

Cessnock Road upgrade at Testers Hollow

Review of Environmental Factors

Roads and Maritime Services | August 2019



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Prepared by Jacobs and Roads and Maritime Services

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Executive summary

The proposal

Roads and Maritime Services (Roads and Maritime) proposes to upgrade MR195 Cessnock Road (also known as Main Road) at Testers Hollow, between Gillieston Heights and Cliftleigh. The proposal would raise the height of Cessnock Road at Testers Hollow to provide a more reliable connection during certain flood events. The proposal is located in the Cessnock Local Government Area (LGA), directly alongside the western boundary of Maitland LGA.

Key features of the proposal include:

- A new two lane 60 and 80 kilometre per hour road, one lane in each direction with two metre shoulders. The new road would be around 900 metres long between Gillieston Heights and Cliftleigh, built alongside the existing Cessnock Road
- The new road would be about 1.5 metres higher than the existing Cessnock Road, which would allow access in a five per cent Annual Exceedance Probability (AEP). AEP refers to the likelihood of a flood event occurring in any one year
- The new road would tie in with the existing road at the northern and southern extents
- Existing access arrangements would be maintained to private property and to the existing combined U-turn bay and intersection at Avery Lane
- New drainage to allow water to pass freely under the new road
- Utility and street light relocations
- Partial property acquisitions
- Ancillary works including drainage works, safety barriers, signs, linemarking, landscaping and environmental protection works
- Temporary ancillary facilities including site compounds and stockpile sites.

The construction of the proposal would be expected to start in mid 2020 and take about two years to complete.

Need for the proposal

The proposal is required to reduce the frequency, duration and impact of flood events along Cessnock Road at Testers Hollow, which has flooded on at least six occasions in the last 10 years. In 2015, flooding of Testers Hollow and surrounding roads such as Cessnock Road and Fishery Creek resulted in Gillieston Heights becoming inundated for five days. On this occasion the combination of flood waters and flood related road damage forced the closure of Cessnock Road at Testers Hollow for 17 days.

Road closures caused by flooding place economic and social costs on the local community. This includes trip diversion costs, loss of economic output/income, high maintenance and traffic management costs and delays to emergency services.

The proposal is required to improve connectivity between the Maitland area, Hunter Expressway and broader community during flooding events and reduce the duration of road closures on Cessnock Road at Testers Hollow.

Proposal objectives and development criteria

The objectives of the proposal include:

- Provide increased flood immunity along Cessnock Road between Gillieston Heights and Cliftleigh
- Minimise the cost of project construction, operation and maintenance
- Minimise impact to the community and environment.

The development criteria for the proposal are to:

- Increase the road level to a height equal to or above a five per cent AEP flood event
- Maintain operational posted speed limit in the proposal area
- Maintain water flow conditions in Testers Hollow.

Options considered

Three route options were considered for the upgrade of the Cessnock Road at Testers Hollow. These route options were located:

- To the east of the current road (known as the Eastern Route)
- To the west of the current road (known as the Western Route)
- Along the same route as the current road (known as the Existing Route).

A “do nothing” option was also considered during the preparation of this review of environmental factors (REF).

The preferred route is the Western Route. This route provides benefits over the Eastern and Existing routes particularly regarding constructability, reduced cost and reduced traffic disruption during construction.

Three options and one alternate option were considered for the road design level. The options were named according to flood immunity:

- Option 1 – five per cent AEP
- Option 1b – an alternate of Option 1, between five per cent AEP and two per cent AEP
- Option 2 – two per cent AEP
- Option 3 – one per cent AEP.

The preferred design option is Option 1 – five per cent AEP. This option is considered the best value for money, offering a substantial improvement in flood immunity over the existing road and substantially reducing the duration of any given flood event. Due to its smaller footprint, Option 1 – five per cent AEP also has the least environmental impact when compared to the other options.

Statutory and planning framework

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 meets the definitions of ‘road infrastructure facilities’ provided 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*. The REF also addresses the relevant considerations of the *Biodiversity Conservation Act 2016* (BC Act), *Fisheries Management Act 1994* (FM Act), *Heritage Act 1977*, *National Parks and Wildlife Act 1974*, and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EBPC Act).

Community and stakeholder consultation

Roads and Maritime has formally consulted with Cessnock City Council, Maitland City Council, State Emergency Services (SES) and the Mine Subsidence District in accordance with the requirements of the ISEPP.

Roads and Maritime has also carried out non-statutory consultation with agencies and utility companies.

Consultation with Aboriginal people has been carried out in accordance with the *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI) (Roads and Maritime Services, 2011), the OEH *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* and the requirements of Clause 80C of the *National Parks and Wildlife Regulation 2009*.

Roads and Maritime will consult with residents, stakeholders and the community during the development of the proposal.

Environmental impacts

The proposal would have some adverse impacts during construction and longer-term positive and adverse impacts during operation which would be managed by the implementation of mitigation measures and safeguards as described in **Chapter 6** of the REF. These are summarised below.

Traffic and flood benefits

The proposal would reduce the frequency, duration and impact of flood events along Cessnock Road at Testers Hollow. It would improve connectivity between the Maitland area, Hunter Expressway and broader community during flooding events. It would also reduce flood-related social, economic and maintenance costs. The proposal would improve safety and reduce flood hazards on Cessnock Road at Testers Hollow.

Biodiversity

The proposal would require the removal of about 1.56 hectares of native vegetation. This includes vegetation meeting the description of the endangered Water Couch - Tall Spike Rush freshwater wetland of the Central Coast and Lower Hunter (about 0.91 hectares), Swamp Oak - Prickly Paperbark - Tall Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast (about 0.56 hectares) and Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter (<0.01 hectares) under the BC Act.

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

Exclusion zones will be defined before construction to protect vegetation outside the proposal area. A pre-clearance inspection by a qualified ecologist will also be carried out before any clearing begins.

Noise and vibration

During construction, there would be noise impacts at some sensitive receivers near the proposal where noise management levels (NMLs) are predicted to be exceeded. For these receivers, noise impacts during some stages of construction may be in the moderate to high range. Noise from additional traffic generated during construction was also assessed and determined to be negligible.

Measures have been developed to mitigate and manage potential noise impacts during construction, including programming of activities generally within day time hours. Consultation will be carried out with potentially affected residents before noisy construction activities begin.

Aboriginal heritage

The proposal area does not contain any previously recorded Aboriginal sites recorded on the Aboriginal Heritage Information Management System (AHIMS). However, two previously unrecorded Aboriginal sites within the study area were identified during site surveys, consisting of an open artefact scatter with Potential Archaeological Deposit (PAD) to the south of Testers Hollow (TH-AS-001) and a PAD to the north of Testers Hollow (TH-PAD-001). The presence of Aboriginal heritage was confirmed via test excavations carried out on TH-PAD-001 and TH-AS-001.

The proposal would have a direct impact on TH-AS-001 and TH-PAD-001. Roads and Maritime will seek an Aboriginal Heritage Impact Permit (AHIP) under the *National Parks and Wildlife Act 1974* before construction. The AHIP application will include a salvage methodology and a proposed exclusion zone for TH-PAD-001.

Landscape character and visual amenity

Once the proposal is built, there would be permanent visual and landscape changes throughout the proposal area. The main visual changes would be due to the new road built next to the existing road and Cessnock Road's overall increase in scale within the low lying setting of Testers Hollow.

The proposal area would be landscaped after construction to help integrate the proposal with the surrounding environment and landform.

Justification and conclusion

The proposal is consistent with state and local transport strategies, as well as plans to improve connectivity during flood events. It also ensures that existing and future infrastructure is resilient to natural hazards.

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

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

The proposal would be unlikely to cause a significant impact on the environment. Therefore, it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Public Spaces (formerly 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. In addition, the proposal is not likely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*. A referral to the Australian Department of the Environment and Energy is not required.

Display of the review of environmental factors

This REF is on display for comment between 20 August and 17 September 2019. You can access the documents in the following ways:

Internet

The documents are available as pdf files on the Roads and Maritime website at rms.work/testershollow.

Printed copies

The documents can be viewed at the following locations:

- Cessnock City Council, 62-78 Vincent Street, Cessnock NSW
- Maitland City Council, 285-287 High Street, Maitland NSW

How can I make a submission?

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

Writing: Project Team
Cessnock Road Upgrade at Testers Hollow
Roads and Maritime Services
Locked Bag 2030, Newcastle NSW 2300

Email: TestersHollow@rms.nsw.gov.au

Submissions must be received by **5pm on Tuesday 17 September 2019**.

Privacy Information

Submissions will be managed in accordance with the Roads and Maritime Services Privacy Statement which can be found at <https://www.rms.nsw.gov.au/about/access-to-information/my-privacy.html> or by contacting privacy@rms.nsw.gov.au.

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

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

The supply of this information is voluntary. Each respondent has free access at all times to the information provided by the respondent but not any identifying information provided by other respondents if a respondent has indicated the representation should be kept confidential. Any respondent may make a correction to the information they have provided by writing to the same address the submission was sent. The information will be held by Roads and Maritime, Level 7, 266 King Street Newcastle 2300.

What happens next?

Roads and Maritime will collate and consider the submissions received during the public display of this REF.

After this consideration, Roads and Maritime will determine whether or not the proposal should proceed as proposed and will inform the community and stakeholders of its decision.

If the proposal is determined to proceed, Roads and Maritime will continue to consult with the community and stakeholders prior to and during construction.

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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 upgrade MR195 Cessnock Road (also known as Main Road) at Testers Hollow, between Gillieston Heights and Cliftleigh. The proposal would raise the height of Cessnock Road at Testers Hollow to provide a more reliable connection during certain flood events. The proposal is located in the Cessnock Local Government Area (LGA), directly alongside the western boundary of Maitland LGA.

Key features of the proposal include:

- A new two lane 60 and 80 kilometre per hour road, one lane in each direction with two metre shoulders. The new road would be around 900 metres long between Gillieston Heights and Cliftleigh built alongside the existing Cessnock Road
- The new road would be about 1.5 metres higher than the existing Cessnock Road, which would allow access in a five per cent Annual Exceedance Probability (AEP). AEP refers to the likelihood of a flood event occurring in any one year
- The new road would tie in with the existing road at the northern and southern extents
- Existing access arrangements would be maintained to private property and to the existing combined U-turn bay and intersection at Avery Lane
- New drainage to allow water to pass freely under the new road
- Utility and street light relocations
- Partial property acquisitions
- Ancillary works including drainage works, safety barriers, signs, linemarking, landscaping and environmental protection works
- Temporary ancillary facilities including site compounds and stockpile sites.

The location of the proposal is shown in **Figure 1.1** and an overview of the proposal is provided in **Figure 1.2**. **Chapter 3** describes the proposal in more detail.

The construction of the proposal would be expected to start in mid 2020 and take about two years to complete.

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

- The 'proposal' refers to all the activities and ancillary sites associated with the road upgrade on Cessnock Road at Testers Hollow
- The 'proposal area' refers to the area that would be directly impacted by the proposal. It includes the total proposal footprint, ancillary sites, and any other areas that would be temporarily disturbed. The proposal area is shown in **Figure 1.2**
- The 'study area' refers to the proposal area and the wider area that may be indirectly impacted by the proposal and has been defined for each specialist study where used.

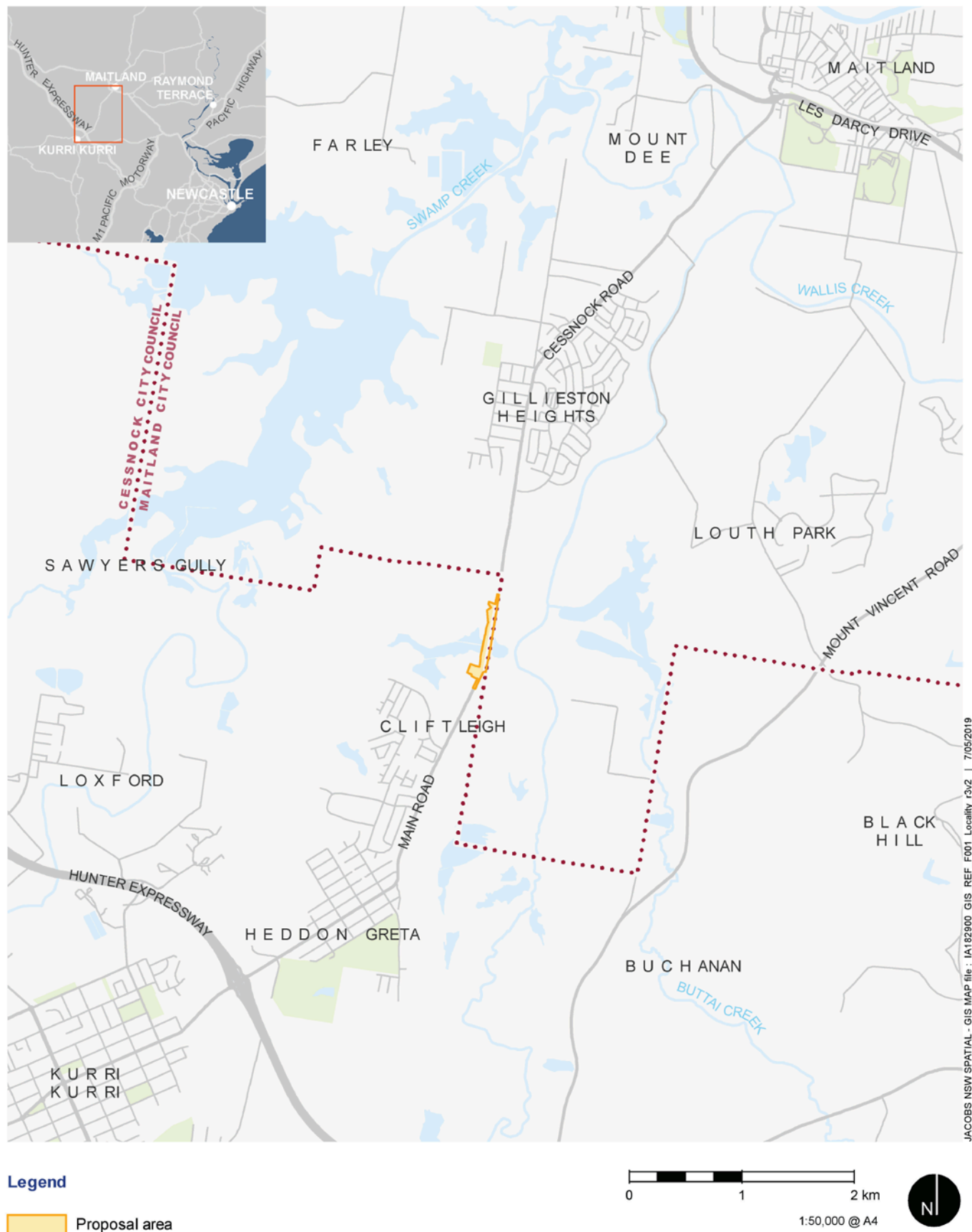
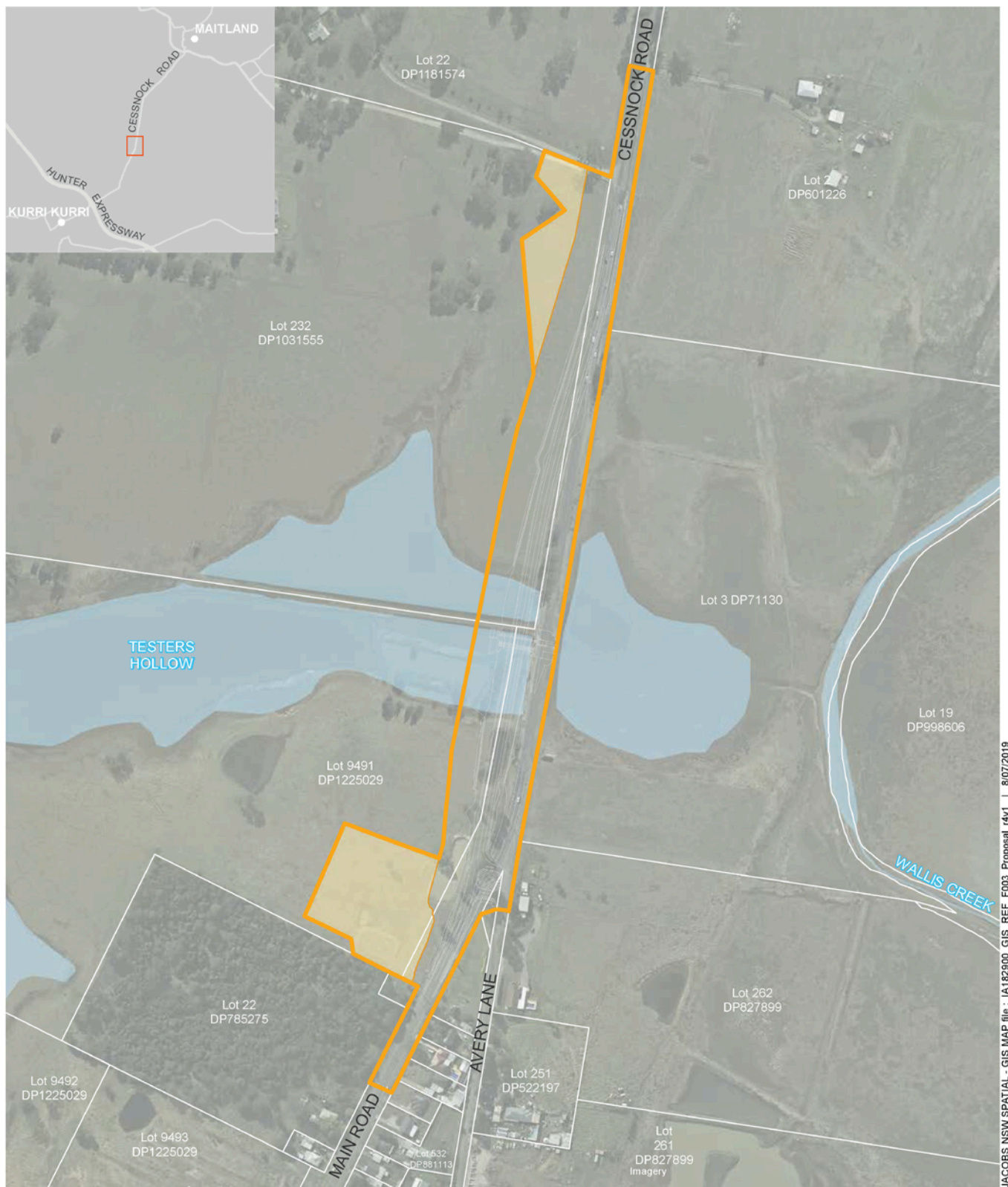


Figure 1.1 Location of the proposal



JACOBS NSW SPATIAL - GIS MAP file : IA182900_GIS_REF_F003_Proposal_4v1 | 8/07/2019

Legend

- Proposal area
- Potential ancillary site
- Waterbody
- Design

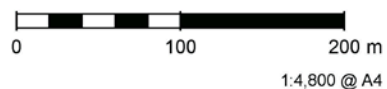


Figure 1.2 The proposal

1.2 Purpose of the report

This 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 has been carried out in the context of clause 228 of the Environmental Planning and Assessment Regulation 2000, the factors in *Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979* (Is an EIS required? guidelines) (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, the REF helps to fulfil the requirements of section 5.5 of the EP&A Act including that Roads and Maritime examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Public Spaces (formerly 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
- The significance of any impact on nationally listed biodiversity matters under the EPBC Act, including whether there is a real possibility that the activity may threaten long-term survival of these matters, and whether offsets are required and able to be secured.

The potential for the proposal to significantly impact any other matters of national environmental significance or Commonwealth land and the need to make a referral to the Australian Government Department of the Environment 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 various options considered and the selection of the preferred option for the proposal.

2.1 Strategic need for the proposal

2.1.1 Need for the proposal

Cessnock Road provides an important connection between the New England Highway and the Hunter Expressway. In doing so, Cessnock Road provides access to jobs, schools and services for the people of Maitland, Heddon Greta, Kurri Kurri and surrounding communities.

Cessnock Road at Testers Hollow is affected by flooding and is overtopped by flood waters during events equivalent to, and in excess of, 20 per cent AEP flood events. Testers Hollow has flooded on at least six occasions, requiring road closures of between two and 17 days between 2007 and 2017. During the April 2015 flooding event, Cessnock Road at Testers Hollow was closed for a period of 17 days due to flooding and damage to the road. This flood event also forced the closure of Cessnock Road at Fishery Creek (about five kilometres north of Testers Hollow) and resulted in isolating the suburb of Gillieston Heights for a period of five days. These flood events highlight the need to upgrade Cessnock Road at Testers Hollow to provide increased flood immunity and reduce flood-related maintenance costs.

Road closures caused by flooding place economic and social costs on the local community and Roads and Maritime. The main costs include:

- Trip diversion costs: Commuters and freight road users are forced to take diversions. This results in increased travel times, increased vehicle operating costs and increased congestion for users of alternative routes. During closures traffic can be diverted around Wentworth Swamp which adds a further 15 minutes on to the trip between Kurri Kurri and Maitland or via Buchanan Road and Mount Vincent Road (an additional eight minutes between Kurri Kurri and Maitland)
- Loss of economic output/income: Loss of connectivity (in particular when suburbs are inundated) results in a loss in industry output and income loss as workers are unable to reach work
- High maintenance and traffic management costs: Flooding of roads leads to major damage to road surfaces and pavements. Roads and Maritime is required to conduct repair and rehabilitation works on Cessnock Road more frequently than roads that are elevated and/or those that lie on a floodplain
- Delays to emergency services: Reduced access to Gillieston Heights and Cliftleigh may result in more costly emergency medical evacuations during certain flood events.

The proposal has been developed to reduce the frequency, duration and impact of flood events along Cessnock Road at Testers Hollow.

2.1.2 Strategic planning and policy framework

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

NSW State Plan 2021: The Plan to 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. This plan places emphasis on investing in and delivering an efficient and effective transport system including road infrastructure that would relieve congestion, improve safety and expand capacity on road corridors.

The proposal would support the goal of investing in critical infrastructure (goal 19) by improving the quality of a rural state road, while supporting local and regional access.

State Infrastructure Strategy

Infrastructure NSW (INSW) is tasked by the NSW Premier to provide independent advice to the NSW Government on the highest infrastructure priorities of the state. This advice is provided through the State Infrastructure Strategy.

The *2012 State Infrastructure Strategy* (Infrastructure NSW, 2012) and 2014 update (Infrastructure NSW, 2014) both emphasise the need to ensure a competitive and connected regional economy, one aspect of which is the need to improve connections between regional centres. By improving flood immunity at Testers Hollow, the proposal would improve connectivity between Kurri Kurri, Maitland and nearby local centres during flooding events. The proposal would therefore be consistent with the aim of a competitive and connected regional economy.

Building Momentum State Infrastructure Strategy 2018-2038 (Infrastructure NSW, 2018) provides the NSW Government with advice about infrastructure policy and investment priorities designed to boost the State's economic prosperity and global competitiveness. It identifies policies and strategies needed to provide the infrastructure that meets the needs of a growing population and a growing economy. This proposal supports the strategic objective of developing and protecting freight and service networks by improving road access to local markets. The proposal also supports the strategic objective of ensuring that existing and future infrastructure is resilient to natural hazards and human related threats by constructing a road that is more resilient to flooding events and associated flood damage.

NSW Long Term Transport Master Plan

The *NSW Long Term Transport Master Plan* (Transport for NSW, 2012) outlines a clear framework to address transport challenges in NSW to 2032. It integrates planning for roads, freight and all other modes of transport and sets out initiatives, solutions and actions to meet NSW transport challenges. The proposal is not specifically identified in this plan although it aligns with actions identified in the plan in that it supports and connects regional communities.

Hunter Regional Transport Plan

The *Hunter Regional Transport Plan* (Transport for NSW, 2014) supports the *NSW Long Term Transport Master Plan* by addressing local transport needs and priorities that are specific to the Hunter Region. The plan includes an action to manage demand and deliver arterial upgrades. Cessnock Road between Kurri Kurri and Maitland is identified in the plan as a potential future improvement.

Hunter Regional Plan 2036

The *Hunter Regional Plan 2036* (Department of Planning and Environment NSW, 2016) was released in October 2016 by the former NSW Department of Planning and Environment (now Department of Planning, Industry and Environment) and is the State Government's 20 year blueprint for the Hunter. The plan's vision is to create a leading regional economy in Australia with a vibrant metropolitan city at its heart. The plan proposes delivery of the vision through the following goals:

- Goal 1 – The leading regional economy in Australia
- Goal 2 – A biodiversity rich natural environment
- Goal 3 – Thriving communities
- Goal 4 – Greater land choice and jobs.

Under these goals, the plan develops 27 directions and associated actions. The most relevant to the proposal is Goal 4 *Direction 26 – Deliver infrastructure to support growth and communities*. The proposal would also support Goal 4 *Direction 16 – Increase resilience to hazards and climate change*.

Flood Risk Management Policy 2017

Cessnock City Council's *Flood Risk Management Policy 2017* guides council decision making for flood risk management. Objectives of the policy are to:

- Consider flood risk in the planning and development process early
- Use the most up to date and accurate flood information in decision making, collect flood information on an ongoing basis and provide flood information to the community in a timely manner
- Appropriately manage the use and development of flood prone land and manage flood risk in the LGA.

The proposal is consistent with the policy. It would reduce the impact of flooding and flood risk in the proposal area.

Cessnock 2027 Community Strategic Plan

The *Cessnock 2027 Community Strategic Plan* (Cessnock City Council, 2017) outlines the community's main priorities and aspirations for the future and identifies strategies for achieving these goals. The plan is structured around five themes, which were identified by the community as the desired outcomes for the LGA. Themes relevant to the proposal include:

- A connected, safe and creative community, which relates to community wellbeing, connectedness and safety. Ensuring roads are safe for motorists and pedestrians is a key direction for this theme
- A sustainable and prosperous economy, which identifies among other things, the need to attract a diverse range of businesses, industries and services. Strategic directions include ensuring the LGA is attractive to and supportive of businesses, the LGA is attractive to visitors, and has employment opportunities
- Accessible infrastructure, services and facilities, which identifies the need for local, state and federal infrastructure, services and facilities to support current and future communities. Better transport links and improving the road network are key objectives, with a quality road network, a key direction for this theme.

The proposal would improve the road network and road safety within the Cessnock LGA by reducing closure frequency due to flooding and improving access reliability along Cessnock Road during flooding events. This would support improved access for residents, visitors and freight to local and regional communities.

Maitland +10 Community Strategic Plan

The *Maitland +10 Community Strategic Plan* (Maitland City Council, 2018) sets a number of outcomes for the future of Maitland. The plan identifies a number of themes, which drive the actions associated with the plan. The themes relevant to the proposal include:

- Built space, which aims to ensure among other things, infrastructure that is well planned, integrated and timely, meeting the needs of current and future communities, and ensuring that residents are able to move around the city safely and easily. Actions to achieve this theme include ensuring that all levels of government work in partnership to plan and deliver roads at the right time and capacity needed to support growth, while ensuring that roads contribute to connected and efficient movement
- A prosperous and vibrant city, which aims to ensure Maitland is a desirable place to live, easy place to work, welcoming place to visit and wise place to invest. Ensuring services and infrastructure are available to generate business investment and growth is identified as an action to support this theme.

Improved flood immunity of Cessnock Road would support improved and more reliable access, making access more efficient for residents of the Maitland LGA.

2.2 Existing infrastructure

Road infrastructure

MR195 Cessnock Road (also known as Main Road) extends between Heddon Greta and Maitland, via Cliftleigh and Gillieston Heights. Within the proposal area Cessnock Road is sealed to a width of 7.5 metres. It has two lanes, with one lane in each direction, and a posted speed limit of 80 kilometres per hour which reduces to 60 kilometres per hour north of the Avery Lane intersection.

Cessnock Road is located on an embankment of about 4.6 metres AHD at its lowest point. The steepest portion of the embankment is protected by a guard rail at part of the western side of the road, while the eastern side has a gentler slope and has guard rails on the section of road over Testers Hollow. The road does not have any sealed shoulders, cycling or pedestrian facilities. The existing road is shown in **Photo 2-1** and **Photo 2-2**.

Cessnock Road requires road maintenance due to flood damage, including repairs to the pavement, guard rails and the embankment.



Photo 2-2 Cessnock Road looking north towards Gillieston Heights



Photo 2-1 Cessnock Road looking south towards Cliftleigh

Intersections and property access

Cessnock Road in the proposal area has one streetlight on the western side of the road, at a combined intersection and U-turn bay at Avery Lane to the south (refer to **Photo 2-3**). This intersection has unrestricted right and left turn access onto Cessnock Road.

Property accesses are located at the northern and southern ends of the proposal. Access to a Hunter Water pump station is located on the western side of the road at the southern end of the proposal. Two private property accesses from the U-turn bay on Avery Lane connect the adjoining farms.



Photo 2-3 Cessnock Road intersection and U-turn bay at Avery Lane (source Google Earth Pro)

Drainage

Within the proposal area one 1200 millimetre diameter precast concrete pipe crosses under Cessnock Road providing hydrologic connectivity for Testers Hollow (refer to **Photo 2-4**). The pipe is in poor condition, with old, chipping and flaking concrete (concrete spalling).



Photo 2-4 Single precast concrete pipe under Cessnock Road

Utilities

A number of utilities are located within and around the proposal area (refer to **Appendix A**). These include:

- Gas:
 - Jemena Gas 150 millimetre steel secondary main running parallel to and east of Cessnock Road
 - Jemena Gas 110 millimetre nylon network main in a six inch (about 150 millimetre) cast iron main parallel west of Cessnock Road south of Avery Lane, and parallel to and east of Cessnock Road north of Avery Lane.
- Electricity:
 - Ausgrid low voltage overhead electrical lines to the west of Cessnock Road south of Avery Lane
 - High voltage overhead electrical lines east of Cessnock Road north of Avery Lane.

- Water and sewer infrastructure
 - Hunter Water 100 millimetre ductile iron cement lined (DICL) rising sewer main parallel to the west and east sides of Cessnock Road south of Avery Lane
 - Hunter Water 200 millimetre unplasticised polyvinyl chloride (UPVC) water main parallel to and east of Cessnock Road, and parallel to and west of Cessnock Road north of the Testers Hollow pipe.
- Telecommunications
 - Telstra/National Broadband Network (NBN) P100 copper telecommunications cable located parallel to the east of Cessnock Road and south of Avery Lane
 - Telstra/National Broadband Network (NBN) P50 copper telecommunications cable from the P100 copper telecommunications cable under Avery Lane
 - Telstra/NBN two P100 optic fibre cables parallel to and west of Cessnock Road.

2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives

The objectives of the proposal:

- Provide increased flood immunity along Cessnock Road between Gillieston Heights and Cliftleigh
- Minimise the cost of project construction, operation and maintenance
- Minimise impact to the community and environment.

2.3.2 Development criteria

The development criteria for the proposal are to:

- Increase the road level to a height equal to or above a five per cent AEP flood event
- Maintain operational posted speed limit in the proposal area.

2.4 Alternatives and options considered

After confirming the proposal need and objectives, three route options and three design options were considered to address issues associated with Cessnock Road's low flood immunity at Testers Hollow.

Figure 2.2 illustrates the general process that was followed to identify the preferred option. **Sections 2.4.1 to 2.4.3** discuss the option identification, analysis and selection process in further detail. A 'do nothing' option has also been assessed as part of the REF in **Section 2.4.3**.

2.4.1 Methodology for selection of preferred option

Route selection

Roads and Maritime carried out a route option study in February 2018 to consider various routes for the proposed upgrade on Cessnock Road. Three routes were considered for the proposed road upgrade. These consisted of a new road to the west of the current road, a new road to the east of the current road and utilising the existing road.

The three routes are discussed in **Section 2.4.2**. The route selection process is shown in **Figure 2.2**.

Considerations in selecting a route for the proposed road upgrade included:

- Property acquisition and property impacts
- Traffic impacts
- Road safety
- Public utility impacts
- Physical constraints
- Environmental impacts
- Geotechnical risks
- Constructability
- Cost.

Design options

Following the selection of a preferred route, three design options were considered. The design options are roads of different heights. The options provide different levels of flood immunity improvement for Cessnock Road at Testers Hollow. The options are discussed in **Section 2.4.2**. The option selection process is shown in **Figure 2.2**.

A value management workshop (VMW) was held in May 2018. The workshop considered the design options and their performance against the proposal objectives (refer to **Section 2.3.1**), and proposal constraints. Considerations included:

- Improving flood immunity
- Reducing road maintenance costs
- Minimising impact to the environment
- Cost and available funding.

The VMW was attended by representatives from Cessnock City Council and Maitland City Council, Roads and Maritime representatives and Jacobs engineering and environmental representatives. The workshop recommended a preferred design option for design development (discussed further in **Section 2.4.3**).

2.4.2 Identified options

Three routes were considered for the proposed upgrade. These included:

- Eastern Route
- Western Route
- Existing Route.

The Western Route was selected as the preferred route. Three design options and alternate design option were considered for the Western Route. They comprised:

- Option 1 – five per cent AEP
- Option 1b – a sub option of Option 1, between five per cent AEP and two per cent AEP
- Option 2 – two per cent AEP
- Option 3 – one per cent AEP.

The following section describes the route and design options in more detail. As part of this REF a 'do nothing' option has also been assessed.

Route options

Three routes were considered and are described below.

Eastern Route

The Eastern Route (refer to **Appendix B**) leaves the existing road at the intersection with Avery Lane. It travels north in a gentle curve on the eastern side of the existing road for about 300 metres before connecting back into the existing road.

Western Route

The Western Route (refer to **Appendix B**) leaves the existing road at the southern approach of the proposal with an 800 metre radius curve, about 150 metres south of the existing intersection with Avery Lane. This option would be to the west, parallel with the existing road, for about 300 metres before connecting back into the existing road at the northern end of the proposal.

Existing Route

This route would involve constructing a new road on the current road two metres above the existing road level.

Design options

The design options considered are discussed in further detail below.

Option 1 – five per cent AEP

This option would involve a proposed road 1.5 metres above the existing height of Cessnock Road.

Option 1b – a sub option of Option 1, between five per cent AEP and two per cent AEP

This option would involve a proposed road 2.2 metres above the existing height of Cessnock Road.

Option 2 – two percent AEP

This option would involve a proposed road 3.2 metres above the existing height of Cessnock Road.

Option 3 – one per cent AEP

This option would involve a proposed road 5.2 metres above the existing height of Cessnock Road.

Heights of Option 1, Option 2 and Option 3 relative to the existing road are shown on **Figure 2.1**.

Do nothing

The 'do nothing' option would involve no change to Cessnock Road at Testers Hollow. During a flood event, Cessnock Road at Testers Hollow would continue to be closed and vehicles would be required to detour via Buchanan Road and Mount Vincent Road. During flood events, distances travelled and travel times would continue to create a negative traffic impact on the surrounding road network. Following flood events, maintenance and repair requirements would remain high due to damage caused by flooding.

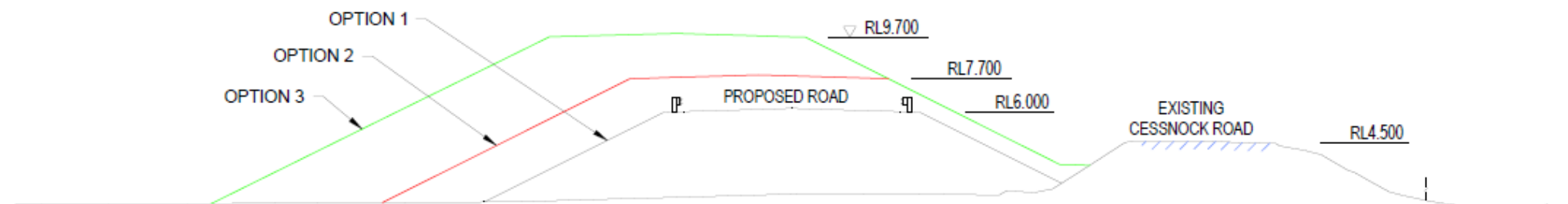


Figure 2.1 Typical cross section of design level options

2.4.3 Analysis of options

Route options

The *Traffic and Transportation Assessment* (Jacobs, 2018a) found that the detour during a flood event can be twice the distance when compared to the normal travel route along Cessnock Road.

Eastern Route

The Eastern Route would result in higher construction cost due to utility impacts. This route would require protection and relocation of the existing water main located to the east of Cessnock Road for the length of the proposal. Existing above ground electricity lines and power poles extend for the length of the proposal. They would also need to be relocated as a result of this option.

The Eastern Route is the second best option for constructability and traffic staging purposes. The route allows for the new road to be built completely separate from the existing road and away from live traffic (offline). The tie in at the northern end is simplistic as the level difference between the proposed and existing road is similar.

There are complex issues associated around the southern tie in to the Avery Lane intersection. Level differences of up to 1.5 metres between the Existing Route and the tie in would require some temporary traffic staging. The temporary works may have impacts on additional public utilities and/or the intersection with Avery Lane, thus making this option undesirable.

Western Route (preferred)

The Western Route is the best case scenario for constructability and traffic staging purposes. The route allows for the new road to be built completely offline, allowing traffic to remain on the existing road during construction. The tie ins at each end are also simplistic due to the similar level differences between the proposed and existing surfaces.

The Western Route has reduced risks, utility and traffic impacts compared with Option 1 and 3.

Existing Route

Keeping the Existing Route along Cessnock Road was considered and ruled out due to constructability issues and traffic disruption during construction. This option would require the existing road to be raised by more than two metres above the existing road level. The difference in level would result in the need of an extended period of detour or a temporary side track to be constructed to maintain traffic flow during construction.

The construction of a temporary side track has risks associated with unknown geotechnical conditions, private property leasing, and public utility relocation.

The existing road formation is too narrow to accommodate wider lanes, shoulders and verges. Additional widening would be required on one or both sides of the existing road if the Existing Route was utilised. Soft soils in and around Testers Hollow may lead to an increased risk of differential settlement along the proposal when widening next to the existing embankment.

Table 2.1 provides a comparison of the three routes against identified constraints.

