Manager | Pre-construction and construction | Standard safeguard    |</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>Impact</th>
<th>Environmental safeguards</th>
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<th>Timing</th>
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</tr>
</thead>
</table>
| W2  | Minimise risks to water quality during construction | Consistent with any specific requirements of the approved ESCP and the SMP, control measures should be implemented to minimise risks associated with erosion and sedimentation and entry of materials into the creek / drainage lines. This may include, but not necessarily be limited to:  
   - Sediment management devices, such as sediment fencing, straw bales or sand bags  
   - Installation of measures at work entry and exit points to minimise movement of material onto adjoining roads, such as rumble grids or wheel wash bays  
   - Appropriate location and storage of construction materials, fuels and chemicals, including bunding where appropriate. | Site Manager            | Construction       | Additional safeguard                                               |
<p>| C1  | Contaminant exposure during construction | If contaminated areas are encountered during construction, appropriate control measures would be implemented to manage the immediate risks of contamination, such as the diversion of surface runoff, capture of any contaminated runoff or temporary capping. All other work that may impact on the contaminated area would cease until the nature of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Environment Manager and/or EPA. | Site Manager            | Construction       | Standard safeguard                                      |
| C2  | Emergency spills                       | A site specific emergency spill plan would be developed and implemented, and include spill management measures in accordance with the Roads and Maritime Code of Practice for Water Management and relevant EPA guidelines. The plan would 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). | Project Manager / Site Manager | Pre-construction and construction | Standard safeguard                                      |</p>
<table>
<thead>
<tr>
<th>No.</th>
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<th>Standard / additional safeguard</th>
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<tbody>
<tr>
<td>T1</td>
<td>Disruptions to traffic and transport</td>
<td>A TMP is to be prepared and implemented as part of the project CEMP. The TMP should be prepared in accordance with the Roads and Maritime Traffic control at worksites manual (Version 4), Australian Standard 1742.3 Manual of uniform traffic control devices, and instruction from the Transport Management Centre. The TMP should include, but not be limited to: • Confirmation of haulage routes and site access points • Site specific traffic control measures (including signage) to manage and regulate traffic movements • Measures to maintain access to properties • Requirements and methods to inform the local community of impacts on the local road network • A response plan for any construction traffic related incidents.</td>
<td>Project Manager and Site Manager</td>
<td>Pre-construction</td>
<td>Standard</td>
</tr>
<tr>
<td>T2</td>
<td>Changed transport and access conditions</td>
<td>Road users, local residents, and local businesses are to be informed in advance of changed conditions, including any likely disruptions to access.</td>
<td>Project Manager and consultation team</td>
<td>Pre-construction and construction</td>
<td>Standard</td>
</tr>
<tr>
<td>T3</td>
<td>Changed transport and access conditions</td>
<td>Consultation is to be carried out with Hunter Valley Buses should the existing Singleton Heights to Stockland Green Hills via Maitland (route 180) bus stops within the project area need to be temporarily relocated. Appropriate temporary stop locations should be agreed and implemented for the defined period.</td>
<td>Project Manager</td>
<td>Pre-construction and construction</td>
<td>Additional</td>
</tr>
<tr>
<td>T4</td>
<td>Disruptions to traffic and transport</td>
<td>Real-time information is to be made available through temporary Variable Message Signs (VMS), the Live Traffic and 131 500 websites, and the media.</td>
<td>Project Manager/ Site Manager</td>
<td>Construction</td>
<td>Standard</td>
</tr>
<tr>
<td>No.</td>
<td>Impact</td>
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</tr>
<tr>
<td>T5</td>
<td>Disruptions to traffic and transport</td>
<td>Construction staging and materials are to be managed to minimise the number of haulage and delivery vehicles required on site.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Standard</td>
</tr>
<tr>
<td>T6</td>
<td>Disruptions to traffic and transport</td>
<td>The designated site access points and haulage routes are to be used.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Standard</td>
</tr>
<tr>
<td>T7</td>
<td>Transport conditions</td>
<td>Affected areas are to be restored to a condition equivalent to that which existed prior to the commencement of the work.</td>
<td>Site Manager</td>
<td>Post-construction</td>
<td>Standard</td>
</tr>
</tbody>
</table>
| NV1 | Construction noise and vibration | A Noise and Vibration Management Plan (NVMP) is to be prepared and implemented as part of the CEMP. The NVMP should generally follow the approach in ICNG and identify:  
- All potential significant noise and vibration generating activities  
- Measures to be implemented during construction to minimise noise and vibration impacts  
- 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. The CEMP should be regularly updated to account for changes in noise and vibration management strategies. | Project Manager/ Site Manager | Pre-construction and construction | Standard safeguard              |
<table>
<thead>
<tr>
<th>No.</th>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>NV2</td>
<td>Construction noise</td>
<td>All sensitive receivers likely to be affected by construction noise are to be notified at least 7 days prior to commencement of any works associated with the activity that may have an adverse impact. The notification will include details of: the project, the construction period and construction hours, contact information for project management staff, complaint and incident reporting, and how to obtain further information.</td>
<td>Site Manager</td>
<td>Pre-construction and construction</td>
<td>Standard safeguard</td>
</tr>
<tr>
<td>NV3</td>
<td>Construction noise</td>
<td>The majority of works are to be carried out during standard working hours (i.e. 7am – 6pm Monday to Friday, 8am –1pm Saturdays). Any work that is performed outside normal work hours or on a Sunday or public holiday is to minimise noise impacts in accordance with Roads and Maritime’s <em>Environmental Noise Management Manual Practice Note 7 – Roadworks Outside of Normal Working Hours</em> and the ICNG.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Standard safeguard</td>
</tr>
<tr>
<td>NV4</td>
<td>Construction noise</td>
<td>Construction personnel are to be made familiar with the potential for noise and vibration impacts upon local residents and encouraged to take all practical and reasonable measures to minimise noise during the course of their activities.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>NV5</td>
<td>Construction noise</td>
<td>Where practical, the location of construction compounds and the layout and positioning of noise-producing plant and activities at each work site is to be optimised to minimise noise emission levels.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>NV6</td>
<td>Construction noise</td>
<td>Where practical, equipment should be selected to minimise noise emissions. Equipment should be fitted with appropriate noise control equipment and be in good working order.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>NV7</td>
<td>Construction noise</td>
<td>Where possible, non-“beeper” reversing movement alarms should be used such as broadband (non-tonal) alarms or ambient noise-sensing alarms. Work sites should also be designed to reduce the need for reversing, potentially minimising the use of reversing beepers.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>No.</td>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
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<td>Standard / additional safeguard</td>
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</tr>
<tr>
<td>NV8</td>
<td>Construction noise</td>
<td>Vehicles, plant and equipment are to be regularly inspected and maintained to avoid increased noise levels from rattling hatches, loose fittings etc.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>NV9</td>
<td>Construction noise</td>
<td>All vehicles, plant and equipment are to be shut off when not in use.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>NV10</td>
<td>Construction vibration</td>
<td>Where required, attended vibration measurements are to be undertaken at the commencement of vibration generating activities to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
</tbody>
</table>
| NV11| Construction vibration    | Where required, the following should be considered to minimise the noise and vibration impacts of blasting:  
  • Choosing the appropriate blast charge configurations  
  • Ensuring appropriate blast-hole preparation  
