

# Newell Highway Heavy Duty Pavements, Narrabri to Moree

Review of Environmental Factors

Roads and Maritime Services | June 2018





# **Newell Highway Heavy Duty Pavements, Narrabri to Moree**


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Roads and Maritime Services | June 2018

Prepared by Jacobs and Roads and Maritime Services  
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## Approval and authorisation

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# Executive summary

## The proposal

Roads and Maritime Services (Roads and Maritime) proposes to carry out major road upgrades to five segments of the Newell Highway between Narrabri and Moree (the highway) in north west NSW, within the existing road corridor (the proposal).

The proposal forms part of the *Newell Highway Corridor Strategy* (Transport for NSW, 2015) to provide an efficient and sustainable corridor that caters for increasing growth and improves safety along the Newell Highway.

The proposal would be delivered in five segments with a combined length of about 33.8 kilometres of upgrades along the highway.

Key features of the proposal include:

- Upgrading and resurfacing five segments of the existing highway to a heavy duty (HD) pavement
- Road widening to provide 3.5 metre wide lanes and two metre shoulders
- Provision of one metre wide painted medians
- Provision of 1.5 kilometre long overtaking lanes at five locations (three northbound and two southbound)
- Upgrading of the existing intersections along the highway to dedicated right hand turn intersections, with additional left hand turn intersection treatments
- Provision of a central two-way right turn lane at Bellata
- Provision of three metre wide shoulders for 30 metres on either side of property accesses
- Improving the Newell Highway flood immunity to a minimum of five year average recurrence interval (ARI) where feasible and reasonable
- Property acquisitions as required
- Utility relocations as required
- Establishing temporary facilities, including construction compounds, stockpile sites and erosion and sedimentation measures within the road corridor as required.

## Need for the proposal

The section along the highway has substantial road surface and structural deficiencies. The road was built in the 1960s. Today, 98 per cent of the road along this section of the highway has a remaining life of 10 years or less. Due to its structural limitations, the road is also at heightened risk of surface failure caused by rainfall.

These road surface deficiencies, coupled with a strong freight demand, are affecting travel reliability and travel times for freight movements between Victoria and Queensland, as well as increasing maintenance costs and reducing road safety.

## Proposal objectives

The objectives of the proposal are:

- Reduce vehicle operating costs on the Newell Highway
- Reduce the costs of maintaining the Newell Highway

- Improve the safety of the Newell Highway
- Improve flood reliability of the Newell Highway
- Reduce travel times on the Newell Highway.

## Options considered

Roads and Maritime considered the following alternatives:

- Do nothing – business as usual
- Replace existing road with a heavy duty pavement entirely within the existing road corridor
- Replace existing road with a heavy duty pavement mostly within the existing road corridor, but with some new sections of road to ease curves.

Roads and Maritime found the cost of the do nothing alternative would be marginal when compared with the heavy duty pavement alternative, but it would not meet the proposal objectives. For this reason, it was no longer considered.

Providing a heavy duty pavement with new sections of road to ease curves would best meet the proposal objectives, and is therefore the preferred option.

## Statutory and planning framework

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

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

This review of environmental factors (REF) fulfils Roads and Maritime's obligations to consider the environmental impacts of the proposal under section 5.5 of the EP&A Act, and has been prepared in accordance with the provisions of clause 228 of the Environmental Planning and Assessment Regulation 2000. This REF also addresses the relevant considerations of the *Biodiversity Conservation Act 2016*, *Fisheries Management Act 1994*, *Heritage Act 1977*, *National Parks and Wildlife Act 1974*, and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

## Community and stakeholder consultation

A Communications and Engagement Plan (CEP) (Roads and Maritime, 2018) has been prepared for the development and delivery of the proposal. The CEP describes the communication and consultation approach and activities for the proposal. It also outlines the proposed communications approach to keep key stakeholders and the community informed during the development of the proposal.

Roads and Maritime also formally consulted with Narrabri Shire and Moree Plains Shire Councils in accordance with the requirements of the ISEPP.

Roads and Maritime invites comments on this REF. Submissions received during the public display period will be addressed in a formal submissions report and, if a decision is made to proceed with the proposal, will be considered during detailed design of the project.

## Environmental impacts

Roads and Maritime has engaged technical experts to assess the potential environmental impacts of the proposal and to identify mitigation and management measures. The key adverse impacts of the proposal are summarised below.

### ***Biodiversity***

The proposal would require the removal of about 47 hectares of native vegetation. This includes about eight hectares of state listed threatened ecological communities (TECs) and 16 hectares of nationally listed TECs. In many instances, the same patches of vegetation are part of both a state listed and a commonwealth listed TEC. An assessment of significance was carried out for threatened species and ecological communities that would be likely to occur in the proposal area. The assessments concluded that, the proposal would not have a significant impact on any species, population or TEC listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and NSW *Fisheries Management Act 1994* (FM Act)

However, the proposal may have a significant impact on two threatened species and a TEC listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The proposal would require the removal of 11 hectares of the TEC Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland TEC which is listed as a critically endangered ecological community under the EPBC Act.

In September 2015, a “strategic assessment” approval was granted by the Federal Minister in accordance with the EPBC Act. The approval applies to Roads and Maritime activities being assessed under Division 5.1 of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species. The strategic assessment approval means that most Roads and Maritime Division 5.1 activities do not require referral to the Department of the Environment and Energy provided that impacts are assessed using Commonwealth guidelines and the avoid, mitigate and offset hierarchy applied through project determinations. This is the case even if the activity is likely to have a significant impact.

Further assessment to confirm the presence of this community and species within the study area, and therefore the significance of the impact, would be carried out in consultation with the Department of the Environment and Energy if required. The outcomes of this assessment would be provided in the submissions report prepared for the proposal. If the proposal is confirmed to have a significant impact on this ecological community and these species described below, then the proposal would be subject to the EPBC Act strategic assessment approval.

Biodiversity impacts have been reduced through the adoption of a design and construction option that would affect less native vegetation. Impacts on threatened biodiversity would be avoided or further minimised through the design process and implementation of management and mitigation measures identified in the REF.

Biodiversity offsets would be required for residual impacts to threatened biodiversity in accordance with the EPBC Act strategic assessment approval and the Roads and Maritime Guideline for Biodiversity Offsets (2016).

### ***Noise and vibration***

During construction, there would be noise impacts at some nearby sensitive receivers where noise management levels (NMLs) are predicted to be exceeded. Most of these receivers where noise during some stages of construction may be in the moderate to high range are in the villages of Edgeroi and Bellata, where the proposed work is closest to sensitive receiver locations. Measures have been developed to mitigate and manage potential noise impacts during construction, including programming of activities generally within day time hours. Where activities involving vibration-generating equipment occur within the vicinity of residents and other sensitive areas, work methods have been developed to avoid the potential for

human discomfort and any building damage. Noise from additional traffic generated during construction was also assessed and determined to be negligible.

Regarding noise resulting from traffic along the upgraded road segments, levels would not be noticeably different from current noise levels and would not result in levels above the accepted noise criteria. The road surface would be improved as part of the upgrades which would improve wheel-road related noise emissions compared with existing conditions.

### **Aboriginal**

As part of Roads and Maritime's Stage 2 Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI), a survey of the study area was carried out in conjunction with three Aboriginal groups (Gomeri People Native Title Claim Group, Narrabri and Moree Local Aboriginal Land Councils). This survey found that the study area is largely disturbed due to the existing roadway and road shoulders. The survey identified a number of Aboriginal heritage items.

The assessment concluded that the construction of the proposal may impact on one potential archaeological deposit (PAD) (BC-HW17-PAD1). If during further development of the design impacts to items of Aboriginal heritage become unavoidable, further assessment in accordance with Stages 3 and 4 of PACHCI and an Aboriginal Heritage Impact Permit (AHIP) under the *National Parks and Wildlife Act 1974* would be required.

### **Socio-economic and property issues**

The proposal would require a strip acquisition of privately and publicly owned land. Affected properties would be partially acquired by Roads and Maritime and consultation would be carried out with any affected owners. This may result in the relocation or demolition of rural infrastructure. In addition, temporarily leases may be required, for the use as ancillary facilities during construction of the proposal.

During construction, temporary adverse changes in local amenity may be experienced by communities and businesses near the proposal due to increased noise, dust and construction traffic. The proposal may also require temporary changes to access and connectivity within the proposal area.

Once completed, the proposal would provide long-term positive impacts to access and connectivity for local communities, businesses and industry in the proposal area and wider region. Roads and Maritime would continue to consult with the community and stakeholders during development of the proposal.

### **Traffic and access**

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

The proposal would improve road safety and travel efficiency along the corridor by providing overtaking lanes, one metre wide painted medians, improved flood immunity and a new road surface.

## **Justification and conclusion**

The proposal is considered to be consistent with a number of relevant strategies and plans including:

- National Road Safety Strategy 2011–2020
- Melbourne–Brisbane Corridor Strategy: Building our National Transport Future
- NSW State Plan 2021: A Plan to Make NSW Number One

- NSW Long Term Transport Master Plan
- State Infrastructure Strategy
- NSW Freight and Ports Strategy
- NSW Road Safety Strategy 2012–2021
- New England North West Regional Transport Plan
- Newell Highway Corridor Strategy
- New England North West Strategic Regional Land Use Plan.

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

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 in accordance with Division 5.1 of the EP&A Act. The proposal would be unlikely to cause a significant impact on the environment. Accordingly, neither an environmental impact statement is required to be prepared, nor approval from the Minister for Planning under Division 5.2 of the EP&A Act.

While the proposal is likely to have a significant impact on matters of national environmental significance within the meaning of the EPBC Act, a referral to the Department of the Environment and Energy is not required, because requirements for considering impacts to these biodiversity matters are the subject of a strategic assessment approval granted under the EPBC Act by the Australian Government in September 2015.

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# 1. Introduction

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

## 1.1 Proposal identification

Roads and Maritime Services (Roads and Maritime) proposes to carry out major pavement upgrades to five segments of the Newell Highway between Narrabri and Moree (the highway) in north west NSW within the existing road corridor (the proposal).

The proposal is located in the Narrabri Shire and Moree Plains Shire Local Government Areas (LGAs).

The proposal forms part of the *Newell Highway Corridor Strategy* (Transport for NSW, 2015) to provide an efficient and sustainable corridor that caters for increasing growth and improves safety along the Newell Highway. The Newell Highway carries substantial freight volumes, large volumes of inter-regional and local freight traffic, and is increasingly catering for substantial volumes of tourist traffic. The strategy identified that a large portion of the northern section of the Newell Highway is nearing its end of life, with regular failures occurring with structural pavement, as well as large sections not meeting desired cross section dimensions.

Key features of the proposal include:

- Upgrading and resurfacing five segments of the existing highway to a heavy duty (HD) pavement
- Road widening to provide 3.5 metre wide lanes and two metre shoulders
- Provision of one metre wide painted medians
- Provision of 1.5 kilometre long overtaking lanes at five locations (three northbound and two southbound)
- Upgrading of the existing intersections along the Newell Highway to channelised right hand turn (CHR), with an axillary left hand turn (AUL) intersection treatments
- Provision of a central two-way right turn lane (TWRTL) at Bellata
- Provision of three metre wide shoulders for 30 metres on either side of property accesses
- Improving the Newell Highway flood immunity to a minimum of five year average recurrence interval (ARI) where feasible and reasonable
- Property acquisitions as required
- Utility relocations as required
- Temporary construction ancillary facilities, including construction compounds, stockpile sites and erosion and sedimentation measures within the road corridor as required.

The proposal would be delivered in five segments with a combined length of about 33.8 kilometres of upgrades along the highway. The five segments and indicative work locations are described in **Table 1-1**. Each segment would be staged to enable work to be completed safely while maintaining traffic flows at all times. Construction would generally involve building one carriageway at a time, and switching traffic between the carriageways to preserve traffic flows for the duration of

work. Further detail regarding the segments and construction staging of the proposal are provided in **Section 3.1** and **Section 3.3**, respectively.

**Table 1-1 Segment and proposed works**

| Segment | Location   | Proposed works  |
|---------|--|---|
| N2MS1   | 6.4 kilometres to 12.9 kilometres north of Narrabri                    | <ul style="list-style-type: none"> <li>Upgrading 6.5 kilometres of the Newell Highway</li> </ul>  |
| N2MS2   | 15.6 kilometres to 25.9 kilometres north of Narrabri at Edgeroi        | <ul style="list-style-type: none"> <li>Upgrading 10.3 kilometres of the Newell Highway</li> <li>Two overtaking lanes – northbound and southbound</li> </ul> |
| N2MS3   | 46.8 kilometres to 51.3 kilometres north of Narrabri at Bellata        | <ul style="list-style-type: none"> <li>Upgrading 4.5 kilometres of the Newell Highway</li> <li>One northbound overtaking lane</li> </ul>                    |
| N2MS4   | 52.4 kilometres to 58.3 kilometres north of Narrabri, north of Bellata | <ul style="list-style-type: none"> <li>Upgrading 5.9 kilometres of Newell Highway</li> </ul>  |
| N2MS5   | 88.4 kilometres to 96.3 kilometres north of Narrabri, south of Moree   | <ul style="list-style-type: none"> <li>Upgrading 7.9 kilometres of the Newell Highway</li> <li>Two overtaking lanes – northbound and southbound</li> </ul>  |

The location of the proposal is shown in **Figure 1-1** and an overview of the proposal is provided in **Figure 1-2**. Further detail regarding the description of the proposal is provided in **Chapter 3**.

## Definitions

The following terms are used in this review of environmental factors (REF):

- The ‘proposal’ refers to all the activities and ancillary sites associated with the pavement upgrade to the five segments of the highway
- The ‘proposal area’ refers to the area that would be directly impacted by the proposal. This is currently based on the 50 % design plus a variable construction buffer.
- The ‘study area’ refers to the proposal area and the wider area that may be indirectly impacted by the proposal
- The ‘survey area’ refers to the area that was surveyed during specialist site assessments.

### 1.1.1 Locality

As shown **Figure 1-1**, the proposal is located between Narrabri and Moree. The Newell Highway provides an essential connection for western NSW and a vital transport corridor between Victoria and Queensland. The proposal is located within both the Narrabri Shire and Moree Plains Shire LGAs.

The area surrounding the proposal is characterised by a rural environment which is predominately cleared of native vegetation. However, there are still areas of remnant native vegetation within and around the proposal area. Within the areas of remnant native vegetation, a number of Plant Community Types (PCTs) identified were consistent with threatened ecological communities (TECs) listed under the *Biodiversity Conservation Act 2016* (BC Act) and the *Environment*

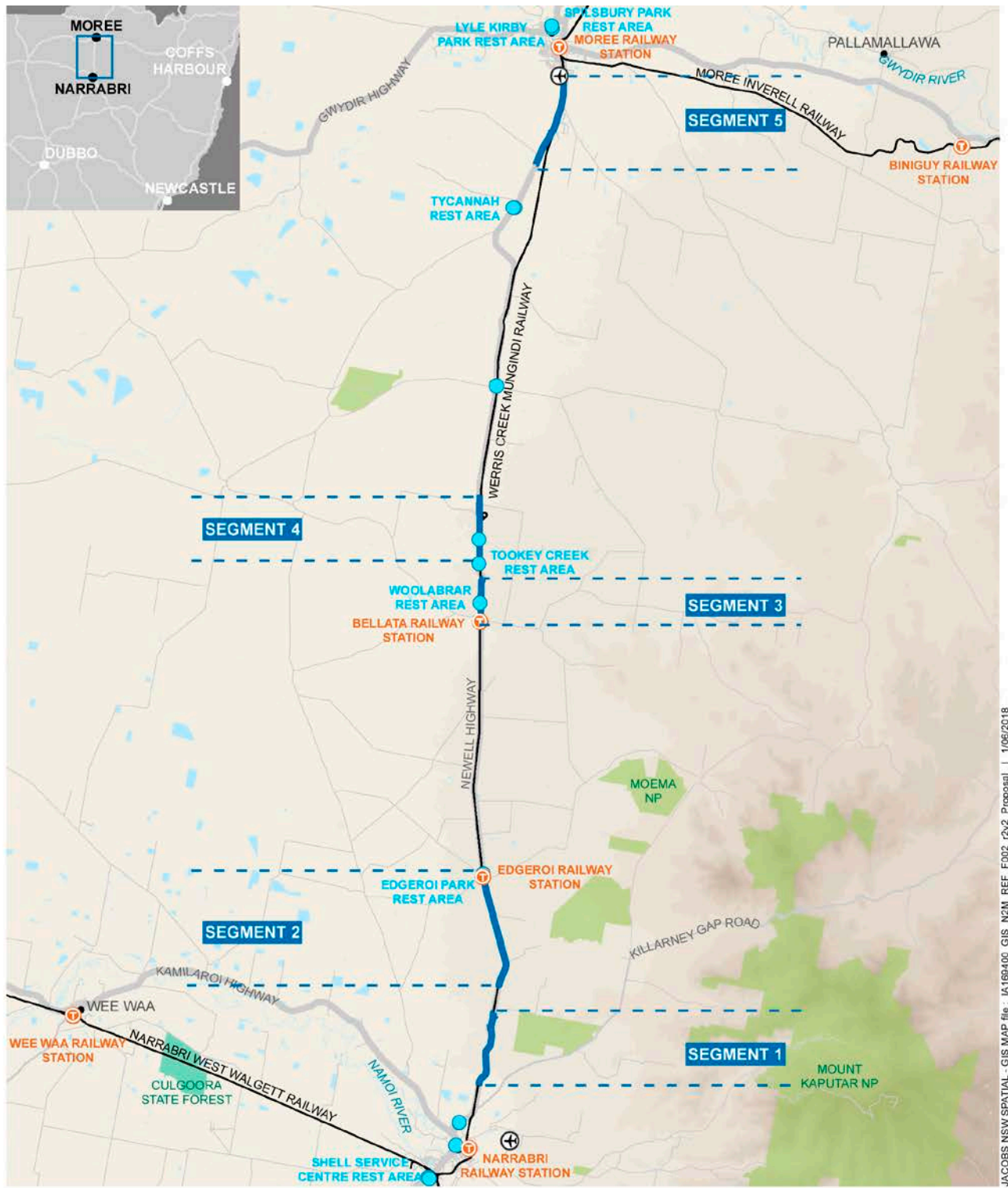
*Protection and Biodiversity Conservation Act 1999* (EPBC Act). There are also four Aboriginal heritage archaeological sites are located within or near to the proposal area.

The environmental constraints for the proposal are shown on **Figure 1-3**.

### 1.1.2 Timeframe and cost estimate

Construction of the proposal is anticipated to start in 2020 and be completed in 2022. The proposal would be delivered in stages, depending on funding arrangements.

The announced cost for the proposal is \$95 million. The overall Newell Highway upgrade program is \$500 million.



JACOBS NSW SPATIAL - GIS MAP file : IA169400\_GIS\_NZM\_REF\_F002\_Pv2\_Proposal | 1/06/2018

**Legend**

- The proposal
- Roadside rest area
- ⊕ Airport
- Ⓣ Train station
- Railway



**Figure 1-1 Location of the proposal**





JACOBS NSW SPATIAL - GIS MAP file - IA169400\_GIS\_N2M\_REF\_F007\_ov1\_Design\_Segment1 | 31/05/2018

— The proposal    ●●●● Railway line  
 — Waterway

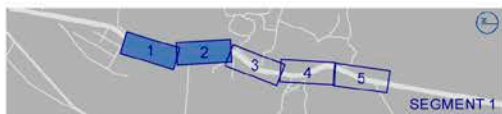
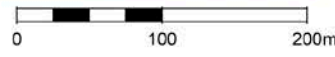


Figure 1-2 The proposal N2M S1, Page 1





JACOBS NSW SPATIAL - GIS MAP file - IA169400\_GIS\_N2M\_REF\_F007\_2v1\_Design\_Segment1 | 31/05/2018

— The proposal    ●●●● Railway line  
 — Waterway

0 100 200m

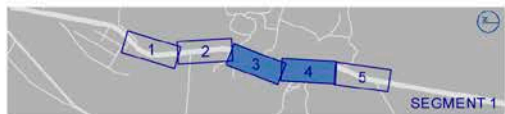
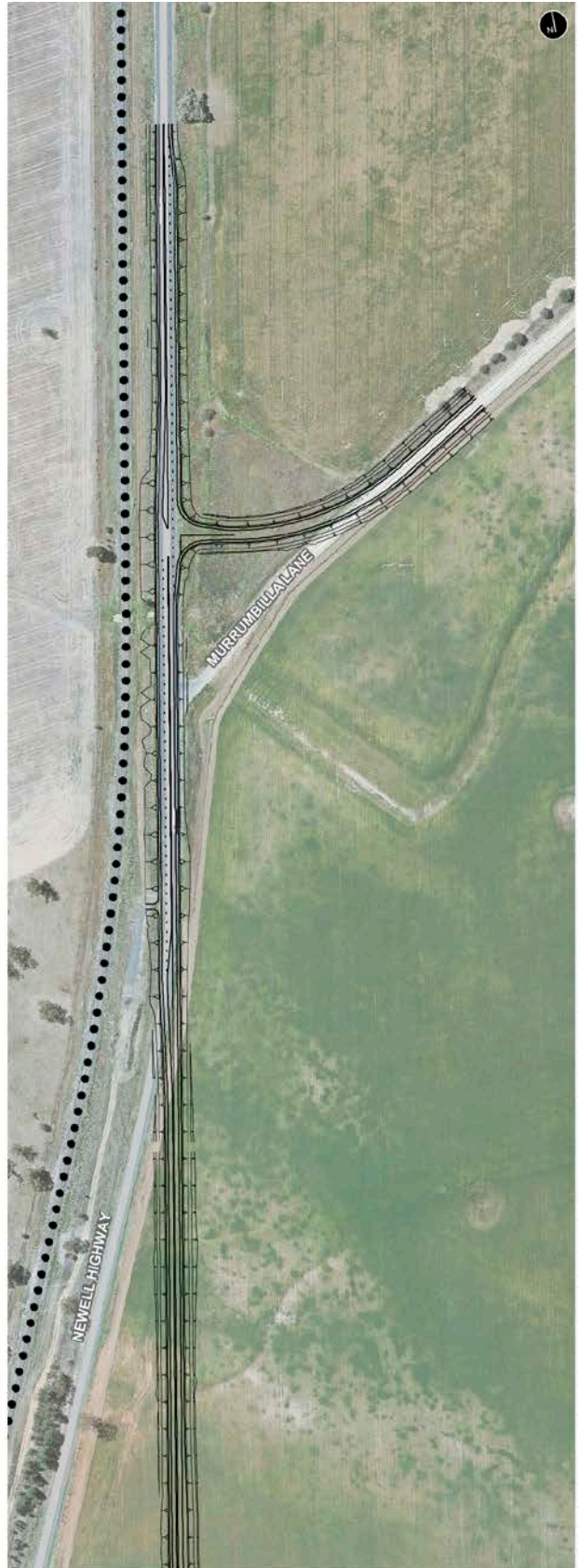


Figure 1-2 The proposal N2M S1, Page 2





JACOBS NSW SPATIAL - GIS MAP file - IA169400\_GIS\_N2M\_REF\_F007\_zv1\_Design\_Segment1 | 31/05/2018

— The proposal    ●●●● Railway line  
 — Waterway

0      100      200m

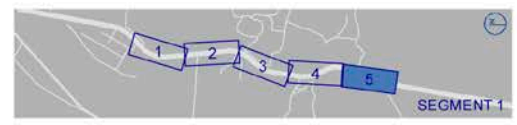


Figure 1-2 The proposal N2M S1, Page 3





JACOBS NSW SPATIAL - GIS MAP file - IA189400\_GIS\_N2M\_REF\_F007\_2v1\_Design\_Segment2 | 31/05/2018

— The proposal    ●●●● Railway line  
 — Waterway

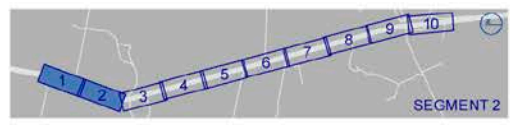
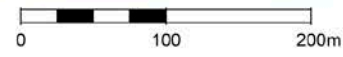
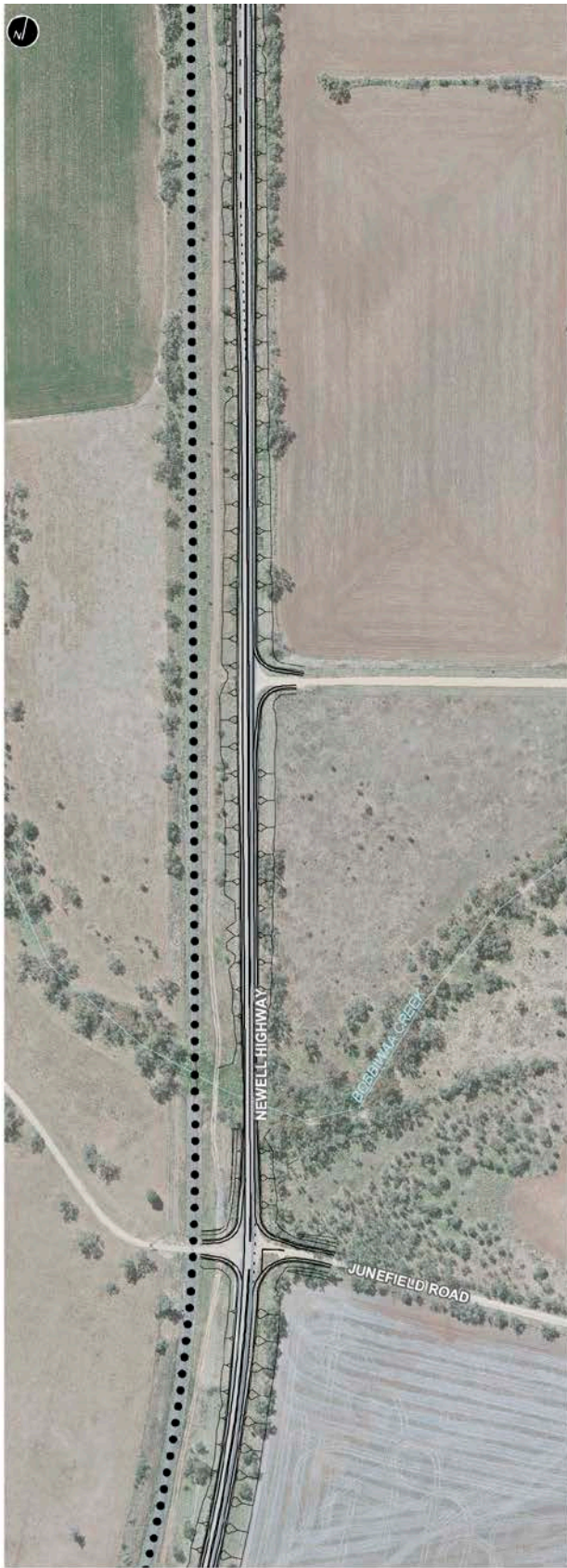


Figure 1-2 The proposal N2M S2, Page 1





JACOBS NSW SPATIAL - GIS MAP file - IA169400\_GIS\_N2M\_REF\_F007\_2v1\_Design\_Segment2 | 31/05/2018

— The proposal    ●●●● Railway line  
 — Waterway

0                      100                      200m

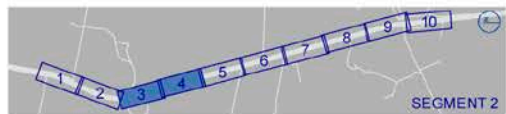


Figure 1-2 The proposal N2M S2, Page 2





JACOBS NSW SPATIAL - GIS MAP file - IA189400\_GIS\_N2M\_REF\_F007\_2v1\_Design\_Segment2 | 31/05/2018

— The proposal    ●●●● Railway line  
 — Waterway

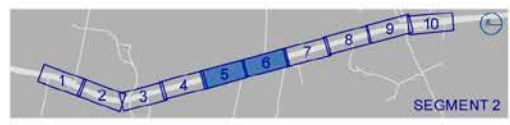
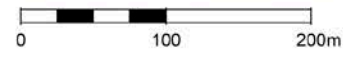


Figure 1-2 The proposal N2M S2, Page 3





Figure 1-2 The proposal N2M S2, Page 4





JACOBS NSW SPATIAL - GIS MAP file - I\169400\_GIS\_N2M\_REF\_F107\_Pv1\_Design\_Segment2 | 31/05/2018

— The proposal    ●●●● Railway line  
 — Waterway

0 100 200m

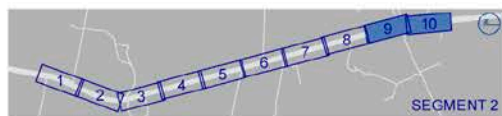
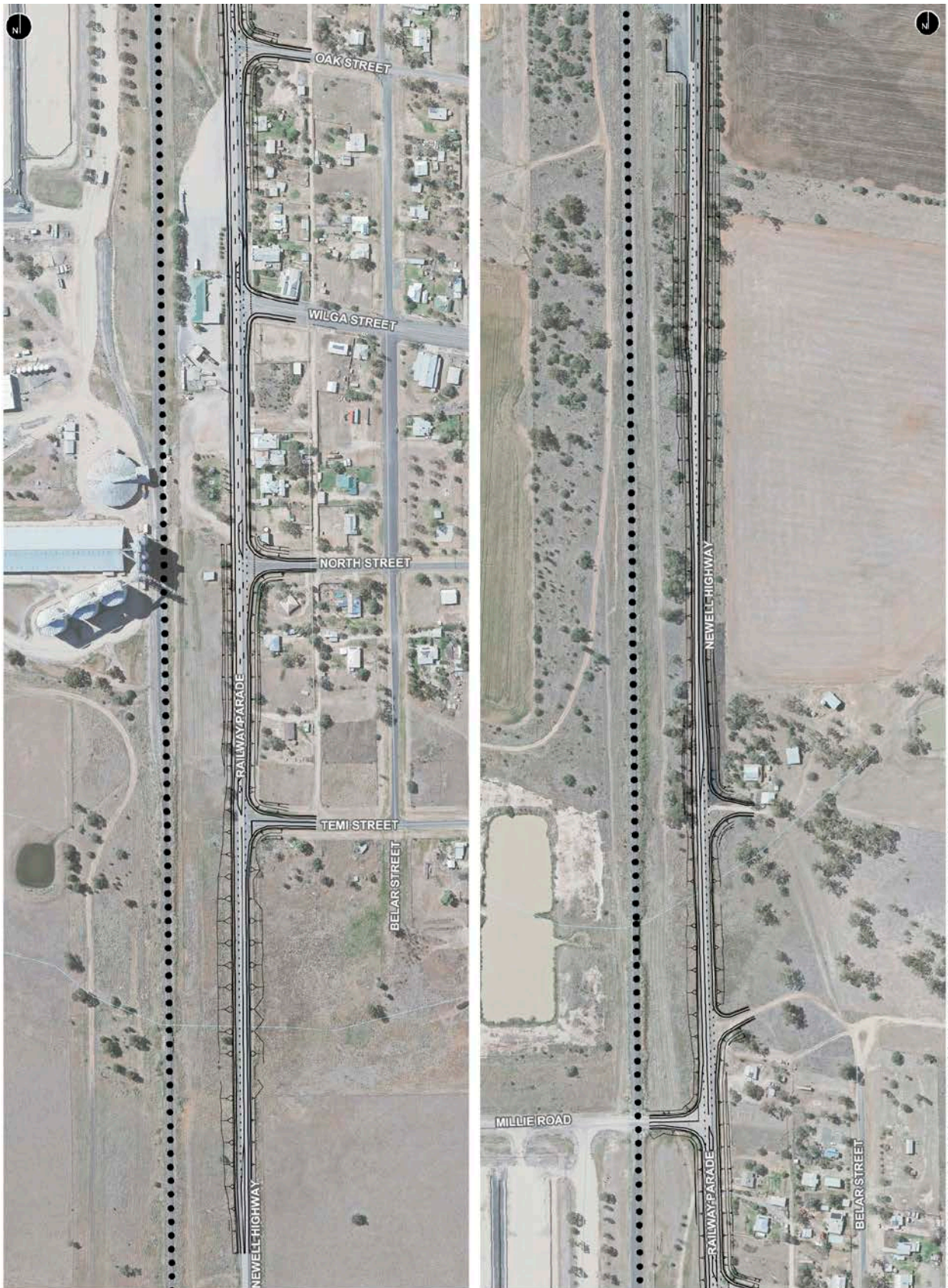


Figure 1-2 The proposal N2M S2, Page 5





JACOBS NSW SPATIAL - GIS MAP file - IA169400\_GIS\_N2M\_REF\_F007\_2v1\_Design\_Segment3 | 31/05/2018

— The proposal    ●●●● Railway line  
 — Waterway

0 100 200m

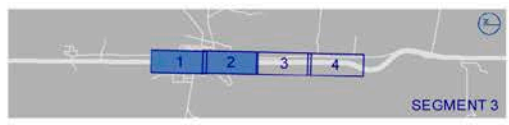


Figure 1-2 The proposal N2M S3, Page 1





JACOBS NSW SPATIAL - GIS MAP file - IA169400\_GIS\_N2M\_REF\_F007\_2v1\_Design\_Segment3 | 31/05/2018

— The proposal    ●●●● Railway line  
 — Waterway

0                      100                      200m

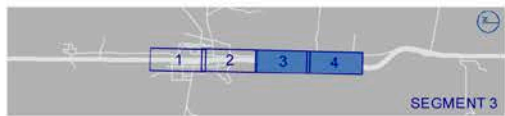


Figure 1-2 The proposal N2M S3, Page 2



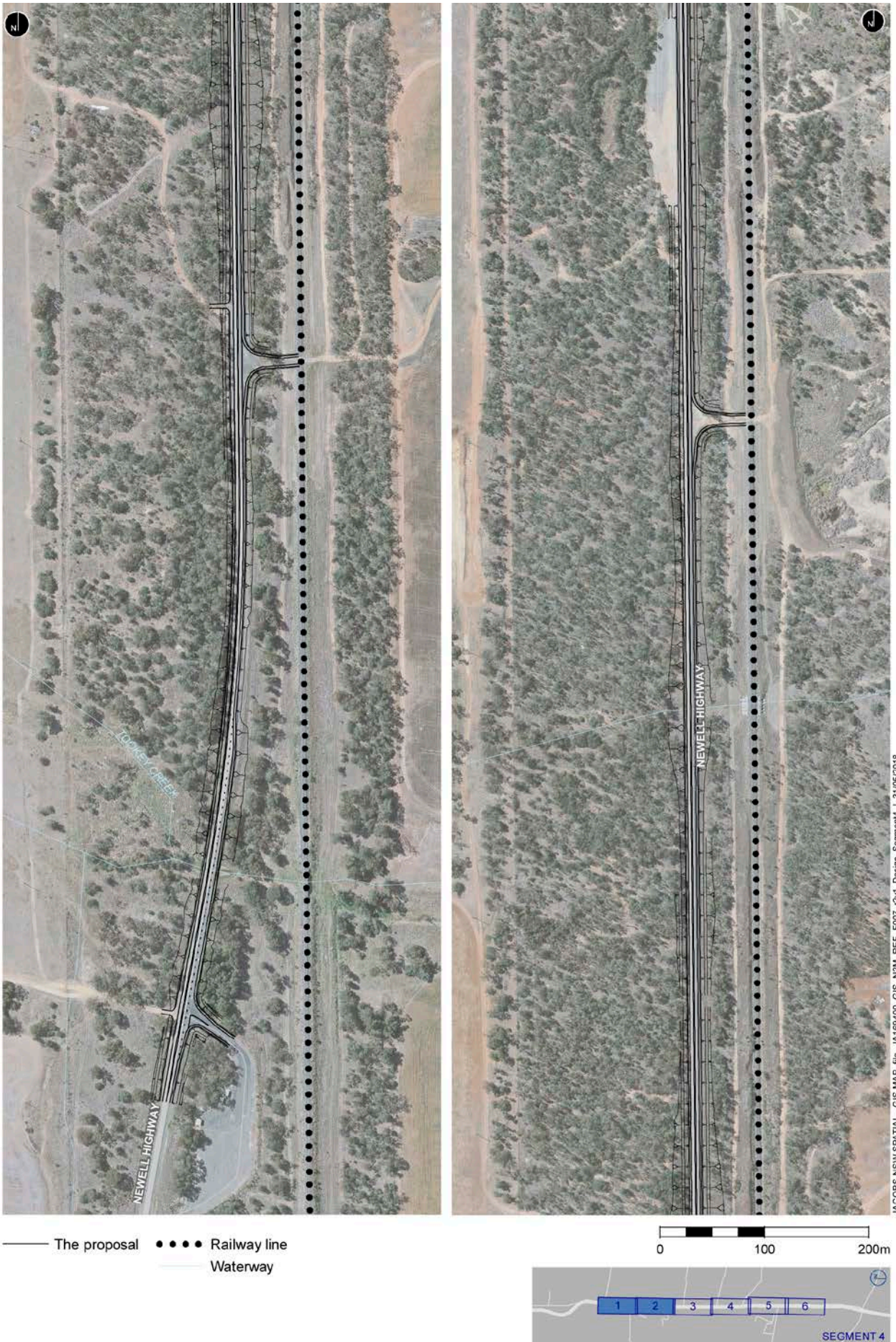
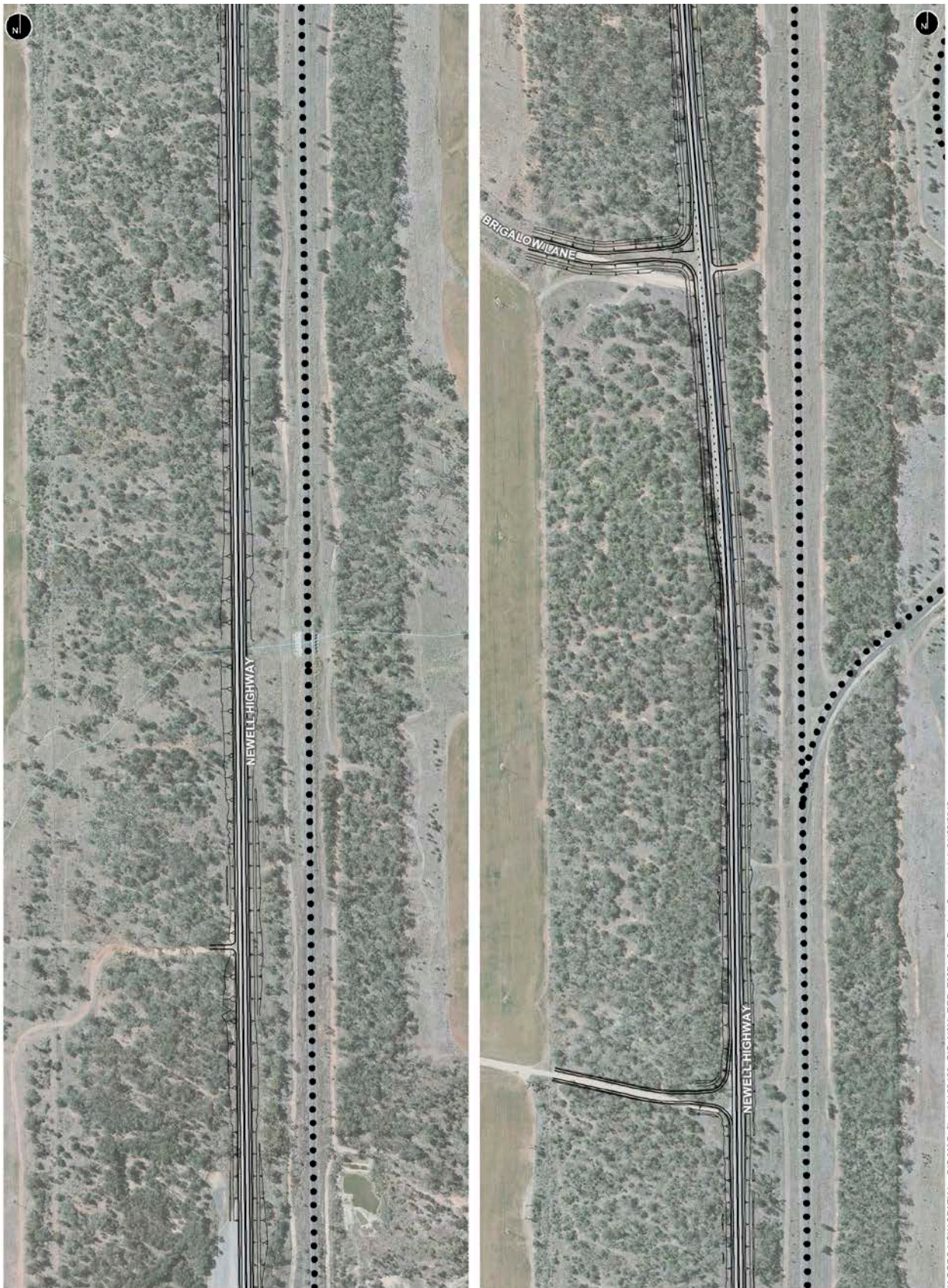


Figure 1-2 The proposal N2M S4, Page 1

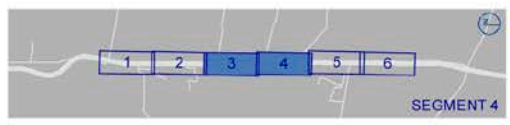




The proposal  
 

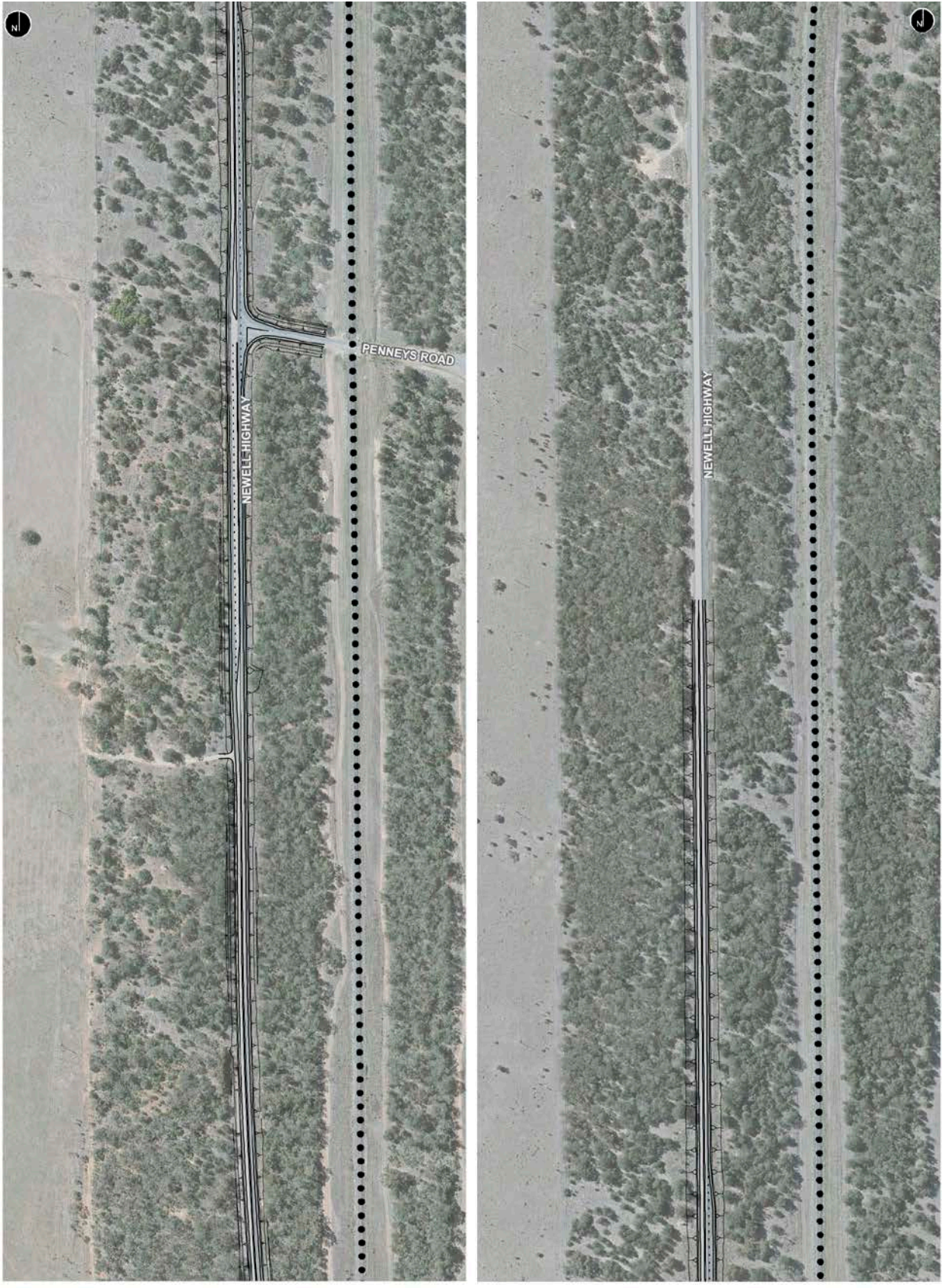

 Railway line  
 Waterway

0 100 200m



**Figure 1-2 The proposal N2M S4, Page 2**





JACOBS NSW SPATIAL - GIS MAP file - IA189400\_GIS\_N2M\_REF\_F007\_2v1\_Design\_Segment4 | 31/05/2018

— The proposal    ●●●● Railway line  
 — Waterway

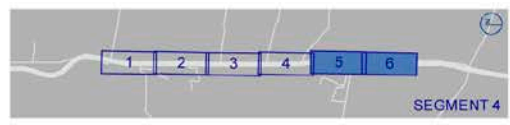
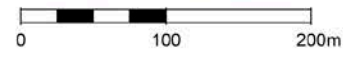


Figure 1-2 The proposal N2M S4, Page 3





JACOBS NSW SPATIAL - GIS MAP file - IA169400\_GIS\_N2M\_REF\_F007\_2v1\_Design\_Segments | 31/05/2018

— The proposal    - - - - Railway line  
 — Waterway

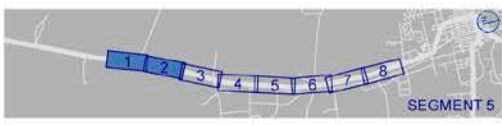
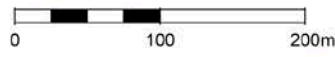
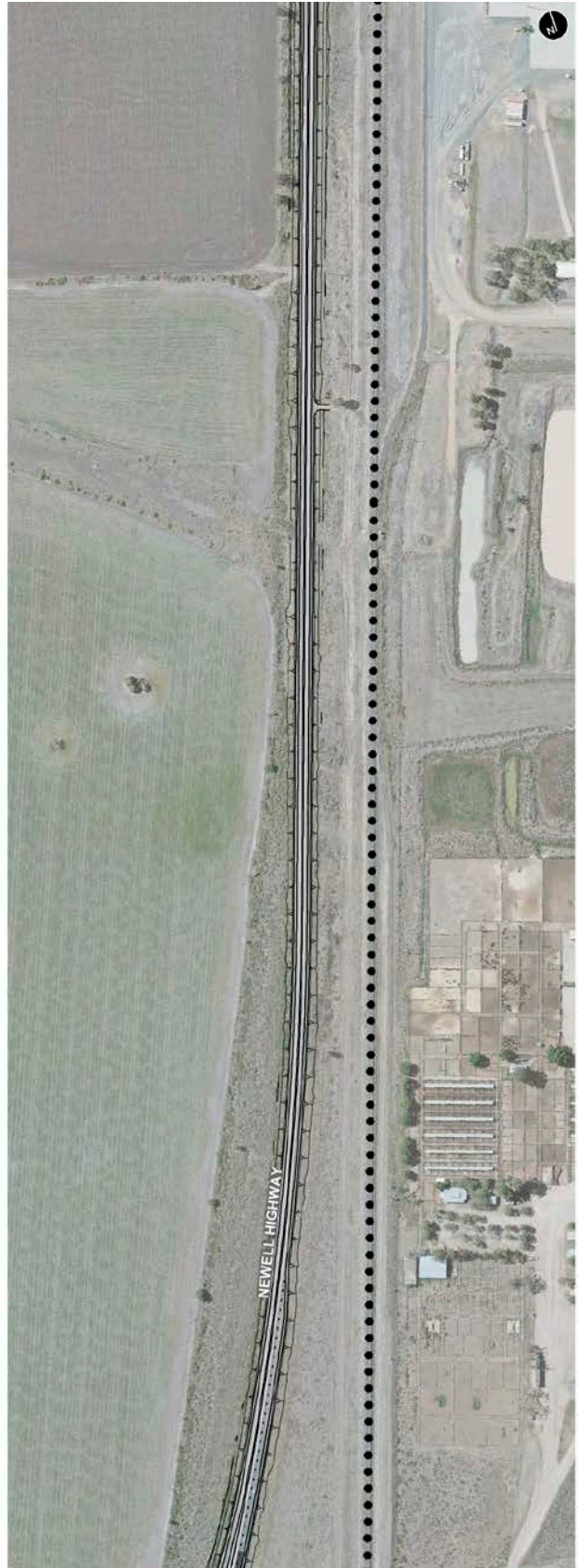
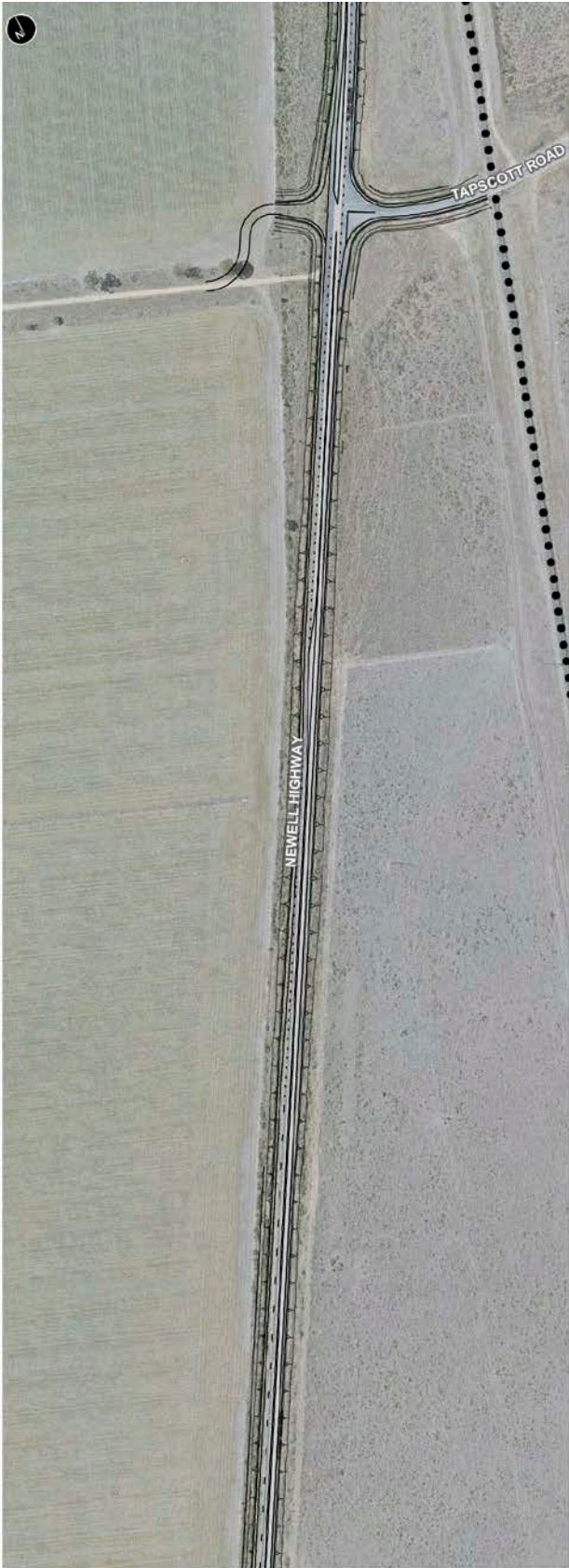


Figure 1-2 The proposal N2M S5, Page 1





JACOBS NSW SPATIAL - GIS MAP file - IA169400\_GIS\_N2M\_REF\_F007\_zv1\_Design\_Segments | 31/05/2018

— The proposal    •••• Railway line  
 — Waterway

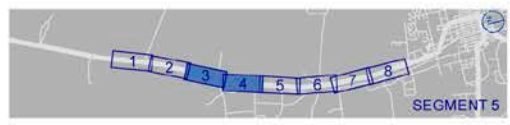
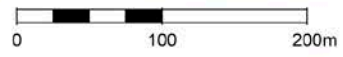
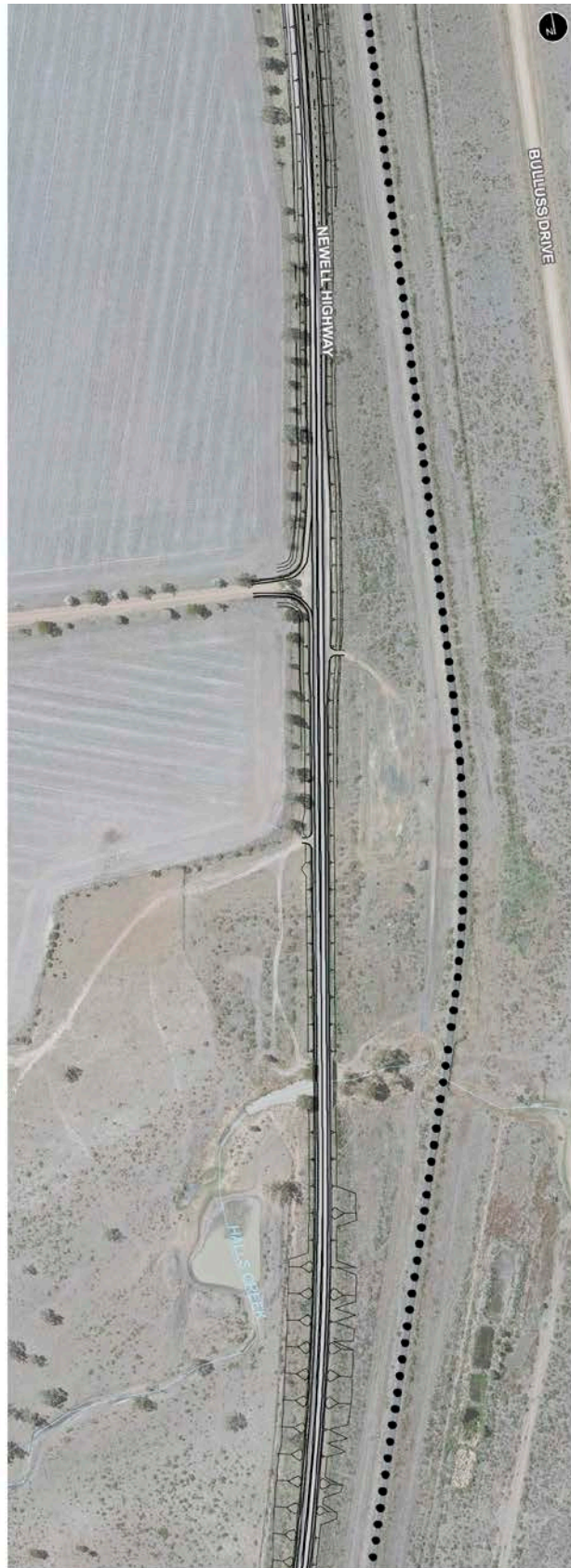


Figure 1-2 The proposal N2M S5, Page 2





JACOBS NSW SPATIAL - GIS MAP file - IA169400\_GIS\_N2M\_REF\_F007\_Cv1\_Design\_Segment5 | 31/05/2018

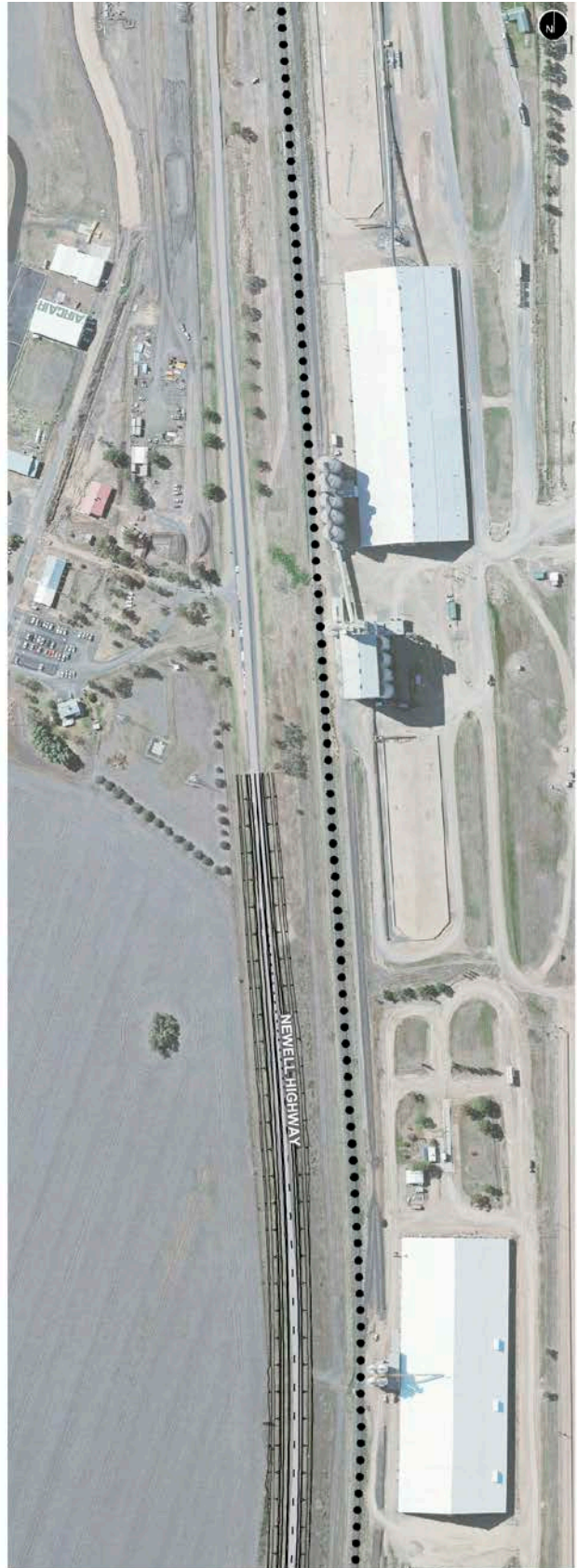
— The proposal    ●●●● Railway line  
 — Waterway

0 100 200m



Figure 1-2 The proposal N2M S5, Page 3





JACOBS NSW SPATIAL - GIS MAP file - IA189400\_GIS\_N2M\_REF\_F007\_2v1\_Design\_Segments5 | 31/05/2018

— The proposal    ●●●● Railway line  
 — Waterway

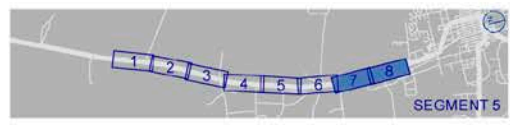
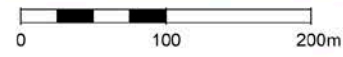


Figure 1-2 The proposal N2M S5, Page 4



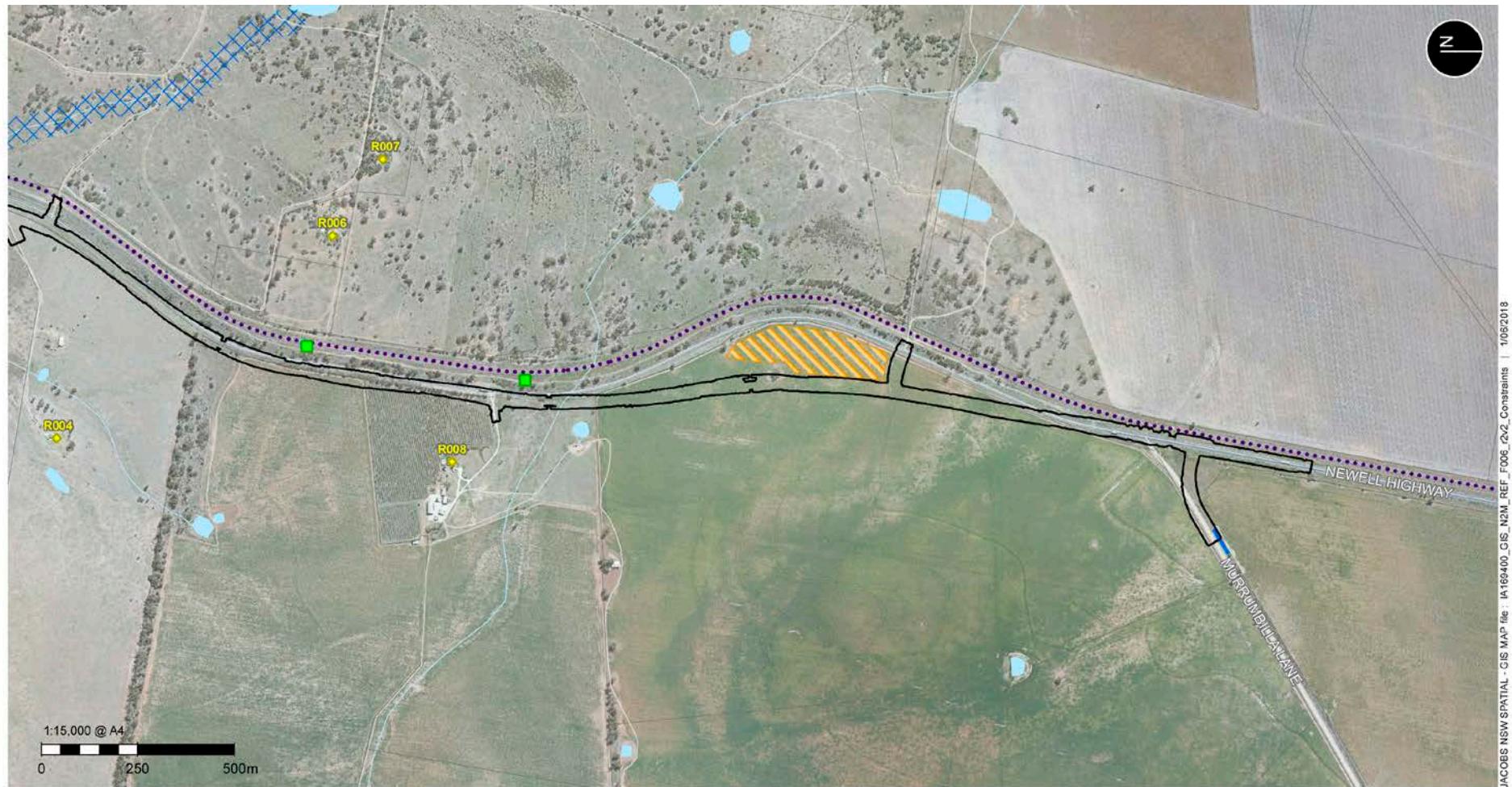


- Road
- Cadastre boundary (Roads and Maritime)
- ..... Werris Creek Mungindi Railway
- ▭ Proposal area
- ▨ Potential compound site
- ⊠ Key fish habitat (DPI)
- ◆ Noise receiver



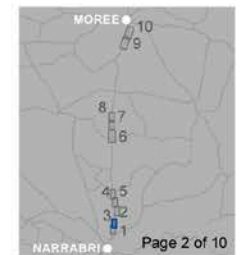
**Figure 1-3 Environmental constraints – Ecology, heritage, sensitive receivers, noise monitoring locations and key view points**





JACOBS NSW SPATIAL - GIS MAP file : I:\169400\_GIS\_N2M\_REF\_F006\_r2v2\_Constraints | 1/05/2018

- Road
  - Cadastral boundary (Roads and Maritime)
  - ..... Werris Creek Mungindi Railway
  - ▭ Proposal area
  - ▨ Potential compound site
  - ▨ Key fish habitat (DPI)
  - ◆ Noise receiver
- Threatened fauna species
  - Grey-crowned Babbler
  - BC Act listed vegetation communities
  - Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Penplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (Endangered).

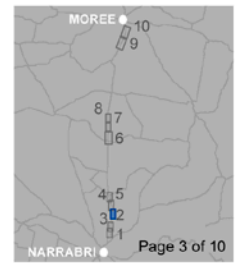


**Figure 1-3 Environmental constraints – Ecology, heritage, sensitive receivers, noise monitoring locations and key view points**





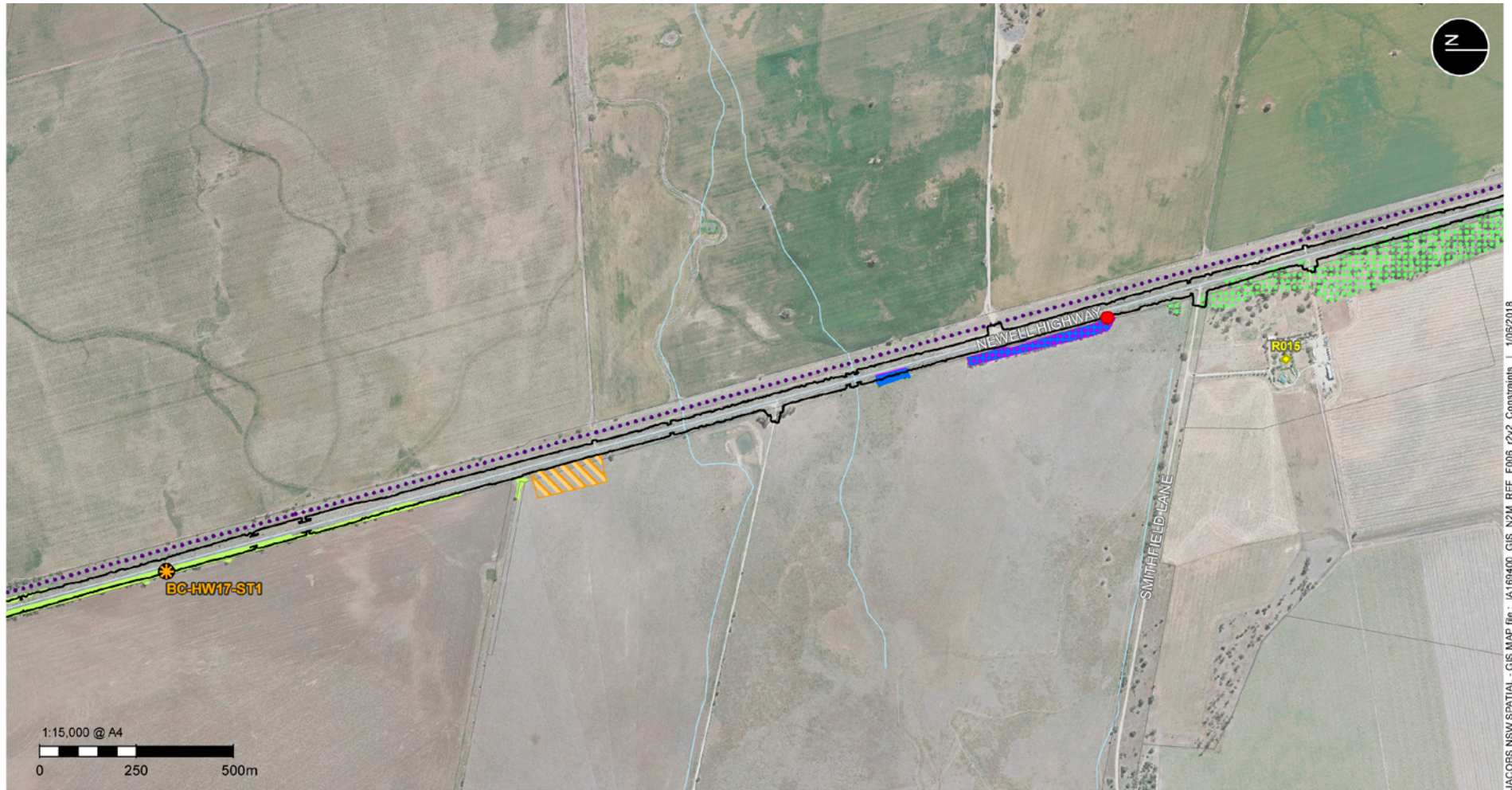
- Road
  - Cadastre boundary (Roads and Maritime)
  - ..... Werris Creek Mungindi Railway
  - ▭ Proposal area
  - ▨ Potential compound site
  - ▨ Key fish habitat (DPI)
  - ★ Aboriginal heritage site
  - ◆ Noise receiver
- 
- EPBC Act listed vegetation communities
  - ▨ Weeping Myall Woodlands (Endangered)
  - BC Act listed vegetation communities
  - ▨ Carbeen Open Forest Community in the Darling Riverine Plains and Brigalow Belt South Bioregions (Endangered)
  - ▨ Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (Endangered).