Table 2.1 Comparison of route options

Constraints	Western Route	Eastern Route	Existing Route
Property acquisition required	Yes	Yes	Potential for limited acquisition on both sides of the existing road to allow for wider embankment. Lease agreements for temporary side track and construction.
Traffic during construction	Limited (at tie ins).	Limited (at tie ins).	Detour or traffic required to use temporary side track.
Road safety	Improved safety with: <ul style="list-style-type: none"> Increased road formation width Improvement to the Avery Lane intersection. 	Improved safety with: <ul style="list-style-type: none"> Increased road formation width. 	Potential for temporary reduction in road safety during use of side track.
Public utilities	<ul style="list-style-type: none"> Impacts to Telstra, NBN co. optic fibre (communications) Minor impact to Jemena (gas) Minor impact to Ausgrid (street lighting and associated power). 	<ul style="list-style-type: none"> Impacts to Telstra - telephone (communications) Impacts to Jemena (gas) Impacts to Hunter Water (water) Impacts to Ausgrid (overhead electricity). 	<ul style="list-style-type: none"> Potential minor impacts to Jemena (gas) Potential minor impacts to Telstra (communications) Potential impacts to Hunter Water (water).
Physical constraints	Existing large dams within private property.	Existing intersection with Avery Lane.	Existing road.
Geotechnical	Poor ground conditions, creating a medium constraint to construction.	Poor ground conditions creating a medium to high constraint to construction.	Road widening would still be required in poor soil conditions.
Constructability	Allows construction of new road. Traffic remains on existing road during construction, with simple tie in arrangements.	Allows greenfield construction of new road. Traffic remains on existing road, with complex tie in arrangements.	Requirement to either build a temporary side track for existing traffic or close the road while under construction. Potential for increased construction complexity and cost associated with variable material geotechnical properties in the existing road formation.

The preferred route option, Western Route, was selected as it:

- Meets all of the proposal objectives
- Is the lowest cost, or close to the lowest (providing best value for money)
- Has the least impact on utilities including water, gas and above ground electricity
- Has superior constructability and safety in design characteristics
- Has the least, or near the least, road user delays during construction.

The Western Route has reduced cost and time risks, utility and traffic impacts compared with the Eastern Route or using the Existing Route. The Western Route provides a far superior result than the 'do nothing' option.

Design options

The following section summarises the advantages and disadvantages for each design option.

Do nothing

This option involves the continued use and maintenance of the existing Cessnock Road at Testers Hollow with no funding allocated for upgrading the flood immunity of the existing road. Under this option:

- The current flood immunity of Cessnock Road would not be increased
- The Gillieston Heights community would continue to be at risk of inundation during future flood events on Cessnock Road
- Accessibility to Gillieston Heights would continue to be limited in flood events
- Increased maintenance costs to address flooding damage to the road, embankments and road infrastructure would continue.

This option would not meet the proposal objectives outlined in **Section 2.3.1** and does not present a solution to the strategic need. On this basis, the do nothing option was rejected.

Option 1 – five per cent AEP

This option involves raising the road level to provide five per cent AEP flood immunity or to a relative level (RL) of 6.0 metres (refer to **Figure 3.2**).

Advantages:

- Smaller footprint reduces potential environmental and heritage impacts
- Maintains access to local land owner driveways and into Avery Lane
- Minimises land acquisition requirements
- Allows flexibility, safe/easier staging during the construction phase
- Could be delivered within the project funding constraints
- Improves accessibility to Gillieston Heights in flood events
- Provides flood immunity up to the five per cent AEP flood event.

Disadvantages:

- Does not cater for flood events above the five per cent AEP.

Option 1b – between five AEP and two AEP

An alternate Option 1b was identified as a sub option of Option 1. Option 1b would have a flood immunity between Option 1 and Option 2. It would be at a flood immunity level higher than the five per cent AEP at RL of 6.8 meters, but less than two per cent AEP of Option 2.

Advantages:

- Provides flood immunity between five per cent and two per cent AEP floods (exact immunity unknown).

Disadvantages:

- Greater cost in comparison to Option 1
- Larger footprint than Option 1 potentially increases environmental and heritage impacts.

Option 2 – two per cent AEP

This option involves raising the road level to provide a two per cent AEP flood immunity. The road level would be raised in height to RL 7.7 metres (refer to **Figure 3.2**).

Advantages:

- Provides flood immunity in a two per cent AEP flood event.

Disadvantages (as compared to Option 1):

- Larger footprint potentially increases environmental and heritage impacts
- Increased footprint increases costs associated with soft soils and treatments
- Greater land acquisition requirements
- Increased earthwork volumes
- Poorer constructability at the northern tie in.

Option 3 – one per cent AEP

This option involves raising the road level to provide a one per cent AEP flood immunity. The road level would be raised in height to RL 9.7 metres (refer to **Figure 3.2**).

Advantages:

- Provides flood immunity in a one per cent AEP flood event.

Disadvantages (as compared to other options):

- Large footprint potentially increases environmental and heritage impacts
- Large footprint increases cost associated with soft soils and treatments
- Greater land acquisition requirements
- Increased earthwork volume due to large footprint
- Poor constructability at the northern tie in.

Although Option 1b, 2 and Option 3 provide improved flood immunity they result in substantially greater financial costs that exceed the project funding constraints. Therefore, Option 1b, Option 2 and Option 3 were rejected by the VMW.

Option assessment

Option 1 was adopted as it provides the greatest flood immunity possible with the available funding. It is the easiest option to build, requires the least acquisition, and has the least environmental impact.

2.5 Preferred option

The preferred route option is the Western Route. The Western Route provides constructability, cost savings and minimises traffic disruption during construction over the Eastern Route and the Existing Route. The Western Route best meets the proposal objectives within the proposal constraints.

The preferred design option is Option 1 – five per cent AEP. This option is considered to offer the best value for money, offering a substantial reduction in the frequency and duration of inundation during flood events while limiting the environmental impacts associated with the new embankment.

Therefore, the preferred option is the Western Route with five per cent AEP design.

The preferred option meets the following objectives of ecological sustainable development by:

- Reducing environmental impact as a result of minimising its footprint (precautionary principle and conservation of biological and ecological diversity)
- Benefiting future generations by improving the flood immunity of Cessnock Road at Testers Hollow as opposed to the 'do nothing' option (intergenerational equity)
- Considering environmental and social issues in the option process and considering the value upon environmental resources (improved valuation, pricing and incentive mechanisms).

The process by which the preferred option was selected is illustrated in **Figure 2.2**.

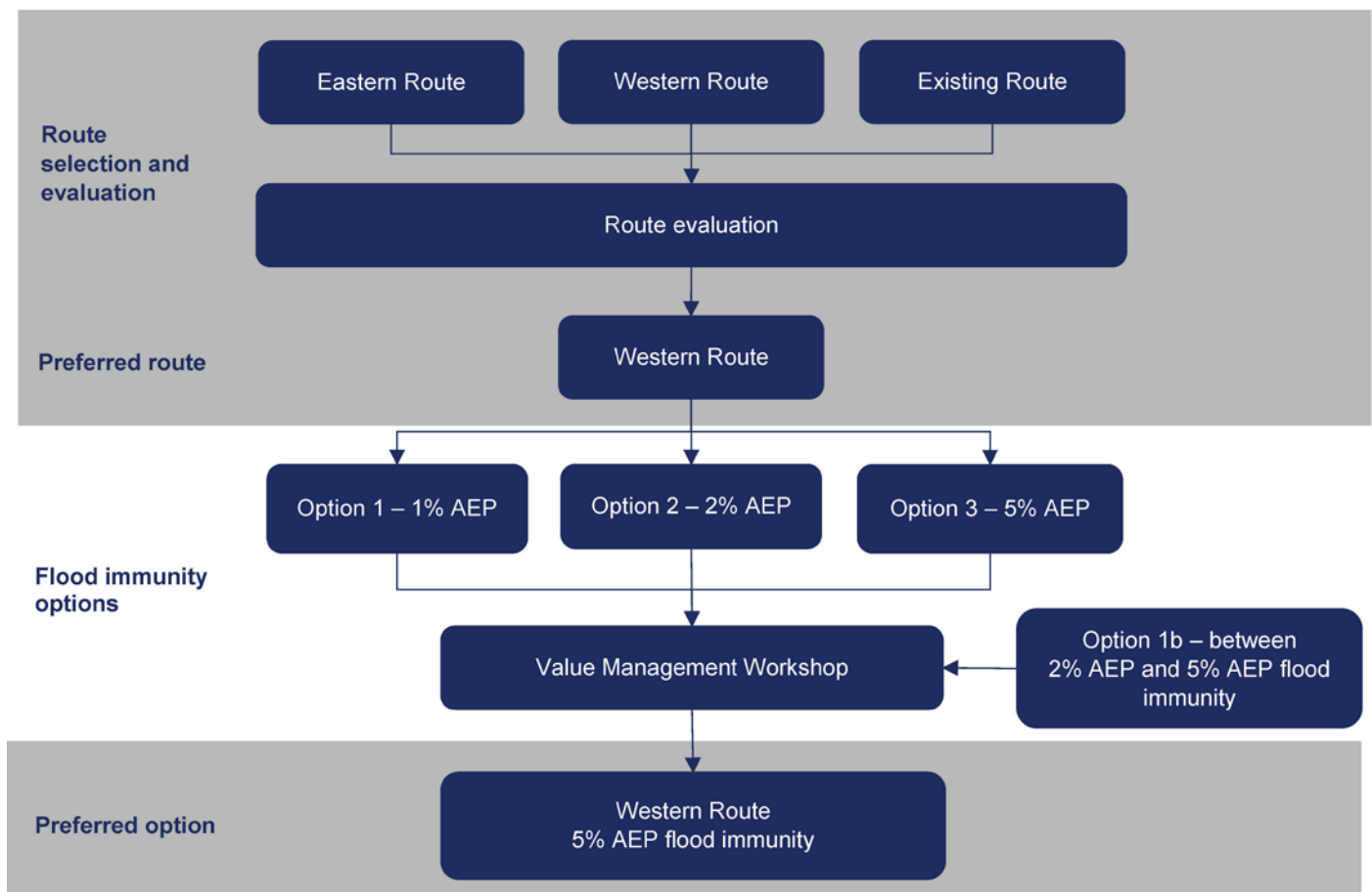


Figure 2.2 Process to identify the preferred option

2.6 Design refinements

Design refinements identified in design workshops to improve constructability and health and safety include:

- Moving the new road formation further west from the existing road formation to make the road safer and easier to construct
- Reducing the length of the project by reducing design speed and tightening curve at the southern tie in
- Adjusting the Avery Lane intersection by simplifying entry and exit arrangements.

Benefits of the design refinements include:

- Increased distance between construction and live traffic
- Increased area for plant, materials and site access between the proposal and Cessnock Road
- Reduced risk of destabilisation of shotcrete on the existing embankment
- Elimination of traffic control requirements during pipe work
- Improvement of Avery Lane design.

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.

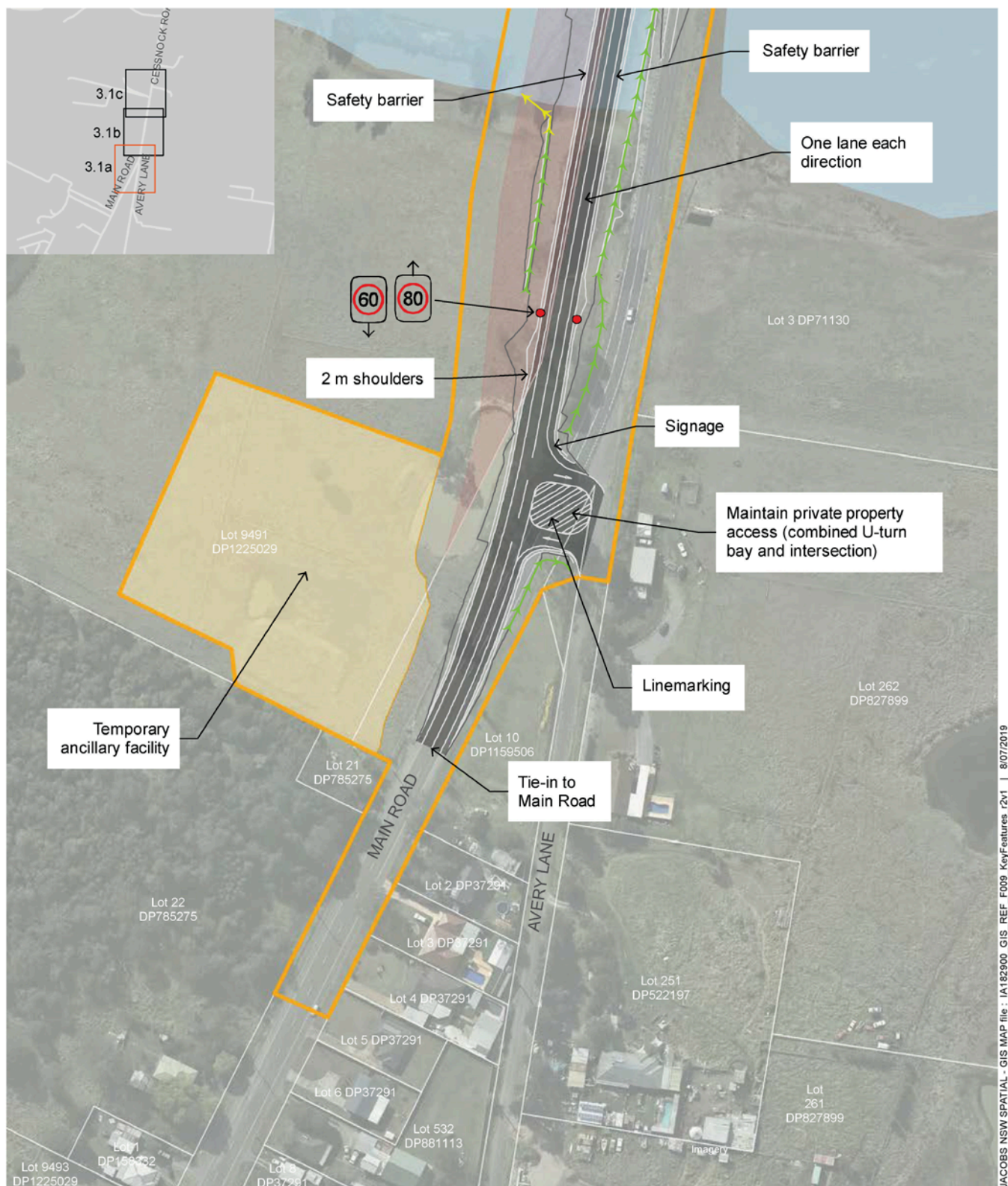
3.1 The proposal

Roads and Maritime Services proposes to upgrade MR195 Cessnock Road (also known as Main Road) at Testers Hollow, between Gillieston Heights and Cliftleigh. The proposal would raise the height of Cessnock Road at Testers Hollow to provide a more reliable connection during certain flood events. The proposal is located in the Cessnock Local Government Area (LGA), directly alongside the western boundary of Maitland LGA. The proposal is shown in **Figure 1.2**.

Key features of the proposal include:

- A new two lane 60 and 80 kilometre per hour road, one lane in each direction with two metre shoulders. It would be around 900 metres long between Gillieston Heights and Cliftleigh, built alongside the existing Cessnock Road
- The new road would be about 1.5 metres higher than the existing Cessnock Road, which would allow access in a five per cent AEP. AEP refers to the likelihood of a flood event occurring in any one year
- The new road would tie in with the existing road at the northern and southern extents
- Existing access arrangements would be maintained to private property and to the existing combined U-turn bay and intersection at Avery Lane
- New drainage to allow water to pass freely under the new road
- Utility and street light relocations
- Partial property acquisitions
- Ancillary works including drainage works, safety barriers, signs, linemarking, landscaping and environmental protection works
- Temporary ancillary facilities including site compounds and stockpile sites.

An overview of the proposal showing key features is shown in **Figure 3.1a** to **Figure 3.1c**.



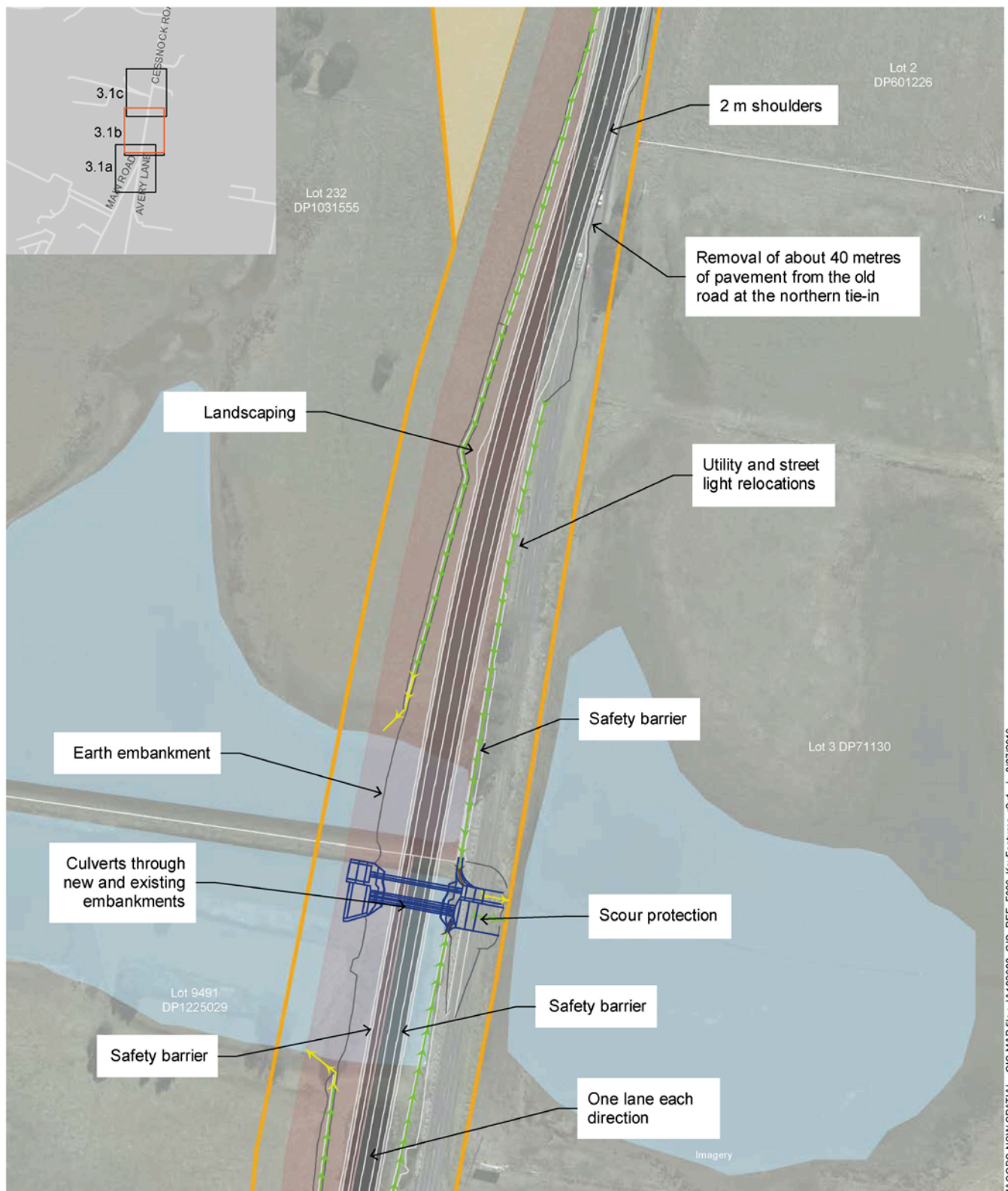
Legend

- | | | |
|--|--|--|
| Proposal area | Alignment pavement | → → → Drainage infrastructure |
| Potential ancillary site | Property acquisition | → → → Channel - grass |
| Design | Waterbody | → → → Channel - rock |
| Batter slope | | |

0 50 100 m
1:2,000 @ A4



Figure 3.1a Key features of the proposal



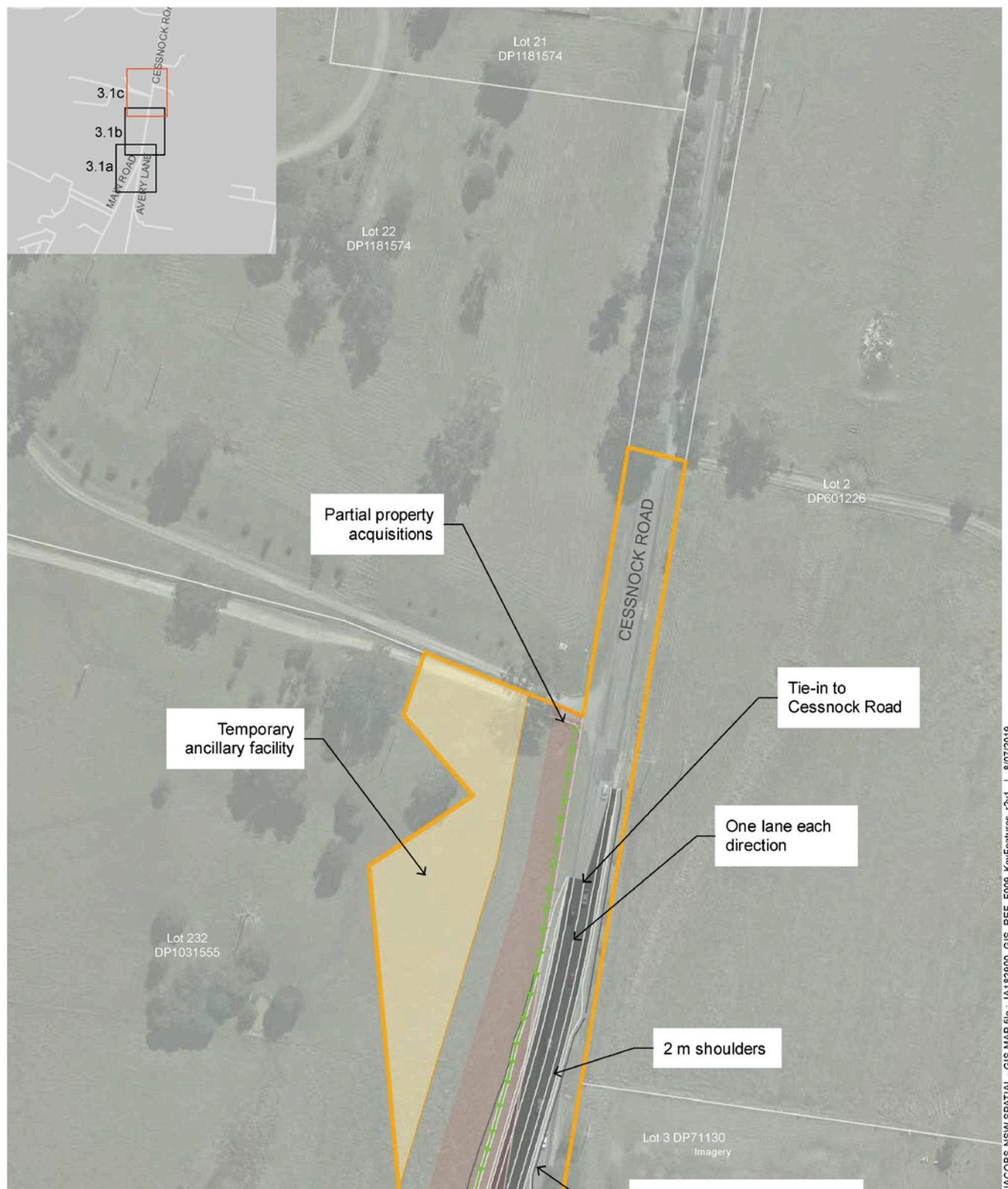
Legend

- | | | |
|---|--|--|
| Proposal area | Alignment pavement | —>—>—> Drainage infrastructure |
| Potential ancillary site | Property aquisition | —>—>—> Channel - concrete |
| Design | Waterbody | —>—>—> Channel - grass |
| Batter slope | | —>—>—> Channel - rock |
| | | — Culvert |

0 50 100 m
1:2,000 @ A4



Figure 3.1b Key features of the proposal



JACOBS NSW SPATIAL - GIS MAP file : IA182900_GIS_REF_F009_KeyFeatures_2v1 | 8/07/2019

Legend

- | | | | | | |
|--|--------------------------|---|----------------------|---|-------------------------|
|  | Proposal area |  | Alignment pavement |  | Drainage infrastructure |
|  | Potential ancillary site |  | Property acquisition |  | Channel - grass |
|  | Design | | | | |
|  | Batter slope | | | | |

Figure 3.1c Key features of the proposal

3.2 Design

The following sections provide a description of the design criteria, major design features and engineering constraints of the proposal.

3.2.1 Design criteria

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

- Austroads Guide to Road Design (Austroads, 2009) and Roads and Maritime supplements to the Austroads Guide
- Austroads Road Safety Audit Manual (Austroads, 2009)
- Roads and Maritime Road Design Guide (Roads and Maritime, undated)
- Roads and Maritime 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	Speed	Design speed: 90 km per hour and 70 km per hour Posted speed: 80 km per hour and 60 km per hour
	Design vehicle	Main road to main road: 25 m B-double Main road to secondary road: 19 m semi-trailer Main road to local road: 12.5 m unit truck
	Checking vehicle	Main road to main road: 30 m Super B-double Main road to secondary road: 25 m B-double Main road to local road: 19 m semi-trailer
	Widths	Lane widths: 3.5 m Auxiliary lane widths: 3.5 m Shoulder width: 2 m Verge: 1 m
	Road height	6 m AHD
	Batter slopes	Fill batter: 2:1 Cut batter: 2:1
	Pavement	20 year design life Tie ins: corrector and a 50 mm wearing course over existing pavement Rehabilitation/ tie ins: 250 mm asphalt over 300 mm of select material Full depth asphalt on new alignment: 250 mm asphalt over 300 mm select material over subgrade
	Flooding	Equal to the 5 % AEP flood event
	Safety barriers	Located on both sides of the road
Drainage	Channels and open drains	Minimum 20 % AEP

3.2.2 Engineering constraints

The main issues and constraints considered by the proposal include:

- Existing alignment: Tie ins to the existing road
- Access: Private property access along Cessnock Road in the proposal area and Avery Lane would need to be maintained during construction
- Utilities: Protection and/or relocation of utilities such as transmission lines, gas and water on the eastern side of the existing road and telecommunications on the western side of the existing road
- Flood levels: No change to flood levels upstream of the new section of road and embankment
- Soils: The poor engineering qualities of soils for road construction such as soft soils, and potentially acid sulfate soils (PASS) specifically settling requirements of soft soils under the weight of the new embankment
- Materials: Shortfall of on-site materials for embankment construction.

3.2.3 Major design features

The major design features include a new section of Cessnock Road on a raised embankment, an upgrade of the Avery Lane intersection and upgrade of drainage under Cessnock Road. They are described below.

Major design feature 1 – New section of road on raised embankment

The new section of Cessnock Road would be about 900 metres long and about 13 metres wide at the top of the embankment. The new road would be on a raised embankment about four metres above the existing ground level (at about six metres AHD) at its highest point about 1.8 metres higher than the existing road. A typical cross section of the new road next to the existing road is shown in **Figure 3.2**.

The speed limit on Cessnock Road is 60 kilometres per hour, increasing to 80 kilometres per hour about 60 metres north of the Avery Lane intersection (refer to **Figure 3.1a**).

The existing Cessnock Road would be closed to public use, but it would be retained for access to utilities and private properties. About 40 metres of road pavement would be removed from the northern tie in to avoid confusion between the old Cessnock Road and the new section of Cessnock Road. No change to the southern tie in has been proposed.

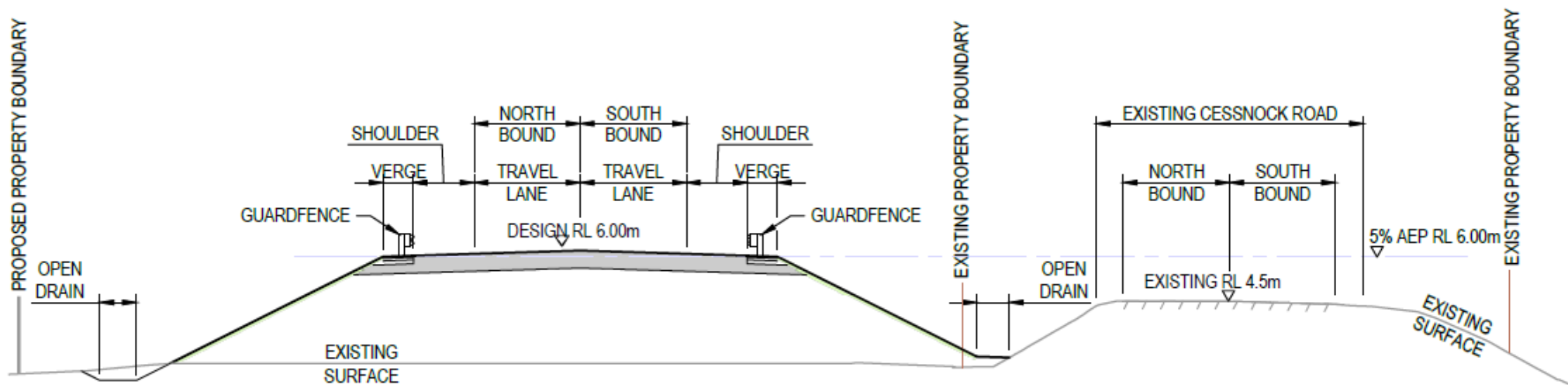


Figure 3.2 Typical cross section

Major design feature 2 – Upgrade of Avery Lane intersection and U-turn bay

The Cessnock Road and Avery Lane intersection would be upgraded, with the new intersection realigned at the Avery Lane approach about 40 metres to the south to form a T-junction with Cessnock Road. The U-turn functionality for service vehicles would be retained by providing a painted island to separate left-in and right-in vehicles from the left-out and right-out movements. Road shoulders on Cessnock Road at this point would be widened by about one metre to improve safety for vehicles turning left and right into the intersection. The proposed intersection upgrade is shown in **Figure 3.3**.

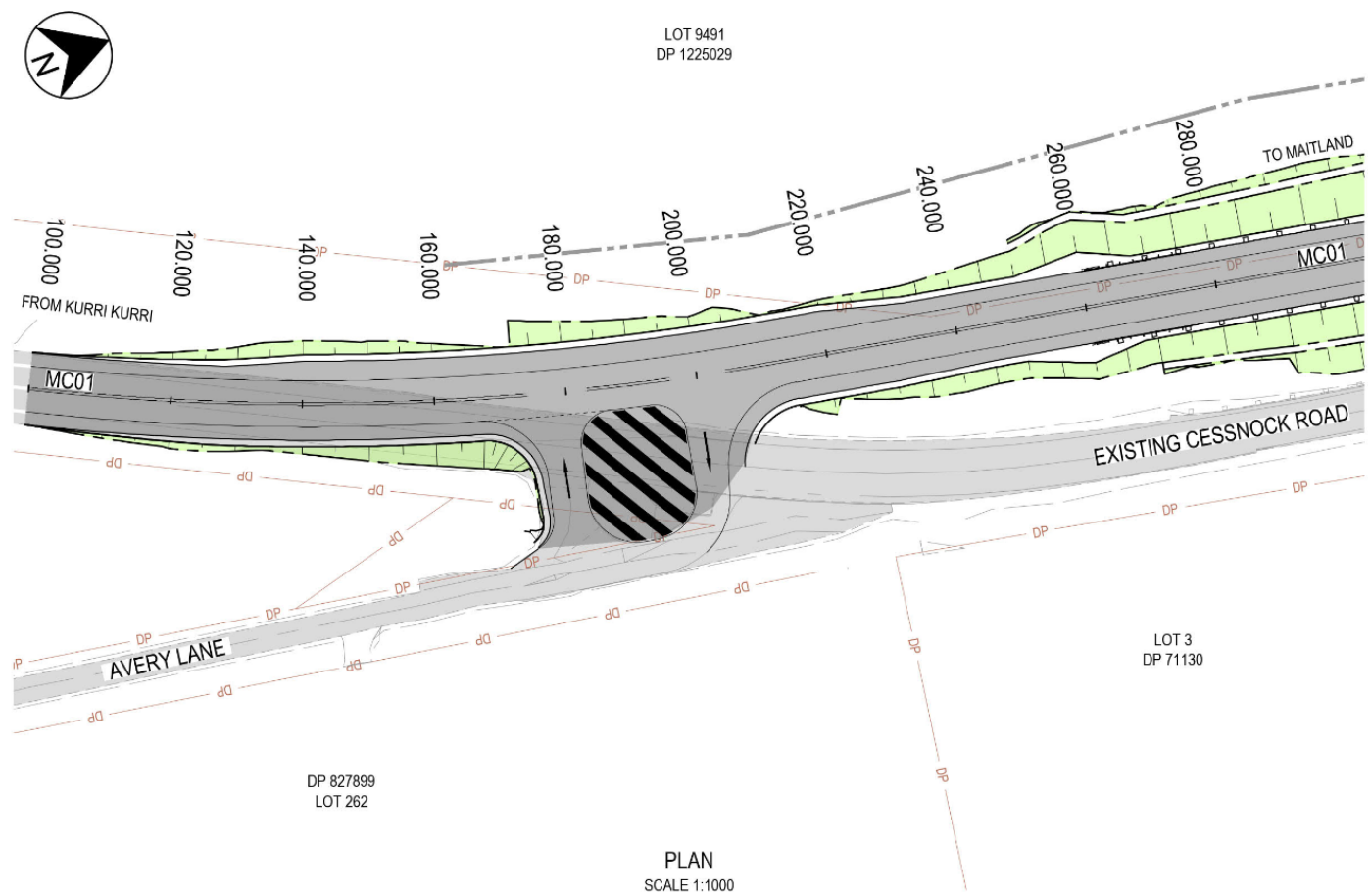


Figure 3.3 Cessnock Road and Avery Lane intersection upgrade

Major design feature 3 – Drainage works

The proposal would involve:

- Three new pipes at Testers Hollow, to replace the existing single pipe under Cessnock Road
- Removal of the existing pipe under Cessnock Road (as described in **Section 2.2**) and construction of a new open channel through the existing embankment
- New open drains along the new section of Cessnock Road to facilitate stormwater flows in the proposal area. These would comprise four vegetated drains to the east and west of the new length of Cessnock Road and two rock-lined drains on the west of Cessnock Road directing flow to existing ponds.

Three new 1500 millimetre diameter reinforced concrete pipes about 25 metres long would be constructed to provide east-west drainage and floodplain connectivity under Cessnock Road (refer to **Figure 3.4**). These pipes would increase capacity in flood events and reduce the likelihood of floodwaters overtopping Cessnock Road. These pipes would replace the existing 1200 millimetre pipe under Cessnock Road.

One of these 1500 millimetre pipes would be located directly to the west of the existing 1200 millimetre pipe under Cessnock Road (as described in **Section 2.2**). It would be about 25 metres long and would have

about six metres of rip rap scour protection upstream and about 15 metres of rip rap scour protection downstream. It would be located at a level similar to the existing pipe (RL 0.95) to maintain waterway connectivity through the embankment (refer to **Figure 3.4**).

The other two 1500 millimetre pipes would be about 23 metres long, located about eight metres south and west of the existing pipe and located about 60 centimetres higher than the single drainage pipe. These pipes would provide additional connectivity in the event of a flood.

The existing road embankment would be removed downstream of these pipes to maintain waterway and floodplain connectivity between Testers Hollow and Wallis Creek.