  • Optimising blast design, location, orientation and spacing  
  • Selecting appropriate blast times, and  
  • Utilising knowledge of prevailing meteorological conditions.  
  AS 2187.2 Explosives-Storage, transport and use, Part 2: Use of Explosives provides more detailed advice on ground vibration and airblast overpressure impact minimisation options. | Site Manager   | Construction | Additional safeguard            |
<p>| LV1 | Visual impacts during construction | Project work sites, including construction areas and supporting facilities (such as storage compounds and offices) must be managed to minimise visual impacts, including appropriate storage of equipment, parking, stockpile screening and arrangements for the storage and removal of rubbish and waste materials. | Site Manager   | Construction | Standard safeguard              |
| LV2 | Temporary lighting        | Temporary site lighting must be installed and operated in accordance with AS4282:1997 Control of the Obtrusive Effect of Outdoor Lighting. | Site Manager   | Construction | Standard safeguard              |</p>
<table>
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<tr>
<th>No.</th>
<th>Impact</th>
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<th>Timing</th>
<th>Standard / additional safeguard</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV3</td>
<td>Landscape design strategy</td>
<td>The landscape design strategy for the proposal should be reviewed during the final detailed project design and implemented as part of the CEMP.</td>
<td>Project Manager and Site Manager</td>
<td>Detailed design and construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>LU1</td>
<td>Property acquisition</td>
<td>All property acquisition is to 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>Project manager</td>
<td>Pre-construction</td>
<td>Standard safeguard</td>
</tr>
<tr>
<td>LU2</td>
<td>Temporary leasing</td>
<td>The temporary leasing of any land is to be managed and setup at the earliest stage possible in the project and all land owners consulted with in accordance with the standard consultation measures.</td>
<td>Project Manager</td>
<td>Pre-construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>LU3</td>
<td>Utility work</td>
<td>Prior to the commencement of utility work, consultation is to be carried out with the identified persons and organisations that may be adversely affected by service disruptions to determine any special requirements or alternative service arrangements.</td>
<td>Project Manager</td>
<td>Pre-construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>No.</td>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Standard / additional safeguard</td>
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</tbody>
</table>
| AQ1 | Air quality impacts during construction | An Air Quality Management Plan (AQMP) is to be prepared and implemented as part of the CEMP. The AQMP should identify:  
- Potential sources of air pollution (such as dust, vehicles transporting waste, plant and equipment) during construction  
- Air quality management objectives consistent with any relevant published EPA and/or OEH guidelines  
- Mitigation and suppression measures to be implemented, such as spraying or covering exposed surfaces, provision of vehicle clean down areas, covering of loads, street cleaning, use of dust screens, maintenance of plant in accordance with manufacturer's instructions  
- Methods to manage work during strong winds or other adverse weather conditions  
- A progressive rehabilitation strategy for exposed surfaces  
- A monitoring program to assess compliance with the identified objectives, and developed in accordance with any relevant published EPA and/or OEH guidelines  
- Community notification and complaint handling procedures. | Project Manager and Site Manager | Pre-construction and construction | Standard safeguard |
<p>| AQ2 | Air quality impacts during construction | All personnel working on-site are to receive training to ensure awareness of requirements of the AQMP. Site-specific training is to be given to personnel working in the vicinity of sensitive receivers. | Site Manager | Pre-construction | Standard safeguard |
| AQ3 | Air quality impacts during construction | Consistent with the approved AQMP, mitigation and suppression measures are to be implemented to protect local air quality. | Site Manager | Construction | Standard safeguard |</p>
<table>
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<tr>
<th>No.</th>
<th>Impact</th>
<th>Environmental safeguards</th>
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<th>Timing</th>
<th>Standard / additional safeguard</th>
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<tr>
<td>SE1</td>
<td>General community</td>
<td>A Communication Plan (CP) is to 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 • A complaints handling procedure The CP will be prepared in accordance with the <em>Community Involvement and Communications Resource Manual</em> (RTA, 2008).</td>
<td>Project Manager and Site Manager</td>
<td>Pre-construction and construction</td>
<td>Standard safeguard</td>
</tr>
<tr>
<td>SE2</td>
<td>Property impacts</td>
<td>Consultation is to be carried out with EC Throsby to identify appropriate management strategies to avoid or minimise impacts on access and operations. These details are to be included in the TMP.</td>
<td>Project Manager</td>
<td>Pre-construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>SE3</td>
<td>Impacts to bus services</td>
<td>Operation of public and school bus services are to be maintained during construction of the project. Appropriate arrangements are to be made with the local school bus provider to ensure safe pick up and drop off points are maintained/ established throughout the construction period. These details are to be included in the project TMP.</td>
<td>Project Manager and Site Manager</td>
<td>Pre-construction and construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>SE4</td>
<td>Emergency services</td>
<td>Access for emergency service vehicles, including police, ambulance, fire and rescue and the rural fire brigade is to be provided at all times during construction. Any special arrangement for emergency vehicles should be communicated with the relevant agency and detailed in the project TMP.</td>
<td>Project Manager and Site Manager</td>
<td>Pre-construction and construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>No.</td>
<td>Impact</td>
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<td>Standard / additional safeguard</td>
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</table>
| WR1 | Construction waste | A Waste Management Plan (WMP) is to be prepared and implemented as part of the CEMP. The WMP should provide specific guidance on measures and controls to be implemented to support minimising the amount of waste produced and appropriately handle and dispose of unavoidable waste. It would also address the importation of waste to the site for use in undertaking the project. The WMP would give effect to any management measures contained in any waste assessment carried out for the project and include, but not necessarily 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 WMP would 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. | Project Manager / Site Manager | Pre-construction and construction | Standard safeguard |
<p>| WR2 | Construction waste | Waste would be classified in accordance with the methods and specifications of the NSW EPA Waste Classification Guidelines 2014.                                                                                                                                                                                                                                                                                                                                                                                   | Site Manager   | Construction                | Additional safeguard |</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>Impact</th>
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<th>Responsibility</th>
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<th>Standard / additional safeguard</th>
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</thead>
<tbody>
<tr>
<td>WR3</td>
<td>Construction green waste</td>
<td>Any trees to be removed are to be reused as millable timber wherever practicable. Other vegetated material from native species shall be mulched and re-use on-site for landscaping or rehabilitation purposes if consistent with the approved FFMP for the project. Weed species, or vegetation not considered appropriate for re-use on-site, would be removed and disposed of to an appropriately licenced facility.</td>
<td>Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>CU1</td>
<td>Cumulative impacts</td>
<td>Cumulative impacts would be incorporated into the traffic management plan and the noise management plan.</td>
<td>Project Manager</td>
<td>Pre-construction and construction</td>
<td>Additional safeguard</td>
</tr>
<tr>
<td>CU2</td>
<td>Cumulative impacts</td>
<td>Management measures within the CEMP would be reviewed in response to any complaints received.</td>
<td>Project Manager / Site Manager</td>
<td>Construction</td>
<td>Additional safeguard</td>
</tr>
</tbody>
</table>
7.3 Licensing and approvals