JACOBS NSW SPATIAL - GIS MAP file : I:\169400\_GIS\_NZM\_REF\_F006\_r2v2\_Constraints | 1/05/2013

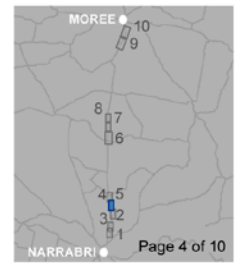
**Figure 1-3 Environmental constraints – Ecology, heritage, sensitive receivers, noise monitoring locations and key view points**





JACOBS NSW SPATIAL - GIS MAP file : I:\169400\_GIS\_NZM\_REF\_F006\_r2x2\_Constraints | 10/5/2013

- |   |  |  |
|---|--|--|
| <ul style="list-style-type: none"> <li>— Road</li> <li>— Cadastre boundary (Roads and Maritime)</li> <li>..... Werris Creek Mungindi Railway</li> <li>▭ Proposal area</li> <li>▨ Potential compound site</li> <li>★ Aboriginal heritage site</li> <li>◆ Noise receiver</li> </ul> | <p><b>Threatened flora species</b></p> <ul style="list-style-type: none"> <li>● <i>Digitaria porrecta</i></li> </ul> | <p><b>EPBC Act listed vegetation communities</b></p> <ul style="list-style-type: none"> <li>▨ Not currently listed but recommended for listing by the TSSC.</li> <li>▨ Weeping Myall Woodlands (Endangered)</li> </ul> <p><b>BC Act listed vegetation communities</b></p> <ul style="list-style-type: none"> <li>▨ Carbeen Open Forest Community in the Darling Riverine Plains and Brigalow Belt South Bioregions (Endangered)</li> <li>▨ Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (Endangered).</li> </ul> |
|---|--|--|

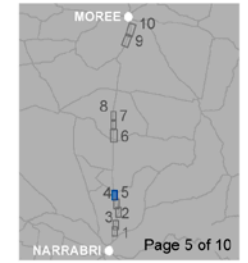


**Figure 1-3 Environmental constraints – Ecology, heritage, sensitive receivers, noise monitoring locations and key view points**





- |   |  |   |
|---|--|---|
| <ul style="list-style-type: none"> <li>— Road</li> <li>— Cadastre boundary (Roads and Maritime)</li> <li>..... Werris Creek Mungindi Railway</li> <li>▭ Proposal area</li> <li>▨ Potential compound site</li> <li>◆ Noise receiver</li> </ul> | <p>Threatened fauna species</p> <ul style="list-style-type: none"> <li>■ Grey-crowned Babbler</li> </ul> <p>Threatened flora species</p> <ul style="list-style-type: none"> <li>● <i>Digitaria porrecta</i></li> <li>● <i>Homopholis belsonii</i></li> </ul> | <p>EPBC Act listed vegetation communities</p> <ul style="list-style-type: none"> <li>▨ Not currently listed but recommended for listing by the TSSC.</li> <li>▨ Weeping Myall Woodlands (Endangered)</li> </ul> <p>BC Act listed vegetation communities</p> <ul style="list-style-type: none"> <li>▨ Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Penepplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (Endangered).</li> </ul> |
|---|--|---|

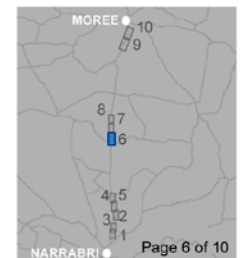


**Figure 1-3 Environmental constraints – Ecology, heritage, sensitive receivers, noise monitoring locations and key view points**





- Road
  - Cadastre boundary (Roads and Maritime)
  - ..... Werris Creek Mungindi Railway
  - ▭ Proposal area
  - ▨ Potential compound site
  - ⊗ Key fish habitat (DPI)
  - ☼ Aboriginal heritage site
  - ▭ Non-aboriginal heritage site
  - ◆ Noise receiver
- 
- EPBC Act listed vegetation communities
  - ▨ Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland (Critically Endangered)
  - ▨ Not currently listed but recommended for listing by the TSSC.



**Figure 1-3 Environmental constraints – Ecology, heritage, sensitive receivers, noise monitoring locations and key view points**

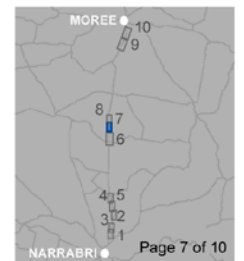




- Road
- Cadastre boundary (Roads and Maritime)
- ..... Werris Creek Mungindi Railway
- ▭ Proposal area
- ▨ Potential compound site
- ▧ Key fish habitat (DPI)
- ⊛ Aboriginal heritage site
- ◆ Noise receiver

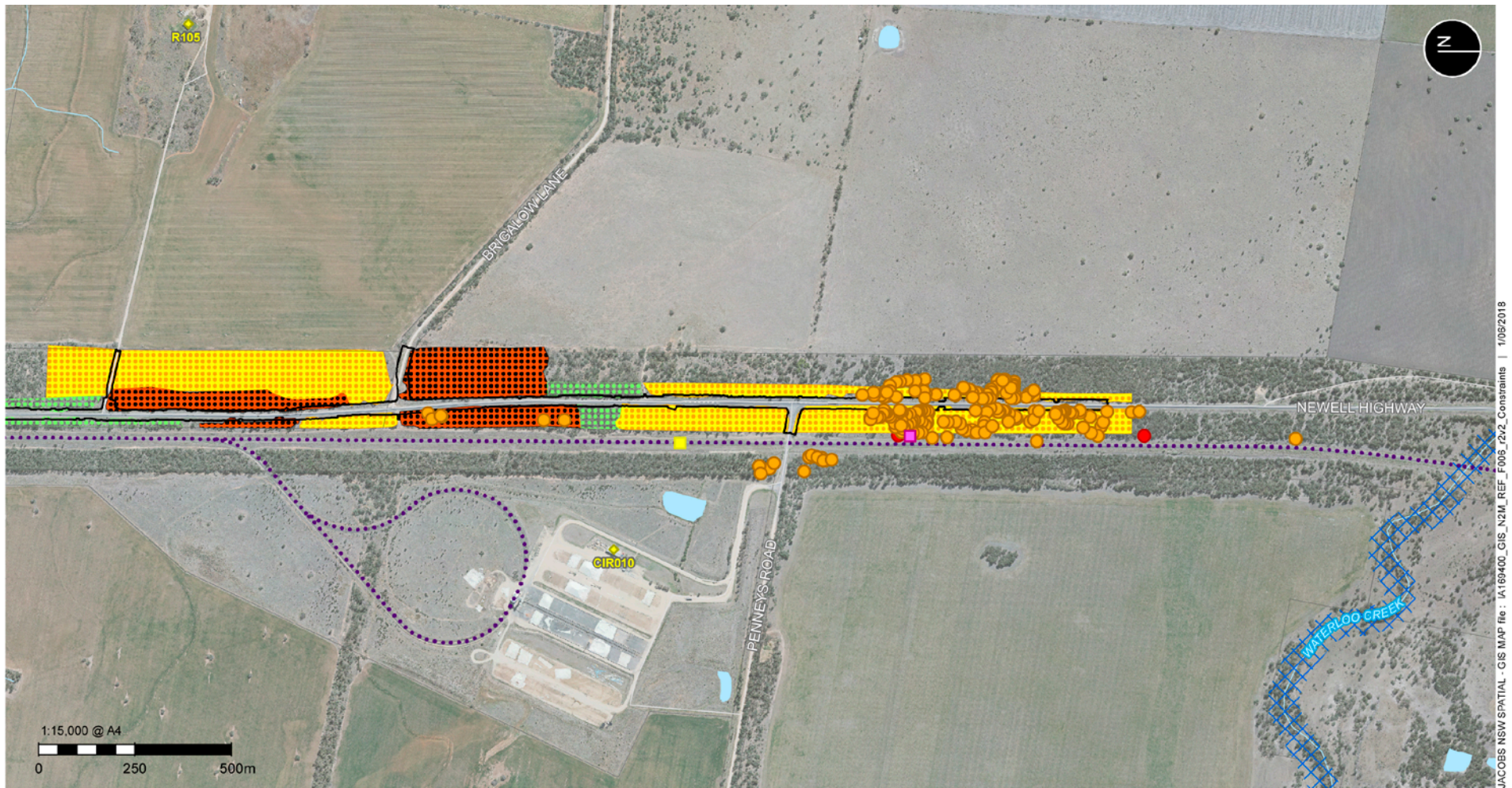
- Threatened flora species
- *Homopholis belsonii*

- EPBC Act listed vegetation communities
- ▨ Brigalow (*Acacia harpophylla* dominant and co-dominant) (Endangered)
  - ▨ Not currently listed but recommended for listing by the TSSC.
  - ▨ Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (Endangered)
- BC Act listed vegetation communities
- ▨ Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions (Endangered)
  - ▨ Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions (Endangered)



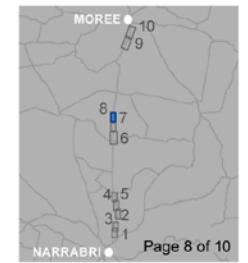
**Figure 1-3 Environmental constraints – Ecology, heritage, sensitive receivers, noise monitoring locations and key view points**





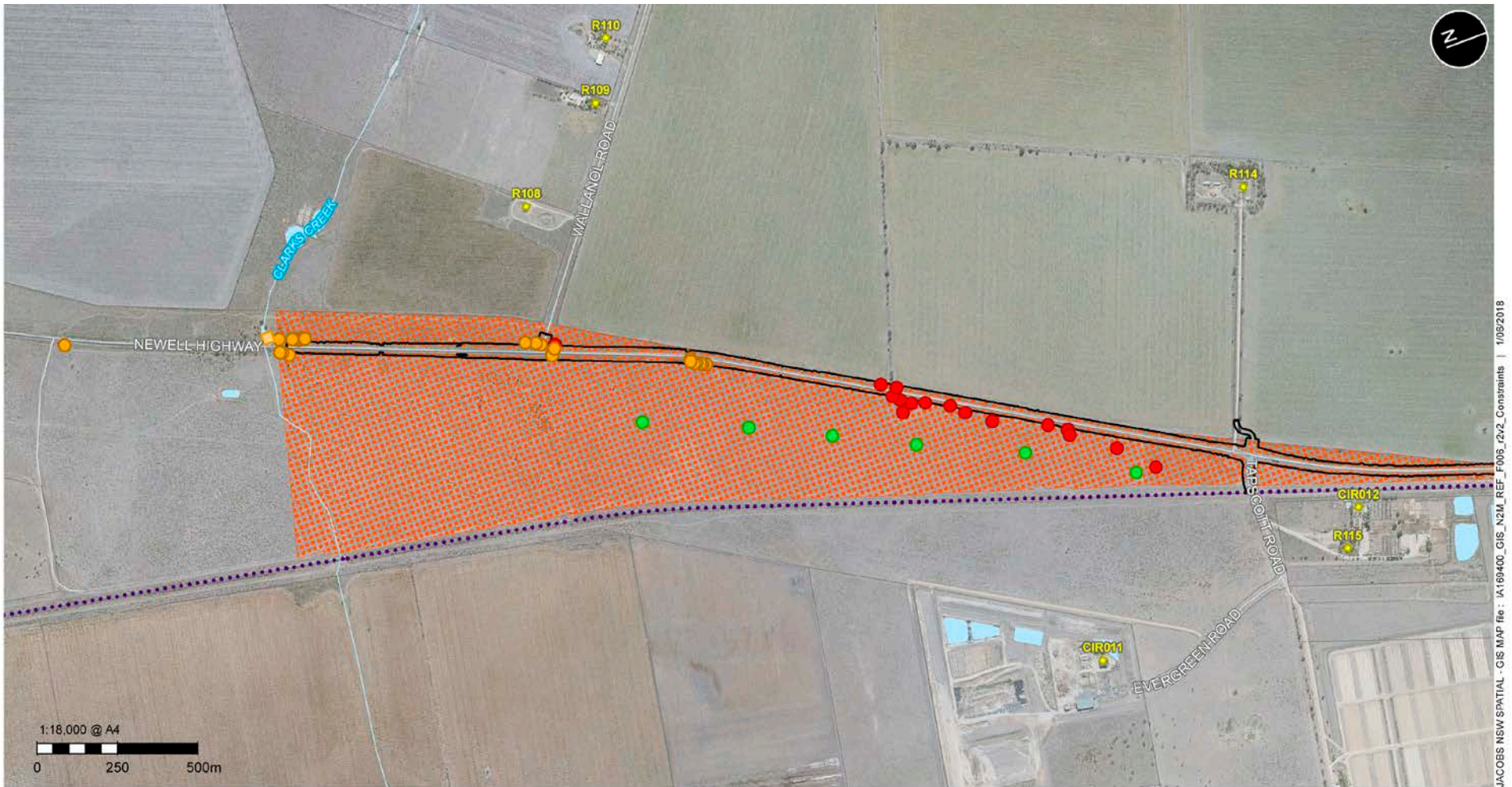
JACOBS NSW SPATIAL - GIS MAP file : I:\160400\_GIS\_N2M\_REF\_F005\_r2v2\_Constraints | 1/05/2018

- |  |   |   |
|--|---|---|
| <ul style="list-style-type: none"> <li>— Road</li> <li>— Cadastre boundary (Roads and Maritime)</li> <li>••••• Werris Creek Mungindi Railway</li> <li>▭ Proposal area</li> <li>⊠ Key fish habitat (DPI)</li> <li>◆ Noise receiver</li> </ul> | <p><b>Threatened fauna species</b></p> <ul style="list-style-type: none"> <li>■ Glossy Black-cockatoo</li> <li>■ Little Eagle</li> </ul> <p><b>Threatened flora species</b></p> <ul style="list-style-type: none"> <li>● <i>Digitaria porrecta</i></li> <li>● <i>Homopholis belsonii</i></li> </ul> | <p><b>EPBC Act listed vegetation communities</b></p> <ul style="list-style-type: none"> <li>▨ Brigalow (Acacia harpophylla dominant and co-dominant) (Endangered)</li> <li>▨ Not currently listed but recommended for listing by the TSSC.</li> <li>▨ Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (Endangered)</li> </ul> <p><b>BC Act listed vegetation communities</b></p> <ul style="list-style-type: none"> <li>■ Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions (Endangered)</li> <li>■ Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions (Endangered)</li> </ul> |
|--|---|---|



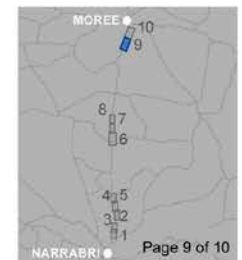
**Figure 1-3 Environmental constraints – Ecology, heritage, sensitive receivers, noise monitoring locations and key view points**





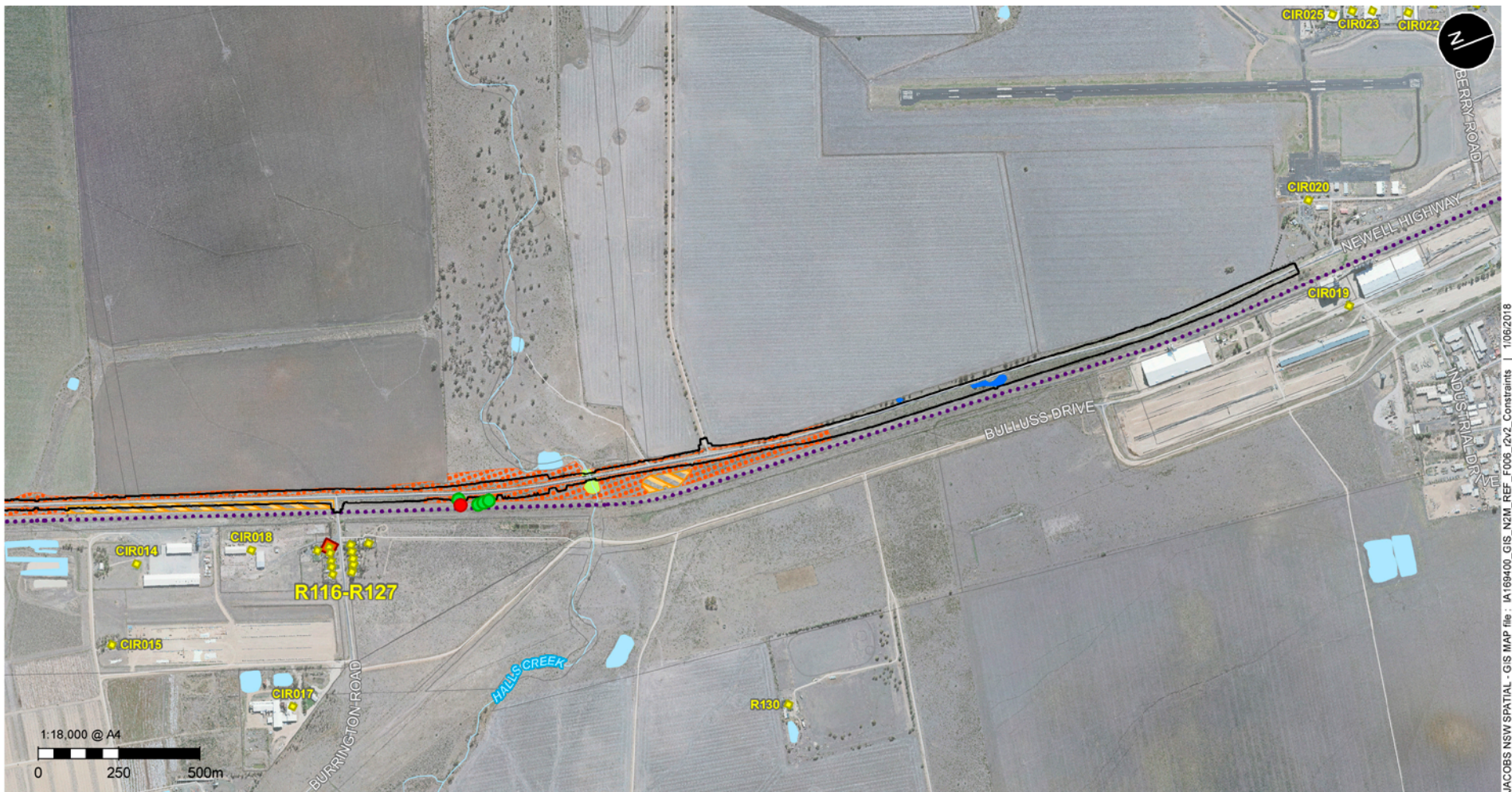
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- |  |  |   |
|--|--|---|
| <ul style="list-style-type: none"> <li>— Road</li> <li>— Cadastre boundary (Roads and Maritime)</li> <li>..... Werris Creek Mungindi Railway</li> <li>▭ Proposal area</li> <li>◆ Noise receiver</li> </ul> | <p><b>Threatened fauna species</b></p> <ul style="list-style-type: none"> <li>▣ Latham's Snipe</li> </ul> <p><b>Threatened flora species</b></p> <ul style="list-style-type: none"> <li>● <i>Desmodium campylocaulon</i></li> <li>● <i>Digitaria porrecta</i></li> <li>● <i>Homopholis belsonii</i></li> </ul> | <p><b>EPBC Act listed vegetation communities</b></p> <ul style="list-style-type: none"> <li>▨ Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland (Critically Endangered)</li> </ul> |
|--|--|---|



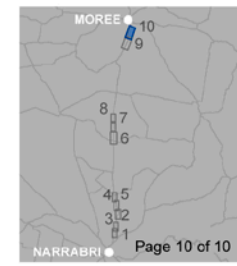
**Figure 1-3 Environmental constraints – Ecology, heritage, sensitive receivers, noise monitoring locations and key view points**





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- |   |   |  |
|---|---|--|
| <ul style="list-style-type: none"> <li>— Road</li> <li>— Cadastre boundary (Roads and Maritime)</li> <li>..... Werris Creek Mungindi Railway</li> <li>▭ Proposal area</li> <li>▨ Potential compound site</li> <li>◆ Noise logger</li> <li>◆ Noise receiver</li> </ul> | <p>Threatened flora species</p> <ul style="list-style-type: none"> <li>● <i>Desmodium campylocaulon</i></li> <li>● <i>Digitaria porrecta</i></li> </ul> | <p>EPBC Act listed vegetation communities</p> <ul style="list-style-type: none"> <li>▨ Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland (Critically Endangered)</li> </ul> <p>BC Act listed vegetation communities</p> <ul style="list-style-type: none"> <li>▨ Carbeen Open Forest Community in the Darling Riverine Plains and Brigalow Belt South Bioregions (Endangered)</li> <li>▨ Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Penepain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (Endangered).</li> </ul> |
|---|---|--|



**Figure 1-3 Environmental constraints – Ecology, heritage, sensitive receivers, noise monitoring locations and key view points**

## 1.2 Purpose of the report

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

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

The description of the proposed work and assessment of associated environmental impacts have been carried out in the context of clause 228 of the Environmental Planning and Assessment Regulation 2000, the factors in Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979 (DUAP, 1995/1996), Roads and Related Facilities EIS Guideline (DUAP 1996), the Biodiversity Conservation Act 2016 (BC Act), the Fisheries Management Act 1994 (FM Act), and the Australian Government's Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

In doing so, this REF helps to fulfil the requirements of section 5.5 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 findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act
- The significance of any impact on threatened species as defined by the BC Act and/or FM Act, in section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report (BDAR)
- 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 and Energy for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.



## 2. Need and options considered

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

### 2.1 Strategic Context

#### 2.1.1 Need for the proposal

The Newell Highway Corridor (A39) is the longest highway in NSW, extending 1,085 kilometres through the state and providing an essential connection for western NSW. The Newell Highway is also a vital transport corridor between Victoria, NSW, and Queensland. The Newell Highway supports access between key regional primary industries and export markets in addition to regional tourism.

The highway has road surface and structural deficiencies. The road was built in the 1960s. About 98 per cent of the road along this section of the Newell Highway has a remaining life of five years or less. Due to its structural limitations, the road is also at heightened risk of surface failure caused by rainfall.

These road surface deficiencies, coupled with a strong freight demand, are affecting travel reliability and travel times for freight movements between Victoria and Queensland, as well as increasing maintenance costs and reducing road safety.

Roads and Maritime has planned for substantial pavement upgrades to about 30 kilometres of the highway (with five overtaking lanes). The proposal responds to the following key strategic considerations:

- Excessive maintenance cost compared to similar roads in NSW
- Increasing traffic volumes complicates maintenance access and Work Health and Safety concerns with the current 110 kilometres per hour speed limit
- Black soil subgrade with an existing pavement dating from the 1960s and anticipated remaining asset life of five years or less
- The road cross section in the area is below that targeted in the *Newell Highway Corridor Strategy* (Transport for NSW, 2015) being less than nine metres sealed and less than 11 metres overall cross section (compared to a target of 12 metres and 14 metres, respectively)
- Portions of the Newell Highway are flood prone during a one in five year event, rather than the desired one in 20 year event
- High accident rates and crash history.

#### 2.1.2 Strategic planning and policy framework

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

The key strategic planning and policy documents relevant to the proposal include:

- National Road Safety Strategy 2011–2020 (Australian Transport Council, 2011)
- Melbourne–Brisbane Corridor Strategy: Building our National Transport Future (Australian Government, 2007)
- NSW State Plan 2021: A Plan to Make NSW Number One (Department of Premier and Cabinet, 2011)
- NSW Long Term Transport Master Plan (Transport for NSW, 2012a)
- State Infrastructure Strategy (Infrastructure NSW, 2014)
- NSW Freight and Ports Strategy (Transport for NSW, 2013)
- NSW Road Safety Strategy 2012–2021 (Transport for NSW, 2012b)
- New England North West Regional Transport Plan (Transport for NSW, 2013)
- Newell Highway Corridor Strategy (NSW Government, 2015)
- New England North West Strategic Regional Land Use Plan (NSW Department of Planning and Environment, 2012).

### ***National Road Safety Strategy 2011–2020***

The *National Road Safety Strategy 2011–2020* (Australian Transport Council, 2011) aims to identify initiatives to improve the safety of Australia’s roads and reduce the annual number of road crash fatalities and serious road crash injuries by at least 30 per cent by the end of 2020. The strategy recognises the critical need to improve road infrastructure, with a focus on road features that are designed to reduce run-off-road, intersection and head-on crashes.

The proposal would provide the opportunity to reduce crashes and help achieve the targets set by the strategy by providing road safety improvements such as a wide centre line, a wider road formation, dedicated overtaking lanes and local road intersection improvements. By improving road safety, the proposal would directly support the aims of the strategy.

### ***Melbourne–Brisbane Corridor Strategy***

The *Melbourne–Brisbane Corridor Strategy: Building our National Transport Future* (Australian Government, 2007) identifies the Newell Highway as a major interstate transport route and a key component of the National Land Transport Network.

The Australian Government provides major infrastructure and maintenance funding for the Newell Highway, due to its significance in terms of facilitating freight movement, transporting produce and providing access between key regional primary industries and their export markets in northern Victoria, central NSW and southern Queensland.

The proposal would help to achieve the following strategic priorities outlined in the strategy:

- Improving the safety, reliability and efficiency of passenger and freight movement on the road corridor
- Improving the safety of the road corridor to reduce casualty crashes particularly in areas of high casualty crash rates and at intersections
- Maintaining and improving where possible economic, local safety and residential amenity for communities along the corridor.



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

The *NSW State Plan 2021: A Plan to Make NSW Number One* (Department of Premier and Cabinet, 2011) identifies priorities and targets for delivering services for NSW. The priority of investing in critical infrastructure and integrated transport aims to support future population and employment growth, improve access to services hubs, and to improve travel efficiency and road safety. The proposal would support these aims as it would improve traffic/freight efficiency and improve road safety.

## ***NSW Long Term Transport Master Plan***

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

The LTTMP has two themes that specifically reference upgrades to the Newell Highway. These themes include:

- Providing essential access for regional NSW
- Supporting an efficient and productive freight industry.

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

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

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

The *State Infrastructure Strategy 2012 (Update 2014)* (Infrastructure NSW, 2014) is a strategy to plan and fund the infrastructure that the NSW Government delivers. For regional transport the strategic objective is to improve regional producers' access to markets through investments supporting freight productivity. The key challenges for meeting the strategic objectives include:

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

The NSW Government's strategic priorities for regional and interstate transport that are relevant to upgrades of the Newell Highway include:

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

The strategy recognises the Newell Highway as a priority corridor under the Regional Road Freight Corridor Program. The proposal would assist in meeting the key challenges to fulfilling the infrastructure priorities of the *State Infrastructure Strategy* (Transport for NSW, 2012) by improving road access into the region to support the growing NSW economy.

### ***NSW Freight and Ports Strategy***

The aim of the *NSW Freight and Ports Strategy* (Transport for NSW, 2013) is to provide a transport network that allows the efficient flow of goods to market. The strategy outlines freight specific objectives which reflect the importance of the freight transport network for a competitive and productive NSW economy, as well as the need to integrate freight transport with other productive and non-productive activities and land uses. The strategies objectives include:

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

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

### ***NSW Road Safety Strategy 2012-2021***

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

This strategy is underpinned by the safe system approach to improving road safety. This takes a holistic view of the road transport system and interactions among the key components of that system – the road user, the roads and roadsides, the vehicle and travel speeds. It recognises that all these components have a role to play in helping to keep road users safe. This strategy contributes to implementing the safe systems approach through assessing the corridors current performance in terms of casualty crash rates, crash types and contributing factors.

This strategy supports road safety infrastructure improvements such as overtaking lanes, wider clear zones, wider sealed shoulders and lanes, as well as, behavioural campaigns to reduce the number and severity of crashes along the corridor; in particular crashes relating to speed and driver fatigue. The proposal would assist in meeting the requirements of the strategy by providing a safer highway with improved pavement, flood immunity, overtaking lanes and wider sealed shoulders.

### ***New England North West Regional Transport Plan***

The *New England North West Regional Transport Plan* (Transport for NSW, 2013) supports the LTTMP and outlines specific actions to address the transport challenges of the New England North West region. It acknowledges the Newell Highway as an important route that connects Melbourne and Brisbane via central NSW.

The heavy duty pavement upgrade of the Newell Highway between Narrabri and the Queensland border and the provision of additional overtaking lanes on the Newell Highway to improve safety are short-term actions under the plan. The proposal would contribute to the completion of these actions.



## ***Newell Highway Corridor Strategy***

Transport for NSW, in collaboration with Roads and Maritime, released the *Newell Highway Corridor Strategy* (Transport for NSW, 2015) in May 2015 to address the transport needs of the corridor. This includes support for greater use of Higher Productivity Vehicles (HPVs) over the full length of the Newell Highway. The report identified a large portion of the northern section of the Newell Highway is nearing the end of its life, with regular failure occurring with structural pavement, as well as large sections not meeting desired cross section dimensions.

The *NSW Long Term Transport Master Plan* (Transport for NSW, 2012a) identified the need to provide heavy duty pavement between Narrabri and the Queensland border as well as additional overtaking lanes to improve overtaking opportunities and safety as a short-term priority.

The need to provide additional overtaking lanes was also identified in the Newell Highway Overtaking Lanes Strategy as part of a study completed in 2011. The strategy listed the overtaking lanes between Narrabri and Moree as medium to high priority for future planning in the *Newell Highway Corridor Strategy* (Transport for NSW, 2015).

The Newell Highway is the longest highway in NSW, running north to south and providing an essential road connection for central-western NSW. This corridor strategy sets out how the NSW Government will manage road transport along the Newell Highway in the long-term, from Tocumwal on the Victorian border to Goondiwindi on the Queensland border.

The strategy will be delivered over a 20 year timeframe, in line with the LTTMP, Regional Transport Plans and other relevant national and State planning frameworks. From road safety and transport efficiency to asset maintenance issues, this strategy sets the direction for managing the Newell Highway into the future.

## ***New England North West Strategic Regional Land Use Plan***

The *New England North West Strategic Regional Land Use Plan* (NSW Department of Planning and Environment, 2012) establishes a planning framework to support growth, protect the environment and respond to competing land uses, while preserving key regional values over the next 20 years in the New England North West region. The plan acknowledges the Newell Highway as part of the National Land Transport Network, as a major connection linking north-western NSW regional centres to Melbourne and Brisbane and is heavily used by industry, with some sections having a 50 per cent heavy vehicle freight mix.

The proposal would provide safer and more efficient connections for road users between Narrabri and Moree.

## **2.2 Existing infrastructure**

The Newell Highway is generally a two-lane, two-way single carriageway road (refer to **Photo 2-1** and **Photo 2-2**). The terrain is relatively flat and the highway alignment is generally characterised by long straights separated by large-radius curves.

### ***Road infrastructure***

The roadway is generally sealed to a width of nine metres on an 11 metre wide formation. There are no existing overtaking lanes on the highway. The existing Newell Highway within the proposal area has a narrow pavement on flat terrain in a generally good alignment. As identified in **Section 2.1**, the road pavement is nearing its end of life, has had regular failures and is vulnerable to rapid deterioration during wet weather events. Therefore, the highway is constantly being heavily

patched (refer to **Photo 2-3**). Currently the Newell Highway has pavement maintenance cost is substantially higher than the state average for similar roads.



**Photo 2-1 Newell Highway**



**Photo 2-2 Newell Highway**



**Photo 2-3 Example of heavy patching along the Newell Highway**

### ***Speed limits***

The posted speed limit on the highway from Narrabri to Moree is generally 110 kilometres per hour. Locations with reduced speed limits include:

- N2MS2 Edgeroi (80 kilometres per hour)
- N2MS3 Bellata (60 kilometres per hour)
- N2MS5 Moree (80 kilometres per hour).

### ***Intersections and property access***

There are 20 local roads and 31 property accesses connecting to the Newell Highway within the proposal area, including:



- Eight basic right turn (BAR) layout junctions
- Six auxiliary right turn (AUR) layout junctions
- Six channelised right turn (CHR) layout junctions.

The local roads and number of accesses within each segment are summarised in **Table 2-1**.

**Table 2-1 Property access and public roads within the proposal area**

| Segment | No. Private accesses   | Public roads   |
|---------|--|--|
| N2MS1   | Six and an access to the University of Sydney Plant Breeding Institute   | <ul style="list-style-type: none"> <li>• Murrumbilla lane</li> </ul>   |
| N2MS2   | Six  | <ul style="list-style-type: none"> <li>• Junefield Road</li> <li>• Smithfield Lane</li> <li>• Curadda Road</li> <li>• Tarlee Road</li> <li>• Queen Street (north)</li> <li>• Queen Street (south)</li> <li>• Future Service Station</li> </ul> |
| N2MS3   | Two and an access to Woolabrar rest area                                 | <ul style="list-style-type: none"> <li>• Temi Street</li> <li>• North Street</li> <li>• Wilga Street</li> <li>• Oak Street</li> <li>• Millie Road</li> </ul>   |
| N2MS4   | Four and an access to Tookey Creek rest area and an unofficial rest area | <ul style="list-style-type: none"> <li>• Brigalow Lane</li> <li>• Penneys Road</li> </ul>  |
| N2MS5   | One  | <ul style="list-style-type: none"> <li>• Two unsignposted roads</li> <li>• Wallanol Road</li> <li>• Tapscott Road</li> <li>• Burrington Road</li> </ul>  |

### **Public transport**

Local bus services operate in Narrabri and Moree that use the Newell Highway. The Newell Highway is a school bus route with school buses stopping at informal bus stops to drop-off and pick-up passengers within the proposal area.

The Newell Highway is used by a number of daily, long distance coaches that service the towns in central NSW from major capital cities and larger regional centres.

The Mungindi railway line runs parallel for the length of the proposal immediately to the west until North of Bellata then swaps to the east. The railway line provides north-south access from Narrabri to Moree, with major stations at Narrabri and Moree and a minor railway station at Bellata. Railway stations at Edgeroi and Gurley are no longer used.

### **Rest areas**

There are four vehicle rest areas located between Narrabri and Moree on the Newell Highway. Rest areas located within or near the proposal include (refer to **Figure 1-2**):

- Edgeroi Park, located within N2MS2, about 24 kilometres to the north of Narrabri within the town of Edgeroi

- Tookey Creek rest area, a light vehicle rest area located north of Bellata, about 53 kilometres north of Narrabri near N2MS4
- Woolabrar rest area located within N2MS3 on the eastern side of the proposal 48.8 kilometres north of Narrabri
- An unofficial rest area currently being used by heavy vehicles one kilometre north of the Tookey Creek rest area located within N2MS4.

### **Drainage**

The existing drainage network within the proposal area includes:

- 37 single cell culverts
- Ten multi cell culverts
- Table drains cut below the natural surface level in areas of flat terrain.

Several locations are prone to flooding at the five year average annual recurrence interval (refer to **Section 6.2.2**).

### **Bridges and other structures**

There are 12 bridges and other like structures along the Newell Highway within the proposal area. The 12 structures consist of two bridges and ten large multi cell culverts as summarised in **Table 2-2**.

**Table 2-2 Bridges and large culverts along the Newell Highway within the proposal area**

| Segment | Watercourse   | Bridge number | Bridge type        | Bridge description              |
|---------|---------------|---------------|--------------------|---------------------------------|
| N2MS1   | Unnamed       | 3565          | Four cell culvert  | Concrete culvert, cast in-place |
| N2MS2   | Bobbiwa Creek | 3567          | Bridge (AB1)       | PSC Plank                       |
|         | Unnamed       | 3568          | Three cell culvert | Concrete culvert, cast in-place |
|         | Unnamed       | 3569          | Five cell culvert  | Concrete culvert, cast in-place |
|         | Tarlee Creek  | 3570          | Four cell culvert  | Concrete culvert, cast in-place |
|         | Tarlee Creek  | 9055          | Four cell culvert  | Concrete Pipe                   |
| N2MS3   | Gehan Creek   | 3581          | Five cell culvert  | Concrete culvert, cast in-place |
| N2MS4   | Tookey Creek  | 3583          | Three cell culvert | Concrete culvert, cast in-place |
|         | Unnamed       | 3584          | Four cell culvert  | Concrete culvert, cast in-place |
| N2MS5   | Unnamed       | 2897          | Three cell culvert | Concrete culvert, cast in-place |
|         | Unnamed       | 2898          | Four cell culvert  | Concrete culvert, cast in-place |
|         | Hall's Creek  | 2899          | Bridge             | Reinforced Concrete Slab        |



## 2.3 Proposal objectives

### 2.3.1 Proposal objectives

The objectives of the proposal and the expected benefits are outlined in **Table 2-3**.

**Table 2-3 The objectives and expected benefits of the proposal**

| Objective  | Comment  |
|--|--|
| <ul style="list-style-type: none"> <li>Reduce travel times on the Newell Highway</li> <li>Reduce vehicle operating costs on the Newell Highway</li> <li>Apply whole of life cost analysis to the pavement design to reduce the costs of maintaining the Newell Highway</li> <li>Improve the safety of the Newell Highway</li> <li>Improve reliability in flood of the Newell Highway.</li> </ul> | <ul style="list-style-type: none"> <li>Reduction in future Travel Time</li> <li>Reduction in future Vehicle operating costs</li> <li>Reduction in future Maintenance costs</li> <li>Reduction in future Casualty Crashes</li> <li>Improved intersection safety and efficiency</li> <li>Improved flood immunity.</li> </ul> |

### 2.3.2 Urban and landscape design objectives and principles

The *Urban Design, Landscape Character and Visual Impact Assessment Report* (Tract, 2018) derived the urban design objectives for the proposal from the nine urban design objectives defined in *Beyond the Pavement: urban design policy, process and principles* (Roads and Maritime, 2014). They reflect both the unique character of the Newell Highway, its rural context and key issues which adjoin it (refer to **Appendix A**). The objectives and principles for the proposal are summarised in **Table 2-4**.

**Table 2-4 Urban design objectives and principles**

| Urban design principles  | Objectives   |
|--|--|
| Principle 1 - Contribute to the overall landscape structure and revitalisation of the region | <ul style="list-style-type: none"> <li>Consider the Newell Highways role in the movement of goods and people in the central region of NSW and its connection to the states and markets of Queensland and Victoria</li> <li>Consider the role townships along the highway can play both within the community that they serve but also that of the travelling community</li> <li>Consider the design response for the road design and its setting to both inform traffic of the changing context but also encourage the breaking of the journey</li> <li>Consider the management of side connections to the highway to encourage the safe movement to and from these access points.</li> </ul> |
| Principle 2 – Respect the land uses and built form of the corridor                           | <ul style="list-style-type: none"> <li>Minimise the footprint of the corridor to limit impacts to adjoining vegetation, communities, and farm holdings</li> <li>Design an alignment which minimises fragmentation of farm holdings or the loss of connections between paddocks</li> <li>Maintain the fundamental characteristics of the existing road corridor which signify the Newell Highway and the experience of the road user</li> <li>Maintain the ecological integrity of the vegetated sections and landscape character of the corridor.</li> </ul>   |

| Urban design principles  | Objectives  |
|--|---|
| Principle 3 – Connecting modes and communities                                     | <ul style="list-style-type: none"> <li>• Consider the relationship between road and rail given the general proximity of the railway line to the alignment. Design to limit impacts on flexibility or functionality of the adjoining network</li> <li>• Provide safe and efficient access to towns</li> <li>• Provide a response which acknowledges the population centres of Bellata and Edgeroi along the highway. Facilitate movement of people within this context providing an environment which reflects this human scale.</li> </ul>  |
| Principle 4 – Fit the landform of the corridor                                     | <ul style="list-style-type: none"> <li>• Consider the relationship between road and rail given the general proximity of the railway line to the alignment. Design to limit impacts on flexibility or functionality of the adjoining network</li> <li>• Minimise the footprint of the corridor to limit impacts to adjoining vegetation communities and farm holdings</li> <li>• Provide a formation which addresses the need for a flood free route.</li> </ul>   |
| Principle 5 – Responding to natural pattern  | <ul style="list-style-type: none"> <li>• The route selection should respond to the grain of the landscape and avoid, where possible, the disruption of stands of vegetation, both natural and cultural</li> <li>• Integrate cut and fill embankments with surrounding terrain by grading out and varying slopes</li> <li>• Preserve existing cultural patterns within the landscape</li> <li>• Vary the gradient of earthworks to provide visual impact interest and reflect characteristics of the surrounding landform and landscape.</li> </ul>  |
| Principle 6 – Protect and enhance the heritage and cultural values of the corridor | <ul style="list-style-type: none"> <li>• Where possible, avoid areas of identified historic and Aboriginal heritage and cultural value</li> <li>• Acknowledge and respond to the heritage and cultural values of the rural landscape</li> <li>• Acknowledge and respond to Aboriginal values and places in the broader landscape</li> <li>• Consider the important value of productive landscape</li> <li>• Consider the interpretation of the areas heritage along the corridor</li> </ul>   |
| Principle 7 – Designing an experience in movement                                  | <ul style="list-style-type: none"> <li>• Maximise the opportunities for high quality and varied views of the rural landscape and adjacent mountain ranges</li> <li>• Provide incidental events or visual stimuli along the corridor to provide a sense of progression and connection with the social, natural and geographic context of the corridor</li> <li>• Celebrate the views of the ranges to the east and the endless plains to the west</li> <li>• Use landscape to frame views</li> </ul>   |
| Principle 8 – Creating self-explaining road environments                           | <ul style="list-style-type: none"> <li>• Provide a landscape design that defines the edge of bends and leads the driver through the landscape</li> <li>• Provide plantings at town centres that reinforces the reduced speed zones of these places</li> <li>• Provide a landscape design which reflects the needs and performance requirements of intersections along the highway.</li> </ul>   |
| Principle 9 - Achieving integrated and minimal maintenance design                  | <ul style="list-style-type: none"> <li>• Develop a consistent approach to the design of bridges along the project. Urban design principals to be consistent with those outlined in <i>Bridge Aesthetics: Design Guidelines To Improve The Appearance of Bridges in NSW</i> (RTA, 2003)</li> <li>• Develop a consistent approach to the design of soft landscaping along the route. Planting design Principles to be consistent with those outlined in the <i>Landscape Guidelines: Landscape Design and Maintenance Guidelines to Improve the Quality, Safety and Cost Effectiveness of Road Corridor Planting and Seeding</i> (RTA, 2008)".</li> <li>• Provide a landscape which is self-reliant and regenerating landscape with minimal maintenance input requirements.</li> <li>• Provide plantings to frame views and guide the driver along the alignment</li> </ul> |



## 2.4 Alternatives and options considered

Roads and Maritime carried out a strategic option study in October 2017, as documented in the Newell Highway - Heavy Duty Pavement Upgrade Strategic Options Report (GHD, 2017) to consider strategic options and design concepts for the highway. The report identified that forecast freight traffic on the highway has triggered the need for a heavy duty pavement upgrade, but there is no capacity or alignment issue requiring a total reconstruction of the road.

As part of the strategic design, four options were considered to address issues associated with the pavement nearing the end of its life, regular failures occurring with structural pavement, as well as large sections not meeting desired cross section dimensions. As part of the Roads and Maritime planning process, an options development workshop and value management workshop was held on 7 September 2016. The objectives of the workshop were to:

- Obtain a common understanding of the current situation of the Newell Highway
- Review the available information, including alternative horizontal and vertical alignments for each of the proposal segments, with a view to making recommendations concerning preferred horizontal and vertical alignments for the various segments, as well as offering commentary on possible staging options for the various segments.

The four horizontal alignment options considered during the strategic design process and value management workshop included:

- Option 1 – Match centreline
- Option 2 – Offset centreline
- Option 3 – Offline within existing corridor where possible
- Option 4 – Increased offline requiring a new corridor.

The vertical alignment options considered, included:

- Do nothing
- Twenty per cent Annual Exceedance Probability (AEP)
- 10 per cent AEP
- Five per cent AEP.

The value management workshop concluded that the horizontal alignment involving offline construction within the existing corridor but coming back online to use existing structures (Option 3) was favoured. This was primarily due to

- Meeting all of the proposal objectives
- Being the lowest cost, or close to the lowest (providing best value for money)
- Having superior constructability and safety in design considerations
- Having benefits and the highest cost benefit ratios the highest or close to the highest
- Facilitating the least, or near the least road user delays during construction
- Positioning the road further from the proposed inland rail line
- Would facilitate safety in design considerations and increased travel speed.

The recommended vertical alignment using a 20 per cent AEP flood immunity was also recommended by this workshop.

However, following the conclusion of the strategic design process, the recommended option (Option 3) was not adopted as the preferred options because the pavement design had not yet been developed. The pavement design could change the cost benefit ratio and therefore has the potential to make the case for the offline option not preferred. Therefore, the alternative online option (Option 1) was to be progressed through to the 50 per cent concept design alongside the recommended option (Option 3) from the value management workshop.

Further details on the strategic design development of the proposal is provided in HW17 Newell Highway – Heavy Duty Pavement Value Management Report (Transport for NSW, 2017), HW17 Newell Highway – Heavy Duty Pavement Upgrade Strategic Options Report (GHD, 2017) and HW17 Newell Highway – Heavy Duty Pavement Upgrade Concept Design Report (GHD, 2017b).

## 2.4.1 Methodology for selection of preferred option

A constructability workshop and Health and Safety in design workshop were held in February 2018 during the 20 per cent concept design phase. The findings from these two workshops are detailed in the *Constructability workshop, Newell Highway – Heavy Duty Pavement Upgrade* (Roads and Maritime, 2018a) and *Health and safety in design workshop, Newell Highway – Heavy Duty Pavement Upgrade* (Roads and Maritime, 2018b) and summarised below.

The aim of the constructability workshop was to optimise the proposal design to ensure efficient construction and maintenance, in order to meet project life cycle objectives for cost, time, quality, work health safety (WHS) and environmental management. The general conclusions drawn from the workshop included:

- The pavement options would have substantial impact on cost and constructability which might impact on option preference
- The off line proposal options would allow work to stop in the event of flooding
- Additional investigative and costing work would be required before clear recommendations can be provided for a preferred option
- The impact on the community/road user for online sections is concern.
- A number of construction concerns around construction water access, sources and quality of materials, potential impacts of flooding on the off line options (due to pooling of water) and managing the risk of end to tail motor vehicle accidents during construction were identified.

The objectives of the safety in design workshop was to identify key hazards associated with the safe construction, operation, maintenance, modification and decommissioning of the proposal and develop appropriate changes in the design to manage the hazards. The areas of concern associated with the proposal from a safety perspective included the following issues:

- Possibility for truck roll over on curves with super elevation and a combination of other design minimums
- Issues with the Bobbiwaa Creek bridge including load limit and non-compliant width and approaches
- Speed environment and traffic control options for Bellata township
- Application of Auxiliary left turn (AUL) at intersections (related to turning traffic volumes).

Workshop attendees acknowledged the impacts of the preferred option on the threatened species and endangered ecological communities (EEC), as well as impacts on Aboriginal heritage, non-Aboriginal heritage, utility conflicts and the Mungindi railway line. The conclusion and issues



identified during these two workshops would inform the proposal design as the design is progressed.

## 2.4.2 Identified options

The options considered at the 20 to 50 per cent concept design phase are as follows.

### ***Horizontal alignment***

The three horizontal strategic design alternatives considered by Roads and Maritime were as follows:

#### Option 1: 'Do nothing'

This option would involve the continued use and maintenance of the existing highway with no funding allocated for upgrading or widening the existing pavement. Normal road maintenance would continue to be carried out.

#### Option 2: Alternative Option: The on line option where the existing pavement is replaced with a heavy duty pavement

Under this option, a heavy duty pavement and a wider centre line would be constructed maintaining the existing horizontal alignment.

#### Option 3: Recommended Option: Offline within in the existing corridor where possible and existing pavement replace with heavy duty pavement with curve easing

Similar to Option 2, except in selected locations, the horizontal alignment would be modified slightly to increase the curve radius (ease the curve). The effect of increasing the curve radius would be to improve travel speed, decrease travel lengths and improve road safety.

### ***Pavement options***

Pavement options currently been considered include:

- Full depth asphalt
- Thick asphalt over heavily bound subbase
- Thick asphalt over foamed bitumen subbase
- Foamed bitumen stabilised base with thin bituminous wearing course (ie sprayed seal or thin asphaltic concrete) over stabilised subgrade
- Heavy duty granular with sprayed sealed/thin bituminous wearing course
- Additional alternatives recommended by pavement consultant.

## 2.4.3 Analysis of options

### ***Horizontal alignment***

#### Option 1 – Do Nothing Option

This option would involve the continued use and maintenance of the existing highway with no funding allocated for upgrading or widening the existing pavement. Under this option:

- Routine maintenance requirements would increase as the road surface and base continue to deteriorate at an increasing rate until complete road failure occurs

- There would be increasing delays due to patching and other maintenance work
- Travel speeds and reliability would decrease and operating costs increase as pavement roughness increases
- The expected pavement quality would be unlikely to improve road safety.

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

To avoid significant impacts on threatened species and EEC, **Table 2-5** presents the options for each segment that were recommended to progress the design. These segments are considered the recommended option and have been assessed in this REF as the proposal.

**Table 2-5 Recommended horizontal alignments to be progressed**

| Segment | Option description recommended to avoid significant impacts on threatened species and EEC  |
|---------|--|
| N2MS1   | Option 3: Offline within in the existing corridor where possible and existing pavement replaced with heavy duty pavement with curve easing |
| N2MS2   | Option 2: Alternative Option: Online where the existing pavement is replaced with a heavy duty pavement                                    |
| N2MS3   | Option 3: Offline within in the existing corridor where possible and existing pavement replace with heavy duty pavement with curve easing  |
| N2MS4   | Option 2: Alternative Option: Online option where the existing pavement is replaced with a heavy duty pavement                             |
| N2MS5   | Option 2: Alternative Option: Online option where the existing pavement is replaced with a heavy duty pavement                             |

### ***Pavement options***

No pavement options have been progressed.

## **2.5 Preferred option**

The preferred design including pavement design would be selected after Project Value Management and Engineering Work shops that are expected to take place after the 50 per cent design workshops. Where the proposal options would be assessed against the project criteria.

The nominated preferred alignment is determined from an environmental perspective as the option that doesn't have any significant impact triggers, and is described in **Table 2-6**. This forms the proposal that has been assessed in this REF.

**Table 2-6 Recommended horizontal alignments to be progressed**

| Segment | Proposal preferred alignment | Location  | Proposed works   |
|---------|------------------------------|---|--|
| N2MS1   | Recommended (Offline)        | 6.4 kilometres to 12.9 kilometres north of Narrabri | <ul style="list-style-type: none"> <li>• Upgrading 6.5 kilometres of the Newell Highway</li> </ul> |



| Segment | Proposal preferred alignment | Location   | Proposed works  |
|---------|------------------------------|--|---|
| N2MS2   | Alternate (online)           | 15.6 kilometres to 25.9 kilometres north of Narrabri at Edgeroi        | <ul style="list-style-type: none"> <li>Upgrading 10.3 kilometres of the Newell Highway</li> <li>Two overtaking lanes – northbound and southbound</li> </ul> |
| N2MS3   | Recommended (Offline)        | 46.8 kilometres to 59.30 kilometres north of Narrabri at Bellata       | <ul style="list-style-type: none"> <li>Upgrading 4.5 kilometres of highway</li> <li>One northbound overtaking lane</li> </ul>                               |
| N2MS4   | Alternate (online)           | 52.4 kilometres to 58.2 kilometres north of Narrabri, north of Bellata | <ul style="list-style-type: none"> <li>Upgrading 5.9 kilometres of highway</li> </ul>   |
| N2MS5   | Alternate (online)           | 88.4 kilometres to 96.4 kilometres north of Narrabri, south of Moree   | <ul style="list-style-type: none"> <li>Upgrading 7.8 kilometres of highway</li> <li>Two overtaking lanes - northbound and southbound</li> </ul>             |

## 3. Description of the proposal

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

### 3.1 The proposal

Roads and Maritime proposes to carry out major pavement upgrades to five segments of the highway, including five overtaking lanes within the existing road corridor. The proposal is located in the north west of NSW, and traverses the Narrabri Shire and Moree Plains Shire LGAs.

Key features of the proposal include:

- Upgrading and resurfacing five segments of the existing highway between Narrabri and Moree to a heavy duty (HD) pavement
- Road widening to provide 3.5 metre wide lanes and two metre shoulders
- Provision of one metre wide painted medians
- Road widening on one side or both sides of the highway
- Provision of 1.5 kilometre long overtaking lanes at five locations (three northbound and two southbound)
- Upgrading of the existing intersections along the highway to either a basic right turn treatment or channelised intersection
- Provision of a central two way right turn lane at Bellata
- Provision of three metre wide shoulders for 30 metres on either side of property accesses
- Improving the highway flood immunity up to a 20-year average recurrence interval where feasible and reasonable
- Property acquisitions as required
- Utility relocations as required
- Temporary construction ancillary facilities, including construction compounds, stockpile sites and erosion and sedimentation measures within the road corridor as required.

The location of the proposal is shown in **Figure 1-1** and an overview of the proposal is provided in **Figure 1-2**.

The proposal would be delivered in five segments with a combined length of about 30 kilometres of upgrades along the highway. The five segments and indicative works are described in **Table 1-1**.

Construction of the proposal would be carried in five segments and each segment would be staged to enable work to be completed safely while maintaining traffic flows at all times. Construction would generally involve building one carriageway at a time, and switching traffic between the carriageways to preserve traffic flows for the duration of work.



## 3.2 Design

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

### 3.2.1 Design criteria

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

- *Austrroads Guide to Road Design* (Austrroads, 2009) and Roads and Maritime supplements to the Austrroads Guide
- Austrroads Road Safety Audit Manual (Austrroads, 2009)
- Roads and Maritime Road Design Guide (Roads and Maritime, undated)
- Roads and Maritime's Delineation Guidelines (Roads and Maritime, undated)
- *Soils and Construction – Managing Urban Stormwater, Volume 1* (Landcom, 2004) and *Volume 2D* (Department of Environment and Climate Change, 2008).

The adopted design criteria for the proposal is summarised in **Table 3-1**.

**Table 3-1 Design criteria**

| Specification      | Criteria  | Design criteria   |
|--------------------|---|---|
| Road Design        | Design speed  | 120 kilometres per hour   |
|                    | Posted speed  | 110 kilometres per hour   |
|                    | Design vehicle and checking vehicle (highway and intersections west of highway) | 36.5 B-triple   |
|                    | Design vehicle and checking vehicle (intersections east of highway)             | B-Double  |
|                    | Number of lanes   | 2.0   |
|                    | Lane widths   | 3.5 metres  |
|                    | Auxiliary and overtaking lane widths  | 3.5 metres  |
|                    | Shoulder width  | 2.0 metres  |
|                    | Median  | 1.0 metre painted median  |
|                    | Verge   | <ul style="list-style-type: none"> <li>• 1.0 wide verge for embankments greater than 1.5 metres in height or where barriers used</li> <li>• 0.5 metre verge for embankments less than 1.5 metre.</li> </ul> |
|                    | Public road junctions   | Channelised right turn (CHR) treatment with rural bus stop  |
|                    | Property access   | Basic right turn (BAR) and Basic left turn (BAL) treatment  |
| Earthworks batters | Maximum 4:1 fill, preferred 6:1   |   |

| Specification                                    | Criteria    | Design criteria   |
|--|-------------|---|
| Noise barriers/mounds and reinforced embankments | Design life | 50 years for noise barriers/mounds and 100 years for reinforced embankments |
| Bridges and culverts                             | Design life | 100 years   |
| Pavement   | Design life | 40 years  |

### 3.2.2 Proposal constraints

The design and construction of the proposal needs to consider a number of issues and constraints including:

- Existing alignment: Proposed alignment need to integrate with tie-ins to the existing alignment
- Flooding: The existing highway is subject to flooding. The topographical profile constrains the ability of the land either side of the road to drain quickly following large flood and rainfall events. Planning would need to consider the potential for flooding during construction
- Soil conditions: The proposal is located within a black soil plain. Black soils expand and contract depending on the available moisture. The proposal would require nonstandard pavement treatments and would potentially need to use existing road formation gravel in order to minimise construction and future maintenance costs (GHD, 2017)
- Crown Land: There are areas where the existing highway is contained within crown land., As such a road reserve would need to be acquired and established in these areas
- Access: Private property owners and residents would need to access their premises during construction. Maintaining property access would need to be considered during detailed design and construction
- Existing road connections: The existing highway intersects with 20 local roads within the proposal area. These intersections would need to be adjusted to tie in with the proposal
- Staging of the proposal: The proposal would generally be constructed on the same alignment as the existing highway. This would pose staging challenges to maintain traffic flows (including oversized vehicles and over mass floats moving through the proposal area) in both directions and access to local roads and properties. The proposal would also most likely be in construction concurrently with a number of other upgrades along the Newell Highway and this cumulative impact would need to be considered during construction planning
- Source of materials: There are limited local gravel sources, in particular conforming gravel or aggregate, within hundreds of kilometres of the proposal. The source of materials would need to be considered prior to construction
- Limited water sources: There are limited reliable water supply options for construction of the proposal. There are no major rivers that water could be extracted from within the proposal area
- Utilities: Utilities in the proposal area would need to be relocated or protected during construction.



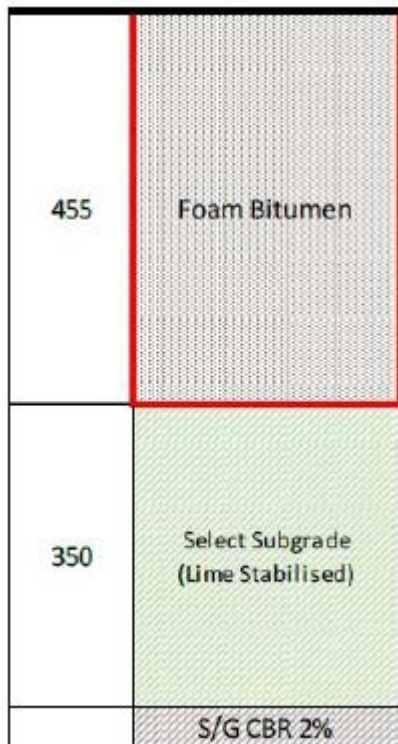
### 3.2.3 Major design features

The major design features include widening works, addition of overtaking lanes, upgraded local road intersections, heavy duty pavement and drainage improvements. The features are briefly described below.

#### *Heavy duty pavement*

The existing pavement would be replaced with new pavement capable of withstanding loads from large heavy vehicles including AB and B-triples and double road trains. A 455 millimetre foamed bitumen pavement has been adopted for the strategic design and 50 per cent concept design. The proposed pavement cross section would be revised and refined during detailed design to ensure it responds to the various geotechnical conditions along the proposal alignment.

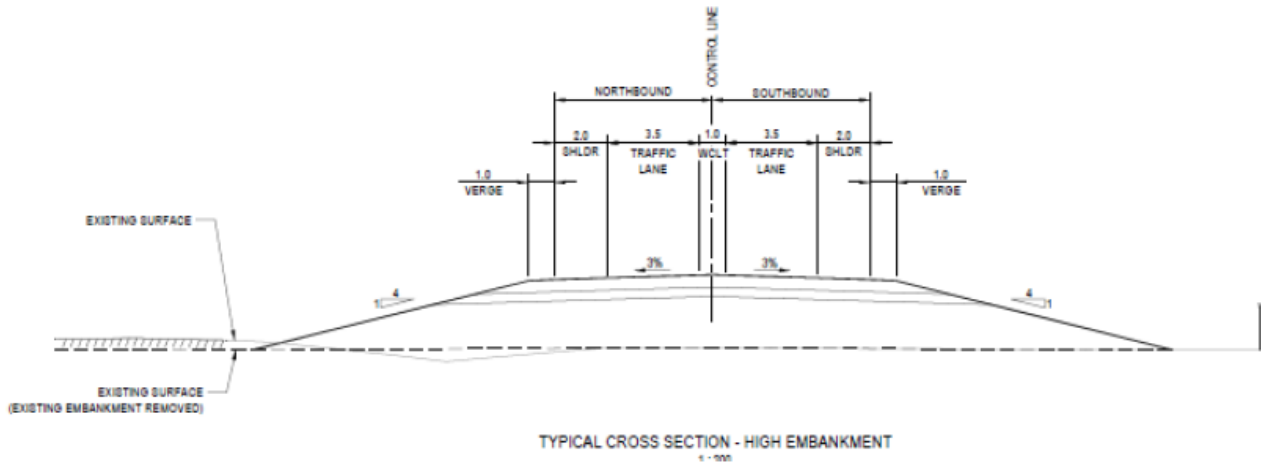
The indicative profile of the proposed pavement is presented in **Figure 3-1**.



**Figure 3-1 Indicative pavement profile (GHD, 2018)**

#### *Road widening*

The width of the existing pavement seal varies throughout the proposal area, and is typically nine metres wide, while the formation is about 11 metres wide. The proposal would widen the seal to 12.0 metres by either widening the pavement of the existing highway or constructing a new pavement adjacent to the existing highway. The typical road cross section is presented in Figure 3-2.



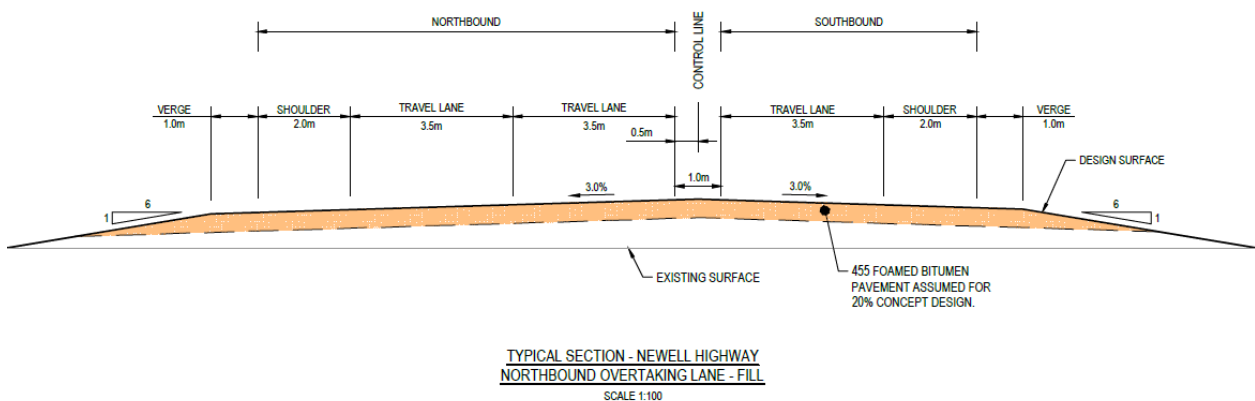
**Figure 3-2 Typical cross section for the upgraded road (GHD, 2018)**

### ***Overtaking facilities***

To allow for slower vehicles to be overtaken, five overtaking lanes would be provided at the following locations:

- Edgeroi Northbound: N2MS2 18.48 kilometres to 19.98 kilometres north of Narrabri
- Edgeroi Southbound: N2MS2 23.09 kilometres to 24.59 kilometres north of Narrabri
- Bellata Northbound: N2MS3 47.80 kilometres to 49.30 kilometres north of Narrabri
- Moree Saleyards Northbound: N2MS5 89.49 kilometres to 90.99 kilometres north of Narrabri
- Moree Saleyards Southbound: N2MS5 94.58 kilometres to 96.08 kilometres north of Narrabri.
- The overtaking lanes would be about 1.5 kilometres long and about 3.5 metres wide. The lanes would be line-marked so all traffic is initially directed into the left lane with the inner lane used for overtaking.

The location of the overtaking lanes is presented in **Figure 1-2** while the typical overtaking lane cross section is shown in **Figure 3-3**.



**Figure 3-3 Typical cross sections for overtaking lanes**

### ***Local road intersection improvements***

The types of local road intersection improvements that would be implemented as part of the proposal are shown in **Figure 3-4** and **Figure 3-5**. These would involve:

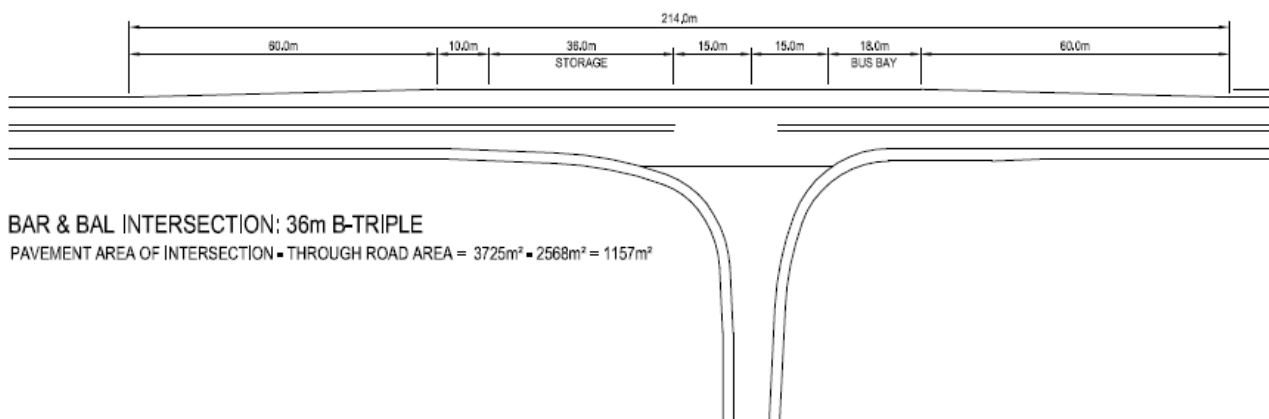


- Basic right-turn (BAR): This intersection improvement would involve shoulder widening on the highway to allow through traffic to manoeuvre around a vehicle slowed or stopped to turn right into a minor road (refer to **Figure 3-4**)
- Basic left-turn (BAL): This intersection improvement would involve shoulder widening on the highway to allow through traffic to manoeuvre around a vehicle slowed or stopped to turn left into a minor road (refer to **Figure 3-4**)
- Channelised right-turn (CHR): This intersection improvement would involve the construction of a designated right-turn lane on the highway for traffic turning into a minor road (refer to **Figure 3-5**)
- Auxiliary left turn (AUL): This treatment would involve a designated left-turn lane for traffic turning into a minor road (refer to **Figure 3-5**)
- A Two way right turn lane (TWRTL) would be provided at Bellata. This is described below and shown in **Figure 3-6**.

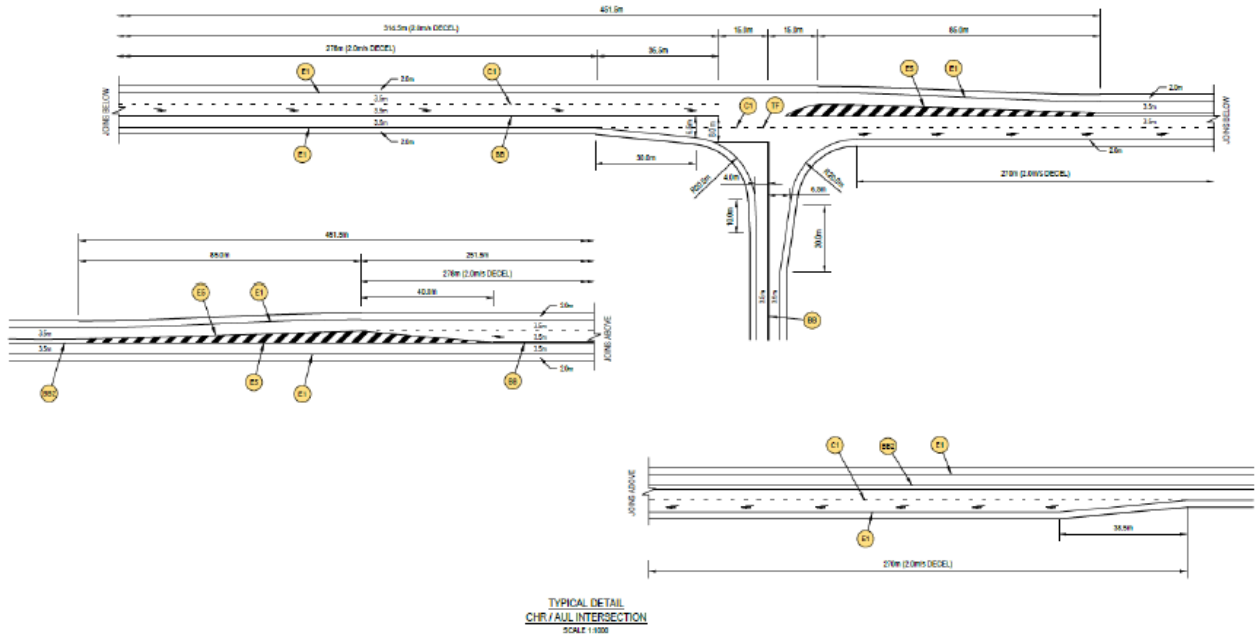
All intersection layouts would be designed to a 120 kilometres per hour design speed and to make allowance for the turning path of a B-triple. The exceptions to this are intersections within Bellata and Edgeroi which would have a design speed of 60 kilometres per hour and 80 kilometres per hour, respectively.

The following criteria have been adopted for public road intersections and access to private residential properties:

- Public road intersection would have a CHR and AUL with rural bus stop. Deceleration lane lengths would be for a deceleration rate of 2.0 metres per second
- Private residence access would have a BAR with rural bus stop. A typical BAR intersection layout is provided in figure.
- No specific treatment would be provided to private accesses not leading to dwelling and railway accesses.



**Figure 3-4 Typical BAR and BAL**



**Figure 3-5 Typical CHR / AUL intersection**

The road intersections to be improved are listed in **Table 3-2** and shown in **Figure 1-2**. The intersections to be improved and the type of improvement proposed would be reviewed and refined during detailed design.