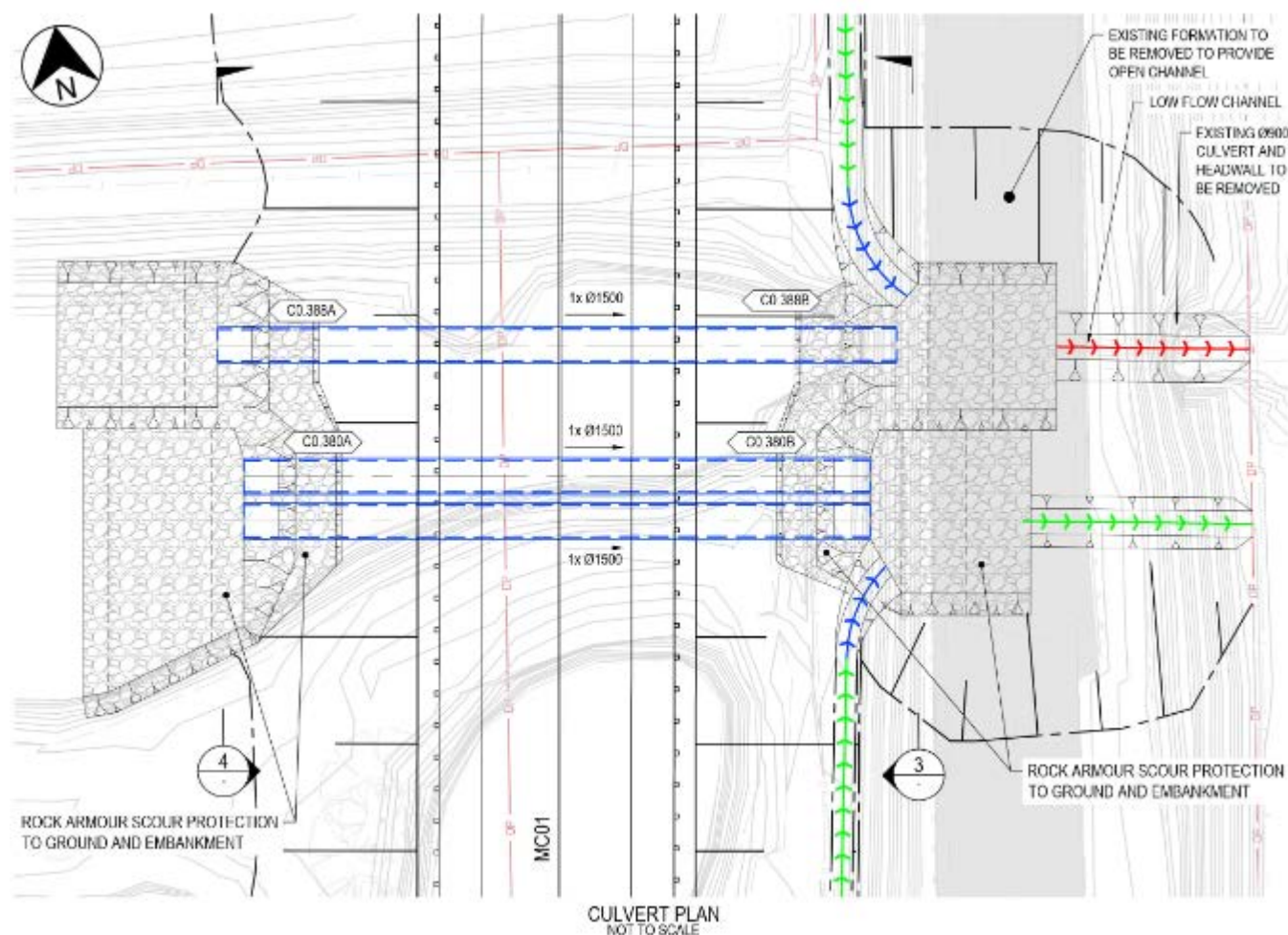


Figure 3.4 New pipes under Cessnock Road

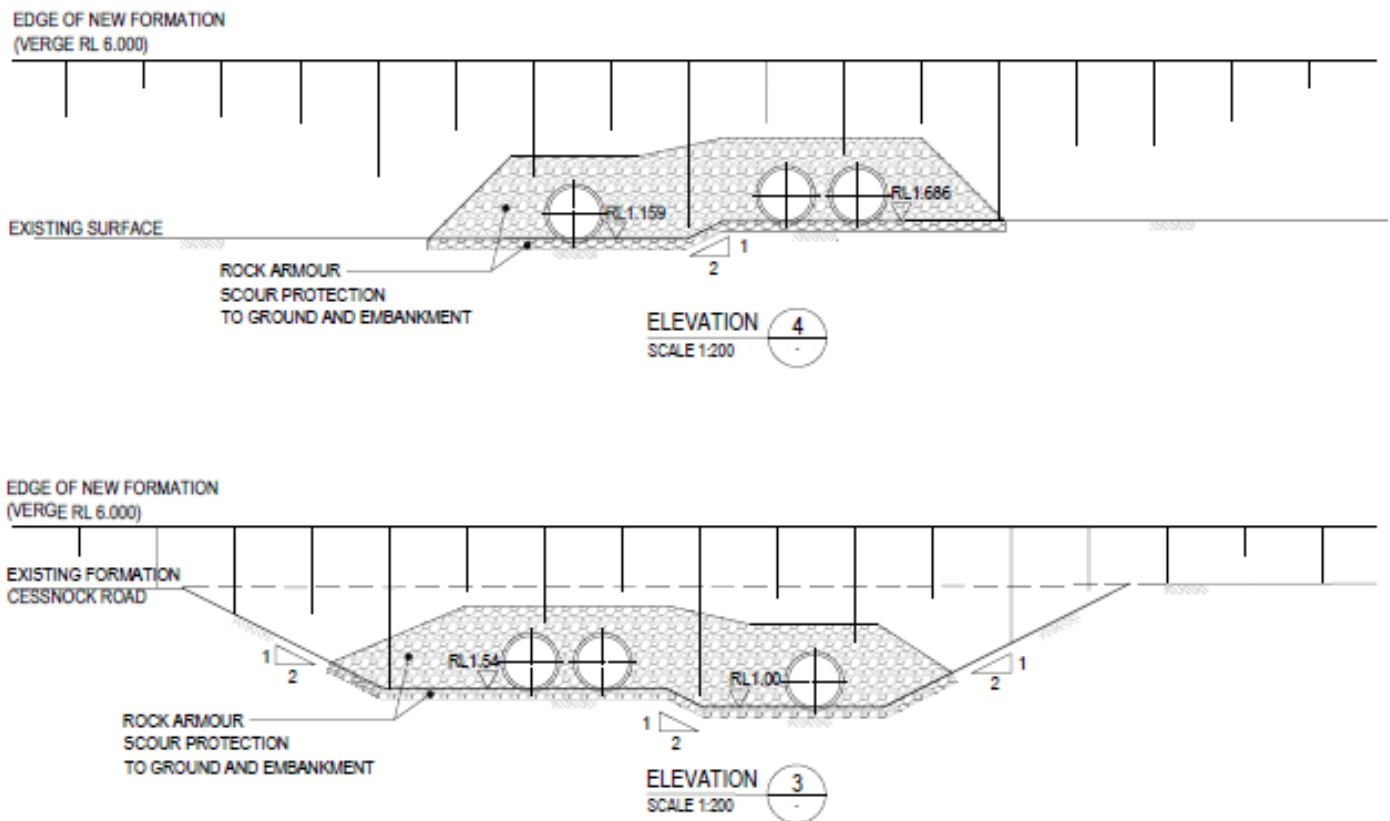


Figure 3.5 Typical drainage cross section

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 during pre-construction.

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

An 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) to ensure construction work is carried out to Roads and Maritime Services specifications. Detailed work methodologies would be identified by the construction contractor and would be refined to respond to engineering and environmental constraints relevant to the proposal area.

The proposal would be constructed using conventional methods used on other road projects. These methods may be modified or refined to respond to engineering and environmental constraints. The indicative construction phases and activities for the proposal are described in **Table 3.2**.

Table 3.2 Indicative construction phases and activities

Construction phase	Indicative activities
Site establishment	<ul style="list-style-type: none"> • Identify and mark sensitive areas as identified in this REF and the CEMP • Establish temporary fencing and exclusion zone fencing, and clear demarcation of clearing limits • Install temporary environmental controls including erosion, sediment and water quality controls • Install drainage infrastructure to divert clean water through the site before ground disturbance • Establish ancillary sites including main site compounds and stockpile areas • Transport plant and equipment to the sites • Property adjustment works (including adjustments to property accesses) • Install traffic management measures, such as safety barriers in accordance with the traffic control plan • Vegetation clearing and grubbing including tree removal where necessary • Relocate or protect utilities as required • Temporary road surface paving, signage and line markings at Avery Lane to accommodate turning construction vehicles.
Embankment and earthworks	<ul style="list-style-type: none"> • Establish temporary drainage to allow unobstructed flow through the existing pipe under Cessnock Road • Topsoil and fill existing ponds in the footprint of the embankment • Construct a bridging layer • Import fill for construction of a preload embankment about 120 m long, about the same width as the final embankment and about three m higher than the finished road level. The settlement period would depend on rates of settlement but could range from six to 12 months • Install wick drains within the preload embankment to accommodate displaced groundwater expelled from the expected settlement • Once settlement is complete, cut down preload embankment to build final formation along entire length • Import and compact select material layer • Replace topsoil and stabilise embankments • Cut small section into the side of a shallow slope at the southern end of proposal.
Drainage works	<ul style="list-style-type: none"> • Install three new pipes under Cessnock Road at Testers Hollow once preloading and settlement activities are complete • Remove the existing drainage pipe and cut channel through the existing Cessnock Road after traffic has been switched to the new section of Cessnock Road • Install scour protection measures upstream and downstream of new pipes.
Paving and finishing work	<ul style="list-style-type: none"> • Install traffic management controls • Install kerbs and gutters where required • Lay asphalt pavement and surfacing • Tie ins to the existing road surface • Replace topsoil and stabilise embankments • Carry out finishing work (this would include installation of safety barriers, fencing, line marking, signposting and road furniture) • Install new street lighting.
Post-construction activities	<ul style="list-style-type: none"> • Transport stockpiled waste and spoil to a licensed facility or suitable location • Rehabilitate ancillary sites • Remove plant and equipment from site

Construction phase	Indicative activities
	<ul style="list-style-type: none"> Remove construction environmental controls Reinstate the site, roadways and all property accesses.

The staging of construction would be sequenced so construction can be completed within the minimum possible timeframe.

3.3.2 Construction workforce, hours and duration

The construction workforce may fluctuate between 35 and 40 personnel, depending on the stage of construction and associated activities.

As discussed in **Section 1.1**, construction is expected to start in mid 2020 and take about two years to complete depending on preload settling times and wet weather. Working hours during the construction phase would be in accordance with *the Roads and Maritime Construction Noise and Vibration Guideline (2016)*:

- Monday – Friday: 7.00am – 6.00pm
- Saturday: 8.00am – 1.00pm
- Sunday and public holidays: No work.

To minimise disruption to traffic along Cessnock Road, some out of hours work would be required (night and weekends). Out of hours work would be carried out in accordance with the Construction Noise and Vibration Guideline (Roads and Maritime, 2016). Night works may be required for:

- Delivery of oversized plant or structures
- Emergency work to prevent to the loss of life or property or to prevent environmental harm
- Other work periods where there may be a justifiable need to operate outside of normal working hours may include:
 - Temporary night works at the northern and southern tie ins as part of pavement and line marking prior to diverting traffic to the new section of road. These night time works are essential to provide a safe working environment and to reduce traffic impacts
 - Utility relocation and installation works to provide safe work conditions
 - Other works on a case by case basis.

3.3.3 Plant and equipment

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

- | | |
|--|---|
| <ul style="list-style-type: none"> Air compressor Air powered scabbler Aggregate spreader truck Asphalt paver Backhoe Chainsaws Concrete vibrators Concrete agitator trucks Concrete pump Concrete saw | <ul style="list-style-type: none"> Hand held power tools Hydraulic vibrating hammer (either crane or rig mounted) Jackhammer - Air powered hand jack hammer Light vehicles and utility vehicles Loaders Pumps Road paver Rollers Soil stabiliser |
|--|---|

- Cranes
- Daymaker portable light
- Generators
- Grader
- Excavator
- Excavator with rock breaker attachment
- Sprinklers
- Temporary barriers
- Tipper trucks
- Under road boring machine
- Water cart
- Welder.

3.3.4 Earthworks

The majority of earthworks for the proposal would be associated with constructing embankments, particularly over the low point at Testers Hollow. Earthworks would involve about 24,000 cubic metres of fill and 1000 cubic metres of cut. These estimates may change depending on the actual quality of material, the depth to bedrock, and the suitability of the material for re-use in construction. The material not obtained from the construction site would be sourced from local areas where practicable. Earthwork quantities would be confirmed before construction.

Section 3.3.5 outlines estimated sources and material quantities required for the proposal and describes how surplus material and water use would be managed during construction.

3.3.5 Source and quantity of materials

Material proposed for construction includes:

- Earthwork materials (e.g. sand, gravel, topsoil, imported fill material, general fill, verge material, rocky fill) and selected material for road formation
- Bitumen and aggregates (e.g. stone, sand, gravel) for pavement production
- Cement and aggregates (e.g. 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 (pipes, pits and headwalls) and miscellaneous work
- Steel for barrier railings and reinforcement in concrete.

The indicative quantities of the main materials are listed in **Table 3.3**. Quantities of materials would be revised as the design develops.

Table 3.3 Indicative material quantities for construction

Material type	Indicative quantity
Asphalt	8,400 m ²
Select material	2,300 m ³
Imported fill	24,000 m ³

About 2,500 cubic metres of spoil is expected at the end of construction. Spoil would either be used for rehabilitation of the ancillary facilities, landscaping or taken to an appropriately licensed location.

The amount of water that would be required during construction is unknown at this stage as it 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 where available.

3.3.6 Traffic management and access

This section outlines the likely changes to traffic during construction. Impacts on traffic would be kept to a minimum through the management measures outlined in **Section 6.7.3**.

Construction vehicles

Construction would lead to a temporary increase in traffic on Cessnock Road. Heavy vehicle movements generated as part of construction are expected to peak at about 80 heavy vehicles and about 20 light vehicle movements per day. This increase is not considered significant in comparison to existing traffic volumes.

Construction vehicle movements are expected to peak during material delivery and during the main earthworks and civil construction with vehicles transporting equipment, materials and spoil, and construction workers accessing the proposal area. Construction traffic would mostly comprise of light vehicles and light and heavy trucks. Heavy vehicles would be used to deliver construction material and to transfer construction materials to ancillary sites.

The majority of light vehicle movements generated by construction workers would occur outside the traffic peak periods due to shift start and finish times (7:00am and 6:00pm). Delivery and heavy vehicle movements would generally occur within standard construction hours.

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 Cessnock Road would be in accordance with an approved Traffic Management Plan (TMP). Further safeguards and management measures for traffic and transport impacts are provided in **Section 6.7.3**.

As most of the required fill material would be sourced from outside the proposal area, truck haulage routes would be required between the proposal area and the sourced material. These routes would be detailed in the TMP and traffic impacts as a result of haulage during construction have been assessed in **Section 6.7**.

Traffic management, control and signage

Where possible, construction would be programmed to minimise impact on traffic using the local and regional road network.

Traffic management measures would be used to minimise impacts on traffic and ensure that traffic flow is maintained in the proposal area. These traffic management measures would be documented in the traffic management plan (TMP) that would be developed and carried out in accordance with Roads and Maritime's Traffic Control at Works Sites Manual and G10 Specification for Traffic Management. The TMP would include traffic control, temporary speed restrictions and temporary lane closures at tie in points and ancillary site access points. It would also detail traffic management measures, lane closures and temporary speed restrictions during pavement and line marking works and the management for oversized vehicles moving through the construction site and along Cessnock Road. A Road Occupancy Licence would be obtained before construction starts, as required.

Construction parking impacts would also be managed through measures identified in the TMP and CEMP. Further details on the management of vehicles during construction are provided in **Section 6.7**.

Access

Access to the construction site and ancillary sites would be via Cessnock Road from Gillieston Heights and Maitland in the north and via Main Road from Cliftleigh and Heddon Greta in the south.

A number of properties directly access Cessnock Road at the northern and southern ends of the proposal area. Access to affected properties would be maintained during construction and temporary property access would be provided where required. Access to Avery Lane would also be maintained during construction. Property access would be maintained by the construction contractor, detailed as part of the

final staging plan for the proposal and addressed in the proposal TMP which forms part of the CEMP (refer to **Section 6.7**). The consultation strategy for the proposal is outlined in **Chapter 5**.

3.4 Ancillary facilities

Construction would require up to two main ancillary sites. One ancillary site would be located on the southern end of the proposal and the other at the northern end with direct access onto Cessnock Road. Indicative locations of these ancillary sites are shown in **Figure 1.2**. Typically, the activities required at the ancillary facility areas may include 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
- Areas for the treatment of acid sulfate soils and drying of wet soils before reuse or disposal
- Truck water tank loading areas
- Temporary water quality controls
- Heavy vehicle turn around facilities
- Vegetation clearing may be required for the ancillary facility on the southern side.

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

- More than 40 metres from a watercourse and above the five per cent AEP flood level (refer to **Figure 6.4**)
- In previously disturbed areas that do not require the clearing of native vegetation
- Outside the drip line of trees and on level ground wherever possible.

Access to the ancillary sites would be established to enable heavy vehicle access and turning movements. The ancillary 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.

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 and approval is required.

Following construction, the ancillary sites, work areas and stockpiles would be removed, and the sites would be cleared of all rubbish and materials and rehabilitated to their existing condition or as otherwise agreed with the landowner on completion of works.

3.4.1 Water quality facilities

Construction of the proposal has the potential to affect water quality through erosion of exposed or disturbed areas and subsequent sedimentation of the watercourse. To mitigate this effect temporary water quality controls will be provided in accordance with the guidelines set out in the *Soils and Construction – Managing Urban Stormwater Volume 1* (Landcom, 2004) and Volume 2D (DECCW, 2008).

3.5 Public utility adjustment

The following utilities may require relocation, protection or adjustment within the proposal area:

- Electricity: Three Ausgrid power poles on the western side of Cessnock Road at the southern end of the proposal area and one Ausgrid street light on the western side of Cessnock Road near the intersection with Avery Lane
- Gas: A 110 millimetre nylon network main in a six inch (about 150 millimetre) cast iron main on the western side of Cessnock Road south of Avery Lane
- Telecommunications: Telstra/NBN fibre optic cables to the west and parallel to the proposal
- Water: Hunter Water 200 millimetre UPVC main located under Cessnock Road.

The utilities located on the eastern side of the Cessnock Road (as detailed in **Section 2.2**) would not be impacted by the proposal.

All utilities to be adjusted as part of the proposal are considered as part of this REF. Utility works with a similar impact to those discussed in the REF may extend outside of the proposal area.

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

3.6 Property acquisition

The proposal requires partial acquisition of private and publicly owned land as outlined in **Table 3.4** and shown in **Appendix C**.

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

Table 3.4 Property acquisition

Area ID	Description	Total area (m ²)	Acquisition type	Current owner	Lot and DP	Land use zone (LEP)
1	Partial acquisition of farm land on the western side of the proposed road	9,582	Partial acquisition	Private property	Lot 232 DP1031555	E2 RU2
2	Partial acquisition of vacant land on the western side of the proposed road	4,135	Partial acquisition	Cessnock City Council	Lot 9491 DP 1225029	RE1
Total acquisition (m²)		13,717				

During construction, additional land within each of these properties would also be temporarily leased for ancillary sites such as construction worksites and laydown areas. Following construction, land occupied by ancillary sites would not be required for the ongoing operation of the proposal and would be reinstated and returned to the landowner.

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 with consideration of clause 228 of the Environmental Planning and Assessment Regulation 2000 (summarised in **Appendix D**), 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 Public Spaces 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).

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 a road and 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 EP&A Act. Development consent from council is not required and therefore Roads and Maritime are the determining authority.

The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974* and does not affect land or development regulated by State Environmental Planning Policy (State and Regional Development) 2011 or State Environmental Planning Policy (State Significant Precincts) 2005. Land regulated by the State Environmental Planning Policy (Coastal Management) 2018 overlaps the proposal area. The relevance and impact of this is discussed further in this section.

Part 2 of the ISEPP contains provisions for public authorities to consult with local councils and other public authorities before 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 Cessnock LGA is listed in 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 are maintained over their present range.

Roads and Maritime is not bound by the provisions of SEPP 44 for Division 5.1 assessments. However, as SEPP 44 is applicable to the Cessnock LGA, the principles of conservation would be adopted for the proposal where applicable. However, the landscape surrounding the proposal has been subject to a history of clearing for agricultural purposes and as a result vegetation is heavily fragmented. Large patches of contiguous vegetation exist to the west of Kurri Kurri.

The biodiversity assessment carried out by Jacobs (Jacobs, 2018b) identified that the Koala would be unlikely to inhabit the proposal area due to no evidence of Koala population and the proposal being unlikely to contain suitable habitat. Therefore, further assessment under SEPP 44 is not required.

State Environmental Planning Policy (Coastal Management) 2018

The State Environmental Planning Policy (Coastal Management) 2018 (Coastal Management SEPP) updates and consolidates into one integrated policy State Environmental Planning Policy 14 (Coastal Wetlands SEPP), State Environmental Planning Policy 26 (Littoral Rainforests SEPP) and State Environmental Planning Policy 71 (Coastal Protection SEPP), including clause 5.5 of the Standard Instrument – Principal Local Environmental Plan. These policies are now repealed.

The Coastal Management SEPP gives effect to the objectives of the *Coastal Management Act 2016* from a land use planning perspective, by specifying how development proposals are to be assessed if they fall within the coastal zone. The coastal zone is comprised of four coastal management areas as follows:

- Coastal wetlands and littoral rainforests area; areas which display the characteristics of coastal wetlands or littoral rainforests that were previously protected by SEPP 14 and SEPP 26
- Coastal vulnerability area; areas subject to coastal hazards such as coastal erosion and tidal inundation
- Coastal environment area; areas that are characterised by natural coastal features such as beaches, rock platforms, coastal lakes and lagoons and undeveloped headlands. Marine and estuarine waters are also included
- Coastal use area; land adjacent to coastal waters, estuaries and coastal lakes and lagoons.

The proposal area is located within the coastal environment area associated with Wallis Creek. Clause 13 of the SEPP applies to development on land within the coastal environmental area. As the proposal is being assessed under Division 5.1 of the EP&A Act, development consent does not apply. Nevertheless, impacts on relevant factors listed in clause 13(1)(a)-(g) have been considered as summarised in **Table 4.1**.

Table 4.1 Assessment of the proposal impact on relevant factors listed in clause 13(1) of the Coastal Management SEPP

Clause	Factor	Where addressed in the REF
13(1)(a)	The integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment	Hydrological impacts are assessed in Section 6.3 , while ecological impacts are assessed in Section 6.1 .

Clause	Factor	Where addressed in the REF
13(1)(d)	Marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms.	Impacts on native vegetation, fauna and their habitats are assessed in Section 6.1 .
13(1)(f)	Aboriginal cultural heritage, practices and places	Impacts on Aboriginal heritage are assessed in Section 6.4 .

4.1.2 Local Environmental Plans

The proposal is located within the Cessnock LGA, on land which is subject to the Cessnock Local Environmental Plan 2011 (Cessnock LEP). The land zoning around the proposal is shown on **Figure 4.1**.

In the Cessnock LGA, the proposal area is located within land zoned as E2 Environmental Conservation, RE1 Public Recreation, RU2 Rural Landscape and SP2 Infrastructure. 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

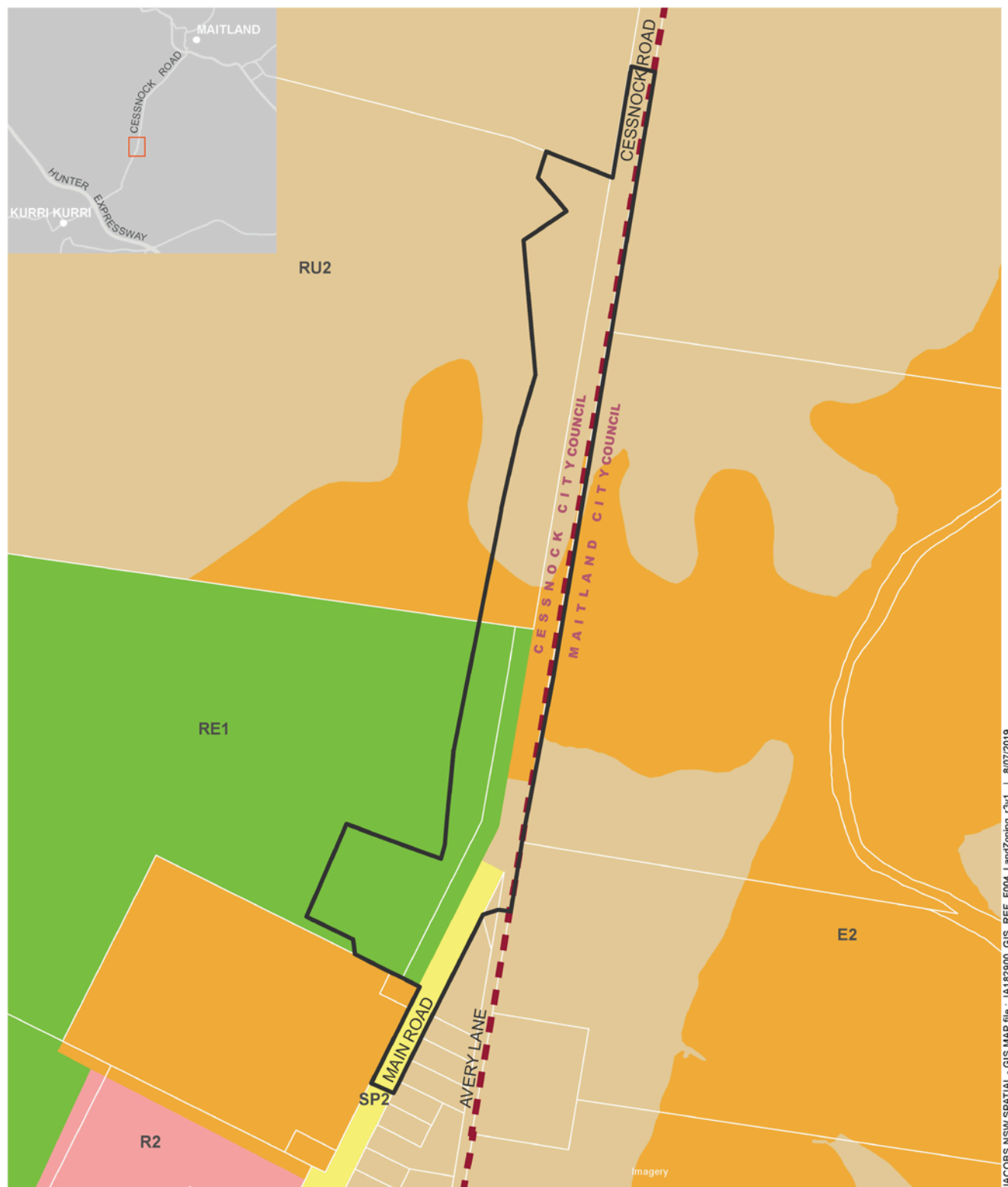
Zone	Objective	Consistency of the proposal with the zone objective
E2 Environmental Conservation	<ul style="list-style-type: none"> To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values To prevent development that could destroy, damage or otherwise have an adverse effect on those values. 	The proposal has been designed to minimise its impact on environmental values of the area.
RE1 Public Recreation	<ul style="list-style-type: none"> To enable land to be used for public open space or recreational purposes To provide a range of recreational settings and activities and compatible land uses To protect and enhance the natural environment for recreational purposes. 	The proposal is generally consistent with this objective. The proposal would not reduce the amount of public open space or recreational land available in the proposal area.
RU2 Rural Landscape	<ul style="list-style-type: none"> To encourage sustainable primary industry production by maintaining and enhancing the natural resource base To maintain the rural landscape character of the land To provide for a range of compatible land uses, including extensive agriculture To enable other forms of development that are associated with rural activity and require an isolated location or support tourism and recreation To ensure that the type and intensity of development is appropriate in relation to the rural capability and suitability of the land, the preservation of the agricultural, mineral and extractive production potential of the land, the rural 	The proposal is generally consistent with this objective and has been designed to avoid fragmenting land for primary industry production.

Zone	Objective	Consistency of the proposal with the zone objective
	<p>environment (including scenic resources) and the costs of providing services and amenities</p> <ul style="list-style-type: none"> • To maintain and enhance the scenic character of the land • To ensure that development does not create unreasonable or uneconomic demands for the provision or extension of services • To minimise the visual impact of vegetation clearing in order to be consistent with the rural character of the locality • To minimise disturbance to the landscape from development through clearing, earthworks, access roads and construction of buildings • To ensure development does not intrude into the skyline when viewed from a road or other public place. 	
SP2 Infrastructure	<ul style="list-style-type: none"> • To provide for infrastructure and related uses • To prevent development that is not compatible with or that may detract from the provision of infrastructure. 	The proposal would provide new and upgraded road related infrastructure and would improve connectivity in the region during flooding events up to a 5% AEP flood event.

The proposal has considered the objectives in the Cessnock LEP and has sought to be consistent with them. The proposal also supports the overarching Cessnock LEP aims to facilitate the efficient and effective provision of amenities and services by providing a more reliable traffic route within the Cessnock LGA.

The LEP zones are shown in **Figure 4.1**. The impacts to land use are discussed in **Section 6.9**. Roads are permissible with development consent under all of the zonings. However, as discussed in **Section 4.1.1**, the proposal is permitted without the consent of council under ISEPP. 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.

Roads and Maritime has consulted with Maitland City Council and Cessnock City Council. Details of consultation are provided in **Chapter 5**.



Legend

- Proposal area
- Local Government boundary

Land zoning (DPE 2018)

- E2 Environmental Conservation
- R2 Low Density Residential
- RE1 Public Recreation
- RU2 Rural Landscape
- SP2 Infrastructure

Figure 4.1 LEP land zoning

4.2 Other relevant NSW legislation

4.2.1 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.

Cessnock Road is a classified road as defined in the Schedule of Classified Roads and Unclassified Regional Roads. The proposal involves construction work on Cessnock Road and would temporarily interrupt traffic flows on Cessnock Road. Under section 138(1) of the Roads Act, consent from Roads and Maritime is required, as the road authority is required for carrying out various activities in, on and over public roads. Approval would be sought for a road occupancy licence for the temporary closure of traffic lanes and, if required, the movement of over-sized vehicles during construction.

4.2.2 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) sets out the environmental impact assessment framework for threatened species, threatened ecological communities and Areas of Outstanding Biodiversity Value (formerly critical habitat) for Division 5.1 activities (amongst other types of development).

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, is assessed using a five-part test. Where a significant impact is likely to occur, a species impact statement (SIS) or Biodiversity Assessment Report (BAR) must be prepared in accordance with the Director-General's requirements.

The biodiversity assessment conducted for this proposal is documented in **Appendix I** and summarised in **Section 6.1**. The proposal would not have a significant impact on threatened species, ecological communities or critical habitat and therefore a SIS is not required.

4.2.3 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) is the primary legislation dealing with Aboriginal cultural heritage in NSW. Items of Aboriginal cultural heritage (Aboriginal objects) or Aboriginal places (declared under section 84) are protected and regulated under the NPW Act. Aboriginal objects are protected under section 86 of the Act. Under section 90(1) of the Act, the Chief Executive 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 Cessnock Road Upgrade at Testers Hollow, Cultural Heritage Assessment Report (Jacobs, 2019a) included as **Appendix E** and summarised in **Section 6.4**. Two new Aboriginal sites (surface artefact scatter with Potential Archaeological Deposit (PAD) and a separate PAD) would be impacted by the proposal. Roads and Maritime would apply for an AHIP for the proposal area before construction.

4.2.4 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.

Work that involves excavating water land or moving material on water land is considered to be dredging work under section 198A of the FM Act ('water land' is defined as land submerged by water (whether permanently or intermittently) under the Act). In addition, any work that involves using any material (such as sand, soil, silt, gravel, concrete, oyster shells, tyres, timber or rocks) to fill in or reclaim water land, depositing any such material on water land for the purpose of constructing anything over water land (such as a bridge) or draining water from water land is considered reclamation land. The proposal includes dredging and reclamation work as defined by section 198A of the FM Act and would require approval under section 199 of the FM Act (refer to **Section 7.3**).

In accordance with the policy and guidelines for fish habitat conservation and management (Department of Primary Industries, 2013) a permit is required for all works that may obstruct the free passage of fish whether permanently or temporarily in Type 1-3 habitats. Based on the proposed activities for the proposal, the proposal may temporarily create a barrier to fish passage. As such, a permit under the FM Act may be required, subject to an assessment by the NSW DPI. Roads and Maritime would consult with DPI (Fisheries) to ensure that all applicable permits for any impacts to fish habitat are obtained before construction. Further discussion relating to the presence and condition of key fish habitat is provided in **Section 6.1.2**.

4.2.5 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 6.5**.

The Non-Aboriginal Heritage Assessment (Jacobs, 2018c) which is provided in **Appendix F**, concluded that the proposal would not impact on any known heritage items provided the management measures outlined in **Chapter 7** are implemented. The Collieries of the South Maitland Coalfields/Greta Coal Measures Group curtilage is partially within the proposal area (although the area within the proposal area does not include any heritage fabric).

In accordance with the NSW Government Gazette (no 110, 5 September 2008) Schedule of Exceptions to subsection 139 (1) and (2) of the Heritage Act, made under subsection 139(4), an Excavation Permit Exception Notification Form is required to be submitted to the former NSW Heritage Division (now part of the Department of Planning, Industry and Environment) with appropriate supporting information including the heritage assessment report. A summary of the non-Aboriginal heritage assessment is provided in **Section 6.5**.

4.2.6 Land Acquisition (Just Terms Compensation) Act 1991

The proposal requires strip acquisition of private and publicly owned land. Property acquisition details for the proposal are provided in **Section 3.6** and shown in **Appendix C**. 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 or a State.

4.2.7 Waste Avoidance and Resource Recovery Act 2001

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

Waste generation and disposal reporting would be carried out during the construction of the proposal. Procedures would be implemented during construction to promote the objectives of the WARR Act (refer to **Section 6.12**).

4.2.8 Water Management Act 2000 and Water Act 1912

The *Water Act 1912* is being progressively phased out and replaced by the *Water Management Act 2000* (WM Act). The WM Act provides for the protection and management of water resources in NSW. The WM Act controls the extraction of water, how water can be used, the construction of works such as dams and weirs, and the carrying out of activities on or near water sources. The proposal area is covered by the Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009 and the Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016. The proposal is therefore subject to the provisions of the WM Act.

Under Schedule 4 of the Water Management (General) Regulation 2018, Roads and Maritime, as the roads authority, is exempt from access licence requirements in relation to water required for road construction and road maintenance.

Sections 89 to 91 of the WM Act establish three types of approvals which may be required by a proponent: - water use approvals, water management work approvals and activity approvals. Water use approvals allow the holder of the approval to use water for a particular purpose at a particular location in a water management area. Clause 34(1) of the Water Management (General) Regulation 2018 provides that Roads and Maritime, as a roads authority, is exempt from a water use approval in relation to the use of water for roads purposes.

Water management work approvals allow the holder to carry out types of water management work at certain locations, including water supply works, certain drainage works and flood works. The proposal can be classified as a flood work as it would have an effect on the distribution or flow of floodwater in times of flood. Clause 47(1) of the Water Management (General) Regulation 2018 provides that Roads and Maritime is exempt from a water management work approval.

Activity approvals are required when a certain activity is likely to affect waterfront land or interfere with an aquifer. The proposal will occur on waterfront land. However, clause 41 of the Water Management (General) Regulation 2018 provides that Roads and Maritime is exempt from a controlled activity approval. Dewatering is not expected as part of the proposal. However, if any dewatering is required, a Crown exemption under section 112 of the *Water Act 1912* would be expected to apply (*Water Act 1912* remains relevant for aquifer interference activities such as construction dewatering because the requirement for aquifer interference approvals under the WM Act has not yet commenced).

Roads and Maritime would consult with the Department of Planning, Industry and Environment (the former NSW Office of Water) to ensure that all applicable licences and/or approvals for any impacts to surface and ground water are obtained before construction. The proposal's impact on surface and groundwater is discussed in **Section 6.3**.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

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

Findings – matters of national environmental significance

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

Findings – nationally listed biodiversity matters

The assessment of the proposal's impact on nationally listed threatened species, endangered ecological communities and migratory species has found that there is unlikely to be a significant impact on relevant matters of national environmental significance. **Chapter 6** of the REF describes the safeguards and management measures to be applied.

4.3.2 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 is located within land currently subject to Native Title Claim by Scott Franks and Anor on behalf of the Plains Clans of the Wonnarua People (NSD39/2019) and Plains Clans of the Wonnarua People (NSD788/2013). The claimants have been consulted during proposal development.

4.4 Confirmation of statutory position

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

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

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

5. Consultation

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

5.1 Consultation strategy

A Community and Stakeholder Engagement Plan (CSEP) has been prepared for the proposal. The CSEP describes the communication and consultation approach and activities for the proposal. The objectives of the strategy are to:

- Keep the local community and key stakeholders regularly informed of proposal progress and latest developments
- Ensure that directly affected community members – including residents of Gillieston Heights and regular commuters along Cessnock Road – have an understanding of the proposal
- Provide timely and accurate information to nearby residents of any activities that may affect them, such as activities which may have noise, dust, vibration and access impacts
- Maintain a productive working relationship with Cessnock and Maitland City Councils
- Ensure that community and stakeholder enquiries about the proposal are managed and resolved effectively
- Ensure that proposal information is distributed in an effective and timely manner.

Key stakeholders identified for the proposal include:

- State and Federal Ministers and Member of Parliament
- Federal Minister for Roads
- Cessnock City Council representatives
- Maitland City Council representatives
- Registered Aboriginal parties (RAPs) (refer to **Section 5.3**)
- Government partners:
 - Federal Department of Infrastructure, Transport, Cities and Regional Development
- Government agencies:
 - NSW Department of Planning, Infrastructure and Environment, which as of 1 July 2019 includes the following former agencies:
 - NSW Office of Environment and Heritage (OEH)
 - Local Land Services – Hunter
 - NSW Resources and Energy
 - Department of Primary Industries (Fisheries)
 - NSW Environment Protection Authority (EPA)
 - National Native Title Tribunal
- Other:
 - Utilities (major telecoms, power and water utilities in the area)
 - Residents impacted by the proposal
 - Road users
 - Community, sporting, action and environmental groups
 - Media
 - Emergency services, including State Emergency Services.

A range of engagement tools and activities would be used before and throughout construction to ensure proposal information is distributed in an effective and timely manner and allow stakeholders and the local community to provide feedback.

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

5.2 Community involvement

To date, consultation for the proposal has been with directly affected property owners and landowners with land adjoining the proposal but not affected.

A summary of the proposed community involvement activities and those carried out to date is provided in **Table 5.1**.

Table 5.1 Summary of issues raised by the community

Group	Issue raised	Response / where addressed in REF
Residents	An improved road standard may encourage speeding and lead to more accidents.	<p>The road has been designed to the 80 km/h posted speed limit in accordance with Australian and Roads and Maritime road design standards. The design standards incorporate a factor of safety to improve the safe handling of vehicles at speed.</p> <p>The design incorporates safety standards and features such as speed advisory signing and safety barriers.</p>

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 and relevant consultation activities for each stage of the PACHCI procedure is provided in **Table 5.2**.

Table 5.2 Summary of Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and investigation

Stage	Description	Relevant consultation activities
Stage 1	Initial Roads and Maritime assessment	<ul style="list-style-type: none"> Aboriginal Heritage Information Management System (AHIMS) search.
Stage 2	Site survey and further assessment	<ul style="list-style-type: none"> Identification of key Aboriginal stakeholders (Mindaribba LALC and Scott Franks and Anor on behalf of the Plains Clans of the Wonnarua People (NSD39/2019) and Plains Clans of the Wonnarua People (NSD788/2013)) Site assessment in June 2018 with representatives from the Plains Clans of the Wonnarua People, native title group and Mindaribba LALC.
Stage 3	Formal consultation and preparation of a	<ul style="list-style-type: none"> Advertisements inviting Aboriginal groups or people to register their interest were placed in local newspapers

Stage	Description	Relevant consultation activities
	cultural heritage assessment report	<ul style="list-style-type: none"> • Consultation with RAPs on the draft excavation methodology in November 2018. • Aboriginal Focus Group (AFG) meeting was held with RAPs in November 2018 to finalise the excavation methodology with RAPs comments • Archaeological test pit excavations were conducted in February 2019 and May 2019 with nominated Aboriginal site officers • A second AFG was held with the RAPs in March 2019 to present the findings of the archaeological test excavations north of Testers Hollow and PACHCI Stage 3 process • A third AFG was held with the RAPs in April 2019 to present the excavation methodology for the area south of Testers Hollow, while outlining management measures for the area north of Testers Hollow.
Stage 4	Implement environmental impact assessment recommendations	<ul style="list-style-type: none"> • A fourth AFG was held in July 2019 with the RAPs to present the findings of the archaeological test excavations south of Testers Hollow and discuss the proposed management measures in the Aboriginal Cultural Heritage Assessment Report. The AFG also discussed the contents of the AHIP applications.

The findings from the Aboriginal assessment have been documented in the *Cessnock Road Upgrade at Testers Hollow – Cultural Heritage Assessment Report* (Jacobs, 2019a) which is summarised in **Section 6.4** and provided in **Appendix E**. This report details that two new Aboriginal sites (surface artefact scatter with Potential Archaeological Deposit (PAD) and a separate PAD) were identified near the proposal.