The additional licenses and approvals as outlined in Table 7-2 would be required prior to the commencement of construction.

Table 7-2: Summary of licences and approvals required

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Timing</th>
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<tbody>
<tr>
<td>Water supply work approval in accordance with Section 92 of the WM Act if groundwater needs to be extracted for dewatering purposes during construction</td>
<td>Prior to the commencement of the work</td>
</tr>
<tr>
<td>Under the NPW Act, an AHIP is required prior to the harm of any Aboriginal objects</td>
<td>Prior to the commencement of the work</td>
</tr>
<tr>
<td>A licence may be required under the WM Act for use of water from the dam if the intended amount of water to be withdrawn is outside the amount within Roads and Maritime’s harvestable right</td>
<td>Prior to the commencement of the work</td>
</tr>
<tr>
<td>An EPL would be required under the POEO Act for the extraction of more than 30,000 tonnes of material in a year</td>
<td>Prior to the commencement of the work</td>
</tr>
</tbody>
</table>


8 Conclusion

8.1 Justification

The proposal has been developed through a robust planning and optioneering process and consultation with a number of stakeholders. The options assessment considered seven road design options, as well as a ‘do nothing’ option, and the preferred option was selected because it would best meet the desirable project objectives and measures. Consultation of the preferred design and potential impacts has been carried out with the Aboriginal community and the broader local community, Singleton Council, the Office of Environment and Heritage (OEH) as well as affected landholders and utility companies. The proposed design has been refined in order to minimise environmental, cultural, business and community impacts while maintaining the integrity and safety of the design against the project objectives.

The proposal would:

- Reduce peak period delays at the New England Highway and Golden Highway intersection, especially for traffic turning right from the Golden Highway
- Improve road safety along the New England Highway between Belford and the Golden Highway, especially at the intersection with the Golden Highway
- Improve average peak hour travel times on the New England Highway
- Increased capacity of two existing culverts under the New England Highway resulting in reduced flooding on the New England Highway
- Provide additional cycling infrastructure at the New England Highway and Golden Highway intersection and on the new flyover
- Support growth in the Hunter region through improved freight movements and road user connections.

The proposal would result in some adverse impacts to the local environment during construction, including impacts to Aboriginal archaeological sites, increased travel times along sections of the New England Highway and Golden Highway, air and noise emissions and reduced visual amenity. However, the mitigation measures provided in this REF would help to reduce these expected impacts.