**Table 3-2 Proposed local road intersection improvements**

| Segment | Intersection                       | Proposed improvement |                      |
|---------|------------------------------------|----------------------|----------------------|
|         |                                    | Left-turn treatment  | Right-turn treatment |
| All     | Private access to dwellings        | New BAL              | New BAR              |
|         | Other private accesses             | No treatment         | No treatment         |
|         | Railway accesses                   | No treatment         | No treatment         |
| N2MS1   | University                         | AUL                  | CHR                  |
|         | Murrumbilla Lane, Narrabri         | BAL                  | CHR                  |
| N2MS2   | Junefield Road, Narrabri           | BAL                  | BAR                  |
|         | Smithfield Lane, Narrabri          | BAL                  | BAR                  |
|         | Couradda Road/Tarlee Road, Edgeroi | AUL                  | CHR                  |
|         | Queen Street (south), Edgeroi      | AUL                  | CHR                  |
|         | Future Service Station, Edgeroi    | AUL                  | CHR                  |
|         | Queen Street (north), Edgeroi      | AUL                  | CHR                  |
| N2MS3   | Tem Street, Bellata                | BAL                  | CHR                  |
|         | North Street, Bellata              | BAL                  | TWRTL                |
|         | Wilga Street, Bellata              | BAL                  | TWRTL                |
|         | Oak Street, Bellata                | BAL                  | TWRTL                |

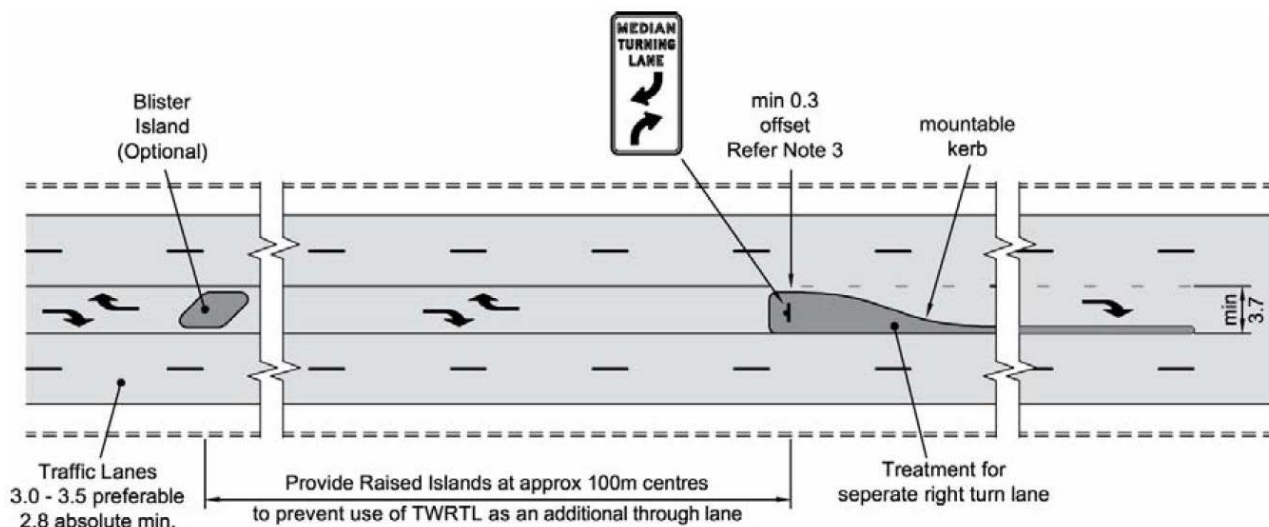


| Segment | Intersection                                      | Proposed improvement |              |
|---------|---|----------------------|--------------|
|         | Millie Road                                       | BAL                  | CHR          |
|         | Northbound rest area, 800 metres north of Bellata | AUL                  | No treatment |
|         | Southbound rest area, 800 metres north of Bellata | AUL                  | No treatment |
| N2MS4   | Brigalow Lane, Bellata                            | AUL                  | BAR          |
|         | Penneys Road                                      | AUL                  | CHR          |
|         | Wallanol Road, Moree                              | AUL                  | CHR          |
| N2MS5   | Tapscott Road, Moree                              | AUL                  | CHR          |
|         | Burrington Road, Moree                            | AUL                  | CHR          |

### Two way right turn lane (TWRTL)

Within the Bellata reduced speed zone, there are a number of public road junctions including Temi Street, North Street, Wilga Street, Oak Street and Millie Road. There is insufficient space to provide back to back CHR intersections for a design speed of 70 kilometres per hour. Also the existing service station accesses are in close proximity to the Wilga Street junction, along with a number of other private accesses.

As part of the concept design it is proposed to provide a central TWRTL from Temi Street through to Millie Road. Concrete blister islands would be located midblock to provide separation between side streets and prevent merging traffic travelling excessive lengths in TWRTL. Refer to **Figure 3-6**.



**Figure 3-6 TWRTL from Temi Street to Millie Road**

### Drainage upgrades

The proposed culverts would be designed to maintain a minimum one in five year flood immunity for the Newell Highway within the proposal. All culverts would be extended where possible to locate the headwalls outside the nominated clearzone requirements for the proposed 120 kilometres per hour design speed.

Existing drainage channels may be upgraded to manage flow from catchments and avoid longitudinal drainage.

Culverts would also be installed under local road intersections to provide continuity for table drains. The existing longitudinal drainage system comprising low embankments with no kerbs would be maintained (table drains).

The locations of the proposed drainage upgrades are shown in **Figure 1-2**. These locations would be reviewed and refined during detailed design.

## 3.3 Construction activities

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

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

A contractor environmental management framework to manage and mitigate impacts is presented in **Chapter 7**. The final construction plan and methods chosen by the contractor would also be required to be consistent with this framework.

### 3.3.1 Work methodology

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

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

The proposal would be constructed using conventional methods used on other road pavement upgrade projects. These methods may be modified or refined to respond to engineering and environmental constraints relevant to the proposal area. The typical construction phases and activities are described in **Table 3-3**.



**Table 3-3 General construction activities**

| Construction phase           | Activities  |
|------------------------------|---|
| Pre-construction activities  | <ul style="list-style-type: none"> <li>• Finalisation and approval of the CEMP</li> <li>• Transport plant and equipment to the site.</li> </ul>   |
| Site establishment           | <ul style="list-style-type: none"> <li>• Identification and marking of sensitive areas as identified in this REF and the CEMP</li> <li>• Establishment of temporary fencing and exclusion zone fencing, and clear demarcation of clearing limits</li> <li>• Installation of temporary environmental controls including erosion, sediment and water quality controls</li> <li>• Installation of drainage infrastructure to keep off site separate from site water</li> <li>• Establishment of ancillary sites including main site compounds and stockpile areas</li> <li>• Property adjustment works</li> <li>• Installation of traffic management measures, such as safety barriers in accordance with the traffic control plan</li> <li>• Vegetation clearing and grubbing including tree removal where necessary</li> <li>• Relocation or protection of utilities as required.</li> </ul>                         |
| Daily site activities        | <ul style="list-style-type: none"> <li>• Establish temporary amenities and environment and safety controls</li> <li>• Establish traffic management measures as required</li> <li>• Remove waste and clean-up site, including road sweeping</li> <li>• Remove temporary traffic controls</li> <li>• Remove temporary amenities and environment and safety controls</li> <li>• Reopen traffic lanes (if closed).</li> </ul>   |
| Pavement upgrade             | <ul style="list-style-type: none"> <li>• Relocation of existing utilities as required</li> <li>• Delineate of the work area from traffic on the Newell Highway</li> <li>• Installation of traffic management controls</li> <li>• Striping, stockpiling and managing of topsoil and unsuitable material</li> <li>• Culvert extension or replacement</li> <li>• Carrying out bulk earthworks</li> <li>• Import and compact select material</li> <li>• Construction of road pavement (this would include demolition of existing road pavement where required; and compaction of select fill)</li> <li>• Installation of kerbs and gutters where required</li> <li>• Asphalt pavement and surfacing</li> <li>• Replace topsoil and stabilise embankments</li> <li>• Carrying out finishing work (this would include installation of safety barriers, fencing, line marking, signposting and road furniture).</li> </ul> |
| Post-construction activities | <ul style="list-style-type: none"> <li>• Transport stockpiled waste and spoil to a licensed facility</li> <li>• Rehabilitate ancillary sites and construction basins</li> <li>• Remove plant and equipment from site</li> <li>• Remove construction environmental controls</li> <li>• Reinstate the site, roadways and all property accesses.</li> </ul>  |

### **Staging**

The indicative traffic staging for on and offline options for the construction of new carriageway, while maintaining two-way flow at all times is presented in **Table 3-4** and shown on **Figure 3-7** to **Figure 3-11**.

To maintain two-way flow at all times during the construction of the online sections, temporary pavement would be required to provide sufficient travel lane widths. Alternatively, a contra-flow

arrangement could be adopted that does not require temporary pavement, however this would impact on road user travel times.

For the purposes of the indicative traffic staging, the following constraints were adopted:

- One traffic lane in each direction would be maintained on the Newell Highway at all times where possible to avoid traffic disruptions
- Reduced speed zone would be within the work area during construction. A speed zone of 60 or 80 kilometres per hour would be assumed for the entire proposal segment, with 40 or 60 kilometres per hour next to construction work areas
- The minimum width of traffic lanes during construction is 3.5 metres. However, three to 3.2 metre lanes would be acceptable, if a 40 kilometres per hour construction speed zone is used. Lane widths would be adjusted as required on bends to allow for long vehicles
- The absolute minimum width of shoulder along the Newell Highway during construction would be one metre, to allow adequate space for cyclists.

**Table 3-4 Construction staging**

| Stage                       | Proposed construction work  |
|-----------------------------|---|
| <b>Offline construction</b> |   |
| 1                           | <ul style="list-style-type: none"> <li>• Traffic would be moved to the left slightly on the existing pavement to allow enough room to establish the work area on the right side of the road</li> <li>• Work area would be separate to the existing formation</li> <li>• The work area would be along the right side of the road. Work would consist of embankment construction, new culverts, new pavements, final wearing course and line marking</li> <li>• An intermediate stage may be necessary prior to Stage 2, to complete work between new and existing roads. This intermediate stage would split traffic, by placing a right hand traffic lane onto new the formation</li> <li>• Concrete barriers may be used along the edge of the existing pavement to maintain a higher speed zone next to the work area.</li> </ul> |
| 2                           | <ul style="list-style-type: none"> <li>• Traffic would be moved onto the new pavement, maintaining two way traffic flow</li> <li>• The work area would be along left side of the road.</li> </ul>   |
| 3                           | <ul style="list-style-type: none"> <li>• Traffic would be in the final arrangement</li> <li>• The centreline would be shifted by generally 9.5 metres to allow two metre shoulders and one metre between travel lanes.</li> </ul>   |
| <b>Online construction</b>  |   |
| 1                           | <ul style="list-style-type: none"> <li>• Traffic would be maintained on the existing arrangement on existing pavement</li> <li>• Work area would be separate to the existing formation</li> <li>• Work would consist of embankment construction, new culverts, new pavements, final wearing course and line marking</li> <li>• Concrete barriers may be used along the edge of the existing pavement to maintain a higher speed zone next to the work area.</li> </ul>  |
| 2                           | <ul style="list-style-type: none"> <li>• Traffic would be moved into final arrangement</li> <li>• The existing pavement would be removed for use in subsequent segments.</li> </ul>   |



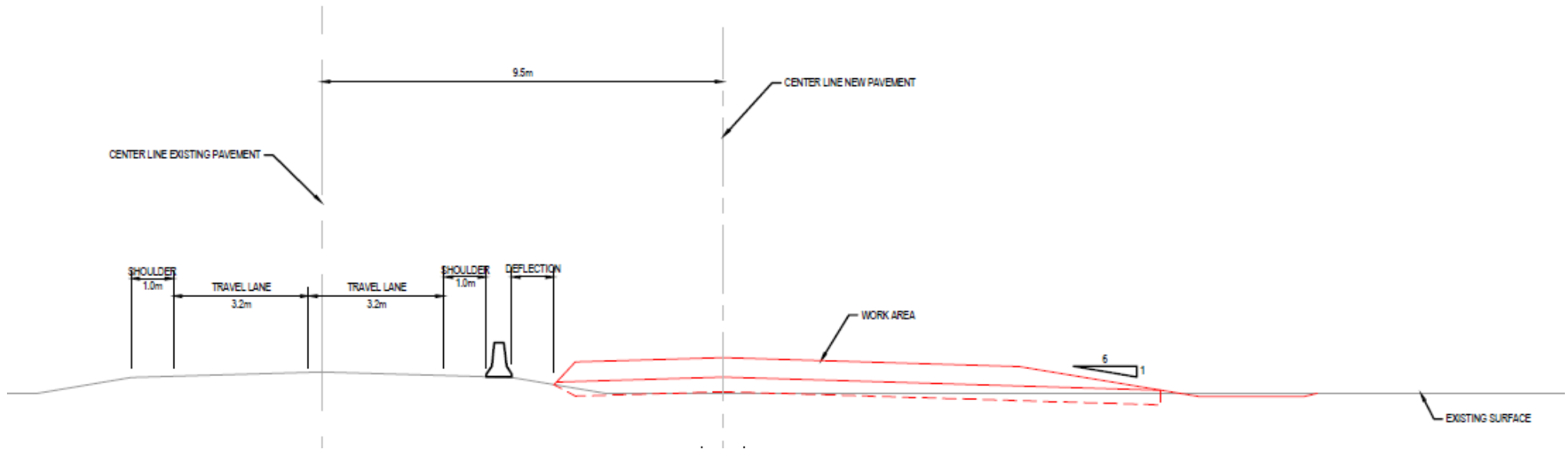


Figure 3-7 Stage 1 offline

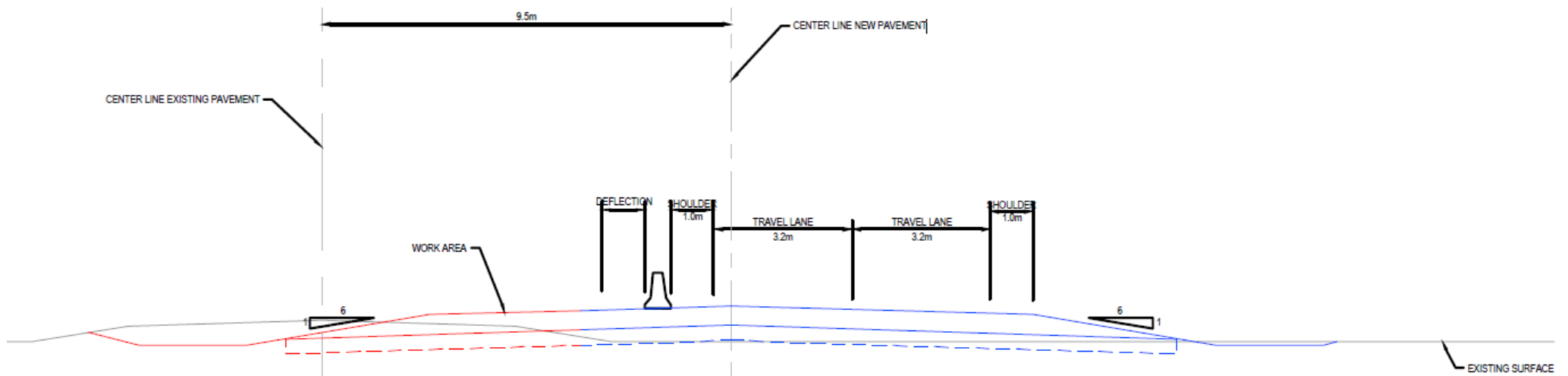


Figure 3-8 Stage 2 offline

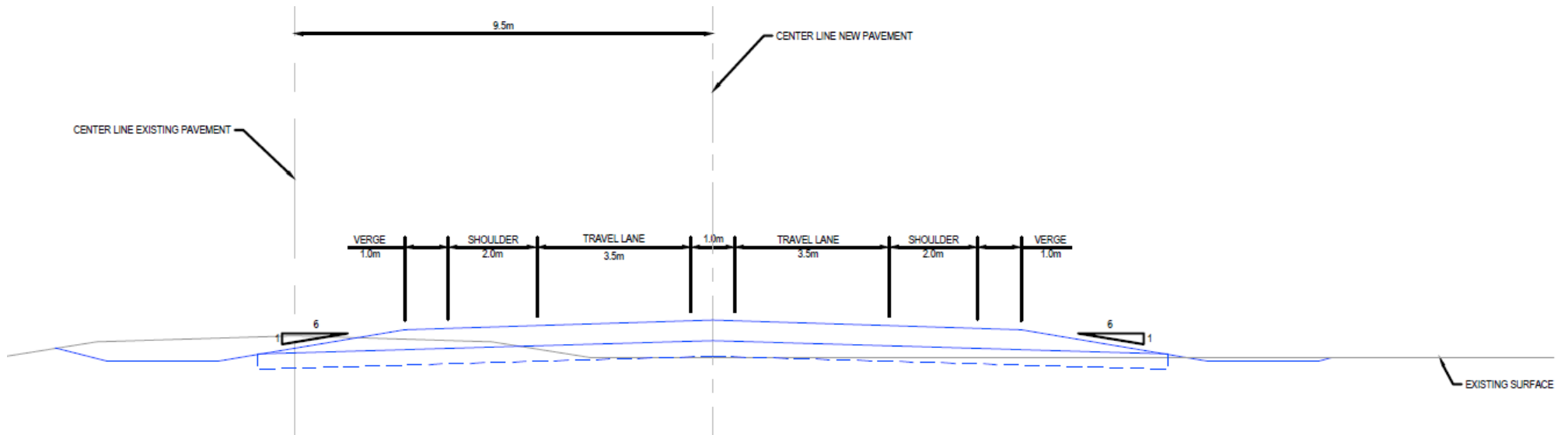


Figure 3-9 Stage 3 offline

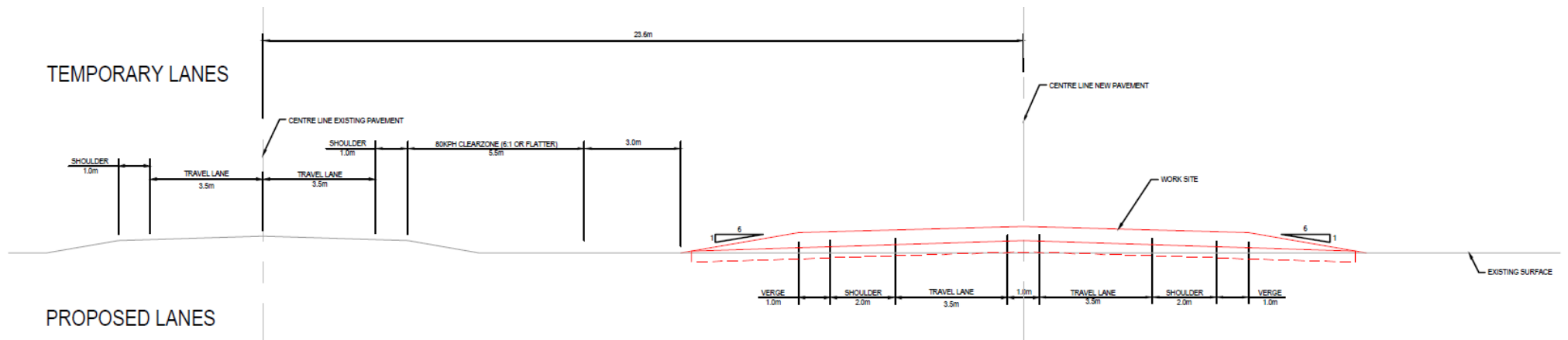
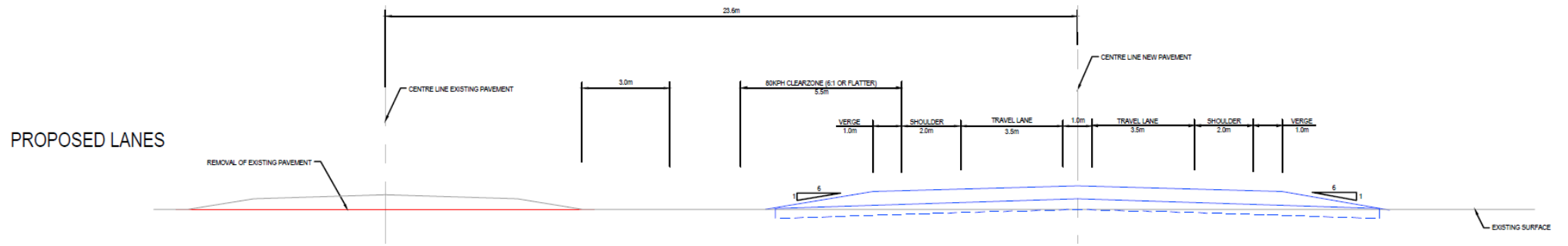


Figure 3-10 Stage 1 online





**Figure 3-11 Stage 2 online**

### 3.3.2 Construction workforce

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

### 3.3.3 Construction hours and duration

Construction may be carried out 24 hours per day, seven days per week to minimise periods of work under excessive heat and other adverse climatic conditions, improve construction efficiencies and construct the proposal earlier than would otherwise be the case with standard working hours.

Construction of the proposal is anticipated to start in 2020 and be completed in 2022. The proposal may be delivered in stages, depending on funding arrangements.

### 3.3.4 Plant and equipment

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

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

### 3.3.5 Earthworks

The proposal would involve earthworks, with the overall aim of maximising the re-use of material on site or between projects along the Newell Highway. Any remaining surplus material would be stockpiled in a suitable location for future use by Roads and Maritime on future projects, or disposed of to an approved site following waste classification. Allowance would be made at the proposed ancillary sites for initial stockpiling of surplus material, either for re use elsewhere on the site, or prior to its disposal. Sufficient space exists across the proposed ancillary sites to accommodate material stockpiles, and these would be managed in accordance with the contractor's CEMP.

The estimated quantities of materials associated with earthworks are provided in **Table 3-5**. The estimates may change depending on the actual quality of material, the depth to bedrock, and the suitability of the material for reuse during construction. Earthwork requirements would be confirmed during detailed design.



**Table 3-5 Indicative earthworks quantities**

| Material                                  | N2MS1  | N2MS2  | N2MS3  | N2MS4  | N2M5   |
|---|--------|--------|--------|--------|--------|
| Excavation (cut) volume (m <sup>3</sup> ) | 24,836 | 42,097 | 17,945 | 41,703 | 32,898 |
| Fill volume (m <sup>3</sup> )             | 11,149 | 0      | 4,418  | 0      | 0      |

### 3.3.6 Source and quantity of materials

The following materials would be required:

- Earthwork materials (eg sand, gravel, topsoil, general fill material) and selected material for road formation
- Bitumen and aggregates (eg stone, sand, gravel) for pavement production and foamed bitumen
- Lime to stabilise and treat the road formation and culvert base
- Cement and aggregates (eg fly ash, gravel, crushed rock) for concrete used in drainage construction, pavement construction, and miscellaneous work such as barrier kerbs, kerbs and gutters, paving and signpost footings
- Precast concrete elements for drainage construction (culverts, pits and headwalls) and miscellaneous work
- Steel for barrier railings and reinforcement in concrete.

There are limited local gravel sources, in particular any conforming gravel or aggregate, within hundreds of kilometres of the proposal. Where possible construction would reuse as much of the existing pavement and road formation material as possible to minimise the imported material needs of the proposal. Consideration would also be given to modified subgrade material. Material would also be sourced from other projects along the Newell Highway and/or appropriately licensed facilities.

The indicative quantities of the main materials are listed in **Table 3-6**. Quantities of materials would be revised as the design develops. Potential quarry sources are listed in **Table 3-7**.

**Table 3-6 Indicative material quantities for construction**

| Material type                             | Quantity |        |        |        |        |
|---|----------|--------|--------|--------|--------|
|   | N2MS1    | N2MS2  | N2MS3  | N2MS4  | N2M5   |
| Foamed bitumen pavement (m <sup>3</sup> ) | 46,100   | 90,300 | 37,700 | 48,300 | 68,800 |
| Lime stabilising agent (t)                | 2,980    | 5,820  | 2,440  | 3,120  | 4,440  |

**Table 3-7 Potential quarry sources**

| Name                                    | Location                          | Distance to the proposal                    |
|---|-----------------------------------|---|
| Boral                                   | Wave Hill Road, Tarrara, NSW 2390 | About 26 kilometres south-east of Narrabri. |
| Johnstone Concrete and Quarries Pty Ltd | Moree, NSW 2400                   | About 26 kilometres south-east of Narrabri  |
| Tookey Pit                              | Bellata NSW 2397                  | About 50 kilometres south of Moree          |

Surplus material that cannot be used within the proposal area would be reused on other projects along the Newell Highway or disposed of in the following order of priority:

- Transferred to other Roads and Maritime projects for immediate reuse in accordance with the NSW Environmental Protection Authority (EPA) Excavated Public Road Material resource recovery exemption
- Transferred to an approved Roads and Maritime stockpile site for future reuse, only if a specific project has been identified before stockpiling and *Protection of the Environment Operations Act 1997* (POEO Act) waste regulatory requirements have been met. If a project cannot be identified the material would not be stockpiled within the proposal
- Transported off-site for reuse by a third party in accordance with a relevant EPA resource recovery exemption or planning approval
- Disposed of at an approved materials recycling or waste disposal facility
- As otherwise provided for by the relevant waste legislation.

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

### 3.3.7 Traffic management and access

Road traffic would be impacted throughout all stages of construction. As described in **Section 3.3.1**, construction would be staged to allow the Newell Highway to remain open to two-way traffic during construction. Vehicle movements

During construction a number of construction vehicles and machinery would require access to the proposal area. A number of ancillary sites would be established at up to suitable locations along the Newell Highway. All ancillary sites would be accessed from the Newell Highway and contained either within the road corridor or on private property under a lease arrangement (if required). The majority of construction plant and machinery would be located at these sites (refer to **Figure 3-4**

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

During normal working days, about 10 to 15 heavy vehicle and 20 to 25 light vehicle movements would be required per day on and offsite. Between 40 to 45 heavy vehicle movements would potentially be required per day during construction. Should the staging of the proposal have two construction fronts occurring simultaneously, there could be over 100 heavy vehicle movements



per day. Heavy vehicles would be used to deliver construction material and to transfer construction materials to ancillary sites.

During construction, it would be necessary to move a large amount of materials to and around the proposal area. Any haulage movement across or along the Newell Highway would be in accordance with an approved Traffic Management Plan (TMP), refer further to mitigation measures included in **Section 6.4**.

As a proportion of the required fill material would be sourced from outside of the proposal area, major material truck haulage routes would be required between the proposal area and the sourced material. This would be detailed in the TMP.

### ***Traffic management, control and signage***

Where possible, construction would be programmed to minimise impact on traffic using the local and regional road network. Traffic delays may occur as a result of construction and would be managed via the TMP for each segment (refer to **Section 6.4**). Standard traffic management measures would be employed to minimise short-term traffic impacts that could be expected during construction. These measures would be identified in the TMP for each segment. The TMP would also require management measures for oversize and over mass floats moving through the construction site and along the Newell Highway. The TMP would be developed for each segment and carried out in accordance with Roads and Maritime's *Traffic Control at Works Sites Manual* (RTA, 2010) and *G10 Specification for Traffic Management* (Roads and Maritime, 2011).

The TMP for each segment would detail traffic management requirements during construction, to ensure that traffic flow along the Newell Highway is maintained throughout construction. Further details on the management of vehicles during construction are provided in **Section 6.4**.

### ***Access***

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

The Newell Highway is a school bus route with school buses stopping to drop and pick-up passengers at informal bus stops within the proposal area. The location of where the bus stops may require relocation or modification during construction would be carried out in consultation with the bus operators.

## **3.4 Ancillary facilities**

Construction of the proposal would require a number of ancillary sites. Typically, the facilities required at these sites would include any of the following:

- Main site compound including site offices, sheds, workshops, storage areas and a first aid post
- Arrival and departure of office staff, workforce and daytime deliveries to compound
- Plant storage, materials laydown and storage, stockpiling and construction parking
- Delivery of excavated material from site by tipper trucks
- General stockpile management and loading of final product into tipper trucks for delivery to site
- General delivery of other construction materials for storage

- Small satellite site compounds for stockpiling
- Truck water tank loading areas
- Asphalt, bitumen batching plants, crushing plants and material processing sites.

The location and number of ancillary sites is not known at this stage. It is expected that they would be located in areas devoid of native vegetation within the road corridor or on adjacent private property under a leasing arrangement. Indicative locations are shown in **Figure 1-3**.

The stockpile areas would be established and managed in accordance with the *Stockpile Site Management Guideline* (Roads and Maritime, 2015) *QA specification R44-Earthworks - IC-QA-R44* (Roads and Maritime, 2011a). They would be located:

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

The exact location and proposed use of ancillary sites would be confirmed by the construction contractor before the start of construction. Where amendments or additional ancillary facilities are identified during construction outside of the proposal area, the contractor would consult with Roads and Maritime's lead environment advisor to confirm the suitability of the proposed amendment or additional facility, and whether any additional environmental assessment is required.

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

### 3.4.1 Construction sediment basins

Construction of the proposal has the potential to affect water quality through erosion of exposed or disturbed areas and subsequent sedimentation of watercourses. To mitigate these effects, it is expected that temporary construction basins would be installed within the proposal area to trap sediments and other pollutants from disturbed areas.

The size or location of the basins was not determined during the concept design. The design criteria for the sedimentation basins are defined in the Blue Book (Soils and Construction, 2004 and 2008 Volume 2D Main Road) which requires that sediment basins be designed for the 85th percentile, five-day rainfall depth for basins located near sensitive receiving environments, and for the 80th percentile for non-sensitive receiving environments. The sediment basins would need to provide sufficient volume for settling and storage of sediments.

This final size and location of the basins would be confirmed during detail design. Additional soil and water management measures would also be developed during detailed design and included in the CEMP.



## 3.5 Public utility adjustment

Existing utilities in the proposal area are detailed in **Section 2.2**. The following utilities may require relocation:

- Telecommunications – Telstra, NextGen, NBN and Soul
- Electricity – Essential Energy
- Water reticulation – Moree Plains Shire Council
- Sewer reticulation – Moree Plains Shire Council.

**Table 3-8** summaries the utilities identified in the *Public Utilities Strategy Report – Strategic Design* (GHD,2017d) that would potentially be impacted by the proposal. The impacts identified are based on Dial Before You Dig (DBYD) results. A detailed survey will be carried out during detailed design.

**Table 3-8 Utilities identified**

| Segment | Utilities   |
|---------|---|
| N2MS1   | <ul style="list-style-type: none"> <li>• Essential Energy assets predominately run along the eastern verge</li> <li>• No expected impact to Narrabri Shire Council (water and sewer) assets</li> <li>• Telstra assets are located on the western and eastern verges</li> <li>• No expected impact to Telecommunication assets.</li> </ul>   |
| N2MS2   | <ul style="list-style-type: none"> <li>• Essential Energy assets predominately run along the western verge, traversing the proposal to the eastern verge at Edgeroi (Tarlee Road/Couradda Road)</li> <li>• No expected impact to Narrabri Shire Council (water and sewer) assets. No expected impact to Telecommunication assets.</li> </ul>  |
| N2MS3   | <ul style="list-style-type: none"> <li>• Essential Energy assets predominately run along the eastern verge</li> <li>• No expected impact to Moree Plains Shire Council or Narrabri Shire Council (water and sewer) assets</li> <li>• Telstra assets are located on the western and eastern verges</li> <li>• No expected impact to Telecommunication assets.</li> </ul>                         |
| N2MS4   | <ul style="list-style-type: none"> <li>• Essential Energy assets predominately run along the western verge</li> <li>• No expected impact to Moree Plains Shire Council (water and sewer) assets. A detailed survey would be carried out during detailed design</li> <li>• Telstra assets are located on the western verge</li> <li>• No expected impact to Telecommunication assets.</li> </ul> |
| N2MS5   | <ul style="list-style-type: none"> <li>• Essential Energy assets predominately run along the eastern verge</li> <li>• No expected impact to Moree Plains Shire Council (water and sewer) assets.</li> <li>• Telstra assets are located on the eastern verge</li> <li>• No expected impact to Telecommunication assets.</li> </ul>   |

Electricity and telecommunications utilities would need to be relocated as part of this proposal. All utilities to be adjusted which are located within the area to be impacted by the proposal are considered to be part of the assessment in this REF. However, any adjustments that extend beyond the impacted area may require a separate environmental assessment.

Ancillary facilities would need to be connected to telecommunications and electricity. Utility infrastructure required to connect these sites would be identified during detailed design.

## 3.6 Property acquisition

Roads and Maritime and Council aim to create a 60 metre minimum width road reserve corridor. Therefore, the proposal would require strip acquisition of private and publicly owned land. The full acquisition details would be confirmed during detailed design.

All acquisitions would be conducted in accordance with the Roads and Maritime Land Acquisition Policy, and compensation would be based on the requirements of the *Land Acquisition (Just Terms) Compensation Act 1991*.



## 4. Statutory and planning framework

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

### 4.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) and its associated regulation provide the framework for assessing the environmental impacts of proposed developments in NSW. The EP&A Act allows for the creation of environmental planning instruments (EPIs) including Local Environmental Plans (LEPs) and State Environmental Planning Policies (SEPPs). Presented below is a discussion on the approval process under the EP&A Act and the relevance of specific EPIs. Also discussed below are other legislative requirements of relevance to the proposal.

As outlined in Chapter 1, Roads and Maritime is the determining authority under Division 5.1 of the EP&A Act. This REF has been prepared by Jacobs on behalf of Roads and Maritime. The purpose of the REF is to describe the proposal, to document the likely impacts of the proposal on the environment, and to detail protective measures to be implemented.

The description of the proposal and associated environmental impacts has been carried out in context of clause 228 of the Environmental Planning and Assessment Regulation 2000 (summarised in **Appendix B**), the BC Act, the FM Act, and the EPBC Act. In doing so, the REF helps to fulfil the requirements of section 5.5 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 findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Infrastructure under Division 5. 2 of the EP&A Act
- The significance of any impact on threatened species as defined by the BC Act and/or FM Act, in section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a BDAR.

#### 4.1.1 State Environmental Planning Policies

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

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

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

As the proposal is for the purposes of a road and associated road infrastructure facilities and is to be carried out on behalf of Roads and Maritime, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979*. Development consent from council is not required.

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

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

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

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

Roads and Maritime is not bound by the provisions of SEPP 44 for Part 5 assessments. However, as SEPP 44 is applicable to the Narrabri and Moree Plains LGAs, the principles of conservation would be adopted for the proposal where applicable.

No conclusive evidence of Koala occupation was found within the study area, however Koalas were recorded north of Moree, during field surveys carried out for North Moree Heavy Duty Pavement upgrade. This is detailed in the *Newell Highway - Heavy Duty Pavement Upgrade between Narrabri and Moree - Biodiversity Assessment Report* (BAR) (Jacobs, 2018). Further details regarding biodiversity are provided in **Section 6.1** and **Appendix C**.

## **4.2 Local Environmental Plans**

The proposal is located within the Narrabri Shire and Moree Plains Shire LGAs, on land which is subject to the Narrabri Shire Local Environmental Plan 2012 (Narrabri Shire LEP) and Moree Plains Local Environmental Plan 2011 (Moree Plains LEP).

### **Narrabri Shire Local Environmental Plan 2012**

The Narrabri Shire LEP applies to land within the Narrabri Shire LGA. In this LGA, the proposal area is located within land zoned as RU1 Primary Production and RU5 Village. The land use objectives for these zones under the LEP, and the proposal's consistency with those objectives, is detailed in **Table 4-1**.

**Table 4-1 Relevant zone objectives**

| <b>Zone</b>            | <b>Objective</b>  | <b>Consistency of the proposal with the zone objective</b>  |
|------------------------|---|---|
| RU1 Primary Production | <ul style="list-style-type: none"> <li>To encourage sustainable primary industry production by maintaining and enhancing the natural resource base</li> <li>To encourage diversity in primary industry enterprises and systems appropriate for the area</li> <li>To minimise the fragmentation and alienation of resource lands</li> <li>To minimise conflict between land uses within this zone and land uses within adjoining zones</li> <li>To allow for non-agricultural land uses that will not restrict the use of other land for agricultural purposes.</li> </ul> | The proposal does not conflict with these objectives as it would encourage diversity in primary industry enterprises and systems by providing a more efficient freight network, while minimising the fragmentation of land, protecting agricultural potential of rural land and maintaining the rural landscape character of the land in the long-term. |

| Zone        | Objective   | Consistency of the proposal with the zone objective  |
|-------------|---|--|
| RU5 Village | <ul style="list-style-type: none"> <li>To provide for a range of land uses, services and facilities that are associated with a rural village</li> <li>To enable development of a scale compatible with the general residential character of village areas and which will not prejudice the viability of established shopping and commercial centres.</li> </ul> | The proposal does not conflict with these objectives as it would improve access for freight and other road users travelling to rural villages between Narrabri and Moree. This would improve access to a range of services and facilities, as well as enable development within these areas. |

### **Moree Plains Local Environmental Plan 2011**

The Moree Plains LEP applies to land within the Moree Plains Shire LGA. In this LGA, the proposal area is located within land zoned as RU1 Primary Production, RU5 Village, SP2 Infrastructure, SP1 Air Transport Facility and B6 Enterprise Corridor Zones. The land use objectives for these zones under the LEP, and the proposal's consistency with those objectives, is detailed in **Table 4-2**.

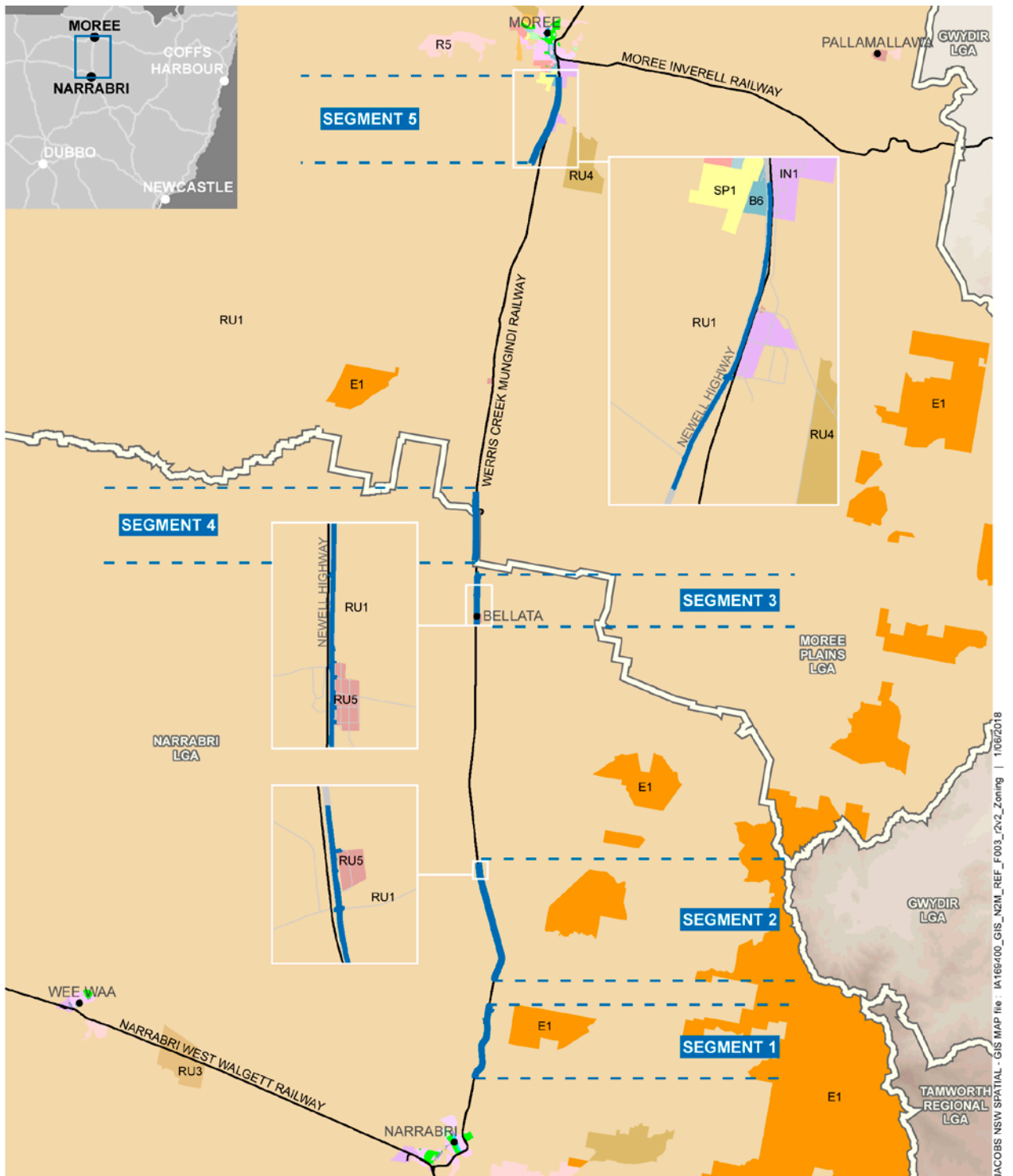
**Table 4-2 Relevant zone objectives**

| Zone                   | Objective  | Consistency of the proposal with the zone objective   |
|------------------------|--|---|
| RU1 Primary Production | <ul style="list-style-type: none"> <li>To encourage sustainable primary industry production by maintaining and enhancing the natural resource base</li> <li>To encourage diversity in primary industry enterprises and systems appropriate for the area</li> <li>To minimise the fragmentation and alienation of resource lands. To minimise conflict between land uses within this zone and land uses within adjoining zones</li> <li>To permit development for certain purposes if it can be demonstrated that suitable land or premises are not available elsewhere.</li> </ul> | The proposal does not conflict with these objectives as it would encourage diversity in primary industry enterprises and systems by providing a more efficient freight network, while minimising the fragmentation of land, protecting agricultural potential of rural land and maintaining the rural landscape character of the land in the long-term. |
| RU5 Village            | <ul style="list-style-type: none"> <li>To provide for a range of land uses, services and facilities that are associated with a rural village</li> <li>To facilitate development that reinforces village viability.</li> </ul>  | The proposal does not conflict with these objectives as it would improve access for freight and other road users travelling to rural villages between Narrabri and Moree. This would improve access to a range of services and facilities, as well as enable development within these areas.  |
| SP2 Infrastructure     | <ul style="list-style-type: none"> <li>To provide for infrastructure and related uses</li> <li>To prevent development that is not compatible with or that may detract from the provision of infrastructure.</li> </ul>   | The proposal would provide new and upgraded road related infrastructure, to improve travel times and safety within the area.  |



| Zone                       | Objective  | Consistency of the proposal with the zone objective   |
|----------------------------|--|---|
| SP1 Air Transport Facility | <ul style="list-style-type: none"> <li>To provide for special land uses that are not provided for in other zones</li> <li>To provide for sites with special natural characteristics that are not provided for in other zones</li> <li>To facilitate development that is in keeping with the special characteristics of the site or its existing or intended special use, and that minimises any adverse impacts on surrounding land.</li> </ul>  | The proposal does not conflict with the objectives of this zone. The proposal would improve travel time and safety between Narrabri and Moree, south of Moree Airport.                    |
| B6 Enterprise Corridor     | <ul style="list-style-type: none"> <li>To promote businesses along main roads and to encourage a mix of compatible uses</li> <li>To provide a range of employment uses (including business, office, retail and light industrial uses)</li> <li>To maintain the economic strength of centres by limiting retailing activity</li> <li>To provide for residential uses, but only as part of a mixed use development</li> <li>To improve the presentation of the major access corridors into Moree.</li> </ul> | The proposal would improve travel times and safety for motorists and other road users travelling between Narrabri and Moree. The proposal is consistent with the objectives of this zone. |

The proposal is permissible in all the zones relevant to the proposal outlined in **Table 4-1** and **Table 4-2**. However, as outlined in **Section 4.1.1** of this REF, under ISEPP the proposal is permitted without the consent of council. Therefore, the consent requirements of the LEP do not apply and the proposal may be determined under Division 5.1 of the EP&A Act. Other relevant NSW legislation. The land zoning around the proposal is shown on **Figure 4-2**.



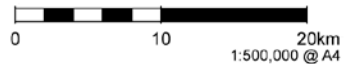
JACOBS NSW SPATIAL - GIS MAP file : I:\166400\_GIS\_NZN\_REF\_F003\_2\2\_Zoning | 11/06/2018

**Legend**

— The proposal   
  LGA boundary   
  Railway

LEP zoning (DPE)

- |  |   |   |  |
|--|---|---|--|
| <ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #e0f7fa; border: 1px solid black; margin-right: 5px;"></span> B1 Neighbourhood Centre</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #e0f7fa; border: 1px solid black; margin-right: 5px;"></span> B2 Local Centre</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #e0f7fa; border: 1px solid black; margin-right: 5px;"></span> B3 Commercial Core</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #e0f7fa; border: 1px solid black; margin-right: 5px;"></span> B4 Mixed Use</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #e0f7fa; border: 1px solid black; margin-right: 5px;"></span> B6 Enterprise Corridor</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #e0f7fa; border: 1px solid black; margin-right: 5px;"></span> B7 Business Park</li> </ul> | <ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ffe0b2; border: 1px solid black; margin-right: 5px;"></span> E1 National Parks and Nature Reserves</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ffe0b2; border: 1px solid black; margin-right: 5px;"></span> E3 Environmental Management</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ffe0b2; border: 1px solid black; margin-right: 5px;"></span> E4 Environmental Living</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ffe0b2; border: 1px solid black; margin-right: 5px;"></span> IN1 General Industrial</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ffe0b2; border: 1px solid black; margin-right: 5px;"></span> IN2 Light Industrial</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ffe0b2; border: 1px solid black; margin-right: 5px;"></span> R1 General Residential</li> </ul> | <ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ffe0b2; border: 1px solid black; margin-right: 5px;"></span> R2 Low Density Residential</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ffe0b2; border: 1px solid black; margin-right: 5px;"></span> R5 Large Lot Residential</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ffe0b2; border: 1px solid black; margin-right: 5px;"></span> RE1 Public Recreation</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ffe0b2; border: 1px solid black; margin-right: 5px;"></span> RE2 Private Recreation</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ffe0b2; border: 1px solid black; margin-right: 5px;"></span> RU1 Primary Production</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ffe0b2; border: 1px solid black; margin-right: 5px;"></span> RU3 Forestry</li> </ul> | <ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ffe0b2; border: 1px solid black; margin-right: 5px;"></span> RU4 Primary Production Small Lots</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ffe0b2; border: 1px solid black; margin-right: 5px;"></span> RU5 Village</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ffe0b2; border: 1px solid black; margin-right: 5px;"></span> SP1 Special Activities</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ffe0b2; border: 1px solid black; margin-right: 5px;"></span> SP2 Infrastructure</li> </ul> |
|--|---|---|--|



**Figure 4-1 LEP Land zoning**

## 4.3 Other relevant NSW legislation

### 4.3.1 Protection of the Environment Operations Act 1997

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

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

- Concrete works (clause 13)
- Crushing, grinding or separating materials (clause 16)
- Land-based or water-based extractive activities, such as extraction, dredging, quarrying, processing or storage (clause 19)
- Dealing with certain types of waste (see below)
- Road construction, widening or re-routing (but not maintenance or operation) where this results in four or more traffic lanes. To activate this clause, the road must be at least one kilometre to five kilometres in length depending on whether it is in a metropolitan or non-metropolitan area and on a freeway, tollway or main road (clause 35). Clause 35 of Schedule 1 identifies 'road construction' as a scheduled activity and states:
  - This clause applies to road construction, meaning the construction, widening or re-routing of roads, but does not apply to the maintenance or operation of any such road
  - The activity to which this clause applies is declared to be a scheduled activity if it results in the existence of 4 or more traffic lanes (other than bicycle lanes or lanes used for entry or exit) for at least:
    - Where the road is classified, or proposed to be classified, as a main road (but not a freeway or tollway) under the Roads Act 1993:
    - Three kilometres of their length in the metropolitan area, or
    - Five kilometres of their length in any other area.

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

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

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



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

These orders and exemptions may be used for the proposal without seeking approval from the EPA.

### 4.3.2 Roads Act 1993

The *Roads Act 1993* (Roads Act) provides for the classification of roads. It also provides for the declaration of Roads and Maritime and other public authorities as roads authorities for both classified and unclassified roads. It also regulates the carrying out of various activities in, on and over public roads.

Under Section 138(1) of the Roads Act, consent from the road authority is required for carrying out various activities in, on and over public roads. The Newell Highway is a classified road and requires consent from the road authority to proceed. Approval would be sought for a road occupancy licence for the temporary closure of traffic lanes and, if required, the movement of oversized vehicles during construction. Consent to carry out works on classified roads is not required as per Schedule 2 clause 5(1) of the Roads Act. However, a Road Occupancy Permit would need to be obtained as necessary prior to construction commencing.

### 4.3.3 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) commenced on 25 August 2017 repealing the *Threatened Species Conservation Act 1995*. The BC Act seeks to conserve biological diversity and promote ecologically sustainable development (ESD); to prevent extinction and promote recovery of threatened species, populations and ecological communities; and to protect areas of outstanding biodiversity value. The BC Act provides a listing of threatened species, populations and ecological communities, areas of outstanding biodiversity value, and key threatening processes.

Part 7 of the BC Act requires that the significance of the impact on threatened species, populations and endangered ecological communities listed under the BC Act or FM Act, are assessed using a five-part test. Where a significant impact is likely to occur, a SIS or Biodiversity Assessment Report (BAR) must be prepared in accordance with the Secretary's requirements.

In September 2015, a "strategic assessment" approval was granted by the Federal Minister in accordance with the EPBC Act. The approval applies to Roads and Maritime activities being assessed under Division 5.1 of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species.

As a result, Roads and Maritime proposals assessed via an REF:

- Must address and consider potential impacts on nationally listed threatened species, populations, ecological communities and migratory species, including application of the "avoid, minimise, mitigate and offset" hierarchy
- Do not require referral to the Federal Department of the Environment for these matters, even if the activity is likely to have a significant impact.

Roads and Maritime must consider impacts to nationally listed threatened species, ecological communities and migratory species as part of the approval process under the strategic assessment. To assist with this, assessments are required in accordance with the Matters of National Environmental Significance: Significant impact guidelines 1.1. *Environment Protection and Biodiversity Conservation Act 1999* (DoE 2013).

#### 4.3.4 National Parks and Wildlife Act 1974

The NPW Act is the primary legislation dealing with Aboriginal cultural heritage in NSW. Items of Aboriginal cultural heritage (Aboriginal objects) or Aboriginal places (declared under section 84) are protected and regulated under the NPW Act. Aboriginal objects are protected under section 86 of the Act. Under section 90(1) of the Act and the Director-General may issue an Aboriginal heritage impact permit (AHIP) for an activity which would harm an Aboriginal object.

An assessment of the potential impacts on Aboriginal cultural heritage is provided in the *Aboriginal and Historical Archaeological Survey Report: Newell Highway HD Pavements – North Narrabri* (OzArk, 2018) and summarised in **Section 6.6**. The assessment concluded that the construction of the proposal would potentially impact on one PAD (BC-HW17-PAD1) and one modified tree (BC-HW17-ST1). If the proposal design is unable to avoid these areas, an AHIP would be required for the proposal prior to construction.

#### 4.3.5 Fisheries Management Act 1994

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

Part 7A Division 4 of the Act prohibits the carrying out, without a licence, of activities that damage habitats or harm threatened species, populations or ecological communities. In determining the significance of impacts, the determining authority must consider the matters listed in section 1.7 of the EP&A Act.

The proposal would not directly impact aquatic habitat or block the passage of fish as no bridges or large culverts would be upgraded as part of the proposal, therefore notice to the Minister is not required.

#### 4.3.6 Heritage Act 1997

The *Heritage Act 1977* (Heritage Act) aims to provide for the identification, registration and conservation of items of State heritage significance. Investigations of the proposal's potential to interact with or impact on items of heritage significance are documented in **Section 6.7**.

The *Aboriginal and Historical Archaeological Survey Report: Newell Highway HD Pavements – Narrabri to Moree* (OzArk, 2018) which is provided in **Appendix D**, concluded that the proposal would not impact on any know heritage items provided the management measures outlined in **Section 7** are implemented. A summary of the Aboriginal heritage assessment is provided in Section **6.7**.

### 4.3.7 Land Acquisition (Just Terms Compensation) Act 1991

The proposal would require strip acquisition of private and publicly owned land. Details regarding property acquisition for the proposal are outlined in **Section 3.6**. All property acquisitions would be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*, which aims to guarantee just compensation terms for land that is acquired by an authority of the State.

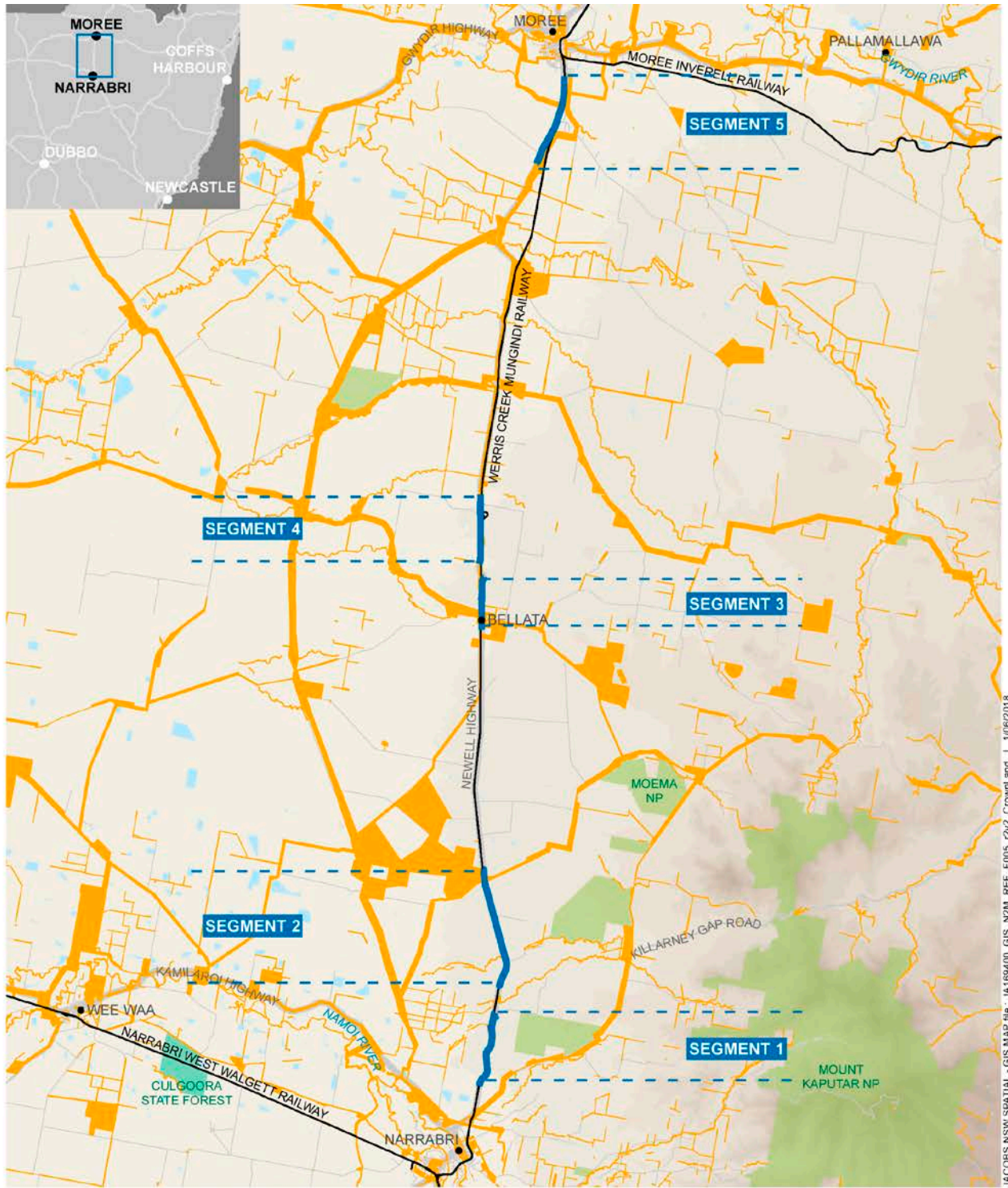
Roads and Maritime would continue to consult with affected landowners during the development of the proposal.

### 4.3.8 Crown Lands Act

The *Crown Lands Act 1989* provides the legislative framework for the administration of land that is vested in the Crown in NSW. Division 5 of the *Crown Lands Act 1989* deals with matters related to the requirements for the creation of easements over Crown land.

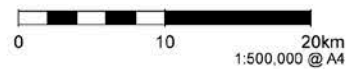
Strip acquisition of Crown land would be required for the proposal (land acquisition details are provided in **Section 3.6**). Roads and Maritime has consulted with the Department of Trade and Investment (Crown lands division) and sent a formal letter stating interest in this parcel of land for the proposal. In response the Crown lands division acknowledged the letter and agreed to further discussion. Further discussion would be carried out during detailed design with this department. The Crown land within and around the proposal is shown on **Figure 4-2**, with land acquisition described in **Section 3.6**.





**Legend**

- The proposal
- Railway
- Crown land (LPI)



**Figure 4-2 Crown land**

### 4.3.9 Biosecurity Act 2015

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

The Biosecurity Act and regulations provide specific legal requirements for high risk activities and State level priority weeds.

The study area contains significant weed growth, mainly in close proximity to the existing Newell Highway and along minor roads and tracks. Weeds of particular concern include exotic perennial grasses such as Coolatai grass (*Hyparrhenia hirta*) and Guinea grass (*Megathyrsus maximus*) which were recorded in the study area.

### 4.3.10 Waste Avoidance and Resource Recovery Act 2001

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

Waste generation and disposal reporting would be carried out during the construction and operation of the proposal. Procedures would be implemented during construction in an attempt to promote the objectives of the WARR Act (refer to **Section 6.10**).

### 4.3.11 Water Management Act

An approval under the *Water Management Act 2000* (WM Act) would be required if access to ground or surface water is required during construction, owing to the existence of the Water Sharing Plan for the Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources 2008. Some provisions of the WM Act (eg for stock and domestic uses and harvestable rights) enable some activities or works to be carried out without the need for licences, provided certain conditions are met.

Roads and Maritime, would consult with the NSW Office of Water to ensure that all applicable licences and/or approvals for any impacts to surface and ground water are obtained prior to construction.

## 4.4 Commonwealth legislation

### 4.4.1 Environment Protection and Biodiversity Conservation Act 1999

Under the EPBC Act a referral is required to the Australian Government for proposed actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land. These are considered in **Appendix B** and **Section 6** of the REF.

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

Potential impacts to these biodiversity matters are also considered as part of **Section 6.1** and **Appendix C**.

The assessment of the proposal's impact on nationally listed threatened species, endangered ecological communities and migratory species found that there is likely to be a significant impact on relevant matters of national environmental significance. **Chapter 6.1.4** describes the safeguards and management measures to be applied to minimise or mitigate impacts. **Chapter 6.1.5** also details the Biodiversity Offset Strategy to be implemented to address residual significant impacts on nationally listed biodiversity matters.

### 4.4.2 Native Title Act 1993

The *Native Title Act 1993* provides the legislative framework that:

- Recognises and protects native title
- Establishes ways in which future dealings affecting native title may proceed, and to set standards for those dealings, including providing certain procedural rights for registered native title claimants and native title holders in relation to acts which affect native title
- Establishes the National Native Title Tribunal.

The National Native Title Tribunal has a number of functions under the Act including maintaining the Register of Native Title Claims, the National Native Title Register and the Register of Indigenous Land Use Agreements and mediating native title claims. The NSW *Native Title Act 1994* was introduced to ensure that the laws of NSW are consistent with the Commonwealth *Native Title Act 1993*.

The proposal area includes crownland currently subject to Native Title Claim by the Gomeroi People (Tribunal file no. NC2011/006; Federal Court file no. NSD2308/2011 (Aboriginal Land Claims 28392, 10420 & 10421) within in N2MS4. The acquisition details would be determined during detail design.

## 4.5 Confirmation of statutory position

The proposal is categorised as development for the purpose of a road and is being carried out by or on behalf of a public authority. Under clause 94 of the ISEPP the proposal is permissible without



consent. The proposal is not State significant infrastructure or State significant development. The proposal can be assessed under Division 5.1 of the EP&A Act.

Roads and Maritime is the determining authority for the proposal. This REF fulfils Roads and Maritime's obligation under clause 5.5 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.

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

# 5. Consultation

This chapter discusses the consultation undertaken to date for the proposal and the consultation proposed for the future.

## 5.1 Community strategy

A Communications Engagement Plan (CEP) has been prepared for the proposal. Consultation objectives of the CEP include:

- Introduce the proposal to the stakeholders and community and build relationships with both
- Introduce the proposal team to the stakeholders and community and provide a central point of contact
- Explain the need for the upgrade and key features and benefits
- Outline how stakeholders and the community can participate in the proposal and how their input will be used in decision making
- Explain the decision making process from this point onwards, key project milestones including being clear when the community will have the opportunity to provide feedback. Demonstrate an understanding of community concerns and values
- Ensure issues relating to the proposal are identified early and effectively managed
- Ensure stakeholders and the community are kept informed of the proposal as it develops through the timely provision of appropriate and accessible information
- Manage stakeholder and community feedback and complaints in a timely, respectful way
- Monitor and evaluate stakeholder and community feedback to measure success and review planning and delivery as necessary
- Build stakeholder and community confidence in Roads and Maritime and leave a positive legacy within the community to enhance Roads and Maritime reputation and relationship with the community
- Effectively communicate and engage with affected property owners, working together to manage proposal impacts
- Working with other project teams effectively to ensure that the community is aware of all Roads and Maritime projects being planned and delivered in Dubbo and a coordinated approach to communications is being implemented where required.

The key stakeholders identified as part of the CEP include:

- State and Federal Ministers and Member of Parliament (MPs)
- Federal Minister for Roads
- Narrabri Shire and Moree Plains Shire Councillors
- ARTC
- Government partners:
  - Federal Department of Infrastructure and Regional Development
  - Transport for NSW
  - Transport for NSW Rail.

- Government agencies:
  - Office of Environment and Heritage (OEH) - NSW
  - NSW Environment Protection Authority
  - National Native Title Tribunal
  - NSW Office of Water
  - Lands Council.
- Other:
  - Utilities (major telecoms, power and water utilities in the area)
  - Residents and businesses impacted by the proposal
  - Business chambers and groups
  - Public transport users
  - Road users
  - Community, sporting, action and environmental groups
  - Media
  - Emergency services.

To ensure that proposal information is distributed in an effective and timely manner. A range of engagement tools and activities will be used prior to and throughout the proposal to provide information to, and receive feedback from stakeholders and the local community.

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

## 5.2 Community involvement

The communication approach will focus on targeted communication with local property owners and key stakeholders including Narrabri Shire and Moree Plains Shire Councils, the freight industry, Gomeroi People Native Title Claim Group (Gomeroi NTCCG), Narrabri Local Aboriginal Land Council (Narrabri LALC), Moree Local Aboriginal Land Council (Moree LALC), emergency services, utilities, community/interest groups and any other government agencies as required.

Roads and Maritime has encouraged community feedback to the proposal through a combination of notifications and consultation with key stakeholders and affected property owners and residents. A summary of the community involvement activities carried out to date is provided in **Table 5-1**.

**Table 5-1 Summary of community involvement activities**

| Date                 | Community involvement activity  |
|----------------------|---|
| 2017-2018            | Notification of investigation work required for the concept design. Consent was obtained from landowners for any investigation on private property.   |
| 2011-May 2018        | Key stakeholders including Narrabri Shire and Moree Plains Shire Councils, the freight industry, Aboriginal groups (Gomeroi People Native Title Claim Group, Narrabri Moree LALCs) and emergency services.  |
| January 2018         | CEP prepared.   |
| February /March 2018 | Information letters, door knocks and one to one meetings with property owners/occupants next to the highway alignment to discuss the proposal and give the opportunity to raise any concerns or questions in relation to their property and any impacts which may result from the proposal. |



| Date                             | Community involvement activity   |
|----------------------------------|--|
| 2018                             | Media notification of the display REF/Display Concept Design   |
| Prior to construction commencing | <ul style="list-style-type: none"> <li>• Doorknocking and targeted consultation with residents and landholders next to the proposal prior to construction.</li> <li>• Start of construction notification letter box drop a minimum of 5 days prior to construction.</li> </ul> |

## 5.3 Aboriginal community involvement

Roads and Maritime is committed to effective consultation with Aboriginal communities about its activities and the potential for impact on Aboriginal cultural heritage. Roads and Maritime's *Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI)* was developed to provide a consistent means of effective consultation with Aboriginal communities about activities which may impact on Aboriginal cultural heritage, and a consistent assessment process for Roads and Maritime activities across NSW. A summary of the four stages of the PACHCI procedure is provided in **Table 5-2**.

**Table 5-2 Summary of PACHCI procedure**

| Stage   | Description   |
|---------|---|
| Stage 1 | Initial desktop assessment to identify whether the proposal is likely to harm Aboriginal cultural heritage.   |
| Stage 2 | Further assessment and site survey with Aboriginal stakeholders to assess a proposal's potential to harm Aboriginal cultural heritage and to identify whether formal Aboriginal community consultation and an Aboriginal cultural heritage assessment report (ACHAR) is required. |
| Stage 3 | Where Stages 1 and 2 have led to the preliminary view that harm to Aboriginal objects or places will occur or is likely to occur, formal consultation and preparation of an ACHAR must be completed. This stage may also involve archaeological test excavations.                 |
| Stage 4 | Implementation of assessment recommendations.   |

Aboriginal community consultation carried out to date has involved a site assessment on 31 May 2017 and 15 to 17 January 2018 by OzArk archaeologists and three Aboriginal groups (Gomerioi People Native Title Claim Group, Narrabri and Moree LALC) under Stage 2 of PACHCI. The findings from the site assessment have been documented in the *Aboriginal and Historical Archaeological Survey Report: Newell Highway HD Pavements – North Narrabri* (OzArk, 2018) which is summarized in **Section 6.6** and provided in **Appendix D**. This report details that three new Aboriginal sites (modified trees) and one new PAD were identified near the proposal.

## 5.4 ISEPP consultation

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

As the proposal would impact on local roads that intersect with the Newell Highway (refer to **Section 2.2**) and is located on flood liable land, therefore consultation was carried out with Narrabri Shire Council and Moree Plains Shire Council under clause 13 and 15 of ISEPP. A letter was sent to council 8 March 2018. The letter provided information on the proposal and requested input in terms of any issues or concerns. Narrabri Shire Council's response was received on 26 March 2018 and Moree Plains Shire Council's response was received 28 March 2018.

Issues that have been raised as a result of this consultation are outlined below in **Table 5-3**.

**Table 5-3 Issues raised through ISEPP consultation**

| Agency                     | Issue raised   | Response/where addressed in REF   |
|----------------------------|--|---|
| Narrabri Shire Council     | <ul style="list-style-type: none"> <li>Narrabri Shire Council raised concern that the figures provided do not clearly illustrate how the proposal will interlink with local roads. The following was requested:</li> <li>Preference for local roads and driveways to extend to the boundaries of the main road corridor, taking into consideration the relative level of roads and driveways, especially in the locations where local roads and driveways cross the level crossings of the rail network.</li> </ul>  | <p>The Road and Maritime project team meet with Narrabri Shire Council in April 2018 to discuss the design.</p> <p>The proposal design, including local road, rail crossing and driveway treatments discussed in <b>Section 3.2.3</b>.</p>              |
|                            | <ul style="list-style-type: none"> <li>A bitumen seal to extend up to and beyond the crossing to ensure all vehicles can stop and take off safely during wet weather events as the clays in the region are known to be extremely slippery when wet. These works should be constructed to minimise grade changes between the highway, rail crossing and local roads, ensuring adequate signage for short staking of trucks or provide turning lanes to avoid this issue altogether.</li> </ul>  | <p>The intersection treatments would pavement seal of the local road that join the Newell Highway within the proposal area. Refer to <b>Section 3.2.3</b>. The grade changes and sight distance will continue to be considered as design processes.</p> |
|                            | <p>Narrabri Shire Council requested more detail on the final width of the reconstructed pavement through Edgeroi and Bellata as it is required to determine if existing assets would be affected. The following concerns were raised:</p> <ul style="list-style-type: none"> <li>Water mains are located in the southbound shoulder in Bellata which will require hydrant points to be raised to the road surface level</li> <li>The existing rising main to the water tower should be replaced where it crosses the highway.</li> </ul> <p>The concerns raised above should be replaced prior to the commencement of works to avoid any delays to the proposal.</p> | <p>The Road and Maritime project team met with Narrabri Shire Council where it was determined that the water main would be relocation by council prior to construction of the proposal.</p>   |
|                            | <p>Narrabri Shire Council raised concern that the extent of any kerb and guttering works that will be replaced or required was unclear.</p>  | <p>Road and Maritime will continue to consult with Narrabri Shire Council as the proposal design progresses.</p>  |
| Moree Plains Shire Council | No comments received.  | -   |

## 5.5 Government agency and stakeholder involvement

Roads and Maritime has consulted on an ongoing basis with key State and local government agencies as well as the Australian Rail Track Corporation (ARTC), utility providers, the freight industry, bus operators, local property owners and businesses in the proposal area. This consultation was designed to ensure issues and concerns were understood, documented and addressed, and that stakeholders had an opportunity to discuss any aspect of the proposal. Consultation has included phone calls, emails, letters and face-to-face meetings.

## 5.6 Ongoing or future consultation

This REF has been placed on public display and community comments are invited. All comments received will be considered before finalising the proposal's concept design. The community will be kept informed of any further changes to the proposal resulting from this and any future consultation process.

Information sessions will be held during the REF public display period. Details of these information dates and locations will be advertised prior to the events and issued in a Roads and Maritime community update.

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

- Proposal information provided through the proposal website:  
<http://www.rms.nsw.gov.au/projects/western-nsw/narrabri-moree-heavy-duty-pavement/index.html>
- Consultation with Narrabri Shire Council and Moree Plains Shire Council, the freight industry and local bus companies will be ongoing in relation to staging plans, traffic management, and temporary road shut-downs
- Property owners identified will continue to be consulted about property acquisition and adjustment requirements
- All directly affected property owners and freight providers / industry using the highway will be consulted before the start of construction and changes to access for private properties (if required)
- Start of construction notification will be carried out via letter box drop to a number of residents around the proposal a minimum of five days prior to the commencement of construction. Start of construction notification will also be provided to the local council and emergency services
- Notifications will be placed in local print media before the start of works detailing the likely timing of the proposal, potential changes to traffic conditions and project management contact details to open communication channels to provide further details or address complaints
- Variable message signs (VMS) will be used along the Newell Highway to inform motorists using this road of the work and potential disruption to the road. The VMS's will be deployed a minimum of five days prior to the commencement of construction.