Roads and Maritime are continuing consultation for the proposal with the Department of Planning, Industry and Environment (the department that now runs the functions of the former NSW Office of Environment and Heritage (OEH)). On 6 November 2018, Roads and Maritime provided a copy of the draft test excavation methodology to OEH for review and comment. Four AFG meetings have been held to date (held on 23 November 2018, 25 March 2019, 30 April 2019 and 2 July 2019). The archaeological test excavation was carried out between 11 and 22 February 2019 and between 13 and 16 May 2019. A copy of the draft Aboriginal Cultural Heritage Assessment Report (ACHAR) has been provided to all RAPs and OEH for review and comment. Consultation with RAPs will be ongoing.

5.4 ISEPP consultation

Clauses 13 to 16 of the 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.

As the proposal would impact on council infrastructure, is located on flood liable land, has the potential to impact local heritage (Collieries of the South Maitland Coalfields/Greta Coal Measures Group) and is on land in a Mine Subsidence District, consultation was carried out with Cessnock City Council, Maitland City Council, the Mine Subsidence Board and the State Emergency Services under clauses 13, 14, 15, 15AA and 16 of ISEPP. **Appendix G** contains an ISEPP consultation checklist that documents how ISEPP consultation requirements have been considered. A letter was sent to the councils and the Mine Subsidence Board on 9 April 2018 and to the State Emergency Services on 11 April 2018. The letter provided information on the proposal and invited responses with any issues or concerns.

No issues specific to ISEPP were raised by Cessnock City Council, Maitland City Council, the Mine Subsidence Board or State Emergency Services. Issues raised by Cessnock City Council and Maitland City Council as part of general consultation have been detailed in **Section 5.5**.

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 utility providers and local property owners in the proposal area. This consultation was designed to ensure issues and concerns were understood, documented and addressed, and that stakeholders had an opportunity to discuss any aspect of the proposed upgrade. Consultation has included phone calls, emails, letters and face-to-face meetings. Details of the consultation carried out are provided below.

Consultation with the Industry and Investment (Fisheries) NSW, NSW Resources and Energy, Local Land Services – Hunter, AAPT / PowerTel, Ausgrid, Hunter Water, Jemena, NBN and Telstra was carried out on 11 April 2018. Consultation was carried out with the Department of Primary Industries (Fisheries) on 29 October 2018 to respond to queries and confirm licensing requirements. A summary of issues raised is provided in **Table 5.3**.

Table 5.3 Issues raised through stakeholder consultation

Agency	Issue raised	Response / where addressed in REF
NSW Department of Primary Industries (Fisheries) (responses received on 23 April 2018, 5 November 2018 and 28 May 2019)	<ul style="list-style-type: none"> The information is unclear on the extent of the works proposed so the department would note the potential for enlarging the pipes under the road to improve water movement from the upper end of Testers Hollow If the proposal is purely to raise the road within the existing road reserve, the Department has no issues with the proposal. 	<p>Three new 1500 mm diameter reinforced concrete pipes at Testers Hollow would be installed to replace the single 1200 mm pipe under Cessnock Road. Further detail associated with the drainage infrastructure has been included in Section 3.2.3.</p> <p>Roads and Maritime provided further information detailing the location of the proposal to Department of Primary Industries (Fisheries) on 2 April 2019.</p>
	<ul style="list-style-type: none"> No permits are required, the only issues required to be managed would be erosion and sediment control A copy of the final REF and plans would need to be provided to the Department of Planning, Industry and Environment in accordance with section 199 of the FM Act. 	<p>Section 6.6.4 lists erosion and sediment safeguards and control measures for the proposal.</p> <p>Section 7.3 outlines the licensing and approvals required for the proposal.</p>
	<ul style="list-style-type: none"> No further issues raised in response to project update. 	Noted.
	<ul style="list-style-type: none"> Should any existing Ausgrid assets require relocating to facilitate the proposal, the relocation work is generally 'contestable' and would be at the applicant's cost. These costs would not only include the cost of the works but also costs associated with the creation of associated easements if required The applicant would be required to submit the relevant application form for any relocation works at an appropriate time. An assessment of Ausgrid's 	Roads and Maritime will continue to consult with Ausgrid regarding the relocation and/or protection of assets (refer to Section 5.6).

Agency	Issue raised	Response / where addressed in REF
	requirements would be undertaken on receipt of the application.	
Hunter Water (response received on 7 November 2018)	<ul style="list-style-type: none"> The new road would be constructed to the north of Hunter Water sewer assets and to the west of Hunter Water assets, therefore not directly affecting any Hunter Water assets. However, some property water services may be affected. 	Roads and Maritime will continue to consult with Hunter Water regarding the relocation and/or protection of assets (refer to Section 5.6).
Cessnock City Council (response received on 22 November 2018)	<ul style="list-style-type: none"> Cessnock City Council noted that their preferred design is the 1 % AEP flood design level. 	The 5 % AEP option was identified as the option that best met the proposal objectives within the project constraints. The options process for the proposal is detailed in Section 2.4 .
	<ul style="list-style-type: none"> An increase in traffic on Cessnock Road is expected as a result of future development in both Cessnock and Maitland LGAs. Cessnock City Council are concerned that the current design of one lane in each direction with a standard shoulder is not sufficient for the expected increase in traffic. 	<p>The purpose of the proposal is to provide increased flood immunity of Cessnock Road at Testers Hollow (refer to Section 2.3.1). The 5 % AEP option was identified as the option that best met the proposal objectives within the project constraints.</p> <p>Any future proposal to increase the traffic capacity of the road would be subject to separate funding and environmental approvals.</p>
	<ul style="list-style-type: none"> There is no provision for pedestrians and cyclists in the proposal. Cessnock City Council requested for Roads and Maritime to consider pedestrian and cycleway facilities. 	Cessnock Road currently has narrow, varied shoulder widths along the length of the proposal area. The proposal would improve active transport infrastructure by providing a wider road with consistent 2 m wide shoulders for cyclist use. This is consistent with Cessnock City Council's <i>Cycling Strategy</i> (2016), which identifies Cessnock Road as a designated regional on-road cycling route. It is noted that Cessnock Road directly to the north of the proposal has been upgraded recently with 1.5 m wide shoulders.
Cessnock City Council (correspondence received on 21 May 2019)	<ul style="list-style-type: none"> Cessnock City Council advised of new information regarding the flood behaviour in Testers Hollow. The Wallis and Swamp Fishery Creek Flood Study was adopted by Cessnock City Council (WMAWater, 2019) on 20 March 2019. 	Noted.
	<ul style="list-style-type: none"> Cessnock City Council sought advice that the new road considers the existing 	The flood modelling for the proposal incorporates existing flood behaviour

Agency	Issue raised	Response / where addressed in REF
	flood behaviour as documented in the studies cited.	and the Wallis and Swamp Fishery Creek Flood Study as cited by Cessnock City Council.
	<ul style="list-style-type: none"> Cessnock City Council noted that the new road design should demonstrate that there is no increase in flood impacts to property and infrastructure within the Hunter River floodplain. 	Flood modelling carried out for the proposal assessed flood impacts once operational. Section 6.3 outlines the impacts.
Maitland City Council (response received on 19 November 2018)	<ul style="list-style-type: none"> Maitland City Council note that the proposal is unlikely to have any significant impacts on the existing capacity or efficiency on Cessnock Road. The retention of the existing turn-around bay at Avery Lane is supported. 	Noted.
	<ul style="list-style-type: none"> Maitland City Council note that a minimum level of 6 m AHD is considered acceptable, as it would ensure that during flood events the Cessnock Road connection on the Maitland side of Gillieston Heights would not open to traffic before Cessnock Road at Testers Hollow. This would avoid through traffic utilising the proposed flood free alternate route through the Hydro residential development at the smelter site at Kurri Kurri, an alternative which would be detrimental to residential amenity. 	Noted.
	<ul style="list-style-type: none"> There is no provision for pedestrians and cyclists [in the proposal]. Maitland City Council note charity events are sometimes held involving pedestrians walking from Maitland to Kurri Kurri/Cessnock. 	Cessnock Road currently has narrow, varied shoulder widths along the length of the proposal area. The proposal would improve active transport infrastructure by providing a wider road with consistent 2 m wide shoulders for cyclist use. It is noted that Cessnock Road directly to the north of the proposal has been upgraded recently with 1.5 m wide shoulders.
	<ul style="list-style-type: none"> The drainage design and sizing of the pipe should ensure that local ponding levels behind Cessnock Road do not increase in depth, particularly in small nuisance events (1, 2 years) so as not to detrimentally impact on the use of adjacent farm lands. 	The existing pipe under Cessnock Road is 1200 mm in diameter. The proposal has been designed to retain and improve hydrologic connectivity through the existing pipe location by increasing the capacity of the existing pipe from 1200 mm to 1500 mm diameter. Drainage design for the proposal is discussed further in Section 3.2.3 .

Agency	Issue raised	Response / where addressed in REF
EPA (response received on 16 November 2018)	<ul style="list-style-type: none"> The EPA identified that the following requirements should be described and assessed in the environmental impact assessment: <ul style="list-style-type: none"> Background water quality Impacts on water quality during construction Impacts on water quality during operation Site water management. 	<p>A water quality assessment has been carried out as part of the REF. Section 6.3.2 discusses background water quality within the proposal area, while Section 6.3.3 describes the potential impacts of the proposal on water quality during construction and operation. Section 3.4.1 discusses water quality measures for the proposal. Site water management would be detailed in the Soil and Water Management Plan (SWMP), which would be prepared as part of the Construction Environmental Management Plan for the proposal (refer to Section 6.3.4).</p>
	<ul style="list-style-type: none"> Potential noise impacts due to construction and operation with specific reference to proposed community consultation and management measures during the construction phase. 	<p>Potential noise impacts during construction and operation are detailed in Section 6.2.4. Management of noise impacts during construction and proposed consultation is outlined in Section 6.2.5.</p>
	<ul style="list-style-type: none"> The EPA note that if scheduled activities are to be undertaken as part of the proposal, the scale of the activity should be clearly stated. 	<p>Under Schedule 1 of the POEO Act the proposal is not considered a scheduled activity. The proposal is less than 1 km in length and does not exceed 30,000 t per year of extraction, processing or storage of extractive materials.</p>
	<p>An attachment was provided that outlined REF requirements for:</p> <ul style="list-style-type: none"> Environmental impacts of the proposal Licensing requirements The proposal and premises Air issues Noise and vibration Water and soils Waste Dangerous goods, chemical storage and bunding Monitoring programs. 	<p>Roads and Maritime has reviewed the attachment and the requirements relevant to this proposal have been addressed in this REF.</p>
DPE Division of Resources and Geoscience (response received on 27 November 2018)	<ul style="list-style-type: none"> DPE Division of Resources and Geoscience noted there are no mineral, coal or petroleum titles or identified mineral, energy (coal or petroleum) or extractive resources that overlap the proposal. 	<p>Noted.</p>

Agency	Issue raised	Response / where addressed in REF
	<ul style="list-style-type: none"> DPE Division of Resources and Geoscience have no concerns regarding impacts to mineral energy or extractive resources in relation to the proposal The proposal does overlap with the western edge of the Maitland West Mine Subsidence District and consultation may be required with Subsidence Advisory NSW. 	Noted. Consultation has been carried out with Subsidence Advisory NSW in accordance with clause 16 of the ISEPP (refer to Section 5.4).
Office of Environment and Heritage (OEH) (response received on 3 December 2018)	<ul style="list-style-type: none"> OEH recommends the REF includes an assessment of flooding impacts as a result of raising the road and that the findings of Wallis and Swamp Fishery Creek Flood Study 2018 be used in design of the proposal. 	Section 6.3 summarises the flood assessment carried out for the proposal. The proposal design has been informed by the findings of the flood model carried out for the proposal. The flood model prepared for the proposal is based on the flood model developed for the Wallis and Swamp Fishery Creek Flood Study 2018. The full Flood Assessment report is provided in Appendix H .

5.6 Ongoing or future consultation

This REF will be placed on public display for comment by stakeholders and the community. Following the display period, Roads and Maritime will collate submissions and respond to comments.

All comments received will be considered. The community will be informed of any further changes to the proposal resulting from this REF and any future consultation process.

The public display period will be advertised in the local paper. Copies of the REF will be available at the Maitland City Council and Cessnock City Council offices and on the Roads and Maritime website at rms.work/testershollow.

Future consultation activities planned for the proposal includes:

- Providing current proposal information through the Roads and Maritime website
- Ongoing consultation with Cessnock City Council, Maitland City Council and utility providers as required
- Ongoing consultation with the Department of Planning, Industry and Environment on matters related to Aboriginal heritage, proposal AHIP(s) and on floodplain works
- Ongoing consultation with RAPs on matters related to Aboriginal heritage
- Consultation with all directly affected property owners and freight providers / industry using Cessnock Road before the start of construction and before any changes to access for private properties (if required)
- Start of construction notification carried out via letter box drop to a number of residents around the proposal a minimum of five working days before construction begins. A start of construction notification would also be provided to the local council and emergency services
- Ongoing notifications carried out via letter box drop notifying residents of any night work, temporary access arrangements or changed traffic conditions Variable message signs (VMS) would be used along Cessnock Road to inform motorists using these roads of the work and potential disruptions. VMS would be deployed a minimum of five days before the commencement of construction
- Roads and Maritime website updated with submissions report and project information on an ongoing basis.

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 D**. 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 Cessnock Road Upgrade at Testers Hollow, Biodiversity Assessment Report* (BAR) (Jacobs, 2018b) provided in **Appendix I**. The potential impacts and safeguards to mitigate them, are summarised in this section.

6.1.1 Methodology

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

The assessment areas referenced throughout this section are defined as:

- Proposal area: This area comprises the limits of the design, ancillary facilities and any other areas that would be temporarily disturbed as outlined in **Figure 1.2**
- Study area: Includes the proposal footprint and surrounding area that may be indirectly affected by the proposal
- Locality: This includes the area within a 10 kilometre radius surrounding the proposal area.

The methodology for the biodiversity assessment involved:

- A desktop review of relevant database records and previous studies within the locality to identify Commonwealth and State listed threatened species, populations and ecological communities
- The mapping of vegetation communities and flora through aerial photograph interpretation, regional spatial data, and elevation data to stratify vegetation and habitats in the study area
- Field surveys were carried out on 10 May 2018 by Jacobs ecologists. The field survey included flora and fauna field surveys. The fauna survey method included rapid habitat assessment at multiple sites, searches for evidence of threatened fauna, and opportunistically recording fauna species active at the time of the survey. No targeted fauna survey techniques such as mammal trapping, and frog surveys were carried out. An aquatic habitat assessment was also carried out during the field survey. The habitat value of each waterway (i.e. habitat sensitivity and classification of waterways for fish passage) have been characterised in accordance with NSW DPI (Fisheries) Document Policy and Guidelines for fish habitat conservation and management (2013 update)
- Targeted fauna surveys were carried out on 10 May 2018 for threatened bird species in the woodland and wetlands and for roosting insectivorous bats within the pipe located beneath Cessnock Road. Survey techniques included visual searches during site traverses, vegetation plots and bat call detectors were placed at the opening of the pipe
- A subsequent survey was carried out on 27 September 2018 to confirm the location of *Eucalyptus parramattensis* subsp. *decadens* in the proposed ancillary site
- Vegetation and habitat condition assessment was consistent with the Biodiversity Assessment Methodology (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

- 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.

Literature and database review

The biodiversity assessment was based on a desktop review of existing information and field survey. Government databases were reviewed to identify potential threatened species, populations and ecological communities within the study area. The following databases were reviewed in May 2018 and again in July 2019:

- NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife Database (NSW OEH, n.d.)
- Department of Environment (DoE) Protected Matters Search Tool (PMST) (DoE, n.d.)
- NSW OEH Register of Declared Areas of Outstanding Biodiversity Value (NSW OEH)
- NSW OEH Bionet Vegetation Classification Database (NSW OEH)
- Bureau of Meteorology's (BoM) Atlas of Groundwater Dependent Ecosystems
- Australian government's directory of important wetlands
- SEPP 14 wetlands register (noting that SEPP 14 has now been replaced by the Coastal Management SEPP (refer to **Section 4.1.1**))
- NSW DPI Aquatic threatened ecological communities (TEC) and freshwater threatened species distribution maps (NSW DPI)
- Department of Planning and Environment State Environmental Planning Policy (Coastal Management) 2018 interactive map
- Department of Primary Industries Aquatic TECs and freshwater threatened species distribution maps.

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 study area is located within the Hunter sub-region of the Sydney Basin Bioregion as defined by Thackway and Cresswell (1995) and within the NSW North Coast Bioregion.

Vegetation in the study area and surrounding landscape is patchy and highly fragmented. It contains a mix of isolated and small remnant and regrowth patches associated with a number of different plant communities. Existing vegetation is a product of landscape and both historical and current land use practices. Historically the study area would likely have contained a mix of floodplain vegetation and grassy woodland vegetation types. Presently the proposal area contains remnant paddock trees, constructed dams/drains, large areas of cleared pasture and patches of regrowth vegetation in and around the road corridor.

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

Plant community types

Four Plant Community Types (PCTs) as described by the NSW Vegetation Information System (VIS) database were identified within the study area. The PCTs are described in **Table 6.1** and shown in **Photo 6-1** and **Photo 6-2**. The distribution of these PCTs is shown in **Figure 6.1**.

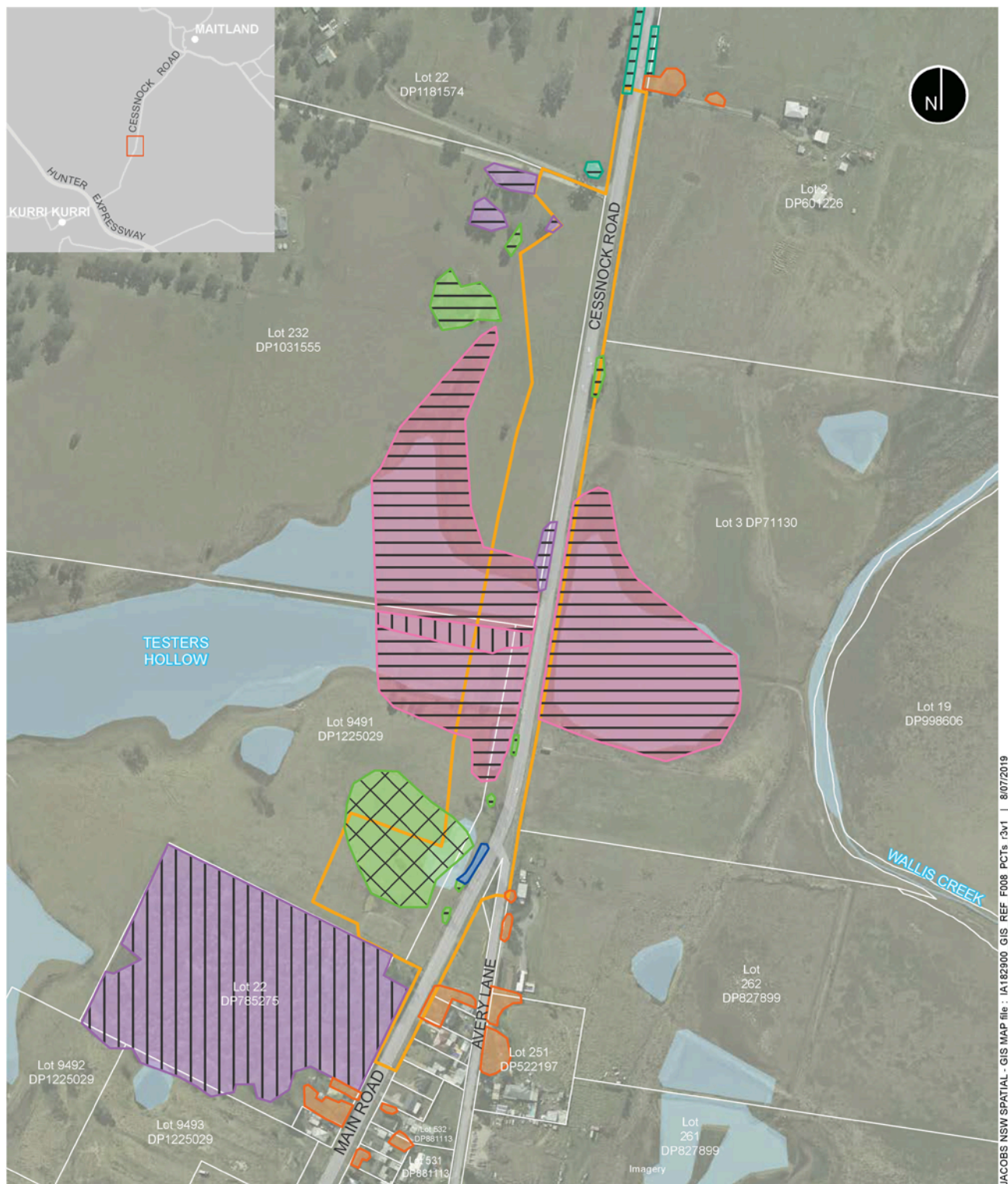
The study area is situated in a historically cleared rural landscape that has been highly modified and disturbed. It is now predominately urbanised and dominated by exotic/pasture grassland and a mixture of roadside/park plantings, maintained lawns, gardens, as well as native tree plantings.

Table 6.1 Plant community types

Plant community type (PCT)	Condition class	Status		Threatened ecological community?	Area (ha) in proposal area ¹	Per cent cleared in bioregion ²
		BC Act	EPBC Act			
Water Couch - Tall Spike Rush freshwater wetland of the Central Coast and lower Hunter (PCT 1736).	Moderate / Good	Endangered ecological community	-	Yes Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	0.09	80%
	Poor				0.82	
Swamp Oak - Prickly Paperbark - Tall Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast (PCT 1728)	Regenerating	Endangered ecological community	-	Yes Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregion	0.52	No value provided in BioNet
	Poor				0.04	
Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter (PCT 1601)	Poor	Endangered ecological community	-	Yes Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion	<0.01	76%
Forest Red Gum grassy open forest on floodplains of the lower Hunter (PCT 1598)	Poor	Endangered ecological community	-	Yes Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions	0.06	No value provided in BioNet
Native regrowth / seed mix	-	-	-	-	0.02	-
Total					1.56	

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

² Based on the BioNet Vegetation Classification database.



Legend

Proposal area

Waterbody

Condition

Moderate / Good

Poor

Regenerating

Plant community type

Forest Red Gum grassy open forest on floodplains of the lower Hunter

Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter

Water Couch - Tall Spike Rush freshwater wetland of the Central Coast and lower

Swamp Oak - Prickly Paperbark - Tall Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast

Planted exotic and non-indigenous

Native regrowth/seed mix

0 100 200 m

1:5,000 @ A4

Figure 6.1 Plant community types



Photo 6-1 Water Couch - Tall Spike Rush freshwater wetland of the Central Coast and lower Hunter – Moderate / Good condition



Photo 6-2 Swamp Oak - Prickly Paperbark - Tall Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast

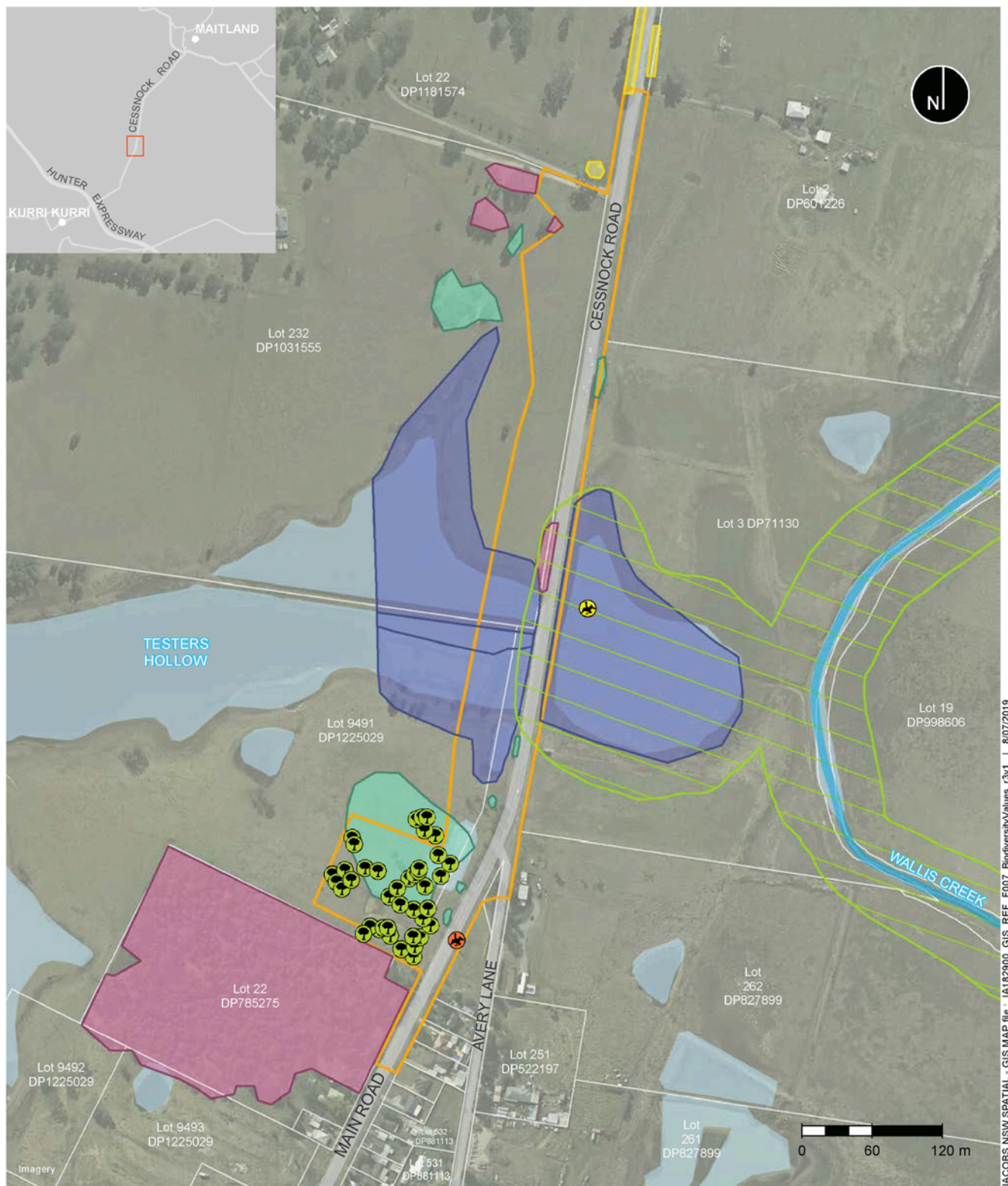
Threatened ecological communities

The BC Act listed TECs identified in the study area are (refer to **Table 6.1**):

- Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions (endangered ecological community)
- Freshwater wetlands on coastal floodplains of the NSW North Coast; Sydney Basin and South East Corner bioregions (endangered ecological community)
- Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion (endangered ecological community)
- Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions (endangered ecological community).

Kurri Sand Swamp Woodland in the Sydney Basin Bioregion (endangered ecological community – BC Act) was identified in the desktop review as potentially occurring in the study area. This TEC was not identified during the field survey. No TECs identified within the study area are listed under the EPBC Act.

The distribution of the TECs within the study area is shown in **Figure 6.2**.



Legend

- Proposal area
- Waterbody
- Key Fish Habitat (DPI 2016)
- Southern Purple Spotted Gudgeon indicative habitat
- Recorded threatened species (BioNet Atlas 2018)
 - Grey-crowned Babbler (eastern subspecies)
 - Eucalyptus parramattensis* subsp. *decadens*
 - White-bellied Sea Eagle

Threatened ecological community (BC Act 2015)

- Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion
- Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions
- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

Figure 6.2 Threatened ecological communities and aquatic ecology

Threatened flora

Twenty-two threatened flora species listed under the EPBC Act and BC Act and two endangered populations listed under the EPBC Act have been previously recorded or modelled as having potential to occur in the locality. Many of these species favour habitats that are not represented in the study area or are only known to exist in populations restricted to specific geologies, vegetation types and localities.

Eucalyptus parramattensis subsp. *decadens*

Juvenile *Eucalyptus parramattensis* subsp. *decadens* are located in the southern section of the proposal area. These were planted as an offset for the construction of the residential subdivision in Cliftleigh (Harper Somers O'Sullivan, 2007). *Eucalyptus parramattensis* subsp. *decadens* is listed as vulnerable under the BC Act and EPBC Act. It is unknown when the trees were planted, however they range from about 30 centimetres to two metres tall and are surrounded by plastic tree guards. The offset for the residential subdivision in Cliftleigh required 300 individuals to be planted, and therefore there may be up to 300 individuals planted in Lot 949 DP1223319, including in areas not impacted by the proposal. Some of the trees in the study area do not have tree guards and may be either *Eucalyptus tereticornis* or *E. amplifolia*. Species identification is difficult at the juvenile stage and some tree guards may have been washed away in previous floods. Therefore, from an impact perspective, it is assumed that all the trees are *Eucalyptus parramattensis* subsp. *decadens*.

Other threatened flora

All other threatened flora species and endangered populations previously recorded within or which have the potential to occur in the locality were recorded in the study area during the field survey and are therefore considered to have a low likelihood of occurrence or are unlikely to be within the extent of the study area. The BAR provided in **Appendix I** includes the full list of threatened flora, endangered populations and associated likelihood of occurrence.

Threatened fauna

Based on regional records and the presence of suitable habitat, 66 threatened fauna species have been identified in the locality. This includes 38 birds, 17 mammals and six frogs listed under the BC Act and 14 birds, eight mammals and five frogs listed under the EPBC Act. The Biodiversity Assessment provided in **Appendix I** lists threatened fauna species identified in the database searches, and their likelihood of occurrence. The study area is unlikely to provide suitable habitat for a number of these species as there is no woodland, sandstone ridge tops or gullies and no wet or rainforest habitat. However, habitats within the study area are of suitable quality for a number of threatened birds and microbats. No suitable habitat for threatened fish is present in the study area. There is also a lack of suitable habitat in the proposal area for Koalas.

White-bellied Sea Eagle (*Haliaeetus leucogaster*)

One White-bellied Sea Eagle listed as vulnerable under the BC Act was observed flying over the study area around 7:30am during the field survey. The individual did not land. The ephemeral and shallow nature of the wetlands in the study area are unlikely to present high quality foraging habitat for the White-bellied Sea Eagle, however it may hunt and may perch in the trees on occasion. Although it is unknown if the wetlands contain any fish species of suitable size for foraging. No large stick nests were identified during the site survey.

Woodland habitat

Woodland vegetation in the study area provides suitable habitat for a number of woodland bird species listed as vulnerable under the BC Act including the Dusky Woodswallow, Varied Sittella, Black-chinned Honeyeater, Little Lorikeet, and Grey-crowned Babbler. However, most species are only likely to occur outside of the proposal area and would not be impacted. The Grey-crowned Babbler is common in the locality and has been previously recorded in the study area in 2005 on the east side of Cessnock Road (BioNet Atlas). This species is known to utilise areas of scattered paddock trees in cleared landscapes and may utilise habitat in the study area. However, no stick nests were observed during the field survey.

The Swift Parrot is also considered to be a potential visitor to the study area in the winter. It is well known from around Kurri Kurri and may utilise flowering *Eucalyptus tereticornis* as a foraging resource. The Grey-headed Flying Fox is also highly likely to occur in the study area due to the presence of winter flowering trees and 16 known camps within 50 kilometres.

Wetland habitat

The wetland habitat in the study area provides habitat for a range of water birds. Eleven different species were observed during the targeted survey. The Black-necked Stork (endangered under the BC Act) is considered moderately likely to occur in the study area on occasion due to the presence of suitable habitat and previous sightings within Testers Hollow. Although this species is relatively uncommon in the Hunter Region compared to the North Coast Bioregion, it is known to breed in the Hunter Wetlands National Park. There is unlikely to be any suitable breeding habitat at Testers Hollow or in the study area, however this species may utilise habitat for foraging. Other aquatic species confined to areas of open water, including the Blue-billed Duck, may occur in Testers Hollow however are restricted to periods following suitable rainfall and unlikely to occur within the study area.

Insectivorous bats

The study area likely provides foraging habitat for a number of threatened insectivorous bats known to occur in the locality including:

- Eastern Bentwing-bat
- Eastern Cave Bat
- Large-eared Pied Bat
- Little Bentwing-bat
- Southern Myotis
- Eastern False Pipistrelle
- Eastern Freetail-bat
- Greater Broad-nosed Bat
- Yellow-bellied Sheath-tail-bat.

A targeted survey of the pipe under Cessnock Road was carried out around dusk using a spotlight and Anabat Express call detectors (one at each end). No bats were seen leaving the pipe or recorded by the call detectors. The pipe is considered to offer low potential for roosting due to the fact that the pipe joins are mostly sealed. Only one hollow-bearing tree was identified in the north west compound site which may offer suitable roosting habitat for hollow roosting species. The wetland habitats were walked after dusk in an attempt to actively record foraging bats. No bats were seen or recorded during this time, however the wetland and woodland habitats in the study area are likely to provide foraging habitat for threatened insectivorous bats.

Green and Golden Bell Frog (*Litoria aurea*)

The study area is close to a recorded key population of the Green and Golden Bell Frog (endangered under the BC Act and vulnerable under the EPBC Act) at Gillieston Heights / East Maitland / Ravensfield. There were also sightings of this species in ponds around the fringes of Wentworth Swamp in Ravensworth. The Green and Golden Bell Frog has not been recorded at these locations or anywhere else in the Middle Hunter since 2000. Considering this species has not been recorded in the Middle Hunter since 2000, and habitat condition in the study area, the Green and Golden Bell Frog is unlikely to remain in the habitat within the study area and is not assessed further (DECC, 2007a).

Aquatic surface water ecosystems and fish habitat

The aquatic habitat in the study area comprises of the constructed unnamed third order stream, artificial agricultural ponds and the surrounding inundation area of the floodplain. An assessment of the fish habitat value of these areas, based on the modelled habitat of threatened fish, field observation and aerial photograph interpretation is provided below. The assessment has also considered the Policy and Guidelines for fish habitat conservation and management (Department of Primary Industries, 2013) and the

current indicative distribution of the threatened Southern Purple Spotted Gudgeon in NSW, modelled from past catchment data and environmental conditions (Department of Primary Industries, 2017).

Key Fish Habitat mapped by DPI in and around the study area includes Wallis Creek (refer to **Photo 6-3**) and the floodplain wetland (refer to **Photo 6-4**) on the eastern side of Cessnock Road (refer **Figure 6.2**). Wallis Creek is about 10 metres wide with murky brown water flowing slowly on the date of the field survey. The banks of the creek are dominated by Couch grass (*Cynodon dactylon*) with occasional occurrences of native sedges (*Juncus sp.*) and mid-stream macrophytes (*Triglochin sp.*).

The ephemeral drainage line has been dammed for agriculture by raised areas for vehicle/cattle crossing and fencing. Wallis Creek is mapped as indicative habitat for the Purple Spotted Gudgeon, which is listed as an endangered species under the FM Act. Therefore, Wallis Creek is considered to be 'Type 1 – Highly sensitive key fish habitat' and 'Class 1 – Major key fish habitat'. As the floodplain wetland on the east side of the road is highly degraded from agricultural practices and is likely only inundated for short periods following rainfall, it is not considered habitat for the Purple Spotted Gudgeon. Therefore, it has been classed as 'Type 3 – Minimally sensitive key fish habitat' and 'Class 4 – Minimal key fish habitat'.



Photo 6-3 Wallis Creek showing impacts of grazing



Photo 6-4 Floodplain wetland between Cessnock Road and Wallis Creek

As can be seen in **Figure 6.2**, the Key Fish Habitat mapping is somewhat indicative as it covers areas occupied by Cessnock Road. Higher quality aquatic areas on the western side of the road (eg Testers Hollow) are also likely to provide suitable fish habitat characteristics, particularly during periods of high rainfall when the entire floodplain is inundated. Testers Hollow is a natural wetland/billabong that has been historically modified to retain and channel water for agricultural purposes (refer to **Photo 6-5**). During periods of high rainfall, the wetlands are charged by water overflowing from Wallis Creek which is able to then be retained within the lower lying areas of the wetland for long periods of time. However, a review of historical imagery

from the study area shows that the Testers Hollow Wetland has ephemeral characteristics, and that water levels generally vary significantly within the system. Using the criteria in Policy and Guidelines for fish habitat conservation and management (Department of Primary Industries, 2013), Testers Hollow wetland and the constructed drain that connects it to Wallis Creek are considered 'Type 3 – Minimally sensitive key fish habitat' and 'Class 4 – Minimal key fish habitat' respectively. The constructed agricultural ponds on the western side of Cessnock Road are not classed as key fish habitat.

Given the highly disturbed nature of this area, there are also likely to be non-threatened species present, including eels.



Photo 6-5 Testers Hollow Wetland (left) and the constructed drain (right)

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, 2019) 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 are restricted to rivers and wetlands including:

- Testers Hollow – Floodplain wetland (directly west of the study area)
- Unnamed wetland – Floodplain wetland (about five kilometres south/upstream of the study area)
- Telarah Lagoon Wetland – Coastal Lagoons and lakes (about seven kilometres north/downstream of the study area)
- Hunter River – Watercourse (about 7.5 kilometres north/downstream of the study area).

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

The floodplain wetland at Testers Hollow is mapped as a 'Moderate potential GDE (national assessment)'. The other three aquatic GDEs in the locality are mapped as 'High potential GDE (national assessment)'. Testers Hollow wetland and the other two wetlands are likely to be facultative GDEs which are reliant on both surface water and groundwater. Testers Hollow has been historically modified to retain and channel water for agricultural purposes. It is fed directly by Wallis Creek which flows into the Hunter River (however the aquatic habitat in the study area is not considered tidal). During periods of high rainfall, the wetlands are charged by water overflowing from Wallis Creek which can be retained for long-periods of time. However, a review of historical imagery from the study area shows that the Testers Hollow Wetland is slightly ephemeral and appears to have lost surface water on several occasions over the last five years. This aquatic GDE is proportionally reliant on groundwater. Other areas more reliant on groundwater (such as Telarah Lagoon) would be in the facultative-highly-dependent category.

Terrestrial groundwater dependent ecosystems

Water Couch – Tall Spike Rush freshwater wetland of the Central Coast and lower Hunter is mapped to occur in the study area. It is considered to have a high potential for GDE interaction. The Atlas of GDEs also shows Parramatta Red Gum – Narrow-leaved Apple – Prickly-leaved Paperbark shrubby open woodland in the Cessnock-Kurri Kurri Area, however this community was not located in the study area during the field survey.

During the field survey a further three communities were identified in the study area and are listed in **Table 6.2**.