The proposal would also result in the permanent loss of around 11.23 ha of threatened vegetation under the TSC Act and 8.20 ha of threatened vegetation under the EPBC Act, reduction of habitat for a range of birds and mammals (including threatened species), loss of fauna habitat connectivity, a permanent change to property access, affecting one private property on the southern side of the New England Highway, loss of around 40 ha of land zoned IN3 – Heavy Industrial as part of the Whittingham Urban Release Area and an increase of the scale and dominance of the road corridor through construction of the flyover. However, a biodiversity offset strategy and provision of an aerial fauna crossing would help offset some of this loss, and impacts to property can be justified on the basis of improved overall travel and accessibility.

Overall the proposal is justified on the basis that it would help reduce existing congestion and delays experienced at the New England Highway and Golden Highway intersection, improve road safety and provide for effective network performance in consideration of future traffic forecasts.
### 8.2 Objects of the EP&A Act

#### Table 8-1: Objects of the EP&A Act

<table>
<thead>
<tr>
<th>Object</th>
<th>Comment</th>
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</thead>
<tbody>
<tr>
<td>5(a)(i) To encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.</td>
<td>The proposal encourages proper management, development and conservation of the natural and artificial resources within the proposal area and surrounding land. Furthermore the proposal would improve social and economic welfare of the community through improvements to road safety and user efficiencies.</td>
</tr>
<tr>
<td>5(a)(ii) To encourage the promotion and co-ordination of the orderly economic use and development of land.</td>
<td>The proposal promotes the orderly economic use and development of the land within the proposal area.</td>
</tr>
<tr>
<td>5(a)(iii) To encourage the protection, provision and co-ordination of communication and utility services.</td>
<td>The proposal promotes the protection of services within the proposal area.</td>
</tr>
<tr>
<td>5(a)(iv) To encourage the provision of land for public purposes.</td>
<td>Not relevant to the proposal</td>
</tr>
<tr>
<td>5(a)(v) To encourage the provision and co-ordination of community services and facilities.</td>
<td>Not relevant to the proposal</td>
</tr>
<tr>
<td>5(a)(vi) To encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.</td>
<td>This REF identifies safeguards and management measures to mitigate potential environmental impacts within the proposal area, including biodiversity, as outlined in Section 7.2.</td>
</tr>
<tr>
<td>5(a)(vii) To encourage ecologically sustainable development.</td>
<td>Ecologically sustainable development is considered in Sections 8.2.1 – 8.2.4 below.</td>
</tr>
<tr>
<td>5(a)(viii) To encourage the provision and maintenance of affordable housing.</td>
<td>Not relevant to the proposal</td>
</tr>
<tr>
<td>5(b) To promote the sharing of the responsibility for environmental planning between different levels of government in the State.</td>
<td>Not relevant to the proposal</td>
</tr>
<tr>
<td>5(c) To provide increased opportunity for public involvement and participation in environmental planning and assessment.</td>
<td>Community and stakeholder consultation for the proposal is described in Section 5.</td>
</tr>
</tbody>
</table>
8.2.1 The precautionary principle
The precautionary principle refers to the principle that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

This REF has been prepared using the precautionary principle and appropriate mitigation measures are outlined to address all potential impacts identified for the proposal.

8.2.2 Intergenerational equity
Intergenerational equity refers to the principle that 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 impact on the health, diversity and productivity of the local environment or communities in a way that would disadvantage future generations.

8.2.3 Conservation of biological diversity and ecological integrity
This means conserving the diversity of flora and fauna and the health and sustainability of ecosystems.

A biodiversity assessment was carried out to consider potential impacts and develop appropriate mitigation measures as outlined in Section 6.1. The proposal would result in loss of around 11.23 ha of threatened vegetation under the TSC Act and 8.20 ha of threatened vegetation under the EPBC Act. The proposal would also reduce habitat for a range of birds and mammals, including threatened species, in the locality and impact habitat connectivity. However, the mitigation measures identified, including a biodiversity offset strategy and provision of an aerial fauna crossing, would help to offset this loss and conserve the diversity of flora and fauna and sustainability of ecosystems.

8.2.4 Improved valuation, pricing and incentive mechanisms
This means integrating long-term and short-term economic, environmental, social and fairness considerations into decision-making. This principle requires that environmental assets should be appropriately valued.

The REF has examined the potential environmental outcomes of the proposal and where necessary, Roads and Maritime has adopted mitigation measures to address the potential impacts of the proposal. In doing so, Roads and Maritime accept the increase in capital and operating costs. This represents an appropriate valuation of environmental resources and effective use of financial resources.

8.3 Conclusion
The proposal is subject to assessment under Part 5 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. This has included consideration (where relevant) of conservation agreements and plans of management under the NPW Act, joint management and biobanking agreements under the TSC Act, wilderness areas, critical habitat, impacts on threatened species, populations and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the Commonwealth 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 this REF, best meets the project objectives but would still result in some permanent impacts to biodiversity and Aboriginal heritage and temporary impacts to the local amenity. Safeguards and
management measures as detailed in this REF would reduce these expected impacts. The proposal would also reduce peak period delays at the New England Highway and Golden Highway intersection, improve road safety along the New England Highway between Belford and the Golden Highway, especially at the intersection with the Golden Highway, improve average peak hour travel times on the New England Highway and support growth in the Hunter region through improved freight movements and road user connections.

On balance the proposal is considered justified and the following conclusions are made.