## 6. Environmental assessment

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

- Potential impacts on matters of national environmental significance under the EPBC Act
- The factors specified in the guidelines *Is an EIS required?* (DUAP 1995/1996) as required under clause 228(1) of the Environmental Planning and Assessment Regulation 2000 and the *Roads and Related Facilities EIS Guideline (DUAP 1996)*. The factors specified in clause 228(2) of the Environmental Planning and Assessment Regulation 2000 are also considered in **Appendix B**
- Site-specific safeguards and management measures are provided to mitigate the identified potential impacts.

### 6.1 Biodiversity

The potential impacts of the proposal on biodiversity are assessed in the *Newell Highway - Heavy Duty Pavement Upgrade between Narrabri and Moree - Biodiversity Assessment Report (BAR)* (Jacobs, 2018), provided in **Appendix C**. The potential impacts, and safeguards to mitigate them, are summarised in this section.

#### 6.1.1 Assessment Methodology

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

The methodology for the biodiversity assessment involved:

- A desktop review of relevant database records and previous studies within the locality to identify Commonwealth and State listed threatened species, populations and ecological communities. A habitat assessment was carried out to assess the likelihood of the species being present in the study area
- The mapping of vegetation communities and flora through aerial photograph interpretation, regional spatial data, and elevation data to stratify vegetation and habitats in the study area
- Vegetation and habitat condition assessment consistent with the Biodiversity Assessment Method (BAM) (OEH, 2017). The flora survey aimed to provide baseline data for the presence of threatened plant species, populations and ecological communities to provide a basis for the prediction of impacts
- Targeted terrestrial flora and fauna surveys which were carried out from 7 December to 10 December 2018 and from the 14 to 18 May 2018
- The fauna survey method included rapid habitat assessment at multiple sites, searches for evidence of threatened fauna, and opportunistically recording fauna species active at the time of the survey. No targeted fauna survey techniques such as mammal trapping, bat (anabat) surveys, spotlighting, frog surveys or call playback, were carried out
- An assessment of threatened species to identify the likely occurrence of State and nationally listed threatened species; these were identified from background reviews based on their habitat requirements

- An assessment of significance for threatened species and ecological communities positively identified during surveys and inspections or that are considered to have a moderate or high likelihood of occurring in the study area
- Identification of impacts and associated mitigation measures to reduce and manage impacts.

### ***Database review***

Database searches were carried out in November 2017. The databases searched included the following:

- BioNet - the website for the Atlas of NSW Wildlife and OEH Threatened Species Profile Database
- NSW Department of Primary Industries (DPI) freshwater threatened species distribution maps
- The federal Department of Environment and Energy Protected Matters Search Tool
- OEH BioNet Vegetation Classification System database
- The federal Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE)
- Department of Environment and Energy directory of important wetlands
- Department of Planning and Environment SEPP 14 wetlands spatial data
- Atlas of Living Australia
- Register of Declared areas of Outstanding Biodiversity Value OEH vegetation information system (VIS) database (OEH, 2015).

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

## **6.1.2 Existing environment**

The locality is located within the Brigalow Belt South Interim Biogeographically Regionalisation of Australia (IBRA) bioregion as defined by Thackway and Cresswell (1995).

The area surrounding the proposal is characterised by a rural environment which is predominately cleared of native vegetation and replaced with cropping and grazing. The retention of remnant vegetation has been greatest in the road reserve which has been traditionally used as a travelling stock reserve. Specifically, the landscape surrounding each segment comprises the following:

- N2MS1 – Grazing and some cropping
- N2MS2 – Mostly cropping, some grazing
- N2MS3 – Mostly grazing, some cropping
- N2MS4 – Mostly grazing, some cropping
- N2MS5 – Mostly cropping, some grazing.

A list of plants and animals recorded during the field surveys is provided in **Appendix C**.

### ***Plant community types***

Eight Plant Community Types (PCT) as described by the NSW Vegetation Information System (VIS) database were identified within the study area. These are described in **Table 6-1** and shown in **Photo 6-1** to **Photo 6-8**.

**Table 6-1 Plant community types**

| Plant community type (PCT)  | Condition class                      | Threatened ecological community?   | Area (ha) in proposal area |
|---|--------------------------------------|--|----------------------------|
| Belah woodland on alluvial plains and low rises in the central NSW wheat belt to Pilliga and Liverpool Plains regions (PCT 55) (refer to <b>Photo 6-1</b> )                               | Moderate to Good (Relatively Intact) | <ul style="list-style-type: none"> <li>Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions (Endangered – BC Act)</li> <li>Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (Endangered – EPBC Act).</li> </ul> | 0.98                       |
|   | Moderate to Poor (Derived Grassland) |  | 0.22                       |
| Brigalow viney scrub open forest on loamy soils in low hill landscapes in the northern Brigalow Belt South Bioregion (PCT 445) (refer to <b>Photo 6-2</b> )                               | Moderate to Good (Relatively Intact) | <ul style="list-style-type: none"> <li>Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions (Endangered – BC Act)</li> <li>Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant) (Endangered – EPBC Act).</li> </ul>                     | 0.66                       |
|   | Moderate to Poor (Derived Grassland) |  | No (See note 1)            |
| Carbeen +/- Coolabah grassy woodland on floodplain clay loam soil on north-western NSW floodplains, mainly Darling Riverine Plain Bioregion (PCT 628) (refer to <b>Photo 6-3</b> )        | Moderate to Good (Relatively Intact) | Carbeen Open Forest Community in the Darling Riverine Plains and Brigalow Belt South Bioregions (Endangered – BC Act)  | 2.98                       |
|   | Moderate to Poor (Derived Grassland) |  | 0.04                       |
| Mock Olive - Wilga - Peach Bush - Carissa semi-evergreen vine thicket (dry rainforest) mainly on basalt soils in the Brigalow Belt South Bioregion (PCT 147) (refer to <b>Photo 6-4</b> ) | Moderate to Good (Relatively Intact) | <ul style="list-style-type: none"> <li>Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions (Endangered – BC Act)</li> <li>Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (Endangered – EPBC Act).</li> </ul> | 0.08                       |
| Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW (PCT 56) (refer to <b>Photo 6-5</b> )  | Moderate to Good (Relatively Intact) | No, but there is a preliminary listing of Endangered for this community under the EPBC Act.  | 3.64                       |
|   | Moderate to Poor (Derived Grassland) |  | 1.05                       |



| Plant community type (PCT)   | Condition class                      | Threatened ecological community?   | Area (ha) in proposal area |
|--|--------------------------------------|--|----------------------------|
| Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion (PCT 397) (refer to <b>Photo 6-6</b> )                                       | Moderate to Good (Relatively Intact) | No, but there is a preliminary listing of Endangered which may include this community under the EPBC Act.  | 8.21                       |
|  | Moderate to Poor (Derived Grassland) |  | 5.35                       |
| Queensland Bluegrass +/- Mitchell Grass grassland on cracking clay floodplains and alluvial plains mainly the northern-eastern Darling Riverine Plains Bioregion (PCT 52) (refer to <b>Photo 6-7</b> ) | Moderate to Good (Relatively Intact) | Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland (Critically Endangered – EPBC Act).   | 11.31                      |
| Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion (PCT 27) (refer to <b>Photo 6-8</b> )   | Moderate to Good (Relatively Intact) | <ul style="list-style-type: none"> <li>Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (Endangered – BC Act)</li> <li>Weeping Myall Woodlands (Endangered – EPBC Act).</li> </ul>             | 3.17                       |
|  | Moderate to Poor (Derived Grassland) | <ul style="list-style-type: none"> <li>Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (Endangered – BC Act)</li> <li>Derive grasslands do not meet EPBC Act condition thresholds.</li> </ul> | 11.06                      |
| <b>Total</b>   | <b>48.28</b>                         |  |                            |

Note 1: Derived grasslands are not included in the definition of the community under the BC Act or EPBC Act.





**Photo 6-1 Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions (PCT 55)**



**Photo 6-2 Brigalow viney scrub open forest on loamy soils in low hill landscapes in the northern Brigalow Belt South Bioregion (PCT 445)**



**Photo 6-3 Carbeen +/- Coolabah grassy woodland on floodplain clay loam soil on north-western NSW floodplains, mainly Darling Riverine Plain Bioregion (628)**



**Photo 6-4 Mock Olive - Wilga - Peach Bush - Carissa semi-evergreen vine thicket (dry rainforest) mainly on basalt soils in the Brigalow Belt South Bioregion (PCT 147)**





**Photo 6-5 Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW (56)**



**Photo 6-6 Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion (397)**



**Photo 6-7 Queensland Bluegrass +/- Mitchell Grass grassland on cracking clay floodplains and alluvial plains mainly the northern-eastern Darling Riverine Plains Bioregion (52)**



**Photo 6-8 Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion (27)**



### ***Aquatic surface water ecosystems and fish habitat***

Within the survey area, surface water was observed as small ponds within ephemerally flowing creeks, including Tookey Creek, Halls Creek, and an unnamed waterway south of Edgeroi (very small shallow pools only in this waterway). Two other named waterways, Bobbiwa Creek and Tarlee Creek, and other unnamed waterways were observed but none of these contained substantial surface water at the time of the December 2017 survey.

The assessment of stream habitats within the proposal area found that:

- Three of the waterways (Halls, Tookey and Bobbiwaa Creeks) would be classified as Class 2 (moderate key fish habitat); or Class 1 (major key fish habitat) if threatened species are present.
- Six of the waterway (Tarlee Creek, Gehan Creek, two unnamed water ways, Halls Creek and Tookey Creek within N2MS4) would be classified as Class 3 as (minimal key fish); or Class 1 (major key fish habitat) if threatened species are present
- The remaining waterways would be classified as Class 4 (unlikely key fish habitat).

An assessment of the fish habitat value of the waterways within the study area was based on the modelled habitat of threatened fish, field observation, aerial photograph interpretation and fish records. The Purple Spotted Gudgeon (*Mogurnda adspersa*) and Eel Tailed Catfish (*Tandanus tandanus*) were considered to have a moderate likely hood of occurrence.

The assessment of fish habitat value of streams within the proposal area are summarised in **Table 6-2**.

**Table 6-2 Assessment of the fish habitat value of streams in the study area (DPI, 2013; 2017)**

| Water body and location                               | Surface water  | Mapped as Key Fish Habitat by DPI | Modelled habitat for threatened species by DPI          | Habitat assessment result   | Key fish habitat sensitivity classification                                      | Key Fish Habitat status based on habitat assessment   |
|---|--|-----------------------------------|---|---|--|---|
| <b>N2MS1</b>  |  |                                   |   |   |  |   |
| Unnamed tributary of Narrabri Creek                   | No sign of any waterway in this location, although there it appears to be ephemeral wetland areas in adjacent paddocks.  | Yes                               | No  | The waterway is expected to have at most intermittent flow following rain events only, has no defined drainage channel, no evidence of free standing water or pools post rain events; ie. it is a shallow depression with no aquatic flora present. It would be unlikely to provide habitat for threatened aquatic species.   | Type 3 – Minimally sensitive key fish habitat                                    | Class 4<br>Unlikely key fish habitat  |
| <b>N2MS2</b>  |  |                                   |   |   |  |   |
| Bobbiwaa Creek, near Junefield Road North of Narrabri | No standing water or obvious ephemeral pools recorded. Aerial photography shows that pools (natural pools and dams) exist upstream and downstream within and next to the stream channel. | Yes                               | Yes<br>Purple Spotted Gudgeon<br><br>Eel Tailed Catfish | Bobbiwaa Creek is a waterway with intermittent flow and sporadic refuge, breeding or feeding areas for aquatic fauna (such as fish, yabbies). It appears that semi-permanent pools form within the waterway after rain events; possibly permanent pools (billabongs and dams) are located close to the channel outside of the study area. This creek has been mapped as habitat for the Purple Spotted Gudgeon and Eel Tailed Catfish. These species would be unlikely to permanently occupy the stretch of the creek within the study area. If present within the creek they may occur in deeper pool refugia upstream and/or downstream, and may use the habitat in the study area during high rainfall periods for movement between these more permanent habitats. | Type 1 - Highly sensitive key fish habitat (expected threatened species habitat) | Class 2:<br>Moderate key fish habitat<br><br>Or<br><br>Class 1: Major key fish habitat if threatened species present) |

| Water body and location   | Surface water   | Mapped as Key Fish Habitat by DPI | Modelled habitat for threatened species by DPI | Habitat assessment result   | Key fish habitat sensitivity classification                                      | Key Fish Habitat status based on habitat assessment   |
|---|---|-----------------------------------|--|---|--|---|
| Tarlee Creek, north of Edgeroi  | No standing water observed but there was evidence of shallow ephemeral pools. Aerial photography shows that pools (natural pools and dams) exist upstream and downstream within and next to the stream channel.                                     | No                                | Yes<br>Purple Spotted Gudgeon                  | Tarlee Creek is a waterway with intermittent flow and sporadic refuge, breeding or feeding areas for aquatic fauna (such as fish, yabbies). Shallow ephemeral pools appear to form within the waterway after rain events; possibly permanent pools (farm dams) are located close to the creek channel outside of the study area. The creek has been mapped as habitat for the Purple Spotted Gudgeon. This species would be unlikely to permanently occupy the stretch of the creek within the study area. If present it may occur in deeper pool refugia (farm dams) upstream and/or downstream and may use the habitat in the study area during high rainfall periods for movement between these more permanent habitats.           | Type 1 - Highly sensitive key fish habitat (expected threatened species habitat) | Class 3<br>Minimal key fish habitat<br><br>Or<br><br>Class 1: Major key fish habitat if threatened species present) |
| Unnamed stream south of Edgeroi - between Smithfield Rd and Couradda Road | A small pool with no emergent aquatic vegetation and an area of impeded drainage (ephemeral wetland) observed in the proposal area. Aerial photography shows that pools (dams) exist upstream and downstream within and next to the stream channel. | No                                | Yes<br>Purple Spotted Gudgeon                  | The stream is a waterway with intermittent flow and sporadic refuge, breeding or feeding areas for aquatic fauna (such as fish, yabbies). Shallow ephemeral pools appear to form within the waterway in the study area after rain events; possibly permanent pools (dams) are located in the stream channel outside of the study area. as the stream has been mapped as habitat for the Purple Spotted Gudgeon. This species would be unlikely to permanently occupy the stretch of the creek within the study area. If present it may occur in deeper pool refugia (farm dams) upstream and/or downstream and may use the habitat in the study area during high rainfall periods for movement between these more permanent habitats. | Type 1 - Highly sensitive key fish habitat (expected threatened species habitat) | Class 3<br>Minimal key fish habitat<br><br>Or<br><br>Class 1: Major key fish habitat if threatened species present) |



| Water body and location                               | Surface water   | Mapped as Key Fish Habitat by DPI | Modelled habitat for threatened species by DPI | Habitat assessment result   | Key fish habitat sensitivity classification                                      | Key Fish Habitat status based on habitat assessment   |
|---|---|-----------------------------------|--|---|--|---|
| Bobbiwaa Creek, near Junefield Road North of Narrabri | No sign of any distinct waterway but there may be ephemeral wetland areas. Small areas of standing water in culverts only.  | No                                | No   | The waterway has at most intermittent flow following rain events only, has no defined drainage channel, no evidence of free standing water or pools post rain events. It was observed to be a shallow depression with no aquatic flora present. It would be unlikely to provide habitat for threatened aquatic species.   | Type 3 – Minimally sensitive key fish habitat                                    | Class 4<br>Unlikely key fish Habitat  |
| <b>N2MS3</b>  |   |                                   |  |   |  |   |
| Gehan Creek north of Bellata 1 north of Millie Road   | No standing water observed in the proposal area but the surrounding area is likely to form an ephemeral wetland after heavy rain. Aerial photography shows that pools (dams) exist upstream and downstream within and next to the stream channel. | No                                | Yes<br>Purple Spotted Gudgeon                  | The stream is a waterway with intermittent flow and sporadic refuge, breeding or feeding areas for aquatic fauna (eg fish, yabbies). Shallow ephemeral pools appear to form within the waterway in the study area after rain events; possibly permanent pools (dams) are located in the stream channel outside of the study area. as the creek has been mapped as habitat for the Purple Spotted Gudgeon. This species would be unlikely to permanently occupy the stretch of the creek within the study area. If present it may occur in deeper pool refugia (farm dams) upstream and/or downstream and may utilise the habitat in the study area during high rainfall periods for movement between these more permanent habitats. | Type 1 – Highly sensitive key fish habitat (expected threatened species habitat) | Class 3<br>Minimal key fish habitat<br><br>Or<br><br>Class 1: Major key fish habitat if threatened species present) |

| Water body and location         | Surface water   | Mapped as Key Fish Habitat by DPI | Modelled habitat for threatened species by DPI | Habitat assessment result   | Key fish habitat sensitivity classification                                      | Key Fish Habitat status based on habitat assessment   |
|---------------------------------|---|-----------------------------------|--|---|--|---|
| Unnamed stream north of Bellata | No standing water observed in the natural stream channel in the study area; a dam lined with emergent aquatic vegetation ( <i>Typha</i> sp. etc.) is located at the edge of the study area. The surrounding area is likely to form an ephemeral wetland after heavy rain. Aerial photography shows one pool (dam) at the upstream edge of the study area and pools (natural pools and dams) downstream within and next to the stream channel. | No                                | Yes<br>Purple Spotted Gudgeon                  | The stream is a waterway with intermittent flow and sporadic refuge, breeding or feeding areas for aquatic fauna (eg fish, yabbies). It appears that shallow ephemeral wetlands form within the waterway in the study area after rain events; possibly permanent pools (dams) are located in the stream channel at the upstream edge of and outside of the study area. The stream is mapped as habitat for the Purple Spotted Gudgeon. This species would be unlikely to permanently occupy the stretch of the creek within the study area but may occupy the dam at the edge. If present it may occur in deeper pool refugia (farm dams) upstream and/or downstream and may use the habitat in the study area during high rainfall periods for movement between these more permanent habitats. | Type 1 – Highly sensitive key fish habitat (expected threatened species habitat) | Class 3<br>Minimal key fish habitat<br><br>Or<br><br>Class 1: Major key fish habitat if threatened species present) |

| Water body and location  | Surface water  | Mapped as Key Fish Habitat by DPI | Modelled habitat for threatened species by DPI | Habitat assessment result   | Key fish habitat sensitivity classification   | Key Fish Habitat status based on habitat assessment  |
|--|--|-----------------------------------|--|---|---|--|
| N2MS4  |  |                                   |  |   |   |  |
| Tookey Creek<br><br>North of Bellata near Tookey Creek rest area | Moderate sized ephemeral ponds; contained standing water at the time of the survey but aerial photography suggests that these pools are ephemeral. Aerial photography shows that substantial pools (natural pools and dams) exist upstream and downstream within and next to the stream channel. | Yes                               | Yes<br>Purple Spotted Gudgeon                  | Tookey Creek appears to be an intermittently flowing creek that retains water for extended periods in a series of disconnected pools after flow ceases. Considered to be possible habitat for the Purple Spotted Gudgeon. It appears that shallow ephemeral pools form within the waterway after rain events; possibly permanent pools (farm dams) are located close to the channel outside of the study area. The creek has been mapped as habitat for the Purple Spotted Gudgeon. This species would be unlikely to permanently occupy the stretch of the creek within the study area. If present it may occur in deeper pool refugia (farm dams) upstream and/or downstream and may use the habitat in the study area during high rainfall periods for movement between these more permanent habitats. | Type 1 – Highly sensitive key fish habitat (expected threatened species habitat)  | Class 2: Moderate key fish habitat<br><br>Or<br><br>Class 1: Major key fish habitat if threatened species present) |
| Tookey Creek<br>North of Bellata near Tookey Creek rest area     | No standing water observed but an area of impeded drainage (ephemeral wetland) observed in the study area. Aerial photography shows that water pools in this area and that pools (dams) exist  | No                                | No   | The stream is a waterway with intermittent flow and sporadic refuge, breeding or feeding areas for aquatic fauna (eg fish, yabbies). Shallow ephemeral pools appear to form within the waterway after rain events; possibly permanent pools (farm dams) are located close to the channel outside of the study area. The creek is not mapped as habitat for any threatened species but is a tributary of Halls Creek which is considered to be potential habitat for the Purple Spotted Gudgeon. This species would be unlikely to permanently occupy the stretch of the stream within the study area. If present it may occur in deeper pool refugia (farm dams) upstream and/or downstream and may   | Type 3 – Minimally sensitive key fish habitat, or<br><br>Type 1 – Highly sensitive key fish habitat (possible threatened species habitat) | Class 3 Minimal key fish habitat<br><br>Or<br><br>Class 1: Major key fish habitat if threatened species present)   |



| Water body and location                                | Surface water  | Mapped as Key Fish Habitat by DPI | Modelled habitat for threatened species by DPI | Habitat assessment result   | Key fish habitat sensitivity classification   | Key Fish Habitat status based on habitat assessment   |
|--|--|-----------------------------------|--|---|---|---|
|  | upstream and downstream within and next to the stream channel.   |                                   |  | use the habitat in the study area during high rainfall periods for movement between these more permanent habitats.  |   |   |
| <b>N2MS5</b>   |  |                                   |  |   |   |   |
| Halls Creek South of Moree (north of Burrington Road)  | No standing water observed but evidence of shallow ephemeral pools recorded. Aerial photography shows that pools (dams) exist upstream and downstream within and next to the stream channel. | No                                | No   | The stream is a waterway with intermittent flow and sporadic refuge, breeding or feeding areas for aquatic fauna (eg fish, yabbies). Shallow ephemeral pools appear to form within the waterway after rain events; possibly permanent pools (farm dams) are located close to the channel outside of the study area. The creek is not mapped as habitat for any threatened species but is a tributary of Tookey Creek which is mapped as habitat for the Purple Spotted Gudgeon. This species would be unlikely to permanently occupy the stretch of the creek within the study area. If present it may occur in deeper pool refugia (farm dams) upstream and/or downstream and may use the habitat in the study area during high rainfall periods for movement between these more permanent habitats. | Type 3 – Minimally sensitive key fish habitat, or<br>Type 1 – Highly sensitive key fish habitat (possible threatened species habitat) | Class 3<br>Minimal key fish habitat<br><br>Or<br>Class 1: Major key fish habitat if threatened species present)   |
| Halls Creek, south of Moree (north of Burrington Road) | Surface water in pools at the time of survey; the presence of fringing vegetation ( <i>Typha</i> sp.) suggests that that the ponds may contain water even during low rainfall periods.       | No                                | No   | Halls Creek appears to be an intermittently flowing creek that retains water for extended periods in a series of disconnected pools after flow ceases. Considered to be possible habitat for one or more of the following threatened species of fish: <ul style="list-style-type: none"> <li>• Purple Spotted Gudgeon</li> <li>• Eel Tailed Catfish (recorded on the creek downstream).</li> </ul>  | Type 1 – Highly sensitive key fish habitat (contains native aquatic plants and is expected threatened species habitat).               | Class 2:<br>Moderate key fish habitat<br><br>Or<br>Class 1: Major key fish habitat if threatened species present) |

## Groundwater dependent ecosystems

The level of groundwater dependence of vegetation communities in the study area has been identified using the Atlas of Groundwater dependent ecosystems (GDE) (Bureau of Meteorology, 2017) and the *Risk Assessment Guidelines for Groundwater Dependent Ecosystems* released by the NSW DPI (Kuginis et al, 2012).

### Aquatic groundwater dependent ecosystems

Mapped aquatic GDEs in the locality between Narrabri and Moree are restricted to rivers and larger creeks, including:

- Namoi River/Narrabri Creek (more than five kilometres north of the proposal)
- Mehi River (more than two kilometres north of the proposal)
- Gurley Creek (more than 10 kilometres from the proposal)
- Tycannah Creek (more than five kilometres north of the proposal)
- Gehan Creek (about 50 metres north of N2MS3).

GDEs associated with these waterbodies would consist of Baseflow streams (subsurface component and surface/free-water component), and groundwater dependent wetlands.

These waterways are likely to be facultative GDEs which are chiefly reliant on surface water but require groundwater in some locations such as permanent wetlands and permanent pools but not in others such as the main channel and ephemeral wetland areas.

Most of these aquatic GDEs are located over two kilometres from the proposal, with the exception of Gehan Creek which is about 50 metres north of the proposal, which is mapped as a moderate potential GDE.

Other smaller streams in the study area which have only ephemeral flow and intermittent expression of surface water would be unlikely to have baseflow characteristics and unlikely to be significantly dependent on groundwater. These systems would be in the facultative-opportunistic category.

### Terrestrial groundwater dependent ecosystems

Most of the terrestrial vegetation types of the study area would be classified as non-dependent ecosystems or possibly facultative-opportunistic ecosystems. Such ecosystems may use groundwater where available during times of water stress but would be dependent chiefly on rainfall. However, two communities are considered to have a potential for groundwater dependence (refer to **Table 6-3**). The low potential GDEs would be classified either as non-dependent ecosystems or as facultative-opportunistic GDEs with only minor interaction with groundwater.

**Table 6-3 Level of groundwater dependence of terrestrial ecosystems in study area**

| <b>Ecosystem</b>   | <b>Potential for GDE interaction (BoM, 2017)</b> | <b>Type of GDE (Kuginis <i>et al.</i> 2012)</b>             | <b>Likely type and degree of groundwater dependence (Kuginis <i>et al.</i> 2012)</b>   |
|--|--|---|--|
| Carbeen +/- Coolibah grassy woodland on floodplain clay loam soil on north-western NSW floodplains,  | High potential GDE - from regional studies       | Groundwater dependent terrestrial ecosystem (phreatophytic) | Facultative-proportional; Likely to be dependent in part on groundwater may be modified (eg in species composition) by changes in groundwater attributes but is unlikely to be destroyed.<br><br>Likely to be moderately reliant on groundwater particularly during times of water stress. |
| Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW   | Moderate potential GDE - from regional studies   | Groundwater dependent terrestrial ecosystem (phreatophytic) | Facultative-opportunistic. Likely to use groundwater where available during times of water stress but to be dependent chiefly on rainfall.   |
| Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions                                   | Low potential GDE - from regional studies        | Groundwater dependent terrestrial ecosystem (phreatophytic) | Non-dependent ecosystems or possibly facultative-opportunistic. May use groundwater where available during times of water stress but to be dependent chiefly on rainfall.  |
| Brigalow viney scrub open forest on alluvial often gilgaied clay from Pilliga Scrub to Goondi  |  |   |  |
| Mock Olive - Wilga - Peach Bush - Carissa semi-evergreen vine thicket (dry rainforest) mainly on basalt soils in the Brigalow Belt South Bioregion     |  |   |  |
| Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt |  |   |  |
| Queensland Bluegrass +/- Mitchell Grass grassland on cracking clay floodplains and alluvial plains mainly the northern-eastern Darling Riverine Plains |  |   |  |
| Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion   |  |   |  |

***Threatened ecological communities***

A number of State and Commonwealth listed threatened ecological communities were recorded within the study area as described below and shown in **Figure 1-3**.



#### BC Act (NSW):

- Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions (Endangered)
- Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions (Endangered)
- Carbeen Open Forest Community in the Darling Riverine Plains and Brigalow Belt South Bioregions (Endangered)
- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (Endangered).

#### EPBC Act (Commonwealth):

- Semi-evergreen Vine Thickets of the Brigalow Belt (North and South) and Nandewar Bioregion (Endangered)
- Brigalow (*Acacia harpophylla* dominant and co-dominant) (Endangered)
- Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland (Critically Endangered)
- Weeping Myall Woodlands (Endangered).

#### Aquatic threatened ecological communities

Waterways within the study area are tributaries of the Darling River via the Namoi River and Gwydir Rivers. Fish and aquatic invertebrates (worms, crustaceans, insects, molluscs, rotifers etc.) in natural creeks, rivers, streams and associated lagoons, billabongs, lakes, anabranches, flow diversions to anabranches and floodplains in the Lower Darling region form part of *The aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River* (Lowland Darling River aquatic ecological community) which is listed as an endangered ecological community under the FM Act.

Manmade/artificial canals, water distribution and drainage works, farm dams and off-stream reservoirs are excluded from the Lowland Darling River aquatic ecological community.

#### Threatened Flora

The field surveys identified three threatened flora species within the study area. A further 12 threatened flora species were considered to have a moderate to high likelihood of occurring. The three threaten flora species are listed in **Table 6-4**, with the full list of threatened flora and their likelihood of occurrence provided in **Appendix C**.

**Table 6-4 Threatened flora recorded during field survey**

| Species name               | Common name        | Status   |        | Location  |
|----------------------------|--------------------|----------|--------|---|
|                            |                    | EPBC Act | BC Act |   |
| <i>Digitaria porrecta</i>  | Finger Panic Grass | -        | E      | Recorded in the study areas of N2MS2, N2MS4 and N2MS5 during field survey.  |
| <i>Homopholis belsonii</i> | Belson's Panic     | V        | E      | Recorded; found in the study areas of N2MS2 and N2MS4 during field surveys. |

| Species name                   | Common name           | Status |   | Location   |
|--------------------------------|-----------------------|--------|---|--|
| <i>Desmodium campylocaulon</i> | Creeping Tick-trefoil | -      | E | Recorded; in the study area of N2MS5 during field surveys. Probable elsewhere in associated habitat. |

### Threatened Fauna

Field surveys identified two threatened bird species within the study area and a further 36 fauna species as having a moderate to high likelihood of occurring, including 22 birds, 11 mammals, two reptiles and one invertebrate. The three threaten fauna species are listed **Table 6-5**, with the full list of threatened flora and their likelihood of occurrence provided in **Appendix C**.

**Table 6-5 Threatened fauna recorded during field survey**

| Species name                              | Common name           | Status   |        | Location   |
|---|-----------------------|----------|--------|--|
|   |                       | EPBC Act | BC Act |  |
| <i>Pomatostomus temporalis temporalis</i> | Grey-crowned Babbler  | -        | V      | Recorded; confirmed in the study areas of N2MS1 and N2MS2 during field surveys. Likely also in N2MS3 and N2MS4.                |
| <i>Calyptorhynchus lathamii</i>           | Glossy-black Cockatoo | -        | V      | Recorded; likely presence confirmed by chewed cones in roadside Belah in N2MS4 during field surveys. Belah habitat widespread. |
| <i>Hieraaetus morphnoides</i>             | Little Eagle          | -        | V      | Recorded; confirmed in the study areas of N2MS3 and during field surveys. Likely also in all segments.                         |

### Wildlife connectivity corridors and habitat fragmentation

The patches of habitat within the study area are fragments that have been formed by historic habitat clearing. The current alignment of the Newell Highway divides the remaining habitats in the study area. The barriers posed by the Newell Highway reduce fauna movement ability between the habitat patches. However, functional habitat connectivity for more mobile species (eg birds, insectivorous bats, insects, and wind-dispersed and bird-dispersed plants) is still present. The current roadway does not totally prevent movement of terrestrial and arboreal fauna (eg koalas, possums, wallabies, reptiles) between habitat fragments; fauna can and likely do cross the road but the road is likely to reduce the frequency of such movements and to present a considerable hazard.

There are no officially mapped wildlife corridors in the IBRA subregions in which the study area is located. The vegetation remnants in the locality are separated by expanses of cleared land now occupied by cropping areas, grazing paddocks, local roadways, a railway line, the Newell Highway and other development. In a highly cleared landscape such as that of the study area, wildlife connectivity corridors often consist primarily of relatively narrow strips of riparian vegetation, roadside vegetation and small patches of vegetation which act as stepping-stones between larger areas of habitat.

### Migratory species

**Table 6-6** lists the nationally listed migratory fauna species considered as having a moderate to high likelihood of occurring within the proposal area based on the presence of suitable habitat.

**Table 6-6 Habitat assessment and survey results for nationally listed migratory fauna**

| Species name                 | Common name               | EPBC Act   | Likelihood of occurrence within the proposal area  |
|------------------------------|---------------------------|--|--|
| <i>Ardea alba</i>            | Great Egret               | Migratory  | High – confirmed north of Moree during field surveys.  |
| <i>Gallinago hardwickii</i>  | Latham's Snipe            | Migratory  | High – confirmed during surveys near the study area in ephemeral wetland (impeded drainage associated with the highway) just south of Moree. Habitat confined to creeks and wetlands and larger areas after suitable rainfall. |
| <i>Rhipidura rufifrons</i>   | Rufous Fantail            | Migratory  | Moderate – few records occur in the locality. Species has been recorded in Narrabri. May pass through the proposal area on occasion.   |
| <i>Tringa nebularia</i>      | Common Greenshank         | Migratory  | Moderate – habitat confined to creeks and wetlands and larger areas after suitable rainfall.   |
| <i>Ardea ibis</i>            | Cattle Egret              | Migratory  | Moderate – may occur in the proposal area when cattle are present.   |
| <i>Merops ornatus</i>        | Rainbow Bee-eater         | Migratory  | Moderate – species have been recorded in the locality. Suitable habitat in proposal area.  |
| <i>Apus pacificus</i>        | Fork-tailed Swift         | Migratory  | Moderate – would likely fly over the proposal area during migration.   |
| <i>Hirundapus caudacutus</i> | White-throated Needletail | Migrator, Priority assessment list for Vulnerable status | Moderate – likely to fly over the proposal area during migration.  |

### 6.1.3 Potential impacts

#### Construction

Removal of native vegetation

**Table 6-7** summarises native vegetation loss within each segment as a result of the proposal. It is estimated that about 47 hectares of native vegetation clearing would be required for the proposal.

**Table 6-7 Native vegetation loss as a result of the proposal**

| Segment | Native vegetation loss (ha) | Loss of state listed TECs (BC Act) | Loss of national listed TECs (EPBC Act) | Confirmed threatened plant species impacted |
|---------|-----------------------------|------------------------------------|---|---|
| N2MS1   | 6.83                        | 0.03                               | -                                       |   |
| N2MS2   | 13.38                       | 5.88                               | 2.54                                    | Yes   |
| N2MS3   | 4.83                        | -                                  | 0.13                                    |   |



| Segment                 | Native vegetation loss (ha) | Loss of state listed TECs (BC Act) | Loss of national listed TECs (EPBC Act) | Confirmed threatened plant species impacted |
|-------------------------|-----------------------------|------------------------------------|---|---|
| N2MS4                   | 6.38                        | 1.72                               | 1.72                                    | Yes   |
| N2MS5                   | 15.27                       | 0.25                               | 11.31                                   | Yes   |
| <b>TOTAL (hectares)</b> | <b>46.69</b>                | <b>7.85</b>                        | <b>15.70</b>                            |   |

A breakdown of native vegetation removal in each PCT and vegetation zone for the whole proposal is shown in **Table 6-8**. The proposal would result in the removal of about:

- 0.47 hectares of planted eucalypts, consisting of a mix of locally native species and species which would be unlikely to occur naturally in the proposal area
- 31.85 hectares of non-native vegetation which consists mainly of grassland/herbfield clearly dominated (more than 50 per cent of vegetation cover) by exotic species.

**Table 6-8 Impacts on vegetation across the proposal including TECs**

| Plant community type (PCT)  | Condition class                                   | BC Act | EPBC Act                       | Removed from the Proposal <sup>1</sup> (hectares) | Per cent cleared <sup>2</sup> |
|---|---|--------|--------------------------------|---|-------------------------------|
| Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions (55)   | Moderate to Good (Relatively Intact)              | EEC    | EEC                            | 0.98  | 75                            |
|   | Moderate to Poor (Derived Grassland)              | No     | No                             | 0.22  |                               |
| Brigalow viney scrub open forest on loamy soils in low hill landscapes in the northern Brigalow Belt South Bioregion (445)  | Moderate to Good (Relatively Intact)              | EEC    | EEC                            | 0.66  | 90                            |
|   | Moderate to Poor (Derived Grassland)              | No     | No                             | 0.53  |                               |
| Carbeen +/- Coolabah grassy woodland on floodplain clay loam soil on north-western NSW floodplains, mainly Darling Riverine Plain Bioregion (628)                     | Moderate to Good (Relatively Intact)              | EEC    | No                             | 2.98  | 90                            |
|   | Moderate to Poor (Derived Grassland)              | No     | No                             | 0.04  |                               |
| Mock Olive - Wilga - Peach Bush - Carissa semi-evergreen vine thicket (dry rainforest) mainly on basalt soils in the Brigalow Belt South Bioregion (147)              | Moderate to Good (Relatively Intact)              | EEC    | EEC                            | 0.08  | 83                            |
| Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW (56) <sup>3</sup>  | Moderate to Good (Relatively Intact)              | No     | EEC recommended (refer note 3) | 3.64  | 78                            |
|   | Moderate to Poor (Derived Grassland)              | No     | No                             | 1.05  |                               |
| Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion (397)                                       | Moderate to Good (Relatively Intact)              | No     | No                             | 8.21  | 45                            |
|   | Moderate to Poor (Derived Grassland)              | No     | No                             | 5.35  |                               |
| Queensland Bluegrass +/- Mitchell Grass grassland on cracking clay floodplains and alluvial plains mainly the northern-eastern Darling Riverine Plains Bioregion (52) | Moderate to Good (Relatively Intact)              | No     | CEEC                           | 11.31   | 70                            |
|   | Moderate to Poor (Derived Grassland - simplified) | No     | No                             |   |                               |
| Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion (27)   | Moderate to Good (Relatively Intact)              | EEC    | EEC (In part - 6.47 ha)        | 3.17  | 86                            |

| Plant community type (PCT)  | Condition class                      | BC Act | EPBC Act | Removed from the Proposal <sup>1</sup> (hectares) | Per cent cleared <sup>2</sup> |
|---|--------------------------------------|--------|----------|---|-------------------------------|
|   | Moderate to Poor (Derived Grassland) | No     | No       | 11.06   |                               |
| Planted eucalypts   | -                                    | No     | No       | <1  | -                             |
| Non-native vegetation   | -                                    | No     | No       | ~30   | -                             |
| Total clearing of BC Act listed threatened ecological communities                     |                                      |        |          |   | 7.88                          |
| Total clearing of EPBC Act listed threatened ecological communities                   |                                      |        |          |   | 15.70                         |
| Total clearing of native vegetation in moderate to good (relatively intact) condition |                                      |        |          |   | 28.31                         |
| Total clearing of native vegetation in moderate to poor (derived grassland) condition |                                      |        |          |   | 18.38                         |
| <b>Total clearing of native vegetation (hectares)</b>                                 |                                      |        |          |   | <b>46.69</b>                  |

1- Area to be cleared based on ground-truthed vegetation mapping within the proposal area.

2- Based on the VIS classification database.

3- There is a preliminary determination to list this community as Endangered under the EPBC Act.



## Removal of threatened ecological communities

The estimated clearing of TECs for the proposal is shown in **Table 6-9** and **Table 6-10**.

**Table 6-9 Description of TECs impacted by the proposal (BC Act)**

| Threatened Ecological Community (BC Act)   | N2MS1 (ha)  | N2MS2 (ha)  | N2MS3 (ha) | N2MS4 (ha)  | N2MS5 (ha)  | Total (ha)  | Impact on local occurrence (per cent) |
|--|-------------|-------------|------------|-------------|-------------|-------------|---------------------------------------|
| Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions (Endangered)  | -           | -           | -          | 1.07        | -           | 1.07        | 2                                     |
| Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions (Endangered)  | -           | -           | -          | 0.66        | -           | 0.66        | 3                                     |
| Carbeen Open Forest Community in the Darling Riverine Plains and Brigalow Belt South Bioregions (Endangered)   | -           | 2.95        | -          | -           | 0.04        | 2.98        | 6                                     |
| Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Penepplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (Endangered) | 0.03        | 2.94        | -          | -           | 0.21        | 3.17        | 2                                     |
| <b>TOTAL (hectares)</b>  | <b>0.03</b> | <b>5.89</b> | <b>0.0</b> | <b>1.73</b> | <b>0.25</b> | <b>7.88</b> | <b>-</b>                              |

**Table 6-10 Description of TECs impacted by the proposal (EPBC Act)**

| Threatened Ecological Community (EPBC Act)   | N2MS1 (ha) | N2MS2 (ha)  | N2MS3 (ha)  | N2MS4 (ha)  | N2MS5 (ha)   | Total (ha)   | Impact on local occurrence (per cent) |
|--|------------|-------------|-------------|-------------|--------------|--------------|---------------------------------------|
| Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregion (Endangered)                                    | -          | -           | -           | 1.73        | -            | 1.73         | 3 %                                   |
| Brigalow (Acacia harpophylla dominant and co-dominant) (Endangered)  | -          | -           | -           | 0.66        | -            | 0.66         | 5 %                                   |
| Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland (Critically Endangered) | -          | -           | 0.13        | -           | 11.31        | 11.44        | 2 %                                   |
| Weeping Myall Woodlands (Endangered)   | -          | 2.54        | -           | -           | -            | 2.54         | 1 %                                   |
| <b>TOTAL (hectares)</b>  | <b>-</b>   | <b>2.54</b> | <b>0.13</b> | <b>1.73</b> | <b>11.31</b> | <b>16.37</b> |                                       |

## Threatened biodiversity

Vegetation that would be removed as part of the proposal provides suitable habitat for a range of threatened fauna and flora species listed under the BC Act and EPBC Act. As such, direct impacts to habitat for threatened species would occur during construction.

The direct impacts of the proposal for threatened flora is provided in **Table 6-11** and for threatened fauna species is provided in **Table 6-12**

**Table 6-11 Summary of impacts on threatened flora species recorded**

| Species name                   | Common name           | Status   |        | Habitat within the proposal area  |
|--------------------------------|-----------------------|----------|--------|---|
|                                |                       | EPBC Act | BC Act |   |
| <i>Digitaria porrecta</i>      | Finger Panic Grass    | -        | E      | Recorded in the study areas of N2MS, N2MS4 and N2MS5 during field surveys in a variety of PCTs (55, 27, 52). A number of individuals were recorded within the proposal area though only a proportion of the proposal area was subject to targeted searches and many more individuals are likely to occur. Habitat for the species includes derived grasslands. Considering this species was found distributed relatively evenly across the whole proposal, it is likely that it could occur anywhere. The impact has been calculated across the whole proposal.<br><b>Total known and potential habitat affected = 35.64 hectares</b> |
| <i>Homopholis belsonii</i>     | Belson's Panic        | V        | E      | Recorded in the proposal areas of N2MS2 and N2MS4 during field surveys in a variety of PCTs (27, 35, 52, 55, 56). The impact to this species has been calculated by suitable habitat impacted in N2MS2 and N2MS4.<br><b>Total known and potential habitat affected = 19.04 hectares</b>   |
| <i>Desmodium campylocaulon</i> | Creeping Tick-trefoil | -        | E      | Recorded in the study area of N2MS5 during field surveys. Probable elsewhere in associated habitat. Habitat for this species includes derived grasslands. The impact to this species has been calculated by suitable habitat impacted in N2MS5.<br><b>Total known and potential habitat affected in N2MS5 = 15.23 hectares</b>  |

**Table 6-12 Summary of habitat impacts on threatened fauna recorded**

| Species name                              | Common name           | Status   |        | Likelihood of occurrence and habitat within the proposal area   |
|---|-----------------------|----------|--------|---|
|   |                       | EPBC Act | BC Act |   |
| <i>Pomatostomus temporalis temporalis</i> | Grey-crowned Babbler  | -        | V      | <b>Recorded;</b> confirmed in the proposal areas of Sections 1 and 2 during field surveys. Also highly likely to be present in N2MS3 and N2MS4. Habitat widespread.<br><b>Total known and potential habitat affected = 18.92 hectares</b> |
| <i>Calyptorhynchus lathami</i>            | Glossy-black Cockatoo | -        | V      | <b>Recorded;</b> likely presence confirmed by chewed cones in roadside Belah in N2MS4 during field surveys. Belah habitat widespread.<br><b>Total known and potential habitat affected = 15.81 hectares</b>                               |

### Aquatic impacts

As impacts on aquatic biodiversity are likely, the *Fisheries NSW policy and guidelines for fish habitat conservation and management* (DPI, 2013) has been considered in the assessment of impacts on aquatic biodiversity. The potential aquatic impacts from the proposal include:

- A slight increase in the obstruction to fish passage and changes to hydrology due to culvert extensions

- Small area of habitat for the Lowland Darling River EEC and Purple Spotted Gudgeon would be disturbed at some locations due to earthworks, culvert extension and road widening. The habitat that would be disturbed consists of part of some ephemeral pools within stream channels and possibly part of a well-vegetated in-stream dam. The disturbance may result in changes to vegetation and the water holding capacity of pools thereby altering their habitat value
- A reduction in habitat quality would be possible due to turbidity and sedimentation from construction and tannins from mulch. The intensity of water quality impacts would be mitigated through adequate stormwater and sediment management
- In suitable habitat (refer to **Table 6-2**), mortality of Purple Spotted Gudgeon individuals may be possible if standing water is present at the time of construction and is drained to facilitate construction.

Impacts on the habitat of threatened fish and threatened aquatic ecological communities are described in **Table 6-13**.

**Table 6-13 Potential impacts on aquatic biodiversity at each waterway crossing**

| Water body  | <b>Potential impacts on the waterway and associated threatened species and the <i>Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River EEC</i></b>   |
|---|---|
| All segments  |   |
| Other unnamed first order streams in study area                           | Unlikely to be impacted by the proposal due to the lack of aquatic habitat.   |
| N2MS1   |   |
| Unnamed tributary of Narrabri Creek                                       | Unlikely to be impacted by the proposal due to the lack of aquatic habitat.   |
| N2MS2   |   |
| Bobbiwaa Creek near Junefield Road North of Narrabri                      | No in-stream works are proposed at this location. Tie-in to the existing bridge only. Potential impact on downstream water quality would be possible due to turbidity and sedimentation from construction.  |
| Tarlee Creek north of Edgeroi   | <p>Culvert extension works in this location would disturb the bed of this ephemeral stream. Direct impacts on Purple Spotted Gudgeon individuals may be possible if standing water is present at the time of construction.</p> <p>Potential impact on downstream water quality would be possible due to turbidity and sedimentation from construction and tannins from mulch. Minimal impact on riparian or aquatic vegetation, logs or other habitat structures. Slight increase in the obstruction to fish passage and changes to hydrology due to culvert extension.</p> <p>A small area of habitat of the Lowland Darling River EEC would be removed at this location due to filling of the stream channel associated with culvert extension and road widening.</p> |
| Unnamed stream south of Edgeroi - between Smithfield Rd and Couradda Road | <p>Culvert extension works at this location would disturb the bed of this ephemeral stream. Direct impacts on Purple Spotted Gudgeon individuals may be possible if standing water is present at the time of construction.</p> <p>Potential impact on downstream water quality would be possible due to turbidity and sedimentation from construction and tannins from mulch. Minimal impact on riparian or aquatic vegetation, logs or other habitat structures. Slight increase in the obstruction to fish passage and changes to hydrology due to culvert extension.</p> <p>A small area of habitat of the Lowland Darling River EEC would be removed in this location due to filling of the stream channel associated with culvert extension and road widening.</p> |



| Water body  | <b>Potential impacts on the waterway and associated threatened species and the <i>Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River EEC</i></b>   |
|---|---|
| Unnamed stream south of Edgeroi - between Smithfield Rd and Couradda Road | <p>Culvert extension works at this location would disturb the bed of this ephemeral stream. Direct impacts on Purple Spotted Gudgeon individuals may be possible if standing water is present at the time of construction.</p> <p>Potential impact on downstream water quality would be possible due to turbidity and sedimentation from construction and tannins from mulch. Minimal impact on riparian or aquatic vegetation, logs or other habitat structures. Slight increase in the obstruction to fish passage and changes to hydrology due to culvert extension.</p> <p>A small area of habitat of the Lowland Darling River EEC would be removed in this location due to filling of the stream channel associated with culvert extension and road widening.</p>   |
| <b>N2MS3</b>  |   |
| Gehan Creek north of Bellata 1 north of Millie Road                       | <p>Culvert extension works at this location would disturb the bed of this ephemeral stream. Direct impacts on Purple Spotted Gudgeon are unlikely as there are no distinct areas of pooling present.</p> <p>Potential impact on downstream water quality would be possible due to turbidity and sedimentation from construction and tannins from mulch but would likely be minor due to the existing disturbed nature of the stream. Minimal impact on the Lowland Darling River EEC.</p>   |
| Unnamed stream north of Bellata   | <p>Culvert extension works at this location would disturb the bed of this ephemeral stream. Direct impacts (habitat removal) on Purple Spotted Gudgeon individuals and their habitat may be possible if the adjacent vegetated instream farm dam is affected by construction.</p> <p>Potential impact on downstream water quality would be possible due to turbidity and sedimentation from construction and tannins from mulch. Slight increase in the obstruction to fish passage and changes to hydrology due to culvert extension.</p> <p>A small area of habitat of the Lowland Darling River EEC would be removed at this location due to disturbance to the in-stream dam associated with culvert extension and road widening.</p>                                 |
| <b>N2MS4</b>  |   |
| Tookey Creek north of Bellata near Tookey Creek rest area                 | <p>Culvert extension works in this location would disturb the bed of this ephemeral stream. Direct impacts on Purple Spotted Gudgeon individuals may be possible if standing water is present at the time of construction.</p> <p>Potential impact on downstream water quality would be possible due to turbidity and sedimentation from construction and tannins from mulch. Minimal impact on riparian or aquatic vegetation, logs or other habitat structures. Slight increase in the obstruction to fish passage and changes to hydrology due to culvert extension.</p> <p>A small area of habitat of the Lowland Darling River EEC would be removed in this location due to filling of the stream channel associated with culvert extension and road widening.</p>   |
| Unnamed tributary of Tookey Creek south of Brigalow Lane                  | <p>Culvert extension works at this location would disturb the bed of this ephemeral stream. Direct impacts on Purple Spotted Gudgeon individuals may be possible if standing water is present at the time of construction.</p> <p>Potential impact on downstream water quality would be possible due to turbidity and sedimentation from construction and tannins from mulch. Minimal impact on riparian or aquatic vegetation, logs or other habitat structures. Slight increase in the obstruction to fish passage and changes to hydrology due to culvert extension.</p> <p>A small area of habitat of the Lowland Darling River EEC would be removed at this location due to disturbance to the instream dam associated with culvert extension and road widening.</p> |
| <b>N2MS5</b>  |   |
| Unnamed highly modified tributary of Halls Creek South of                 | <p>Culvert extension works at this location would disturb the bed of this ephemeral stream. Direct impacts on Purple Spotted Gudgeon individuals may be possible if standing water is present at the time of construction.</p> <p>Potential impact on downstream water quality would be possible due to turbidity and</p>   |

| Water body  | Potential impacts on the waterway and associated threatened species and the Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River EEC   |
|---|---|
| Burrington Road Moree                                 | <p>sedimentation from construction and tannins from mulch. Minimal impact on riparian or aquatic vegetation, logs or other habitat structures. Slight increase in the obstruction to fish passage and changes to hydrology due to culvert extension.</p> <p>A small area of habitat of the Lowland Darling River EEC would be removed at this location due to disturbance to the in-stream dam associated with culvert extension and road widening.</p> |
| Halls Creek south of Moree (north of Burrington Road) | <p>No in-stream works are proposed at this location. Tie-in to existing bridge only. Earthworks would be carried out near the waterway. Potential impact on downstream water quality would be possible due to turbidity and sedimentation from the works and tannins from mulch. Minimal impact on riparian or aquatic vegetation, logs or other habitat structures.</p>  |

### Fauna mortality

Fauna injury or death has the greatest potential to occur during construction when vegetation clearing would occur. The extent of this impact would be proportionate to the extent of vegetation that is cleared. Less mobile species (eg ground dwelling reptiles), or those that are nocturnal and nest or roost in trees during the day (eg arboreal mammals and microchiropteran bat species), may find it difficult to rapidly move away from the clearing when disturbed. The study area is known to contain a number of arboreal species (including the Koala) and birds that may be injured or killed during vegetation removal. Reptiles and frogs may also be injured or killed during construction as habitat is cleared.

Entrapment of wildlife in any trenches or pits that are dug is a possibility if the trenches are deep and steep sided.

Mitigation measures designed to reduce injury and mortality of fauna are provided in **Section 6.1.4**.

### Proliferation of weeds

Proliferation of weed and pest species would be an indirect impact (i.e. not a direct result of proposal activities). The most likely causes of weed dispersal and importation associated with the proposal would include earthworks, movement of soil, and attachment of seed (and other propagules) to vehicles and machinery during construction of the proposal. The study area contains substantial weed growth, mainly near the existing Newell Highway and along minor roads and tracks. The spread and proliferation of weeds would be managed during construction. Weeds of particular concern include exotic perennial grasses such as Coolatai grass (*Hyparrhenia hirta*) and Guinea grass (*Megathyrsus maximus*) which were recorded in the study area.

Mitigation measures designed to limit the spread and germination of weeds are provided in **Section 6.1.4**.

### Pest species

The proposal area is currently known or likely habitat for a range of pest species including feral pigs (*Sus scrofa*), foxes (*Vulpes vulpes*), rabbits (*Oryctolagus cuniculus*), cats (*Felis catus*), goats (*Capra hircus*), deer (*Cervidae family*) and wild dogs (*Canis lupus spp.*).

The proposal has the potential to disperse pest species across the surrounding landscape. The magnitude of this impact would be low and mitigation measures would not likely to be effective and were not deemed necessary.

### Pathogens

Several pathogens that occur in NSW have potential to impact on biodiversity as a result their movement and infection during construction. Of these, three are listed as a key threatening process under either the EPBC Act and/or BC Act including:

- Dieback caused by Phytophthora (Root Rot; EPBC Act and BC Act)
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis (EPBC Act and BC Act)
- Introduction and establishment of exotic Rust Fungi of the order Pucciniales on plants of the family Myrtaceae (BC Act).

While these pathogens were not observed or tested for in the proposal area the potential for pathogens to occur should be treated as a risk during construction. The most likely causes of pathogen dispersal and importation associated with the proposal include earthworks, movement of soil, and attachment of plant matter to vehicles and machinery during construction of the proposal. Pathogens would be managed within the proposal area according to the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (NSW Roads and Traffic Authority, 2011b) (refer to **Section 6.1.4**).

#### Noise, light and vibration

Lighting would be used at night to enable work to be completed that may result in impacts to nocturnal fauna. Nocturnal species such as possums and microbats may avoid habitat in the proposal area during construction as temporary 'daylight' conditions would be created by the mobile lighting system. This impact is considered temporary and would not have long lasting effects on the biodiversity of the proposal area. The magnitude of this impact would be low and mitigation measures were not deemed necessary.

It has been assumed for the purposes of this assessment that no permeant lighting would be installed in areas that are not currently lit.

#### Groundwater dependent ecosystems

##### Aquatic GDEs

Most of the aquatic GDEs in the locality are quite distant from the proposal and no lands within the banks of these waterbodies or nearby would be affected by the proposal. Therefore, the GDEs would be unlikely to be affected by the localised effects on groundwater likely to result from the increased width and elevation of the proposal.

The proposal is located about 50 metres north of Gehan Creek within N2MS3, which is mapped as a moderate potential GDE. There is some potential for impacts on the GDE, associated with altered groundwater movement patterns associated with the proposal. The proposal would not directly affect lands within the banks of Gehan Creek, regularly inundated areas and would be unlikely to result in substantial changes to surface water penetration or groundwater movement. Therefore, it would be unlikely to substantially affect this GDE.

Other smaller streams in the proposal area which have only ephemeral flow and intermittent surface water and would be unlikely to have baseflow characteristics and unlikely to be substantially dependent on groundwater. These systems would be in the facultative-opportunistic category and would be unlikely to be substantially affected by the likely minor influence of the proposal on groundwater.

##### Terrestrial GDEs

Most of the terrestrial vegetation types within the proposal area are mapped as having low potential to be GDEs and would be unlikely to be affected by the proposal. Impacts to the two communities considered to have a potential for groundwater dependence includes:

- Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW is likely to use groundwater where available during times of water stress but to be dependent chiefly on rainfall and would be unlikely to be significantly affected by the proposal.
- The Carbeen +/- Coolibah grassy woodland on floodplain clay loam soil on north-western NSW floodplains along waterways may be modified (e.g. in species composition) by changes in groundwater



attributes but would be unlikely to be destroyed by groundwater changes. The small scale, low intensity changes in groundwater likely to result from the proposal would be unlikely to substantially impact such ecosystems.

## **Operation**

### **Proliferation of weeds and pathogens**

Operation of the proposal may result in weed and pathogen dispersal and importation, such as through the attachment of seed (and other propagules) to vehicles.

### **Wildlife connectivity and habitat fragmentation**

In several locations, the proposal would further fragment habitats. The proposal would increase the number of isolated habitats as the current habitat patches would be made smaller by increasing the physical distance between habitat fragments. The isolation that may be caused by the proposal would not be likely to have a substantial impact on nomadic or migratory species such as many species birds and bats, however, it may impact the dispersal ability of less mobile fauna such as ground-dwelling and arboreal reptiles and mammals. For example, the proposal would divide or break apart an area of continuous habitat; a patch of native grassland at the north end of N2MS2.

The proposal would contribute to an increase in isolation of habitats through loss of some small stepping stone patches, narrowing and degradation of linear patches of vegetation, and an increased distance between habitats on the eastern and western sides of the Newell Highway. The predicted level of isolation from the proposal would not likely be enough to prevent the breeding and dispersal of plant pollinators. The dispersal of plant propagules (seed or other vegetative reproductive material) between habitat patches would continue with little impact for those species with seeds dispersed by wind and larger animal. The dispersal capabilities of plants with no specialised dispersal mechanisms and those with ant dispersed seeds may however be impacted. Functional connectivity for many species would remain in the study area. However, local division of some wildlife populations, isolation of key habitat resources, loss of genetic interchange, and loss of population viability for some species may result.

This impact would be of moderate magnitude and targeted mitigation measures to restore habitat connectivity and thereby address this impact are considered necessary. Mitigation measures designed to reduce the impact of the proposal on wildlife connectivity and habitat fragmentation are provided in **Section 6.1.4**.

### **Noise, light and vibration**

There would be potential for impacts to fauna from noise and vibration during construction, which may result in fauna temporarily avoiding habitats next to the construction. The magnitude of this impact would be low and mitigation measures are not deemed necessary.

Considering the existing levels of noise and vibration from the existing Newell Highway by vehicles, there would be unlikely to be a substantial increase in noise and vibration during operation of the proposal that would result in any increased impacts to biodiversity within the proposal area.

### **Cumulative impacts**

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

The accumulating impacts of historic vegetation clearing for agriculture, urban development, and development and maintenance of infrastructure have contributed to the loss of biodiversity in the Brigalow Belt South Bioregion.

While data from all recent projects in the locality is not freely available, some information on the likely biodiversity impacts from recent projects is available from:

- North Moree Heavy Duty Pavement upgrade
- Newell Highway Mungle Back Creek to Boggabilla heavy duty pavement
- Previous Newell Highway upgrade projects.

The cumulative impacts of these projects are summarised in **Table 6-14**.

**Table 6-14 Summary of potential cumulative impacts for EEC and threatened species recorded in the proposal area**

| Value impacted (area of community or species habitat)   | Newell Highway Heavy Duty Pavement proposals/projects – clearing in hectares |                                       |   | Other recent and future proposals in the region | Cumulative impact   |
|---|--|---------------------------------------|---|---|---------------------|
|   | Narrabri to Moree (this proposal)  | North Moree (planned proposal)        | Mungle Back Creek to Boggabilla (proposal approved) |   |                     |
| Brigalow-Belah Woodland (Brigalow TEC; BC Act and EPBC Act)   | 0.66 ha  | 0 ha                                  | 17.5 ha   | Not known                                       | 18.02 ha            |
| Weeping Myall open woodland (Weeping Myall TEC; BC Act and EPBC Act) (PCT 27)   | 3.17 ha (BC Act) / 2.54 (EPBC Act)   | 4.40 ha (BC Act) / 3.92 ha (EPBC Act) | 0   | Not known                                       | About 7 ha or more  |
| Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland (EPBC Act CEEC) (PCT 52) | 11.31 ha   | 11.98 ha                              | -   | Unknown   | About 23 ha or more |
| <i>Homopholis belsonii</i> (Belson's Panic)   | 19.04 ha   | 12.05                                 | 34 ha   | Unknown   | About 50-100 ha     |
| <i>Desmodium campylocaulon</i> (Creeping Tick-trefoil)  | 15.23 ha   | 14.37                                 | 41 ha   | Unknown   | About 50-90 ha      |
| Grey-crowned Babbler ( <i>Pomatostomus temporalis</i> )   | 18.98 ha   | 6.44                                  | 34 ha   | Unknown   | About 50-60 ha      |

### EPBC Act Strategic Assessment

In September 2015, a “strategic assessment” approval was granted by the Federal Minister in accordance with the EPBC Act. The approval applies to Roads and Maritime activities being assessed under Part 5 of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species.

The Roads and Maritime Services *Environment Protection and Biodiversity Conservation Act 1999 – Strategic Assessment policy* states biodiversity offsets are required when a significant impact is likely for threatened biodiversity listed under the EPBC Act (Roads and Maritime Services 2005). The proposal may result in a significant impact upon two threatened species and one threatened ecological community listed under the EPBC Act; therefore, biodiversity offsets are required. The strategic assessment recommends that biodiversity offsets are calculated using the FBA methodology. A Biodiversity Offset Strategy (BOS) would be prepared for the proposal.

While impacts to some threatened species and one threatened ecological community may be significant under the EPBC Act criteria, they are unlikely to be of such an intensity or spatial extent that they would be considered unacceptable.



## Assessments of significance

An Assessment of Significance has been carried out for threatened species that have been positively identified within the proposal area or that are considered to have a moderate or high likelihood of occurring in the study area due to the presence of suitable habitat.

The assessments under the BC Act and FM Act concluded that, the proposal would not have a significant impact on the affected species and communities.

However, the assessment of relevant species and communities under the EPBC Act significance criteria identified a likely significant impact for one ecological community and two species, as summarised below:

- *Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland* (Critically Endangered Act– EPBC): Almost entirely restricted to N2MS5. The proposal would remove about 11.31 hectares of this community.
- *Homopholis belsonii* (Belson's Panic) (BC Act): The proposal would reduce the extent of local populations by about 19.04 hectares
- Five-clawed Worm Skink (*Anomalopus mackayi*) (Endangered BC Act and EPBC Act). Much of the vegetation in the study area can be considered important habitat for the species, it is known to occur in five of the PCTs identified. The proposal would removal about 34.50 hectares of potential habitat across the proposal. Mostly associated with N2MS2, N2MS4 and N2MS5.

## Conclusion on significance of impacts

The proposal would not be likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the BC Act or FM Act 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. The REF and BAR 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 the Biodiversity Offset Strategy for the proposal.

Further assessment to confirm the presence of this community and species within the study area and therefore the significance of the impact, would be carried out in consultation with the Federal Department of the Environment and Energy if required. The outcomes of this assessment would be reported in the submissions report prepared for the proposal. If the proposal is confirmed to have a significant impact on this endangered ecological community (CEE) and species, then the proposal would be subject to the EPBC Act strategic assessment approval.

## 6.1.4 Safeguards and management measures

Safeguards and management measures for biodiversity are presented in **Table 6-15**.

**Table 6-15 Summary of mitigation measures – Biodiversity**

| Impact                       | Environmental safeguards   | Responsibility | Timing                             | Reference   |
|------------------------------|--|----------------|------------------------------------|---|
| Biodiversity                 | <p>A Flora and Fauna Management Plan will be prepared in accordance with Roads and Maritime's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</i> (RTA, 2011) and implemented as part of the CEMP. It will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas</li> <li>Requirements set out in the <i>Landscape Guideline</i> (RTA, 2008)</li> <li>Pre-clearing survey requirements in accordance with Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)</li> <li>Procedures for unexpected threatened species finds and fauna handling</li> <li>Procedures addressing relevant matters specified in the <i>Policy and guidelines for fish habitat conservation and management</i> (DPI Fisheries, 2013)</li> <li>Protocols to manage weeds and pathogens.</li> </ul> | Contractor     | Detailed design / pre-construction | Section 4.8 of QA G36 <i>Environment Protection</i> |
| Biodiversity                 | Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.   | Contractor     | Detailed design / pre-construction | Core standard safeguard                             |
| Removal of native vegetation | <ul style="list-style-type: none"> <li>Vegetation removal would be carried out in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)</li> <li>Native vegetation would be re-established in accordance with <i>Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)</li> <li>Exclusion zones would be set up at the limit of clearing (ie the edge of the impact area) in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).</li> </ul>   | Contractor     | Construction                       | Additional safeguard                                |

| Impact   | Environmental safeguards  | Responsibility     | Timing                             | Reference            |
|--|---|--------------------|------------------------------------|----------------------|
| Removal of threatened species habitat and habitat features | <ul style="list-style-type: none"> <li>Habitat would be replaced or re-instated in accordance with <i>Guide 5: Re-use of woody debris and bushrock</i> and <i>Guide 8: Nest boxes</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)</li> <li>The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal area.</li> </ul> | Contractor         | Detailed design / pre-construction | Additional safeguard |
| Aquatic impacts  | Aquatic habitat would be protected in accordance with <i>Guide 10: Aquatic habitats and riparian zones</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) and Section 3.3.2 <i>Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013</i> (DPI (Fisheries NSW) 2013).   | Contractor         | Construction                       | Additional safeguard |
| Injury and mortality of fauna                              | <ul style="list-style-type: none"> <li>Fauna would be managed in accordance with <i>Guide 9: Fauna handling</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)</li> <li>Investigate the potential benefits and drawbacks of installing fauna fencing in N2MS4.</li> </ul>   | Contractor         | Construction                       | Additional safeguard |
| Invasion and spread of weeds and pests                     | <ul style="list-style-type: none"> <li>Weed species would be managed in accordance with <i>Guide 6: Weed management</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).</li> <li>Pest species would be managed within the proposal area.</li> </ul>   | Contractor         | Construction                       | Additional safeguard |
| Invasion and spread of pathogens and disease               | Pathogens would be managed in accordance with <i>Guide 2: Exclusion zones</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).   | Contractor         | Construction                       | Additional safeguard |
| Noise, light and vibration                                 | Shading and artificial light impacts would be considered and minimised where possible through detailed design.  | Contractor         | Detailed design                    | Additional safeguard |
| Biodiversity offsets                                       | The final design impact area will be ground-truthed and offsets will be calculated and implemented as per <i>Guideline for Biodiversity Offsets</i> (November 2016)   | Roads and Maritime | Detailed design                    | Additional safeguard |



## 6.1.5 Biodiversity offsets

Although efforts have been made to avoid, minimise and mitigate potential ecological impacts from the proposal, some residual impacts would occur.

The Roads and Maritime Guideline for Biodiversity Offsets (November 2016) indicates that offsets are to be considered where there is any clearing of national or NSW listed critically endangered ecological communities in moderate to good condition.

In addition, this biodiversity assessment identifies that the proposal would be likely to have a significant impact on threatened biodiversity listed under the EPBC Act.

Roads and Maritime would provide biodiversity offsets or where offsets are not reasonable or feasible, supplementary measures for impacts that exceed the thresholds in **Table 6-16**.

**Table 6-16 Roads and Maritime offset thresholds**

| Description of activity or impact  | Consider offsets or supplementary measures                          | Applicability to proposal   |
|--|---|---|
| Activities in accordance with Roads and Maritime Services Environmental assessment procedure: Routine and Minor Works (RTA 2011)   | No  | Not applicable.   |
| Works on cleared land, plantations, exotic vegetation where there are no threatened species or habitat present   | No  | Applies to areas mapped as 'not native'.  |
| Works involving clearing of vegetation planted as part of a road corridor landscaping program (this includes where threatened species or species comprising listed ecological communities have been used for landscaping purposes) | No  | Applies to the planted eucalypts vegetation only.   |
| Works involving clearing of national or NSW listed critically endangered ecological communities (CEEC)   | Where there is any clearing of a CEEC in moderate to good condition | Applies to the Natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Queensland community listed as Critically endangered under the EPBC Act.   |
| Works involving clearing of nationally listed threatened ecological community (TEC) or nationally listed threatened species habitat  | Where clearing >1 ha of a TEC                                       | Applies to the following TECs: <ul style="list-style-type: none"> <li>Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland (Critically Endangered – EPBC Act)</li> <li>Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Penepplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (Endangered – BC Act).</li> <li>Weeping Myall Woodlands (Endangered – EPBC Act)</li> <li>Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions (Endangered – EPBC Act and BC Act).</li> </ul> |

| Description of activity or impact  | Consider offsets or supplementary measures                         | Applicability to proposal  |
|--|--|--|
| Works involving clearing of NSW endangered or vulnerable ecological community  | Where clearing >1 ha or where the species is the subject of an SIS | Does not apply   |
| Works involving clearing of NSW listed threatened species habitat where the species is a species credit species as defined in the OEH Threatened Species Profile Database (TSPD) | Where clearing >5 ha or where the species is the subject of an SIS | <p>Applies to the habitat of multiple species and includes the TECs and some better condition areas of non-threatened vegetation types:</p> <ul style="list-style-type: none"> <li>• Belah woodland (0.98 ha – intact)</li> <li>• Brigalow viney scrub open forest (0.66 ha)</li> <li>• Mock Olive - Wilga - Peach Bush - Carissa (0.08 ha)</li> <li>• Poplar Box - Belah woodland (3.64 ha)</li> <li>• Poplar Box - White Cypress Pine woodland (8.21 ha)</li> <li>• Queensland Bluegrass +/- Mitchell Grass (11.31 ha)</li> <li>• Weeping Myall open woodland (3.17 ha - intact).</li> </ul> |
| Works involving clearing of NSW listed threatened species habitat and the species is an ecosystem credit species as defined in OEH's Threatened Species Profile Database (TSPD)  | Where there is any net loss of habitat                             | <p>Applies to the habitat of multiple species and includes the TECs and some better condition areas of non-threatened vegetation types:</p> <ul style="list-style-type: none"> <li>• Belah woodland (0.98 ha – intact)</li> <li>• Brigalow viney scrub open forest (0.66 ha)</li> <li>• Mock Olive - Wilga - Peach Bush - Carissa (0.08 ha)</li> <li>• Poplar Box - Belah woodland (3.64 ha)</li> <li>• Poplar Box - White Cypress Pine woodland (8.21 ha)</li> <li>• Queensland Bluegrass +/- Mitchell Grass (11.31 ha)</li> <li>• Weeping Myall open woodland (3.17 ha - intact).</li> </ul> |
| Type 1 or Type 2 key fish habitats (as defined by NSW Fisheries)   | Where there is any net loss of habitat                             | Applies to predicted habitat of the Purple Spotted Gudgeon. To be calculated based on the detailed design. Estimated at around 0.03 ha in total based on around 50 square metres of net loss of habitat at each of six culvert extension locations affecting predicted habitat for the Purple Spotted Gudgeon.   |

For aquatic biodiversity listed under the FM Act, offsets are to be provided in accordance with DPI's Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013).