Two communities are considered to have a high potential for groundwater dependence as shown in **Table 6.2**. The low potential GDEs would be classified either as non-dependent ecosystems or as facultative-opportunistic GDEs with only minor interaction with groundwater.

Table 6.2 Level of groundwater dependence of terrestrial ecosystems in the study area

Ecosystem	Potential for GDE interaction (BoM, 2017)	Type of GDE (Kuginis et al. 2012)	Likely type and degree of groundwater dependence (Kuginis et al. 2012)
Water Couch - Tall Spike Rush freshwater wetland of the Central Coast and lower Hunter	High potential GDE – from regional studies	Groundwater dependent terrestrial ecosystem (phreatophytic)	<ul style="list-style-type: none"> 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 Likely to be moderately reliant on groundwater particularly during times of water stress.
Swamp Oak - Prickly Paperbark - Tall Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast (PCT 1728)	High potential GDE – from regional studies	Groundwater dependent terrestrial ecosystem (phreatophytic)	<ul style="list-style-type: none"> 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 Likely to be moderately reliant on groundwater particularly during times of water stress.
Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter (PCT 1601)	Low potential GDE – from regional studies	-	<ul style="list-style-type: none"> Non-dependent ecosystems or possibly facultative-opportunistic May use groundwater where available during times of water stress but to be dependent chiefly on rainfall.
Forest Red Gum grassy open forest on floodplains of the lower Hunter (PCT 1598)	Low to high potential GDE – from regional studies	-	<ul style="list-style-type: none"> Facultative-opportunistic Likely to use groundwater where available during times of water stress but to be dependent chiefly on rainfall.

Subterranean groundwater dependent ecosystems

There is no data on the GDE atlas for subterranean GDEs in the region. Apart from the subsurface component of the streams discussed under aquatic ecosystems, no other shallow subterranean GDEs would be likely to occur in the study area.

Fauna species richness

The study area is considered to have moderate fauna species richness, due to avifauna using the aquatic habitats. A total of 27 fauna species were recorded during field survey, comprising 26 birds and one terrestrial mammal (Eastern Grey Kangaroo). One threatened fauna species, White-bellied Sea Eagle (listed as vulnerable under the BC Act), was recorded in the study area.

Migratory and marine species

One White-bellied Sea Eagle (*Haliaeetus leucogaster*), was recorded flying over the study area during survey. The study area provides potential foraging and perching habitat for this species. This species did not land in the study area. White-bellied Sea Eagle is listed as a marine species under the EPBC Act, however it is not listed as migratory as such, does not require an assessment of significance under this Act.

Wildlife connectivity corridors

Habitats within the study area are heavily fragmented and exist as a mix of planted, remnant and regrowth vegetation and floodplain wetlands highly modified by a history of agricultural activities. There has been little connectivity through the study area by way of vegetated corridors for a long period of time. The greatest area of remaining east-west connectivity is via the wetlands and constructed drain that connects Testers Hollow with Wallis Creek. Most of the time the wetlands in the study area are dry and not connected by open water with Wallis Creek.

Potential impacts

Construction

Removal of native vegetation

The potential loss of vegetation associated with the proposal has been quantified by calculating the area of vegetation communities in the proposal area. The potential loss of vegetation associated with the proposal is summarised in **Table 6.1**. The proposal would potentially impact on up to about 1.56 hectares of native vegetation and 0.01 hectares of planted exotic/non-indigenous vegetation. The native vegetation impacted by the proposal comprises:

- 0.56 hectares of Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions (endangered ecological community), associated with PCT 1728
- 0.91 hectares of Freshwater wetlands on coastal floodplains of the NSW North Coast; Sydney Basin and South East Corner bioregions (endangered ecological community), associated with PCT 1736
- <0.01 hectares of Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion (endangered ecological community), associated with PCT 1601
- 0.06 hectares of Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions (endangered ecological community), associated with PCT 1598.
- 0.02 hectares of native regrowth / seed mix.

Threatened fauna habitat

The proposal would potentially impact up to about 1.56 hectares of native vegetation and 0.01 hectares of exotic vegetation. This vegetation provides potential habitat for 15 threatened species listed under the BC Act (refer to **Table 6.3**).

The White-bellied Sea Eagle was the only threatened species identified within the study area. This species is likely to breed in larger and less disturbed patches of vegetation to the west of the study area. The potential impact to the White-bellied Sea Eagles habitat is expected to be low.

The vegetation to be impacted also provides some potential habitat for many other threatened fauna species. These are all highly mobile species including birds and bats.

Habitat that would be impacted by the proposal is generally limited to foraging habitat due to its disturbed nature. *Eucalyptus tereticornis* and *Corymbia maculata* would offer an important winter flowering resource for nectarivorous species such as the Grey-headed Flying Fox and Swift Parrot. Vegetation may also provide foraging habitat for the Grey-crowned Babbler and numerous cave roosting and hollow-roosting insectivorous bats. No hollow-bearing trees are expected to be impacted by the proposal. The existing pipe under Cessnock Road may offer some suitable roosting habitat for several insectivorous bat species that are known to roost in artificial structures, and this would be removed by the proposal. No bat species were identified during the field survey. All of the pipe joins are sealed except for one at the western end which may offer a shallow roost site, however this is not considered to be an important (maternity) roost for any of these species.

Table 6.3 Impacts on threatened fauna and fauna habitat

Species	Potential occurrence	Impacted by proposal?	Impact
Eastern Bentwing-bat	Moderate - foraging habitat for these species is widespread in and around the study area. The pipe has limited roosting opportunities.	Yes	Removal of 1.56 hectares of potential foraging habitat and one low quality temporary roost site.
Eastern Cave Bat			
Large-eared Pied Bat			
Little Bentwing-bat			
Southern Myotis			
Eastern False Pipistrelle	Moderate - foraging habitat for these species is widespread in and around the study area. Roosting habitat limited.	Yes	Removal of 1.56 hectares of potential foraging habitat. No expected impact to roosting habitat.
Eastern Freetail-bat			
Greater Broad-nosed Bat			
Yellow-bellied Sheath-tail-bat			
Grey-headed Flying Fox	High - foraging habitat widespread. Back Hill camp 11 kilometres south east of the study area and a further 15 camps within 50 kilometres.	Yes	Removal of 0.59 hectares of potential foraging habitat. No expected impact to roosting habitat.
Grey-crowned Babbler	All woody vegetation in the study area presents suitable foraging and perching habitat.	Yes	Removal of 0.59 hectares of foraging habitat. No nesting/breeding habitat likely to be impacted by the proposal.
Swift Parrot	<i>Eucalyptus tereticornis</i> and <i>Corymbia maculata</i> are winter flowering and offer suitable foraging habitat for migrating individuals.	Yes	Removal of 0.64 hectares of potential foraging resources. No nesting/breeding habitat likely to be impacted by the proposal.
White-bellied Sea Eagle	This species was observed flying over the study area during survey but did not land. It may hunt and perch in the study area on occasion however the	Yes	Removal of 1.52 hectares of potential foraging habitat. No nesting/breeding habitat

Species	Potential occurrence	Impacted by proposal?	Impact
	ephemeral wetlands are unlikely to be an important resource.		likely to be impacted by the proposal.
Black-necked Stork	Moderate – this species is a rare resident of the Hunter Region. It may occur in the floodplain around the study area at any time, though particularly after suitable rainfall.	Yes	Removal of 0.91 hectares of habitat potentially used for temporary refuge or transient birds moving through the region. No nesting/breeding habitat likely to be impacted by the proposal.
Purple Spotted Gudgeon	Moderate – Wallis Creek is mapped by DPI as indicative habitat for this species. It may spread into Testers Hollow wetland during periods of high rainfall and inundation. The study area does not contain high quality habitat for this species.	Yes	Removal of 0.09 hectares of potential aquatic habitat (moderate/good freshwater wetlands) for this species. Not recorded.

The assessment provided in **Appendix I** concludes that there is no significant impact on any of the threatened fauna species considered likely to occur in the study area.

Threatened flora

Section 6.1.2 discusses the presence of Eucalyptus trees within the proposal area. The proposal would potentially impact about 35 juvenile planted Eucalypt trees. Given that identification of the juveniles is difficult between *Eucalyptus parramattensis* subsp. *decadens*, *E. tereticornis* or *E. amplifolia*, it has been assumed that all Eucalypt trees potentially impacted by the proposal are *Eucalyptus parramattensis* subsp. *decadens*. Assessments under the BC Act and EPBC Act have been carried out and are provided in **Appendix I**. The removal of up to 35 juvenile planted *Eucalyptus parramattensis* subsp. *decadens* trees is unlikely to result in a significant impact to this species.

Impacts to threatened flora are summarised in **Table 6.4**.

Table 6.4 Impacts on threatened flora (planted individuals only)

Threatened species	Ecosystem or species credit species	Status		Habitat or individuals to be impacted	Habitat or individuals in the study area
		BC Act	EPBC Act		
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	Species	V	V	The proposal would result in the removal of 35 planted trees.	Up to 300 planted trees may have been planted as part of residential subdivision in Lot 949 DP 1223319.

Impacts to aquatic habitat

The proposal may result in the temporary modification of aquatic habitat along the unnamed ephemeral creek adjoining Wallis Creek and Testers Hollow wetland. Instream impacts are considered likely in the unnamed creek and surrounding floodplain during the proposed construction works.

Construction activities such as removal and installation of pipes, widening of the road and installation of coffer dams are likely to impact the instream environment.

One threatened fish species listed as endangered under the FM Act, the Southern Purple Spotted Gudgeon (*Mogurnda adspersa*), has been mapped as having indicative habitat in Wallis Creek, about 200 metres east of the study area. During periods of high rainfall, Wallis Creek overflows and much of the study area can become inundated during which time the Southern Purple Spotted Gudgeon may be transported into Testers Hollow wetland. As such there may be individuals of this species that inhabit Testers Hollow wetland. Habitat in the study area is generally unsuitable for this species outside of these periods of inundation, particularly the artificial ponds on the western side of Cessnock Road which are stagnant and have little vegetation or refuge. An Assessment of Significance (7-part test) has been completed for the Southern Purple Spotted Gudgeon (see Appendix B of the BAR in **Appendix I**) in accordance with section 220ZZ of the FM Act and the *Threatened Species Assessment Guidelines: The Assessment of Significance* (Department of Environment and Climate Change, 2007).

Considering the likely marginal impact of the proposal on aquatic habitat and the extent of higher quality habitat in the locality, an overall conclusion has been made that the proposal would be unlikely to result in a significant effect to the Southern Purple Spotted Gudgeon.

Table 6.5 outlines the potential impacts the proposal would have on aquatic habitats during construction.

Table 6.5 Potential impacts of the proposal construction on aquatic habitats

Potential impacts of activities in aquatic habitats	Impact of proposal
Activation of acid sulfate soils and associated acid metal pollution of water	<p>Construction activities such as excavation and land clearing pose a risk to water quality when the activity is carried out in areas of actual or potential acid sulfate soils (ASS). Disturbance and exposure of ASS to oxygen from construction activities could generate sulphuric acid and toxic quantities of aluminium and other heavy metals that could be readily released into the surrounding environment, polluting nearby surface waters and potentially resulting in a loss of aquatic flora and fauna.</p> <p>The Australian Soil Resource Information System (ASRIS) search identified much of the low lying areas around the unnamed creek between Wallis Creek and Testers Hollow as being high risk for containing ASS on the premise that ASS occurs predominantly on coastal lowlands, with elevations generally below five metres. However, ASS has not been mapped as likely to be present in the substrates associated with the study area (OEH, 2018). Construction activities may expose ASS, however suitable controls will be incorporated as part of the Acid Sulfate Materials Management Plan (refer to Section 6.1.4).</p>
Changed hydrology; flow velocity, depth, turbulence, flooding regime	The proposal would likely result in some temporary changes to factors including flow velocity and turbulence. The extent of these changes would be controlled through design measures and construction environmental management and would likely be temporary during the construction phase of the proposal. The changes associated with the proposal would only likely occur during periods when the unnamed waterway is flowing and given their temporary nature was considered unlikely to significantly impact the hydrology of the waterway.
Loss of aquatic habitat	The proposal would result in the loss and modification of aquatic habitat by the partial filling of existing ponds and installation of new drainage pipes. This small loss and modification of habitat would be unlikely to significantly impact the aquatic ecosystems of the Testers Hollow and Wallis Creek floodplain environment.
Obstruction to fish passage	The proposed activities likely to impact the instream environment include installation of new pipes on the new section of Cessnock Road. However, the unnamed stream only flows during periods of high rainfall, obstruction

Potential impacts of activities in aquatic habitats	Impact of proposal
	to fish passage during construction would only likely be temporary and limited to the area between Testers Hollow and the small ponded area of wetland on the eastern side of Cessnock Road. Based on the above proposed activities it was considered that the proposal may temporarily create a barrier to fish passage along the unnamed stream during construction works.
Potential impacts of tannins entering waterways from mulch	Any riparian revegetation activities would exclude the mulching of areas likely to be inundated and use alternative materials for soil stabilisation such as rocks and erosion matting. As such, the risk of substantial tannin pollution of the waterways would be low.
Temporary displacement of fauna	The proposal would result in the modification of a small area of habitat during the construction of the new pipes. The displacement of any fauna (eg water fowl) would likely be temporary during the construction works. The time-lag between construction and the completion of aquatic habitat restoration in these areas would be unlikely to be significant so as to permanently displace any fauna.
Turbidity and sedimentation	Proposal construction activities could result in sediment entering the waterways. With the installation of standard erosion and sediment controls, the risk of substantial amounts of sediment entering the waterways would be low. Small amounts of sediment may enter the waterway despite the installation of sediments controls. However, due to the very low flow conditions any sediment would be likely to settle almost entirely in the immediate vicinity of the proposal area and unlikely to significantly affect habitat downstream.
Groundwater displacement and recharge	The ephemeral GDEs in the study area regularly experience variable levels of inundation and would not be affected by the proposed wick drain displacement and recharge of groundwater.

Injury and mortality

Fauna injury or death has the greatest potential to occur during construction when vegetation clearing, and pipe replacement occurs. Vegetation removal within the disturbance area would be minimal and limited to planted and regrowth roadside trees. Trees identified for removal within the study area do not provide significant habitat features such as hollows and hollow dependent fauna are unlikely to use these to nest or roost. Those that are likely to be present, such as birds, are highly mobile and would be able to leave the impact area during clearing activities. Less mobile species such as reptiles and frogs may be injured or killed during construction as habitat is cleared, particularly in the waterways. Other aquatic species (such as eels) may also be impacted by work in waterways.

The study area may provide roosting habitat in the pipe underneath Cessnock Road for threatened cave-roosting insectivorous bat species. An inspection of the pipe revealed only one roosting opportunity near the western end of the pipe as nearly all the pipe joints have been sealed. However, no roosting bats were identified or recorded during the field survey. The pipe would be unlikely to provide breeding habitat and may only be used for roosting on occasion. A thorough inspection of the pipe would be carried out by a suitable qualified ecologist for roosting bats before the removal of the pipe.

Pathogens

While pathogens were not observed or tested for in the study area the potential for pathogens to occur should be treated as a risk during construction. Safeguards and mitigation measures for the potential introduction and spread of pathogens are provided in **Section 6.1.4**.

Groundwater dependent ecosystems

Most of these aquatic GDEs are quite distant from the proposal. The area is unlikely to be affected by localised effects on groundwater that could result from the increased width and elevation of the roadway.

Other aquatic habitats in the study area, such as the broader freshwater wetlands that are not shown by the Atlas of GDE mapping, have only ephemeral flow and intermittent expression of surface water are unlikely to have base flow characteristics and are unlikely to be significantly dependent on groundwater. These systems would be in the facultative-opportunistic category. They are therefore unlikely to be significantly affected by the potential minor influence of the proposal on groundwater.

The proposal is next to Testers Hollow and crosses an unnamed creek that connects to Testers Hollow. There is therefore some potential for impacts on the Testers Hollow GDE, related to altered groundwater movement patterns associated with the proposal. The proposal would directly affect lands within regularly inundated areas of the broader waterways, however not the mapped GDE itself. The proposal would be unlikely to result in significant changes to surface water penetration or groundwater movement. The proposal would therefore be unlikely to significantly affect these GDEs.

The proposal may cause minor local impacts to groundwater such as slight, localised changes to groundwater depth, but would be unlikely to cause significant alteration to groundwater conditions outside of the immediate vicinity of the study area. While there may be minor alteration to groundwater conditions in the locality, the proposal would be unlikely to result in permanent damage or loss of GDEs outside of the proposal.

Subterranean groundwater dependent ecosystems

The proposal would therefore be unlikely to significantly impact subterranean GDEs.

Migratory and marine species

The Fork-tailed Swift and White-throated Needletail may potentially fly over the study area on occasion during seasonal migration however, these species are considered unlikely to utilise the habitat within the study area. Several wetland species are considered moderately likely to occur after suitable rainfall including Latham's Snipe, Little Curlew and Marsh Sandpiper. These species are only considered likely to occur around Testers Hollow and are unlikely to be impacted by the proposal.

The full list of species considered in this assessment are provided in **Appendix I**.

Wildlife connectivity corridors

The upgrade to the road and pipe would remove a small area of Water Couch – Tall Spike Rush freshwater wetland of the Central Coast and lower Hunter habitat however the new drainage pipes would be larger and should improve this connectivity.

As the proposal would remove a small area of vegetation, it would contribute to the fragmentation of habitat. However, the impact is not considered to be significant due to the presence of more viable habitat, with greater connectivity in the surrounding area and the already heavily fragmented nature of the vegetation.

Offsets

Vegetation removal as part of the proposal does not meet any of the biodiversity offset thresholds. Therefore, biodiversity offsets are not required for the proposal.

Operation

Proliferation of weeds and pest species

No invasive species were observed in the study area during the site survey. However, the study area may be habitat for several common species including the feral cat and European Red Fox. Due to the minimal vegetation clearing, the proposal would be unlikely to result in invasion or spread of pest species. Work within the waterway may spread aquatic weeds. Hygiene protocols would be included in the Flora and

Fauna Management Plan to reduce the risk of the proposal spreading both terrestrial and aquatic weeds (refer to **Section 6.1.4**).

Wildlife connectivity and habitat fragmentation

The proposal would improve hydrological connectivity between the western and eastern sides of Cessnock Road, as discussed in **Section 6.3**. Improved hydrological connectivity and larger pipes beneath Cessnock Road would result in improved wildlife connectivity and reducing habitat fragmentation, particularly for aquatic species after sufficient rainfall.

The proposal would permanently remove a small area of Water Couch – Tall Spike Rush freshwater wetland of the Central Coast and lower Hunter habitat. This impact is not considered to be significant due to the proposal also providing connectivity to the surrounding area, by installing larger culverts connecting Testers Hollow to more viable habitat, while taking into consideration the heavily fragmented nature of vegetation in the local area.

Noise, light and vibration

Noise, light and vibration are direct impacts that would likely result from proposal construction activities.

The proposed working hours are likely to include the following:

- Mondays – Fridays: 7.00am – 6.00pm
- Saturdays – 8.00am – 1.00pm
- Sundays and public holidays – No work.

Night works would be likely required for the proposal. Artificial lighting would be required during night works.

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

During all phases of the proposal, there would be increased noise and vibration levels in the study area and immediate surrounds due to vegetation clearing, ground disturbance, machinery and vehicle movements and general human presence. The noise and vibration from activities associated with the proposal would potentially disturb resident fauna and may disrupt foraging, reproductive, or movement behaviours.

There would likely be an impact from noise and vibration but the level of noise and vibration into nearby habitats during construction and operation cannot be quantified. The proposed work would not be carried out near any areas of high quality habitat that would be expected to contain a high abundance of fauna and therefore the impact was considered to be minor.

Aquatic habitat

While the proposal would improve connectivity between the western and eastern sides of Cessnock Road, the proposal would not significantly change its hydrological behaviour under non-flood conditions, thereby having a minimal impact on aquatic habitat in the study area. The larger pipes and scour protection would be likely to have a minor impact by reducing downstream velocity, but this is expected to have a negligible impact on downstream habitats, and an improved impact on sedimentation and erosion. The proposal would have minor to negligible impact on the ponding behaviour in Testers Hollow as the new pipe would be installed at the same level as the existing pipe, while the two new pipes would be installed at a higher level and would only be in use during heavy rainfall and flooding events.

The proposal would result in the loss and modification of aquatic habitat by the partial filling of existing farm dams/ponds and installation of new drainage pipes. This small loss and modification of habitat would be unlikely to significantly impact the aquatic ecosystems of the Testers Hollow and Wallis Creek floodplain environment.

Conclusion on significance of impacts

The proposal would not likely significantly impact threatened species or ecological communities or their habitats, within the meaning of the BC Act or FM Act and therefore a Species Impact Statement or Biodiversity Development Assessment Report is not required.

The proposal is not likely to significantly impact threatened species, ecological communities or migratory species within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*.

6.1.4 Safeguards and management measures

Safeguards and management measures for biodiversity are presented in **Table 6.6**.

Table 6.6 Safeguards and management 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 Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RTA, 2011) and implemented as part of the CEMP. It will include, but not be limited to:</p> <ul style="list-style-type: none">Plans showing areas to be cleared and areas to be protected (including hollow-bearing and habitat trees), including exclusion zones, protected habitat features and revegetation areas and identified on site construction drawings and during construction staff inductionVegetation and habitat to be cleared and retained to be identified and protected by suitable fencing, signage or markingsHygiene protocols to manage weeds, pest species and pathogensProtocols for vegetation removalProtocols for working in waterwaysProtocols for unexpected finds procedure for threatened species or ecological communities not identified in assessed in the REFRequirements set out in the Landscape Guideline (RTA, 2008)Pre-clearing survey requirementsProcedures addressing relevant matters specified in the Policy and guidelines for fish habitat conservation and management (DPI Fisheries, 2013)	Contractor	Pre-construction	<p>Core standard safeguard B1</p> <p>Section 4.8 of QA G36 <i>Environment Protection</i></p>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> • Protocols to re-establish native vegetation. 			
Minimise risks to native flora and fauna during construction	In accordance with the Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects (RTA, 2011) a pre-construction check of native flora and fauna species and habitat will be carried out.	Contractor	Construction	Core standard safeguard B2
Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated prior to construction and implemented where practicable and feasible.	Contractor	Pre-construction	Core standard safeguard B3
Protect native flora and fauna, minimise edge effects and avoid inadvertent impacts	All personnel working on site will receive training to ensure awareness of requirements of the Flora and Fauna Management Plan and relevant statutory responsibilities. Site-specific training will be given to personnel when working in the vicinity of areas of identified biodiversity value that are to be protected.	Contractor	Construction	Core standard safeguard B4
Temporary obstruction to fish	Temporary obstruction of fish passage may require a NSW Fisheries Permit, subject to assessment by the Department of Planning, Industry and Environment.	Contractor	Construction	Additional standard safeguard B8
Removal of juvenile <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	Thirty-five <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> would be planted in a suitable location to replace those removed by the proposal.	Contractor	Construction	Additional safeguard
Stockpiles, plant and ancillary sites	No-go areas will be delineated in accordance with the Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects (RTA, 2011) and the Flora and Fauna Management Plan.	Contractor	Construction	Additional standard safeguard B10
Fauna handling	Safe fauna handling will be consistent with the Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects, and any specific requirements of the approved Flora and Fauna Management Plan.	Contractor	Construction	Additional safeguard B11

6.2 Noise and vibration

Potential noise and vibration impacts on sensitive receivers during construction and operation of the proposal have been assessed as part of the *Cessnock Road upgrade at Testers Hollow – Noise and Vibration Report* (NVA) (Jacobs, 2018d) provided in **Appendix J**.

6.2.1 Methodology

The NVA provided in **Appendix J** 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 (NMG) (Roads and Maritime, April 2015)
- Noise Model Validation Guideline (NMVG), (Roads and Maritime, 2018a)
- Road Noise Policy (RNP) (EPA, 2011)
- Assessing Vibration: a technical guideline (DEC, 2006)
- 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 (CoRTN) (UK Department of Transport, 1988)
- Noise Policy for Industry (NPI) (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 600 metres of the proposal. The study area was extended to three kilometres from the proposal area in the vicinity of Louth Park, due to the topography of the area and to ensure all exceedances of construction and operational noise limits were identified. The study area is shown in **Figure 6.3**.

Noise monitoring

Unattended noise monitoring was carried out to identify background noise levels for the proposal from 7 August 2018 to 15 August 2018 at representative locations (refer to **Figure 6.3**) using automatic unattended noise monitoring equipment (Type 1 Ngara noise loggers). The monitors continuously measured the level of ambient noise over 15-minute periods for the duration of the monitoring period at each location.

Additional attended noise monitoring was carried out at three locations (as shown in **Figure 6.3**) to understand the range of background noise levels.

During unattended noise monitoring a dog interfered with the noise logger at Location 1 (Cessnock Road north). This monitor was knocked over during the monitoring period and upon retrieval, the microphone was

at ground level. Additionally, the night time L_{Amax} was influenced by the frequent barking of nearby dogs. The quality of monitoring results at Location 1 are not considered acceptable and the results were therefore removed from the noise monitoring dataset. The noise environment at Location 2 is considered to be very similar to that at Location 1 and was considered adequate for the noise modelling exercise.

Noise modelling

To evaluate potential noise impacts for sensitive receivers during construction and operation, a model was developed using the SoundPlan 8 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 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 ground borne 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.

Noise model validation

The noise model used for the assessment was subject to a validation process to ensure the accuracy of its traffic noise predictions.

The model validation process allows for the identification of any errors in the modelling setup (e.g. identifying inconsistencies in the geospatial data), and to also then demonstrate that the noise model accurately represents the existing, real-world conditions (within the limitations of the prediction algorithm).

The validation process compared predicted and measured traffic noise levels acquired from the long-term, unattended traffic noise monitoring locations having an unobstructed exposure to traffic noise. Three noise monitoring locations were excluded from the validation process (Locations 1, 4 and 5) as the monitor at Location 1 was damaged by a dog and Cessnock Road was not audible at Location 4 and 5. However the remaining two validation sites (Locations 2 and 3) are considered adequate for the purposes of noise model validation for a road section of this size.

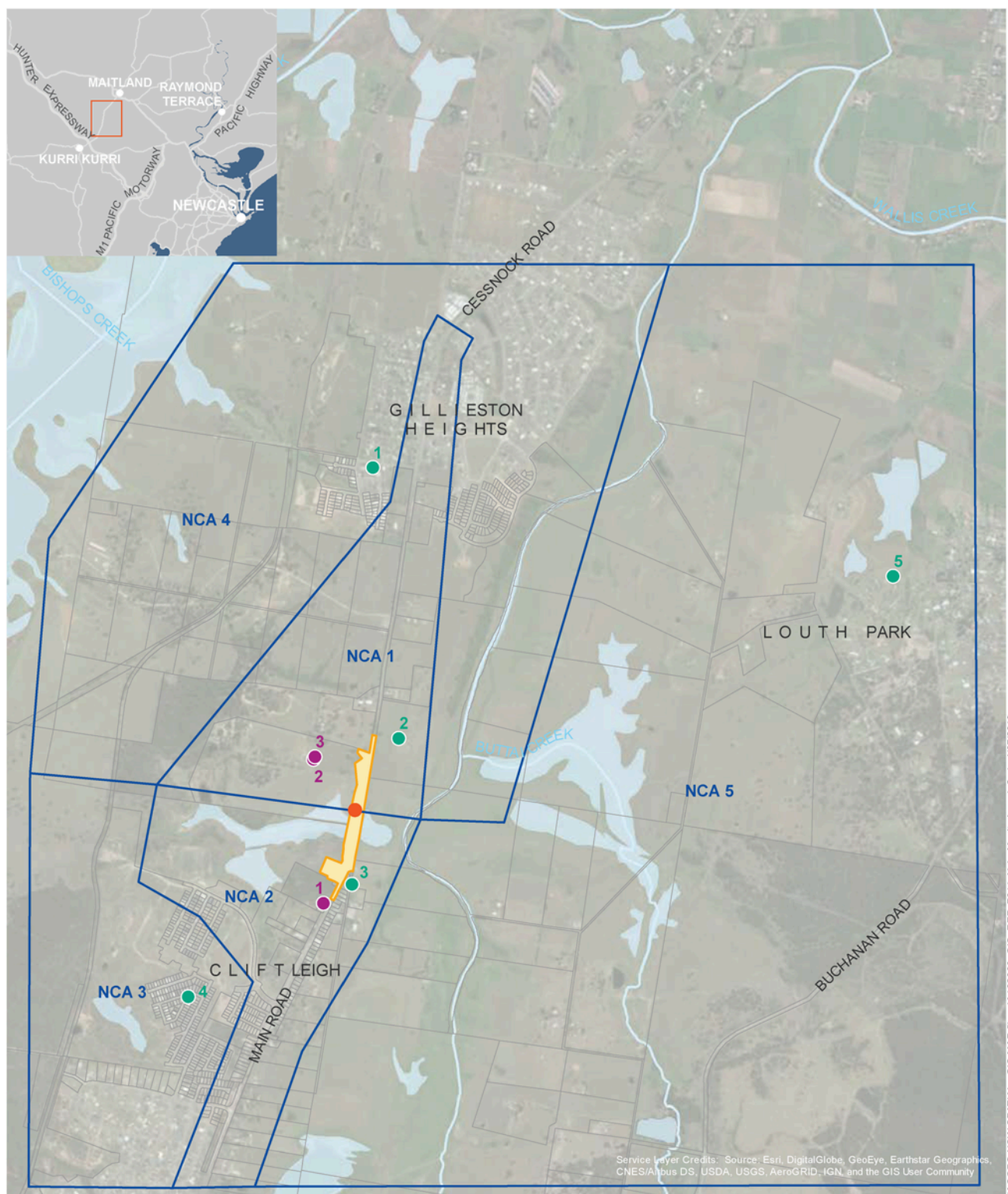
The validation model was configured to reflect actual site conditions (e.g. receiver distance from the road, total angle of view to traffic, type of road surface) and traffic volumes and speeds measured during the monitoring period (refer to traffic count locations in **Figure 6.3**).

Table 6.7 outlines the validation testing for each of the noise monitoring locations selected for model validation for both daytime and night time periods.

Table 6.7 Comparison of measured and modelled road traffic noise levels

Location	Monitoring results		Modelled		Difference	
	L_{Aeq} Day	L_{Aeq} Night	L_{Aeq} Day	L_{Aeq} Night	L_{Aeq} Day	L_{Aeq} Night
2	58.2	54.0	60	53.2	+1.8	-0.8
3	50.0	40.0	48.8	41.9	-1.2	+1.9

These results indicate that modelled noise levels are within the permissible ± 2 dB(A) and therefore that this model is expected to provide an accurate indication of road traffic noise for the proposal area.



JACOBS NSW SPATIAL - GIS MAP file : IA182900_GIS_REF_F011_NoiseMonitoring_T1V2 | 4/07/2019

Legend

- Proposal area
- Noise catchment area
- Additional attended noise monitoring
- Unattended noise monitoring locations
- Traffic count location
- Property boundary

0 500 1000 m
1:30,000 @ A4



Figure 6.3 Noise and vibration study area, noise monitoring location and NCAs

6.2.2 Existing environment

Sensitive receivers

About 617 residential, commercial and recreational area properties are located within the study area. The nearest receivers are shown in **Figure 6.3**.

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

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 carried out at representative locations within the study area (refer to **Figure 6.3**).

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 6.8**. The rating background level (RBL) refers to the median value of monitored background noise levels measured over each 15 minute period. 'L_{Aeq}' is the equivalent continuous sound level or energy-time average for the relevant 15 minute period of monitoring.

Table 6.8 Noise monitoring results

Monitoring location	Road noise results L _{Aeq} dB(A)		Construction noise monitoring results RBL dB(A)					
	Day (15 hour)	Night (9 hour)	Mon-Fri 7am to 6pm, Sat 8am to 1pm)*		Evening (Mon-Fri 6pm to 10pm, Sat 7am to 8am / 1 pm to 10pm, Sun / Pub hol 8am to 6pm)*		Night (Mon-Fri 10pm to 7am, Sat 10pm to 8am, Sun / Pub hol 6pm to 7am)*	
			RBL	L _{Aeq}	RBL	L _{Aeq}	RBL	L _{Aeq}
1**	55	51	52	56	43	53	29	51
2	58	54	55	59	52	57	50	54
3	44	40	37	50	32	43	30	40
4	50	40	38	51	36	48	32	41
5	43	39	37	45	33	40	30	40

* Time periods are referred to in CNVG (refer to Section 7)

** The noise loggers at Location 1 had been damaged by a dog. These results were not being used in this assessment. Instead Location 2 was used to consider noise impacts at all of Cessnock / Main Road properties.

6.2.3 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 RBL, with the relevant criteria applied in accordance with the ICNG for works during recommended standard hours and works outside these hours. **Table 6.9** identifies the methodology applied in the development of NMLs for residential receivers.

Table 6.9 Development of construction noise management levels (NML)

Time of day	NML LAeq (15 min)	How to apply
Recommended standard hours Monday to Friday 7.00am to 6.00pm 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. Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and the duration, as well as contact details.
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. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) 2. If the community is prepared to accept longer construction periods of higher noise activities over a shorter overall duration, in exchange for respite periods extending the length of time it takes for these works to be performed (for guidance on negotiating agreements see Section 7.2.2 of the ICNG (DECC, 2009).
Outside recommended standard hours	Noise affected (RBL + 5 dB)	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see Section 7.2.2 of the ICNG (DECC, 2009).

Source: Interim Construction Noise Guideline (DECC, 2009)

Receivers potentially affected by noise from construction of the proposal have been grouped in five Noise Catchment Areas (NCAs) as indicated in **Figure 6.3**. NCAs provide a logical grouping of receivers affected by the same work to assist with assessment, consultation or notification. The NCAs are defined as follows:

- NCA 1: Cessnock Road north – Properties in this area are a mix of rural and suburban residences, located in close proximity to Cessnock Road to the north of the proposal area and including parts of Gillieston Heights
- NCA 2: Cessnock Road south – Properties in this area are a mix of rural and suburban residences, located in close proximity to Cessnock Road to the south of the proposal area and including parts of Cliftleigh
- NCA 3: Cliftleigh – Properties in this area are a mix of rural and suburban residences, located away from Cessnock Road in the south of the proposal area
- NCA 4: Gillieston Heights – Properties in this area are a mix of rural and suburban residences, located away from Cessnock Road in the north of the proposal area

- NCA 5: Louth Park – Semi rural properties located to the east of Cessnock Road and overlooking the proposal area.

Based on the results from the noise monitoring presented in **Table 6.8** and the applications of the criteria presented in **Table 6.9**, the following construction NMLs have been established as outlined in **Table 6.10**.

Table 6.10 Construction noise management levels

NCA	Noise management level (NML) L_{eq} 15 minute dB(A)					
	Standard hours of construction (Mon-Fri 7am to 6pm, Sat 8am to 1pm)		Outside recommended standard hours of construction			
			OOHW Period 1 (Mon-Fri 6pm to 10pm, Sat 7am to 8am / 1pm to 10pm, Sun / Pub hol 8am to 6pm)		OOHW Period 2 (Mon-Fri 10pm to 7am, Sat 10pm to 8am, Sun / Pub hol 6pm to 7am)	
	RBL	NML (+10dB)	RBL	NML (+5dB)	RBL	NML (+5dB)
1*	55	65	52	57	50	55
2	55	65	52	57	50	55
3	37	47	32	37	30	35
4	38	48	36	41	32	37
5	37	47	33	43	30	35

* Noise levels at NCA1 were noted as invalid. Monitoring results from NCA2 were used for residential receivers in NCA1 to establish construction noise management levels.

For other relevant land uses within the proposal area, the noise criteria in **Table 6.11** would apply.

Table 6.11 Noise management levels for non-residential land uses (INCG, DECC 2009)

Land use	Management level L_{Aeq} 15 minute dB(A) (when in use)
Commercial premises	70 dB(A) external noise level
Outdoor recreational area (passive)	60 dB(A) external 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. If the noise levels from construction traffic increase by more than 2 dB(A) (ie 2.1 dB(A) or more relative to existing conditions) further assessment is required by the CNVG. This assessment would need to be carried out in accordance with the Roads and Maritime's Criteria Guideline, which documents the Roads and Maritime approach to implementing the Road Noise Policy. Consideration should also be given under the Noise Criteria Guideline as to whether construction traffic or a 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 VDV values are provided in **Table 6.12**.

Table 6.12 Preferred and maximum values for continuous and impulsive vibration acceleration (m/s²) 1-80 Hz (DECC, 2006)

Locations	Assessment period ¹	Preferred values		Maximum values	
		z-axis	X and y axis	z-axis	X and y axis
Continuous vibration					
Critical areas ²	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
Impulsive vibration					
Critical areas ²	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

¹ Daytime is 7am to 10pm. Night-time is 10pm to 7am

² Includes hospital operating theatres or precision laboratories.

Intermittent vibration is assessed differently using VDV values. Preferred and maximum VDV values are also provided in *Assessing Vibration: a technical guideline*, (DECC, February 2006) and have been reproduced in **Table 6.13**.

Table 6.13 Preferred and maximum VDV for intermittent vibration (ms-1.75), (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 ¹	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

¹ 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 6.14**.

Table 6.14 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 millimetres per second at one to 10 Hertz 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)) 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 6.15**.

Table 6.15 Recommended safe working distances for vibration-intensive plant and equipment, (CNVG, Roads and Maritime 2016)

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

Plant	Rating / description	Safe working distance (metres)	
	>300 kN (typically 13-18 t)	20	100
	>300 kN (> 18 t)	25	100
Small hydraulic hammer	300 kg – 5 to 12 t excavator	2	7
Medium hydraulic hammer	900 kg – 12 to 18 t excavator	7	23
Large hydraulic hammer	1600 kg – 18 to 34 t 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 noise

In 2015, Roads and Maritime formalised the Noise Criteria Guideline (NCG), Noise Mitigation Guideline and other supporting documents including the Noise Model Validation Guideline (NMVG) to further define and standardise the methods for assessing road noise and its mitigation from the guidance presented in the RNP.

Applying the Noise Criteria Guideline

Impacts of the realignment on traffic numbers are discussed in the Traffic and Transport Assessment for this proposal (Jacobs, 2018a). This document states that the proposal would not change the traffic carrying capacity or accommodate a significant increase in heavy vehicle traffic. In accordance with Section 5.5 of the NCG, a consideration of traffic impacts classifies the road as 'Minor Works'.