**Significance of impact under NSW legislation**

The proposal is not be likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the *Threatened Species Conservation Act 1995* or *Fisheries Management Act 1994*. Therefore a Species Impact Statement and concurrence from the Chief Executive of the Office of Environment and Heritage is not required.

There would be no significant impact on any other aspect of the environment. Therefore it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Part 5.1 of the EP&A Act. The proposal is subject to assessment under Part 5 of the EP&A Act. Consent from Council is not required.

**Significance of impact under Australian legislation**

The proposal is likely to have a significant impact on threatened species, populations or ecological communities or migratory species, within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*. This REF has considered the consistency of the activity with relevant recovery plans, threat abatement plans, conservation advices and guidelines provided by the Australian Government. This REF finds that the activity will not threaten the long term survival of nationally listed biodiversity matters and that suitable offset measures can be secured as set out in a Biodiversity Offset Strategy for the proposal.

This REF has been prepared to meet the requirements of the EPBC Act strategic assessment approval for Roads and Maritime Part 5 road activities. Therefore a referral to the Australian Department of the Environment is not required.
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.

Leah Howell  
Senior Consultant  
Arup  
Date: 27.6.17.

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

Philip Davidson  
A/Senior Project Development Manager  
Hunter Regional Project Officer  
Date: 27.6.2017

Bureau of Metrology 2017, *Climate statistics for Australian locations: Singleton STP*,


NSW Government 2008, *Singleton Local Environmental Plan 1996 (Amendment No 45)*,