The final offset requirement for the proposal would be determined during detailed design and development of the offset package. During the detailed design phase the proposal area may change from that assessed here which would result in a different offset requirement for the proposal than what is presented in this report.

## 6.2 Hydrology and flooding

The potential impacts of the proposal on hydrology and flooding are assessed in the *Newell Highway Upgrade Strategic Design and Concept Design Flood Study (Preliminary)* (GHD, 2017a). A summary of the assessment is presented in this section, together with safeguards and management measures to mitigate any negative impacts.

### 6.2.1 Methodology

The Newell Highway Upgrade Strategic Design and Concept Design Flood Study (Preliminary) (GHD, 2017) has been used to inform this assessment.

Source information was also obtained from the following resources in December 2017:

- Newell Highway Heavy Duty Pavements, North Moree Preliminary environmental investigation (WSP, 2017)
- Reviews of relevant online aerial photography and mapping tools
- Narrabri Flood Study (WRM, 2016)
- Review of Moree and environs Flood Study/Floodplain Risk Management (WRM, 2017)
- Newell Highway Upgrade Interim Flood Risk Mapping (GHD, 2017a).

### 6.2.2 Existing environment

Two key drainage catchments are located within the study area. N2MS1 and N2MS2 are located within the Namoi River Catchment, while N2MS3 to N2MS5 are located in the Gwydir River Catchment. Both catchments flow in a westerly direction from headwaters within the Great Diving Range. The proposal is not located in the vicinity of either major rivers, however minor tributaries transect the proposal at various locations along its extent.

#### *Surface waters and associated features*

The proposal crosses a number of waterways including Bobbiwaa Creek, Tarlee Creek, Gehan Creek, Tookey Creek and Halls Creek as well as other intermittent watercourses and irrigation canals (refer to **Figure 1-1**). The waterways within each segment are outlined in **Table 6-17**.

**Table 6-17 Water way within in proposal area**

| Segment | Catchment    | Water ways   |
|---------|--------------|--|
| N2MS1   | Namoi River  | The segment traverses several minor ephemeral watercourses   |
| N2MS2   | Namoi River  | The segment traverses the two intermittent watercourses of Bobbiwaa Creek and Taree Creek, as well as several minor ephemeral watercourses     |
| N2MS3   | Gwydir River | The segment traverses the two minor ephemeral tributaries of Tookey Creek and Gehan Creek  |
| N2MS4   | Gwydir River | The segment traverses the intermittent watercourse of Tookey Creek and two minor ephemeral tributaries of Tookey Creek                         |
| N2MS5   | Gwydir River | The segment is close to the intermittent watercourse of Clarks Creek, and also traverses Halls Creek which is also an intermittent watercourse |



## Groundwater

The proposal is within the Great Artesian Basin groundwater management area, Surat Groundwater Source, which is regulated by the Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources 2008.

Groundwater quality within both the Namoi and Gwydir river catchments, and specifically the study area, has been identified as predominantly moderate (500–1500 Total Dissolved Solids milligrams per litre) suitable for domestic, stock and some irrigation purposes. The groundwater quality improves close to the town of Moree, with groundwater in the vicinity of N2MS5 identified as moderate/ fresh (500–1500 Total Dissolved Solids milligrams per litre) and suitable for domestic, stock of all ages, and some irrigation purpose, municipal use (WSP, 2017).

The Geotechnical Desktop Study (Transport for NSW, 2017) reviewed groundwater data from the NSW Department of Primary Industries – Office of Water Continuous Water Monitoring Network (<http://allwaterdata.water.nsw.gov.au/water.stm>) for the identified 46 existing boreholes within the study area (refer to **Table 6-18**).

**Table 6-18 Groundwater and boreholes (Transport for NSW, 2017)**

| Segment | Number and depth of bore holes   | Depth of water bearing material   |
|---------|--|---|
| N2MS1   | 10 bores, ranging in depth from 35 metres to 162 metres.   | Water bearing material typically consists of sands, gravels and clays at varying depths from 18 metres to 160 metres.             |
| N2MS2   | Nine bores, primarily located at the northern end of the section ranging in depth from 23 metres to 230 metres             | Water bearing material typically consists of sandstone and fractured shale at varying depths from 19 metres to 227 metres.        |
| N2MS3   | Seven bores, primarily located at the southern end of the section. Boreholes range in depth from 5m to 605m.               | Water bearing material typically consists of fractured shale over consolidated sandstone, from depths of 32 metres to 515 metres. |
| N2MS4   | No boreholes were identified   | -   |
| N2MS5   | Twenty boreholes, primarily located at the northern end of the section. Borehole depths range from 25 metres to 740 metres | Water bearing material predominantly consists of sands and clays, ranging in depth from five metres to 500 metres.                |

## Flooding

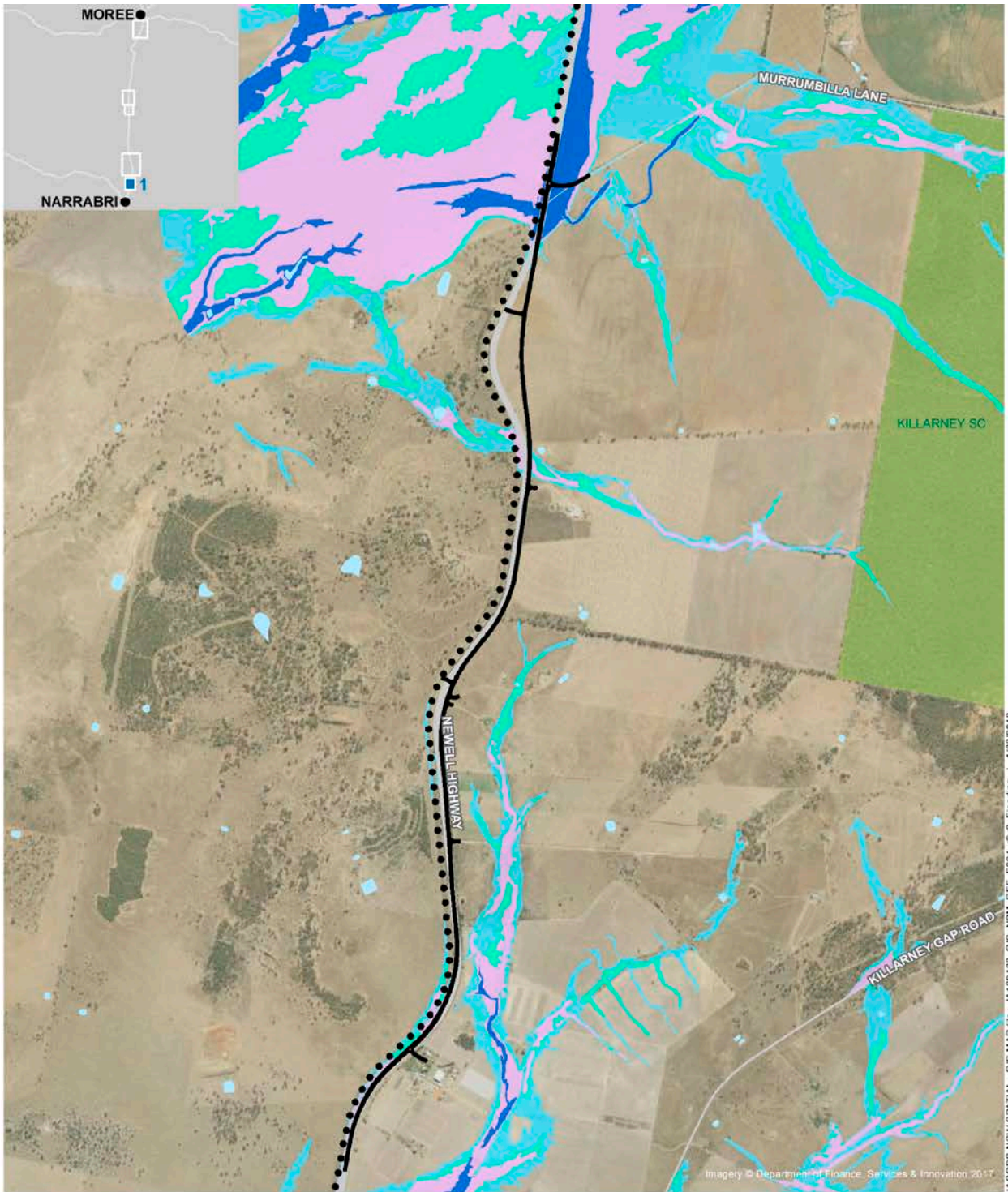
Both the Namoi River and Gwydir River catchments have a long history of flooding, with flooding based studies focused on the catchments and population centres of Moree and Narrabri (WRM, 2016). The Narrabri Flood Study (WRM, 2016) indicated that periodic flooding on average 10-year basis and due to local topography, the area at highest risk of flooding, is low lying areas directly within the township of Narrabri and to the south and north-west.

The preliminary flood study (GHD 2017a) was carried out to understand the flooding patterns and existing level of flood immunity along the proposal. This study indicated that the various waterways that cross the Newell Highway within the proposal area have a variable level of existing flood immunity. Some segments have less than 50 per cent AEP immunity, while others have better than five per cent AEP immunity. The flooding risk for the proposal is summarised in **Table 6-19** and shown on **Figure 6-1**.

Flood-related road closures of the Newell Highway are currently governed by critical closure points (i.e. the location of most frequent and/or longest duration closures).

**Table 6-19 Flooding behaviour**

| Segment | ARI                               | Flooding behaviour  |
|---------|-----------------------------------|---|
| N2MS1   | ARI greater than 20               | Impacted by a 1 in 10-year flooding event while the northern section of the segment near Murrumbilla Lane would be inundated by a 1 in 2-year event.  |
| N2MS2   | ARI between two and less than two | In a 1 in 2-year flood event, the flood risk is mainly associated with Tarlee Creek to the south around Edgeroi. The Mungindi railway line which is located next to the highway is also impacted during these events. |
| N2MS3   | ARI 2                             | In a 1 in 2-year flood event, the flood risk is mainly associated with Gehan Creek to the around Bellata.   |
| N2MS4   | ARI between 5 and 10              | Flood risk in this segment is mainly restricted to creek crossings, with impacts associated with a 1 in 2-year event.   |
| N2MS5   | ARI greater than 20               | Flood risk is considered low in this segment with the exception of the Halls Creek highway crossing, which would be impacted by a 1 in 10-year flooding event.  |



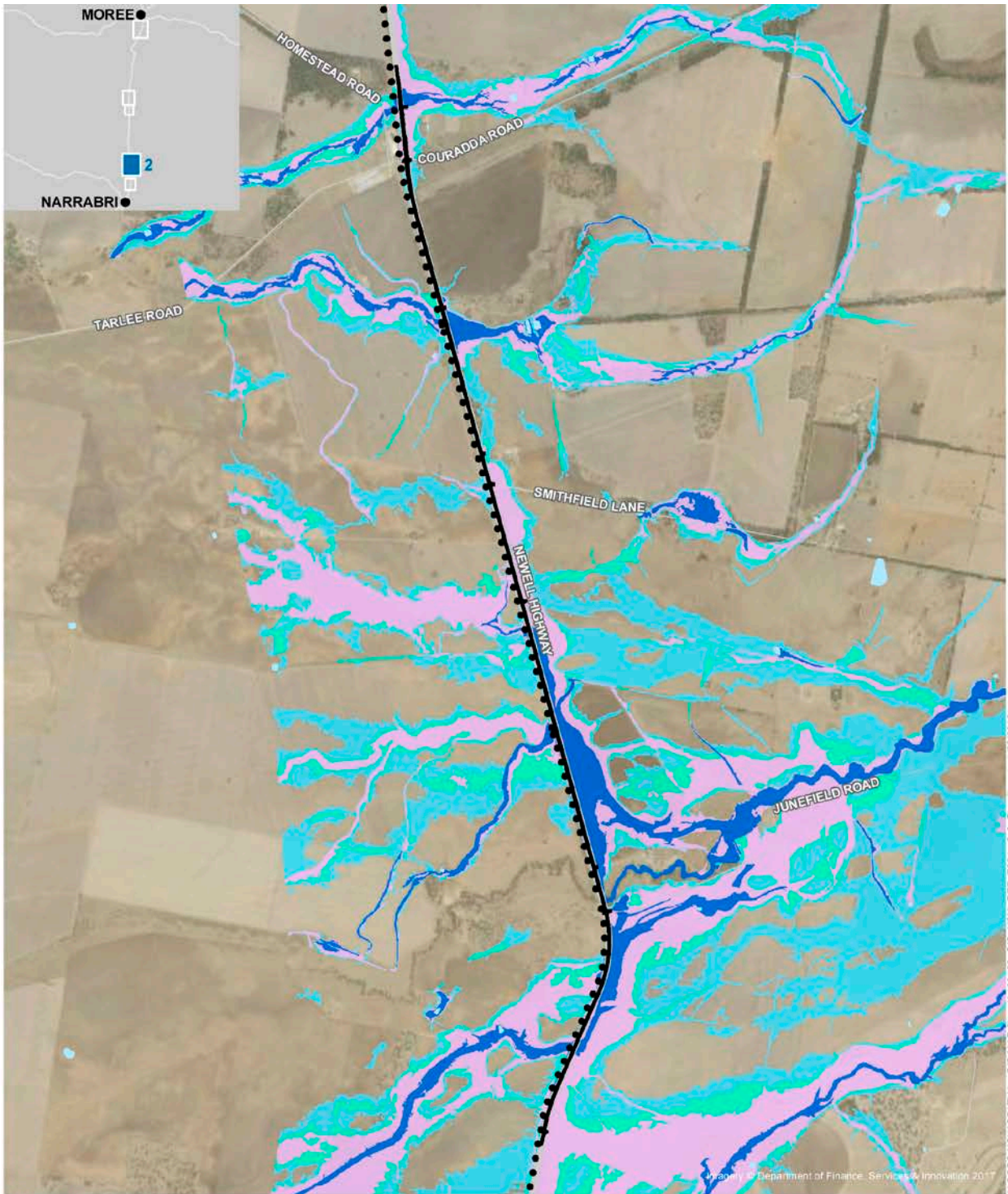
**Legend**

- The proposal    ●●●● Werris Creek Mungindi Railway
- 2 year ARI flood extent    ■ 20 year ARI flood extent
- 10 year ARI flood extent    ■ 50 year ARI flood extent



**Figure 6-1 Flood risk – Page 1 of 5**





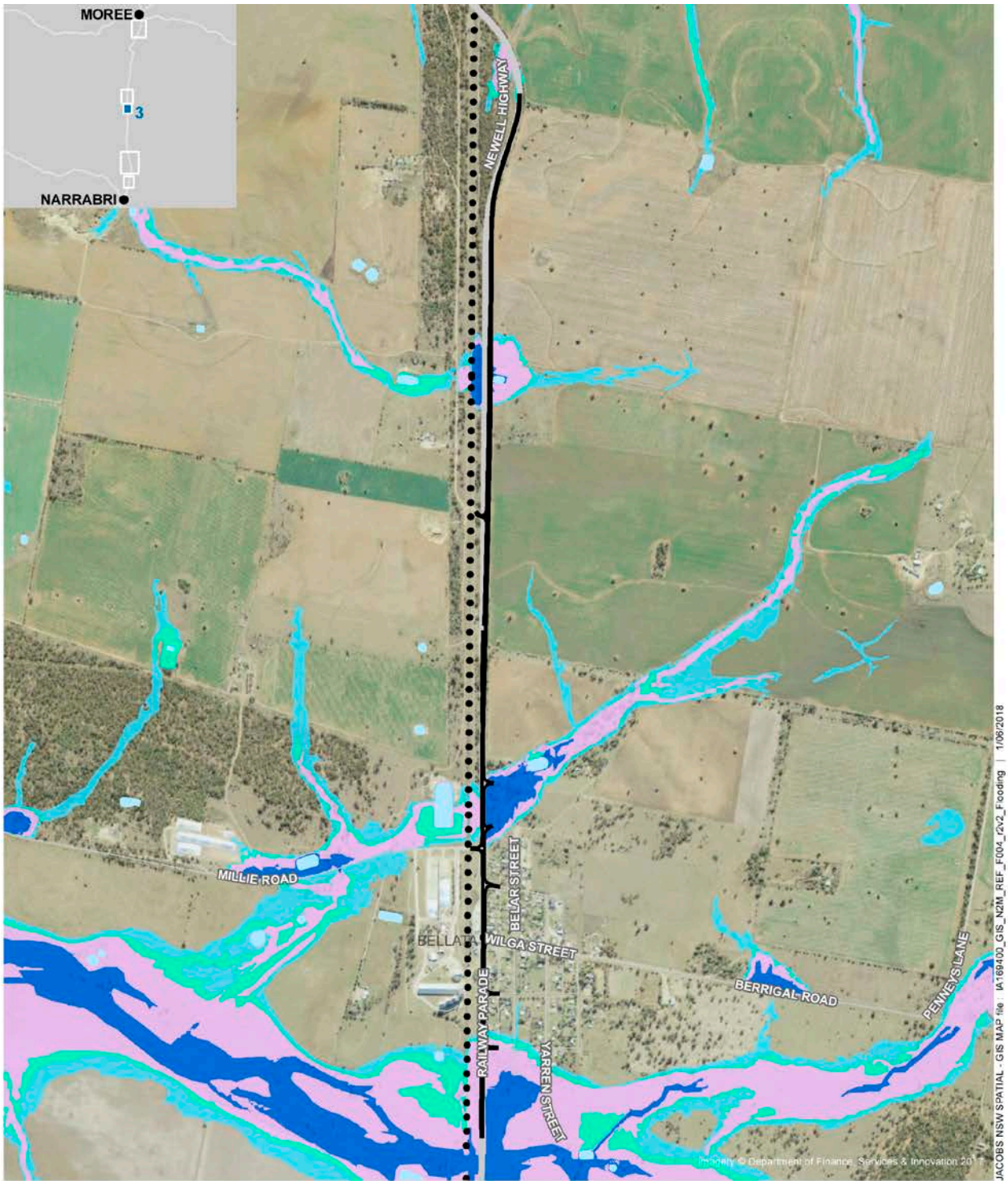
**Legend**

- The proposal    ●●●● Werris Creek Mungindi Railway
- 2 year ARI flood extent    ■ 20 year ARI flood extent
- 10 year ARI flood extent    ■ 50 year ARI flood extent



**Figure 6 1 Flood risk – Page 2 of 5**





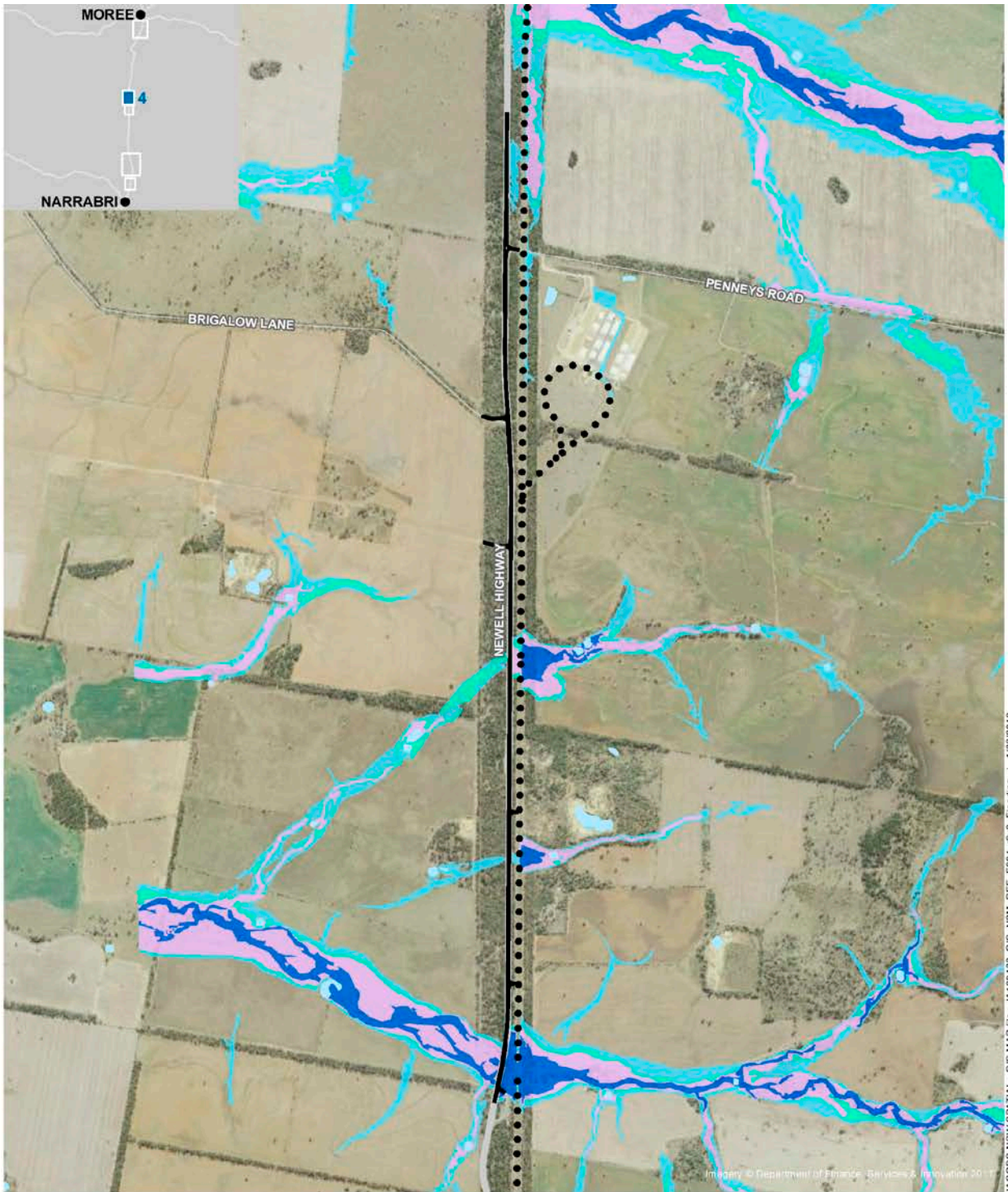
**Legend**

- The proposal    ●●●● Werris Creek Mungindi Railway
- 2 year ARI flood extent    ■ 20 year ARI flood extent
- 10 year ARI flood extent    ■ 50 year ARI flood extent



**Figure 6 1 Flood risk – Page 3 of 5**





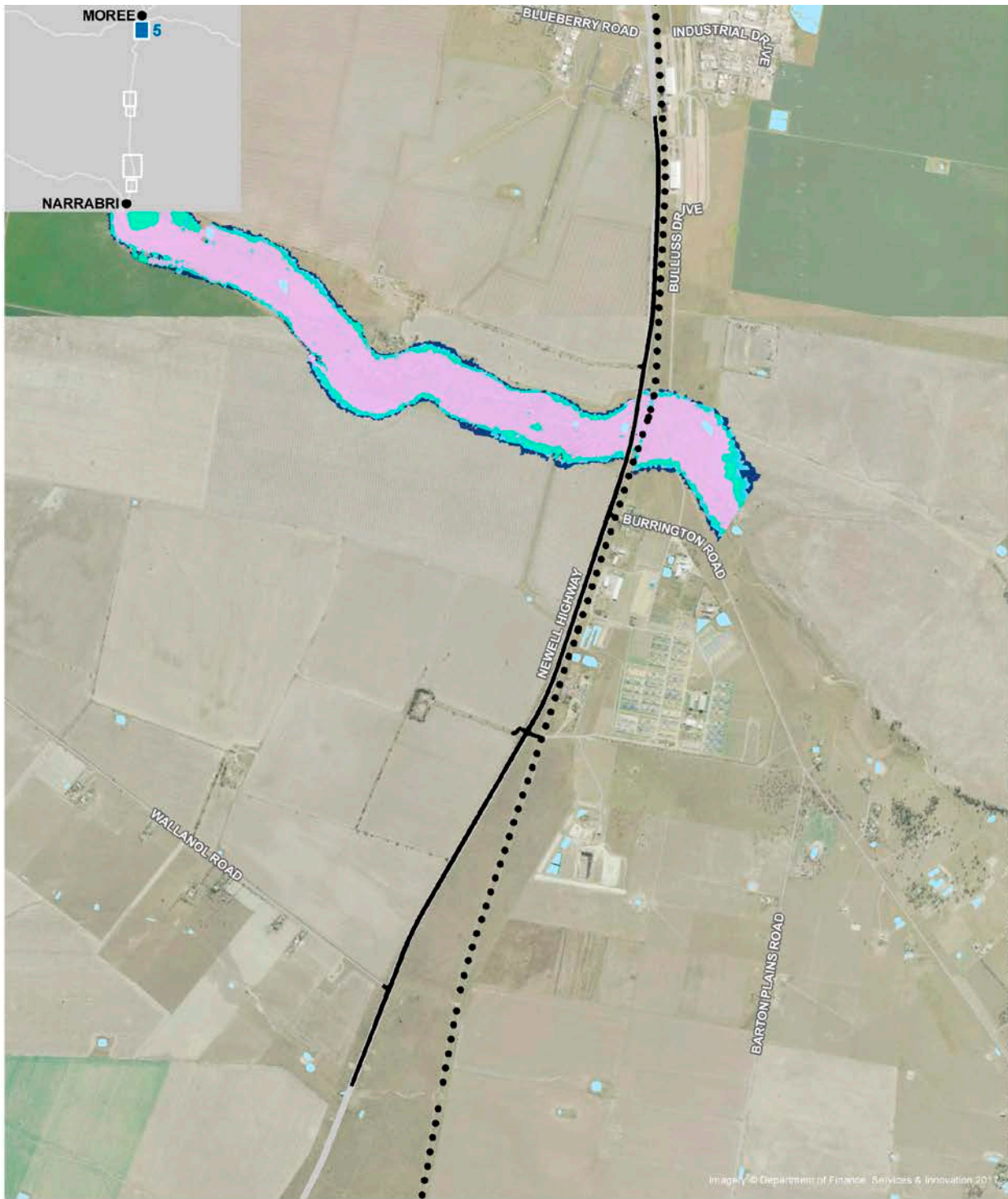
**Legend**

- The proposal    ●●●● Werris Creek Mungindi Railway
- 2 year ARI flood extent    ■ 20 year ARI flood extent
- 10 year ARI flood extent    ■ 50 year ARI flood extent



**Figure 6 1 Flood risk – Page 4 of 5**





**Legend**

- The proposal    ●●●● Werris Creek Mungindi Railway
- |  |   |
|--|---|
| <div style="width: 20px; height: 10px; background-color: #FFB6C1; border: 1px solid black; display: inline-block;"></div> 10 year ARI flood extent | <div style="width: 20px; height: 10px; background-color: #87CEEB; border: 1px solid black; display: inline-block;"></div> 50 year ARI flood extent  |
| <div style="width: 20px; height: 10px; background-color: #00CED1; border: 1px solid black; display: inline-block;"></div> 20 year ARI flood extent | <div style="width: 20px; height: 10px; background-color: #00008B; border: 1px solid black; display: inline-block;"></div> 100 year ARI flood extent |

0                      1                      2km
   
 1:45,000 @A4

NI

**Figure 6 1 Flood risk – Page 5 of 5**

## 6.2.3 Potential impacts

### **Construction**

Construction activities with the potential to impact on local water quality and flooding include:

- Vegetation removal and earthworks including stripping of topsoil, excavation and filling of cuts near waterways including the unnamed drainage lines within and near the proposal
- Stockpiling of topsoil and vegetation
- Widening of the Newell Highway
- Transportation of cut and/or fill materials
- Movement of heavy vehicles across exposed earth
- Accidental spills of fuels, oils or other chemicals from construction vehicles or equipment
- Blocking or diverting local drainage lines which have the potential to result in localised areas of flooding and scour during rainfall events
- Operation of the asphalt batch plant.

These potential impacts would have implications for aquatic ecosystem health and human water users, including effects on sensitive receiving environments. Risks to water quality are considered to be minimal with the use of sediment basins and the implementation of safeguards and management measures (refer to **Section 6.2.4**).

As described in **Section 6.3.2**, the proposal is located in a high salinity risk area. Construction does not involve deep excavation or drilling and would therefore be unlikely to impact groundwater. The proposal would be unlikely to result in substantial rises in groundwater levels, or the mobilisation of saline groundwater (where present) toward surface soils. Impacts associated with work within a high salinity risk area were considered to be low and manageable with mitigation measures (refer to **Section 6.3.4**).

The ancillary sites would not be located in areas prone to flash flooding and would be located more than 40 metres from a watercourse.

As indicated in **Section 3.2.2**, there are limited water sources in the proposal area. Non potable water sources (including the potential for water extraction from waterways and existing boreholes (refer to **Section 6.2.2**) would be investigated during detailed design to minimise the reliance on potable water where feasible. Construction water is expected to be sourced from the Moree or Narrabri town supply and transported to the proposal area. Any water extraction from waterways or bores would occur only after consultation with the NSW Office of Water, and acquisition of associated permits and approvals.

### **Operation**

During operation, the main risk to water quality would be surface runoff from impervious surfaces.

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

Mitigation measures to reduce any additional impact to water quality as a result of the proposal have been provided in **Table 6-21**.

### **Flooding assessment**

The preliminary flood study (GHD, 2017a), assessed the flood immunity upgrade scenarios for the water crossings within the proposal area for the 50 per cent, 20 per cent, 10 per cent and 5 per cent AEP design flood events. For each highway design scenario (ie the existing/base case, as well as the two year, five year, 10 year and 20 year ARI design cases), the most likely expected number of closures during the 30 year economic appraisal timeframe were calculated as shown in **Table 6-20**.

**Table 6-20 Preliminary Flood Time of Closure Assessment**

| Segment | Existing flood immunity (ARI) | Most likely total duration of closures for base case & upgrade ARI scenarios (days) |        |          |         |         |
|---------|-------------------------------|---|--------|----------|---------|---------|
|         |                               | Existing  | 2 year | 5 year   | 10 year | 20 year |
| N2MS1   | >20                           | 0   | 0      | 0        | 0       | 0       |
| N2MS2   | Varies between 2 and >2       | 3- 7.5  | 3      | 3        | 0.8     | 0       |
| N2MS3   | 2                             | 3   | 3      | 3        | 0.8     | 0       |
| N2MS4   | Between 5 and 10              | 0.8-1.5   | 0.-1.5 | 0.8 -1.5 | 0.8     | 0       |
| N2MS5   | >20                           | 0   | 0      | 0        | 0       | 0       |

As shown in Table 6-20, time of closure results indicate that for the existing scenario, the critical crossings in terms of the total duration of closures are crossings that have less than two year ARI immunity. This has been estimated to be up to 7.5 days over the 30-year appraisal period. If the flood immunity of these crossings is improved to at least a two year ARI standard, the critical total duration of closure for the Newell Highway drops to about three days.

However, the flood immunity of the highway is governed by the Gwydir River floodplain to the north of Moree. Raising the ARI, to two, 5, 10 or even 20 years still results in the duration of closures of six days over the 30 year period. Therefore, flood immunity improvements beyond the two year ARI standard have limited benefits in terms of total duration of closure, as the Gwydir River floodplain near Moree is the limiting factor.



## 6.2.4 Safeguards and management measures

Safeguards and management measures for hydrology and flooding are presented in **Table 6-21**.

**Table 6-21 Summary of mitigation measures – Hydrology and flooding**

| Impact   | Environmental safeguards   | Responsibility          | Timing                           | Reference  |
|--|--|-------------------------|----------------------------------|--|
| Soil and water   | A Soil and Water Management Plan (SWMP) will be prepared for each segment and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction.  | Contractor              | Detailed design/pre-construction | Section 2.1 of QA G38 <i>Soil and Water Management</i> |
| Soil and water   | <ul style="list-style-type: none"> <li>A site specific Erosion and Sediment Control Plan/s (ESCP) will be prepared for each segment and implemented as part of the Soil and Water Management Plan.</li> <li>The plan will include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.</li> </ul>   | Contractor              | Detailed design/Pre-construction | Section 2.2 of QA G38 <i>Soil and Water Management</i> |
| Contaminants entering receiving environments during construction | <p>Control measures to minimise the risk of water pollution will be implemented including:</p> <ul style="list-style-type: none"> <li>All fuels, chemicals, and liquids will be stored at least 40 metres away from the existing stormwater drainage system and stored in an impervious bunded area within the compound site</li> <li>Plant and maintenance machinery will be refuelled in impervious bunded areas in the designated compound area</li> <li>Vehicle wash downs and/or concrete truck washouts would be undertaken within a designated bunded area of an impervious surface or carried out off-site.</li> </ul> | Construction contractor | Construction                     | Additional safeguard                                   |

| Impact                         | Environmental safeguards   | Responsibility                               | Timing       | Reference            |
|--------------------------------|--|--|--------------|----------------------|
| Extraction of water            | Non potable water sources (including the potential for waterway, borehole extraction and sourcing from private landowners) would be investigated during detailed design to minimise reliance on potable water where feasible.  | Roads and Maritime / Construction contractor | Construction | Additional safeguard |
| Hydrology and flood management | <p>A Flood Management Plan will be prepared prior to the work starting. This plan would include:</p> <ul style="list-style-type: none"> <li>• Review and coordination with existing local flood plans and evacuation procedures</li> <li>• Flood emergency preparation, response, and recovery measures which will be implemented during construction</li> <li>• Procedure for daily review of The Bureau of Meteorology website</li> <li>• Site protection measures to be implemented prior to and in the event of flooding</li> <li>• Procedure for monitoring and maintenance of protection measures during heavy rainfall events.</li> </ul> | Construction contractor                      | Construction | Additional safeguard |
| Flooding                       | The CEMP will consider the potential impacts of temporary construction works including trenching, solid traffic barriers and stockpiles on overland flows and incorporate appropriate management measures to address these issues.   | Contractor                                   | Construction | Additional safeguard |

## 6.3 Topography, geology, soils and contamination

Potential impacts on local topography, geology, soils and contamination are presented in this section, together with safeguards and management measures to manage any negative impacts.

### 6.3.1 Methodology

The *HW17 Narrabri to Moree Heavy Duty Pavements and Geotechnical Desktop Study* (TfNSW, 2017) and has been used to inform this assessment. Information was also obtained from the following resources in December 2017:

- Narrabri 1:250 000 Geological Sheet SH-55-12 (Wallis G.R. 1971, 1st edition, Geological Survey of New South Wales, Sydney)
- Moree 1:250 000 Geological Sheet SH/55-08 (Staudé W.J., 1968, Moree, 1st edition, Geological Survey of New South Wales, Sydney).
- NSW (Mitchell) Landscapes  
(<http://www.environment.nsw.gov.au/resources/conservation/landscapesdescriptions.pdf>)
- Acid sulfate soil risk maps from the NSW Coastal Acid Sulphate Soil Mapping Series (Department of Land and Water Conservation, 1995)
- Databases maintained by the NSW EPA:
  - Contaminated Land Records of Notices and POEO Act Public Register
  - Australian Soil Resource Information System (ASRIS) to confirm acid sulphate soil (ASS) potential
  - Australian Department of Agriculture and Water Resources, NSW Dryland Salinity Assessment 2000 – Assessment of Dryland Salinity extent 2050
  - NSW DPI Salinity hazard report for Catchment Action Plan upgrade – Borders Rivers – Gwydir CMA (Nicholson A et.al, 2012).

### 6.3.2 Existing environment

#### ***Topography, geology and soils***

The highway is typically flat to gently undulating (less than 10 percent grade) on an alluvial flood plain associated with the Mehi and the Gwydir Rivers. The proposal is located within the Brigalow Belt South bioregion (NPWS 2003: 131–137) and within in three Mitchell landscape units: Kaputar Slopes, Gwydir Alluvial Plains and Bellata Sands.

The proposal is dominated by Quaternary aged riverine plain deposit of clayed silt, sand and coarse gravels overlaying the Cretaceous Rolling Downs Group of claystone, siltstone and sandstone. Typically, soils encountered along the project length are composed of medium to heavy clays with a varying sand content. Soils are typically developed on alluvial sediments and/or clay and are typically poorly drained with low permeability.

The majority of the proposal area is undelayed by black soils. This means that the subgrade conditions are not well suited for road infrastructure and the soils are known expand and contract depending on the amount of moisture available on the ground. This in turn creates road settlement and shape loss issues. However, these soils are suitable for cropping which dominates the region (GHD, 2017a).



The geology, Mitchel landscape and soils for each segment are summarised in **Table 6-22**.

**Table 6-22 Regional geology and soils**

| Segment | Geology   | Mitchell landscape unit                 | Soils  |
|---------|---|---|--|
| N2MS1   | Predominantly Jurassic quartz sandstone, conglomerate and claystone largely obscured by Quaternary sands and talus material (Qrt/Jp). Quaternary alluvium gravel, sand, silt and clay (Qrs) is present at the northern extent of the Section.                   | Kaputar Slope                           | Soils are composed of: shallow stony red-brown loam and clay loam in uniform profiles on basalts; yellow and yellow-brown texture-contrast profile on sandstones; and deep black earths in the lowest valleys. |
| N2MS2   | Predominantly Quaternary aged alluvium gravel, sand, silt and clay (Qrs). Also within close proximity to the Section is a small area of Jurassic quartz sandstone, conglomerate and claystone largely obscured by Quaternary sands and talus material (Qrt/Jp). | Gwydir Alluvial Plains                  | Soils are composed of grey and brown silty clay deposited from suspended sediments in floodwater, often with gilgai. The elevated floodplain margins are composed of red-brown texture-contrast soils.         |
| N2MS3   | Predominantly consists of Tertiary aged polymictic gravel, including some sandstone (Tg).   | Belata Sands                            | Soils are composed of red-brown to red-yellow earths with uniform or gradational profiles.   |
| N2MS4   | Predominantly consists of Tertiary aged polymictic gravel, including some sandstone (Tg). Quaternary aged riverine plain deposits of black and red clayey silt, sand and coarse gravel (Qrs) is present at the northern extent of the section.                  | Gwydir Alluvial Plains and Belata Sands | As above in N2MS3.   |
| N2MS5   | Predominantly consists of Quaternary aged riverine plain deposits of black and red clayey silt, sand and coarse gravel (Qrs).   | Gwydir Alluvial Plains                  | As above in N2MS3.   |

### **Acid sulfate soils**

Given the distance of the study area from the coast and the elevation of the areas, no acid sulfate soils are expected or known to occur along the proposal. This was confirmed by a review of the CSIRO Australian Soil Resource Information System carried out on 7 December 2017. The search indicated that there is a low probability of encountering any acid sulfate soils within the proposal area.

### **Salinity**

Salinity is the degree to which water contains dissolved salts. Dryland salinity typically occurs in non-irrigated areas. A review NSW DPE Salinity hazard report for Catchment Action Plan upgrade – Borders Rivers-Gwydir CMA indicates that the salinity risk within the proposal is high and very high.

## **Contamination**

A search of official databases did not reveal any known contaminated sites within the proposal area. The following databases were searched on the 15 February 2018:

- OEH contaminated land records for Moree Plains Shire Council and Narrabri Shire Council: This search identified six properties that are currently or formerly regulated under the Contaminated Land Management Act 1997. None of these properties are located within 200 metres of the proposal
- EPA NSW contaminated sites notified to the EPA for the Narrabri and Moree Plains Shire LGAs identified 16 contaminated sites in the LGAs. Notifications are predominately attributed to underground storage tanks at service stations and fuel depots and also an evaporation pond located within the Moree Airport. Only the evaporation pond located within the Moree Airport is within one kilometre of the proposal
- The POEO Act: This showed that there were a large number of licences on record around Moree and Narrabri. However, there were no clean up or penalty notices issued to licence holders, properties or operations within and/or immediately next to the proposal area
- The review of contamination databases indicates low potential for contamination within the proposal area. However, agricultural practices around the proposal area may have used pesticides and herbicides and there would also be potential for illegal dumping of waste products along the highway.

In addition to the search results, there may be contamination surrounding the proposal area associated with agricultural practices, accidental spills or leaks from parked vehicles and construction activities next to the BP Service Station located in Bellata. Contamination is, however, considered a low risk to the proposal due to the low intensity of development surrounding the proposal area.

### **6.3.3 Potential impacts**

#### **Construction**

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

- Topography: The earthworks would result in a minor change to the topography of the proposal area. However, this change is consistent with the existing topography and would not be expected to be substantial
- Soil erosion and loss of topsoil: This could result from the removal of vegetation (clearing and grubbing) along both sides of the proposal area, and disturbance of the ground surface during site preparation, earthworks, excavation and other construction activities. Earthmoving activities have the potential to expose loose soils and mobilise these materials. Soil erosion and loss of top soil would be most likely to occur in areas of larger excavation such as where the cut and fill batters would be trimmed and excavated
- Salinity: In raised areas away from watercourses, vegetation clearing and earthworks could potentially result in deeper saline soil units being brought to the surface, presenting risks to vegetative growth and erosion and salt export to surface waterbodies. However, the proposal area has been largely cleared of vegetation for agricultural purposes. Vegetation clearing associated with the proposal would be unlikely to result in substantial rises in groundwater levels, or the mobilisation of saline groundwater (where present) toward surface soils.
- Vegetation clearing: The proposal area has been largely cleared of vegetation for agricultural purposes. Vegetation clearing required for the proposal has the potential to result in increased erosion and sedimentation

- Disturbance of contaminated soil: Contamination is considered a low risk due to the low intensity of development surrounding the proposal area, however there may be contamination within the proposal area associated with agricultural practices and illegal dumping (refer to **Section 6.4.1**). If contamination is present in these areas, the proposal would have the potential to disperse contaminated materials. Disturbance of potentially contaminated materials may also expose construction workers and/or the general public to these contaminants if appropriate controls are not put in place
- Spills of contaminating materials: There would be potential for construction activities to result in contamination of soil and/or water due to leaks and spills of potentially contaminating materials. Spill containment would be used at ancillary site to contain spills and spill response procedures would be followed. These impacts would generally be temporary, and mitigation measures to reduce the impacts are summarised in **Table 6-23**.

### Operation

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

### 6.3.4 Safeguards and management measures

Safeguards and management measures for impacts to soils and contamination are presented in **Table 6-23**.

**Table 6-23 Safeguards and mitigation measures – Soils and contamination**

| Impact            | Environmental safeguards   | Responsibility | Timing                             | Reference   |
|-------------------|--|----------------|------------------------------------|---|
| Contaminated land | If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA if required. | Contractor     | Detailed design/Pre - construction | Section 4.2 of QA G36 <i>Environment Protection</i> |
| Accidental spill  | A site specific emergency spill plan will be developed, and include spill management measures in accordance with the Roads and Maritime <i>Code of Practice for Water Management</i> (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).   | Contractor     | Detailed design/Pre - construction | Section 4.3 of QA G36 <i>Environment Protection</i> |



| Impact                             | Environmental safeguards  | Responsibility          | Timing       | Reference                     |
|------------------------------------|---|-------------------------|--------------|-------------------------------|
| Stockpile management               | Stockpiles will be designed, established, operated and decommissioned in accordance with the Roads and Maritimes' <i>Stockpile Site Management Guideline 2015</i> .   | Construction contractor | Construction | Additional standard safeguard |
| Soil stabilisation and restoration | The rehabilitation of disturbed areas will be carried out progressively as construction stages are completed, and in accordance with: <ul style="list-style-type: none"> <li>• Landcom's Managing Urban Stormwater: Soils and Construction series</li> <li>• RTA Landscape Guideline</li> <li>• Roads and Maritimes' Guideline for Batter Stabilisation Using Vegetation (2015).</li> </ul>   | Construction contractor | Construction | Additional standard safeguard |
| Pollution from run-off             | The ancillary facilities will be managed within the ESCP. The following measures will be included to limit sediment and other contaminations entering receiving waterways: <ul style="list-style-type: none"> <li>• Chemicals will be stored within a sealed or bunded area</li> <li>• Appropriate controls will be in place where plant is stored</li> <li>• Run-off from ancillary sites will be controlled and treated before discharging into downstream waterways</li> <li>• Vehicle movements will be restricted to designated pathways where feasible</li> <li>• Areas that will be exposed for extended periods, such as car parks and main access roads, will be stabilised where feasible.</li> </ul> | Construction contractor | Construction | Additional safeguard          |

## 6.4 Traffic and transport

The potential impacts of the proposal on traffic and transport are assessed in the *Newell Highway Upgrade Strategic Design and Concept Design Traffic and Transport Assessment* (GHD, 2017c). A summary of the assessment is presented in this section.

### 6.4.1 Methodology

The *Newell Highway Upgrade Strategic Design and Concept Design Traffic and Transport Assessment* (GHD, 2017c) has been used to inform this assessment. Information was also obtained from the following resources in December 2017:

- Newell Highway Heavy Duty Pavements, North Moree Preliminary Environmental Investigation (WSP, 2017)
- Reviews of relevant online aerial photography and mapping tools
- The schedule of classified and unclassified roads (Roads and Maritime, 2017).

### 6.4.2 Existing environment

#### **Road network**

The Newell Highway is a State classified road (road number A39) and is the longest highway in NSW. It is 1,060 kilometres long and runs north to south from Goondiwindi on the Queensland border to Tocumwal on the Victorian border. The highway is a major interstate freight corridor, being the third largest in NSW providing access between key regional primary industries and export markets. The highway supports regional tourism with caravans being a major road user.

The Newell Highway in the proposal area is nominally a two-lane, two-way single carriageway road. There are no existing overtaking lanes on the highway within the proposal area. Despite this, there are many opportunities for overtaking using gaps in oncoming traffic.

The Newell Highway has a posted speed limit of 110 kilometres per hour through rural areas. The speed limit on rural road is 110 kilometres per hour, limited to 60 to 80 kilometres per hour through towns and urban areas, refer to **Section 2.2**.

There are a number of local roads and access roads that connect to the Newell Highway in the proposal area as described in **Section 2.2**.

#### **Traffic volume and mix**

Classified traffic count data was collected by Roads and Maritime in April 2012 between Brigalow Lane and Penneys Road within N2MS4. The average annual daily traffic (AADT) on the Newell Highway between Narrabri to Moree in 2012 was 2,924 vehicles per day which included 190 trucks, 335 semi-trailers and 720 multi-articulated vehicles. The northbound peak occurred at 11:00 am, with 127 vehicles per hour and the southbound peak occurred at 2:00 pm, with 109 vehicles per hour. The survey data recorded generally more vehicles travelling northbound than southbound (about 53/47 per cent directional split).

Heavy vehicles, defined as Austroads Class 3 and above, made up about 40 percent of the traffic stream. The majority of heavy vehicles recorded were high productivity vehicles, including B-Doubles and longer (about 55 per cent of heavy vehicles).

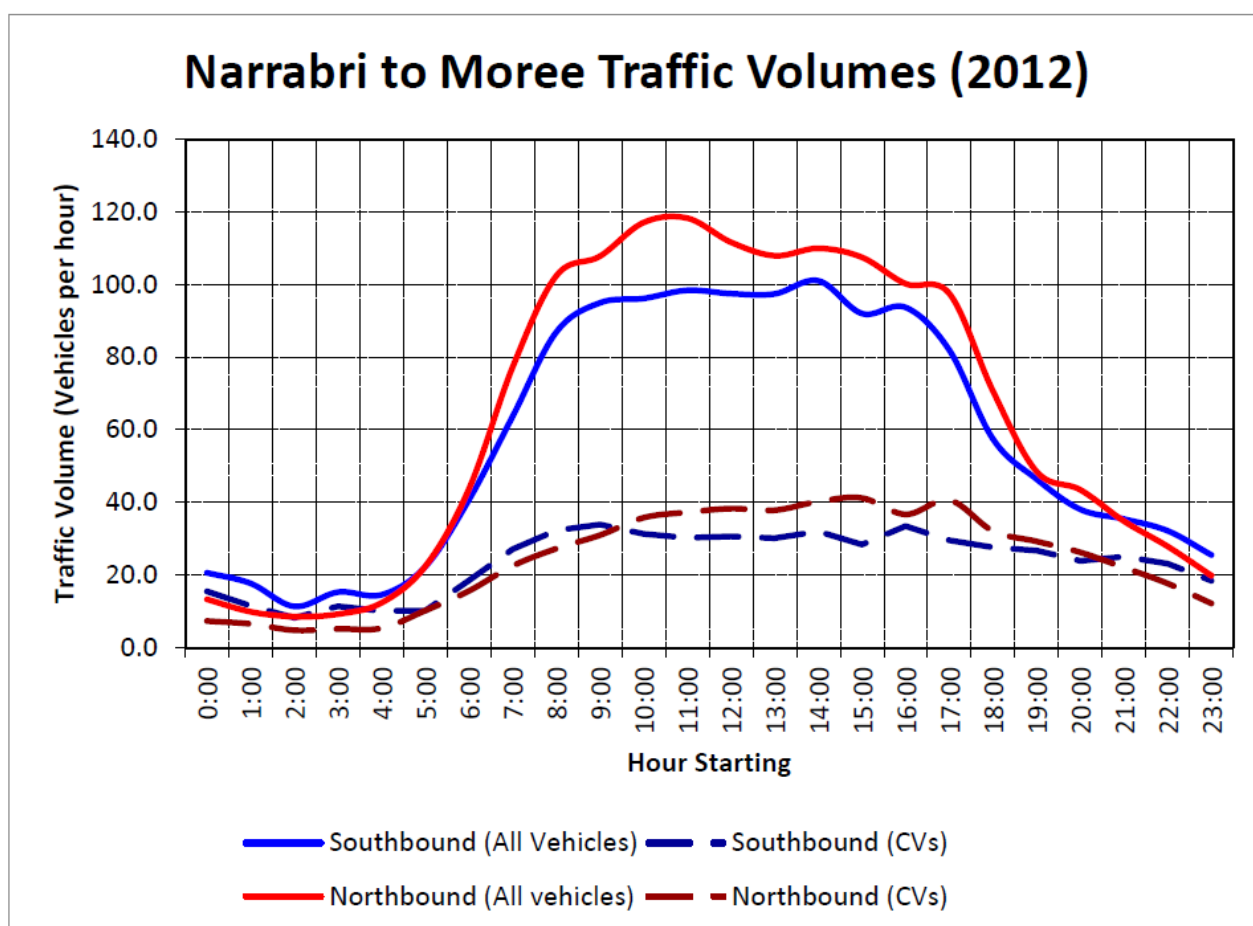
The *Newell Highway Corridor Strategy* (Road and Maritime, 2015) provides estimated growth in AADT and freight volumes on the Newell Highway to 2031 in the order of total of 0.8 and 3.8 per cent per annum respectively.

A summary of traffic data collected in 2012 between Narrabri to Moree is presented in **Table 6-24** and **Figure 6-2**.

**Table 6-24 Narrabri to Moree 2012 traffic volumes**

| Statistic                       | AADT  | Northbound peak (11.00 am) |          | Southbound peak (2.00 pm) |          |
|---------------------------------|-------|----------------------------|----------|---------------------------|----------|
|                                 |       | Northbound                 | Opposing | Southbound                | Opposing |
| Traffic volume                  | 2,924 | 127                        | 106      | 109                       | 118      |
| Total% Heavy vehicles (two-way) | 40.5  | 32.5                       |          | 35.7                      |          |

Source: Newell Highway Corridor Strategy (Transport for NSW, 2015)



**Figure 6-2 2012 Daily traffic profile (GHD, 2017c)**

### Crash history

Crash data for each segment is provided in **Table 6-25** for the period covering 1 January 2006 to 24 August 2017.



**Table 6-25 Newell Highway North Narrabri crash history (2006-2016) (GHD, 2017c)**

| Segment      | Total crashes | Casualty crashes | Casualty crashes per year per km | Average AADT (2006-2017) | Casualty crashed per 100Mvehkm |
|--------------|---------------|------------------|----------------------------------|--------------------------|--------------------------------|
| N2MS1        | 12            | 3                | 0.051                            | ~2,900                   | 4.5                            |
| N2MS2        | 11            | 6                | 0.053                            |                          | 4.7                            |
| N2MS3        | 5             | 3                | 0.067                            |                          | 5.9                            |
| N2MS4        | 11            | 6                | 0.094                            |                          | 8.4                            |
| N2MS5        | 5             | 4                | 0.045                            |                          | 4.1                            |
| <b>Total</b> | <b>44</b>     | <b>22</b>        | <b>0.060</b>                     |                          | <b>5.3</b>                     |

### **Level of Service**

Level of Service (LoS) of a road is a measure of how easily traffic flows on the road. The LoS assessment is based on various factors, including traffic volumes and proportion of heavy vehicles, terrain and frequency of intersections. LoS is ranked on 'A' representing the best performance to LoS 'F' representing the worst. According to the traffic and transport assessment (GHD, 2017c), the Newell Highway between Narrabri to Moree operates at an overall Level of service (LoS) of B both northbound and southbound. The LoS of each segment ranges from LoS A to LoS C.

The target LoS for the Newell Highway is LoS B which is described by Austroads (2013) as situations where passing demand and passing capacity are balanced, with a higher degree of platooning than for LoS A and some reduction in speed compared to the free flow speed.

### **Public transport**

There are local bus services that operate in both Narrabri and Moree that use the Newell Highway. The local school bus service stops at a number of informal locations along the Newell Highway to pick up and drop of passengers. The Newell Highway is used by a number of daily, long distance coaches that service the towns in central NSW from major capital cities and larger regional centres.

The Mungindi railway line runs parallel for the length of the proposal immediately to the west. The railway line provides north-south access from Narrabri to Moree, with railway stations at Narrabri and Moree and a railway station at Bellata. Railway stations at Edgeroi and Gurley are out of use.

### **Pedestrian, cycling and road user facilities**

There are no dedicated pedestrian or cycle paths along the Newell Highway or roads that connect to the highway within the proposal area. The exception to this, is at Bellata where a section of pedestrian footpaths are provided along the highway and there are road shoulders which would be suitable for cyclists (refer to **Photo 6-9**).



**Photo 6-9 Pedestrian footpaths and wide road shoulders at Bellata (Source: Google Earth, 2018)**

There are four vehicle rest areas located between Narrabri and Moree on the Newell Highway. Rest areas located within the proposal include:

- Edgeroi Park, located about 24 kilometres to the north of Narrabri within the town of Edgeroi
- Tookey Creek rest area, a light vehicle rest area located north of Bellata, about 53 kilometres north of Narrabri
- Woolabrar rest area located on the eastern side of the proposal 48.8 kilometres north of Narrabri
- An unofficial rest area currently being used by heavy vehicles one kilometre north of the Tookey Creek rest area.

#### Property access

There are about 30 property accesses connecting to Newell Highway within the proposal area.

### 6.4.3 Potential impacts

#### **Construction**

Construction is planned to occur over a 24-month period (weather permitting) starting 2020 (refer to **Section 1.1.2**). Construction traffic (comprising light vehicles, haulage trucks, concrete trucks and delivery trucks) would lead to a temporary increase in traffic on the Newell Highway.

Where work would be carried out offline, the impacts would be primarily due to reduced speed limits in the area. For online construction on the active carriageway, there would be the largest construction traffic impacts due to some sections of the highway operate under two-way, reversible flow conditions with traffic control which would introducing additional delays along the Newell Highway.

During construction, the potential impact would be generally associated with an increase in traffic numbers associated with construction vehicles and deliveries, as well as a change in the type of traffic using the Newell Highway. The majority of construction truck movements for the proposal would be expected to be tipper trucks, which would be either single trucks (bogies) or 'truck and

dog' trailers. Vehicles that are over-height, oversize or over-mass would not be expected to be required to construct the proposal. Haulage would be in accordance with the TMP.

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

#### Increased travel times

During construction, the speed limit would be reduced to allow for safe working practices and to facilitate temporary lane closures and switching where required through the proposal area. This would delay travel time by up to 42 seconds per five kilometres across the proposal (GHD, 2017c) (refer to Table 6-26). There may also be additional delays due to traffic control to allow construction vehicles to travel through the proposal and carrying out works. This would be monitored throughout construction to ensure traffic flow is maintained on the road network. The TMP, would minimise delays to road users.

**Table 6-26 Estimated average road user delay per segment**

| Segment | Length (Kilometres) | Worst case delay (seconds) |
|---------|---------------------|----------------------------|
| N2MS1   | 5.4                 | 118                        |
| N2MS2   | 10.3                | 225                        |
| N2MS3   | 4.1                 | 89                         |
| N2MS4   | 5.8                 | 126                        |
| N2MS5   | 8                   | 175                        |

#### Local access

Access to properties would be maintained for the duration of construction. However, there may be a need to temporarily change access to some properties, rest areas and the informal school bus stops along the highway, to establish safe construction working areas while maintaining local through traffic. These temporary changes to local access would include:

- Changes to access arrangements for vehicles using the Newell Highway, and for property access for properties (including business) located within the proposal area
- Disruption to the informal school bus stops within the proposal area
- Short-term lane closures may be required, which could disrupt traffic and impact travel times on Newell Highway
- Impact to rest areas, including area closures or reduced facilities.

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



## Operation

Operation of the proposal is not expected to impact on the forecasted traffic growth or composition of the vehicles using the highway.

The proposal would improve the traffic efficiency and safety of the highway for all road users due to the following road improvements:

- Lane and shoulder widening
- Improved horizontal arrangement
- Five new overtaking lanes
- The provision of left and right turn lanes into minor roads and property accesses
- Wide centre-line treatment.

The traffic assessment (GHD, 2017c) found that the proposal would also:

- Increase the average travel speed on Newell Highway by around four to five kilometres per hour (by about six per cent)
- Decrease the percent time spent following other vehicles by around four to eight per cent
- Improve the LoS of the highway from LoS C to LoS B or better for all segments.
- Reduce the existing casualty crash rate by about 27 per cent (0.95 casualty crashes per year).

### 6.4.4 Safeguards and management measures

Safeguards and management measures for traffic and transport are presented in **Table 6-27**.

**Table 6-27 Summary of mitigation measures – Traffic and Transport**

| Impact                | Environmental safeguards   | Responsibility | Timing                           | Reference   |
|-----------------------|--|----------------|----------------------------------|---|
| Traffic and transport | <p>A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the <i>Roads and Maritime Traffic Control at Work Sites Manual</i> (RTA, 2010) and <i>QA Specification G10 Control of Traffic</i> (Roads and Maritime, 2008). The TMP will include:</p> <ul style="list-style-type: none"> <li>• Confirmation of haulage routes</li> <li>• Measures to maintain access to local roads and properties</li> <li>• Site specific traffic control measures (including signage) to manage and regulate traffic movement</li> <li>• Measures to maintain pedestrian and cyclist access</li> <li>• Requirements and methods to consult and inform the local community of impacts on the local road network</li> <li>• Access to construction sites including entry and exit locations and measures to prevent</li> </ul> | Contractor     | Detailed design/Pre-construction | Section 4.8 of QA G36 <i>Environment Protection</i> |

| Impact  | Environmental safeguards  | Responsibility                                 | Timing                           | Reference                     |
|---|---|--|----------------------------------|-------------------------------|
|   | <p>construction vehicles queuing on public roads.</p> <ul style="list-style-type: none"> <li>• A response plan for any construction traffic incident</li> <li>• Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic</li> <li>• Monitoring, review and amendment mechanisms.</li> </ul> |  |                                  |                               |
| Property access - pre-construction                                | Requirements for any changes to local access arrangements will be confirmed during detailed design in consultation with the local road authority and any affected landowners.   | Roads and Maritime                             | Pre-construction/detailed design | Additional standard safeguard |
| Notifications to landowners                                       | Disruptions to property access and traffic will be notified to landowners at least five in accordance with the relevant community consultation processes outlined in the TMP.   | Roads and Maritime and Construction Contractor | Construction                     | Additional standard safeguard |
| Property access - during construction                             | Access to properties will be maintained during construction. Where that is not feasible or necessary, temporary alternative access arrangements will be provided following consultation with affected landowners and the relevant local road authority.   | Roads and Maritime and Construction Contractor | Construction                     | Additional standard safeguard |
| Reduce speeds, traffic delays and disruptions during construction | Road users, local communities and the freight industry will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.  | Roads and Maritime and Construction Contractor | Construction                     | Additional standard safeguard |
| Disruption to public transport, including school bus services     | Access for public transport services, including school bus services, will be maintained. The requirements for any temporary changes will be confirmed following consultation with local bus operators and the community.  | Roads and Maritime and Construction Contractor | Construction                     | Additional standard safeguard |
| Impacts of the regional road network                              | Where possible, the most disruption work (such as work that requires lane closures) will be carried out at night to minimise potential impacts on the regional road network. This, combined with temporary effective traffic management, will assist in minimising impacts to traffic and transport using the Newell Highway.   | Roads and Maritime and Construction Contractor | Construction                     | Additional safeguard          |

## 6.5 Noise and vibration

The potential noise and vibration impacts on sensitive receivers during construction and operation of the proposal have been assessed as part of the *Newell Highway - Heavy Duty Pavement Upgrade between Narrabri and Moree - Noise and Vibration Assessment Report (NVA)* (Jacobs, 2018a) provided in **Appendix F**. The main findings of the report are summarised below.

### 6.5.1 Methodology

The NVA provided in **Appendix F** has been prepared in accordance with the following:

- *Interim Construction Noise Guideline*, Department of Environment and Climate Change NSW, July 2009 (ICNG)
- *Construction Noise and Vibration Guideline (CNVG)*, (Roads and Maritime, 2016)
- *Noise Mitigation Guideline*, Roads and Maritime Services, April 2015 (NMG)
- *Noise Model Validation Guideline (NMVG)*, (Roads and Maritime, 2018)
- *Road Noise Policy*, NSW EPA, 2011 (RNP)
- *Assessing Vibration: a technical guideline*, DEC, 2006
- *Environmental Noise Management Manual (ENMM)*, (Roads and Traffic Authority, 2001)
- British Standard 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting [BS 6472-1: 2008]
- British Standard 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2, BSI, 1993
- Australian Standard AS2187.2 – 2006 Explosives – Storage and use Part 2: Use of explosives.
- DIN 4150: Part 3-1999 Structural vibration - Effects of vibration on structures, Deutsches Institute fur Normung, 1999.
- *Calculation of Road Traffic Noise, UK Department of Transport, 1988 (CoRTN)*.
- *Noise Policy for Industry, (EPA, 2017)*.

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

- Identifying noise and vibration sensitive receivers and defining the study area
- Carrying out noise monitoring to determine the existing noise environment
- Establishing noise and vibration assessment criteria
- Prediction of construction and operational noise levels
- Assessing predicted noise and vibration levels against the relevant criteria to identify potential impacts
- Identify safeguards and management measures to be implemented to minimise impacts.

#### **Study area**

The study area for the noise and vibration assessment has been defined as sensitive receivers located within two kilometres of each segment. This was reduced in some areas where substantial building shielding was present. Receivers were identified using aerial photography, GIS databases and information gathered from site visits. Consistent with Section 6 of the NMG, an operational noise study area of 600 metres was considered around the proposal.



## Noise monitoring

Unattended noise monitoring to identify background noise levels for the proposal was carried out from 29 November 2017 to 13 December 2017 at representative locations (refer **Figure 1-3**) using automatic unattended noise monitoring equipment (Type 1 Ngara noise loggers). The loggers continuously measured the level of ambient noise over 15-minute periods for the duration of the monitoring period at each location, with the exception of the noise logger at N2MS1 as it finished recording on the 7 December 2018 due to a flat battery.

## Noise modelling

To evaluate potential noise impacts for sensitive receivers during construction and operation, a model was developed using the SoundPlan 7.4 predictive software package. Key acoustic features of the existing environment were incorporated into the model including terrain, surrounding buildings, ground and air absorption, receivers, and local meteorological conditions. Sound power levels for construction noise sources were derived from Roads and Maritime's guidance material, with road noise levels estimated for the different assessment scenarios using site traffic data and standard corrections applied for assessments in NSW, as well as, guidance from Evaluation of Calculation of Road Traffic Noise in Australia, (Peng, Kessissoglou & Parnell, 2017).

The potential for groundbourne vibration impacts during construction were evaluated using guidance for safe setback distances from vibration generating plant and equipment, and prediction methods from relevant standards. Noise associated with additional traffic generated during construction was quantitatively reviewed using Roads and Maritime's Construction Noise Estimator (CNE) tool.

## 6.5.2 Existing environment

### Sensitive receivers

The proposal is located in sparsely developed areas with only a small number of surrounding sensitive receivers, though portions of N2MS2, N2MS3 and N2MS5 have more populated areas. About 238 rural residential properties are located within the study area, with the nearest receiver located about 15 metres from the proposal within Bellata in N2MS3. The receivers around the proposal are shown in **Figure 1-3** and summarised in **Table 6-28**.

**Table 6-28 Summary of sensitive receivers around the proposal**

| Segment | Summary  |
|---------|--|
| N2MS1   | Nine residential receivers and one non-residential receiver (University of Sydney Research Institute facility) are within this segment. The nearest (R008) is located about 160 metres from the proposal, and seven are located within 600 metres.   |
| N2MS2   | Eighteen residential receivers and two non-residential receivers (Edgeroi rail siding and storage facility and Edgeroi Fuel Shop) are located within this segment. Most receivers are located within the village of Edgeroi. The nearest residential receivers (R018 and R019) are located within 30 metres of the proposal.   |
| N2MS3   | Seventy six residential receivers were identified in this segment. Most are located in the village of Bellata, with the nearest located along the Newell Highway and along intersecting streets including Temi Street, North Street, Wilga Street and Oak Street. Several non-residential receivers are also located at Bellata including shops and industrial facilities; a community centre; two public outdoor recreational areas, a place of worship and a school. |

| Segment | Summary  |
|---------|--|
| N2MS4   | Six residential and one commercial receiver are located with this segment. Of the six residential receivers, only one is set within 600 metres of the proposal (R103) which is located about 220 metres east of the proposal.  |
| N2MS5   | This segment is near the southern outskirts of Moree. The study area contains 129 residential receivers, with most more than 600 metres from the proposal. The nearest residential receivers (R126 and R127) are around 140 metre east of the proposal. There are a number of non-residential receivers including several commercial and industrial facilities off the Newell Highway. These non-residential receivers include: Burrington Road and Des Young Drive. Moree Airport, The Bureau of Meteorology Moree Meteorological Office and a nearby place of worship. |

### Existing noise environment

The existing noise environment was identified based on the results of noise monitoring carried out at representative locations within the study area. Unattended monitoring was undertaken at sensitive receiver 117 (NM02) within N2MS5 and two other locations north of Moree, refer to **Figure 1-3**.

Noise results were post-processed to eliminate inconsistent features (including wind speed greater than five metres per second, rain and seasonal insect noise) and to develop the data into the relevant metrics for assessment. The noise monitoring results are presented in **Table 6-29**. The rating background level (RBL) refers to the median value of monitored background noise levels measured over each period. 'LAeq' is the equivalent continuous sound level or energy-time average for the relevant period of monitoring.

**Table 6-29 Noise monitoring results**

| Location | Road noise results L <sub>Aeq</sub> dB(A) |                | Construction noise measured RBLs dB(A) |      |                      |      |                     |      |
|----------|---|----------------|--|------|----------------------|------|---------------------|------|
|          | Day (15 hour)                             | Night (9 hour) | Day (7am to 6pm)                       |      | Evening (pm to 10pm) |      | Night (10pm to 7am) |      |
|          |   |                | RBL                                    | LAeq | RBL                  | LAeq | RBL                 | LAeq |
| NM02     | 57.7                                      | 54.7           | 39.0                                   | 56.7 | 40.4                 | 59.0 | 37.4                | 54.7 |
| NM03     | 56.7                                      | 53.2           | 39.3                                   | 56.8 | 33.4                 | 53.2 | 39.0                | 55.5 |
| NM04     | 51.6                                      | 46.2           | 29.9                                   | 51.4 | 34.9                 | 46.2 | 30.9                | 46.2 |

As shown in **Table 6-29**, higher background noise levels were recorded at monitoring locations NM02 and NM03 which are both located near busier sections of the Newell Highway and more affected by local traffic movements than at NM04. High 'evening' and 'night' time RBLs at each of the monitoring locations was attributable to the high frequency of moderate winds during evening and night time periods, though as above it is noted that wind speeds greater than 5 m/s were excluded from the analysis.