Further consideration of potential changes to the road alignment are outlined in Appendix A1 of the NCG. This section presents that where the proposed road alignment is inside 'six times the existing total lane width' (in this case 42 metres), the road is not classified as substantially realigned. At its furthest realignment point, the alignment of Cessnock Road is shifting by a distance of 19 metres and as such remains well within the identified 42 metre allowance. Thus the proposal is considered 'Minor Works'.

Operational noise criteria for residential receivers

For the assessment of noise impacts associated with assessments of 'Minor Work' proposal, it must first be evaluated whether noise levels increase by 2.1 dB(A) or more relative to existing levels at the worst-affected residential receiver. If this is found to be the case, all sensitive receivers within the study area must be assessed against this relative increase criterion, as well as the applicable road type criteria from the NCG and RNP shown in **Table 6.16**. It is noted that 'transition zones' requirements do not need to be considered for 'Minor Works'.

Table 6.16 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	L _{Aeq} (15hr) 55 (external)	L _{Aeq} (9hr) 50 (external)
	2. Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial roads	L _{Aeq} (15hr) 60 (external)	L _{Aeq} (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 _{Aeq} (15hr) (external) + 12 dB(A)	Existing L _{Aeq} (9hr) (external) + 12 dB(A)

Operational noise criteria for non-residential receivers

All non-residential receivers along Cessnock Road are located well outside the proposal operational study area (i.e. 600 metres) and are highly unlikely to be affected by changes in road traffic noise as a result of this proposal. As such, these receiver locations were not considered further in this assessment.

6.2.4 Potential impacts

Construction

The proposal would be constructed over a two year period (weather permitting) starting in mid 2020. The criteria established in **Section 6.2.3** was applied, with the following default construction scenarios evaluated:

- Stage 1 – Early works / utility relocation
- Stage 2 – Site compound establishment
- Stage 3 – Stripping and clearing
- Stage 4 – Drainage works
- Stage 5 – Earthworks
- Stage 5a – Piling and wick drain installation
- Stage 6 – Pavement works
- Stage 7 – Open to traffic (no construction involved with this stage)
- Stage 8 – Finishing works.

Sound power levels (SWLs) for these assessment scenarios were adopted from Roads and Maritime's Construction noise and Vibration Guideline.

The final construction methodology and staging would be refined prior to construction 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 the operation of ancillary sites would also be assessed where they are inconsistent with this assessment.

Proposed plant and equipment to be used during each stage of construction are provided in **Section 3.3.3** and have been factored into the assessment of construction noise and vibration impacts during each stage of construction.

Predicted construction noise impacts

The following noise impacts are predicted during construction activities:

- Stage 1 – Early works / utility relocation:
 - Ten properties located in the vicinity of the southern end of the proposal area would be expected to be acutely impacted [$>75\text{dB(A)}$] when works are underway in close proximity to their properties
 - Exceedances of daytime NMLs during early works may extend south as far as 24 Main Road, Heddon Greta. To the north, exceedances may reach properties within 501 Cessnock Road, Gillieston Heights
 - Where early works are conducted during OOHW period 1, exceedances may extend south into Cliftleigh beyond properties on Trader Way. To the north exceedances would be likely to reach into the Gillieston Grove housing estate towards Davies Street
 - During OOHW period 2 activities, exceedances would extend throughout Testers Hollow. Noise levels in Louth Park would be expected to remain below the NMLs for the NCA.
- Stage 2 – Site compound establishment:
 - This assessment has assumed both site compounds are established simultaneously. This presents a conservative result, and as such noise levels would likely be lower than the results presented in this section
 - The loudest equipment included in this work stage would be earthmoving equipment around the site office, in particular front end loaders and graders. Where earthmoving equipment is not in use around the office, noise levels would be substantially lower
 - No properties are predicted to be acutely impacted [ie $>75\text{dB(A)}$] by establishment activities at the ancillary sites
 - Exceedances of daytime NMLs during site compound establishment may extend south as far as 30 Main Road, Heddon Greta. To the north, exceedances may reach properties within 501 Cessnock Road, Gillieston Heights
 - Where site compounds are established during OOHW period 1, exceedances may extend south beyond the front row of properties in the Cliftleigh housing estate. To the north these exceedances may reach the front rows of houses within Gillieston estate. On Cessnock Road, NMLs may be exceeded as far north as 411 Cessnock Road, Gillieston Heights and south to the intersection of Main Road and William Tester Drive
 - During OOHW period 2, exceedances may extend south into Cliftleigh beyond properties on Trader Way. To the north exceedances would be likely to reach into the Gillieston Grove housing estate, extending towards Davies Street.
- Stage 3 – Stripping and clearing:
 - Ten properties located at the southern end of Cessnock Road would be expected to be acutely impacted [$>75\text{dB(A)}$] when works are underway in close proximity to their properties
 - Exceedances of daytime NMLs during stripping and clearing may extend south as far as 24 Main Road, Cliftleigh. To the north, exceedances may reach properties within 501 Cessnock Road, Gillieston Heights
 - Where stripping and clearing activities are conducted during OOHW period 1, exceedances may extend south into Cliftleigh beyond properties on Trader Way. To the north exceedances would be likely to reach into the Gillieston Grove housing estate towards Davies Street
 - During OOHW period 2 activities, exceedances would extend throughout Testers Hollow. Noise levels in Louth Park would be expected to remain below the NMLs for the NCA.

- Stage 4 – Drainage works:
 - Eight properties located at the southern end of Cessnock Road would be expected to be acutely impacted [$>75\text{dB(A)}$] when works are underway in close proximity to their properties
 - Exceedances of daytime NMLs during drainage works may extend south as far as 30 Main Road, Cliftleigh. To the north, exceedances may reach properties within 501 Cessnock Road, Gillieston Heights
 - Where drainage works would be conducted during OOHW period 1, exceedances may extend south beyond the front row of properties in the Cliftleigh housing estate. To the north these exceedances may reach the front rows of houses within Gillieston estate. On Cessnock Road, NMLs may be exceeded as far north as 411 Cessnock Road, Gillieston Heights and south to the intersection of Main Road and William Tester Drive
 - During OOHW period 2, exceedances may extend south into Cliftleigh beyond properties on Trader Way. To the north exceedances would be likely to reach into the Gillieston Grove housing estate, extending towards Davies Street.
- Stage 5 – Earthworks:
 - Eight properties located at the southern end of Cessnock Road would be expected to be acutely impacted [$>75\text{dB(A)}$] when works are underway in close proximity to their properties
 - Exceedances of daytime NMLs during earthworks may extend south as far as 20 Main Road, Cliftleigh. To the north, exceedances may reach properties within 501 Cessnock Road, Gillieston Heights
 - Where earthworks are conducted during OOHW period 1, exceedances may extend south into Cliftleigh beyond properties on Trader Way. To the north, exceedances would be likely to reach into the Gillieston Grove housing estate towards Davies Street
 - During OOHW period 2 activities, exceedances would extend throughout Testers Hollow. Noise levels in Louth Park would be expected to remain below that NCAs NMLs.
- Stage 5a – Piling and wick drain installation
 - No properties have been predicted to be acutely impacted [ie $>75\text{dB(A)}$] by activities at the construction compounds
 - Exceedances of daytime NMLs during piling and wick drain installation activities may occur at the nearest three properties to the proposal area located to the south along Main Road
 - Where piling and wick drain installation would be conducted during OOHW period 1, exceedances may extend south as far as 26 Main Road, Cliftleigh, beyond the front row of properties in the Cliftleigh housing estate. To the north these exceedances may reach 527 Cessnock Road, Gillieston Heights
 - During OOHW period 2, exceedances may extend south into Cliftleigh beyond properties on Trader Way. To the north exceedances would be likely to reach the front row of houses in the Gillieston Grove housing estate.
- Stage 6 – Paving activities:
 - Eight properties located at the southern end of Cessnock Road are expected to be acutely impacted [$>75\text{dB(A)}$] when works are underway in close proximity to their properties
 - Exceedances of daytime NMLs during paving activities may extend south as far as 20 Main Road, Cliftleigh. To the north, exceedances may reach properties within 501 Cessnock Road, Gillieston Heights
 - Where paving would be conducted during OOHW period 1, exceedances may extend south into Cliftleigh beyond properties on Trader Way. To the north exceedances would be likely to reach into the Gillieston Grove housing estate towards Davies Street

- During OOHW period 2 activities, exceedances would extend throughout Testers Hollow. Noise levels in Louth Park would be expected to remain below that NCA's NMLs.
- Stage 8 – Finishing works:
 - Proposed use of a front end loader and crane during this final work stage contribute substantially to overall noise levels
 - Eight properties located at the southern end of Cessnock Road would be expected to be acutely impacted [$>75\text{dB(A)}$] when works are underway in close proximity to their properties
 - Exceedances of daytime NMLs during finishing works may extend south as far as 20 Main Road, Cliftleigh. To the north, exceedances may reach properties within 501 Cessnock Road, Gillieston Heights
 - Where finishing works would be conducted during OOHW period 1, exceedances may extend south into Cliftleigh beyond properties on Trader Way. To the north exceedances would be likely to reach into the Gillieston Grove housing estate towards Davies Street
 - During OOHW period 2 activities, exceedances would extend throughout Testers Hollow. Noise levels in Louth Park are expected to remain below that NCA's NMLs.
- Site compound operation:
 - This assessment has assumed both site compounds would be operating simultaneously. This is not likely as such noise levels are likely to be somewhat lower than the results presented
 - No properties have been predicted to be acutely impacted [ie $>75\text{dB(A)}$] by activities at the construction compounds
 - No properties are expected to experience exceedances of daytime NMLs from operations at the site compounds
 - During work outside of standard hours, activities at the southern compound site may result in exceedances of OOHW1 and OOHW2 NMLs at the nearest three properties located to the south of the proposal.

Overall, construction noise impacts have been predicted to occur where construction activities are carried out in the southern built up areas of the proposal, along Cessnock Road and the intersection with Avery Lane. These impacts would be more substantial during tie in works which may be required to be carried out during night time hours.

Construction noise contours for each construction stage are presented in Appendix B of **Appendix J**.

Construction traffic noise impact

Noise impacts associated with construction traffic were assessed against an increase of 2dB(A) over existing levels. This equates to an increase in heavy vehicle numbers of about 60 per cent.

Existing daytime heavy vehicle movements are between 300-500 per day in each direction. A peak traffic increase of 40 heavy vehicle movements in each direction equates to an increase of no more than 13 per cent and would be likely to result in an increase in road traffic noise along Cessnock Road of no more than 0.3dB(A) . This was verified using the CNE, with input information applied as displayed in Appendix C of **Appendix J**.

An increase of this scale is not likely to be noticeable and is below the 2.1dB(A) threshold for construction traffic noise. Therefore, noise from additional traffic movements generated during construction would not likely represent an issue during construction of the proposal.

Sleep disturbance impacts

Works would generally be completed during standard hours of construction. However, some works may occasionally be required to be carried out outside these hours due to road access and for safety reasons. Such activities would include tie in at the northern and southern ends of the existing Cessnock Road.

Construction noise contour maps are displayed in **Appendix J**. These maps present estimated internal L_{A1} noise levels for the purposes of assessing potential sleep disturbance impacts.

The predicted levels indicate that sleep disturbance screening and awakening criterion may be exceeded at receivers set at distances of up to around 50 metres from the proposal. This prediction is conservative, noting that the sleep disturbance awakening criterion is based on a 'worst-case' façade transmission loss of 10 dB(A). Mitigation and management measures should be developed with the aim of limiting any sleep disturbance impacts during the proposal.

Mitigation and management measures

To manage potential impacts during the proposal, standard mitigation measures listed in Appendix B of the CNVG would be implemented as well as relevant additional measures from **Appendix J**. These additional measures are summarised in **Section 6.5.5**.

Construction vibration impacts

Some vibration-intensive equipment may be used during the proposal including compaction equipment. Relevant recommended safe setback distances to maintain building cosmetic and human comfort criteria for these types of plant are shown in **Table 6.15**.

Piling activities are understood to be proposed in soft soil areas only. These sites are located more than 100 metres from the nearest residences and 80 metres from the nearest structures. As such vibration impacts would not be expected to arise during piling works.

Vibratory compaction may occur about 20 metres from the nearest residential properties. At this distance, there would be the potential for exceedances of the human comfort criteria, however building damage would be unlikely.

Operation

Potential changes in operational traffic noise levels may occur as a result of changes in the horizontal and vertical alignment of the proposal. There would be no increase in the volume of traffic, mix of traffic, or posted speed as a result of the proposal.

Detailed predictions of the existing traffic noise and the proposal's operational traffic noise at receivers representative of each NCA (refer to **Figure 6.3**) are presented in **Table 6.17**.

Table 6.17 Comparison of traffic noise under existing traffic numbers

NCA	Location	Existing traffic noise		Predicted traffic noise		Difference	
		L_{Aeq} Day	L_{Aeq} Night	L_{Aeq} Day	L_{Aeq} Night	L_{Aeq} Day	L_{Aeq} Night
1	A1	54	47.1	52.2	45.4	-1.8	-1.7
2	A3	64.3	57.3	62.2	55.2	-2.1	-2.1
3	1	57.7	50.9	55.8	49	-1.9	-1.9
4	2	60	53.2	57.8	50.9	-2.2	-2.3
5	3	36.9	30	34.9	28	-2	-2
1	4	48.8	41.9	46.9	40	-1.9	-1.9
2	5	33.4	26.5	31.5	24.7	-1.9	-1.8

Predicted traffic noise for 2028 is summarised in **Table 6.18**.

Table 6.18 Comparison of traffic noise in 2028

NCA	Location	Existing traffic noise		Predicted traffic noise		Difference	
		L _{Aeq} Day	L _{Aeq} Night	L _{Aeq} Day	L _{Aeq} Night	L _{Aeq} Day	L _{Aeq} Night
1	A1	56.1	51.2	54.3	49.5	-1.8	-1.7
2	A3	66.4	61.5	64.3	59.4	-2.1	-2.1
3	1	59.8	55	57.9	53.1	-1.9	-1.9
4	2	62.1	57.3	59.9	55	-2.2	-2.3
5	3	39	34.1	37	32.1	-2	-2
1	4	50.9	46	49	44.1	-1.9	-1.9
2	5	35.5	30.6	33.6	28.8	-1.9	-1.8

The road surface type is another variable noted to affect noise generated from road operations. The proposal would change the road surface from 10 millimetre chip seal to dense graded asphaltic (DGA) road surface which would have the potential to reduce wheel-generated noise. Most receivers in the study area would be expected to experience a reduction in road traffic noise due to the use of DGA.

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

However, where the influence of the road surface is not considered, a maximum increase in road traffic noise of 0.3dB(A) is forecast. This level of increase is below the permissible 2.1dB(A) and would not be noticeable. Therefore the predicted noise levels are considered acceptable.

6.2.5 Safeguards and management measures

Safeguards and management measures for noise and vibration are presented in **Table 6.19**.

Table 6.19 Safeguards and management measures – Noise and vibration

Impact	Environmental safeguards	Responsibility	Timing	Reference
Noise and vibration	<p>A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP and updated regularly to account for changes in the noise and vibration issues and strategies. The NVMP will generally follow the approach in the Interim Construction Noise Guideline (ICNG) (DECC, 2009) and identify:</p> <ul style="list-style-type: none"> All potential significant noise and vibration generating activities associated with the proposal Feasible and reasonable mitigation measures from the CNVG (Roads and Maritime, 2016) to be implemented <p>Receivers that require</p>	Contactor	Pre-construction	<p>Core standard safeguard NV1</p> <p>Section 4.6 of QA G36 <i>Environment Protection</i></p>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<p>additional mitigation (as listed in Table 4-6 of Appendix I)</p> <ul style="list-style-type: none"> • Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria. 			
Noise and vibration	<p>All sensitive receivers (local residents) likely to be affected will be notified at least five days before 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"> • The proposal • The construction period and construction hours • Contact information for project management staff • Complaint and incident reporting • How to obtain further information. 	Contactor	Pre-construction	Core standard safeguard NV2

6.3 Hydrology, flooding and water quality

The potential impacts of the proposal on hydrology and flooding are assessed in the *MR195 Cessnock Road Upgrade at Testers Hollow – Flood Assessment* (WMA Water, 2018b) provided in **Appendix H**. Groundwater information from the Geotechnical Interpretive and Design Report (Jacobs, 2019) has also been included in this section. A desktop assessment was also carried out by Jacobs to assess the expected impacts to water quality and groundwater from the proposal. A summary of these assessments is presented in this section, together with safeguards and management measures to mitigate any negative impacts.

6.3.1 Methodology

The *MR195 Cessnock Road Upgrade at Testers Hollow – Flood Assessment* (WMA Water, 2018b):

- Defined existing flood behaviour (comprising flood depth, velocity and hazard mapping and depth and duration of road overtopping) for the 20, five, two and one per cent AEP events and the probable maximum flood (PMF) event
- Assessed the proposal for various flood immunities.

A qualitative assessment was also carried out by Jacobs to:

- Describe the groundwater setting of the study area and to identify and assess the expected impacts to groundwater from the proposal
- Identify and assess the expected impacts to groundwater and surface water quality from the proposal
- Describe the impact of the proposal on hydrological behaviour in the study area.

6.3.2 Existing environment

Regional setting

The proposal is located in the Wallis Creek and Swamp-Fishery Creek catchment. The catchment covers an area of about 400 square kilometres and is subject to flooding from local run off and from the Hunter River in the lower part of the catchment. Swamp-Fishery Creek and Wallis Creek are the two main creeks in the catchment. Cessnock Road runs between these creeks, with Wallis Lake on the eastern side and Swamp-Fishery Creek on the western side.

The proposal is situated within the floodplain that connects Testers Hollow west of Cessnock Road, to Wallis Creek to the east. The arm of Wallis Creek near the proposal area is a fifth order stream (Strahler) that flows north for about 5.5 kilometres where it turns into a sixth order stream and then eventually meets the Hunter River (ninth order stream) a further 3.5 kilometres north east. The aquatic habitat in the proposal area comprises of the constructed and ephemeral unnamed third order stream that connects Wallis Creek with Testers Hollow, artificial agricultural ponds and the surrounding floodplain inundation area.

Hydrology and flooding

Testers Hollow is a swampy area which drains eastward to Wallis Creek, about 200 metres downstream of Cessnock Road. It is a natural low point that has been historically modified to retain and channel water for agricultural purposes. Other than water flow from its relatively small catchment area, Testers Hollow is heavily influenced by backwaters from Wallis Creek, which flow westwards into Testers Hollow during periods of heavy rainfall.

Cessnock Road at Testers Hollow has immunity equivalent to, and in excess of, 20 per cent AEP flood events. Flooding of Cessnock Road within the study area can be characterised as follows (WMA Water, 2018b):

- Flooding events can occur from the east (from Wallis Creek and/or Hunter River) and from the west (from the local catchment draining to Testers Hollow)
- Flooding events originating from the local catchment in the west tend to have lower flood levels and inundation duration, and are not the dominant mechanism of flooding in this area
- Flooding events originating from the east (from Wallis Creek and/or the Hunter River) dominate flooding events with greater peak flood levels and inundation duration
- The Hunter River dominates for events rarer than the five per cent AEP events.

Flood depths and levels for the proposal area for the five per cent AEP flood are shown in **Figure 6.4**.

A 1200 millimetre diameter precast concrete pipe is located underneath Cessnock Road to provide cross-drainage connectivity between the eastern and western sides of the road embankment (refer to **Section 2.2**). In flooding events, when the side to the east of Cessnock Road is flooded by Wallis Creek or the Hunter River, floodwater builds up behind the eastern road embankment until Cessnock Road is overtopped at about 4.6 metres AHD. A number of flood events resulted in overtopping Cessnock Road at Testers Hollow, most recently in June 2007, March 2013, April 2015 and January 2016.

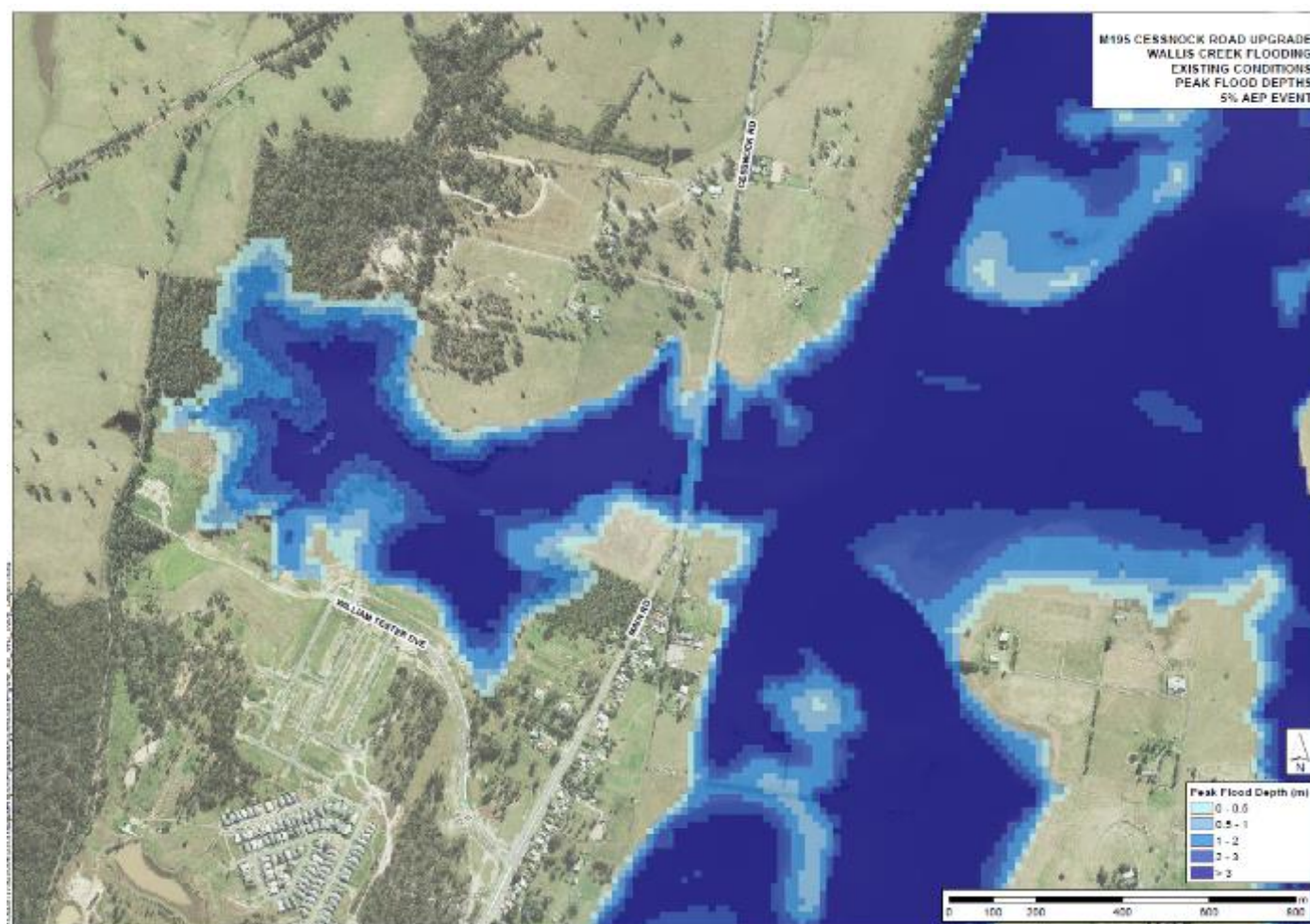


Figure 6.4 Flood depth and levels 5% AEP - existing conditions (WMAWater, 2018b)

Groundwater

The proposal is located in the Sydney Basin – North Coast groundwater source area subject to the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016*. A search of the Australian Groundwater Explorer on 5 October 2018 identified no recorded boreholes with standing water

levels within about two kilometres of the proposal. Further discussion on aquatic habitats is described in **Section 6.1**. A review of the DPI continuous water monitoring network shows that there is no groundwater data available within the proposal area (Jacobs, 2018e).

Standpipe piezometers installed in three boreholes during geotechnical investigations for the proposal indicate a shallow groundwater table with groundwater drilling and monitoring depths ranging between 0.3 and 2.5 metres. A shallow groundwater level is supported by the presence of existing waterways and groundwater dependent ecosystems within and around the proposal area (refer to **Section 6.1.2** and **Appendix I**). Groundwater is at or close to ground surface in the centre of the proposal area, and deeper below ground level at the north and south, where the proposal area is elevated.

Water quality

Surface water quality within Testers Hollow is influenced by surrounding land uses, which is dominated by grazing and cattle farming activities. The Ayrfield Colliery (discussed further in **Section 6.5.2**) lies upstream from Testers Hollow. It may continue to have an influence on the acidity of water in Testers Hollow. Previous water quality investigations carried out by Douglas Partners between 2001 and 2003 identified the water quality in Testers Hollow to be acidic, brackish/saline, with elevated nutrient levels (Douglas Partners, 2005). Water quality testing carried out for the proposal in May 2018 found that water in Testers Hollow ranges from neutral to moderately acidic and ranges from normal to elevated conductivity (which could be due to contribution from groundwater which typically has higher conductivities than surface water).

Groundwater quality in the proposal area is unknown. Given the presence of potential acid sulfate soils at Testers Hollow as well as known acidity in the surface water, groundwater within the proposal area has the potential to have acidic characteristics.

6.3.3 Potential impacts

Construction

Hydrology and flooding

During construction, a temporary pipe would maintain hydrologic connectivity between the east and west sides of Cessnock Road. Flooding impacts of the proposal during construction would therefore be expected to be minor and the construction activities would not be expected to impact on regional flooding behaviour. Ancillary sites would be located outside the 10 per cent AEP flood level.

A flood event during construction from either Wallis Creek or Hunter River flooding has the potential to inundate the work area, mobilise sediment from exposed surfaces, and delay the schedule by weeks while the flood water drains.

Dewatering, blocking or diverting local drainage lines as part of construction activities (for instance dewatering of the waterlogged area to the west of Cessnock Road during construction) have the potential to result in localised areas of flooding during rainfall events.

Groundwater flows and levels

Wick drains would be installed within the preload embankment to accommodate displaced groundwater expelled from the expected settlement of soft soils. Displaced groundwater would infiltrate back into the groundwater table. This temporary displacement of groundwater is not considered likely to result in any demonstrable impact to groundwater conditions.

Water quality

Surface water quality within Testers Hollow is poor and influenced heavily by surrounding land uses (refer to **Section 6.3.2**). Construction activities within and outside of Testers Hollow have the potential to impact water quality by disturbing sediments. In the case of activities within Testers Hollow, these sediments may be mobilised into the water column. In the case of activities outside of Testers Hollow, these sediments

may be transported offsite into receiving watercourses which may include Testers Hollow, the unnamed stream east of Testers Hollow, Wallis Creek and eventually the Hunter River. Activities that may increase erosion potential, resulting in an impact on local water quality through sedimentation include:

- Establishing the preload embankment
- Filling farm dams to the west of Testers Hollow with rock material
- Diverting local drainage lines, and thereby changing local drainage and scour patterns within the proposal area
- Removing vegetation
- Earthworks, including topsoil stripping, excavation and fill placement
- Stockpiling of topsoil and vegetation
- Transporting cut and/or fill materials
- Moving heavy vehicles across exposed earth.

Other activities that may influence surface water quality include:

- Accidental spills of fuels, oils or other chemicals from construction vehicles or equipment
- Seepage of potentially acidic groundwater displaced by the preload embankment.

The potential impact of unmitigated construction activities on receiving surface waters include:

- Increased sedimentation. This may be due to increased erosion during rainfall events. Increased sedimentation has the potential to physically smother aquatic habitat, flora and fauna as discussed in **Section 6.1.3**
- Increased turbidity from sedimentation, resulting in reduced oxygen levels, clarity of water and restricting light and photosynthesis
- Contamination from chemical, heavy metal, oil and grease, and petroleum hydrocarbon spills from construction machinery directly contaminating the unnamed waterway and Wallis Creek
- Increased acidity from the influx of acidic groundwater which may be displaced by the preload embankment.

As the proposal is in an undulating and hilly area, the unmitigated risks to water quality from sediment or chemical runoff during construction would be moderate. These potential impacts can, however, be readily mitigated with standard construction site management measures. Water quality on site during construction would be managed with temporary water quality controls in accordance with the guidelines set out in the Soils and Construction – Managing Urban Stormwater Volume 1 (Landcom, 2004) and Volume 2D (DECCW, 2008). A monitoring and management plan has been proposed as part of the Soil and Water Management Plan to monitor and manage the quality of groundwater displaced by the preload embankment (refer to **Table 6.21**). With the implementation of the proposed safeguards and management measures, the proposal would result in a minimal residual risk to surface and ground water quality.

Operation

Hydrology and flooding

The proposal would improve hydrologic connectivity between the western and eastern sides of Cessnock Road, by replacing the existing pipe with a larger pipe. Hydrologic connectivity would be improved further during and after heavy rainfall events when the water level reaches the two additional pipes that will be installed at a higher level than the existing pipe.

The proposal would also improve floodplain connectivity and reduce flood hazard during operation.

Additional pipes as described in **Section 3.2.3** would improve floodplain connectivity under Cessnock Road. Improved floodplain connectivity would reduce the time required for floodwaters to equalise between the western and eastern sides of Cessnock Road.

An assessment of floodplain storage, water levels and velocity identified minor or no adverse impact to flooding as a result of the proposal:

- Floodplain storage: Modelling results identified that the proportion of flood storage lost as a result of the proposal would be negligible compared to the total available flood storage in the Wallis and Swamp-Fishery Creek catchment
- Floodplain water levels: Raising Cessnock Road has the potential to allow floodwaters to build up to higher levels on the eastern side of Cessnock Road. This would result in greater differences in water level between the eastern and western sides of the embankment and a longer duration for water levels on both sides to equalise. This would result in higher velocities through the pipe (potentially resulting in scour impacts) and increase the risk of seepage of water through the road embankment, which has the potential to lead to slope instabilities or piping failure. The additional pipe capacity described in **Section 3.2.3** would provide the floodplain connectivity under Cessnock Road required to avoid an imbalance of flood levels on the west and east sides of Cessnock Road
- Flood velocity: The proposal would result in some minor changes in velocity (increases of up to 0.2 metres per second and reductions in up to three metres per second) at the inlets and outlets of the pipes in the modelled flood events for both Hunter River and Wallis Creek flooding events.

The proposal would reduce road closure time during flood events, with Cessnock Road at Testers Hollow being flood free in the five per cent AEP event from both Wallis Creek and Hunter River flooding. In events larger than five per cent AEP, flood depth across Cessnock Road and duration of inundation are reduced substantially (by several days). **Table 6.20** summarises the change in depth and duration of inundation from the proposal.

The proposal would have a substantial positive impact on the average annual duration of inundation at Cessnock Road following flooding events. The proposal would reduce the average annual duration of inundation by 79 per cent (18.5 hours), from 23.5 hours to five hours. Design flood events (20 per cent AEP, five per cent AEP, two per cent AEP, one per cent AEP and PMF) have been used to calculate these statistics (further detail provided in **Appendix H**).

The proposal would have a substantial positive impact on flood hazard over Cessnock Road, especially in the case of Wallis Creek flooding where hazard categories are dropped by four categories in the one, two and five per cent AEP flooding events (refer to **Table 6.20** and **Figure 6.5**). In all cases but the Hunter River PMF, the proposal has a positive impact on flood hazard within the study area.

Table 6.20 Change to depth and duration of inundation and flood hazard with the proposal

Flood event	Depth of inundation in metres with the proposal (change)	Duration of inundation in hours with the proposal (change)	Maximum flood hazard category with the proposal (existing hazard category)
Historic flood events			
June 2007	0.49 (-1.63)	120 (-95)	Not assessed
March 2013	Not flooded (-0.85)	Not flooded (-169)	Not assessed
April 2015	0.45 (-1.63)	106 (-102)	Not assessed
January 2016	Not flooded (-1.15)	Not flooded (-99)	Not assessed
Wallis Creek flooding			
20% AEP	Not flooded (not flooded)	Not flooded (Not flooded)	Not flooded
5% AEP	Not flooded (-1.34)	Not flooded (-86)	Not flooded (H5)
2% AEP	0.07 (-1.63)	6 (-102)	H1 (H5)
1% AEP	0.20 (-1.63)	32 (-107)	H1 (H5)

Flood event	Depth of inundation in metres with the proposal (change)	Duration of inundation in hours with the proposal (change)	Maximum flood hazard category with the proposal (existing hazard category)
PMF	3.42 (-1.63)	135 (-90)	H5 (H6)
Hunter River flooding			
5% AEP	Not flooded (-1.38)	Not flooded (-127)	Not flooded (H5)
2% AEP	1.70 (-1.63)	89 (-121)	H4 (H5)
1% AEP	3.58 (-1.63)	133 (-115)	H5 (H6)
PMF	5.58 (-1.63)	161 (-98)	H6 (H6)

Existing hazard categories:

H1 – Generally safe

H2 – Unsafe for small vehicles

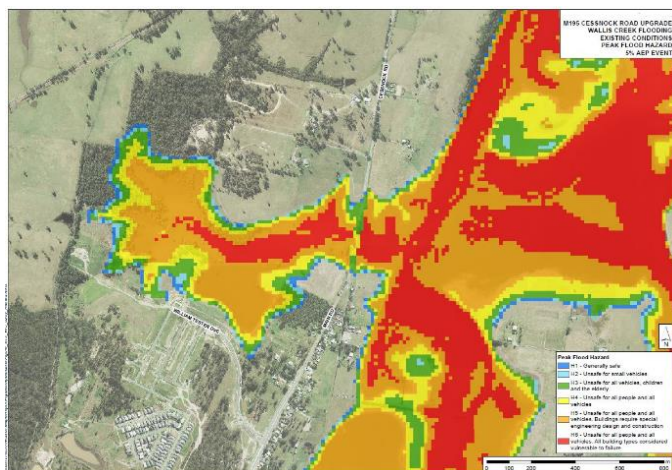
H3 – Unsafe for all vehicles, children and the elderly

H4 – Unsafe for all people and all vehicles

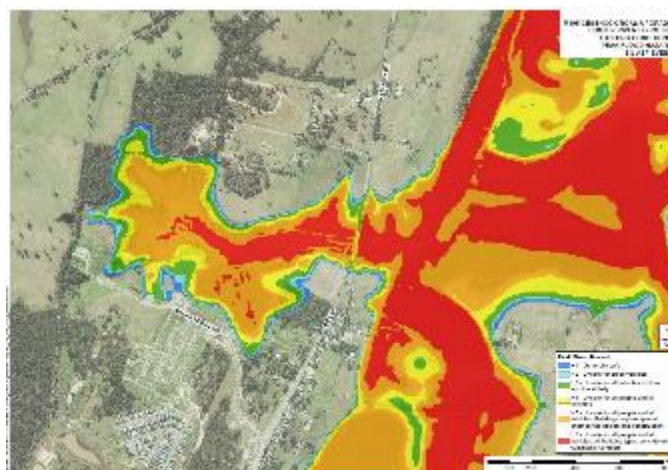
H5 – Unsafe for all people and all vehicles. Buildings require special engineering design and construction

H6 – Unsafe for all people and all vehicles. All building types considered vulnerable to failure

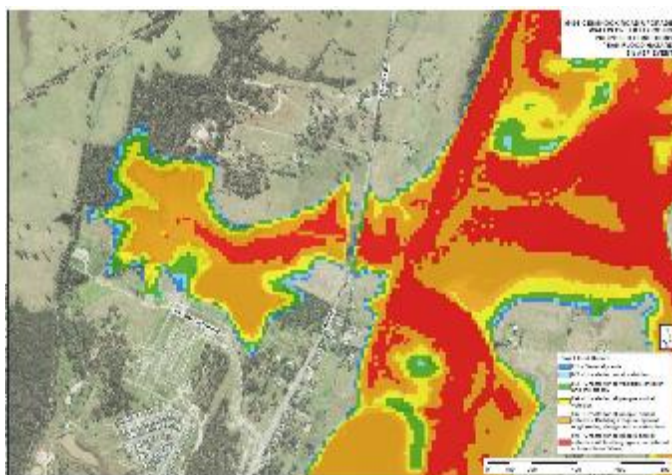
The historic flood events have not been modelled with the proposal. The information presented in **Table 6.20** is estimated based on the existing condition results.



Existing conditions



Proposed conditions with Hunter River flooding



Proposed conditions with Wallis Creek flooding

Figure 6.5 Peak flood hazard - existing and proposed conditions for 5 per cent AEP flooding events Hunter River and Wallis Creek (WMAWater, 2018b)

Groundwater flows and levels

Operation of the proposal would not impact on groundwater.

Water quality

Drainage infrastructure is proposed along Cessnock Road to facilitate stormwater flows in the study area (refer to **Section 3.2.3**). Improved formalised drainage with built in scour protection (in the form of vegetated and rock lined drains) would slow stormwater down and reduce the potential for erosion and sedimentation to receiving waterways. Installation of scour protection on the eastern and western sides of the proposed pipes (refer to **Section 3.2.3**) would also reduce the potential for erosion during rainfall and flooding events.

Groundwater seepage from beneath the new road embankment during operation is expected to be negligible. Accordingly, the proposal would not impact on groundwater quality during operation.

Provided that appropriate water quality management measures are implemented as discussed in **Section 3.2.3**, operation of the proposal would not be expected to have impacts on water quality additional to those already present.

6.3.4 Safeguards and management measures

Safeguards and management measures for hydrology and water quality are presented in **Table 6.21**.