NSW Government 2016a, *Golden Highway Corridor Strategy*,


Transport for NSW 2012, *NSW Long Term Transport Master Plan*,

**Terms and acronyms used in this REF**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAPT</td>
<td>APPT Limited telecommunications company</td>
</tr>
<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
</tr>
<tr>
<td>AFG</td>
<td>Aboriginal focus group</td>
</tr>
<tr>
<td>AHD</td>
<td>Australian Height Datum</td>
</tr>
<tr>
<td>AHIP</td>
<td>Aboriginal Heritage Impact Permit</td>
</tr>
<tr>
<td>AHIMS</td>
<td>Aboriginal Heritage Information Management System</td>
</tr>
<tr>
<td>AHMP</td>
<td>Aboriginal Heritage Management Plan</td>
</tr>
<tr>
<td>AM</td>
<td>Morning</td>
</tr>
<tr>
<td>AQMP</td>
<td>Air Quality Management Plan</td>
</tr>
<tr>
<td>AR5</td>
<td>Fifth Assessment Report of the UN IPCC</td>
</tr>
<tr>
<td>ARTC</td>
<td>Australian Rail Track Corporation</td>
</tr>
<tr>
<td>BCR</td>
<td>Benefit cost ratio</td>
</tr>
<tr>
<td>BS</td>
<td>British Standard</td>
</tr>
<tr>
<td>CCTV</td>
<td>Closed-circuit television</td>
</tr>
<tr>
<td>CEMP</td>
<td>Construction environmental management plan</td>
</tr>
<tr>
<td>CHAR</td>
<td>Cultural heritage assessment report</td>
</tr>
<tr>
<td>CLM Act</td>
<td><em>Contaminated Land Management Act 1997</em></td>
</tr>
<tr>
<td>CMA</td>
<td>Catchment Management Authority</td>
</tr>
<tr>
<td>CNVG</td>
<td>Roads and Maritime Construction Noise and Vibration Guideline</td>
</tr>
<tr>
<td>CO</td>
<td>Carbon monoxide</td>
</tr>
<tr>
<td>CO₂</td>
<td>Carbon dioxide</td>
</tr>
<tr>
<td>COP</td>
<td>Conference of the Parties to the 1992 UNFCCC</td>
</tr>
<tr>
<td>CP</td>
<td>Communication Plan</td>
</tr>
<tr>
<td>CSIRO</td>
<td>Commonwealth Scientific and Industrial Research Organisation</td>
</tr>
<tr>
<td>CTC</td>
<td>Community Technology Centre</td>
</tr>
<tr>
<td>DA</td>
<td>Development Application</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>dB</td>
<td>Decibel</td>
</tr>
<tr>
<td>DEC</td>
<td>Department of Environment and Conservation</td>
</tr>
<tr>
<td>DECC</td>
<td>Department of Environment and Climate Change</td>
</tr>
<tr>
<td>DIN</td>
<td>Deutsches Institut für Normung e.V.</td>
</tr>
<tr>
<td>DLWC</td>
<td>Department of Land and Water Conservation</td>
</tr>
<tr>
<td>DUAP</td>
<td>Department of Urban Affairs and Planning</td>
</tr>
<tr>
<td>DPI</td>
<td>Department of Primary Industries</td>
</tr>
<tr>
<td>EEC</td>
<td>Endangered ecological communities</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental impact assessment</td>
</tr>
<tr>
<td>EIS</td>
<td>Environmental impact statement</td>
</tr>
<tr>
<td>ENMM</td>
<td>Environmental Noise Management Manual</td>
</tr>
<tr>
<td>EP&amp;A Act</td>
<td><em>Environmental Planning and Assessment Act 1979</em></td>
</tr>
<tr>
<td>EPA</td>
<td>Environment Protection Agency</td>
</tr>
<tr>
<td>EPBC Act</td>
<td><em>Environment Protection and Biodiversity Conservation Act 1999</em></td>
</tr>
<tr>
<td>EPL</td>
<td>Environment protection licence</td>
</tr>
<tr>
<td>EPS</td>
<td>Environmental Property Services</td>
</tr>
<tr>
<td>ESCP</td>
<td>Erosion and sediment control plan</td>
</tr>
<tr>
<td>ESD</td>
<td>Ecologically sustainable development</td>
</tr>
<tr>
<td>FBA</td>
<td>Framework for Biodiversity Assessment</td>
</tr>
<tr>
<td>FFMP</td>
<td>Flora and Fauna Management Plan</td>
</tr>
<tr>
<td>FM Act</td>
<td><em>Fisheries Management Act 1994</em></td>
</tr>
<tr>
<td>GHG</td>
<td>Greenhouse Gas</td>
</tr>
<tr>
<td>HMP</td>
<td>Non-Aboriginal Heritage Management Plan</td>
</tr>
<tr>
<td>Hunter RTP</td>
<td>Hunter Regional Transport Plan</td>
</tr>
<tr>
<td>ICNG</td>
<td><em>Interim Construction Noise Guideline</em></td>
</tr>
<tr>
<td>ID</td>
<td>Identification</td>
</tr>
<tr>
<td>INP</td>
<td><em>NSW Industrial Noise Policy</em></td>
</tr>
<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
</tr>
<tr>
<td>ISEPP</td>
<td><em>State Environmental Planning Policy (Infrastructure) 2007</em></td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>KNC</td>
<td>Kelleher Nightingale Consulting</td>
</tr>
<tr>
<td>kV</td>
<td>Kilovolt</td>
</tr>
<tr>
<td>LALC</td>
<td>Local Aboriginal Land Council</td>
</tr>
<tr>
<td>LCVIA</td>
<td>Landscape Character and Visual Impact Assessment</td>
</tr>
<tr>
<td>LCZ</td>
<td>Landscape character zone</td>
</tr>
<tr>
<td>LEP</td>
<td>Local Environmental Plan</td>
</tr>
<tr>
<td>LGA</td>
<td>Local government area</td>
</tr>
<tr>
<td>LTTMP</td>
<td><em>NSW Long Term Transport Master Plan</em></td>
</tr>
<tr>
<td>MP</td>
<td>Member of parliament</td>
</tr>
<tr>
<td>NAH</td>
<td>Non-aboriginal heritage</td>
</tr>
<tr>
<td>NBN Co Limited</td>
<td>National Broadband Network Co Limited telecommunications company</td>
</tr>
<tr>
<td>NEH</td>
<td>New England Highway</td>
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<tr>
<td>NCG</td>
<td>Noise Construction Guideline</td>
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<td>NMG</td>
<td>Noise Mitigation Guideline</td>
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<td>NML</td>
<td>Noise Management Level</td>
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<td>NPW Act</td>
<td><em>National Parks and Wildlife Act 1974</em></td>
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<td>NPV</td>
<td>Net present value</td>
</tr>
<tr>
<td>NVMP</td>
<td>Noise and Vibration Management Plan</td>
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<tr>
<td>OEH</td>
<td>Office of Environment</td>
</tr>
<tr>
<td>PACHCI</td>
<td><em>Procedure for Aboriginal cultural heritage consultation and investigation</em></td>
</tr>
<tr>
<td>PAD</td>
<td>Potential archaeological deposit</td>
</tr>
<tr>
<td>PEMP</td>
<td>Project Environmental Management Plan</td>
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<td>PM</td>
<td>Afternoon</td>
</tr>
<tr>
<td>POEO Act</td>
<td><em>Protection of the Environment Operations Act 1997</em></td>
</tr>
<tr>
<td>RBL</td>
<td>Rating background level</td>
</tr>
<tr>
<td>Rebuilding NSW</td>
<td><em>Rebuilding NSW: State Infrastructure Strategy 2014</em></td>
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<td>REF</td>
<td>Review of Environmental Factors</td>
</tr>
<tr>
<td>RNP</td>
<td><em>NSW Road Noise Policy</em></td>
</tr>
<tr>
<td>Roads Act</td>
<td><em>Roads Act 1993</em></td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Roads and Maritime</td>
<td>Roads and Maritime Services</td>
</tr>
<tr>
<td>SEPP</td>
<td>State Environmental Planning Policy</td>
</tr>
<tr>
<td>SEPP 44</td>
<td>State Environmental Planning Policy No 44 – Koala Habitat Protection</td>
</tr>
<tr>
<td>SHR</td>
<td>State Heritage Register</td>
</tr>
<tr>
<td>SMP</td>
<td>Soil Management Plan</td>
</tr>
<tr>
<td>SIS</td>
<td>Species Impact Statement</td>
</tr>
<tr>
<td>TMP</td>
<td>Traffic management plan</td>
</tr>
<tr>
<td>TSC Act</td>
<td>Threatened Species Conservation Act 1995</td>
</tr>
<tr>
<td>VDV</td>
<td>Vibration dose value</td>
</tr>
<tr>
<td>WM Act</td>
<td>Water Management Act 2000</td>
</tr>
<tr>
<td>WMP</td>
<td>Waste Management Plan</td>
</tr>
</tbody>
</table>
Appendix A

Consideration of clause 228(2) factors and matters of national environmental significance
Clause 228(2) Checklist