Levels recorded at NM02 were used to characterise background noise conditions at receivers within 200 metres of the Newell Highway and/or otherwise located in areas also affected by reasonable local traffic movements, whereas the measurements collected at NM04 were used as an estimate of background noise levels at more distant and remote receivers for the purpose of assessing construction noise impacts.

## 6.5.3 Criteria

### Construction noise criteria

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

The NMLs for residential receivers were derived from the existing background noise levels, or rating background levels (RBL), with the relevant criteria applied in accordance with the ICNG for works during recommended standard hours and works outside these hours. **Table 6-30** identifies the methodology applied in the development of NMLs for residential receivers.

**Table 6-30 Development of construction noise management levels (NML)**

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

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

Based on the results, background noise statistics (RBLs) presented in **Table 6-29** and the application of the criteria presented in **Table 6-30**, the following construction NMLs have been established as outlined in **Table 6-31**.



**Table 6-31 Construction noise management levels**

| Noise catchment area | Applies to  | Noise management level (NML) $L_{eq\ 15\ minute}$ dB(A) |   |                        |  |
|----------------------|---|---|---|------------------------|--|
|                      |   | Standard hours of construction                          | Outside recommended standard hours of construction  |                        |  |
|                      |   |   | Day (1 pm to 6 pm Saturday and 8 am to 6 pm Sunday) | Evening (6pm to 10 pm) | Night (10 pm to 7 am [8 am on Weekends]) |
| NCA01                | Receivers in developed areas and within 200 m of proposal | 49  | 45 <sup>#</sup>                                     | 45                     | 42                                       |
| NCA02                | Remote receivers  | 40  | 40 <sup>#</sup>                                     | 40                     | 36                                       |

It is noted that the NML for day time works outside standard hours were adjusted so that they were not lower than the evening and night time values.

For other relevant land uses within the proposal area, the noise criteria in **Table 6-32** would apply.

**Table 6-32 Noise management levels for non-residential land uses (ICNG, DECC 2009)**

| Land use                            | Management level $LA_{eq\ 15\ minute}$ dB(A) (when in use) |
|-------------------------------------|--|
| Educational facilities              | 45 dB(A) internal noise level                              |
| Place of worship                    | 45 dB(A) internal noise level                              |
| Commercial premises                 | 70 dB(A) external noise level                              |
| Industrial premises                 | 75 dB(A) external noise level                              |
| Outdoor recreational area (passive) | 60 dB(A) external noise level                              |
| Community center                    | 50 dB(A) internal noise level                              |

### ***Sleep disturbance criteria***

A sleep disturbance screening criteria of 55 dB(A)  $L_{A\ 1\ minute}$  has been adopted for the construction of the proposal based on the guidance in the RNP regarding the potential for sleep disturbance within residences.

### ***Construction traffic***

The CNVG provides guidance for the assessment of noise associated with additional traffic generated during construction, therefore a relative increase criteria of 2 dB(A) has been adopted for the assessment of construction traffic impacts associated with the proposal.

If the noise levels increase by more than 2 dB(A) (ie 2.1 dB(A) relative to existing conditions) further assessment is required using CMG. This documents RMS' approach to implementing the Road Noise Policy. Consideration should be given under the Noise Criteria Guideline as to whether

construction traffic or temporary reroute triggers new road criteria due to changes in road category’.

### Construction vibration criteria

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

#### Human comfort criteria

The NSW EPA classifies vibration as one of three types:

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

Construction vibration is typically classed as intermittent and is assessed using the vibration dose values (VDVs). Relevant assessment criteria expressed as preferred and maximum VDVs are provided in **Table 6-33**.

**Table 6-33: Preferred and maximum values for continuous and impulsive vibration acceleration (m/s<sup>2</sup>) 1-80 Hz (DECC, 2006)**

| Locations  | Assessment period <sup>1</sup> | Preferred values |              | Maximum values |              |
|--|--------------------------------|------------------|--------------|----------------|--------------|
|  |                                | z-axis           | X and y axis | z-axis         | X and y axis |
| <b>Continuous vibration</b>                                      |                                |                  |              |                |              |
| Critical areas*  | Day or night                   | 0.0050           | 0.0036       | 0.010          | 0.0072       |
| Residences   | Day                            | 0.010            | 0.0071       | 0.020          | 0.014        |
|  | Night                          | 0.007            | 0.005        | 0.014          | 0.010        |
| Offices, schools, educational institutions and places of worship | Day or night                   | 0.020            | 0.014        | 0.040          | 0.028        |
| Workshops  | Day or night                   | 0.04             | 0.029        | 0.080          | 0.058        |
| <b>Impulsive vibration</b>                                       |                                |                  |              |                |              |
| Critical areas <sup>2</sup>                                      | Day or night                   | 0.0050           | 0.0036       | 0.010          | 0.0072       |
| Residences   | Day                            | 0.30             | 0.21         | 0.60           | 0.42         |
|  | Night                          | 0.10             | 0.071        | 0.20           | 0.14         |
| Offices, schools, educational institutions and places of worship | Day or night                   | 0.64             | 0.46         | 1.28           | 0.92         |
| Workshops  | Day or night                   | 0.64             | 0.46         | 1.28           | 0.92         |

<sup>1</sup> Daytime is 7am to 10pm. Night-time is 10pm to 7am

<sup>2</sup> Includes hospital operating theatres or precision laboratories.

Intermittent vibration is assessed differently using VDV<sub>s</sub>. Preferred and maximum VDV<sub>s</sub> are also provided in *Assessing Vibration: a technical guideline*, (DECC, February 2006) and have been reproduced in **Table 6-34**.

**Table 6-34 Preferred and maximum VDV<sub>s</sub> for intermittent vibration (ms<sup>-1.75</sup>), (DECC, 2006)**

| Location   | Day time (7 am to 10 pm) |             | Night time (10 pm to 7 am) |             |
|--|--------------------------|-------------|----------------------------|-------------|
|  | Preferred VDV            | Maximum VDV | Preferred VDV              | Maximum VDV |
| Critical areas <sup>1</sup>                                      | 0.10                     | 0.20        | 0.10                       | 0.2         |
| Residences   | 0.20                     | 0.40        | 0.13                       | 0.26        |
| Offices, schools, educational institutions and places of worship | 0.40                     | 0.80        | 0.40                       | 0.80        |
| Workshops  | 0.80                     | 1.60        | 0.80                       | 1.60        |

<sup>1</sup> Includes operating theatres, precision laboratories and other areas where vibration-sensitive activities may occur.

### Buildings and structures

The British Standard 7385-2:1993 is used as a guide to assess the likelihood of building damage from ground vibration such as that caused by piling, compaction, construction equipment and road and rail traffic. The standard recommends levels at which ‘cosmetic’, ‘minor’ and ‘major’ categories of damage might occur based on the type of structure affected, using the peak particle velocity (PPV) parameter. The criteria are presented in **Table 6-35**.

**Table 6-35 Structural damage criteria for cosmetic building damage, (BS7385-2: 1993)**

| Group | Type of structure   | Peak particle velocity (PPV) - mm/s |              |                |
|-------|---|-------------------------------------|--------------|----------------|
|       |   | 4Hz to 15Hz                         | 15Hz to 40Hz | 40Hz and above |
| 1     | Reinforced or framed structures Industrial and heavy commercial buildings               | 50                                  |              |                |
| 2     | Un-reinforced or light framed structures Residential or light commercial type buildings | 15 to 20                            | 20 to 50     | 50             |

Guidance for more sensitive structures is presented in the DIN 4150-3:1999-02. Vibration velocities not exceeding 3 mm/s at 1 to 10 Hz are recommended in this standard.

Section 7 of the CNVG (Roads and Maritime, 2016) recommends safe working distances for achieving human comfort (*Assessing Vibration: a technical guideline*, (DECC, February 2006)) 2006) and cosmetic building damage (BS7385-2:1993) criteria for a range of different plant and equipment. Although it is noted that these distances are indicative and vary depending on local geotechnical conditions; these offsets have been considered for the initial assessment of potential vibration impacts during the construction of the proposal. These have been reproduced in **Table 6-36**.



**Table 6-36 Recommended safe working distances for vibration-intensive plant and equipment, (CNVG, Roads and Maritime 2016)**

| Plant                   | Rating / description               | Safe working distance (meters)   |                             |
|-------------------------|------------------------------------|----------------------------------|-----------------------------|
|                         |                                    | Cosmetic damage (BS7385-2: 1993) | Human response (DECC, 2006) |
| Vibratory Roller        | <50 kN (typically 1-2 tonne)       | 5                                | 15 to 20                    |
|                         | <100 kN (typically 2-4 tonne)      | 6                                | 20                          |
|                         | <200 kN (typically 4-6 tonne)      | 12                               | 40                          |
|                         | <300 kN (typically 7-13 tonne)     | 15                               | 100                         |
|                         | >300 kN (typically 13-18 tonne)    | 20                               | 100                         |
|                         | >300 kN (> 18 tonne)               | 25                               | 100                         |
| Small hydraulic hammer  | 300 kg – 5 to 12 tonne excavator   | 2                                | 7                           |
| Medium hydraulic hammer | 900 kg – 12 to 18 tonne excavator  | 7                                | 23                          |
| Large hydraulic hammer  | 1600 kg – 18 to 34 tonne excavator | 22                               | 73                          |
| Vibratory pile driver   | Sheet piles                        | 2 to 20                          | 20                          |
| Pile boring             | ≤800 mm                            | 2 (nominal)                      | 4                           |
| Jackhammer              | Hand held                          | 1 (nominal)                      | 2                           |

\* Includes operating theatres, precision laboratories and other areas where vibration sensitive activities may occur

### **Operational traffic noise**

Where a proposal has the potential to generate a new source of noise for residential receivers due to changes in road alignment or where a proposal would result in a change to the volume or mix of vehicles, an operational traffic noise assessment is carried out.

Where the changes of an existing road alignment are only minor, such as relating to safety projects, where the project is not intended to increase traffic carrying capacity or traffic mix, activities are classified as ‘minor works’ and a less intensive assessment of traffic noise impacts is required.

Criteria relevant to the residential receiver (R008) around segment N2MS1 involving ‘new’ and ‘redeveloped’ ‘Freeway/arterial/sub-arterial’ road are shown below in **Table 6-37**. This receiver may be exposed to noise from both ‘new’ and ‘redeveloped’ road upgrade areas, and as such ‘transition zone’ criteria were applied as outlined in Section 7.1 of the NMG.

The remaining road upgrade segments (N2MS2 -N2MS5) all comprise of ‘minor works’. In accordance with the NMG and RNP the minor works requirement for criteria of noise levels not to result in an increase of more than 2.1 dB(A) relative to existing noise levels at the worst affected receiver apply. As such, the primary operational noise requirement considered for this assessment is whether the proposal would result in a traffic noise increase of more than 2.1 dB(A) at any nearby receiver.

**Table 6-37 Road noise control criteria**

| Road category                       | Type of project/land use  | Assessment criteria dB(A)                              |   |
|-------------------------------------|---|--|---|
|                                     |   | Day (15 hour)  | Night (9 hour)  |
| Freeway/arterial/sub-arterial roads | 1. Existing residences affected by noise from new freeway/arterial/sub-arterial road corridors  | LA <sub>eq</sub> (15hr) 55 (external)                  | LA <sub>eq</sub> (9hr) 50 (external)                  |
|                                     | 2. Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial roads                             | LA <sub>eq</sub> (15hr) 60 (external)                  | LA <sub>eq</sub> (9hr) 55 (external)                  |
|                                     | 3. New road corridor/redevelopment of existing road/land use development with potential to generate additional traffic on existing road | Existing L <sub>Aeq</sub> (15hr) (external) + 12 dB(A) | Existing L <sub>Aeq</sub> (9hr) (external) + 12 dB(A) |

## 6.5.4 Potential impacts

### Construction

It is expected that the proposal would be constructed over a 24 month period starting in 2020. The criteria established in **Section 6.4.3** was applied, with the following default construction scenarios evaluated:

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

Sound power levels (SWLs) for these assessment scenarios were adopted from Roads and Maritime’s Construction Noise Estimator (CNE).

The final construction methodology and staging would be refined during the detailed design phase of the proposal, and associated noise and vibration impacts and mitigation measures reassessed as required. It is also expected that noise and vibration impacts associated with the establishment and then operation of ancillary sites would also be assessed.

Proposed plant and equipment to be used during each stage of construction are provided in **Section 3.3.4** and have been factored into the assessment of construction noise and vibration impacts during each stage of construction.

### Predicted construction noise impacts

Construction noise impacts were evaluated at each receiver for the eight construction scenario listed above. The range of results and impacts are summarised **Table 6-38**.

**Table 6-38 Summary of construction noise results for receivers**

| NCA          | Receivers                   | Noise management levels $L_{eq\ 15\ minute}$ dB(A) |                        |         |       | Range of predicted results $L_{eq\ 15\ minute}$ dB(A) |
|--------------|-----------------------------|--|------------------------|---------|-------|---|
|              |                             | Standard hours of construction                     | Outside standard hours |         |       |   |
|              |                             |  | Day                    | Evening | Night |   |
| <b>N2MS1</b> |                             |  |                        |         |       |   |
| NCA01        | R008                        | 49   | 45                     | 45      | 42    | 43 to 56  |
| NCA02        | R001 to R007, R009          | 40   | 40                     | 40      | 36    | Less than 20 to 52                                    |
| <b>N2MS2</b> |                             |  |                        |         |       |   |
| NCA01        | R017 to R024                | 49   | 45                     | 45      | 42    | 43 to 75  |
| NCA02        | R010 to R016, R025 and R026 | 40   | 40                     | 40      | 36    | 21 to 53  |
| <b>N2MS3</b> |                             |  |                        |         |       |   |
| NCA01        | R028 to R098                | 49   | 45                     | 45      | 42    | 21 to 80  |
| NCA02        | R027, R099 to R102          | 40   | 40                     | 40      | 36    | 24 to 52  |
| <b>N2MS4</b> |                             |  |                        |         |       |   |
| NCA02        | R103 to R107                | 40   | 40                     | 40      | 36    | Less than 20 to 53                                    |
| <b>N2MS5</b> |                             |  |                        |         |       |   |
| NCA01        | R115 to R127, R131 to R236  | 49   | 45                     | 45      | 42    | 20 to 58  |
| NCA02        | R108 to R114, R128 to R130  | 40   | 40                     | 40      | 36    | Less than 20 to 47                                    |

The construction noise impacts are summarised as follows:

- N2MS1: Noise levels from construction activities would result in some exceedances at surrounding receivers. Levels greater than NMLs for standard hours of construction were predicted at seven residential receivers, with exceedances greater than 10 dB(A) predicted at R003 during corridor clearing (scenario 03) and bulk earthworks (scenario 04).
- N2MS2: Thirteen residential receivers would experience noise levels above NMLs for standard hours. Levels up to 75 dB(A) during bulk earthworks (scenario 04) were predicted at receivers R018 and R019, with exceedances greater than 10 dB(A) predicted at six receivers during at least one or more phases of construction. Noise levels exceeding the ICNG ‘highly noise affected’ value of 75 dB(A) was also predicted at the commercial/industrial premises CIR003 during bulk earthworks (scenario 04).
- N2MS3: The highest number construction noise exceedances were predicted at receivers in this segment. Levels well above NMLs for standard hours were predicted at some of the nearest receiver locations. Five residential and four commercial/industrial receivers were predicted to be ‘highly noise affected’ during bulk earthworks (scenario 04). No impacts were predicted at the nearby educational, place of worship and community facility receivers.



- N2MS4: Only two residential receivers were predicted to experience noise levels exceeding NMLs for standard hours. The highest predicted exceedance was 13 dB(A) above standard hours NMLs at R103 during the bulk earthworks (scenario 04).
- N2MS5: Noise impacts from construction activities were predicted to be low. Levels exceeding NMLs for standard hours were predicted at 17 receivers, although in all cases the extent of the exceedance was less than 10 dB(A).

### Construction traffic noise

The CNE was used to assess potential impacts arising from construction traffic. The 2018 existing traffic conditions input as well as the additional traffic generated during construction as described in **Section 3.3.7**. Impacts were evaluated at the nearest residential receivers in relation to 60 kilometres per hour and 110 kilometres per hour sections of the proposal. The assessment predicted that at these most-affected residential locations, day and night time equivalent noise levels would increase by 0.2 and 0.5 dB(A) respectively, which is below the 2.1 dB(A) allowance adopted in the CNVG.

### Construction vibration impacts

Some vibration-intensive equipment may be used during the proposal including compaction equipment. Relevant recommended safe setback distances to maintain building cosmetic and human comfort criteria for these types of plant are reproduced below in **Table 6-39**.

**Table 6-39 Recommended safe setback distances for relevant vibration-generating plant**

| Plant            | Rating / description            | Safe working distance (metres)   |                             |
|------------------|---------------------------------|----------------------------------|-----------------------------|
|                  |                                 | Cosmetic damage (BS7385-2: 1993) | Human response (DECC, 2006) |
| Vibratory Roller | <50 kN (typically 1-2 tonne)    | 5 metres                         | 15 m to 20 metres           |
|                  | <100 kN (typically 2-4 tonne)   | 6 metres                         | 20 metres                   |
|                  | <200 kN (typically 4-6 tonne)   | 12 metres                        | 40 metres                   |
|                  | <300 kN (typically 7-13 tonne)  | 15 metres                        | 100 metres                  |
|                  | >300 kN (typically 13-18 tonne) | 20 metres                        | 100 metres                  |
|                  | >300 kN (> 18 tonne)            | 25 metres                        | 100 metres                  |

Considering these safe working setback distances (refer to **Table 6-39**) and the distance to nearby structures and receivers, there would be some potential for building cosmetic and human comfort impacts at the nearest receivers around Edgeroi and Bellata in N2MS2 and N2MS3, should these setback distances not be adhered to.

For the identified heritages structures/items described above **Section 6.7**, peak particle velocities were identified for different setback distances from different sizes of vibratory rollers and operating settings (low and high amplitude) using the methods detailed in (BS 5228-1:2009). These heritage items are less than 50 metres from the proposal.

This is presented in **Table 6-40**, with the lower value relating to operations in 'low amplitude mode' (i.e. lower vibratory setting for the drum) and the higher value relevant to operations completed in 'high amplitude mode'.

**Table 6-40 Guidance for avoiding vibration-related damage to surrounding heritage items**

| Vibratory roller details |                                | DIN 4150-3:1999-02 criteria   | Peak particle velocity (ppv) mm/s at specified distance (metres) |           |          |         |        |            |
|--------------------------|--------------------------------|---|--|-----------|----------|---------|--------|------------|
| Size                     | Specifics                      |   | 1  | 2         | 5        | 10      | 20     | 50         |
| Small                    | 4 tonne, 0.8 metre drum width  | 50 mm/s (Masonry, plastic)  | 40   | 21        | 7        | 3       | 1      | 0.3        |
| Medium                   | 11 tonne, 2.1 metre drum width | 80 mm/s (Clay, concrete, reinforced concrete, pre-stressed concrete, metal) | 39 to 120  | 26 to 79  | 11 to 35 | 5 to 16 | 2 to 6 | 0.6 to 1.8 |
| Large                    | 19 tonne, 2.1 metre drum width | 100 mm/s (Steel)  | 50 to 152  | 33 to 100 | 15 to 44 | 7 to 20 | 3 to 8 | 0.7 to 2.2 |

As shown **Table 6-40**, provided that the setback distances are adhered to, it would be expected that vibration-related impacts at these locations could be avoided.

### **Operation**

The relative increase in noise levels for operation was reviewed at the most affected receiver along each noise segment, refer to **Table 6-41**.

As shown in **Table 6-41**, noise levels would not increase by 2.1 dB(A) or more, at the most affected receivers along any of the five segments.

In general, it is expected that the new pavement would reduce noise levels associated with wheel and road interactions; particularly for light vehicles. In the middle and northern sections of N2MS1 and the northern portion of segment N2MS3 the proposal involves straightening the road, which is expected to reduce associated noise effects resulting from heavy vehicles. There are no geometric features of the road along segments N2MS2, N2MS4 and N2MS5 which might affect the frequency of maximum noise events, particularly from heavy vehicles (such as features leading to acceleration and deceleration). Where overtaking lanes will be added along N2MS2, N2MS3 and N2MS5 there is the potential for additional maximum traffic-related noise events at nearby receivers.

**Table 6-41 Review of relative change in noise levels at most-affected receiver**

| Minor works road segment | Assessment year | Receiver experiencing highest change | Highest change in day time noise levels $L_{Aeq}$ (15hr) | Highest change in night time noise levels $L_{Aeq}$ (9hr) | Day time noise levels complies with +2.1 dB(A) allowance? | Night time noise levels complies with +2.1 dB(A) allowance? | If no, below NMG day time criteria ( $L_{Aeq}$ (15hr) 60 (external))? | If no, below NMG night time criteria ( $L_{Aeq}$ (9hr) 55 (external))? |
|--------------------------|-----------------|--------------------------------------|--|---|---|---|---|--|
| N2MS1                    | 2022            | R004                                 | +1.6   | +1.6  | Yes   | Yes   | N/A   | N/A  |
|                          | 2032            | R004                                 | +1.5   | +1.6  | Yes   | Yes   | N/A   | N/A  |
| N2MS2                    | 2022            | R014                                 | +1.2   | +1.2  | Yes   | Yes   | N/A   | N/A  |
|                          | 2032            | R014                                 | +1.2   | +1.2  | Yes   | Yes   | N/A   | N/A  |
| N2MS3                    | 2022            | R076                                 | +1.8   | +1.8  | Yes   | Yes   | N/A   | N/A  |
|                          | 2032            | R095                                 | +1.8   | +1.8  | Yes   | Yes   | N/A   | N/A  |
| N2MS4                    | 2022            | R103                                 | +0.6   | +0.6  | Yes   | Yes   | N/A   | N/A  |
|                          | 2032            | R103                                 | +0.6   | +0.6  | Yes   | Yes   | N/A   | N/A  |
| N2MS5                    | 2022            | R221                                 | +0.6   | +0.6  | Yes   | Yes   | N/A   | N/A  |
|                          | 2032            | R221                                 | +0.6   | +0.6  | Yes   | Yes   | N/A   | N/A  |



## 6.5.5 Safeguards and management measures

Safeguards and management measures for noise and vibration are presented in **Table 6-42**.

**Table 6-42 Safeguards and mitigation measures – Noise and vibration**

| Impact              | Environmental safeguards   | Responsibility | Timing                             | Reference   |
|---------------------|--|----------------|------------------------------------|---|
| Noise and vibration | <p>A Noise and Vibration Management sub-plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will identify:</p> <ul style="list-style-type: none"> <li>• All potential significant noise and vibration generating activities associated with the activity</li> <li>• Feasible and reasonable mitigation measures to be implemented, taking into account <i>Beyond the Pavement: urban design policy, process and principles</i> (Roads and Maritime, 2014).</li> <li>• A monitoring program to assess performance against relevant noise and vibration criteria</li> <li>• Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures</li> <li>• Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.</li> </ul> | Contractor     | Detailed design / pre-construction | Section 4.6 of QA G36 <i>Environment Protection</i> |
| Noise and vibration | <p>All sensitive receivers (eg schools, local residents) likely to be affected will be notified at least five days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of:</p> <ul style="list-style-type: none"> <li>• The project</li> <li>• the construction period and construction hours</li> <li>• Contact information for project management staff</li> <li>• Complaint and incident reporting</li> <li>• How to obtain further information.</li> </ul>   | Contractor     | Detailed design / pre-construction | Core standard safeguard                             |
| Site induction      | <p>All personnel working on site will receive training to ensure awareness of requirements of the NVMP. Site-specific training will be given to personnel when working in the vicinity of sensitive receivers.</p>   | Contractor     | Pre-construction / construction    | Additional safeguard                                |

| Impact                     | Environmental safeguards  | Responsibility          | Timing                          | Reference            |
|----------------------------|---|-------------------------|---------------------------------|----------------------|
| Noise and vibration        | Where possible, works outside of standard construction hours will be planned so that noisier works are carried out in the earlier part of the evening or night time.  | Contractor              | Pre-construction / construction | Additional safeguard |
| Noise and vibration        | Where there are complaints about noise from an identified work activity, the work activity will be reviewed, and where feasible and reasonable, action additional control measures. This may include monitoring to confirm that predicted impacts are in line with levels predicted in this assessment.   | Contractor              | Construction                    | Addition safeguard   |
| Reducing Vibration impacts | <ul style="list-style-type: none"> <li>• Choosing alternative, lower-impact equipment or methods wherever possible</li> <li>• Scheduling the use of vibration-causing equipment at the least sensitive times of the day (wherever possible)</li> <li>• Locating high vibration sources as far away from sensitive receiver areas as possible</li> <li>• Sequencing operations so that vibration-causing activities do not occur simultaneously.</li> <li>• Keeping equipment well maintained</li> <li>• Do not conduct vibration intensive works within the building damage distances outlined in <b>Table 6-40</b>. Where possible, avoid the use of vibration intensive plant within the nominated human comfort distances. Where this isn't possible, an attendee should be present during the works to suspend activities in the instance of any issues or complaints.</li> <li>• Wherever practical, static compaction techniques should be utilised for compaction required within the applicable setback distances recommended to avoid human comfort impacts</li> </ul> | Construction contractor | Construction                    | Additional safeguard |

| Impact  | Environmental safeguards   | Responsibility          | Timing   | Reference            |
|---|--|-------------------------|--|----------------------|
| Vibration impacts on buildings and heritage items | <ul style="list-style-type: none"> <li>• Building condition inspection reports must be completed in accordance with QA Specification G36 for all heritage structures in the proposal area and any other nearby structures or buildings at risk from vibration impacts.</li> <li>• A follow up building condition inspection of all heritage structures in the work area will be carried out when all the construction work is complete.</li> </ul> | Construction contractor | Pre-construction and during construction as required | Additional safeguard |
| Vibration impacts to Heritage items               | The use of high intensity vibratory compaction equipment near underground services will be limited. If vibration-intensive plant and equipment change from that which has been in the Noise and Vibration Assessment (Jacobs, 2018a), a review will be carried out prior to commencing work.   | Construction contractor | Construction   | Additional safeguard |



## 6.6 Aboriginal heritage

The potential impacts of the proposal on Aboriginal heritage items are assessed in the *Aboriginal and Historical Archaeological Survey Report: Newell Highway HD Pavements – North Narrabri* (OzArk, 2018) provided in **Appendix D**. The potential impacts, and safeguards to mitigate them, are summarised in this section.

### 6.6.1 Methodology

A Stage 1 investigation has been carried out under the PACHCI found sufficient evidence to progress investigations to Stage 2 of the PACHCI. The *Aboriginal and Historical Archaeological Survey Report: Newell Highway HD Pavements – North Narrabri* (Ozark 2018) was prepared in accordance with the Stage 2 requirements of the Roads and Maritime PACHCI, the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (OEH, 2010) and *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011).

The site survey component of this assessment was carried out in two phases by OzArk archaeologists and three Aboriginal groups (Gomeri People Native Title Claim Group, Narrabri Local Aboriginal Land Council (LALC) and Moree LALC): The site survey are as follows:

- The first survey effort was limited to the existing road corridor and carried out on the 31 May 2017
- The second survey carried out between 15 to 17 January 2018 included the broader study area and areas impacted on by the proposal.

### 6.6.2 Existing Environment

#### ***Land use history and Aboriginal background***

Aboriginal people have sustainably managed and harvested resources in the vicinity of Narrabri and Moree for tens of thousands of years. The area began to be occupied by pastoralists around the 1830s. Around this time, Europeans began to displace Aboriginal traditional custodians with locally contingent Aboriginal responses including: fierce resistance, disease epidemics, economic hardship, resilience and opportunism.

In the interim, the region has been subject to a variety of landscape disturbances due to pastoralism, mining, vegetation clearance, forestry, cropping and water management. Other sources of disturbance include: the construction of urban centres at Moree and Narrabri; smaller towns (eg Bellata) and subdivisions; associated houses; commercial precincts; roads; highways; railways; and electricity transmission and telecommunications infrastructure. Large scale irrigation schemes have also been developed to support the cultivation of cotton and other crops.

The study area includes a variety of landforms, geological features, soil types, hydrological conditions and vegetation types, which once had the potential to provide Aboriginal people with suitable locations for occupation (eg camp sites), particularly those close to water with flat or gently sloping topographies. Occupation of the area, was mostly likely near waterways and on raised landforms near seasonally inundated floodplains. Areas with suitable vegetation and fauna also had the potential to provide Aboriginal people with areas for resource extraction.

However, post depositional processes of erosion and sedimentation, and possibly the accumulation of later historical deposits, could impede the detection of archaeological sites. In

addition, land use disturbances, may have removed or dispersed evidence of past Aboriginal occupation.

The proposal is located within Kamilaroi and Weraerai (also Wiriyaraay) country. The surveyor-general Sir Thomas Livingstone Mitchell (1839) described two Aboriginal villages on the Moree plains. The first was located on the Gwydir River:

*Each hut was semi-circular, or circular; the roof conical, and from one side a flat roof stood forward like a portico, supported by two sticks. Most of them were close to the trunk of a tree, and they were covered, not as in other parts, by sheets of bark, but with a variety of materials, such as reeds, grass, and boughs. (Mitchell, 1839)*

The second village was located on a lagoon between Collarenbri and Bellata and comprised seven huts of substantial construction, neatly thatched with dry grass and reeds (Mitchell, 1839). By the late 1830s, many prime grazing sites along the Namoi River and Gwydir River had been taken up by European settlers, including James Cox at Moree, Thomas Simpson Hall at Wee Bella Bolla and John Fleming at Mundi Bundie (Elder, 2003).

Balme (1986) compiled a list of objects that likely comprised the toolkit used by Aboriginal people in the region from reports by Mitchell (1839), Oxley (1820) and Sturt (1834). Based on this list, the toolkit used by Kamilaroi people is likely to have included: bark containers for holding water and gathering food; throwing sticks for hunting; cloaks of kangaroo skin; wooden clubs for fighting; hafted stone axes; nets for catching fish and birds; spears and spear throwers; and fish traps constructed in major creeks and rivers.

### **Search of heritage registers and databases**

A search of OEH's Aboriginal Heritage Information Management System (AHIMS) in May 2017 identified 100 records within a 27 kilometre wide by 100 kilometre area which encompassed the proposal. One site has a restriction applied with no information about the location or site features provided. No sites are located in the proposal area; and the nearest sites are located more than 300 metres away.

Of these AHIMS records, the culturally modified trees are the most commonly represented site type in the study area (75 records) followed by artefact scatters and isolated finds (12 records). There were also AHIMS records for two PADs, one is associated with an artefact near the Mehi River and the other located near Skinners Creek. Both of these sites are over one kilometre from the proposal. Four burials have been recorded, including two associated with culturally modified trees, mostly located close to major watercourses, none of these are near the proposal. A broad range of other site types at low frequencies, including two resource and gathering sites, a stone quarry, a habitation structure, a ceremonial ring and a conflict site (the Waterloo Creek massacre site).

The study area includes land currently subject to Native Title Claim by the Gomeroi People (Tribunal file no. NC2011/006; Federal Court file no. NSD2308/2011).

### **Field survey results**

As a result of the desktop assessment and the predictive model, a sampling strategy was developed for the site survey. The survey identified three new Aboriginal sites (modified trees) and one new PAD as summarised in **Table 6-43** and shown in **Figure 1-3** and described further below. The results of the survey are consistent with the predictive model, which suggested a general scarcity of Aboriginal archaeological sites in the region.

### **Table 6-43 Summary of newly recorded Aboriginal sites within the study area**

| Segment | Site ID      | Features      | Land form                   |
|---------|--------------|---------------|-----------------------------|
| N2MS2   | BC-HW17-PAD1 | PAD           | Bobbiwaa Creek -Stream bank |
| N2MS2   | BC-HW17-ST1  | Modified tree | Plain                       |
| N2MS3   | BL-HW17-ST1  | Modified tree | Plain                       |
| N2MS4   | TC-HW17-ST1  | Modified tree | Plain                       |

#### Bobbiwaa Creek PAD (BC-HW17-PAD1)

BC-HW17-PAD1 is on the northern and western bank of Bobbiwaa Creek within a highly modified open woodland and riparian habitat within segment N2MS2 (refer to **Photo 6-10** and **Photo 6-11**). The PAD extends for about 100 metres east of the proposal and encompasses a flat, slightly raised landform above the creek bank. The PAD was identified on the basis of the moderate–high archaeological potential of the landform. Vegetation clearance, animal grazing and trampling, fencing, the construction and maintenance of the Newell Highway and possibly ploughing are likely to have affected the integrity any archaeological deposits. Nevertheless, intact archaeological deposits are likely to exist in the PAD area.



**Photo 6-10 Overview of BC-HW17-PAD1 showing the flat slightly elevated landform above the northern and western creek bank, facing southeast (OzArk, 2018)**



**Photo 6-11 View showing the Newell Highway and the existing bridge over Bobbiwaa Creek from the northern bank, facing south. The BC-HW17-PAD1 boundary is on the left (OzArk, 2018)**



### Modified tree (BC-HW17-ST1)

BC-HW17-ST1 is an Aboriginal culturally modified tree within a highly-modified woodland environment within segment N2MS2 (refer to **Photo 6-12** and **Photo 6-13**). The tree contains a



**Photo 6-12 Overview of BC-HW17-ST1 showing the context of the tree, facing east (OzArk, 2018)**



**Photo 6-13 Overview of the BC-HW17-ST1 bark slab (sheet) removal scar, facing east (OzArk, 2018)**

single oval shaped scar which is orientated to the southwest.

### Modified tree (BL-HW17-ST1)

BL-HW17-ST1 is an Aboriginal culturally modified tree located within a highly disturbed roadside rest area to the south of Bellata within segment N2MS3 (refer to **Photo 6-14** to Photo 6-7). The tree contains a single oval shaped scar which is orientated to the northwest.

The site appears to have been previously assessed and managed during the construction of the rest area including the installation of two protective concrete bollards. However, the site does not appear to have been registered on AHIMS. The tree is in overall good condition, despite a very small area at the base of the tree (about three metres by three metres) being left uncovered by bitumen.





**Photo 6-14 Overview of BL-HW17-ST1, facing southeast (OzArk, 2018)**



**Photo 6-15 Overview of BL-HW17-ST1 scar, facing southeast (OzArk, 2018)**

Modified tree Creek (TC-HW17-ST1)

TC-HW17-ST1 is an Aboriginal culturally modified tree on an undulating alluvial plain near to Tookey Creek within a generally undisturbed woodland environment (refer to **Photo 6-16** and **Photo 6-17**). The tree contains a single, elongated scar facing northeast.



**Photo 6-16 Overview of TC-HW17-ST1, facing northwest (OzArk, 2018)**



**Photo 6-17 Overview of TC-HW17-ST1 scar, facing northwest (OzArk, 2018)**

**Assessment of significance**

The summary of the significance assessment of newly recorded Aboriginal cultural heritage items is provided in **Table 6-44**. The scientific, cultural and public significance are the baseline elements of significance assessment, and it is through the combination of these elements that the overall cultural heritage value is determined.

**Table 6-44 Summary of the significance of the identified Aboriginal items**

| Name         | Social or Cultural value | Archaeological / Scientific Value | Aesthetic value | Historical value |
|--------------|--------------------------|-----------------------------------|-----------------|------------------|
| BC-HW17-PAD1 | Undetermined:            | Undetermined                      | Undetermined    | Undetermined     |
| BC-HW17-ST1  | High                     | Moderate                          | Moderate        | Nil              |

| Name        | Social or Cultural value | Archaeological / Scientific Value | Aesthetic value | Historical value |
|-------------|--------------------------|-----------------------------------|-----------------|------------------|
| BL-HW17-ST1 | High                     | Moderate                          | Moderate        | Nil              |
| TC-HW17-ST1 | High                     | Moderate                          | Moderate        | Nil              |

The significant assessment of BC-HW17-PAD1 is undetermined as the landform is a good representation of a PAD, which are rare in the region. However, the landform has been affected by disturbance. The nature and extent of any subsurface archaeological deposits would need to be determined by archaeological test excavation.

### 6.6.3 Potential impacts

#### **Construction**

The construction of the proposal would potentially impact on the PAD (BC-HW17-PAD1). The potential impacts are described in **Table 6-45**.

If further refinements of the proposal are unable to avoid impacts the PAD, then further investigation would need to be carried out on the PAD to determine if any Aboriginal objects exist within in it. The investigation would normally involve a limited test excavation program to determine the nature and extent of any archaeological deposits. If the test excavation results show that Aboriginal objects present in the PAD area at risk of harm, then an AHIP would be required to harm the site. If the test excavation concludes that no archaeological deposits, Aboriginal objects or PADs are present in the area at risk of harm, then work could proceed in the area, provided any management recommendations to avoid harming the remaining BC-HW17-PAD1 area are followed.

If the proposal design is unable to avoid the modified tree (BC-HW17-ST1), then an Aboriginal AHIP would be required. The other two modified trees (BL-HW17-ST1 and TC-HW17-ST1) are not within the construction footprint and provided the mitigation measures provided in **Section 6.4.4** are implement, no impacts would be expected. The proposal would not impact on any recorded AHIMS registered archaeological sites as they are located outside the proposal area.

**Table 6-45 Potential impacts to Aboriginal items**

| Site/PAD name (AHIMS ID) | Type of Impact | Degree of impact                              | Consequence of Harm   |
|--------------------------|----------------|---|---|
| BC-HW17-PAD1             | Direct         | Partial (with management)                     | <b>Partial loss of value:</b> If construction of the new road formation is proposed in this area. Specific management recommendations apply to this site to mitigate harm arising from the proposal.  |
| BC-HW17-ST1              | Direct or none | Total loss of value or none (with management) | <b>Total loss of value:</b> The site would not be able to be avoided by a suitable buffer if the recommended alignment is to be constructed at this location.<br><b>No loss of value:</b> The proposal would avoid this item. Specific management recommendations apply to this site to ensure no direct or indirect harm arises from the proposal. if the proposal is able to avoid this item. |

## Operation

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

### 6.6.4 Safeguards and management measures

Safeguards and management measures for Aboriginal heritage are presented in **Table 6-46**.

**Table 6-46 Safeguards and mitigation measures – Aboriginal heritage**

| Impact   | Environmental safeguards   | Responsibility    | Timing                             | Reference   |
|--|--|-------------------|------------------------------------|---|
| Aboriginal heritage  | An Aboriginal Heritage Management Plan (AHMP) will be prepared in accordance with the <i>Procedure for Aboriginal cultural heritage consultation and investigation</i> (Roads and Maritime, 2012) and <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented for managing impacts on Aboriginal heritage. | Contractor        | Detailed design/p re-construct ion | Section 4.9 of QA G36 <i>Environment Protection</i> |
| Aboriginal heritage  | <ul style="list-style-type: none"> <li>The <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction.</li> <li>Work will only re-commence once the requirements of that procedure have been satisfied.</li> </ul>   | Contractor        | Detailed design/p re-construct ion | Section 4.9 of QA G36 <i>Environment Protection</i> |
| Impacts to Aboriginal heritage                                     | If impact to Aboriginal heritage are unavoidable then the Aboriginal cultural heritage investigation must proceed to PACHCI Stage 3 (RMS 2011).  | Road and Maritime | Detailed design/p re-construct ion | Additional safeguard                                |
| Aboriginal heritage  | Any further changes to the proposal area outside the survey area will be assessed by a suitably qualified heritage professional.   | Road and Maritime | Detailed design/p re-construct ion | Additional safeguard                                |
| Minimise risks to Aboriginal cultural heritage during construction | All personnel working on site will receive training to ensure awareness of requirements of the Aboriginal Heritage Management Plan and relevant statutory responsibilities. Site-specific training will be given to personnel when working in the vicinity of identified Aboriginal heritage items.  | Contractor        | Detailed design/p re-construct ion | Additional standard safeguard                       |



| Impact  | Environmental safeguards  | Responsibility | Timing                             | Reference            |
|---|---|----------------|------------------------------------|----------------------|
| Aboriginal heritage items BR-HW17-ST1 and BR-HW17-ST2 | <ul style="list-style-type: none"> <li>• During construction, BR-HW17-ST1 and BR-HW17-ST2 and BC-HW17-ST1 will be demarcated using high visibility ground markers to delineate the site perimeter (such as staking and flagging) encompassing the tree canopy</li> <li>• The ground markers will be visible to any person in the vicinity of the site, whether on foot or in a vehicle</li> <li>• BR-HW17-ST1, BR-HW17-ST2 and BC-HW17-ST1 will be mapped on the CEMP and detailed design plans and the canopy extent demarcated as a 'no-go' and 'no-harm' area</li> <li>• Vehicles will not be driven on, or in the immediate vicinity of BR-HW17-ST1, BR-HW17-ST2 and BC-HW17-ST1 site extent</li> <li>• If required, appropriate sediment control measures will be installed, operated and maintained to prevent sediment moving onto the site extent during the construction of the proposal.</li> </ul> | Contractor     | Detailed design /pre-construct ion | Additional safeguard |
| Aboriginal heritage item BL-HW17-ST1                  | <ul style="list-style-type: none"> <li>• If the bitumen currently surrounding BL-HW17-ST1 is to be removed as part of the proposal, this will be done without harming the tree's absorption roots</li> <li>• The area surrounding the tree will not subsequently be built upon, providing an area large enough to allow adequate moisture to reach the tree's absorption roots. Minimally, this area will fully encompass the tree canopy extent and this area must be excluded from bitumen cover and compaction</li> <li>• Sufficient distances will be provided to allow vehicles to access the rest area where the tree is located, without colliding with or damaging the tree</li> <li>• If a significant residual risk of collision remains, steps will be taken to minimise that risk (eg installation of bollards and/or permanent high visibility barriers).</li> </ul>                             | Contractor     | Construction                       | Additional safeguard |

## 6.7 Non-Aboriginal heritage

An assessment has been prepared to identify the extent and magnitude of potential impacts of the proposal on non-Aboriginal heritage items. This assessment is presented in the *Aboriginal and Historical Archaeological Survey Report: Newell Highway HD Pavements – Narrabri to Moree* (OzArk, 2017) which is provided in **Appendix D**. A summary of the report is presented in this section, together with safeguards and management measures to mitigate any negative impacts.

### 6.7.1 Methodology

The non-Aboriginal heritage assessment comprised of:

- Background historical research, including a review of previous heritage assessments to identify the potential for archaeological and heritage items to be present within the proposal area, to further define the scope of the field investigation
- A search of all available heritage registers based on a 500 metre buffer on 22 May 2017 and updated on the 21 December 2017. This included the State Heritage Register (SHR), State Heritage Inventory (SHI), NSW Roads and Maritime Services Section 170 Heritage and Conservation Register, relevant LEPs, National Trust of Australia (NSW) list (NTAR), Register of the National Estate (RNE), Commonwealth Heritage List (CHL), National Heritage List (NHL) and World Heritage List (WHL) to identify previously recorded non-Aboriginal heritage items in the proposal area, and related legislative obligations
- A review of current aerial imagery to identify areas of heritage potential prior to the field survey
- A field survey of the study area carried out by OzArk on 15 to 17 January 2018 to identify any areas/items of potential heritage significance
- Further desktop assessment of new areas added to the proposal area following design changes
- Identification and assessment of potential impacts of the proposal on non-Aboriginal heritage items, conservation areas and archaeology
- The development of measures to manage the proposal's potential impact on non-Aboriginal heritage items, conservation areas and archaeology through the application of the 'avoid, minimise and mitigate' hierarchy.

The study area for the non-Aboriginal heritage assessment is the proposal area plus 500 metres.

### 6.7.2 Existing environment

#### *Historical context*

European colonisation of north central NSW occurred relatively late, as the expansion had halted at Wellington Valley during the 1820s. The Moree plains area between Narrabri and Moree began to be occupied by pastoralists shortly after Mitchell passed through the area in 1831 and Coxen in 1835, each reporting good pastoral land.

An early pastoral centre was established at Warialda (to the east of the proposal), which was home of the Commissioner of Crown Lands. In 1850, Warialda included a courthouse and lockup that served the region. The town of Moree was laid out in 1860 and an additional court was established

there in 1862, although a courthouse building was not built until 1874. Moree soon eclipsed Warialda with the establishment of two inns, two stores, a post office, a pound and a population of 43 in 1861. By 1871, Moree had a population of 107, three hotels, a butcher, a saddler and a school. Major growth occurred during the 1880s with accelerated European occupation and the establishment of a Land Office to administer it. Moree became a municipality in 1891. The first of many bores was sunk into the Great Artesian Basin at Moree in 1895 and bores have continued to provide pastoral water supplies to the region, despite the depletion and westward retreat of the artesian basin. Moree's hot artesian water initially sustained a wool-scouring industry and continues to be exploited as a tourist attraction today (NSW HO and DUAP 1996).

Narrabri is located on the northern edge of the Pilliga Scrub where sawmilling was historically important. A nearby early pastoral settlement was established at Wee Waa. In 1880, the larger town of Narrabri was established on a water reserve on Narrabri Creek, a tributary of the Namoi River, at an important crossing place on the droving route south. By 1871, Narrabri's population was 350 and the town included stores, inns, a bank and school. The railway reached the town in 1882 and Narrabri became an official municipality the following year, when a courthouse was also built (NSW HO and DUAP 1996).

The small town of Bellata which is located midway between Narrabri and Moree (within in segment N2MS3), was a small rural centre in the early to mid-twentieth century that included a post office, two general stores, two stock and station agencies, two garages, a cafe, a telephone exchange, a railway station and a doctor's surgery. The Nandewar Hotel was a two-storey colonial style hotel constructed in 1902 and was regarded as a local landmark until destroyed by fire in 2006. The Bellata Police station and residential quarters was originally designed in 1902 for use as a courthouse by the government architect Walter Liberty Vernon.



### ***Listed non-Aboriginal heritage items***


The search of heritage registers identified six heritage items within 500 metres of the proposal. All of the items are located at Bellata within segment N2MS3. There are six historic heritage sites in listed on the SHI, but only four of these are registered on the LEP. There is also an additional site listed on the LEP that is not on the SHI. The items description and listing are summarised in Table 6-47 and shown in Table 6-47. One of the items, the Nandewar Hotel, burnt down more than a decade ago and no longer exists.



Table 6-47 Listed heritage items within 500 metres of the proposal

| Heritage item name              | Register                | Local listing Number | Description  | Photo (OzArk, 2018)  |
|---------------------------------|-------------------------|----------------------|--|--|
| AB Meppem & Co building         | Narrabri LEP 2012 & SHI | 1013                 | The AB Meppem & Co building is a small weatherboard building. The satellite imagery suggests the western part of the building extends slightly beyond the curtilage frontage to the west. A veranda is attached to the building, covering the pavement further west of the building and, as such, is situated outside of the curtilage boundary. |   |
| Bellata Police Station building | Narrabri LEP 2012 & SHI | 1016                 | The Bellata Police Station building is a weatherboard building and double garage. The main building is contained within the curtilage boundary. The satellite imagery suggests that the boundary fence and double garage extend slightly west and south of the curtilage boundary.   |  |
| Nandewar Hotel                  | SHI                     | -                    | Item no longer exists  | Item no longer exists  |

| Heritage item name           | Register                | Local listing Number | Description   | Photo (OzArk, 2018)  |
|------------------------------|-------------------------|----------------------|---|--|
| Oldhams Smallgoods building  | Narrabri LEP 2012 & SHI | 1015                 | The Oldhams Smallgoods building is a weatherboard building with large shopfront windows with a weatherboard and plasterboard extension to the south. The satellite imagery suggests the western part of the building extends slightly beyond the curtilage frontage to the west. A large veranda is attached to the building, covering the pavement further west of the building and, as such, is situated outside of the curtilage boundary. |   |
| Bellata Post Office building | Narrabri LEP 2012 & SHI | 1014                 | The Bellata Post Office building is a weatherboard building. The satellite imagery suggests the western part of the building extends slightly beyond the curtilage frontage to the west. A large veranda is attached to the building, covering the pavement further west of the building and, as such, is situated outside of the curtilage boundary.   |  |

| Heritage item name               | Register          | Local listing Number | Description   | Photo (OzArk, 2018)   |
|----------------------------------|-------------------|----------------------|---|---|
| LS Rowe Stock and Station Agents | Narrabri LEP 2012 | 1012                 | The LS Rowe Stock and Station Agents building is a weatherboard and plasterboard building with large shopfront windows and doors, a large corrugated metal fascia with shop signage and an awning overhanging the pavement. The satellite imagery suggests the western part of the building and awning extend slightly beyond the curtilage frontage to the west. |  |



## 6.7.3 Potential impacts

### **Construction**

While no direct impacts are expected to any of the five items that are located close to the proposal, potential remains for these items or their curtilage to be inadvertently impacted. Therefore, specific mitigation measures are provided in **Section 6.7.4**. The site extent for each heritage item encompassing the curtilage boundary and all parts of the building is shown in Section 9.1 of the *Aboriginal and Historical Archaeological Survey Report: Newell Highway HD Pavements – Narrabri to Moree* which is provided in **Appendix D**.

### Statement of Heritage impact

The Statement of Heritage impact concluded that:

The following aspects of the proposal respect or enhance the heritage significance of the item or conservation area for the following reasons: No heritage items or conservation areas are located within the proposal area. The five historic heritage items that are located next to proposal. Inadvertent impacts to these items would be avoided in order to maintain their heritage values.

The following aspects of the proposal could detrimentally impact on heritage significance. The reasons are explained as well as the measures to be taken to minimise impacts: There are no identified direct impacts to heritage items from the proposal. The historic heritage items are located next to the proposal area and management is required to avoid inadvertent impacts.

Ground disturbing work must remain outside the 'historic item - site extent'. Once the nature and extent of the proposed work surrounding the buildings has been finalised, a condition assessment may be required to determine how structurally sound the individual buildings are. The results of the condition assessment would then determine whether or not a vibration assessment would be required.

**The following sympathetic solutions have been considered and discounted for the following reasons:** No alternative sympathetic solutions have been considered and discounted as there would be no identified direct impacts to heritage item from the proposed work. Inadvertent impacts to the historic heritage items can be avoided via the implementation of appropriate management strategies including a condition and vibration assessment.

### **Operation**

There are no operation impacts expected on any known heritage items in the vicinity of the proposal.

## 6.7.4 Safeguards and management measures

Safeguards and management measures for non-Aboriginal heritage are presented in **Table 6-48**.

**Table 6-48 Safeguards and management measures – Non-Aboriginal heritage**

| Impact   | Environmental safeguards   | Responsibility | Timing                           | Reference  |
|--|--|----------------|----------------------------------|--|
| Non-Aboriginal heritage  | A Non-Aboriginal Heritage Management Plan (NAHMP) will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts on non-Aboriginal heritage.   | Contractor     | Detailed design/pre-construction | Section 4.10 of QA G36 <i>Environment Protection</i> |
| Non-Aboriginal heritage  | <ul style="list-style-type: none"> <li>The <i>Standard Management Procedure – Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of non-Aboriginal origin are encountered</li> <li>Work will only re-commence once the requirements of that Procedure have been satisfied.</li> </ul>   | Contractor     | Detailed design/pre-construction | Section 4.10 of QA G36 <i>Environment Protection</i> |
| Non-Aboriginal heritage  | Non-Aboriginal heritage awareness training must be provided for all contractors and personnel prior to commencement of construction to outline the identification of potential heritage items and associated procedures to be implemented in the event of the discovery of non-Aboriginal heritage materials, features or deposits (that is, unexpected finds), or the discovery of human remains.   | Contractor     | Pre-construction                 | Additional safeguard                                 |
| AB Meppem & Co, Bellata Post Office, Oldhams Smallgoods, Bellata Police Station and LS Rowe Stock and Station Agents | <ul style="list-style-type: none"> <li>All heritage items will be demarcated during the construction of proposal using high visibility ground markers to delineate historic site extent along the western boundary next to the Newell Highway</li> <li>The demarcation method will be developed in consultation with property owners and/or tenants to ensure that the method is practical and fit for purpose</li> <li>The ground markers used must be visible to any person in the vicinity of the site, whether on foot or in a vehicle</li> <li>A 'no-go' and 'no-harm' area must be mapped on the CEMP</li> </ul> | Contractor     | Pre-construction                 | Additional safeguard                                 |

| Impact | Environmental safeguards   | Responsibility | Timing | Reference |
|--------|--|----------------|--------|-----------|
|        | <p>and detailed design plans encompassing the historic site extent as shown in section 9 of the <i>Aboriginal and Historical Archaeological Survey Report: Newell Highway HD Pavements – Narrabri to Moree</i> (OzArk, 2018) provide in <b>Appendix D</b>.</p> <ul style="list-style-type: none"> <li>• All ground-disturbing work will be confined to areas, outside of the identified historic site extends and 'no-go' and 'no-harm' areas</li> <li>• Once the nature and extent of the proposal in the vicinity of the heritage buildings has been finalised, a condition assessment may be required to determine how structurally sound the building is and whether or not and a vibration assessment may be required.</li> </ul> |                |        |           |



## 6.8 Landscape character and visual impacts

Potential impacts of the proposal on landscape character and visual amenity are assessed in the *Urban Design, Landscape Character and Visual Impact Assessment Report* (Tract, 2018) which is provided in **Appendix A**. A summary of the assessment is presented in this section, together with safeguards and management measures to mitigate any negative impacts.

### 6.8.1 Methodology

The Landscape Character and Visual Impact Assessment was prepared in accordance with the Environmental Impact Assessment Practice Note EIA-N04 – Guidelines for Landscape Character and Visual Impact Assessment (Roads and Maritime, 2013).

Both landscape character and visibility are assessed in a similar way and adopt the same matrix as part of the assessment process. This matrix assesses both the sensitivity of a site to change as well as the magnitude of the proposed change to identify a level of impact for the proposal. These terms are defined below:

- **Sensitivity** refers to the qualities of an area, the type number and type of receivers and how sensitive the existing character of the setting is to the proposed change. For example, a pristine natural environment will be more sensitive to change than a built up industrial area.
- **Magnitude** refers to the nature of the project. For example, a large interchange would have a very different impact on landscape character than a localised road widening in the same area.

**Table 6-49** summaries the ranking of the assessment of these two criteria and how they are combined to provide an overall impact assessment.

**Table 6-49 Landscape character and visual impact matrix (Roads and Maritime, 2013)**

|             |            | Magnitude     |               |              |            |
|-------------|------------|---------------|---------------|--------------|------------|
|             |            | High          | Moderate      | Low          | Negligible |
| Sensitivity | High       | High          | Moderate/High | Moderate     | Negligible |
|             | Moderate   | Moderate/High | Moderate      | Moderate/Low | Negligible |
|             | Low        | Moderate      | Moderate/Low  | Low          | Negligible |
|             | Negligible | Negligible    | Negligible    | Negligible   | Negligible |
|             |            |               |               |              |            |

### 6.8.2 Existing environment

#### **Land zoning**

The proposal is located within the Narrabri Shire and Moree Plains Shire LGA, on land which is subject to the Narrabri LEP and Moree LEP respectively. Land zoning which applies to the proposal is discussed in **Section 4.2**.

#### Landform

The Newell Highway corridor is relatively flat along its length, reflecting its location within the alluvial floodplain of the Mehi and Gwydir Rivers. Mountain ranges associated with Mount Kaputar

National Park are visually dominant in south-eastern views from north of Bellata through to Narrabri.

### **Drainage**

Two key drainage catchments are located within the study area. N2MS1 and N2MS2 are located within the Namoi River Catchment, while N2MS3 to N2MS5 are located in the Gwydir River Catchment. Further detail regarding waterways near the proposal is provided in **Section 6.2.2**.

The proposal crosses a number of waterways including Bobbiwaa Creek, Tarlee Creek, Gehan Creek, Tookey Creek and Halls Creek. The proposal also crosses a number of other intermittent waterways and irrigation canals. Three of these creeklines have been identified as Class 3 Key Fish Habitat and include an unnamed tributary of Narrabri Creek, Bobbiwaa Creek and Tookey Creek. Further detail regarding Key Fish Habitat near the proposal is provided in **Section 6.1.2**.

### **Vegetation**

The area surrounding the proposal is characterised by a rural environment which is predominately cleared of native vegetation and replaced with cropping and grazing. The retention of remnant vegetation has been greatest in the road reserve which has been traditionally used as a travelling stock reserve (TSR). Specifically, the landscape surrounding each segment comprises the following:

- N2MS1 – Grazing and some cropping
- N2MS2 – Mostly cropping, some grazing
- N2MS3 – Mostly grazing, some cropping
- N2MS4 – Mostly grazing, some cropping
- N2MS5 – Mostly cropping, some grazing.

Further detail regarding vegetation near the proposal is provided in **Section 6.1**.

### **Landscape character**

For the purpose of the landscape character assessment, the study area was divided into five landscape character zones (LCZs) as described below and shown on **Figure 6.3** to **Figure 6.7**:

- Intensive agricultural – Big Sky LCZ: This LCZ comprises typically flat and open cultivated land with intensive cropping, primarily wheat and cotton. There are often expansive vistas. The LCZ experiences frequent and ongoing changes in appearance based on the type of crops or seasonal variation and often has expansive local and regional vistas. The LCZ typically has a low sensitivity to external influences and adjacent development (refer to **Photo 6-18**)
- Broad Scale Agriculture LCZ: This LCZ comprises general grazing lands and typically has less management than other landscape character zones and has minor seasonal changes in appearance based on type of vegetation and grazing patterns. The generally has less seasonal variation in appearance than the intensive agricultural LCZ. This LCZ consists of two sub zones:
  - Open woodland LCZ: The LCZ is grassland with dominant woodland character. It has a long-term vegetation structure which providing screening of views. This LCZ has a moderate sensitivity to external influences and adjacent development (refer to **Photo 6-19**)

- Grassland LCZ: This zone is open grassland which is briefly interrupted by larger vegetation. The LCZ typically has a low sensitivity to external influences and adjacent development (refer to **Photo 6-20**)
- Enclosed Vegetated Corridor – Remnant Woodland or Screening Vegetation LCZ: The LCZ generally comprises of fenced reserve or grasslands, with dominant woodland or avenue tree character (refer to **Photo 6-21**). The LCZ typically has minimal seasonal changes in appearance depending on the type of vegetation or grazing or roadside maintenance patterns. It generally has well established long-term or permanent vegetation structure with a high density and continuous screening of adjacent land, local and regional views. The LCZ typically has a high sensitivity to external influences and adjacent development.
- Rural village LCZ: This LCZ typically has a higher level of development and more intensive management than other landscape character zones in the proposal area. The key attributes are urban precinct with a concentration of agricultural infrastructure such as storage silos and facilities, low density housing and occasional commercial development. The vegetation structure is often more formalised with linear avenue plantings and screening trees oriented along property boundaries and road margins. The views are typically streetscape and limited local views. The LCZ typically has a high sensitivity to external influences and adjacent development (refer to **Photo 6-22**)
- Industrial and Airport Precinct LCZ: This LCZ setting is characterised by the built form and infrastructure associated with the processing and storage of the products of the land and service functions that support a rural community. Its key attributes are large scale built form and infrastructure and limited vegetation cover (refer to **Photo 6-23**).



**Photo 6-18: Intensive agricultural LCZ (source: Tract, 2018)**





**Photo 6-19 Broad Scale Agriculture Woodland LCZ (source: Tract, 2018)**



**Photo 6-20 Broad Scale Agriculture Grassland LCZ (source: Tract, 2018)**



**Photo 6-21 Enclosed vegetated corridor LCZ (source: Tract, 2018)**

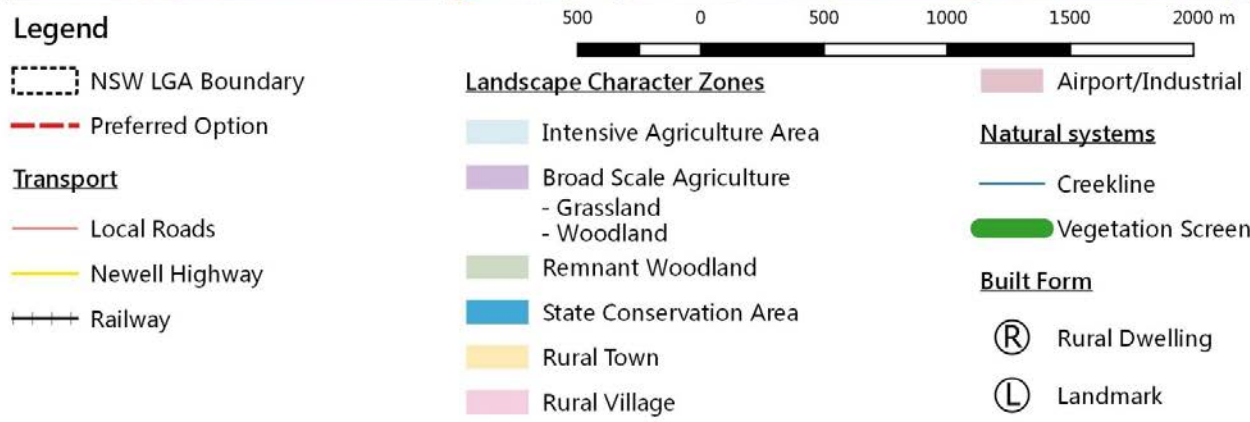
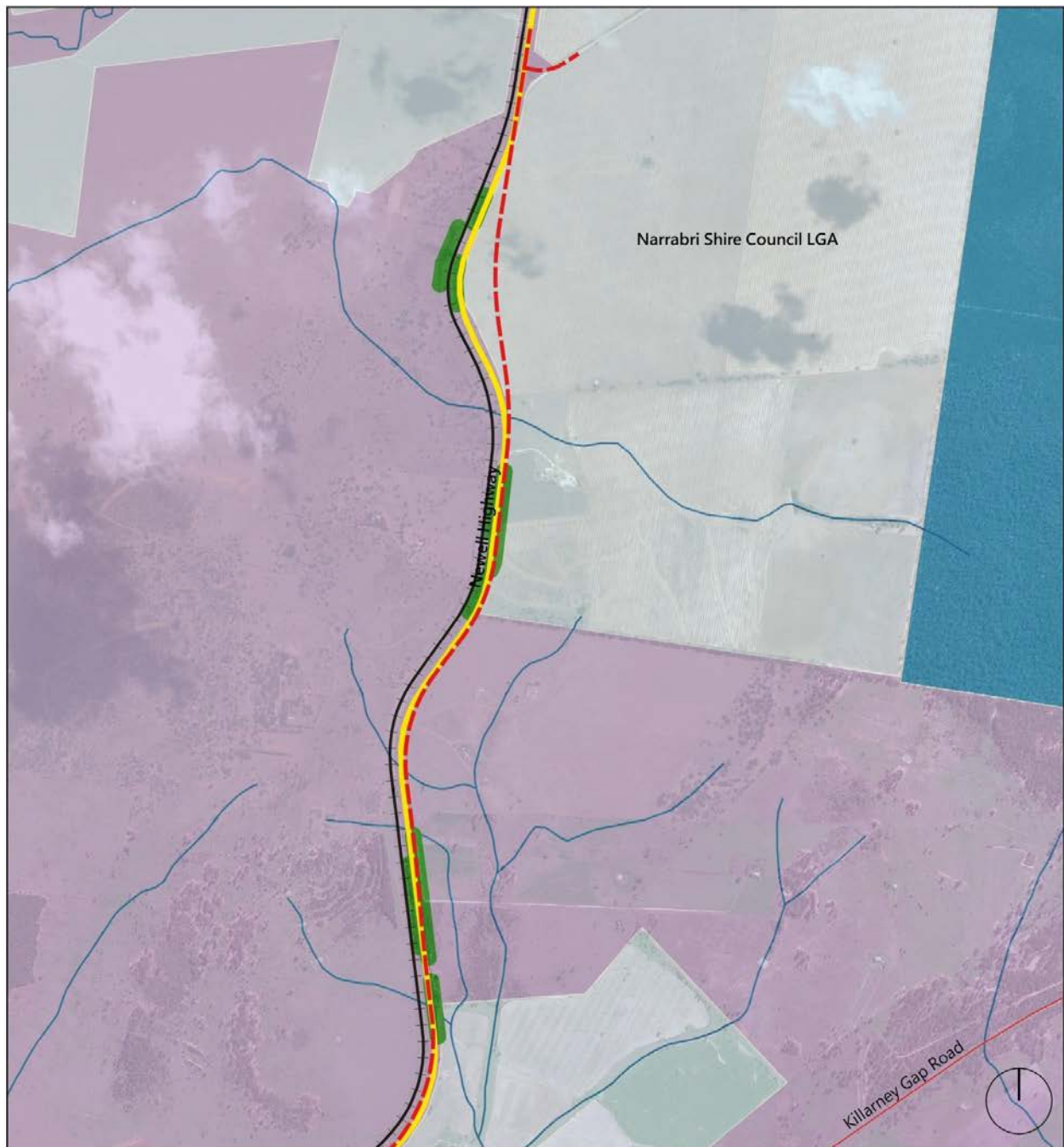