Table 6.21 Safeguards and management measures – Hydrology, flooding and water quality

Impact	Environmental safeguards	Responsibility	Timing	Reference
Soil and water	A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution (including expelled groundwater) and describe how these risks will be addressed during construction.	Contractor	Pre-construction	Core standard safeguard SW1 Section 2.1 of QA G38 Soil and Water Management
Soil and water	<ul style="list-style-type: none">A site specific Erosion and Sediment Control Plan (ESCP) will be prepared and implemented as part of the SWMPThe plan will include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.	Contractor	Pre-construction	Core standard safeguard SW2 Section 2.2 of QA G38 Soil and Water Management
Contaminants entering receiving environments during construction	Control measures to minimise the risk of water pollution will be included in the ESCP. The following measures will be included to limit sediment and other contaminants entering receiving waterways: <ul style="list-style-type: none">All fuels, chemicals, and liquids will be stored at least 50 metres away from any waterway and stored in an	Construction contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<p>impervious bunded area within the compound site</p> <ul style="list-style-type: none"> Plant and maintenance machinery will be refuelled in impervious bunded areas at least 40 m from waterways Run-off from ancillary sites will be controlled and treated before discharging into downstream waterways Vehicle washdowns and/or concrete truck washouts would be carried out within a designated bunded area of an impervious surface or carried out off-site Vehicle movements will be restricted to designated pathways and hardstand areas Areas that will be exposed for extended periods, such as car parks and main access roads, will be stabilised where feasible. 			
Extraction of water	Non potable water sources (including the potential for water extraction from the Hunter River) would be investigated during pre-construction to minimise reliance on potable water where feasible. Any water extraction would occur only after consultation with the Department of Planning, Industry and Environment (who now manages the functions of the NSW Office of Water), and acquisition of associated permits and approvals, if required.	Roads and Maritime / Construction contractor	Pre-construction / Construction	Additional safeguard
Flood management for the construction site	<p>A Flood Management Plan will be prepared before construction. This plan will include:</p> <ul style="list-style-type: none"> Review and coordination with existing local flood plans and evacuation procedures Flood emergency preparation, response, and recovery measures which will implemented during construction Procedure for daily review of the Bureau of Meteorology website Site protection measures to be implemented before and in the event of flooding. 	Construction contractor	Pre-construction / Construction	Additional safeguard
Potentially acidic groundwater expelled by	A water sampling and management regime will be implemented as part of the SWMP to mitigate against water quality impacts arising from the temporary release of potentially acidic groundwater. The water	Construction contractor	Pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
preload embankment	sampling regime will include monitoring of water quality before construction to provide a baseline.			

6.4 Aboriginal heritage

The potential impacts on Aboriginal heritage during construction and operation of the proposal have been assessed as part of the ACHAR (Jacobs, 2019a), provided in **Appendix E**. A summary of the assessment is provided below, together with safeguards and management measures to mitigate any negative impacts.

6.4.1 Methodology

The Aboriginal heritage assessment was carried out in accordance with the Roads and Maritime Procedure for Aboriginal cultural heritage consultation and investigation (PACHCI) (Roads and Maritime, 2011). The assessment encompasses findings from:

- Desktop risk assessment to determine whether the proposal would potentially impact on Aboriginal cultural heritage and require further assessment or investigation (Stage 1 of PACHCI)
- Further desktop studies, a site survey and preparation of an archaeological methodology for test excavations (Stage 2 of PACHCI).

Studies and consultation carried out as part of Stage 2 of PACHCI identified the need to progress to PACHCI Stage 3 and carry out further investigations. Key tasks as part of PACHCI Stage 3 included:

- A review of the legislative and policy framework relevant to the proposal and assessment of Aboriginal heritage
- A cultural values assessment which documented interviews carried out with knowledge holders identified by the RAPs for the proposal
- Test excavations carried out in February 2019 for the PAD north of Testers Hollow (north side) and the PAD south of Testers Hollow in May 2019 (south side)
- Preparation of an Archaeological Assessment Report, which describes the archaeological research, fieldwork and analysis carried out following test excavations
- An assessment of the heritage significance of the identified Aboriginal site in accordance with the NSW heritage significance criteria
- An assessment of direct and indirect impacts from the proposal on identified Aboriginal sites, potential Archaeological deposits and their significance
- Recommendation of management measures to mitigate potential impacts of the proposal on Aboriginal sites and their values
- Preparation of an ACHAR in accordance with the *National Parks and Wildlife Act 1974*, *The Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011) and *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010).

Consultation carried out as part of the Aboriginal heritage assessment has been summarised in **Section 5.3** and detailed in the ACHAR (Jacobs, 2019a).

6.4.2 Existing environment

Database searches

A search of the AHIMS database was carried out on 19 April 2018 and updated on 11 February 2019. The AHIMS searches identified 94 registered Aboriginal sites within a 10 kilometre radius of the proposal area, comprising:

- Fifty-seven artefacts scatters/open camp sites, two with a PAD component
- Twenty isolated artefacts
- Thirteen untested or partially tested PADs
- One modified tree (carved or scarred)
- One restricted site (destroyed)
- Two open campsites registered as Aboriginal resource sites
- One PAD that was found not to be a site.

Of the 94 registered Aboriginal sites identified, 13 have been destroyed. The search results confirmed that one registered Aboriginal site (AHIMS #38-4-0898) is located about 200 metres south west of the proposal area.

A search of the National Heritage List, Commonwealth Heritage List, Australian Heritage Places List, Register of the National Estate (non-Statutory) and National Trust Register was carried out on 4 October 2018 and 10 July 2019. No Aboriginal heritage sites within or around the proposal were found on these registers.

The proposal area is located within land currently subject to Native Title Claim by the Scott Franks and Anor on behalf of the Plains Clans of the Wonnarua People (NSD39/2019) and Plains Clans of the Wonnarua People (NSD788/2013).

Aboriginal context

The proximity of permanent water, ephemeral streams and wetland areas indicates the area is likely to have been suitable for Aboriginal occupation. The geological and soil features of the area are discussed in further detail in **Section 6.4**.

The proposal is located within the boundaries of the Mindaribba Local Aboriginal Land Council (LALC) and within traditional boundaries of the Wonnarua Nation. Before the arrival of the Europeans the Wonnarua was a large grouping of individual family units and bands which occasionally came together for religious and ceremonial functions (Davidson and Lovell-Jones, 1993:3). Social responsibilities and obligations meant that people also travelled beyond their own territories to attend ceremonies with neighbours, to trade and to develop social networks that linked people across extensive areas. There were documented links between the Wonnarua and the Awabakal and other tribal groups along the coastline and into western New South Wales (Brayshaw, 1986: 38-41).

Former land use and disturbance

Land use across the proposal area since European occupation began in the early-to-mid 19th century, has been primarily for grazing practices and the broader changes/impacts observed have occurred primarily from European land management strategies.

Previous ground disturbing activities in the proposal area include:

- Dam construction
- Localised bulk earthworks to the west of Cessnock Road (including dam backfilling) (the topographic changes associated with these activities are detailed further in **Section 6.6.2**)
- Cessnock Road construction
- Farming practices, including vegetation clearance for paddock creation, fencing and stock grazing

- Vegetation clearance.

Construction of dams, Cessnock Road and bulk earthworks would have resulted in major ground disturbance, while vegetation clearance for farming activities would have resulted in low levels of ground disturbance.

Field survey

Predictive modelling carried out as part of Stage 2 of the PACHCI, informed by the results of the desktop assessment, was used to identify the archaeological sensitivity of particular landforms within the study area. The predictive model was used to identify areas of potential archaeological sensitivity based on known patterns of site distribution in similar landscape regions or archaeological landscapes. The assessment identified two Aboriginal sites within the proposal area. A program of archaeological test excavations was recommended at the Aboriginal sites to identify the nature, extent and archaeological significance of each area.

As part of this process, a field survey was conducted in June 2018 attended by representatives from Mindaribba LALC, Plains Clans of the Wonnarua People and Scott Franks and Anor on behalf of the Plains Clans of the Wonnarua People. The site survey identified one new Aboriginal artefact scatter and an area of PAD within the proposal area. These sites were numbered TH-AS-001 (AHIMS #38-4-1998) and TH-PAD-001 (AHIMS #38-4-1997) respectively (refer to **Photo 6-6** and **Photo 6-7**).

Open artefact scatter – TH-AS-001 (AHIMS #38-4-1998)

TH-AS-001 is an open artefact scatter (comprising of 18 stone artefacts) with PAD that was recorded on the alluvial plain south of Testers Hollow (refer to **Photo 6-6** and **Photo 6-7**). It was noted during the survey that several Aboriginal artefacts were identified along the eastern and north-eastern margins of the back-filled dam.

The presence of Aboriginal artefacts along the margins of the dam suggest they were displaced during the excavation of the dam, and/or during the backfilling of the dam. As part of the scatter, Aboriginal stone artefacts were also identified in locations in the immediate vicinity of deposited concrete and brick rubble. Disturbance in these areas allowed for greater ground surface visibility.



Photo 6-6 General view of TH-AS-001 looking south



Photo 6-7 Flaked piece - ventral surface

PAD – TH-PAD-001 (AHIMS #38-4-1997)

TH-PAD-001 is an area of PAD located on a mid and lower-slope covered with a thick layer of pasture. Areas of ground exposure within the PAD are limited to the fence line (refer to **Photo 6-8** and **Photo 6-9**).

The area of PAD is bounded by a drainage line to the west, which flows south-west to Testers Hollow, and the alluvial plain of Testers Hollow to the east where it joins with the alluvial plain of Wallis Creek. It is noted

that Wallis Creek is separated from the unnamed creek in Testers Hollow by a small raised area and as such the Testers Hollow area is dammed during low flow events.

Based on observations made during the survey, it was determined that the area of PAD has been subject to low levels of ground disturbance which are unlikely to have resulted in the removal of the topsoil and subsoil (A1) and A2 horizons and therefore it was therefore considered likely that the artefact-bearing deposit remained relatively intact.



Photo 6-8 Looking south-west towards TH-PAD-001



Photo 6-9 General view within TH-PAD-001

Archaeological test excavation and artefact analysis

An archaeological test excavation program was held between 11 and 22 February 2019 (north side) and 13 and 16 May 2019 (south side). These test excavations were carried out in accordance with the OEH Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales and the methodology agreed with RAPs at AFG meetings held in November 2018 (north side) and 30 April 2019 (south side) (refer to **Section 5.3** for further details on consultation). Representatives from the Mindaribba LALC, RAPs, Jacobs archaeologists and Roads and Maritime personnel were involved in the test excavations. Details of the test excavations are provided in the ACHAR (Jacobs, 2019a), provided in **Appendix E**.

Test excavations carried out at TH-PAD-001 identified over 200 Aboriginal objects, including tools exhibiting evidence of use. Raw material and artefact typology and technology are consistent with other sites in the Hunter Region. Based on these findings, it is likely that this site was either used as a campsite or is in proximity to a camping area, although greater densities of artefacts would generally be expected for a camp site. Radiometric dating carried out on charcoal samples yielded dates in the mid-Holocene to early Holocene period.

Test excavations carried out at TH-AS-001 identified 13 Aboriginal objects. Excavations indicated that the southern side of the proposal area is disturbed as a result of earthmoving activities. Based on the stratigraphy in this area, the soils and the associated artefact assemblage were found to be substantially disturbed.

Summary of significance assessment

A significance assessment is made up of several significance criteria that attempt to define why a site is important. The assessment of Aboriginal cultural heritage was based upon the four criteria of the Australia ICOMOS Burra Charter (Australia ICOMOS 2013) which include social values, historical values, scientific values and aesthetic values. Each of these values were assessed for both sites, and an overall significance has been assigned based on an average across the values. The significance assessment ultimately informs the management of sites and places. **Table 6.22** summarises the significance assessment for the Aboriginal sites in the proposal area.

Table 6.22 Summary of significance assessment

Site/PAD name (AHIMS ID)	Site type	Significance criteria			
		Social	Historical	Scientific	Aesthetic
TH-PAD-001	PAD	High	N/A	Moderate to high	Moderate
TH-AS-001	Artefact scatter with PAD	High	N/A	Low	N/A

Overall, TH-PAD-001 is of moderate significance at the local level and TH-AS-001 is of low significance at the local level. They have high social significance at the local level as they provide tangible evidence of the use of the area by Aboriginal people. They have low historical significance. TH-PAD-001 has moderate to high scientific significance with rankings of high integrity, high structure, moderate contents and moderate representativeness/rarity. The site has excellent research and educational potential with high potential to educate about the way local Aboriginal populations used this type of landform. TH-AS-001 has low scientific significance. The artefacts present at TH-AS-001 have low representativeness/rarity and the site has low integrity due to disturbance from previous land use activities. As both sites abut the floodplain and creek system, they have the potential to divulge information on how Aboriginal people used surrounding aquatic resources.

Aboriginal cultural values

A Cultural Values Assessment (CVA) report was prepared by Jacobs to document consultation with Aboriginal knowledge holders (included as an attachment to the ACHAR, provided in **Appendix E**). Much of the cultural values expressed related to the lower Hunter Valley region and less specifically to the study area. Knowledge holders expressed a strong ongoing cultural knowledge of cultural sites in the landscape surrounding the study area. Knowledge holders also expressed an overarching concern for the wider cultural landscape and concern about the negative cumulative impacts of development on that landscape. In the context of the proposal, there are strong ongoing connections to the study area as well as strong interests in the manner in which the study area is managed.

6.4.3 Potential impacts

Construction

The proposal would avoid all previously recorded AHIMS registered archaeological sites as they are located outside of the proposal area. However, the proposal would directly impact all of TH-AS-001 and some of TH-PAD-001, as summarised in **Table 6.23**.

Table 6.23 Potential impacts to Aboriginal cultural heritage without mitigation

Site name	Site type	Overall significance	Type of impact	Degree of impact	Consequence of harm
TH-AS-001	Artefact scatter with PAD	Low	Direct	Whole	Total loss of value
TH-PAD-001	PAD	Moderate	Direct	Partial	Partial loss of value

However, it should be noted that the proposal area forms part of the much larger stream and wetland area of Testers Hollow and the broader Wallis Creek and Wentworth Swamp Precinct. This wider precinct was used by Aboriginal people for occupation and resource gathering and, as a broader landscape, is of cultural significance to the RAPs. As such, as a small part of Testers Hollow, the potential impact of the proposal on the wider landscape and associated Aboriginal sites and its cultural, scientific and aesthetic heritage values would be minimal.

Roads and Maritime would apply for an Aboriginal heritage impact permit (AHIP) under part 6 of the *National Parks and Wildlife Act 1974* (refer to **Section 6.4.4**). As part of the AHIP application process, an exclusion zone for TH-PAD-001 and a procedure for salvage of Aboriginal heritage for both PADs would be proposed to mitigate some of the impact from the proposal.

Operation

The proposal would not adversely impact Aboriginal heritage significance or archaeological potential along Cessnock Road during operation.

6.4.4 Safeguards and management measures

Safeguards and management measures for Aboriginal heritage are presented in **Table 6.24**.

Table 6.24 Safeguards and management measures – Aboriginal heritage

Impact	Environmental safeguards	Responsibility	Timing	Reference
Impacts to Aboriginal heritage	<p>An AHIP for harm to TH-AS-001 and TH-PAD-001 will be required before potential impact to Aboriginal heritage. The AHIP application will include the following as detailed in the ACHAR (refer to Appendix E):</p> <ul style="list-style-type: none"> • A methodology for further archaeological salvage excavation of TH-PAD-001 outside of the proposed exclusion zone, in consultation with the RAPs • A proposal for surface collection of artefacts for TH-AS-001 by RAPs • Care and control for the recovered assemblage • Harm without salvage for all objects in the proposal outside of the existing recorded Aboriginal sites. 	Roads and Maritime	Pre-construction	Additional safeguard
Aboriginal heritage	An Aboriginal Heritage Management Plan (AHMP) will be prepared in accordance with the Procedure for Aboriginal cultural heritage consultation and investigation (Roads and Maritime, 2012) and Standard Management Procedure - Unexpected Heritage Items (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	Contactor	Pre-construction	Section 4.9 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	heritage. The AHMP will be prepared in consultation with all relevant Aboriginal groups.			
Aboriginal heritage – unexpected finds	The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Roads and Maritime does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place. Work will only re-commence once the requirements of that procedure have been satisfied.	Contractor	Pre-construction	Section 4.9 of QA G36 <i>Environment Protection</i>
Minimise risks to Aboriginal cultural heritage during construction	All personnel working on site will receive training to ensure awareness of requirements of the AHMP and relevant statutory responsibilities. Site-specific training will be given to personnel when working in the vicinity of identified Aboriginal heritage items.	Contractor	Pre-construction	Additional standard safeguard AH3
Aboriginal heritage	An exclusion zone in the area of high archaeological sensitivity within TH-PAD-001 will be identified and fenced off before construction (as shown in the ACHAR (refer to Appendix E)).	Contractor	Construction	Additional safeguard
Additional Aboriginal heritage impacts	Any further impacts proposed beyond those assessed in this REF or beyond the boundary of the assessed areas would be subject to further assessment including consultation with Aboriginal stakeholders.	Roads and Maritime	Construction	Additional safeguard

6.5 Non-Aboriginal heritage

Potential impacts of the proposal on non-Aboriginal heritage items have been assessed in the *MR195 Cessnock Road, Testers Hollow Non-Aboriginal Heritage Assessment Report* (Jacobs, 2018c) which is provided in **Appendix F**. A summary of the report is presented in this section, together with safeguards and management measures to mitigate any negative impacts.

6.5.1 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 16 July 2018 and again on 10 July 2019. 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 field survey of the study area carried out by Jacobs on 28 May 2018 to identify any areas/items of potential heritage significance
- Prepare succinct historical summary of the proposal area and surrounding region
- Prepare predictive statement about types of previously unidentified non-Aboriginal heritage which may be present in the proposal area
- Review significance assessments for known heritage items and prepare preliminary significance assessments for any heritage items identified during field survey
- 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.

6.5.2 Existing environment

Historical context

European settlers had acquired portions of land near to the west of Black Hill near today's township of Kurri Kurri in 1838. In the 1830s Richard Windeyer, a lawyer and free settler, developed some of the first vineyards in the Hunter Valley. Testers Hollow is named after a Mr William Tester who had farmed this and several other areas in the district (Parkes, 1979).

The proposal area is significant in the history of the Hunter Valley and is located in an area known for its historical collieries. The commencement of coal mining in 1862 followed the discovery of a large Permian coal bed known as the Greta Coal Measure in a location where it uplifts dramatically towards the surface. The discoveries were followed by the establishment of townships at Telarah, East Greta, Heddon Greta, Stanford Merthyr, Pelaw Main, Kurri Kurri, Weston, Abermain, Neath, Kearsley, Abernethy, Kitchener, Aberdare, Paxton, Pelton and Bellbird (Parkes, 1979). The proposal area has also played a significant role in the development of railways in the district. The first of the coal transporting railways developed between Cessnock and Newcastle passes to the northwest of Testers Hollow via the government railways and shipping facilities to the Port of Newcastle.

Ayrfield No.1 Colliery

Mining of the Greta Coal Measures was conducted at the Ayrfield No.1 Colliery between 21 January 1910 and 22 November 1938. The first lease of Ayrfield No.1 Colliery (located next to the proposal area) was carried out in 1910. The colliery was located underground between the Maitland to Kurri Road and the Stanford Railway Line and included the development of a 'bord and pillar' system in which the mined coal was extracted across a horizontal plane, creating horizontal arrays of rooms and pillars (Eardley, 1969). Initially coal and spoil were brought to the surface by 'horse wheeling' which was later replaced by an upright boiler operating a steam-driven haulage engine.

Two tunnels were driven 25 metres apart known as the North and South Tunnels. An up-cast shaft was sunk during late 1923 and used in conjunction with an underground furnace and later with a steam driven fan. The colliery chimney stack was made from galvanised iron. A transmission line was connected to the colliery in 1928. Pit top facilities included a winding house, poppet-head, tumblers and screens, a timber stack coal holding box, bath house, engine house, boiler house, lamp cabin, fan, explosives magazine, blacksmith shop, colliery office, two dams and a rail branch track that hauled the coal to the Stanford Railway Line (Douglas Partners, 2005).

Underground fires in 1938 and 1946 destroyed the North and South Tunnels and above ground buildings. By 1947 the remaining fabric of the mine was bulldozed (Eardley, 1969) and the surface entrances were eventually sealed (Insite Heritage 2005: 5). The majority of extant structures connected to the Colliery are located close to the disused rail siding. These include mounded earth and concrete footings, a linear concrete pit and some now infilled dams. The closest of these remnant features is located 850 metres to the west of the proposal area.

South Maitland Railway

The South Maitland Railway was once an extensive network of privately owned colliery and passenger railway lines which served the South Maitland coalfields. The first section of the line was opened to East Greta in 1893 (McNicol, 1982). This line was built by the East Greta Coal Mining Company to service their East Greta Colliery. This colliery was joined in 1896 by the East Greta No.2 Colliery which was located towards Maitland (Eardley, 1969). The construction of the 8.2 kilometre Stanford Railway by the company in the vicinity of the proposal area included a number of cuttings, embankments and five bridges. The alignment of the railway is still evident today in existing embankments to the north west of Testers Hollow. All of these features are located outside of the current proposal area.

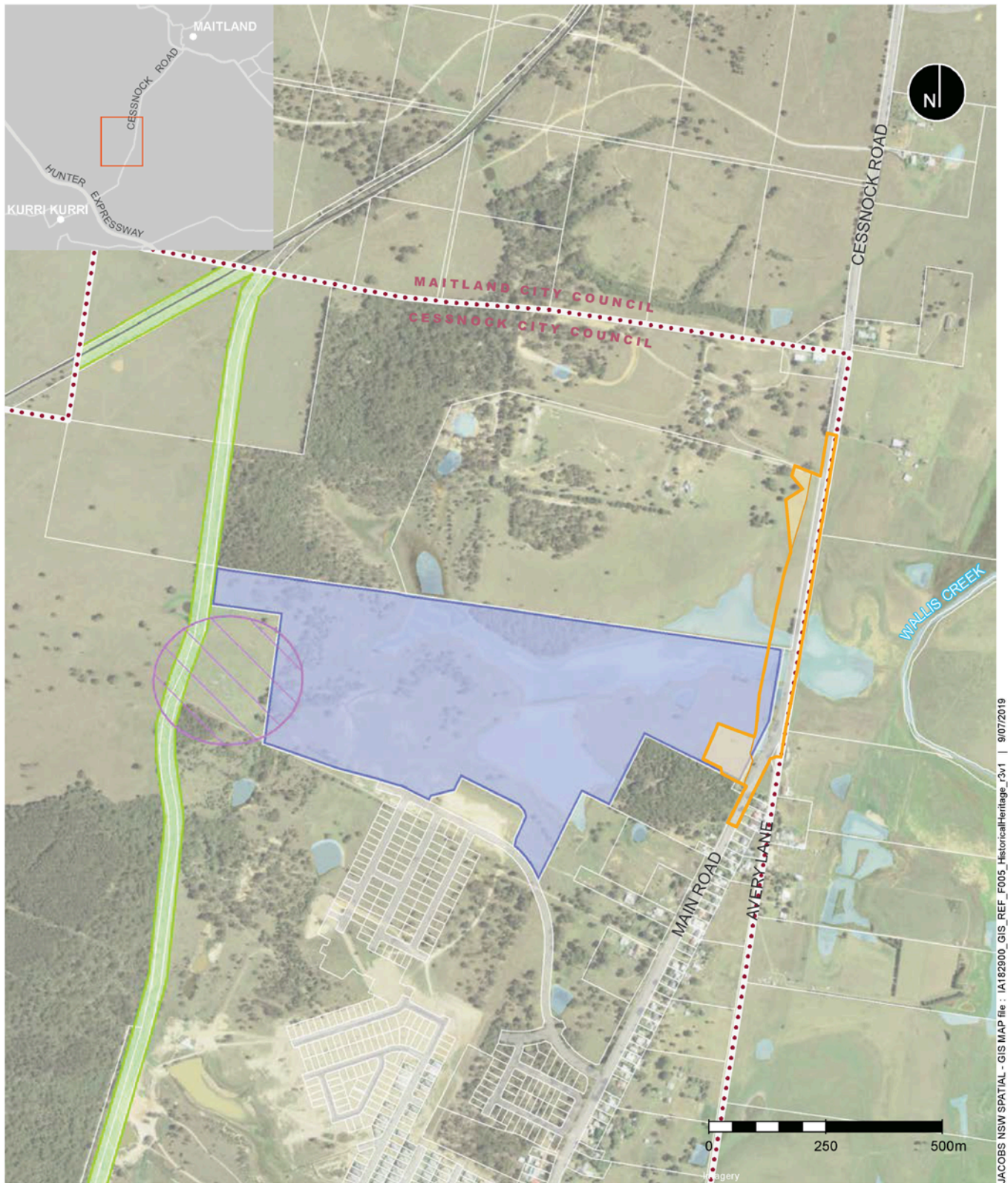
Listed non-Aboriginal heritage items

The search of heritage registers identified two heritage items within 500 metres of the proposal (refer to **Table 6.25** and shown on **Figure 6.6**). The historic heritage sites are listed on the Cessnock LEP.

Table 6.25 Listed heritage items within 500 metres of the proposal area

Name	Source	Number	Location	Comments
Collieries of the South Maitland Coalfields/Greta Coal Measures Group (1340721)	Cessnock LEP	I215	Within the proposal area	Ayrfield Colliery is a part of the Cessnock LEP (L215) listing, amongst other collieries in the Cessnock LGA including the Hillend Colliery, Ellalong Colliery and Cessnock to Aberdare Extended Colliery Railway. The Colliery precinct is partially located within the southern section of the proposal area and extends to the west to the site of the Ayrfield Colliery 'pit top' some 850 m to the west (refer to indicative location of the 'pit top' in Figure 6.6). The Colliery site is ruinous following a destructive fire in 1938 and contains limited evidence of the associated buildings (concrete foundations) all of which are located well outside of the proposal area.

Name	Source	Number	Location	Comments
South Maitland Railway System	Cessnock LEP	I212	Next to the proposal area	-



JACOBS NSW SPATIAL - GIS MAP file : IA182900_GIS_REF_F005_HistoricalHeritage_r3v1 | 9/07/2019

Legend








- | | |
|--|---|
|  Proposal area |  Aryfield Colliery site (pit top and extent features) |
|  Potential ancillary site | LEP-listed heritage (DPE 2019) |
|  Local Government boundary |  Collieries of the South Maitland Coalfields/Greta Coal Measures Group (1340721) |
|  Railway |  South Maitland Railway System |

Figure 6.6 Non-Aboriginal heritage items near the proposal

6.5.3 Potential impacts

Construction

The proposal area contains a locally listed heritage item consisting of the coal precinct identified in the Cessnock Local Environmental Plan 2011 as the Collieries of the South Maitland Coalfields/Greta Coal Measures Group. This coal precinct is partially located in the southern end of the proposal area. The principal remaining features of the Ayrfield colliery site are located at least 850 metres to the west of the proposal area. Review of previous assessments and a field visit carried out on 28 May 2018 for the proposal indicated that there is little or no historical archaeological potential in the proposal area.

A statement of significance was carried out (as described below) in which it was found that the heritage significance or any remaining features of the Ayrfield Colliery site would not be impacted by the proposal. Specific mitigation measures are provided in **Section 6.5.4**.

Statement of significance

The Ayrfield Colliery is an archaeological site, representative of the coal mining period circa 1860s to late 20th century which took place in the Greta coal measures. It is possible that further information about the local heritage significance of the colliery may be recoverable from further studies of the site, oral history and historical documents.

The site has also been the focus of small scale animal husbandry since the colliery demise after the 1938 fire when substantial mining structures were destroyed. Additionally, efforts have been made to remove any structural debris from the proposal area following the demolition of structures related to animal husbandry and re-grading of the site that took place there in more recent times.

Any remaining structures associated with animal husbandry have been removed and small dams that occupied the proposal area have been infilled. The proposal area to the south of Testers Hollow was the focus of re-grading in 2014 which involved disturbance to topsoil to a depth of at least 250 millimetres. Additionally, construction of the Main Road embankment and pipes at Testers Hollow has had considerable impact on the integrity of soils in the area.

Operation

There are no operational impacts expected on any known heritage items in the vicinity of the proposal.

6.5.4 Safeguards and management measures

Safeguards and management measures for non-Aboriginal heritage are presented in **Table 6.26**.

Table 6.26 Safeguards and management measures – non-Aboriginal heritage

Impact	Environmental safeguards	Responsibility	Timing	Reference
Non-Aboriginal heritage	<ul style="list-style-type: none">The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encounteredWork will only re-commence once the requirements of that procedure have been satisfied.	Contacto	Construction	Section 4.10 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
Non-Aboriginal heritage	Non-Aboriginal heritage awareness training will be provided for all contractors and personnel before 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

6.6 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.

6.6.1 Methodology

Geotechnical investigations were carried out in 2018. The *MR195 Cessnock Road – Testers Hollow Geotechnical Interpretive and Design Report* (Jacobs, 2019b) has been used to inform this assessment.

The investigations identified the distribution of rock types, strength, weathering and other geotechnical information. The findings of the report are summarised in this section.

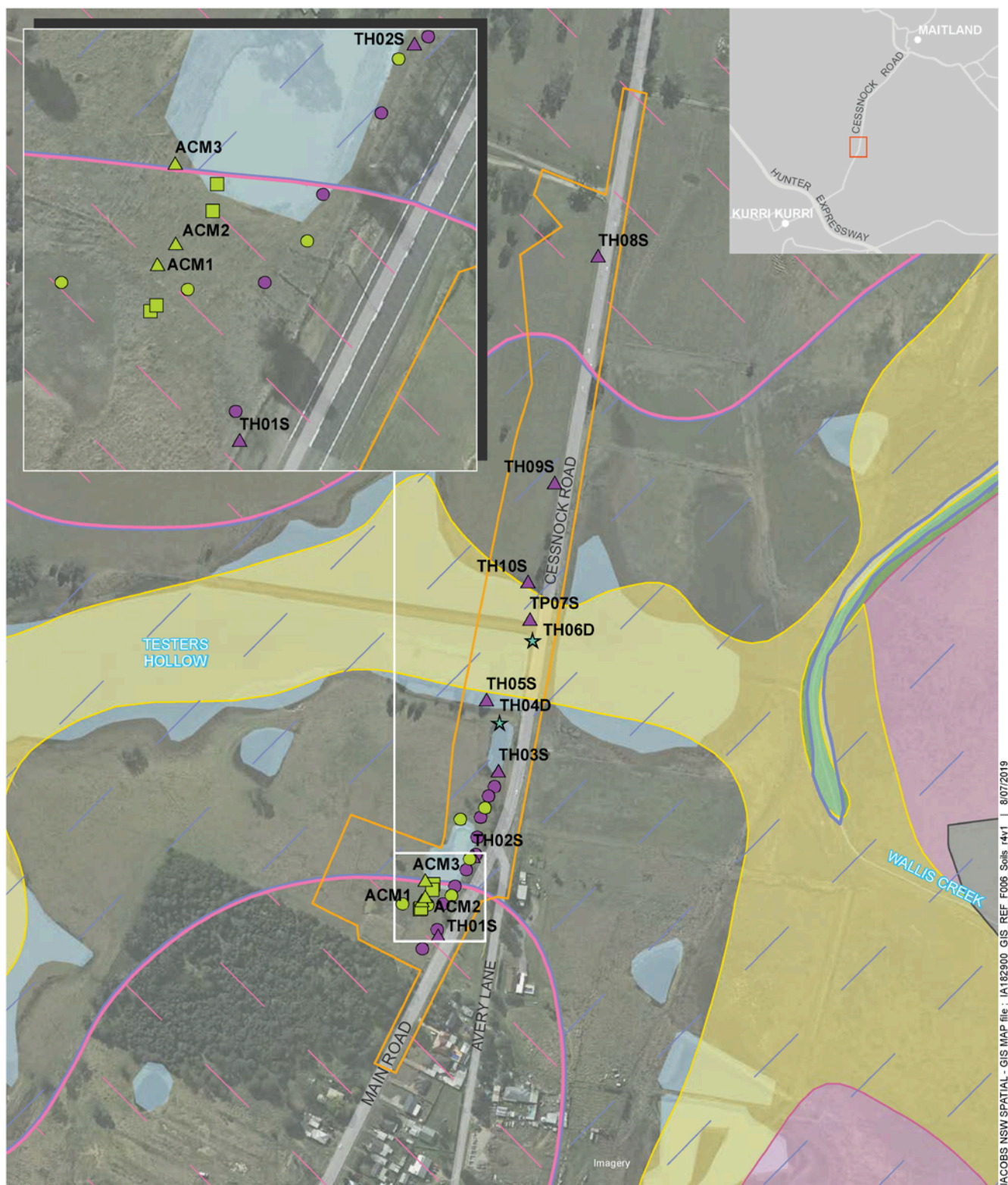
A Preliminary Site Investigation (PSI) was carried out for the proposal. It comprised a review of publicly available information, a review of proposal-specific historical aerial photography and a site inspection. Potential impacts of the proposal on contamination have been assessed in the *Upgrade to Cessnock Road (Main Road) at Testers Hollow – Preliminary Site Investigation* (Jacobs, 2018e) which is provided in **Appendix K**.

A site inspection was conducted on 27 September 2018. The site inspection focused on the proposal area, particularly those areas likely to be affected by construction activities. Adjacent land uses were also considered. A combination of grab samples and hand auger samples were taken to capture at surface and shallow soil samples, the locations of which are shown on **Figure 6.7**.

A site inspection and surface soil sampling was carried out on 6 May 2019 to detect the presence of asbestos containing material, specifically friable asbestos. Surface soil sampling and a collection of asbestos containing material (bonded asbestos) was carried out south of Testers Hollow.

Information was also obtained from the following resources:

- Newcastle 1:250,000 Geological Series Sheet 9232
- Newcastle 1:250,000 Soil Landscape Sheet 9232
- eSPADE database, Office of Environment and Heritage
- 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 sulfate soil (ASS) potential.



Legend

Proposal area

Soil landscapes (OEI 2017)

Bolwarra Heights

Wallis Creek

Acid sulfate soil risk (OEI 2011)

High risk 1-2m

High risk 2-4m

Low risk sediments

No risk

▲ Asbestos containing material collected September 2018

■ Asbestos containing material collected July 2018

● Asbestos containing material collected May 2019

▲ Grab sample collected September 2018

● Grab sample collected May 2019

★ Hand auger location September 2018

0 100 200 m

1:5,000 @ A4



Figure 6.7 PSI sample locations, soil landscapes and acid sulfate soils

6.6.2 Existing environment

Topography, geology and soils

Testers Hollow is a flat valley below 10 metres above sea level which drains to the east into Wallis Creek, with its interface at the tidal limit of Wallis Creek. To the north of the proposal area the land rises at a slope of between 1:15 and 1:25 to a height of 40 metres above sea level. The higher ground to the north of the proposal is part of a ridge running north to north east. Cessnock Road traverses this ridge and crosses a number of spur lines on its way north, which results in an undulating alignment.

Dam construction and backfilling activities have resulted in a substantial modification of topography south of Testers Hollow. Backfilling activities were carried out as part of a development application approved by Cessnock City Council (Development Consent 8/2007/757/16). The construction certificate as part for these works was endorsed in July 2014. **Figure 6.8** is a cross section indicating depth of excavation and **Figure 6.9** indicates the location of these works in the context of the proposal area.

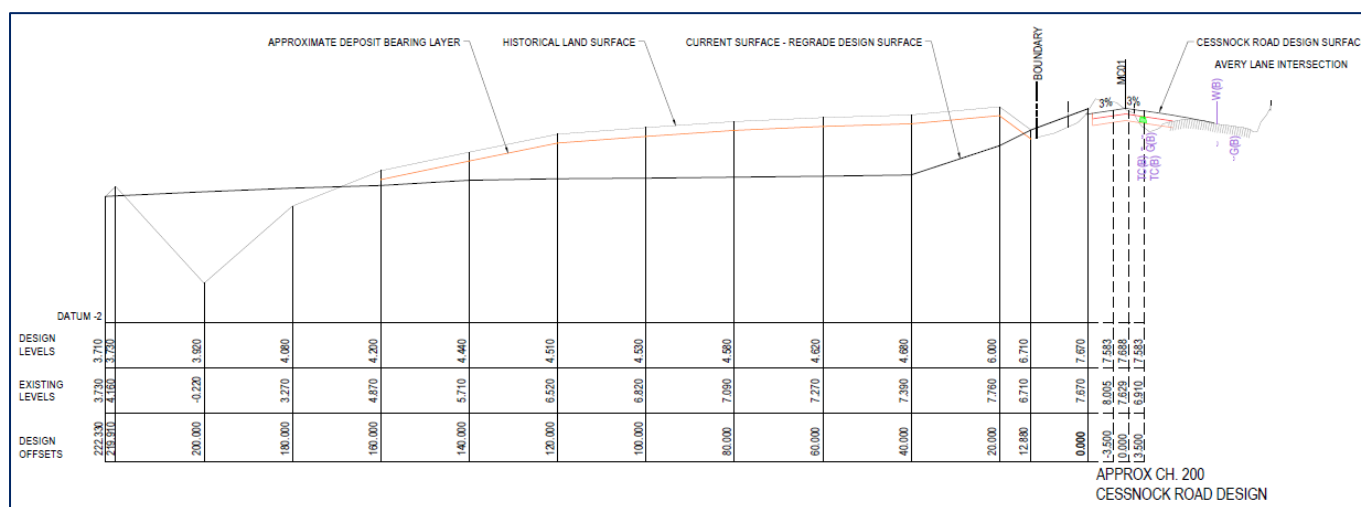


Figure 6.8 Regrade cross section (where approximate deposit bearing layer refers to cultural heritage deposits)

The proposal area can be divided into two separate soil units (refer to **Figure 6.7**). The central low-lying section comprises of the Wallis Creek soil unit and at the southern and northern ends of the proposal is underlain by the Bolwarra Heights soil unit.

The Bolwarra Heights soil unit is described as moderately deep (<1.5 metres) residual soil associated with the Maitland Group Formation. The Wallis Creek soil unit, on the other hand, includes deep Quaternary alluvium consisting primarily of sand and minor clay deposits.

The proposal area is underlain by Early Permian age Mulbring Siltstone, Muree Sandstone and Branxton Formation, all from the Maitland Group. These are primarily sub-horizontally bedded sedimentary strata comprising interbedded siltstones, sandstones and conglomerates.