In addition to the requirements of the *Is an EIS required?* guideline (DUAP 1995/1996) and the Roads and Related Facilities EIS Guideline (DUAP 1996) as detailed in the REF, the following factors, listed in clause 228(2) of the Environmental Planning and Assessment Regulation 2000, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a. Any environmental impact on a community?</strong></td>
<td></td>
</tr>
<tr>
<td>Construction of the proposal would have a number of environmental impacts. The local community would experience changing traffic conditions, an altered visual amenity and noise and air quality impacts. Aboriginal archaeological sites would also be impacted. The management measures proposed in this REF would help reduce these impacts. Salvage of Aboriginal objects is expected to occur prior to construction, under the provision of a project AHIP.</td>
<td>Short-term negative impacts</td>
</tr>
<tr>
<td>The proposal would remove around 27.73 ha of vegetation listed as threatened under the TSC Act and EPBC Act, as well as reduce the habitat available for a range of birds and mammals.</td>
<td>Long-term negative impacts</td>
</tr>
<tr>
<td>The proposal would reduce existing congestion and delays experienced at the New England Highway / Golden Highway intersection, improve road safety and provide for effective network performance in consideration of future traffic forecasts.</td>
<td>Long-term positive impacts</td>
</tr>
<tr>
<td><strong>b. Any transformation of a locality?</strong></td>
<td></td>
</tr>
<tr>
<td>The proposal would have some minor visual, air and noise amenity impacts during construction. The management measures proposed in this REF would help reduce these impacts.</td>
<td>Short-term negative impacts</td>
</tr>
<tr>
<td>The proposal would result in the permanent removal of around 27.73 ha of vegetation. Around 40 ha of land zoned Heavy Industrial as part of the Whittingham Urban Release Area would be acquired and the scale and dominance of the road corridor in the locality would be increased through construction of the flyover and duplication of the New England Highway. The Whittingham rest area would also be removed by the project.</td>
<td>Long-term negative impacts</td>
</tr>
<tr>
<td><strong>c. Any environmental impact on the ecosystems of the locality?</strong></td>
<td></td>
</tr>
<tr>
<td>The proposal would result in the loss of around 11.23 ha of threatened vegetation under the TSC Act and 8.20 ha of threatened vegetation under the EPBC Act. The proposal would also reduce habitat for a range of birds and mammals, including threatened species, in the locality and impact habitat connectivity. However, the mitigation measures identified, including a biodiversity offset strategy and provision of an aerial fauna crossing, would help to offset this loss and conserve the diversity of flora and fauna and sustainability of ecosystems.</td>
<td>Nil</td>
</tr>
<tr>
<td>Factor</td>
<td>Impact</td>
</tr>
<tr>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>d. Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?</td>
<td>Short-term negative impacts</td>
</tr>
<tr>
<td>The proposal would have some temporary adverse impacts on local aesthetic values during construction. Aboriginal archaeological sites of moderate scientific value would also be impacted. The management measures proposed in this REF would help reduce these impacts. Salvage of Aboriginal objects is expected to occur prior to construction, under the provision of a project AHIP. The proposal would also result in the permanent removal of around 11.23 ha of threatened vegetation under the TSC Act and 8.20 ha of threatened vegetation under the EPBC Act. However, the mitigation measures identified, including a biodiversity offset strategy, would help to offset this loss. The Whittingham rest area would also be removed by the project, however other light and heavy vehicle rest areas are located around 10 kilometres away.</td>
<td>Long-term negative impacts</td>
</tr>
<tr>
<td>e. Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations?</td>
<td>Long-term negative impacts</td>
</tr>
<tr>
<td>As above, the proposal would result in impact to Aboriginal archaeological sites of moderate scientific value. However, salvage of Aboriginal objects is prior to construction would help to conserve the science associated with these site.</td>
<td></td>
</tr>
<tr>
<td>f. Any impact on the habitat of protected fauna (within the meaning of the National Parks and Wildlife Act 1974)?</td>
<td>Long-term negative impacts</td>
</tr>
<tr>
<td>The proposal would remove around 27.73 ha of habitat for a range of birds and mammals, including the Squirrel Glider listed as threatened under the TSC Act. However, this is considered unlikely to result in an adverse effect on the lifecycle of the Squirrel Glider such that a viable local population is placed at risk of extinction. This is primarily due to the extensive habitat that extends to the north and south of the proposal. Mitigation measure, such as the construction of an aerial fauna crossing, would help mitigate any impacts to the lifecycle of the Squirrel Glider.</td>
<td></td>
</tr>
<tr>
<td>g. Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?</td>
<td>Nil</td>
</tr>
<tr>
<td>It is considered unlikely that the proposal would have an adverse effect on the lifecycle of any of the six threatened species recorded in the study area.</td>
<td></td>
</tr>
<tr>
<td>Factor</td>
<td>Impact</td>
</tr>
<tr>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>h. Any long-term effects on the environment?</td>
<td>Long-term negative impacts</td>
</tr>
<tr>
<td>The proposal would impact Aboriginal archaeological sites of moderate scientific value. However, salvage of Aboriginal objects is prior to construction would help to conserve the science associated with these sites. The proposal would also remove around 27.73 ha of vegetation listed as threatened under the TSC Act and EPBC Act and reduce the habitat available for a range of birds and mammals. However a biodiversity offset strategy would help to offset this loss.</td>
<td></td>
</tr>
<tr>
<td>i. Any degradation of the quality of the environment?</td>
<td>Short-term negative impacts</td>
</tr>
<tr>
<td>The proposal would have temporary environmental impacts during construction associated with changed traffic conditions, noise and air emissions and visual amenity impacts. These impacts are anticipated to be minor and not likely to result in degradation of the quality of the environment. The proposal would not affect the quality of the environment during operation.</td>
<td></td>
</tr>
<tr>
<td>j. Any risk to the safety of the environment?</td>
<td>Short-term negative impacts</td>
</tr>
<tr>
<td>During construction, the proposal may require the transportation and storage of hazardous or contaminated materials in limited quantities. These materials would be managed in accordance with the mitigation measures proposed in this REF. The potential risk to the safety of the environment would be minor and limited to the construction period. The proposal would improve the current road safety, especially at the New England Highway / Golden Highway intersection.</td>
<td></td>
</tr>
<tr>
<td>k. Any reduction in the range of beneficial uses of the environment?</td>
<td>Long-term neutral impacts</td>
</tr>
<tr>
<td>The proposal requires acquisition of around 40 ha of land zoned as Heavy Industrial as part of the Whittingham Urban Release Area. This would reduce the land available for development as part of an industrial estate. However, the proposal would also contribute to improved accessibility to this precinct. The Whittingham rest area would also be removed by the project, however other light and heavy vehicle rest areas are located around 10 kilometres away.</td>
<td></td>
</tr>
<tr>
<td>l. Any pollution of the environment?</td>
<td>Short-term negative impacts</td>
</tr>
<tr>
<td>Construction of the proposal would result in dust generation and air and noise emissions from machinery and construction vehicles. The management measures proposed in this REF would help reduce these impacts. During operation, pollution would largely be consistent with the current use.</td>
<td></td>
</tr>
</tbody>
</table>