**Photo 6-22 Rural Village LCZ (source: Tract, 2018)**

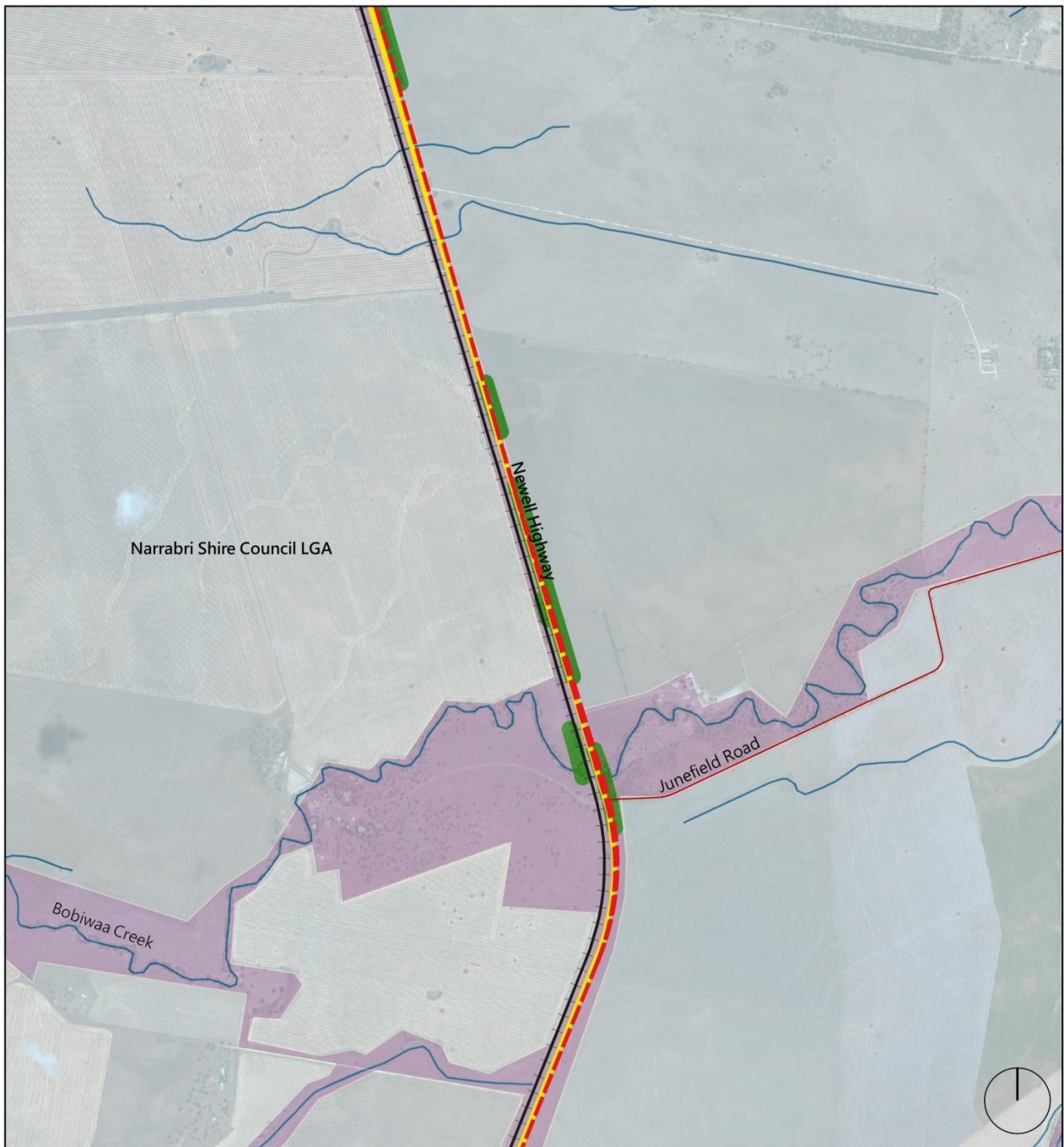


**Photo 6-23 Industrial and Airport LCZ (source: Tract, 2018)**



**Figure 6-3 Landscape character zones N2MS1 (source: Tract, 2018)**





**Legend**

NSW LGA Boundary

Preferred Option

**Transport**

Local Roads

Newell Highway

Railway

**Landscape Character Zones**

Intensive Agriculture Area

Broad Scale Agriculture  
- Grassland  
- Woodland

Remnant Woodland

State Conservation Area

Rural Town

Rural Village

Airport/Industrial

**Natural systems**

Creekline

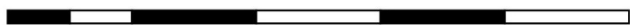
Vegetation Screen

**Built Form**

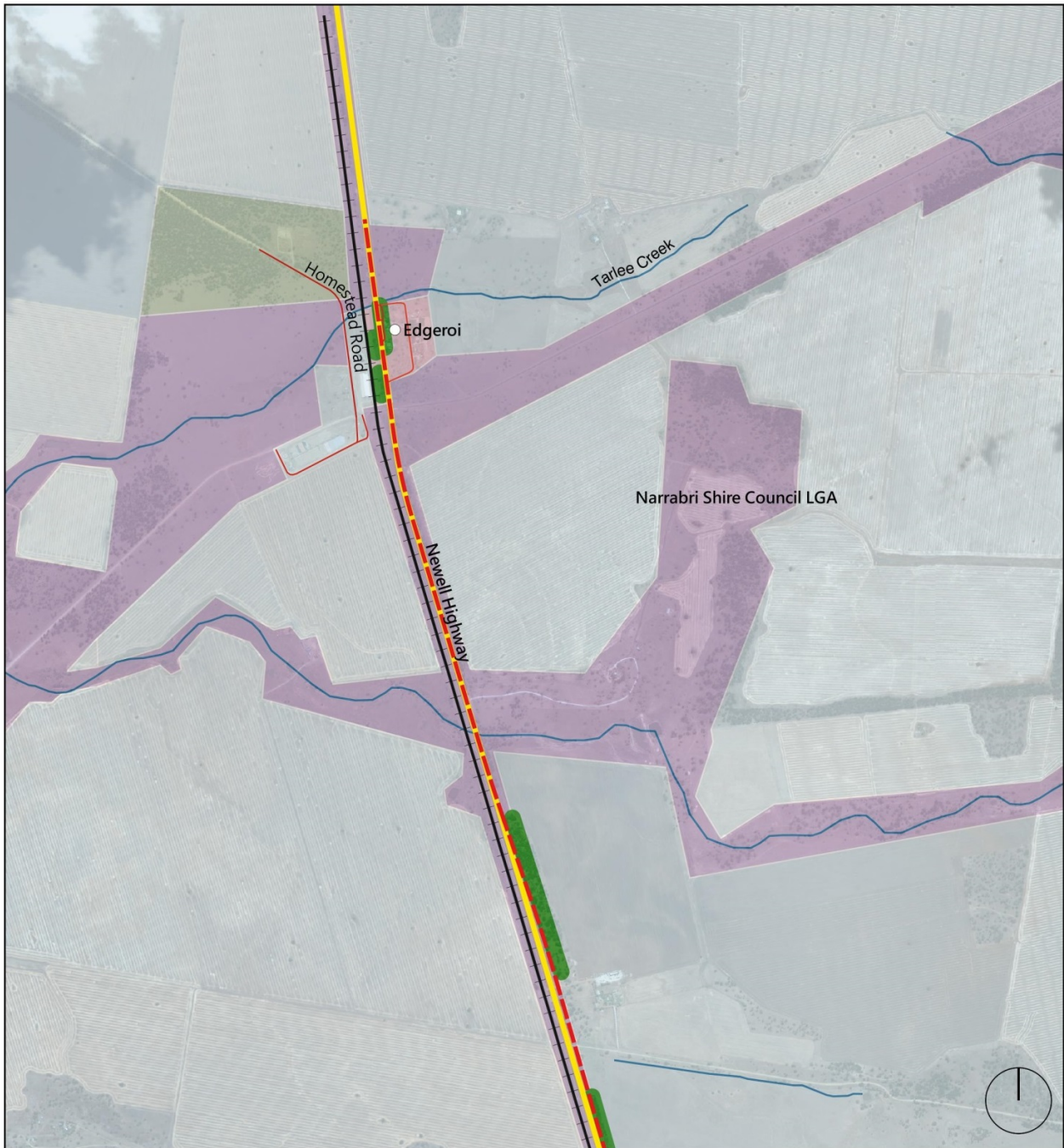
Rural Dwelling

Landmark

500 0 500 1000 1500 2000 m



**Figure 6-4a Landscape character zones N2MS2 (source: Tract, 2018)**



**Legend**

NSW LGA Boundary

Preferred Option

**Transport**

Local Roads

Newell Highway

Railway

**Landscape Character Zones**

Intensive Agriculture Area

Broad Scale Agriculture  
- Grassland  
- Woodland

Remnant Woodland

State Conservation Area

Rural Town

Rural Village

Airport/Industrial

**Natural systems**

Creekline

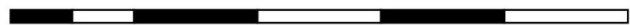
Vegetation Screen

**Built Form**

Rural Dwelling

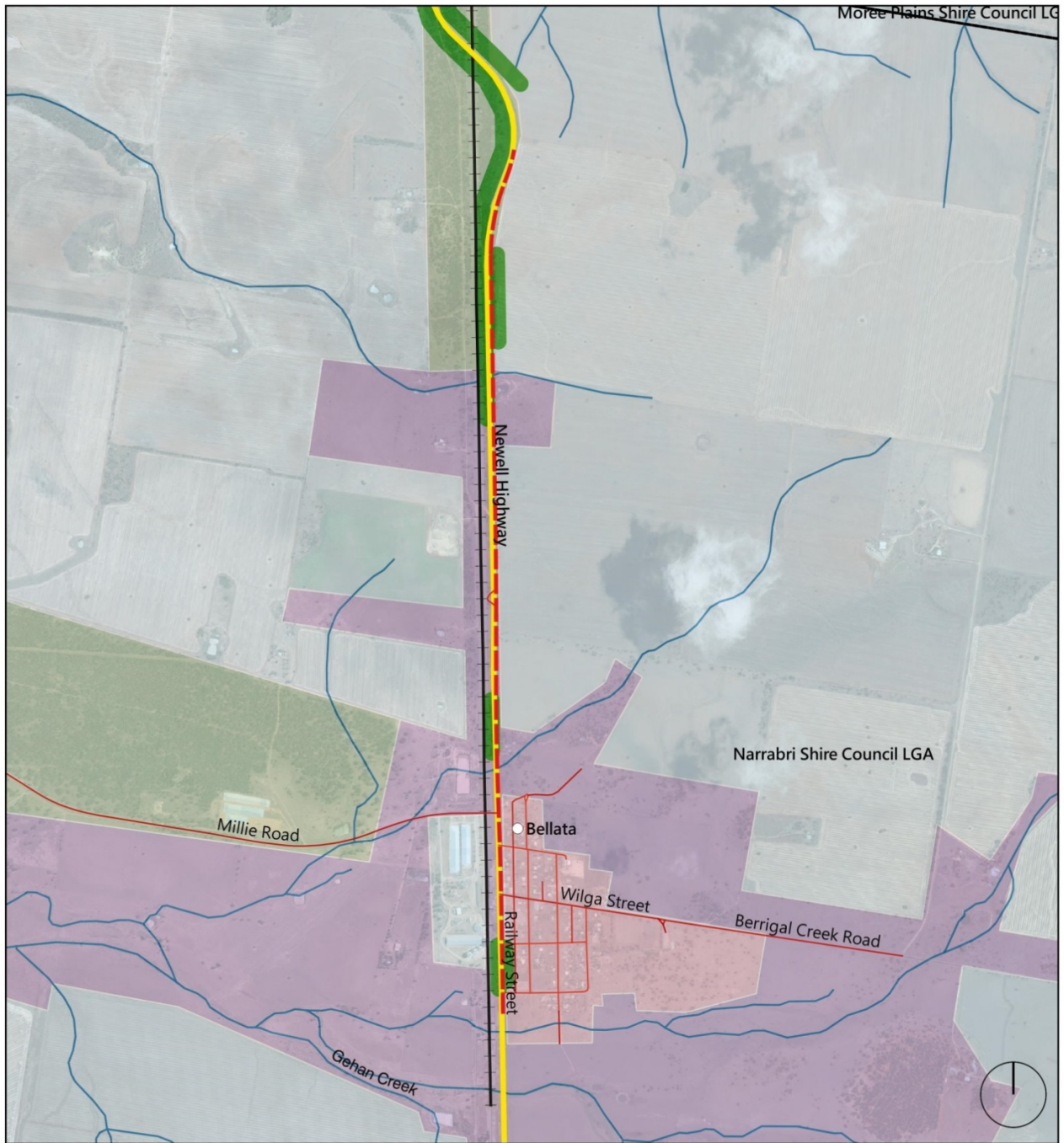
Landmark

500 0 500 1000 1500 2000 m



**Figure 6.4b Landscape character zones N2MS2 (source: Tract, 2018)**





**Legend**

NSW LGA Boundary

Preferred Option

**Transport**

Local Roads

Newell Highway

Railway

**Landscape Character Zones**

Intensive Agriculture Area

Broad Scale Agriculture  
- Grassland  
- Woodland

Remnant Woodland

State Conservation Area

Rural Town

Rural Village

Airport/Industrial

**Natural systems**

Creekline

Vegetation Screen

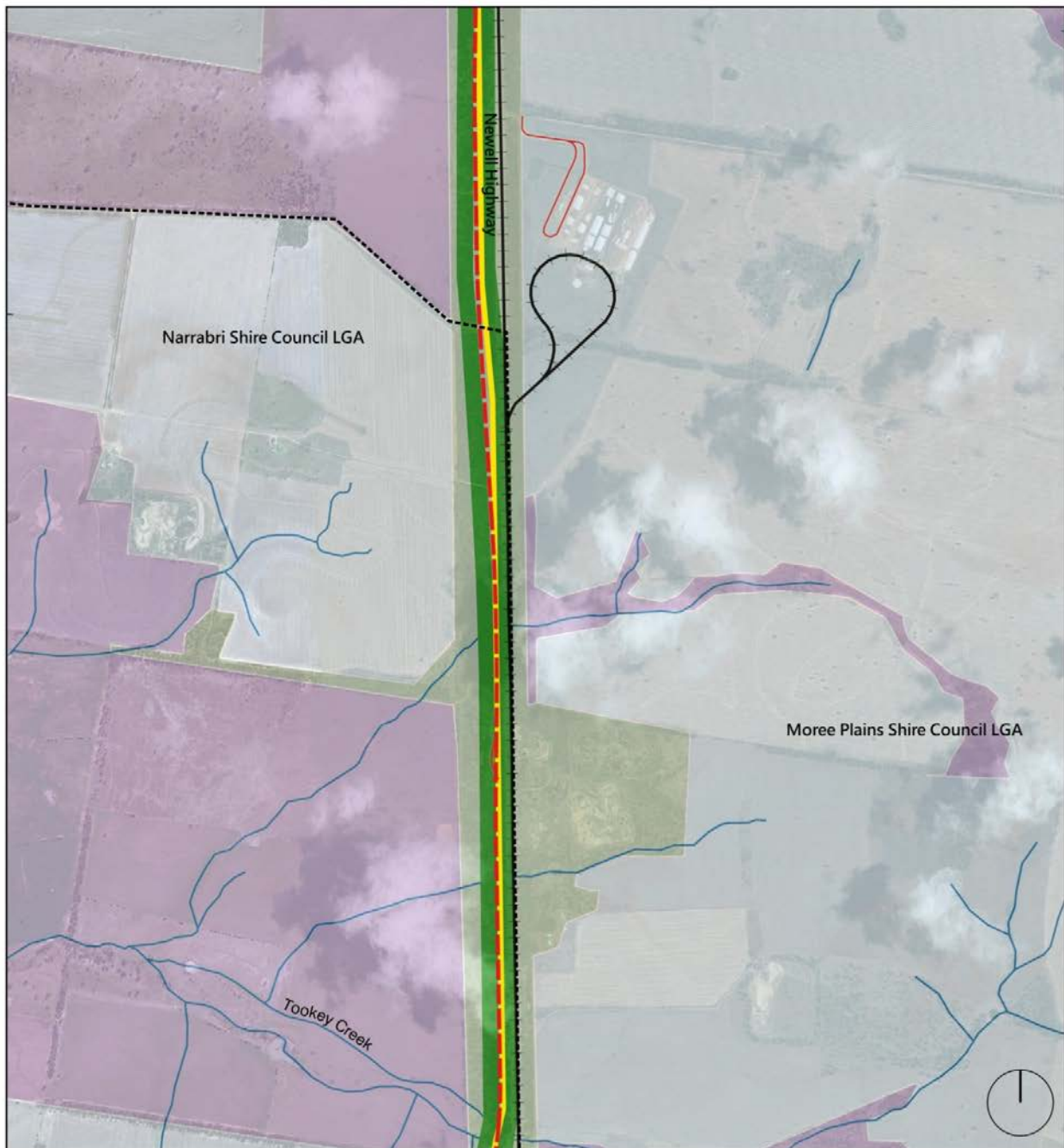
**Built Form**

Rural Dwelling

Landmark

500 0 500 1000 1500 2000 m

**Figure 6-5 Landscape character zones N2MS3 (source: Tract, 2018)**



**Legend**

NSW LGA Boundary

Preferred Option

**Transport**

Local Roads

Newell Highway

Railway

**Landscape Character Zones**

Intensive Agriculture Area

Broad Scale Agriculture  
- Grassland  
- Woodland

Remnant Woodland

State Conservation Area

Rural Town

Rural Village

Airport/Industrial

**Natural systems**

Creepline

Vegetation Screen

**Built Form**

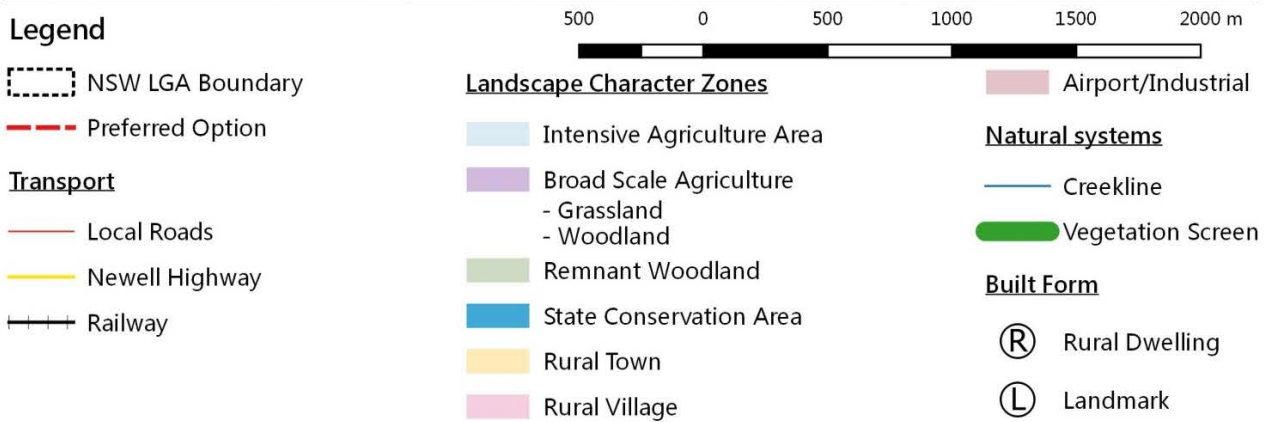
Rural Dwelling

Landmark

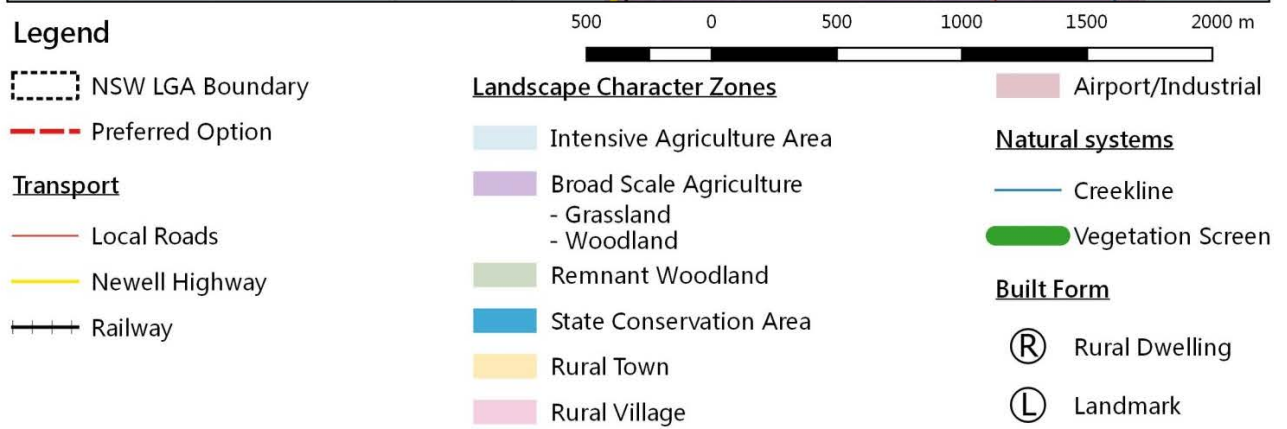
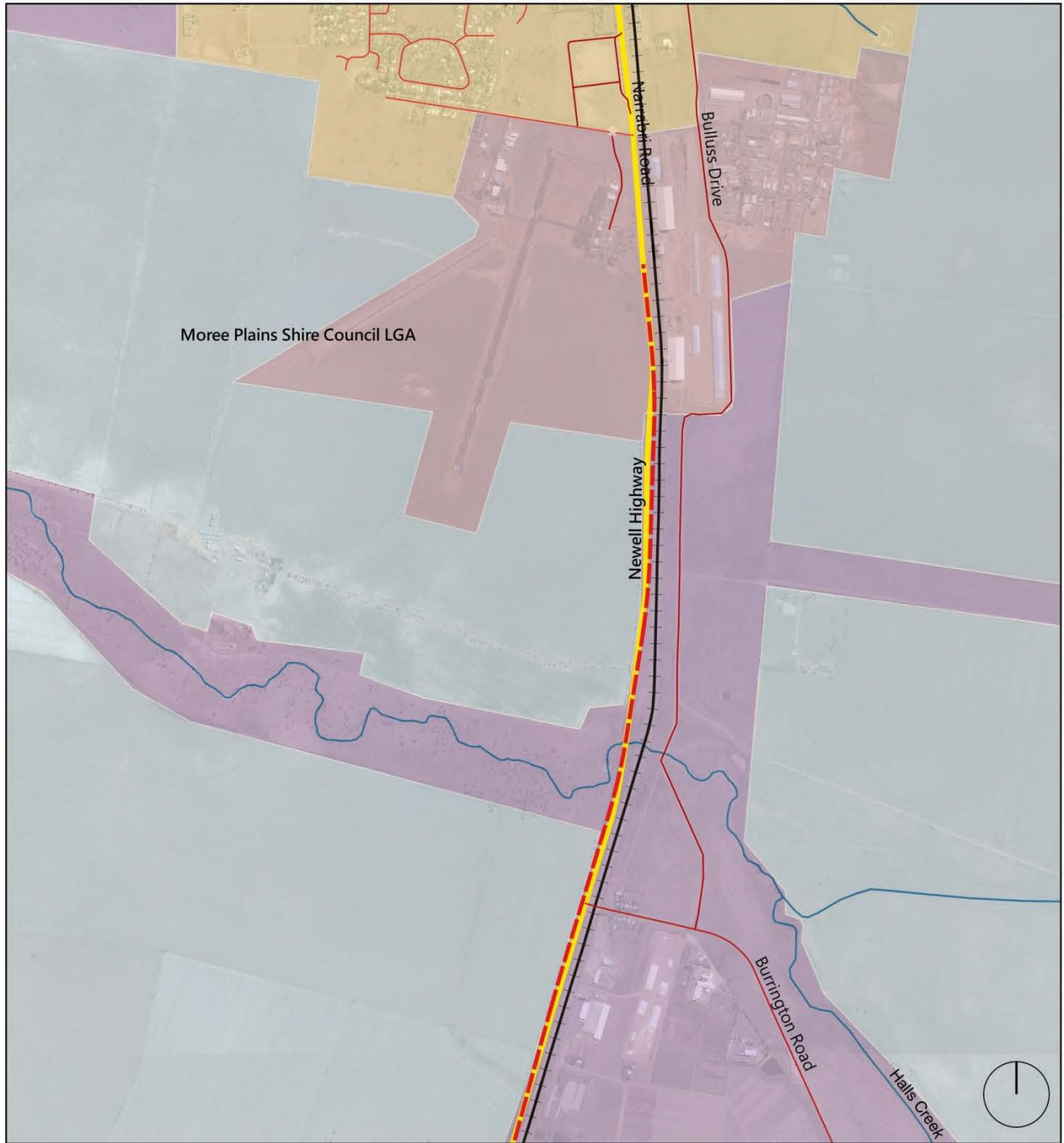
500 0 500 1000 1500 2000 m

**Figure 6-6 Landscape character zones N2MS4 (source: Tract, 2018)**





**Figure 6-7a Landscape character zones N2MS5 (source: Tract, 2018)**



**Figure 6.7b Landscape character zones N2MS5 (source: Tract, 2018)**



## Visual catchment

The visual catchment of the study area varies substantially. N2MS1 and N2MS2 have a broad range of views and visual character from enclosed highway and rail corridor views to rural village streetscapes, regional big sky horizon views and mountain vistas. N2MS3 views are typically limited to the Bellata rural village streetscape surrounds and approaches.

N2MS4 has a restricted visual envelope with dense woodland lining both sides of the Newell Highway. The visual envelope of N2MS5 is predominantly a progression of open vistas that become increasingly focussed towards the Newell Highway corridor as advertising signage and large industrial built elements take visual priority. Avenue planting encourages road users to focus on the journey into and out of Moree.

Visual receptors within the Newell Highway corridor are typically heavy freight vehicle traffic, interstate buses, commercial farm vehicles and holiday caravans with the rest made up by local commuters and visitors. Typically, the viewers were assessed to have a low or moderate sensitivity to the changes. Nineteen viewpoints (VPs) were assessed as part of the proposal. The VPs are described in **Table 6-51**.

## 6.8.3 Potential impacts

### **Construction**

During construction, there would be temporary impacts on visual amenity from the clearing of vegetation, generation of wastes and construction activities (such as ancillary facilities). During construction, temporary lighting would be required at the ancillary sites and for night works, where these are required. Particular attention would be given to design and siting of temporary lighting, to avoid light spill into residences. These impacts would occur throughout construction. Construction staging would result in the impact not being spread across the entire proposal area at the one time.

Mitigation measures to ameliorate the visual impacts are summarised in **Section 6.8.4**.

### **Operation**

The potential impacts of the completed proposal on landscape character were assessed for each LCZ in terms of the zone's sensitivity to change and the magnitude of the proposed changes in that zone. The overall impact on landscape character is a combination of sensitivity and magnitude, is summarised in **Table 6-50**.

Most of these LCZ have been identified as having a low to moderate sensitivity to the proposal, including intensive agricultural landscape, broad scale grassland and rural industrial areas (refer to **Table 6-50**).

The proposal would have a high impact on the Enclosed Vegetated Corridor LCZ located within N2MS1 and N2MS4. This LCZ has high sensitivity due to the presence of well-established and continuous vegetation screening along the Newell Highway corridor. The LCZ would experience a moderate to high magnitude of change due to the removal of screening vegetation, resulting in an overall high impact. The proposal would also have a low to moderate impact on LCZ Rural Village at Edgeroi in N2MS2 and Bellata in N2MS3. Other LZCs located within the proposal area have been assessed to have a low impact.

**Table 6-50 Potential impacts on landscape character zones**

| Segment | Landscape character zone                   | Sensitivity: | Magnitude:       | Summary:        | Post mitigation impact |
|---------|--|--------------|------------------|-----------------|------------------------|
| N2MS1   | Broad Scale Agricultural                   | Low          | Low              | Low             | Low                    |
|         | Intensive Agriculture – Big Sky Views      | Low          | Low              | Low             | Low                    |
|         | Enclosed Vegetated Corridor                | High         | Moderate to High | High            | Moderate to High       |
| N2MS2   | Intensive Agriculture – Big Sky            | Low          | Low              | Low             | Low                    |
|         | Broad Scale Agriculture                    | Moderate     | Low              | Low to Moderate | Low to Moderate        |
|         | Rural Village – Edgeroi                    | High         | Low              | Moderate        | Moderate               |
| N2MS3   | Broad Scale Agriculture – South of Bellata | Low          | Low              | Low             | Low                    |
|         | Rural Village – Bellata                    | High         | Low              | Moderate        | Moderate               |
|         | Broad Scale Agriculture - North of Bellata | Low          | Moderate         | Low to Moderate | Low                    |
|         | Intensive Agriculture – Big Sky            | Low          | Low              | Low             | Low                    |
| N2MS4   | Enclosed Vegetated Corridor                | High         | Low              | Moderate        | Moderate               |
| N2MS5   | Broad Scale Agriculture                    | Low          | Low              | Low             | Low                    |
|         | Intensive Agriculture – Big Sky            | Low          | Low              | Low             | Low                    |
|         | Industrial – Airport Precinct              | Low          | Low              | Low             | Low                    |

The potential impact of the proposal on visual amenity was assessed for the 19 key representative VPs. These impacts are summarised in **Table 6-51**.





The proposal would impact on the VPs as follows:

- One VP would have a high visual impact
- One VP would have a moderate to high visual impact
- Three VP would have a moderate visual impact
- Eight VP would have a low to moderate visual impact
- Six VP would have a low visual impact.


Overall, the visual impact of the proposal would be low and low to moderate due to the retention of existing separation and screening of residential receivers from the proposal and present low level of amenity currently provided by the existing road corridor.





The proposal would have a high visual impact on one identified VP, which provides a view of the entrance to Bellata, due to the removal of vegetation screening. The potential impact of the proposal on visual amenity was assessed for the 19 key representative VPs. These impacts are summarised in **Table 6-51**.





**Table 6-51 Visual impact assessment**

| VP    | Location   | Photo (Tract, 2018)  |
|-------|--|--|
| N2MS1 |  |  |
| VP1   | <p>Looking south along the Newell Highway from a private access road north of I.A. Watson Grains Research Centre. Broad scale agricultural land uses are located on both sides of the road corridor.</p> <p>Sensitivity: Low<br/>Magnitude: Moderate<br/>Impact: Low to Moderate</p> |    |
| VP2   | <p>Looking south along the Newell Highway. Broad scale agricultural land uses are located on both sides of the road corridor.</p> <p>Sensitivity: Moderate<br/>Magnitude: Moderate<br/>Impact: Low to Moderate</p>   |   |
| VP3   | <p>Looking south-east along the Newell Highway towards a private farmstead.</p> <p>Sensitivity: High<br/>Magnitude: Moderate<br/>Impact: Moderate to High</p>  |  |
| VP4   | <p>Looking south from Murrumbilla Lane.</p> <p>Sensitivity: Low<br/>Magnitude: Moderate<br/>Impact: Low to Moderate</p>  |  |






| VP    | Location   | Photo (Tract, 2018)  |
|-------|--|--|
| N2MS2 |  |  |
| VP5   | <p>Looking north along the Newell Highway, about 800 metres north from the southernmost portion of N2MS2.</p> <p>Sensitivity: Low<br/>Magnitude: Low<br/>Impact: Low</p> |    |
| VP6   | <p>Looking south along the Newell Highway across Bobbiwaa Creek bridge.</p> <p>Sensitivity: Low<br/>Magnitude: Moderate<br/>Impact: Low to High</p>                      |   |
| VP7   | <p>Looking east near Bobbiwaa Creek to residential farmstead from entry to private access road.</p> <p>Sensitivity: Low<br/>Magnitude: Low<br/>Impact: Low</p>           |  |
| VP8   | <p>Looking south-east from near Smithfield Lane.</p> <p>Sensitivity: Low<br/>Magnitude: Low<br/>Impact: Low</p>  |  |

| VP    | Location  | Photo (Tract, 2018)  |
|-------|---|--|
| VP9   | Looking south along the Newell Highway towards Edgeroi.<br><br>Sensitivity: Low<br>Magnitude: Moderate<br>Impact: Low to Moderate |    |
| N2MS3 |   |  |
| VP10  | Looking north along the Newell Highway towards Bellata.<br><br>Sensitivity: Low<br>Magnitude: Low<br>Impact: Low                  |   |
| VP11  | Looking north along the Newell Highway towards Bellata.<br><br>Sensitivity: High<br>Magnitude: High<br>Impact: High               |  |
| VP12  | Looking north along the Newell Highway from Bellata.<br><br>Sensitivity: Low<br>Magnitude: Moderate<br>Impact: Low to Moderate    |  |

| VP    | Location   | Photo (Tract, 2018)  |
|-------|--|--|
| VP13  | <p>Looking south along the Newell Highway, north of Bellata.</p> <p>Sensitivity: Moderate<br/>Magnitude: Moderate<br/>Impact: Moderate</p>                         |    |
| VP 14 | <p>Looking north along the Newell Highway at Woolabrar Rest Area.</p> <p>Sensitivity: Moderate<br/>Magnitude: Low<br/>Impact: Low to Moderate</p>                  |   |
| N2MS4 |  |  |
| VP 15 | <p>Looking north from the Tookey Creek culvert.</p> <p>Sensitivity: Moderate<br/>Magnitude: Low<br/>Impact: Low to Moderate</p>                                    |  |
| VP 16 | <p>Looking north along the Newell Highway, about 500 metres north of Tookey Creek.</p> <p>Sensitivity: Moderate<br/>Magnitude: Low<br/>Impact: Low to Moderate</p> |  |



| VP    | Location  | Photo (Tract, 2018)  |
|-------|---|--|
| N2MS5 |   |  |
| VP 17 | <p>Looking north from near the Wallanool Road intersection.</p> <p>Sensitivity: Low<br/>Magnitude: Low<br/>Impact: Low</p>              |    |
| VP 18 | <p>Looking north along the Newell Highway from near Burrington Road.</p> <p>Sensitivity: Low<br/>Magnitude: Low<br/>Impact: Low</p>     |   |
| VP 19 | <p>Looking north along the Newell Highway, towards Moree.</p> <p>Sensitivity: Moderate<br/>Magnitude: Moderate<br/>Impact: Moderate</p> |  |



## 6.8.4 Safeguards and management measures

Safeguards and management measures for landscape character and visual impacts are presented in **Table 6-52**.

**Table 6-52 Summary of mitigation measures – Landscape character and visual impacts**

| Impact                                | Environmental safeguards  | Responsibility | Timing                             | Reference               |
|---------------------------------------|---|----------------|------------------------------------|-------------------------|
| Landscape character and visual impact | <p>An Urban Design Plan will be prepared to support the final detailed project design and implemented as part of the CEMP.</p> <p>The Urban Design Plan will present an integrated urban design for the project, providing practical detail on the application of design principles and objectives identified in the environmental assessment. The Plan will include design treatments for:</p> <ul style="list-style-type: none"> <li>• Location and identification of existing vegetation and proposed landscaped areas, including species to be used</li> <li>• Built elements including retaining walls and bridges</li> <li>• Fixtures such as seating, lighting, fencing and signs</li> <li>• Details of the staging of landscape works taking account of related environmental controls such as erosion and sedimentation controls and drainage</li> <li>• Procedures for monitoring and maintaining landscaped or rehabilitated areas.</li> </ul> <p>The Urban Design Plan will be prepared in accordance with relevant guidelines, including:</p> <ul style="list-style-type: none"> <li>• <i>Beyond the Pavement urban design policy, process and principles</i> (Roads and Maritime, 2014)</li> <li>• <i>Landscape Guideline</i> (RTA, 2008)</li> <li>• <i>Bridge Aesthetics</i> (Roads and Maritime 2012).</li> </ul> | Contractor     | Detailed design /pre-construction  | Core standard safeguard |
| Landscape character and visual impact | Limit vegetation loss - either through revisions to alignment or scale of proposed cross section.   | Contacto       | Detailed design / pre-construction | Additional safeguard    |
| Landscape character and visual impact | Provide screening to properties which have been impacted by the proposal through the opening up of views to the proposed alignment.   | Contacto       | Detailed design / pre-construction | Additional safeguard    |
| Landscape character and visual impact | Provide definition to the changing land uses associated with the townships through which the highway passes.  | Contacto       | Detailed design / pre-construction | Additional safeguard    |
| Landscape character and visual impact | Providing interest to the motorist along their journey in an effort to breakdown the sense of distance and provide a sense of progression and connection to context.  | Contacto       | Detailed design / pre-construction | Additional safeguard    |

## 6.9 Property, land use and socio-economic

Potential property, land use and socio-economic impacts of the proposal are presented in this section, together with safeguards and management measures to manage any negative impacts.

### 6.9.1 Methodology

This assessment has been developed in accordance with Roads and Maritime's *Environmental Impact Assessment Practice Note N05 – Socio-economic assessment* (Roads and Maritime, 2013). The methodology for the socio-economic and land use assessment involved:

- Scoping of the potential socio-economic issues for the proposal and identification of communities likely to be affected by the proposal
- Describing the existing socio-economic environment in the proposal corridor
- Assessing potential impacts of the proposal's construction and operation on the socio-economic environment of the study area
- Identifying safeguards and management measures to avoid, minimise or mitigate potential socio-economic impacts identified in the assessment.

The description of the existing socio-economic environment of the study area principally draws on information from the Australian Bureau of Statistics (ABS), supplemented with information and data from:

- Government agencies such as the NSW Department of Planning and Environment and Destination NSW
- Local councils, including the Narrabri Shire and Moree Plains councils
- Previous technical Roads and Maritime reports associated with the proposal.

The study area for this assessment includes those communities located on, or near to, the Newell Highway. It includes the ABS State Suburbs of:

- Narrabri
- Edgeroi
- Bellata
- Gurley
- Moree.

This assessment also considers at a broader level impacts on regional communities and businesses in the Narrabri Shire and Moree Plains Shire LGAs.

### 6.9.2 Socio-economic policy context

This section provides an overview of the strategic policy framework relevant to the socio-economic environment of the study area.

## **New South Wales**

### **New England North West Regional Plan**

The *New England North West Regional Plan 2036* (NSW Department of Planning and Environment, 2017) outlines the vision, goals and directions for the New England North West region over the next 20 years.

This plan outlines a number of goals to guide the regions' productivity, liveability, environmental management and to achieve the Government's vision for 'nationally valued landscapes and strong, successful communities from the Great Dividing Range to the rich black soil plains'. A goal relevant to the proposal includes 'strong infrastructure and transport networks for a connected future'. A direction of this goal is to enhance transport and infrastructure networks.

The plan identifies the Newell Highway as providing a high capacity freight network that contributes to the region's productivity and competitiveness. The proposal would support the vision and goals of this plan by providing a more efficient connection for road users, including freight, between Narrabri and Moree.

### **New England North West Strategic Regional Land Use Plan**

The *New England North West Strategic Regional Land Use Plan* (NSW Department of Planning and Infrastructure, 2012) establishes a planning framework to support growth, protect the environment and respond to competing land uses, while preserving key regional values for the New England North West region over the next 20 years.

This plan acknowledges the Newell Highway as part of the National Land Transport Network, as a major connection linking regional centres of north-western NSW to Melbourne and Brisbane and is heavily used by industry, with some sections having a 50 per cent heavy vehicle freight mix.

The proposal would support this plan by providing a safer and more efficient connection, which caters for increasing growth, for road users, including inter-regional and local freight traffic, on the highway.

## **Local government**

### **Narrabri Shire Council**

The *Narrabri Shire Community Strategic Plan 2013 – 2023* (Narrabri Shire Council, 2013) (Community Strategic Plan) outlines the long-term strategy for the Narrabri Shire LGA. It sets the strategic direction for the LGA to 2023, including its vision, strategies and measurements of success.

The Community Strategic Plan outlines a number of themes and strategic objectives to guide development and growth within the LGA and achieve the vision to be a 'strong and vibrant regional growth centre providing a quality living environment for the entire Shire community'.

Themes relevant to the proposal include 'A place to thrive – a strong, diverse economy that attracts and retains businesses, services and tourists'. A strategic objective of this theme is for regional standard infrastructure with a measures of including 'infrastructure that meets current and future needs' and community satisfaction regarding the condition and status of roads.

The proposal would support the themes and strategic objectives of the Community Strategic Plan by addressing asset condition, improving road safety, and improving traffic and freight efficiency on the highway.

## Moree Plains Shire Council

The *Moree Plains 2027 – Your Shire. The Plan. Our Future* (Moree Plains Council, 2017) (Community Strategic Plan) outlines the themes, directions, goals and strategies for the LGA over the next 10 years. The theme relevant to the socio-economic environment of the proposal includes to achieve ‘A vibrant regional economy: A direction of this theme is ‘keeping us connected’, which includes a strategy to ‘provide a local road network that meets the Shire’s transport and freight needs’.

The Community Strategic Plan identifies the Moree Plains LGA as one of Australia’s most productive agricultural LGAs, and recognises the impacts of freight on the local road network. The proposal would generally meet the strategies of the Community Strategic Plan by providing a more efficient connection for road users, including inter-regional and local freight traffic, on the highway.

### 6.9.3 Existing environment

#### **Regional profile**

The proposal is located within the New England North West region in northern NSW. The region comprises the New England district and North West district. The proposal is located within the North West district, which includes the Moree Plains, Narrabri Shire, Gwydir, Gunnedah, Liverpool Plains and Tamworth Regional LGAs. The New England district includes the LGAs of Tenterfield, Inverell, Glen Innes Severn, Armidale Region, Walcha and Uralla.

Narrabri and Moree are identified within the *New England North West Regional Plan* (NSW Department of Planning and Environment, 2017) as strategic centres within the North West district. Gunnedah, located south east of Narrabri, and Inverell, located east of Moree, are identified as strategic centres within the New England district. Armidale and Tamworth are identified as regional centres within the New England North West Region and are located along the New England Highway.

In 2014-2015, the gross value of agricultural commodities within the New England North West region was \$2.1 billion. The top five agricultural commodities included cattle and calves, cereal grains, cotton, poultry including eggs, and wool (NSW Department of Planning and Environment, 2017).

The Newell Highway is the longest highway in NSW, extending from the Victorian border at Tocumwal to the Queensland border at Goondiwindi. The highway forms part of the National Highway network and is an important link for the transport of freight and livestock, tourism and regional communities. A number of other important freight routes operate within the New England North West region that connect to the Newell Highway, including Gwydir Highway, Carnarvon Highway, Kamilaroi Highway, and Bruxner Highway.

#### **Key communities**

The Newell Highway serves as an important link for local communities in the study area. The proposal is located within or near the regional centres of Narrabri and Moree and the rural communities of Edgeroi, Bellata and Gurley. The population of communities located near the proposal are outlined in **Table 6-53**. At the 2016 Census, there were 17,612 people living in the study area, of which about 96 per cent lived in the regional centres of Narrabri or Moree. Further information on the regional centres is provided below.



**Table 6-53 Townships along the Newell Highway (from Narrabri to Moree)**

| Location     | Population (2016) |
|--------------|-------------------|
| Narrabri     | 7,606             |
| Edgeroi      | 109               |
| Bellata      | 350               |
| Gurley       | 236               |
| Moree        | 9,311             |
| <b>Total</b> | <b>17,612</b>     |

Source: ABS 2016 Census (ABS State Suburbs)

### Narrabri

Narrabri is located in the Central West of NSW, about 340 kilometres north-west of Newcastle, within the Narrabri Shire LGA. At the 2016 Census, the Narrabri State Suburb had a population of 7,606 people (ABS, 2017).

Narrabri is well-known for agricultural industries including farming cotton, cattle, wheat and sheep. Annual festivals celebrate these agricultural roots including the Boggabri Drovers' Campfire event held in April and the Nosh Narrabri food and wine festival in August. A monthly market, known as the Gypsy Willow Market, are held on the banks of the Narrabri Creek.

Tertiary education facilities located within Narrabri include the TAFE New England Narrabri Campus and the I.A. Watson Grains Research Centre, which forms part of the University of Sydney – Sydney Institute of Agriculture. Narrabri's main schools include Narrabri Public School, Narrabri West Public School and Narrabri High School.

Major attractions in Narrabri include the Paul Wild Observatory and Crossing Theatre, which provides a venue for film screenings, conferences, and concerts. Narrabri also serves as an access to the Mount Kaputar National Park and Pilliga Forest, which allows for informal outdoor recreational activities such as bushwalking and birdwatching.

Main roads servicing Narrabri include the Newell Highway, Kamilaroi Highway and Wee Waa Road. Narrabri Airport is located north of the Narrabri town centre, about five kilometres south-east of the proposal. The airport includes one operational runway and provides domestic flights to Brisbane and Sydney. A strategic objective of the *Narrabri Shire Community Strategic Plan... Towards 2023* (Narrabri Shire Council, 2013) is for Narrabri Airport to be of regional quality, with measurements of success including adequate air transport in Narrabri Shire which is accessible and affordable.

### Moree

Moree is located in the Central West of NSW, about 430 kilometres north-west of Newcastle, within the Moree Plains LGA. At the 2016 Census, the Moree State Suburb had a population of 9,311 people (ABS, 2017).

Moree is a major centre for Australia's cotton industry. Other common agricultural products include pecans, wheat, cattle, olives and vineyards. Major community events annually celebrate the region's agricultural identity and include the Moree Show held in April and the Moore on a Plate Food and Wine Festival held in May.

Moree has a variety of schools which service students from agricultural regions surrounding and within the township of Moree, including Moree Public School, Moree East Public School, St. Philomena's Moree and Moree Secondary College.

The Moree Plains Artesian Pools and Moree Water Park are major tourist attractions. Other recreational clubs and facilities, including tennis, football, hockey, swimming, soccer and golf, are also located within Moree.

Main roads servicing Moree include the Newell Highway, Gwydir Highway, Boggabilla Road and Carnarvon Road. Moree Regional Airport is located south of the Moree town centre, adjacent to the proposal at the northern end of the Newell Highway. The airport includes two operational runways and provides domestic flights to and from Sydney. Over the 12 months to quarter three in 2016, Moree Regional Airport provided services for 34,036 passengers (Transport for NSW, undated).

### ***Land use***

Land use zones on the Narrabri LEP and Moree Plains LEP are discussed in **Section 4.2**.

The proposal is located within the black coal resources basin, with coal mines operating about 40 kilometres south-east of Narrabri. These include the open cut Boggabri Coal Mine and Tarrawonga Coal Mine, and the Whitehaven Coal Mine.

The proposal is located within three Current Petroleum Titles – PEL 6, PEL 427, and PEL 238 (NSW Department of Planning and Environment, undated). A number of Current Petroleum Applications, Current Coal Titles, and Current Coal Applications are located south of Narrabri, while a number of Current Mineral Titles and Current Mineral Applications are located to the east of the proposal at Bingara.

The study area also includes land currently subject to Native Title Claim by the Gomeroi People (Tribunal file no. NC2011/006; Federal Court file no. NSD2308/2011).

### ***Social infrastructure***

Social infrastructure located near the proposal is limited and includes:

- I.A. Watson Grains Research Centre, located on the Newell Highway at Narrabri. The research centre forms part of the University of Sydney – Sydney Institute of Agriculture. The research centre is located next to the proposal
- Bellata Public School, located at Gurley Street, Bellata. The school provides primary education for students in Kindergarten to Year 6. In 2016, the school had 29 students enrolled (My School, 2017). The school is located about 500 metres east of the proposal
- Sugar's Park, located on the Newell Highway at Bellata. The park is a day rest area for motorists and provides picnic tables and seats. The park is located next to the proposal
- Bellata Golf Club, located at Berrigal Creek Road, about 750 metres east of the proposal
- Holy Rosary Catholic Church Bellata, located on the Newell Highway at Bellata. Services are held on Sunday mornings. The church is located next to the proposal
- St Thomas' Church Bellata, located at Gurley Street, Bellata. The church is located next to the proposal.

### ***Business and industry***

#### ***Agriculture***

As discussed previously, agricultural commodities, such as cattle and calves, cereal grains, cotton, poultry including eggs and wool, are important to the region.

A goal of the *New England North West Regional Plan 2036* (NSW Department of Planning and Environment, 2017) is for a strong and dynamic regional economy, with directions to expand agribusiness and food processing sectors, build agricultural productivity, and protect and enhance productive agricultural lands identified.

The Narrabri Shire and Moree Plains LGAs are recognised as the ‘two most productive agricultural areas in Australia in normal seasons’ (Regional Development Australia, undated). Cereal crops and other broadacre crops (such as cotton) represent the highest proportion of agricultural production in the Narrabri Shire and Moree Plains LGAs and provide export industries for the region. Large processing plants for cereal crops and cotton seed are located within the LGAs.

### Mining

The New England North West region is located within the Gunnedah coal basin and contains black coal resources. The region also contains deposits of gemstones, industrial minerals and extractive materials (NSW Department of Planning and Environment, 2017). Coal mines operating near the proposal include the open cut Boggabri Coal Mine and Tarrawonga Coal Mine, and the Whitehaven Coal Mine, about 40 kilometres south-east of Narrabri.

### Tourism

From July 2016 to June 2017, the New England North West region received over 1.5 million domestic overnight visitors and over 40,000 international overnight visitors. This was an increase of 13.2 per cent and 27.3 per cent from the previous year respectively (Destination NSW, 2017).

The Newell Highway is a popular tourist route, running through central NSW from the Queensland to Victorian borders. The Newell Highway provides connectivity between a number of towns such as Tocumwal, Narrandera, West Wyalong, Forbes, Parkes, Dubbo, Gilgandra, Coonabarabran, Narrabri, Inverell, Moree and Goondiwindi. A number of iconic tourist attractions are located within these towns, such as the Parkes Observatory at Parkes, the Taronga Western Plains Zoo at Dubbo, Mount Kaputar National Park at Narrabri, Moree Plains Artesian Pools at Moree, and gem fossicking at Inverell (Newell Highway Promotions Committee, undated). Accommodation and other tourism-related services are provided along the Newell Highway

Regional and local community plans identify the importance of tourism growth within the study area with expansion of tourism and visitor opportunities identified as a direction of the *New England North West Regional Plan 2036* (NSW Department of Planning and Environment, 2017). Opportunities to expand tourism and visitation to the area identified in the regional plan include Moree Water Park, broadacre farming and other agricultural activities, Aboriginal tourism, and nature-based tourism, such as the Moree Artesian Baths and Mount Kaputar. The *Moree Plains 2027 – Your Shire. The Plan. Our Future* (Moree Plains Council, 2017) and *Narrabri Shire Community Strategic Plan... Towards 2023* (Narrabri Shire Council, 2013) identify goals for tourism growth.

### Local businesses

As noted previously, Moree and Narrabri have been identified as strategic centres within the North West district (NSW Department of Planning and Environment, 2017). Businesses in Moree and Narrabri consist of a mix of commercial, professional and health care services and office buildings. These are likely to cater for both local and regional communities.

Moree and Narrabri also include a number of tourism-related businesses, such as short-term accommodation including motels, cabins, caravans and other ‘guest’ accommodation and an information centre, which cater for tourists including those traveling along the Newell Highway.

Local businesses near the proposal include:

- Edgeroi Fuel Shop

- Australia Post – Bellata LPO
- BP Service Station, Bellata
- McGregor Gourlay Agricultural Services.

A number of grain storage and handling facilities are also located at various locations along and next to the proposal.

### **Community values**

Community values include those values held as important to residents for quality of life and well-being. Local amenity and character in the study area is mainly influenced by rural land uses, including agriculture and rural residential uses, as well as small villages and regional centres at Narrabri and Moree.

The agricultural identity of the Narrabri Shire and Moree Plains Shire LGAs is important to the local community. Both the Narrabri Shire and Moree Plains Shire LGAs are known for their agricultural productivity, including cotton, pecans, wheat, olive groves and vineyards, cattle and sheep and a number of annual festivals celebrate the agricultural roots of the community. The rural character of communities near the proposal is also likely to be important to the local community, with small villages located at Homestead Road, Bellata, Gurley and south of Moree.

Tourism is an important industry and economic contributor for the study area, with many tourists attracted to the region for its natural environment and features, lifestyle and heritage. Therefore, protecting these natural, lifestyle and heritage values is important for many communities. The *New England North West Regional Plan 2036* (NSW Department of Planning and Environment, 2017) recognises that ‘historic heritage assets enrich its identity and character and attract visitors to support local economies and communities’.

### **Access and connectivity**

The study area includes a number of major roads that provide access to communities, employment and infrastructure within the study area as well as the New England North West region. The Newell Highway carries substantial freight volumes, large volumes of inter-regional and local freight traffic, and is increasingly catering for substantial volumes of tourist traffic. There are also local roads and access roads that connect to the Newell Highway in the study area. A number of rest areas are located along the highway, including Tookeys Creek Rest Area and Tycannah Rest Area.

Public transport on the Newell Highway is generally restricted to urban areas. A local bus service operates in Moree, with one route using the Newell Highway. The Mungindi railway line runs parallel for the length of the proposal immediately to the west. The railway line provides north-south access from Narrabri to Moree, with major stations at Narrabri and Moree and a minor station at Bellata. Stations at Edgeroi and Gurley are out of use. The proposed Narrabri to North Star inland rail project would be located next to the proposal.

Dedicated walking and cycling corridors are restricted to towns. As discussed in **Section 6.4**, a section of pedestrian footpaths is provided along the Newell Highway at Bellata, with road shoulders which would be suitable for cyclists. No other dedicated pedestrian or cycle paths are located along the Newell Highway or roads that connect to the highway within the proposal area.

Further details regarding traffic and transport near the proposal is provided in **Section 6.4**.



## 6.9.4 Potential impacts

### *Property impacts*

The proposal would require the strip acquisition of land owned by private landowners, Roads and Maritime, council and the State (refer to **Section 3.4**).

Strip acquisition of residential properties for the proposal would not require the relocation of residents. Consequently, the proposal is not anticipated to change, either directly or indirectly, population and demography within the study area or disrupt social networks and community relationships as a result of property acquisition.

Where partial acquisition of rural properties occurs, infrastructure within the proposal area would be demolished and/or relocated prior to construction. Consultation would be carried out with property owners about adjustment requirements. Where infrastructure is impacted, this would be considered through the property acquisition process.

All acquisitions would be conducted in accordance with the Roads and Maritime Land Acquisition Policy, and compensation would be based on the requirements of the *Land Acquisition (Just Terms) Compensation Act 1991*.

Temporary leases of land may be required during construction to accommodate ancillary facilities including site compounds, truck water tank loading areas, batch plants, crushing plant and material processing, stockpile sites and construction sediment basins (refer to **Section 3.4.1**). Following construction, land occupied by ancillary facilities would not be required for the ongoing operation of the project and would be reinstated and/or returned to the landowner.

### *Construction*

#### Land use

Construction of the proposal would have a direct impact on land currently zoned as RU1. Following construction, land which would not be required for the ongoing operation of the proposal would be reinstated and/or returned to its original land use.

#### Social infrastructure

At a regional level, construction of the proposal may impact access to district level facilities in Moree and Narrabri, such as secondary schools, tertiary education facilities, health care and district level recreation, due to delays and disruptions due to road works. This may increase travel times for some individuals who already have to travel some distance to access facilities.

Some social infrastructure is located adjacent to proposed works at Bellata. This includes Sugar's Park, which provides a day rest area for motorists, picnic tables and seats, and Holy Rosary Catholic Church Bellata, which provides church services on Sunday mornings. Construction of the proposal would be carried out 24 hours per day, seven days per week to minimise periods of work under excessive heat and other adverse climatic conditions, and to improve construction efficiencies. Where works are required on Sunday mornings or during hours that the church is in use, temporary impacts on amenity may be experienced due to increased noise, dust and construction traffic, and delays and disruptions due to changes in local access and construction traffic. Temporary impacts on amenity may also be experienced by users of other social infrastructure located near construction activities. These impacts are expected to be minor and would be managed through the implementation of safeguards and management measures (refer to **Section 6.9.5**).

## Local business and industry

Construction activities along the highway may also increase travel times for some individuals accessing businesses within the local township and beyond. This impact is expected to be minor but may increase travel times for some people who already travel some distance to access these businesses, refer to **Section 6.4**

During construction, the proposal would also be likely to have a beneficial impact on some local businesses through increased demand for local goods and services. In particular, increased demand by construction workers for short-term accommodation including motels, cabins, caravans and other 'guest' accommodation in and around Narrabri and Moree, would provide economic benefits for some accommodation owners. However, the use of tourist accommodation by construction workers may temporarily impact on the availability of short-term accommodation, particularly during periods of peak tourist demand. Demand for tourist accommodation would need to be managed to avoid any ongoing impacts on tourism accommodation and tourism in Moree, Narrabri and other communities or tourist areas near the proposal. Early and ongoing consultation and communication should also be carried with local accommodation providers to ensure that demands on short-term accommodation are appropriately managed, particularly during peak tourist times.

Temporary negative impacts may also be experienced by local businesses nearest to construction works, such as those at Bellata, due to temporary changes to access and changes to amenity resulting from noise and vibration impacts and dust impacts. These impacts are expected to be minor and would be managed through the implementation of safeguards and management measures (refer to **Section 6.9.5**).

## Community values

Potential impacts on community values during construction may be experienced by communities near the proposal due to:

- Temporary adverse changes in local amenity for residents, businesses, facilities and natural areas near construction sites and surface works due to noise and dust generated from construction activities
- Construction noise level that may be moderately and even highly intrusive in the villages of Edgeroi and Bellata, where the planned activities are nearest to these sensitive receiver locations. There may also be noise and light spill from night-time construction activities if required
- Temporary changes in local access and connectivity, including for motorists, resulting in delays and disruptions
- Adverse changes in visual amenity and local character due to the presence of construction sites and surface works, infrastructure, and clearing of vegetation within the study area, such as near Bellata.

The Newell Highway is a popular tourist route. Construction of the proposal may result in increased construction traffic and changes to existing traffic conditions. This may result in delays and disruptions for tourists, who may be less familiar with the road conditions of the Newell Highway.

During construction, night-time work may be carried out near residential properties, such as at Bellata. Noise and lighting from these works may temporarily impact on night-time amenity or disrupt sleeping patterns for some residents closest to construction activities

The proposal would also require the removal of roadside trees, including mature trees on either side of the Newell Highway. These trees are likely to contribute to the visual amenity for road users and the loss of these trees may be a concern for some people. Further discussion regarding the

potential impacts of the proposal on landscape character and visual amenity is provided in **Section 6.8**.

### Access and connectivity

Temporary impacts on access and connectivity may be experienced during construction for road users and freight networks, including from:

- Temporary partial closure of lanes to facilitate construction, potentially leading to temporary stoppages of traffic
- Increase in construction traffic along the Newell Highway, including heavy vehicles
- Speed limit reductions in construction areas to allow for safe working practices and to facilitate temporary lane closures and switching.

Private property accesses next to the proposal would be affected during construction of the proposal. Suitable access arrangements would be implemented and early notification would be provided to affected communities and businesses about proposed temporary changes.

A detailed assessment of potential impacts of the proposal on traffic and transport is provided in **Section 6.4**.

## Operation

### Land use

Operation of the proposal would have a direct impact land currently zoned as RU1. This impact is considered to be minor due to the small areas to be acquired, and their location beside an existing major road corridor. In addition, the proposal is not anticipated to have any direct impacts on the viability of land for future urban development.

### Social infrastructure

Operation of the proposal would provide benefits for access to social infrastructure in the study area and wider region. In particular, the proposal would reduce travel times and improve safety along the Newell Highway for communities and visitors in the study area, supporting improved access to district level facilities in Moree and Narrabri, such as secondary schools, tertiary education facilities, health care and district level recreation.

### Local business and industry

Operation of the proposal would provide benefits for local business and industry in the study area and wider region. The Newell Highway carries substantial freight volumes and tourist traffic. The proposal would reduce transport costs for businesses and industries by providing improved access for agricultural businesses near the proposal to and from the Victorian and Queensland borders, as well as regional centres in western NSW. The proposal would also provide improved access and safety for tourists, supporting growth in the area. This may also result in beneficial impacts for tourism-related businesses located along the Newell Highway.

### Community values

The proposal would improve safety, reduce travel times and provide an efficient and sustainable Newell Highway corridor, which would support community values identified through the *Moree Plains 2027 – Your Shire. The Plan. Our Future* (Moree Plains Council, 2017) and *Narrabri Shire Community Strategic Plan... Towards 2023* (Narrabri Shire Council, 2013) relating to efficient road networks.

## Access and connectivity

The proposal would improve access for local residents, businesses and tourists to regional centres, towns and villages, employment opportunities and regional level community services and facilities such as education, healthcare, and leisure facilities along the highway. In particular, it would:

- Reduce travel times for motorists travelling between some centres and towns. This would be a benefit for many community members, with some currently experiencing long commuting times to major centres for work, school or leisure
- Improve driving conditions and road safety of the highway benefiting local and regional communities, tourists and freight transport operators
- Improve property access for property owners and other road users by providing widened shoulders on either side of the highway
- Improve travel times for freight along the highway. Travel-time savings are a particularly important outcome for the transport of freight, with quicker journey times resulting in cost savings and efficiency improvements for manufacturers transporting raw materials and transporting.

## 6.9.5 Safeguards and management measures

Safeguards and management measures for property, land use and socio-economic impacts are presented in **Table 6-54**.

**Table 6-54 Safeguards and management measures – Property, land use and socio-economic**

| Impact       | Environmental safeguards   | Responsibility     | Timing                            | Reference   |
|--------------|--|--------------------|-----------------------------------|---|
| Consultation | A Project Communications Plan (CP) will be prepared and implemented as part of the CEMP  | Contractor         | Detailed design/pre-construction  | Section 3.7 of QA G36 <i>Environment Protection</i> |
| Consultation | Individual project CPs will be prepared and implemented to help provide timely and accurate information to the community during construction. The CPs will include (as a minimum): <ul style="list-style-type: none"> <li>• Mechanisms to provide details and timing of proposed activities to affected residents and businesses, including changed traffic and access conditions</li> <li>• Contact name and number of complaints</li> </ul> The CPs will be prepared in accordance with the <i>Community Involvement and Communications Resource Manual</i> (RTA, 2008). | Roads and Maritime | Pre-construction and construction | Core standard safeguard                             |



| Impact                   | Environmental safeguards   | Responsibility     | Timing                            | Reference            |
|--------------------------|--|--------------------|-----------------------------------|----------------------|
|                          | Early and ongoing consultation and communication should be carried with local accommodation providers and tourism industry representatives to ensure that demands on short-term accommodation are appropriately managed, particularly during peak tourist times. | Roads and Maritime | Pre-construction and construction | Additional safeguard |
| Emergency vehicle access | Access for emergency vehicles will be maintained at all times during construction. Any site-specific requirements will be determined in consultation with the relevant emergency services agency.  | Roads and Maritime | Pre-construction and construction | Additional safeguard |

## 6.10 Waste and resource management

Potential impacts of the proposal on waste and resource management are presented in this section, together with safeguards and management measures to manage any negative impacts.

### 6.10.1 Policy setting

The WARR Act promotes waste avoidance and resource recovery by developing waste avoidance and resource recovery strategies and programs.

Roads and Maritime endeavours to reduce and manage waste to conserve resources and reduce impacts associated with waste disposal through the implementation of the waste management hierarchy established under the WARR Act as follows:

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

### 6.10.2 Existing environment

The existing highway within the proposal area currently generates minimal waste. Waste sources are currently limited to roadside litter, some waste material from clearing roadside drainage features and green waste from the maintenance of roadside vegetation.

### 6.10.3 Potential impacts

#### **Construction**

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

- Green waste from cleared vegetation
- Road construction materials from construction of the widened road
- Bitumen, concrete (ie culverts) and asphalt from removal of any existing road surfaces
- Roadside materials (ie guide posts, guard rails, traffic signage)
- Excess fill material from any excavation of soils and fill embankments during construction
- Construction wastes created from the demolition of old road pavement from the Newell Highway
- Oil, grease and other liquid wastes from the maintenance of construction plant and equipment
- General wastes and sewage from site compounds and offices

- Plant and equipment maintenance waste including liquid wastes from cleaning, repairing and maintenance
- Packaging materials from items delivered to site, such as pallets, crates, cartons, plastics and wrapping materials.

There is potential for waste to be inappropriately managed, which may result in an impact outside the proposal area.

The quantities of each type of waste would be defined during detailed design. Contaminated soils and materials may also be disturbed during construction works (refer to **Section 6.3**). This may include fuels, oils, exhaust deposition, brake shoes, pest control, degraded asphalt and sediments. In addition, an EPL may be required for the proposal (refer to **Section 4.3**).

### Operation

Potential impacts associated with the operation of the proposal include littering by road users and spills of materials, including hazardous materials resulting from vehicle collisions.

## 6.10.4 Safeguards and management measures

Safeguards and management measures for waste and resource management are summarised in **Table 6-55**.

**Table 6-55 Safeguards and management measures – Waste and resource management**

| Impact                           | Environmental safeguards   | Responsibility | Timing                               | Reference   |
|----------------------------------|--|----------------|--------------------------------------|---|
| Generation of construction waste | <p>A Waste Management Plan will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to:</p> <ul style="list-style-type: none"> <li>• Measures to avoid and minimise waste associated with the project</li> <li>• Classification of wastes generated by the project and management options (re-use, recycle, stockpile, disposal)</li> <li>• Classification of wastes received from off-site for use in the project and management options</li> <li>• Identifying any statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions</li> <li>• Procedures for storage, transport and disposal</li> <li>• Monitoring, record keeping and reporting, including any documentation management obligations arising from resource recovery exemptions.</li> </ul> <p>The Plan will be prepared taking into account the Roads and Maritime <i>Environmental Procedure - Management of Wastes on Roads and Maritime Services Land</i> and relevant <i>Roads and Maritime Waste Fact Sheets</i>, as well as the adopting the Resources Management Hierarchy principles of the WARR Act.</p> | Contractor     | Pre-construction/<br>detailed design | Section 4.2 of QA G36 <i>Environment Protection</i> |

| Impact                                | Environmental safeguards  | Responsibility | Timing                               | Reference                  |
|---------------------------------------|---|----------------|--------------------------------------|----------------------------|
| Existing condition of ancillary sites | Prior to land being used for ancillary construction purposes (compounds, storage, parking, etc) a pre-construction land assessment will be carried out to identify the presence of any pre-existing wastes.       | Contractor     | Pre-construction/<br>detailed design | Core standard safeguard W2 |
| Final condition of ancillary sites    | A post-construction land assessment will be carried out of land that was used for ancillary construction purposes (compounds, storage, parking, etc) to determine the suitability for hand-back to the landowner. | Contractor     | Post construction/<br>operation      | Additional standard W12    |



## 6.11 Air quality, climate change and greenhouse gas

Air quality issues can arise when emissions from an activity result in deterioration of local ambient air quality. Similarly, activities resulting in the emission of greenhouse gases contribute to climate change. The potential impacts of the proposal on air quality, greenhouse gas and climate change are presented in this section, together with safeguards and management measures to manage any negative impacts.

### 6.11.1 Methodology

The methodology for the air quality, climate change and greenhouse gasses assessment involved:

- Characterisation of the existing environment in terms of local climate, meteorological conditions and air quality
- Identification of air quality key risks during construction and operation of the proposal
- Risk-based assessment of potential impacts of the proposal
- Development of suitable safeguards and management measures.

### 6.11.2 Existing environment

#### *Surrounding receivers*

The proposal is located between the Narrabri and Moree regional centres and passes through the villages of Edgeroi, Bellata and Gurley. A number of sensitive receivers are located near the proposal, including rural and/or residential properties within 500 metres to one kilometre of the proposal. The proposal is also located near Moree Airport and a number of commercial and industrial properties to the south of the Moree town centre.

#### *Local climate and meteorological conditions*

Meteorological conditions are important for identifying the direction and rate at which air emissions from a source disperse. The nearest weather station with long-term historical records operated by the Bureau of Meteorology (BoM) is the Moree Aero Club Automatic Weather Station (AWS) (Station Number 53115), around 700 metres north of the proposal. Historical average climate data for the Moree Aero Club AWS is shown in **Table 6-56**.

**Table 6-56 Long-term temperature and rainfall data from Moree Aero Club AWS (BoM, 2017)**

| Month    | Mean maximum temperature (°C) | Mean minimum temperature (°C) | Mean rainfall (mm) | Mean number of rain days (> 1 mm) |
|----------|-------------------------------|-------------------------------|--------------------|-----------------------------------|
| January  | 33.9                          | 20.1                          | 83.8               | 6.0                               |
| February | 33.1                          | 19.7                          | 67.6               | 5.2                               |
| March    | 31.0                          | 17.2                          | 53.5               | 4.5                               |
| April    | 27.1                          | 12.7                          | 23.6               | 2.5                               |
| May      | 22.5                          | 8.2                           | 29.1               | 3.2                               |

| Month         | Mean maximum temperature (°C) | Mean minimum temperature (°C) | Mean rainfall (mm) | Mean number of rain days (> 1 mm) |
|---------------|-------------------------------|-------------------------------|--------------------|-----------------------------------|
| June          | 18.9                          | 6.0                           | 41.3               | 4.2                               |
| July          | 18.1                          | 4.5                           | 36.3               | 3.9                               |
| August        | 20.4                          | 5.2                           | 25.4               | 2.9                               |
| September     | 24.5                          | 8.9                           | 35.1               | 4.1                               |
| October       | 28.1                          | 12.7                          | 46.3               | 5.2                               |
| November      | 30.8                          | 16.5                          | 75.4               | 6.0                               |
| December      | 32.6                          | 18.5                          | 69.3               | 6.6                               |
| <b>Annual</b> | <b>26.8</b>                   | <b>12.5</b>                   | <b>586.4</b>       | <b>54.3</b>                       |

The data indicates that the locality around the proposal experiences warm and wet summers with mean daily maximum temperatures of around 34 degrees Celsius. Winter and the beginning of spring are the coldest and driest periods of the year, with average monthly rainfall from June to August around 35 millimetres per month.

To identify prevailing wind conditions around the proposal, annual and seasonal wind data were reviewed for the years 1995 to 2017 from the Moree Aero Club AWS. Annual and seasonal trends were generally consistent over the 12 years. During summer, winds commonly prevail from the north, while during winter and autumn winds commonly prevail from the southwest. Wind direction during spring is varied. Calm conditions (that is wind speeds less than 0.5 metres per second) were most common in autumn and winter; occurring around three per cent of the time during these seasons.

### ***Greenhouse gas and climate change***

Greenhouse gases include carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, hydrofluorocarbons and perfluorocarbons. These gases have heat absorbing capacity or global warming potential. They absorb heat that is reflected from the earth, which results in warming of the air. This effect is known as the greenhouse effect. The primary human-produced greenhouse gas is carbon dioxide. Human activities, such as the combustion of carbon-based fuels, increase the amount of greenhouse gases in the atmosphere. This leads to an increase in atmospheric temperatures and is known as the enhanced greenhouse effect.

Greenhouse gases near the proposal would likely be associated with agricultural activities and productions, agricultural plant and equipment and vehicle usage on local roads and highways.

Climate change refers to the projected long-term changes to global climatic patterns as a result of increases in the concentration of greenhouse gases in the atmosphere. There is a need to understand these projected changes to future climatic conditions and the effect they could have on existing and potential projects and infrastructure. Moreover, it is important to understand how the proposal might influence these changes.

Climate change projections detailed in this assessment have utilised publicly available information. **Table 6-57** provides information on climate change forecasts for the New England North West region of NSW. The table provides details of the climatic change projections for the area surrounding the proposal to the year 2050, adapted from the NSW Climate Impact Profile (DECCW, 2010).

**Table 6-57 Projected climatic change predictions for the New England North West region of NSW to 2050**

| Season | Seasonal rainfall | Temperature |             | Evaporation |
|--------|-------------------|-------------|-------------|-------------|
|        |                   | Minimum     | Maximum     |             |
| Spring | ↑ 10–20%          | ↑ 1.5–2.0°C | ↑ 2.0–3.0°C | ↑ 20–50%    |
| Summer | ↑ 10–20%          | ↑ 1.0–1.5°C | ↑ 1.5–2.0°C | ↑ 10–20%    |
| Autumn | ↑ 5–10%           | ↑ 1.0–1.5°C | ↑ 1.5–3.0°C | ↑ 10–20%    |
| Winter | ↓ 10–20%          | ↑ 1.0–1.5°C | ↑ 2.0–3.0°C | ↑ 10–20%    |

Source: Adapted from the *NSW Climate Impact Profile* (DECCW, 2010)

As shown in **Table 6-57**, the expected regional climatic changes for the New England North West region include:

- Increased average daily minimum and maximum temperatures
- Increased rainfall in spring summer, autumn and decreased rainfall in winter
- Increased evaporation in all seasons.

The *NSW Climate Impact Profile* (DECCW, 2010) also predicts increased intensity of extreme events (eg droughts, floods, and severe storms).

### **Background air quality**

Local air quality near the proposal is likely to be influenced by local sources including traffic along the Newell Highway, as well as regional influences arising from agricultural activities, dust from the operation of the grain storage and handling facilities in the study area, and other road traffic. The main air pollutants from motor vehicles are carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>) and fine particles (PM<sub>10</sub>, ie particulate matter with equivalent aerodynamic diameters of less than 10 microns) and volatile organic compounds (VOCs). The primary pollutants of concern during construction and operations of the proposal would include total suspended solids, deposited dust, particulate matter, CO, NO<sub>x</sub> (as NO<sub>2</sub>) and VOCs.

## **6.11.3 Potential impacts**

### **Construction**

#### **Air quality**

During construction, air quality issues may arise from temporary increases in local dust (including total deposited dust, total suspended solids and fine particulate matter) emissions associated with vegetation clearing, excavation and demolition works and the handling, storage and disturbance of soils and materials; and other emissions such as exhaust fumes associated with the operation of construction machinery.

Although all phases of construction have the potential to adversely impact upon local ambient air quality, the following activities present the greatest risk:

- Excavation activities
- Materials handling and storage operations

- Demolition works
- Compound, laydown and storage area operations.

The primary issues which need to be managed associated with these phases of construction are identified below:

- Site preparation and clearing: Increased risk of windborne erosion arising from disturbed and exposed surfaces
- Earthwork and excavations: Temporary increases in local dust and exhaust emissions associated with:
  - Windborne dust emanating from disturbed/exposed surfaces
  - Odours and emissions arising from uncovered contaminated and/or hazardous materials
  - Dust and debris arising from haulage of materials.
- Revegetation work: Increased risk of windborne erosion arising from non-vegetated surfaces.

During construction, air quality issues may arise from temporary increases in local dust (particulate matter) emissions associated with vegetation clearing, excavation work and the handling and disturbance of soils and materials; and other emissions such as exhaust fumes associated with the operation of construction machinery.

Materials may also be excavated which exhibit other risks to air quality such as odour. These types of materials would most likely to be uncovered during excavation works, including utility and drainage relocation activities.

Receivers in the direction of prevailing winds and set close to the proposal (including ancillary sites) would be most susceptible to dust-related impacts.

### Greenhouse

Greenhouse gases would be produced during construction of the proposal (due to the need to consume energy and resources, the proposal would not be able to completely avoid the generation of greenhouse gas emissions). These emissions would include:

- Carbon dioxide, methane and nitrous oxide generated from liquid fuel (eg diesel and petrol) used in plant and vehicles
- Embedded emissions associated with the manufacture and delivery of construction materials
- Methane generated from depositing carbon-based waste to landfill.
- The volume of greenhouse gas emissions generated during construction would depend on the quantity of construction materials used and the types of construction plant and equipment operated within the proposal area. Typically, the quantification of greenhouse gas impacts occurs during the detailed design phase when more accurate information is available for items including material types and quantities, and resourcing and disposal locations. As such, specific assessment of greenhouse gas would be carried out during detail design. Such measures include designing infrastructure in accordance with relevant standards and guidelines and ensuring that stormwater drainage is designed with sufficient capacity to account for the projected effects of climate change on the New England North West region.

### Climate change

Climate change risks during construction would primarily be associated with the occurrence of severe weather events. For example, the increased frequency and severity of rainfall events would place increased pressure on erosion and sediment control measures and/or flooding of work sites.



However, climate change risks are generally considered to be minor and would be readily manageable through the application of standard mitigation measures that have been designed to respond to the potential for the increased frequency and severity of rainfall events.

## Operation

### Air quality

Operation of the proposal would not be likely to result in a change and or reduction air quality near the proposal.

### Greenhouse gases

During operation, greenhouse gas emissions may increase with the expected initial increase in traffic volumes, however upgrades to the road surface and additional overtaking lanes may improve fuel efficiency. With the NSW government proposed shift of freight from road to rail the overall emissions and particulate matter may reduce over time and may result in marginal improvements to air quality for passing motorists and local rural residents.

### Climate change

Climate change risks during the operation of the proposal would primarily be associated with:

- Increased average temperatures and heatwaves, which could affect the integrity of the road surface and other construction materials. Direct impacts could include more rapid deterioration of infrastructure, which could result in higher operational and maintenance costs. Indirectly, evaporative changes could result in changes to soil moisture content and soil instability, which could impact foundations of structures, cause cracking and/or softening of pavements and road rutting
- Increased frequency and severity of rainfall events, which would place increased pressure on drainage infrastructure and/or result in flooding of the proposal area.

However, it would be unlikely that the infrastructure provided for the proposal would be more susceptible to climate change risks than the existing road network.

## 6.11.4 Safeguards and management measures

Safeguards and management measures for air quality, climate change and greenhouse gas are presented in **Table 6-58**.

**Table 6-58 Safeguards and management measures – Air quality, climate change and greenhouse gas**

| Impact                                     | Environmental safeguards   | Responsibility | Timing                           | Reference   |
|--|--|----------------|----------------------------------|---|
| Impacts on air quality during construction | An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to: <ul style="list-style-type: none"> <li>• Potential sources of air pollution</li> <li>• Air quality management objectives consistent with any relevant published EPA and/or OEH guidelines</li> <li>• Mitigation and suppression measures to be implemented</li> <li>• Methods to manage work during strong winds or other adverse weather</li> </ul> | Contractor     | Detailed design/pre-construction | Section 4.4 of QA G36 <i>Environment Protection</i> |

| Impact  | Environmental safeguards  | Responsibility          | Timing           | Reference            |
|---|---|-------------------------|------------------|----------------------|
|   | <p>conditions</p> <ul style="list-style-type: none"> <li>• A progressive rehabilitation strategy for disturbed areas.</li> </ul>  |                         |                  |                      |
| Impacts on climate change during construction | <p>During construction, the following measures will be considered and implemented where possible:</p> <ul style="list-style-type: none"> <li>• Plant and equipment will be switched off when not in use</li> <li>• Vehicles, plant and construction equipment will be appropriately sized for the task and properly maintained so as to achieve optimum fuel efficiency</li> <li>• Materials will be delivered with full loads and will come from local suppliers, where possible</li> <li>• Energy efficiency and related carbon emissions will be considered when selecting vehicles and equipment</li> <li>• Vegetation clearing will be reduced as much as feasible, and re-established in suitable areas when construction is completed</li> <li>• Waste will be reduced and recycled as a preference before disposing to landfill.</li> </ul> | Construction contractor | Construction     | Additional safeguard |
| Climate change risks to construction          | Environmental safeguards and management measures in the CEMP will be designed to accommodate and respond to the increased frequency and severity of rainfall events.  | Construction contractor | Pre-construction | Additional safeguard |

## 6.12 Cumulative impacts

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

### 6.12.1 Study area

The study area used for the assessment of cumulative impacts has been defined by identifying other developments or activities that are under way now, or are likely to commence during the proposals scheduled construction timeframe. Construction of the proposal is anticipated to start in 2020 and be completed in 2022. The proposal may be delivered in stages, depending on funding arrangements.

The cumulative impact assessment has considered the suburbs of Narrabri, Edgeroi, Bellata, Gurley and Moree.

### 6.12.2 Broader program of work

As outlined in **Section 2.1**, the proposal originated as part of a wider program of work to upgrade the Newell Highway as part of the *Newell Highway Corridor Strategy* (Transport for NSW, 2015). The following projects may be carried out as part of this program and are located near the proposal:

- Newell Highway Mungle Back Creek to Boggabilla heavy duty pavement
- Newell Highway North Moree heavy duty pavement
- Newell Highway overtaking lanes. Nineteen overtaking lanes have already been constructed in. Another further eight have been funded for completion by 2018, and 27 additional have funding for development
- Realignment at Grong Grong (major works)
- Improvement of road alignment at Trewilga, near Peak Hill
- Upgrades to West Wyalong Bypass
- Traffic signal installation at Newell Highway / Mitchell Highway intersection
- New Dubbo Bridge
- Upgrades at Parkes
- Upgrades at Coonabarabran
- Upgrades at Boggabilla
- Three Heavy Vehicle enforcement sites.
- Other projects and developments.

**Table 6-59** describes the identified development projects with the potential to occur simultaneously with the proposal.

#### **Table 6-59 Other projects and developments within the area**

| Project  | Description   |
|--|---|
| Newell Highway Upgrade (North Moree)                     | The project would include major pavement upgrades to three segments of the Newell Highway north of Moree in northern NSW. The project would have a combined length of about 32 kilometres and is anticipated to start in 2020 and be completed in 2022. An environmental assessment is currently being prepared for the project.  |
| Newell Highway Upgrade (Mungle Back Creek to Boggabilla) | The project includes major pavement upgrades to 28 kilometres of the Newell Highway, intersection improvements, widening of road shoulders and provision of two new overtaking lanes. The project is located about 85 kilometres north of Moree. Construction of the project is expected to start in 2018 and take about 24 months to complete  |
| Inland Rail Line (Narrabri to North Star)                | The project includes an upgrade to about 188 kilometres of rail track within the existing rail corridor and construction of about 1.6 kilometres of new rail corridor between Narrabri and North Star.  |
| Narrabri Gas Project                                     | The project would include the development of natural gas in the Gunnedah Basin, about 20 kilometres south-west of Narrabri. The project would require the installation of gas wells, gas and water gathering systems, gas processing and compression facilities and other infrastructure. Construction for the project would commence in 2018, with some project components ongoing for about 20 years. A submissions report is currently being prepared for the project. |
| Western Slopes Gas Pipeline                              | The project would include the construction and operation of about 450 kilometres of gas transmission pipeline between the Narrabri Gas Project and existing Moomba Sydney Pipeline. An environmental assessment is currently being prepared for the project.  |
| Narrabri Grain Storage and Rail Transfer Facility        | The project would include the construction and operation of a grain storage and rail transfer facility north of Narrabri. The project would be located on rural land, adjacent to the Newell Highway and I.A Watson Research Centre. The Secretary's Environmental Assessment Requirements have been issued for the project by the NSW Department of Planning and Environment.  |
| Narrabri South Solar                                     | The project would include construction and operation of a 60 mega-watt solar photovoltaic facility on about 200 hectares of farmland. The project would be located about 7.5 kilometres south-east of Narrabri. An environmental assessment is currently being prepared for the project.  |
| Moree Gateway Project                                    | Moree Gateway is a future development located to the west of the Newell Highway and east of the Moree Airport (adjacent to the proposal). The project will include a mixed-use development for commercial and light industrial businesses. Land within the Moree Gateway site is currently advertised for sale.   |

### 6.12.3 Potential impacts

In terms of cumulative impact, this proposal would most likely be perceived as part of a larger, staged overall upgrade of the Newell Highway, with the effects from construction being similar for all receivers located near to the proposal. Property owners, residents and businesses located along the Newell Highway and road users may experience 'construction fatigue' due to extended periods of disruption caused by construction activities, construction traffic, noise and dust, interruptions to access, and occasional night-time construction work.

The likely cumulative impacts of the proposal, other projects and developments during construction and operation are summarised in **Table 6-60**.



**Table 6-60 Potential cumulative impacts**

| Environmental factor                   | Construction  | Operation  |
|--|---|--|
| Traffic and transport                  | As a result of the proposal and other nearby proposals that form part of the Newell Highway Corridor Strategy within a similar time period. There is potential for impacts on traffic and transport to be greater than those that were identified for the proposal in isolation. Impacts would primarily be a result of road and lane closures and an increase in construction-related traffic. Potential cumulative impacts would include:<br>Increased travelling time on the road network<br>Reduced traffic speeds on the road network<br>Increased construction traffic volumes along the highway<br>Impacts to oversize freight scheduling. | The proposal and other road upgrades along the Newell Highway would have a positive cumulative impact on travel times and road safety resulting in an improved transport corridor. |
| Biodiversity                           | Long-term plans for Newell Highway and other individual projects that would contribute to the loss of endangered species and EECs. The proposal would result the removal of about 47 hectares of vegetation This would include the removal of about eight hectares of state listed TEC under the BC Act and 16 hectares of national listed TECs under the EPBC Act.   | No cumulative impact is anticipated during operation of the proposal.  |
| Social impacts                         | Multiple construction activities over an extended period would likely result in 'construction fatigue' for local residents and road users.  | The proposal and other planned road upgrades as part of the Newell Highway Strategy would have a positive cumulative impact on travel times, freight efficiency and road safety.   |
| Landscape character and visual amenity | Multiple construction activities would have a cumulative impact on visual amenity. Earthworks, construction compounds, stockpile sites, and construction machinery would be highly visible.   | Overall, the proposal would be considered to be in keeping with the scale and bulk of existing road infrastructure.  |

### 6.12.4 Safeguards and management measures

Safeguards and management measures for potential cumulative impacts are proved in **Table 6-61**.

**Table 6-61 Safeguards and management measures for cumulative impacts**

| Impact  | Environmental safeguards  | Responsibility     | Timing                            | Reference            |
|---|---|--------------------|-----------------------------------|----------------------|
| Cumulative impacts from construction of multiple projects | The CEMP will be updated as required to address cumulative impacts as other projects/activities begin. This will include a process to review and update mitigation measures as new work begins or if complaints are received. | Contractor         | Pre-construction and Construction | Additional safeguard |
| Cumulative impacts to biodiversity                        | Biodiversity offsets will be secured as per the Roads and Maritime's <i>Guideline for Biodiversity Offsets</i> (November 2016).   | Roads and Maritime | Detailed design                   | Additional safeguard |

Other safeguards and management measures that would address cumulative impacts are identified in **Sections 6.1 to 6.11**.

## 7. Environmental management

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

### 7.1 Environmental management plans (or system)

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

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

The CEMP will be prepared prior to construction of the proposal and must be reviewed and certified by the Roads and Maritime Environment Officer, Dubbo 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 would be developed in accordance with the specifications set out in the:

- QA Specification G36 – Environmental Protection (Management System)
- QA Specification G38 – Soil and Water Management (Soil and Water Plan)
- QA Specification G40 – Clearing and Grubbing
- QA Specification G10 – Traffic Management.

## 7.2 Summary of safeguards and management measures

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

**Table 7-1 Consolidated safeguards and management measures for the proposal**

| No.            | Impact   | Environmental safeguards   | Responsibility                                  | Timing                             | Reference               |
|----------------|--|--|---|------------------------------------|-------------------------|
| <b>General</b> |  |  |   |                                    |                         |
| GEN1           | General - minimise environmental impacts during construction | <p>A CEMP will be prepared for each segment and submitted for review and endorsement of the Roads and Maritime Environment Manager prior to commencement of the activity.</p> <p>As a minimum, the CEMP will address the following:</p> <ul style="list-style-type: none"> <li>• Any requirements associated with statutory approvals</li> <li>• Details of how the project will implement the identified safeguards outlined in the REF</li> <li>• Issue-specific environmental management plans</li> <li>• Roles and responsibilities</li> <li>• Communication requirements</li> <li>• Induction and training requirements</li> <li>• Procedures for monitoring and evaluating environmental performance, and for corrective action</li> <li>• Reporting requirements and record-keeping</li> <li>• Procedures for emergency and incident management</li> <li>• Procedures for audit and review.</li> </ul> <p>The endorsed CEMP will be implemented during the undertaking of the activity.</p> | Contractor / Roads and Maritime project manager | Pre-construction / detailed design | Core standard safeguard |
| GEN2           | General - notification                                       | All businesses, residential properties and other key stakeholders (eg schools, local councils) affected by the activity will be notified at least five days prior to commencement of the activity.   | Contractor / Roads and Maritime project manager | Pre-construction                   | Core standard safeguard |

| No.  | Impact                            | Environmental safeguards   | Responsibility                                  | Timing                             | Reference               |
|------|-----------------------------------|--|---|------------------------------------|-------------------------|
| GEN3 | General – environmental awareness | <p>All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular "toolbox" style briefings.</p> <p>Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include:</p> <ul style="list-style-type: none"> <li>• Areas of Aboriginal heritage sensitivity</li> <li>• Threatened species habitat</li> <li>• Aboriginal heritage management including unexpected finds procedures</li> <li>• Threatened species habitat and EEC.</li> </ul>   | Contractor / Roads and Maritime project manager | Pre-construction / detailed design | Core standard safeguard |
| GEN4 | Utilities                         | <p>Prior to the commencement of works:</p> <ul style="list-style-type: none"> <li>• The location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners</li> <li>• If the scope or location of proposed utility relocation works falls outside of the assessed proposal scope and footprint, further assessment will be carried out.</li> </ul>  | Contractor                                      | Detailed design / pre-construction | Core standard safeguard |
| GEN5 | Hazards and risk management       | <p>A Hazard and Risk Management Plan (HRMP) will be prepared and implemented as part of the CEMP. The HRMP will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>• Details of hazards and risks associated with the activity</li> <li>• Measures to be implemented during construction to minimise these risks</li> <li>• Record keeping arrangements, including information on the materials present on the site, material safety data sheets, and personnel trained and authorised to use such materials</li> <li>• A monitoring program to assess performance in managing the identified risks</li> <li>• Contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations.</li> </ul> <p>The HRMP will be prepared in accordance with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, and EPA or Office of Environment and Heritage publications.</p> | Contractor                                      | Detailed design / pre-construction | Core standard safeguard |
| GEN6 | General – environmental awareness | The RMS Project Manager will notify the RMS Environment Manager at least five days prior to the commencement of the activity. The notification will include a copy of any local community notification undertaken (GEN2).  | Contractor                                      | Pre-construction / detailed design | Additional safeguard    |



| No.                 | Impact                            | Environmental safeguards   | Responsibility | Timing                             | Reference   |
|---------------------|-----------------------------------|--|----------------|------------------------------------|---|
| GEN7                | General – environmental awareness | <p>Standard construction hours:</p> <ul style="list-style-type: none"> <li>Monday to Friday 7.00 am to 6.00 pm</li> <li>Saturdays 8.00 am to 1.00 pm</li> <li>No construction on Sundays or Public Holidays.</li> </ul> <p>Works outside standard construction hours (including those detailed within this REF) will be undertaken in accordance with the management and mitigation measures detailed within the Noise and Vibration Management Plan.</p>  | Contractor     | Construction                       | Core standard safeguard                             |
| <b>Biodiversity</b> |                                   |  |                |                                    |   |
| B1                  | Biodiversity                      | <p>A Flora and Fauna Management Plan will be prepared in accordance with Roads and Maritime's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</i> (RTA, 2011) and implemented as part of the CEMP. It will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas</li> <li>Requirements set out in the <i>Landscape Guideline</i> (RTA, 2008)</li> <li>Pre-clearing survey requirements in accordance with Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)</li> <li>Procedures for unexpected threatened species finds and fauna handling</li> <li>Procedures addressing relevant matters specified in the <i>Policy and guidelines for fish habitat conservation and management</i> (DPI Fisheries, 2013)</li> <li>Protocols to manage weeds and pathogens.</li> </ul> | Contractor     | Detailed design / pre-construction | Section 4.8 of QA G36 <i>Environment Protection</i> |
| B2                  | Biodiversity                      | Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.   | Contractor     | Detailed design / pre-construction | Core standard safeguard                             |
| B3                  | Removal of native vegetation      | <ul style="list-style-type: none"> <li>Vegetation removal would be carried out in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)</li> <li>Native vegetation would be re-established in accordance with <i>Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)</li> <li>Exclusion zones would be set up at the limit of clearing (i.e. the edge of the impact area) in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).</li> </ul>   | Contractor     | Detailed design / pre-construction | Additional safeguard                                |

| No. | Impact   | Environmental safeguards   | Responsibility     | Timing                             | Reference            |
|-----|--|--|--------------------|------------------------------------|----------------------|
| B4  | Removal of threatened species habitat and habitat features | <ul style="list-style-type: none"> <li>Habitat would be replaced or re-instated in accordance with <i>Guide 5: Re-use of woody debris and bushrock</i> and <i>Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)</li> <li>The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal area.</li> </ul> | Contractor         | Detailed design / pre-construction | Additional safeguard |
| B5  | Aquatic impacts  | Aquatic habitat would be protected in accordance with <i>Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) and Section 3.3.2 <i>Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013</i> (DPI (Fisheries NSW) 2013).   | Contractor         | Construction                       | Additional safeguard |
| B6  | Injury and mortality of fauna                              | <ul style="list-style-type: none"> <li>Fauna would be managed in accordance with <i>Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)</li> <li>Investigate the potential benefits and drawbacks of installing fauna fencing in N2MS4.</li> </ul>   | Contractor         | Construction and operation         | Additional safeguard |
| B7  | Invasion and spread of weeds                               | <ul style="list-style-type: none"> <li>Weed species would be managed in accordance with <i>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).</li> <li>Pest species would be managed within the proposal area.</li> </ul>   | Contractor         | Construction                       | Additional safeguard |
| B8  | Invasion and spread of pathogens and disease               | Pathogens would be managed in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).   | Contractor         | Construction                       | Additional safeguard |
| B9  | Noise, light and vibration                                 | Shading and artificial light impacts would be considered and minimised where possible through detailed design.   | Contractor         | Detailed design                    | Additional safeguard |
| B10 | Biodiversity offsets                                       | The final design impact area will be ground-truthed and offsets will be calculated and implemented as per <i>Guideline for Biodiversity Offsets</i> (November 2016)  | Roads and Maritime | Detailed design                    | Additional safeguard |

| No.                           | Impact   | Environmental safeguards  | Responsibility                               | Timing                           | Reference  |
|-------------------------------|--|---|--|----------------------------------|--|
| <b>Hydrology and flooding</b> |  |   |  |                                  |  |
| HF1                           | Soil and water   | A Soil and Water Management Plan (SWMP) will be prepared for each segment and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction.   | Contractor                                   | Detailed design/pre-construction | Section 2.1 of QA G38 <i>Soil and Water Management</i> |
| HF2                           | Soil and water   | <ul style="list-style-type: none"> <li>A site specific Erosion and Sediment Control Plan/s (ESCP) will be prepared for each segment and implemented as part of the Soil and Water Management Plan.</li> <li>The plan will include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.</li> </ul>  | Contractor                                   | Detailed design/Pre-construction | Section 2.2 of QA G38 <i>Soil and Water Management</i> |
| HF3                           | Contaminants entering receiving environments during construction | Control measures to minimise the risk of water pollution will be implemented including: <ul style="list-style-type: none"> <li>All fuels, chemicals, and liquids will be stored at least 40 metres away from the existing stormwater drainage system and stored in an impervious bunded area within the compound site</li> <li>Plant and maintenance machinery will be refuelled in impervious bunded areas in the designated compound area</li> <li>Vehicle wash downs and/or concrete truck washouts would be undertaken within a designated bunded area of an impervious surface or carried out off-site.</li> </ul>         | Construction contractor                      | Construction                     | Additional safeguard                                   |
| HF4                           | Extraction of water  | Non potable water sources (including the potential for waterway, borehole extraction and sourcing from private landowners) would be investigated during detailed design to minimise reliance on potable water where feasible.   | Roads and Maritime / Construction contractor | Construction                     | Additional safeguard                                   |
| HF5                           | Hydrology and flood management                                   | A Flood Management Plan will be prepared prior to the work starting. This plan would include: <ul style="list-style-type: none"> <li>Review and coordination with existing local flood plans and evacuation procedures</li> <li>Flood emergency preparation, response, and recovery measures which will be implemented during construction</li> <li>Procedure for daily review of The Bureau of Meteorology website</li> <li>Site protection measures to be implemented prior to and in the event of flooding</li> <li>Procedure for monitoring and maintenance of protection measures during heavy rainfall events.</li> </ul> | Construction contractor                      | Construction                     | Additional safeguard                                   |

| No.                            | Impact                             | Environmental safeguards  | Responsibility          | Timing                           | Reference   |
|--------------------------------|------------------------------------|---|-------------------------|----------------------------------|---|
| HF6                            | Flooding                           | The CEMP will consider the potential impacts of temporary construction works including trenching, solid traffic barriers and stockpiles on overland flows and incorporate appropriate management measures to address these issues.  | Contractor              | Construction                     | Additional safeguard                                |
| <b>Soils and contamination</b> |                                    |   |                         |                                  |   |
| SC1                            | Contaminated land                  | If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA if required.  | Contractor              | Detailed design/Pre-construction | Section 4.2 of QA G36 <i>Environment Protection</i> |
| SC2                            | Accidental spill                   | A site specific emergency spill plan will be developed, and include spill management measures in accordance with the Roads and Maritime <i>Code of Practice for Water Management</i> (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).  | Contractor              | Detailed design/Pre-construction | Section 4.3 of QA G36 <i>Environment Protection</i> |
| SC3                            | Stockpile management               | Stockpiles will be designed, established, operated and decommissioned in accordance with the Roads and Maritimes' <i>Stockpile Site Management Guideline 2015</i> .   | Construction contractor | Construction                     | Additional safeguard                                |
| SC4                            | Soil stabilisation and restoration | The rehabilitation of disturbed areas will be carried out progressively as construction stages are completed, and in accordance with: <ul style="list-style-type: none"> <li>Landcom's Managing Urban Stormwater: Soils and Construction series</li> <li>RTA Landscape Guideline</li> <li>Roads and Maritimes' Guideline for Batter Stabilisation Using Vegetation (2015).</li> </ul>   | Construction contractor | Construction                     | Additional standard safeguard                       |
| SC5                            | Pollution from run-off             | The ancillary facilities will be managed within the ESCP. The following measures will be included to limit sediment and other contaminations entering receiving waterways: <ul style="list-style-type: none"> <li>Chemicals will be stored within a sealed or bunded area</li> <li>Appropriate controls will be in place where plant is stored</li> <li>Run-off from ancillary sites will be controlled and treated before discharging into downstream waterways</li> <li>Vehicle movements will be restricted to designated pathways where feasible</li> <li>Areas that will be exposed for extended periods, such as car parks and main access roads, will be stabilised where feasible.</li> </ul> | Construction contractor | Construction                     | Additional safeguard                                |



| No.                          | Impact                                | Environmental safeguards   | Responsibility                                 | Timing                           | Reference   |
|------------------------------|---------------------------------------|--|--|----------------------------------|---|
| <b>Traffic and transport</b> |                                       |  |  |                                  |   |
| TT1                          | Traffic and transport                 | <p>A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Roads and Maritime <i>Traffic Control at Work Sites Manual</i> (RTA, 2010) and <i>QA Specification G10 Control of Traffic</i> (Roads and Maritime, 2008). The TMP will include:</p> <ul style="list-style-type: none"> <li>• Confirmation of haulage routes</li> <li>• Measures to maintain access to local roads and properties</li> <li>• Site specific traffic control measures (including signage) to manage and regulate traffic movement</li> <li>• Measures to maintain pedestrian and cyclist access</li> <li>• Requirements and methods to consult and inform the local community of impacts on the local road network</li> <li>• Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads.</li> <li>• A response plan for any construction traffic incident</li> <li>• Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic</li> <li>• Monitoring, review and amendment mechanisms.</li> </ul> | Contractor                                     | Detailed design/Pre-construction | Section 4.8 of QA G36 <i>Environment Protection</i> |
| TT2                          | Property access - pre-construction    | Requirements for any changes to local access arrangements will be confirmed during detailed design in consultation with the local road authority and any affected landowners.  | Roads and Maritime                             | Pre-construction/detailed design | Additional standard safeguard                       |
| TT3                          | Notifications to landowners           | Disruptions to property access and traffic will be notified to landowners at least five in accordance with the relevant community consultation processes outlined in the TMP.  | Roads and Maritime and Construction Contractor | Construction                     | Additional standard safeguard                       |
| TT4                          | Property access - during construction | Access to properties will be maintained during construction. Where that is not feasible or necessary, temporary alternative access arrangements will be provided following consultation with affected landowners and the relevant local road authority.  | Roads and Maritime and Construction Contractor | Construction                     | Additional standard safeguard                       |

| No.                        | Impact  | Environmental safeguards  | Responsibility                                 | Timing                             | Reference   |
|----------------------------|---|---|--|------------------------------------|---|
| TT5                        | Reduce speeds, traffic delays and disruptions during construction | Road users, local communities and the freight industry will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.  | Roads and Maritime and Construction Contractor | Construction                       | Additional standard safeguard                       |
| TT6                        | Disruption to public transport, including school bus services     | Access for public transport services, including school bus services, will be maintained. The requirements for any temporary changes will be confirmed following consultation with local bus operators and the community.  | Roads and Maritime and Construction Contractor | Construction                       | Additional standard safeguard                       |
| TT7                        | Impacts of the regional road network                              | Where possible, the most disruption work (such as work that requires lane closures) will be carried out at night to minimise potential impacts on the regional road network. This, combined with temporary effective traffic management, will assist in minimising impacts to traffic and transport using the Newell Highway.   | Roads and Maritime and Construction Contractor | Construction                       | Additional safeguard                                |
| <b>Noise and vibration</b> |   |   |  |                                    |   |
| NV1                        | Noise and vibration   | <p>A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will generally follow the approach in the <i>Interim Construction Noise Guideline</i> (ICNG) (DECC, 2009) and identify:</p> <ul style="list-style-type: none"> <li>• All potential significant noise and vibration generating activities associated with the activity</li> <li>• Feasible and reasonable mitigation measures to be implemented, taking into account <i>Beyond the Pavement: urban design policy, process and principles</i> (Roads and Maritime, 2014).</li> <li>• A monitoring program to assess performance against relevant noise and vibration criteria</li> <li>• Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures</li> </ul> <p>Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.</p> | Contractor                                     | Detailed design / pre-construction | Section 4.6 of QA G36 <i>Environment Protection</i> |

| No. | Impact                     | Environmental safeguards   | Responsibility          | Timing                             | Reference                 |
|-----|----------------------------|--|-------------------------|------------------------------------|---------------------------|
| NV2 | Noise and vibration        | All sensitive receivers (eg schools, local residents) likely to be affected will be notified at least [insert no. of days] prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of: <ul style="list-style-type: none"> <li>The project</li> <li>The construction period and construction hours</li> <li>Contact information for project management staff</li> <li>Complaint and incident reporting</li> <li>How to obtain further information.</li> </ul>   | Contractor              | Detailed design / pre-construction | Core standard safeguard N |
| NV3 | Site induction             | All personnel working on site will receive training to ensure awareness of requirements of the NVMP. Site-specific training will be given to personnel when working in the vicinity of sensitive receivers.  | Contractor              | Pre-construction / construction    | Additional safeguard      |
| NV4 | Noise and vibration        | Where possible, works outside of standard construction hours will be planned so that noisier works are carried out in the earlier part of the evening or night time.   | Contractor              | Pre-construction / construction    | Additional safeguard      |
|     | Noise and vibration        | Where there are complaints about noise from an identified work activity, the work activity will be reviewed, and where feasible and reasonable, action additional control measures. This may include monitoring to confirm that predicted impacts are in line with levels predicted in this assessment.  | Contractor              | Construction                       | Addition safeguard        |
| NV5 | Reducing Vibration impacts | <ul style="list-style-type: none"> <li>Choosing alternative, lower-impact equipment or methods wherever possible</li> <li>Scheduling the use of vibration-causing equipment at the least sensitive times of the day (wherever possible)</li> <li>Locating high vibration sources as far away from sensitive receiver areas as possible</li> <li>Sequencing operations so that vibration-causing activities do not occur simultaneously.</li> <li>Keeping equipment well maintained</li> <li>Do not conduct vibration intensive works within the building damage distances outlined in Table 6-40. Where possible, avoid the use of vibration intensive plant within the nominated human comfort distances. Where this isn't possible, an attendee should be present during the works to suspend activities in the instance of any issues or complaints.</li> <li>Wherever practical, static compaction techniques should be utilised for compaction required within the applicable setback distances recommended to avoid human comfort impacts</li> </ul> | Construction contractor | Construction                       | Additional safeguard      |

| No.                        | Impact   | Environmental safeguards   | Responsibility          | Timing   | Reference   |
|----------------------------|--|--|-------------------------|--|---|
| NV6                        | Vibration impacts on buildings and heritage items                  | <ul style="list-style-type: none"> <li>Building condition inspection reports must be completed in accordance with QA Specification G36 for all heritage structures in the proposal area and any other nearby structures or buildings at risk from vibration impacts.</li> <li>A follow up building condition inspection of all heritage structures in the work area will be carried out when all the construction work is complete.</li> </ul>                   | Construction contractor | Pre-construction and during construction as required | Additional safeguard                                |
| NV7                        | Vibration impacts to Heritage items                                | The use of high intensity vibratory compaction equipment near underground services will be limited. If vibration-intensive plant and equipment change from that which has been in the Noise and Vibration Assessment (Jacobs, 2018a), a review will be carried out prior to commencing work.   | Construction contractor | Construction   | Additional safeguard                                |
| <b>Aboriginal heritage</b> |  |  |                         |  |   |
| AH1                        | Aboriginal heritage  | An Aboriginal Heritage Management Plan (AHMP) will be prepared in accordance with the <i>Procedure for Aboriginal cultural heritage consultation and investigation</i> (Roads and Maritime, 2012) and <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented for managing impacts on Aboriginal heritage. | Contractor              | Detailed design/pre-construction                     | Section 4.9 of QA G36 <i>Environment Protection</i> |
| AH2                        | Aboriginal heritage  | <ul style="list-style-type: none"> <li>The <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction.</li> <li>Work will only re-commence once the requirements of that procedure have been satisfied.</li> </ul>   | Contractor              | Detailed design/pre-construction                     | Section 4.9 of QA G36 <i>Environment Protection</i> |
| AH3                        | Impacts to Aboriginal heritage                                     | If impact to Aboriginal heritage items are unavoidable then the Aboriginal cultural heritage investigation must proceed to PACHCI Stage 3 (RMS 2011).  | Road and Maritime       | Detailed design/pre-construction                     | Additional safeguard                                |
| AH4                        | Aboriginal heritage  | Any further changes to the proposal area outside the survey area will be assessed by a suitably qualified heritage professional.   | Road and Maritime       | Detailed design/pre-construction                     | Additional safeguard                                |
| AH5                        | Minimise risks to Aboriginal cultural heritage during construction | All personnel working on site will receive training to ensure awareness of requirements of the Aboriginal Heritage Management Plan and relevant statutory responsibilities. Site-specific training will be given to personnel when working in the vicinity of identified Aboriginal heritage items.  | Contractor              | Detailed design/pre-construction                     | Additional standard safeguard A                     |



| No.                            | Impact  | Environmental safeguards  | Responsibility | Timing                            | Reference  |
|--------------------------------|---|---|----------------|-----------------------------------|--|
| AH7                            | Aboriginal heritage items BR-HW17-ST1 and BR-HW17-ST2 | <ul style="list-style-type: none"> <li>During construction, BR-HW17-ST1 and BR-HW17-ST2 and BC-HW17-ST1 will be demarcated using high visibility ground markers to delineate the site perimeter (ie staking and flagging) encompassing the tree canopy</li> <li>The ground markers will be visible to any person in the vicinity of the site, whether on foot or in a vehicle</li> <li>BR-HW17-ST1, BR-HW17-ST2 and BC-HW17-ST1 will be mapped on the CEMP and detailed design plans and the canopy extent demarcated as a 'no-go' and 'no-harm' area</li> <li>Vehicles will not be driven on, or in the immediate vicinity of, the BR-HW17-ST1, BR-HW17-ST2 and BC-HW17-ST1 site extent</li> </ul> <p>If required, appropriate sediment control measures will be installed, operated and maintained to prevent sediment moving onto the site extent during the construction of the proposal.</p> | Contractor     | Detailed design /pre-construction | Additional safeguard                                 |
| AH8                            | Aboriginal heritage item BL-HW17-ST1                  | <ul style="list-style-type: none"> <li>If the bitumen currently surrounding BL-HW17-ST1 is to be removed as part of the proposal, this will be done without harming the tree's absorption roots</li> <li>The area surrounding the tree will not subsequently be built upon, providing an area large enough to allow adequate moisture to reach the tree's absorption roots. Minimally, this area will fully encompass the tree canopy extent and this area must be excluded from bitumen cover and compaction</li> <li>Sufficient distances will be provided to allow vehicles to access the rest area where the tree is located, without colliding with or damaging the tree</li> <li>If a significant residual risk of collision remains, steps will be taken to minimise that risk (eg installation of bollards and/or permanent high visibility barriers).</li> </ul>                         | Contractor     | Construction                      | Additional safeguard                                 |
| <b>Non-Aboriginal heritage</b> |   |   |                |                                   |  |
| NH1                            | Non-Aboriginal heritage                               | A Non-Aboriginal Heritage Management Plan (NAHMP) will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts on non-Aboriginal heritage.  | Contractor     | Detailed design/pre-construction  | Section 4.10 of QA G36 <i>Environment Protection</i> |
| NH2                            | Non-Aboriginal heritage                               | <ul style="list-style-type: none"> <li>The Standard Management <i>Procedure – Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of non-Aboriginal origin are encountered</li> <li>Work will only re-commence once the requirements of that Procedure have been satisfied.</li> </ul>  | Contractor     | Detailed design/pre-construction  | Section 4.10 of QA G36 <i>Environment Protection</i> |

| No. | Impact   | Environmental safeguards  | Responsibility | Timing           | Reference            |
|-----|--|---|----------------|------------------|----------------------|
| NH3 | Non-Aboriginal heritage  | Non-Aboriginal heritage awareness training must be provided for all contractors and personnel prior to commencement of construction to outline the identification of potential heritage items and associated procedures to be implemented in the event of the discovery of non-Aboriginal heritage materials, features or deposits (that is, unexpected finds), or the discovery of human remains.  | Contractor     | Pre-construction | Additional safeguard |
| NH4 | AB Meppem & Co, Bellata Post Office, Oldhams Smallgoods, Bellata Police Station and LS Rowe Stock and Station Agents | <ul style="list-style-type: none"> <li>All heritage items will be demarcated during the construction of proposal using high visibility ground markers to delineate historic site extent along the western boundary next to the Newell Highway</li> <li>The demarcation method will be developed in consultation with property owners and/or tenants to ensure that the method is practical and fit for purpose</li> <li>The ground markers used must be visible to any person in the vicinity of the site, whether on foot or in a vehicle</li> <li>A 'no-go' and 'no-harm' area must be mapped on the CEMP and detailed design plans encompassing the historic site extent as shown in section 9 of the <i>Aboriginal and Historical Archaeological Survey Report: Newell Highway HD Pavements – Narrabri to Moree</i> (OzArk, 2018) provide in <b>Appendix D</b>.</li> <li>All ground-disturbing work will be confined to areas, outside of the identified historic site extends and 'no-go' and 'no-harm' areas</li> <li>Once the nature and extent of the proposal in the vicinity of the heritage buildings has been finalised, a condition assessment may be required to determine how structurally sound the building is and whether or not and a vibration assessment may be required.</li> </ul> | Contractor     | Pre-construction | Additional safeguard |

### Landscape character and visual impacts

|     |                                       |  |            |                                  |                         |
|-----|---------------------------------------|--|------------|----------------------------------|-------------------------|
| LC1 | Landscape character and visual impact | <p>An Urban Design Plan will be prepared to support the final detailed project design and implemented as part of the CEMP.</p> <p>The Urban Design Plan will present an integrated urban design for the project, providing practical detail on the application of design principles and objectives identified in the environmental assessment. The Plan will include design treatments for:</p> <ul style="list-style-type: none"> <li>Location and identification of existing vegetation and proposed landscaped areas, including species to be used</li> <li>Built elements including retaining walls and bridges</li> <li>Fixtures such as seating, lighting, fencing and signs</li> <li>Details of the staging of landscape works taking account of related environmental controls such as erosion and sedimentation controls and drainage</li> <li>Procedures for monitoring and maintaining landscaped or rehabilitated areas.</li> </ul> <p>The Urban Design Plan will be prepared in accordance with relevant guidelines, including:</p> | Contractor | Detailed design/pre-construction | Core standard safeguard |
|-----|---------------------------------------|--|------------|----------------------------------|-------------------------|

| No.  | Impact                                | Environmental safeguards   | Responsibility     | Timing                             | Reference   |
|--|---------------------------------------|--|--------------------|------------------------------------|---|
|  |                                       | <ul style="list-style-type: none"> <li>• <i>Beyond the Pavement urban design policy, process and principles</i> (Roads and Maritime, 2014)</li> <li>• <i>Landscape Guideline</i> (RTA, 2008)</li> <li>• <i>Bridge Aesthetics</i> (Roads and Maritime 2012).</li> </ul>   |                    |                                    |   |
| LC2  | Landscape character and visual impact | Limit vegetation loss - either through revisions to alignment or scale of proposed cross section.  | Contractor         | Detailed design / pre-construction | Additional safeguard                                |
| LC3  | Landscape character and visual impact | Provide screening to properties which have been impacted by the proposal through the opening up of views to the proposed alignment.  | Contractor         | Detailed design / pre-construction | Additional safeguard                                |
| LC4  | Landscape character and visual impact | Provide definition to the changing land uses associated with the townships through which the highway passes.   | Contractor         | Detailed design / pre-construction | Additional safeguard                                |
| LC5  | Landscape character and visual impact | Providing interest to the motorist along their journey in an effort to breakdown the sense of distance and provide a sense of progression and connection to context.   | Contractor         | Detailed design / pre-construction | Additional safeguard                                |
| <b>Property, land use and socio-economic</b> |                                       |  |                    |                                    |   |
| SE1  | Consultation                          | A Project Communications Plan (CP) will be prepared and implemented as part of the CEMP  | Contractor         | Detailed design/pre-construction   | Section 3.7 of QA G36 <i>Environment Protection</i> |
| SE2  | Consultation                          | <p>Individual project CPP will be prepared and implemented to help provide timely and accurate information to the community during construction. The CPs will include (as a minimum):</p> <ul style="list-style-type: none"> <li>• Mechanisms to provide details and timing of proposed activities to affected residents and businesses, including changed traffic and access conditions</li> <li>• Contact name and number of complaints</li> </ul> <p>The CPs will be prepared in accordance with the <i>Community Involvement and Communications Resource Manual</i> (RTA, 2008).</p> | Roads and Maritime | Pre-construction and construction  | Core standard safeguard                             |

| No.                                  | Impact                                | Environmental safeguards   | Responsibility     | Timing                            | Reference   |
|--------------------------------------|---------------------------------------|--|--------------------|-----------------------------------|---|
| SE3                                  | Consultation                          | Early and ongoing consultation and communication should be carried with local accommodation providers and tourism industry representatives to ensure that demands on short-term accommodation are appropriately managed, particularly during peak tourist times.   | Roads and Maritime | Pre-construction and construction | Additional safeguard                                |
| SE4                                  | Emergency vehicle access              | Access for emergency vehicles will be maintained at all times during construction. Any site-specific requirements will be determined in consultation with the relevant emergency services agency.  | Roads and Maritime | Pre-construction and construction | Additional safeguard                                |
| <b>Waste and resource management</b> |                                       |  |                    |                                   |   |
| WR1                                  | Generation of construction waste      | <p>A Waste Management Plan will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to:</p> <ul style="list-style-type: none"> <li>Measures to avoid and minimise waste associated with the project</li> <li>Classification of wastes generated by the project and management options (re-use, recycle, stockpile, disposal)</li> <li>Classification of wastes received from off-site for use in the project and management options</li> <li>Identifying any statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions</li> <li>Procedures for storage, transport and disposal</li> <li>Monitoring, record keeping and reporting, including any documentation management obligations arising from resource recovery exemptions.</li> </ul> <p>The Plan will be prepared taking into account the Roads and Maritime <i>Environmental Procedure - Management of Wastes on Roads and Maritime Services Land</i> and relevant <i>Roads and Maritime Waste Fact Sheets</i>, as well as the adopting the Resources Management Hierarchy principles of the WARR Act.</p> | Contractor         | Pre-construction/ detailed design | Section 4.2 of QA G36 <i>Environment Protection</i> |
| WR2                                  | Existing condition of ancillary sites | Prior to land being used for ancillary construction purposes (compounds, storage, parking, etc.) a pre-construction land assessment will be carried out to identify the presence of any pre-existing wastes.   | Contractor         | Pre-construction/ detailed design | Core standard safeguard W                           |
| WR3                                  | Final condition of ancillary sites    | A post-construction land assessment will be carried out of land that was used for ancillary construction purposes (compounds, storage, parking, etc.) to determine the suitability for hand-back to the landowner.   | Contractor         | Post construction/ operation      | Additional standard                                 |



| No.   | Impact  | Environmental safeguards   | Responsibility          | Timing                            | Reference  |
|---|---|--|-------------------------|-----------------------------------|--|
| <b>Air quality, climate change and greenhouse gas</b> |   |  |                         |                                   |  |
| AQ1   | Impacts on air quality during construction                | An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to: <ul style="list-style-type: none"> <li>• Potential sources of air pollution</li> <li>• Air quality management objectives consistent with any relevant published EPA and/or OEH guidelines</li> <li>• Mitigation and suppression measures to be implemented</li> <li>• Methods to manage work during strong winds or other adverse weather conditions</li> <li>• A progressive rehabilitation strategy for disturbed areas.</li> </ul>  | Contractor              | Detailed design/pre-construction  | Core standard safeguard<br><br>Section 4.4 of QA G36 <i>Environment Protection</i> |
| AQ2   | Impacts on climate change during construction             | During construction, the following measures will be considered and implemented where possible: <ul style="list-style-type: none"> <li>• Plant and equipment will be switched off when not in use</li> <li>• Vehicles, plant and construction equipment will be appropriately sized for the task and properly maintained so as to achieve optimum fuel efficiency</li> <li>• Materials will be delivered with full loads and will come from local suppliers, where possible</li> <li>• Energy efficiency and related carbon emissions will be considered when selecting vehicles and equipment</li> <li>• Vegetation clearing will be reduced as much as feasible, and re-established in suitable areas when construction is completed</li> <li>• Waste will be reduced and recycled as a preference before disposing to landfill.</li> </ul> | Construction contractor | Construction                      | Additional safeguard   |
| AQ3   | Climate change risks to construction                      | Environmental safeguards and management measures in the CEMP will be designed to accommodate and respond to the increased frequency and severity of rainfall events.   | Construction contractor | Pre-construction                  | Additional safeguard   |
| <b>Cumulative impacts</b>                             |   |  |                         |                                   |  |
| CU1   | Cumulative impacts from construction of multiple projects | The CEMP will be updated as required to address cumulative impacts as other projects/activities begin. This will include a process to review and update mitigation measures as new work begins or if complaints are received.  | Contractor              | Pre-construction and Construction | Additional safeguard   |
| CU2   | Cumulative impacts to biodiversity                        | Biodiversity offsets will be secured as per the Roads and Maritime's <i>Guideline for Biodiversity Offsets</i> (November 2016).  | Roads and Maritime      | Detailed design                   | Additional safeguard   |

## 7.3 Licensing and approvals

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

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

| <b>Instrument</b>  | <b>Requirement</b>   | <b>Timing</b>                          |
|--|--|--|
| <i>Protection of the Environment Operations Act 1997</i>         | Environment protection licence (EPL) for scheduled activities (road construction / extractive activities / crushing, grinding or separating waste processing or storage) >30,000t/pa from the EPA. | Prior to start of the activity.        |
| <i>Roads Act 1993</i>  | Road Occupancy Permit would need to be obtained as necessary prior to construction commencing.   | Prior to start of the activity.        |
| <i>Crown Lands Act 1989 (s6)</i>                                 | Licence to occupy areas of Crown land  | Prior to start of the activity         |
| <i>Permission to enter from private landowners and residents</i> | Permission to enter from private landowners and residents must be obtained to access proposal work sites. This would likely be obtained through temporary lease arrangements or land acquisition.  | Before accessing any private property. |

## 8. Conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

### 8.1 Justification

The Newell Highway is a vital transport corridor between Victoria, NSW, and the Queensland border. The highway supports access between key regional primary industries and export markets in addition to regional tourism.

The highway has road surface and structural deficiencies and no longer meet the operational requirements of the road. These road surface deficiencies, coupled with a strong freight demand, affect travel reliability and travel times for freight movements between Victoria and Queensland, as well as increasing maintenance costs and reducing road safety. Within this context, the proposal is required to improve road safety and traffic and freight efficiency for vehicles using the highway.

The proposal would:

- Reduction in future Travel Time
- Reduction in future Vehicle operating costs
- Reduction in future Maintenance costs
- Reduction in future Casualty Crashes
- Improved intersection safety and efficiency
- Improved flood immunity.

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

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

#### 8.1.1 Social factors

As documented in **Section 6.9**, the proposal would have some minor short-term negative social impacts as a result of the disturbance and change that would occur during construction. The combined effect of construction noise, dust, local access changes, and general disturbance caused by construction activity, construction traffic and machinery movements would result in a general loss of amenity for residents, motorists, workers and others who live near the proposal area and those who visit the proposal area on a regular basis during construction.

However, the long-term effect would be an overall social benefit, through improved safety and efficiency of the highway.

## 8.1.2 Biophysical factors

The proposal involves widening five segment of the existing highway along or close to its existing alignment. The proposal would therefore minimise the amount of land required for its development and the consequential impact on adjoining land uses and ecosystems. The proposal would generally follow the existing topography and existing alignment and would thereby minimise the need for major earthworks.

Some clearing of native vegetation would be required to construct the proposal. As discussed in **Section 6.1**, the proposal would require the clearing of about 47 hectares of native vegetation. This includes about eight hectares of state listed threatened ecological communities (TECs) and 16 hectares of nationally listed TECs. In many instances, the same patches of vegetation are part of both a State listed and a Commonwealth listed TEC. An assessment of significance was carried out for threatened species and ecological communities that would be likely to occur in the proposal area. The assessments concluded that, the proposal would not have a BC Act and FM Act.

However, the proposal may have a have significant impact, as defined under the Commonwealth EPBC Act on two threatened species, Belson's Panic and Five-clawed Worm-skink, and a TEC listed under the EPBC Act. The proposal would require the removal of 11 hectares of the TEC natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Queensland TEC which is listed as a critically endangered ecological community under the EPBC Act.

The removal of native vegetation would be offset by Roads and Maritime through a separate strategic program of biodiversity offsets that would address vegetation clearing across a number of Roads and Maritime proposals in the New England North West region.

The proposal has also been designed to avoid impacting the four archaeological sites located near to the proposal area (refer to **Section 6.2**).

As discussed in **Section 3.2**, the proposal has been designed to improve flood immunity to a minimum of five year ARI.

## 8.1.3 Economic factors

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

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

## 8.1.4 Public interest

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

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

As a result, the proposal is considered to be in the public interest.



## 8.2 Objects of the EP&A Act

The objects of the EP&A Act, and how these are addressed in the proposal, are presented in **Table 8-1**.

**Table 8-1 How the proposal addresses the objects of the EP&A Act**

| Object  | Comment  |
|---|--|
| 1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.      | <p>The proposal would also improve the social and economic welfare of the community by improving the road safety on this section of the Newell Highway.</p> <p>The proposal design, impact, safeguards and management measures detailed in this REF allow for the proper management, development and conservation of natural and artificial resources.</p> |
| 1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment. | Ecologically sustainable development is considered in <b>Sections 8.2.1 to 8.2.4</b> .   |
| 1.3(c) To promote the orderly and economic use and development of land.   | The proposal is not expected to impact on the economic use of land. However, the proposal would improve the economic use of the road by improving freight efficiency for the local mines and freight industry.   |
| 1.3(d) To promote the delivery and maintenance of affordable housing.   | This clause is not relevant to the proposal.   |
| 1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.                              | Impacts to native animals and plants, including threatened species, populations and ecological communities and their habitats were considered in <b>Section 6.1</b> .  |
| 1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).   | Not relevant to the proposal.  |
| 1.3(g) To promote good design and amenity of the built environment.   | Not relevant to the proposal.  |
| 1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.   | Not relevant to the project.   |
| 1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.  | Not relevant to the proposal.  |
| 1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.   | The proposal development process has involved consultation with relevant stakeholders. Consultation carried out and proposed is outlined in <b>Chapter 5</b> .   |

## 8.2.1 The precautionary principle

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

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

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

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

## 8.2.2 Intergenerational equity

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

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

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

Should the proposal not proceed, the principle of intergenerational equity may be compromised, as future generations would inherit a highway with caravans, heavy and oversize vehicle travelling slowly with impacts on average travel speeds and decreases productivity of the route.

## 8.2.3 Conservation of biological diversity and ecological integrity

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

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

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

The biodiversity assessment (refer to **Section 6.1** and the Biodiversity Impact Assessment Technical Paper in **Appendix C**) concluded that the proposal would not have a significant impact on any species, population or TEC listed under the NSW Biodiversity Conservation Act 2016 (BC Act) and NSW Fisheries Management Act 1994 (FM Act). However, the proposal may have a have significant impact, as defined

under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) on two threatened species, Belson's Panic and Five-clawed Worm-skink, and the Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales NSW and southern Queensland. The findings of the biodiversity assessment indicate that the potential impacts would be acceptable and minimised through the proposed safeguards (refer to Chapter 7).

## 8.2.4 Improved valuation, pricing and incentive mechanisms

This principle is defined as:

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

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

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

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

## 8.3 Conclusion

The proposed Newell Highway Heavy Duty Pavements upgrade between Narrabri and Moree to is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

This has included consideration (where relevant) of conservation agreements and plans of management under the NPW Act, joint management and biobanking agreements under the BC 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 Federal EPBC Act.

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

### ***Significance of impact under NSW legislation***

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

### ***Significance of impact under Australian legislation***

The proposal is likely to have a significant impact on threatened species, populations or ecological communities or migratory species, within the meaning of the EPBC ACT. 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. The 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 the Biodiversity Offset Strategy for the proposal.



## 9. Certification

This review of environmental factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.

Tina Donovan




Senior Environmental Scientist

Jacobs

Date:

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



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## Terms and acronyms used in this REF

| Term/Acronym | Description  |
|--------------|--|
| AADT         | Average annual daily traffic   |
| ABS          | Australian Bureau of Statistics  |
| ACHAR        | Aboriginal cultural heritage assessment report   |
| AEP          | The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage   |
| AHIMS        | Aboriginal Heritage Information Management System  |
| AHIP         | Aboriginal heritage impact permit  |
| AHMP         | Aboriginal Heritage Management Plan  |
| AQMP         | Air Quality Management Plan  |
| ARI          | Average Recurrence Interval<br>The long-term average number of years between the occurrences of a flood as big as or larger than the selected event. For example, floods with a discharge as great as or greater than the 20 year ARI flood event would occur on average once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event.<br>The Annual Exceedance Probability (AEP) is the preferred notation for the frequency or magnitude of flood events. |
| ARTC         | Australian Rail Track Corporation  |
| ASRIS        | Australian Soil Resource Information System  |
| ASS          | Acid sulphate soil   |
| AUL          | Auxiliary left turn  |
| AUR          | Auxiliary right turn   |
| AWS          | Automatic Weather Station  |
| BAL          | Basic left turn  |
| BAR          | Basic right-turn   |
| CEMP         | Construction Environmental Management Plan   |
| CEP          | Communications Engagement Plan   |
| CHL          | Commonwealth Heritage List   |
| CHR          | Channelised right turn   |
| CMA          | Catchment Management Authority   |
| DPE          | Department of Planning and Environment   |
| DPI          | Department of Primary Industries   |
| EEC          | Endangered ecological community  |
| EIA          | Environmental Impact Assessment  |
| EIS          | Environmental Impact Statement   |
| EPA          | Environmental Protection Agency  |



| Term/Acronym | Description   |
|--------------|---|
| EP&A Act     | Environmental Planning and Assessment Act 1979 (NSW). Provides the legislative framework for land use planning and development assessment in NSW  |
| EPBC Act     | Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.            |
| EPL          | Environmental Protection License  |
| ESCP         | Erosion and Sediment Control Plan   |
| ESD          | Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased |
| FM Act       | <i>Fisheries Management Act 1994 (NSW)</i>  |
| Heritage Act | <i>Heritage Act 1977 (NSW)</i>  |
| HRMP         | Hazard and Risk Management Plan   |
| ICNG         | Interim Construction Noise Guideline  |
| ISEPP        | State Environmental Planning Policy (Infrastructure) 2007   |
| LALC         | Local Aboriginal Land Council   |
| LCZ          | Landscape Character zone  |
| LEP          | Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.  |
| LGA          | Local Government Area   |
| LOS          | Level of Service. A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers.  |
| LTTMP        | <i>NSW Long Term Transport Master Plan</i>  |
| NAHMP        | Non-Aboriginal Heritage Management Plan   |
| NES          | Matters of national environmental significance under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.  |
| NHL          | National Heritage List  |
| NPW Act      | <i>National Parks and Wildlife Act 1974 (NSW)</i>   |
| NSW          | New South Wales   |
| NTAR         | National Trust of Australia Register (NSW)  |
| NTCG         | Native Title Claim Group  |
| NVMP         | Noise and Vibration Management Plan   |
| OEH          | Office of Environment and Heritage  |
| PACHCI       | Procedure for Aboriginal Cultural Heritage Consultation and Investigation   |
| PAD          | Potential Archaeological Deposit  |
| PEMP         | Project Environmental Management Plan   |
| POEO         | <i>Protection of the Environment Operations Act 1997</i>  |

| Term/Acronym       | Description  |
|--------------------|--|
| QA Specifications  | Specifications developed by Roads and Maritime Services for use with road work and bridge work contracts let by Roads and Maritime Services. |
| REF                | Review of Environmental Factors  |
| Roads and Maritime | Roads and Maritime Services  |
| RNE                | Register of the National Estate  |
| SEPP               | State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.  |
| SHI                | State Heritage Inventory   |
| SHR                | State Heritage Register  |
| SIS                | Species Impact Statement   |
| SOHI               | Statement of Heritage Impact   |
| SWMP               | Soil and Water Management Plan   |
| TMP                | Traffic Management Plan  |
| VMS                | Variable message signs   |
| WARR               | <i>Waste Avoidance and Resource Recovery Act 2001</i>  |
| WHL                | World Heritage List  |
| WHS                | Work Health and Safety   |
| WMP                | Waste Management Plan  |

# Appendix A

## Urban Design, Landscape Character and Visual Impact Assessment Report (Tract, 2018)

## Appendix B

### Consideration of clause 228(2) factors and matters of national environmental significance





| Factor   | Impact              |
|--|---------------------|
| <p><b>d. Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?</b></p> <p>During construction, the proposal would have the potential to create a reduction in the overall aesthetic quality of the proposal area due to the equipment associated with the construction worksite, dust and noise generation as well as traffic and access disruption. However, impact would be minimised as far as practicable through the implementation of safeguards outlined in <b>Section 7.2</b>.</p> <p>No recreational or scientific qualities of the proposal area are anticipated to be impacted during the construction or operation of the proposal.</p>  | Short-term negative |
| <p><b>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?</b></p> <p>The proposal would potentially impact on one potential archaeological deposit (PAD) (BC-HW17-PAD1) and one modified tree (BC-HW17-ST1). However, it is expected that as the design progresses, these items can be avoided, refer to <b>Section 6.6</b>.</p>  | Nil                 |
| <p><b>f. Any impact on the habitat of protected fauna (within the meaning of the <i>National Parks and Wildlife Act 1974</i>)?</b></p> <p>The proposal would require the removal of about 47 hectares of native vegetation. This includes about eight hectares of state listed TECs and 16 hectares of nationally listed TECs.</p> <p>An assessment of significance was carried out for threatened species and ecological communities that would be likely to occur in the proposal area. The assessments concluded that, the proposal would not have a significant impact on any species, population or TEC listed under the BC Act and FM Act. However, the proposal may have a significant impact, on two threatened species (Belson's Panic and Five-clawed Worm-skink), and one TEC (natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Queensland) listed under the EPBC Act (refer to <b>Section 6.1</b>).</p> <p>Impacts on threatened biodiversity would be further minimised through the design process and implementation of management and mitigation measures identified in the REF, including avoidance through design.</p> | Long term, negative |
| <p><b>g. Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?</b></p> <p>The vegetation that be removed as part of the proposal provides suitable habitat for a range of threatened fauna and flora species listed under the BC Act and EPBC Act. The significant assessments concluded that, the proposal would not have a significant impact on any species, population or TEC listed under the BC Act and FM Act. However, the proposal may have a significant impact, on two threatened species (Belson's Panic and Five-clawed Worm-skink), and one TEC (natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Queensland) listed under the EPBC Act (refer to <b>Section 6.1</b>).</p>   | Long term, negative |

| Factor   | Impact   |
|--|--|
| <p><b>h. Any long-term effects on the environment?</b></p> <p>The proposal would also have an overall moderate negative long-term impact on the existing environment through the permanent clearance of up about 47 hectares of native vegetation. This includes about eight hectares of state listed TECs and 16 hectares of nationally listed TECs. Around 11 hectares of the critically natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Queensland would be directly impacted in N2MS5.</p> <p>The proposal would have positive long-term effects on the environment due to improved safety for road users</p>  | <p>Long term, negative</p> <p>Long term, positive</p>                |
| <p><b>i. Any degradation of the quality of the environment?</b></p> <p>The proposal has the potential to degrade the quality of the environment through accidental spills and erosion and sediment during construction. An Erosion and Sediment Control Plan would be implemented to mitigate the impact.</p>  | <p>Short-term, minor, negative</p>                                   |
| <p><b>j. Any risk to the safety of the environment?</b></p> <p>The construction work has the potential to temporarily decrease safety along the Newell Highway and local roads within proposal area due to road work and movement of construction plant.</p> <p>Operation of the proposal would improve road safety through addition over taking lane, improved pavement and flood immunity.</p>   | <p>Short-term, minor, negative</p> <p>Nil impacts</p>                |
| <p><b>k. Any reduction in the range of beneficial uses of the environment?</b></p> <p>The proposal would result in traffic impacts during construction which would include an increase in the volume of heavy vehicles, interruption of traffic flow and temporary change in speed limit. These impacts would reduce the beneficial use of highway during construction.</p> <p>In the long-term, the proposal would be consistent with future uses and there would be no reduction in the range of beneficial uses of the environment that do not currently exist.</p>   | <p>Short-term, minor, negative</p> <p>Nil impacts</p>                |
| <p><b>l. Any pollution of the environment?</b></p> <p>The proposal would have the potential to result in some minor negative short-term water pollution risks including from sediments, soil nutrients, waste, and spillage of fuels and chemicals. Management of water quality impacts would be carried out in accordance with the safeguards and management measures outlined in <b>Section 7</b>.</p> <p>Short-term noise and air quality impacts (dust and exhaust emissions) would be expected during the construction of the proposal. Management of noise and air quality impacts would be carried out in accordance with the safeguards and management measures summarised in <b>Section 7</b>.</p> <p>The operation of the proposal would be unlikely to substantially alter the air quality from the existing conditions. Some minor long-term benefits to air quality could occur through reduced vehicle emissions generated by an improved travel times</p> | <p>Short-term, minor, negative</p> <p>Long-term, minor, positive</p> |

| Factor   | Impact   |
|--|--|
| <p><b>m. Any environmental problems associated with the disposal of waste?</b></p> <p>Contaminated waste is not anticipated as a result of the proposal. Ancillary sites would be managed in a way that minimise waste on site and manage excess materials. Waste associated with the proposal would be managed in accordance with the <i>Waste Avoidance and Resource Recovery Act 2001</i> and recycled where possible. Issues associated with the disposal of waste are not expected.</p>   | Nil  |
| <p><b>n. Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply?</b></p> <p>The proposal would require a number of resources as described in <b>Section 6.10</b>. None of these resources are or are likely to become in short supply as a result of the proposal. Resource use management measures are provided which would include reuse and recycling when feasible.</p>  | Nil  |
| <p><b>o. Any cumulative environmental effect with other existing or likely future activities?</b></p> <p>The proposal forms part of wider Newell Highway Corridor Strategy package of works designed to improve road safety and freight efficiency along the highway. As part of this strategy a number of road improvement projects would be carried out along the Newell Highway over the next few years. A number of cumulative impacts are expected as a result of these projects. These impacts would include impacts on traffic, noise, vibration, air quality and biodiversity. These would, however, be temporary and would be managed through construction work staging and the implementation of project specific controls.</p> <p>In the long term, the cumulative environmental effects would be positive. These would include an improvement in the road safety, reliability and travel times along the Newell Highway.</p> | <p>Short term major negative</p> <p>Long term minor positive</p> |
| <p><b>p. Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?</b></p> <p>The proposal is not located within a coastal area and would not result in any impact on coastal processes and coastal hazards.</p>   | Nil  |



# 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 and Energy.

A referral is not required for proposed actions that may affect nationally listed threatened species, 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.

| Factor   | Impact                     |
|--|----------------------------|
| <p><b>a. Any impact on a World Heritage property?</b></p> <p>There would be no impact to World Heritage properties by the proposal.</p>  | Nil                        |
| <p><b>b. Any impact on a National Heritage place?</b></p> <p>There would be no impact to National Heritage places by the proposal.</p>   | Nil                        |
| <p><b>c. Any impact on a wetland of international importance?</b></p> <p>There would be no impact to wetlands of international importance by the proposal.</p>   | Nil                        |
| <p><b>d. Any impact on a listed threatened species or communities?</b></p> <p>The Biodiversity Assessment (Jacobs, 2018) identified the proposal would require the removal of vegetation which provides habitat for a range of threatened flora and fauna species as outline in <b>Section 6.1</b>. However, the tests of significance found no significant impact to these species as a result of the proposal. Safeguards and mitigation measures to manage impacts to these species are summarised in <b>Section 6.3.4</b>.</p> |                            |
| <p><b>e. Any impacts on listed migratory species?</b></p> <p>The Biodiversity Assessment (Jacobs, 2018) identified the proposal break apart continuous habitats into separate smaller 'fragments'. The isolation that may be caused by the proposal is not likely to have an appreciable impact on nomadic or migratory species such as many species of birds and bats.</p>  | Long-term, minor, negative |
| <p><b>f. Any impact on a Commonwealth marine area?</b></p> <p>There would be no impact to Commonwealth marine areas by the proposal.</p>   | Nil                        |
| <p><b>g. Does the proposal involve a nuclear action (including uranium mining)?</b></p> <p>The proposal does not involve a nuclear action (including uranium mining)</p>   | Nil                        |
| <p><b>h. Additionally, any impact (direct or indirect) on Commonwealth land?</b></p> <p>Roads and Maritime and Council aim to create a 60 metre minimum width road reserve corridor. Therefore, the proposal would require the proposal would require strip acquisition of private and publicly owned land. Much of the publicly own land would be crown land.</p>   | Long term, minor negative  |

# Appendix C

Newell Highway – Heavy Duty Pavement Upgrade between Narrabri and Moree – Biodiversity Assessment Report (BAR) (Jacobs, 2018)

## Appendix D

Aboriginal and Historical Archaeological Survey Report Newell Highway  
HD Pavements – Narrabri to Moree (OzArk, 2017)

# Appendix E

## Statutory consultation checklists



# Infrastructure SEPP

## Council related infrastructure or services

| Issue                      | Potential impact   | Yes / No | If 'yes' consult with                    | ISEPP clause      |
|----------------------------|--|----------|--|-------------------|
| Stormwater                 | Are the works likely to have a <i>substantial</i> impact on the stormwater management services which are provided by council?  | No       |  | ISEPP cl.13(1)(a) |
| Traffic                    | Are the works likely to generate traffic to an extent that will <i>strain</i> the existing road system in a local government area?   | No       |  | ISEPP cl.13(1)(b) |
| Sewerage system            | Will the works involve connection to a council owned sewerage system? If so, will this connection have a <i>substantial</i> impact on the capacity of any part of the system?  | No       |  | ISEPP cl.13(1)(c) |
| Water usage                | Will the works involve connection to a council owned water supply system? If so, will this require the use of a <i>substantial</i> volume of water?  | No       |  | ISEPP cl.13(1)(d) |
| Temporary structures       | Will the works involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, will this cause more than a <i>minor</i> or <i>inconsequential</i> disruption to pedestrian or vehicular flow? | Yes      |  | ISEPP cl.13(1)(e) |
| Road & footpath excavation | Will the works involve more than <i>minor</i> or <i>inconsequential</i> excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?  | Yes      | Narrabri and Moree Plains Shire Councils | ISEPP cl.13(1)(f) |

## Local heritage items

| Issue          | Potential impact  | Yes / No      | If 'yes' consult with                    | ISEPP clause |
|----------------|---|---------------|--|--------------|
| Local heritage | Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the works? If yes, does a heritage assessment indicate that the potential impacts to the heritage significance of the item/area are more than <i>minor</i> or <i>inconsequential</i> ? | Yes<br><br>No | Narrabri and Moree Plains Shire Councils | ISEPP cl.14  |

## Flood liable land

| Issue             | Potential impact  | Yes / No | If 'yes' consult with                    | ISEPP clause |
|-------------------|---|----------|--|--------------|
| Flood liable land | Are the works located on flood liable land? If so, will the works change flood patterns to more than a <i>minor</i> extent? | Yes      | Narrabri and Moree Plains Shire Councils | ISEPP cl.15  |

### Public authorities other than councils

| Issue                              | Potential impact  | Yes / No | If 'yes' consult with                               | ISEPP clause       |
|------------------------------------|---|----------|---|--------------------|
| National parks and reserves        | Are the works adjacent to a national park or nature reserve, or other area reserved under the <i>National Parks and Wildlife Act 1974</i> , or on land acquired under that Act?   | No       | Office of Environment and Heritage                  | ISEPP cl.16(2)(a)  |
| National parks and reserves        | Are the works on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?  | No       | Office of Environment and Heritage                  | ISEPP cl. 16(2)(b) |
| Aquatic reserves                   | Are the works adjacent to an aquatic reserve or a marine park declared under the <i>Marine Estate Management Act 2014</i> ?   | No       | Department of Industry                              | ISEPP cl.16(2)(c)  |
| Sydney Harbour foreshore           | Are the works in the Sydney Harbour Foreshore Area as defined by the <i>Sydney Harbour Foreshore Authority Act 1998</i> ?   | No       | Sydney Harbour Foreshore Authority                  | ISEPP cl.16(2)(d)  |
| Bush fire prone land               | Are the works for the purpose of residential development, an educational establishment, a health services facility, a correctional centre or group home in bush fire prone land?  | No       | Rural Fire Service                                  | ISEPP cl.16(2)(f)  |
| Artificial light                   | Would the works increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map? (Note: the dark sky region is within 200 kilometres of the Siding Spring Observatory) | No       | Director of the Siding Spring Observatory           | ISEPP cl.16(2)(g)  |
| Defence communications buffer land | Are the works on buffer land around the defence communications facility near Morundah? (Note: refer to Defence Communications Facility Buffer Map referred to in clause 5.15 of Lockhardt LEP 2012, Narrandera LEP 2013 and Urana LEP 2011.             | No       | Secretary of the Commonwealth Department of Defence | ISEPP cl. 16(2)(h) |
| Mine subsidence land               | Are the works on land in a mine subsidence district within the meaning of the <i>Mine Subsidence Compensation Act 1961</i> ?  | No       | Mine Subsidence Board                               | ISEPP cl. 16(2)(i) |

## Appendix F

Newell Highway – Heavy Duty Pavement Upgrade between Narrabri and Moree – Noise and vibration Assessment Report (NVA) (Jacobs, 2018a)



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