Appendix A
<table>
<thead>
<tr>
<th>Factor</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>m. Any environmental problems associated with the disposal of waste?</td>
<td>Short-term negative impacts</td>
</tr>
<tr>
<td>During construction, a number of waste streams would be produced by</td>
<td>Long-term neutral impacts</td>
</tr>
<tr>
<td>the proposal. Waste would be classified to identify suitable recycling</td>
<td></td>
</tr>
<tr>
<td>and safe disposal methods in accordance with Roads and Maritime</td>
<td></td>
</tr>
<tr>
<td>Environmental Procedure – Management of Wastes on Roads and Maritime</td>
<td></td>
</tr>
<tr>
<td>Services Land and the requirements of the Waste Classification</td>
<td></td>
</tr>
<tr>
<td>Guidelines.</td>
<td></td>
</tr>
<tr>
<td>During operation, waste generation is expected to be minimal and</td>
<td></td>
</tr>
<tr>
<td>consistent with the current use.</td>
<td></td>
</tr>
<tr>
<td>n. Any increased demands on resources (natural or otherwise) that are,</td>
<td>Nil</td>
</tr>
<tr>
<td>or are likely to become, in short supply?</td>
<td></td>
</tr>
<tr>
<td>The proposal is unlikely to affect any resources that are, or are</td>
<td></td>
</tr>
<tr>
<td>likely to become, in short supply.</td>
<td></td>
</tr>
<tr>
<td>o. Any cumulative environmental effect with other existing or likely</td>
<td>Short-term negative impacts</td>
</tr>
<tr>
<td>future activities?</td>
<td>Long-term positive impacts</td>
</tr>
<tr>
<td>There is potential for adverse cumulative impacts to occur during</td>
<td></td>
</tr>
<tr>
<td>construction of the project, including traffic, noise, air quality</td>
<td></td>
</tr>
<tr>
<td>and visual amenity impacts. These impacts would be short-term and</td>
<td></td>
</tr>
<tr>
<td>manageable. Further, all cumulative impacts can be justified by the</td>
<td></td>
</tr>
<tr>
<td>long-term positive impacts of the proposal.</td>
<td></td>
</tr>
<tr>
<td>p. Any impact on coastal processes and coastal hazards, including</td>
<td>Nil</td>
</tr>
<tr>
<td>those under projected climate change conditions?</td>
<td></td>
</tr>
<tr>
<td>The proposal would not impact coastal processes or coastal hazards,</td>
<td></td>
</tr>
<tr>
<td>including those under projected climate change conditions.</td>
<td></td>
</tr>
</tbody>
</table>
Matters of National Environmental Significance

Under the environmental assessment provisions of the *Environment Protection and Biodiversity Conservation Act 1999*, the following matters of national environmental significance and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of the Environment.

A referral is not required for proposed actions that may affect nationally listed threatened species, populations, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Any impact on a World Heritage property?</td>
<td>The proposal would not impact any World Heritage properties. Nil</td>
</tr>
<tr>
<td>b. Any impact on a National Heritage place?</td>
<td>The proposal would not impact any National Heritage places. Nil</td>
</tr>
<tr>
<td>c. Any impact on a wetland of international importance?</td>
<td>The proposal would not impact any wetlands of international importance. Nil</td>
</tr>
<tr>
<td>d. Any impact on a listed threatened species or communities?</td>
<td>The proposal would result in the clearing of around 8.2 ha of vegetation listed as an EEC under the EPBC Act. A biodiversity offset strategy would be prepared and implemented to help offset this loss. This REF has been prepared to meet the requirements of the EPBC Act strategic assessment approval for Roads and Maritime Part 5 road activities. Therefore a referral to the Australian Department of the Environment is not required. Nil</td>
</tr>
<tr>
<td>e. Any impacts on listed migratory species?</td>
<td>The White-throated Needletail migratory species was recorded in the study area and habitat considered potential for the other migratory species would be removed by the proposal. However, it is considered that the proposal would not result in any significant impact to migratory species. Nil</td>
</tr>
<tr>
<td>f. Any impact on a Commonwealth marine area?</td>
<td>The proposal would not impact a Commonwealth marine area. Nil</td>
</tr>
<tr>
<td>g. Does the proposal involve a nuclear action (including uranium mining)?</td>
<td>The proposal does not involve nuclear action. Nil</td>
</tr>
</tbody>
</table>

Additionally, any impact (direct or indirect) on Commonwealth land?

The proposal would not impact on Commonwealth land. Nil