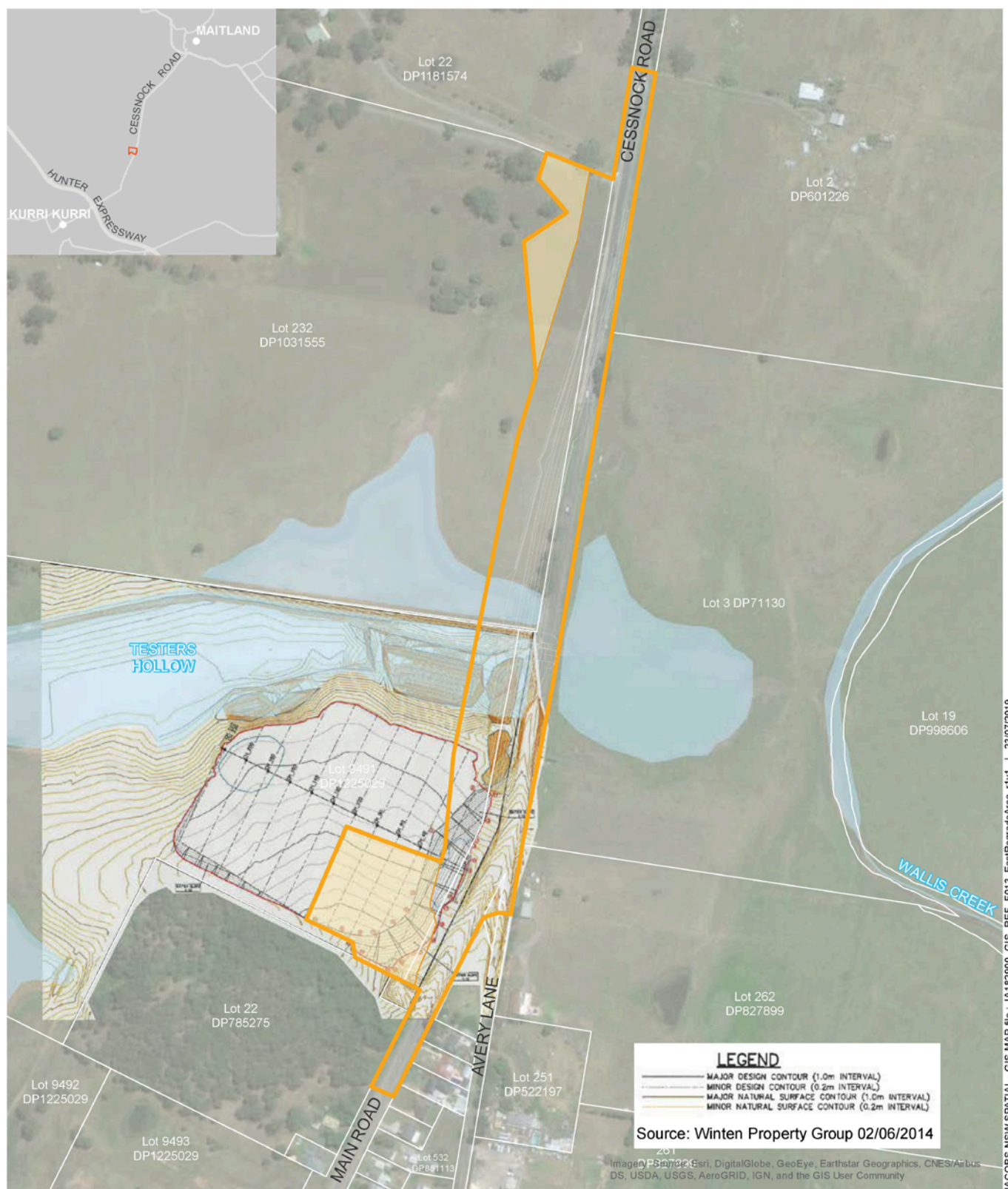


Figure 6.9 Regrade area within the proposal area

Acid sulfate soils

Acid sulfate soils (ASS) are soils and sediments containing iron sulfides (commonly pyrite) that, when disturbed and exposed to oxygen, generate sulfuric acid and toxic quantities of aluminium and other heavy metals. The sulfuric acid and heavy metals are produced in forms that can be readily released into the environment, with potential adverse effects on the natural and built environment and human health. The majority of ASS are formed by natural processes under specific environmental conditions. This generally limits their occurrence to low lying sections of coastal floodplains, rivers and creeks where surface elevations are less than about five metres AHD.

A review of the Australian Soil Resource Information System ASS mapping demonstrates that areas correlating with the Wallis Creek soil unit (i.e. the central portion of the site) are considered to have a high probability for ASS (refer to **Figure 6.7**). However, areas correlating with the Bolwarra Heights soil unit (i.e. northern and southern ends of the site) are mapped as having no known occurrence of ASS. This is consistent with the topographic and geomorphological setting for the proposal, where the central low-lying water saturated portion of the alignment indicates potential ASS. Geotechnical investigations in the proposal area indicate that acid sulfate soils are present (Jacobs, 2019).

Salinity

Salinity is the accumulation of salts in soil and water to levels that impact on human and natural assets. Salinity occurs where salt in the landscape is mobilised and redistributed closer to the soil surface and / or into waterways by rising groundwater. Salinity has not been identified as being present in the Bolwarra Heights soil landscape, however is identified as potentially being present in the topsoil of the Wallis Creek soil landscape (Matthei, 1995).

Contamination

A search of the NSW EPA Contaminated Land Record of Notices, List of NSW Contaminated sites notified to the NSW EPA and the EPA POEO Act public register in December 2018 and 10 July 2019 did not reveal any known contaminated sites within the proposal area. The review of contamination databases indicates no records of businesses that would be associated with contaminating activities in the proposal area, no records of contamination notices and no records on the National Waste Management Site Database with the exceptions of licensed activities related to waterways within the site.

The PSI identified that agricultural practices around the proposal area may have used pesticides and herbicides, and there would also be potential for illegal dumping of waste products within the proposed compound site. A review of aerial photography for sample years between 1954 and 2015 also indicated open field space, planted trees, series of fill mounds and historic chicken shed demolitions with indications of potential areas of fill and/or dumping. Asbestos containing material (ACM) was collected during the site investigation and appeared to be bonded (the source of which is likely to be from fly tipped waste and demolition waste from historic chicken sheds) (refer to **Figure 6.7**). However, no asbestos fibres were identified in soil samples analysed for asbestos at the locations tested. Additionally, elevated levels of polycyclic aromatic hydrocarbons (PAH) were detected at some soil sample locations. The likely source of elevated levels of PAH is coal tar bitumen particles from the roadway close to where soil samples were collected.

Excluding PAH and bonded asbestos in soil, there were no other exceedances of applied human health criteria at the locations tested.

The site inspection and surface soil sampling carried out subsequent to the PSI identified bonded ACM (refer to **Figure 6.7**). Soil samples returned negative for friable asbestos at locations sampled.

6.6.3 Potential impacts

Construction

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

- Topography: The earthworks would result in a substantial change to the topography of the proposal area due to the road height being increased by 1.5 metres
- Soil erosion and loss of topsoil: This could result from the removal of vegetation (clearing and grubbing) 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
- Exposure of ASS: This could result from any excavation or underboring works within the area classified as high potential for ASS. Run-off from these areas could pollute waterways within or next to the proposal area
- Salinity: Identified as potentially being present in the topsoil of the Wallis Creek soil landscape. 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. It is noted, however, that the water in Testers Hollow has been identified as being saline (refer to **Section 6.3.2**). Additionally, 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
- 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 sites to contain spills and spill response procedures would be followed. These impacts would generally be temporary. Safeguards and management measures which would be implemented to reduce these impacts are provided in **Section 6.3.4**
- The results of the PSI indicate that shards of ACM tested reported positive concentrations of asbestos fibres. As discussed above, a likely source of asbestos contamination has been identified as being fly-tipped waste and demolition waste from historic chicken sheds. This material could potentially pose a risk to construction workers if ground disturbance and specifically activities that would crush and disperse this material were to occur. In consideration of the risk of disturbance of bonded ACM and the limited area sampled during the PSI, the potential to liberate asbestos fibres during construction activities is unquantified.

Operation

Once the proposal is operational, there would be potential for indirect impacts on soils as a result of run-off and drainage. These potential impacts would be managed by revegetating exposed soils and operational water quality measures, which are described in **Section 3.4.1**.

Contamination impacts would generally be associated with contaminated run-off, which may arise from normal vehicle operation (tyre wear, minor leaks of lubricants and fuels), maintenance practices, or a spill or accident. The proposal is not expected to result in more contamination impacts than the existing Cessnock Road.

6.6.4 Safeguards and management measures

Safeguards and management measures for impacts to topography, geology, soils and contamination are presented in **Table 6.27**.

Table 6.27 Safeguards and management measures – Topography, geology, soils and contamination

Impact	Environmental safeguards	Responsibility	Timing	Reference
Accidental spill	A site specific emergency spill plan will be developed and include spill management. 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	Pre-construction	Section 4.3 of QA G36 Environment Protection
Acid sulfate	An Acid Sulfate Materials Management Plan will be prepared and implemented as part of the CEMP. The Plan will be prepared in accordance with the Guidelines for the Management of Acid Sulfate Materials (RTA, 2005) and Acid Sulfate Soils Management Advisory committee guidelines .	Construction contractor	Pre-construction	Additional safeguard
Stockpile management	Stockpiles will be designed, established, operated and decommissioned in accordance with the Roads and Maritime Stockpile Site Management Guideline 2015.	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"> Landcom's Managing Urban Stormwater: Soils and Construction series RTA Landscape Guideline Roads and Maritimes' Guideline for Batter Stabilisation Using Vegetation (2015). 	Construction contractor	Construction	Additional standard safeguard
Asbestos containing material	Waste management of contaminated land will be incorporated as part of the CEMP. The Managing asbestos in or on soil (WorkCover NSW, 2014) and the Guideline for the Management of Contamination (Roads and Maritime, 2013), will be adopted to manage surface soils and fill material impacted by asbestos	Construction contractor	Pre-construction/ Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Asbestos containing material and other contaminated	An 'unexpected finds' protocol will be prepared as part of the CEMP to plan for and accommodate potential ACM waste during construction. Any 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.	Construction contractor	Construction	Additional safeguard

6.7 Traffic and transport

The potential impacts of the proposal on traffic and transport are assessed in the *Cessnock Road upgrade at Testers Hollow Traffic and Transport Assessment* (Jacobs, 2018a). A summary of the assessment is presented in this section.

6.7.1 Existing environment

Traffic environment

Cessnock Road extends between Heddon Greta and Maitland, via Cliftleigh and Gillieston Heights and connects Maitland and Kurri Kurri. It also provides connections to the New England Highway and the Hunter Expressway. Cessnock Road has two lanes with one lane in each direction and a posted speed limit of 80 kilometres per hour that reduces to 60 kilometres per hour at the Avery Lane intersection.

During normal operation, vehicles travelling between Kurri Kurri and Maitland can travel via the shortest path using Cessnock Road. However, during a flood event, Cessnock Road at Testers Hollow becomes impassable and these vehicles are required to detour via Buchanan Road and Mount Vincent Road (an additional 9.5 kilometres and about eight additional minutes of travel) (refer to **Figure 6.12**). In addition to increased travel times and distances, high volumes of traffic (as outlined in **Table 6.28**) are redirected onto a route that passes through town centres and onto local roads.

Traffic volume and mix

Traffic count data was collected by Jacobs in August 2018 to determine the average daily traffic volumes on Cessnock Road. The average annual daily traffic (AADT) on Cessnock Road between Gillieston Heights and Cliftleigh was about 16,500 vehicles per day. **Table 6.28** summarises the average daily traffic volumes of light vehicles and heavy vehicles in the proposal area.

Table 6.28 Existing average daily traffic volumes

Direction	Light vehicles	Heavy vehicles	Total
Northbound	7,791	500	8,292
Southbound	7,560	595	8,154

The traffic data also identified:

- The weekday morning peak hour occurs between 8.00 am and 9.00 am
- The weekday evening peak hour occurs between 4.00 pm and 5.00 pm
- The average weekday daily traffic volume is 17,800 vehicles, of which 1,400 (or 7.9 per cent) are heavy vehicles
- The weekend peak hour is between 11.00 am and 12.00 pm
- The average weekend daily traffic volume is 13,700 vehicles, of which 530 (or 3.9 per cent) are heavy vehicles
- The average weekend daily traffic volume represents 77 per cent of the average weekday daily traffic volume.

The average hourly weekday traffic counts are shown in **Figure 6.10**. The average weekend hourly weekend traffic numbers are shown in **Figure 6.11**.

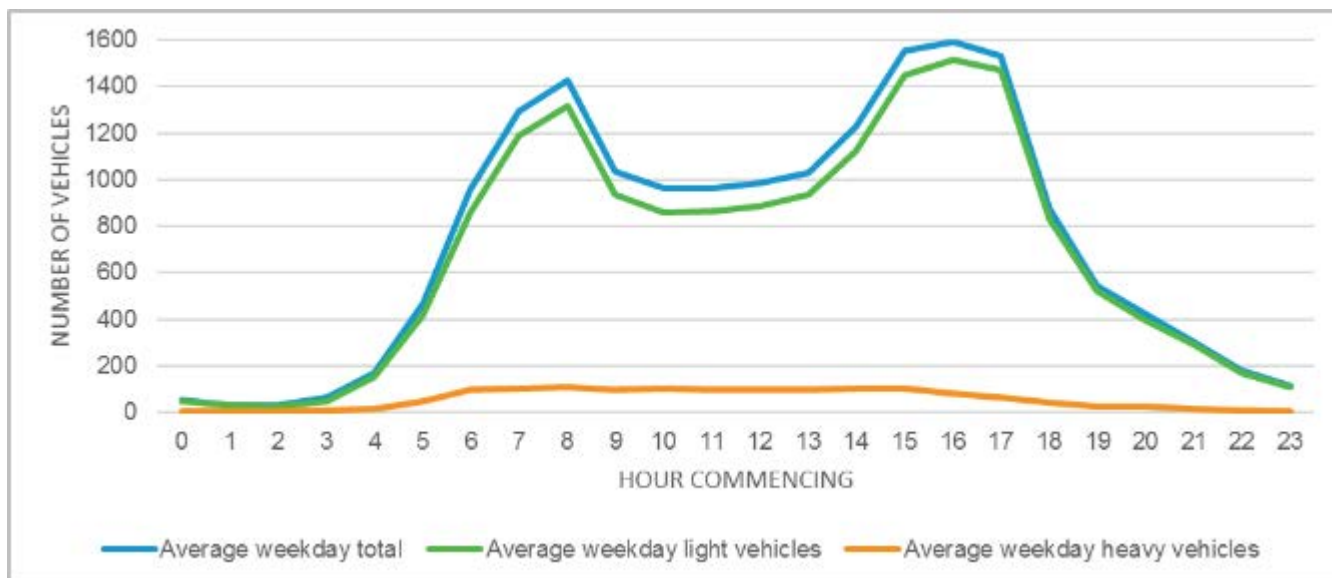


Figure 6.10 Average weekday traffic numbers on Cessnock Road

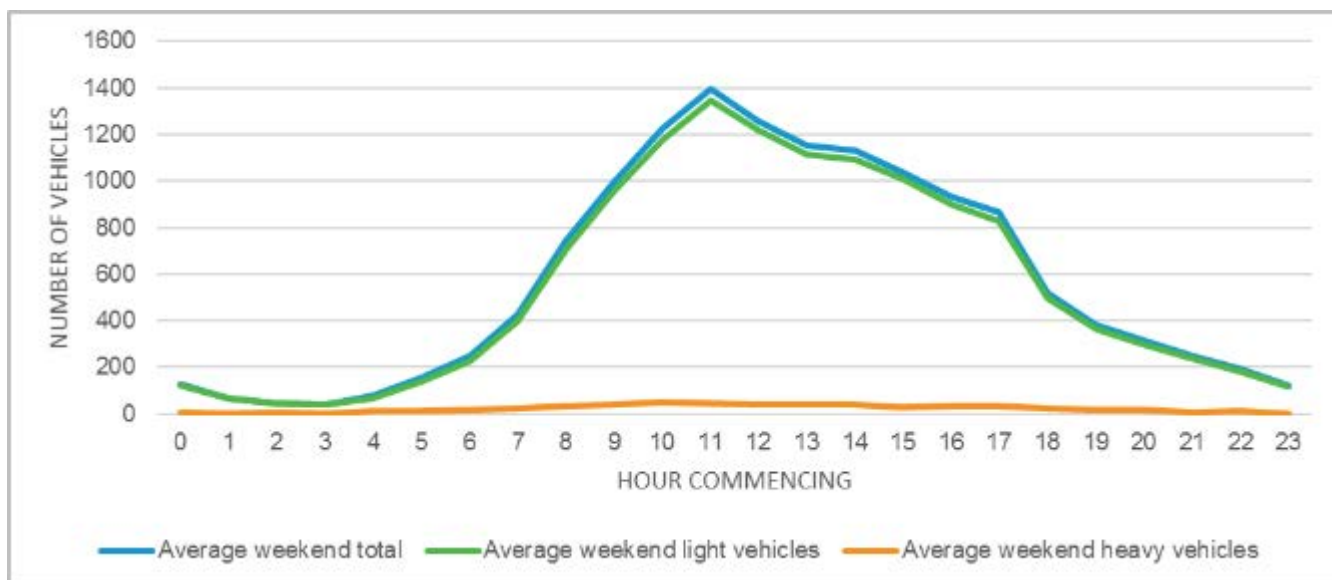
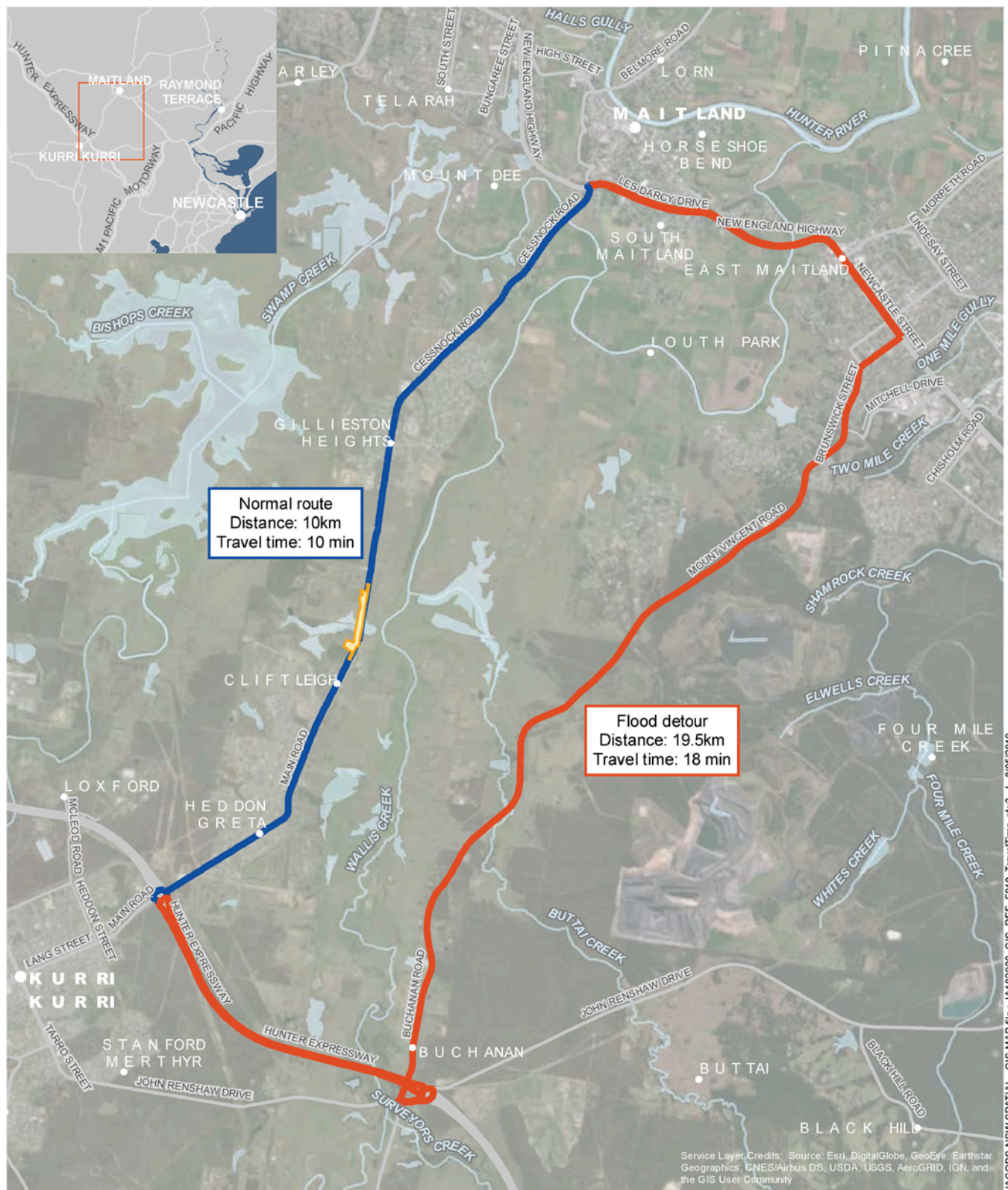


Figure 6.11 Average weekend traffic numbers on Cessnock Road



Legend

- Proposal area
- Normal route
- Flood detour

0 1 2 km
1:65,000 @ A4



Figure 6.12 Travel time and distance between Kurri Kurri and Maitland

Public transport

Bus services for Transport for NSW travel through the proposal area, however, there are no bus stops located within the proposal area. The closest bus stops to the proposal area are located on both sides of Cessnock Road about 100 metres to the south and about 250 metres to the north of the proposal area. Rover Coaches also operate school bus services to schools in Cessnock, Kurri Kurri and Maitland, and are likely to operate within the proposal area. Cessnock Road is used by bus routes 164 and 166, which connect Cessnock, Kurri Kurri and Maitland. These routes are operated by Rover Coaches for Transport for NSW. Bus route 164 operates through the proposal area generally every hour in each direction on weekdays and Saturdays and two hourly on Sundays. Bus route 166 operates through the proposal area between one and three hourly in each direction on weekdays, and two hourly on Saturdays, with no services on Sundays.

A summary of service frequencies on each route is provided in **Table 6.29**.

Table 6.29 Bus service frequency

Route number	Description of route	Number of weekday services (both directions)	Number of weekend services (both directions)
164	Cessnock to Maitland via Kurri Kurri	34	24 (Saturday), 12 (Sunday)
166	Kurri Kurri to Maitland	12	6 (Saturday), no services on Sunday

Source: Transport for NSW (2018)

Pedestrian, cycling and road user facilities

There are no dedicated pedestrian paths along Cessnock Road in the vicinity of the proposal.

Cessnock City Council's *Draft Cycling Strategy* (2016) identifies Cessnock Road as a designated regional on-road cycling route, but no dedicated off-road cycling facilities are located on Cessnock Road in the proposal area.

Property access

Property accesses are located at the southern and northern end of the proposal area.

6.7.2 Potential impacts

Construction

Construction is planned to occur over a two year period (subject to preload embankment settling times and wet weather) starting mid 2020 (refer to **Section 3.3.2**). Construction traffic (comprising light vehicles and light and heavy trucks) would lead to a temporary increase in traffic on Cessnock Road. About 80 heavy vehicle movements are expected per day. This is not expected to be substantial in relation to existing traffic conditions.

Delivery and heavy vehicle movements would generally occur within standard construction hours.

During construction the majority of the work would be carried out separate from live traffic. Impacts would generally be due to reduced speed limits in the area, temporary lane closures and diversions. During construction of the tie ins, line marking and utility adjustments, construction traffic impacts would be experienced where Cessnock Road would operate under one-way, reversible flow conditions with traffic control. This would introduce additional delays along Cessnock Road.

Vehicular access to and from the proposal area would be from Cessnock Road. Haulage routes are expected to be via Cessnock Road to the Hunter Expressway about 3.7 kilometres south of the proposal or via the New England Highway located about five kilometres north of the proposal. Alternative haulage and travel routes are generally not available due to the location of the proposal and the limited number of through roads. 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 along Cessnock Road 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 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. 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 where possible. There would also be increased travel times due to traffic lane closures during tie in works, line marking and utility adjustments., This would also increase the volume of traffic along these roads.

Local access

Access to properties would be maintained for the duration of construction. However, there may be a need to temporarily change access to some properties and Avery Lane 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 Cessnock Road and Avery Lane, and for property access for properties located within the proposal area
- Short-term lane closures may be required, which could disrupt traffic and impact travel times on Cessnock Road and Avery Lane
- Temporary delays and disruptions to bus routes 164 and 166 may result from changes to road conditions, impacting on some commuters, however these impacts are expected to be minor and managed through notification to bus users and ongoing engagement with the bus service operator. No changes are proposed to the bus stops located north and south of the proposal area.

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

Operation

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

Operation of the proposal would result in fewer road closures as a result of flooding. Where road closures occur, the proposal would reduce the duration of the closure as detailed in **Section 6.3.3**. This would allow traffic to use Cessnock Road sooner after a flooding event. In addition, the detour via Buchanan Road and Mount Vincent Road would be required less frequently and for a shorter duration during flood events. This would increase travel time reliability for general traffic and heavy vehicles during flood events.

6.7.3 Safeguards and management measures

Safeguards and management measures for traffic and transport are presented in **Table 6.30**.

Table 6.30 Safeguards and management 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 Roads and Maritime Traffic Control at Work Sites Manual and QA Specification G10 Control of Traffic. The TMP will include:</p> <ul style="list-style-type: none"> • Confirmation of haulage routes • Measures to maintain access to local roads and properties • Site specific traffic control measures (including signage) to manage and regulate traffic movement • Measures to maintain pedestrian and cyclist access • Requirements and methods to consult and inform the local community of impacts on the local road network • Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads • A response plan for any construction traffic incident • Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic • Monitoring, review and amendment mechanisms. 	Contractor	Pre-construction	Section 4.8 of QA G36 <i>Environment Protection</i>
Property access - during construction	Access to properties will be maintained during construction. Where that is not feasible, temporary alternative access arrangements will be provided following consultation with affected landowners and the relevant local road authority. Any disruptions to property access and traffic will be notified to landowners at least five days prior in accordance with the relevant community consultation processes outlined in the TMP.	Roads and Maritime and Construction Contractor	Construction	Additional standard safeguard
Reduce speeds, traffic delays and disruptions during construction	Road users and local communities will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.	Roads and Maritime and Construction Contractor	Construction	Additional standard safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Impacts to the regional road network	The most disruptive work (such as work that requires lane closures) will be carried out at night to minimise potential impacts on the regional road network.	Roads and Maritime and Construction Contractor	Construction	Additional safeguard

6.8 Landscape character and visual impacts

Potential impacts of the proposal on landscape character and visual amenity are assessed in the *Landscape Character and Visual Impact Assessment Report* (Tract, 2018) which is provided in **Appendix L**. 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).

The study area for the assessment includes areas from which the proposal is visible. The extent of the study area is the same extent as **Figure 6.13**.

Landscape character

As part of the landscape character assessment, the study area was divided into five landscape character zones (LCZs) which correspond to landscape character types in the area. These LCZs are shown on **Figure 6.13** and include:

- LCZ 1 – Residential landscape
- LCZ 2 – Bushland
- LCZ 3 – Floodplain landscape
- LCZ 4 – New subdivision landscape
- LCZ 5 – Ridge/elevated landscape.

The assessment of impact on landscape character is based on a combination of the sensitivity of the identified landscape character zones and the magnitude (physical size and scale) of the proposal in that zone. This is used to derive an impact assessment rating for the proposal within each landscape character zones (refer to **Table 6.31**). **Table 6.31** summaries the ranking of the assessment of these two criteria and how they are combined to provide an overall impact assessment.

Table 6.31 Landscape character and visual impact matrix (Roads and Maritime, 2013)

Sensitivity	Magnitude				
		High	Moderate	Low	Negligible
	High	High	Moderate/High	Moderate	Negligible
	Moderate	Moderate/High	Moderate	Moderate/Low	Negligible
	Low	Moderate	Moderate/Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

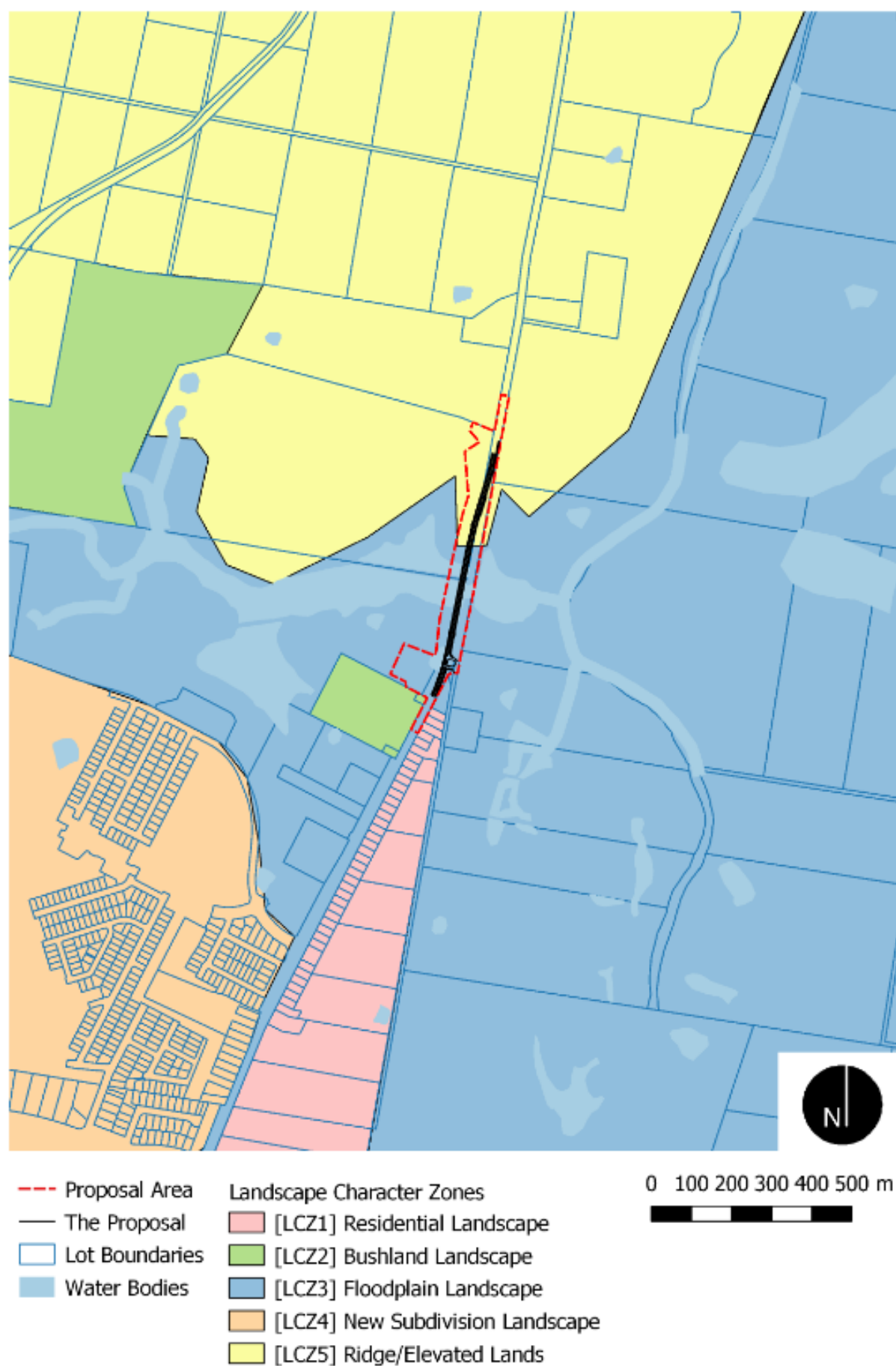


Figure 6.13 Landscape character zones

Visual impact assessment

A visual impact assessment has been carried out to understand the day-to-day visual effects of the proposal on people's views. It is based on the assessment of a number of selected viewpoints that are rated according to the sensitivity of the view and the magnitude of the proposal within that view. The locations and directions of the chosen viewpoints (VP) are representative of the range of viewpoints both within and beyond the road corridor.

Seven VPs were identified within the proposal visual catchment (the area from which the proposal is visible), as shown on **Figure 6.14**. The VPs were selected to be representative of the road users, residents and visitors to the properties located within the proposal area, and representative of the locations where visual impacts are expected during construction and operation.

The assessment of the visual impact on these VPs considered the sensitivity of the view (that is, the quality of the view and how it would be affected by the proposal) and the magnitude of the proposal within that view (that is, the physical size and scale of the change and its proximity to the viewer). The combination of sensitivity and magnitude was then used to derive the visual impact rating (refer to **Table 6.31**).

Table 6.32 summarises the VPs used for the visual impact assessment for the proposal, and the stages of the proposal (construction and operation) that have been assessed.

Table 6.32 Viewpoints considered for the visual impact assessment

Viewpoint	Construction assessment	Operational assessment
VP1 – Cessnock Road looking north from the southern end of the proposal		✓
VP2 – Cessnock Road looking west		✓
VP3 – View from the centre of Testers Hollow looking north	✓	✓
VP4 – View looking south down Cessnock Road from the boundary of the proposal		✓
VP5 – Looking south from the elevated ridge from near the northern boundary of the proposal		✓
VP6 – Looking west from the intersection of Avery Lane and Cessnock Road	✓	
VP7 – View from Cliftleigh housing estate from William Tester Drive		✓

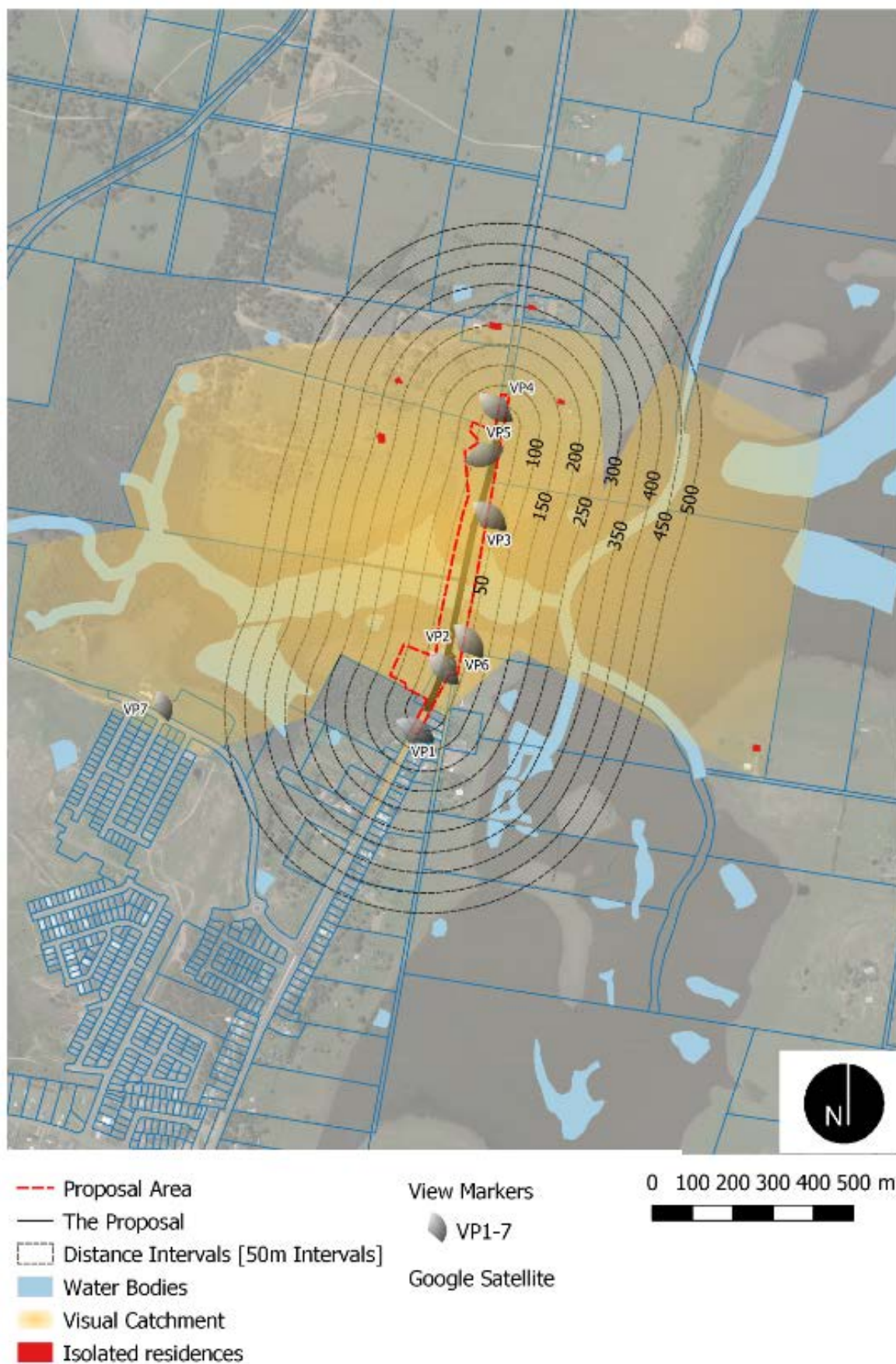


Figure 6.14 Visual catchment and key viewpoints

6.8.2 Existing environment

Landform

The topography and landform of the area around the proposal are described in **Section 6.6.2**. In general, the proposal is located in a flat valley area over Testers Hollow, with a higher ridge area located to the north. Gillieston Heights is located behind this rise, however, is beyond the visual catchment of Testers Hollow. A small crest to the west of the proposal area separates Testers Hollow from the catchment of Swamp-Fishery Creek, which is an adjoining broad flat valley.

Vegetation

The area surrounding the proposal mostly comprises cleared exotic grassland and disturbed native vegetation with some remnant and planted trees. The road corridor contains a mix of isolated and small remnant and regrowth patches associated with a number of different plant communities. Existing vegetation is a product of landscape and both historical and current land use practices. Vegetation in the proposal area is further described in **Section 6.1.2**.

Landscape character assessment

For the purpose of the landscape character assessment, the study area was divided into five zones which reflect the different landscapes in and around the proposal area. These landscape character zones (LCZs) are described below and shown on **Figure 6.13**:

- LCZ1 – Residential landscape: this LCZ comprises a narrow strip of single storey housing which addresses the road and is located on the small strip of elevated land between Wallis Creek and Swamp-Fishery Creek floodplains. Properties typically have large (about 20 metre) setback from the road with front yards primarily lawn and occasional small shrub beds (refer to **Photo 6-10**). The LCZ typically has a moderate sensitivity to change due to external influences
- LCZ2 – Bushland landscape: this LCZ is defined by the vegetated edge which fronts the western side of Cessnock Road. The vegetation has a frontage of about 150 metres. Vegetation consists of a disturbed edge margin with weed growth and with Casurina and Eucalypts dominating the view beyond (refer to **Photo 6-11**). This LCZ typically has a low sensitivity to change due to external influences
- LCZ3 – Floodplain landscape: this LCZ comprises of low lying lands with expansive views. Views are interrupted by scattered trees or those on the horizon in the background. Waterways are visible within this landscape. This LCZ comprises the majority of the study area (refer to **Photo 6-12**). This LCZ has a moderate sensitivity to change due to external influences
- LCZ4 – New subdivision landscape: this LCZ is located to the southwest of the proposal. This LCZ comprises much of the western side of the southern approach to the proposal. The setback of the subdivision has seen a landscape buffer retained between the road and back fences of the properties. The development consists of single storey residential properties and only rooftops are visible from the road corridor (refer to **Photo 6-13**). This LCZ has a moderate sensitivity to change due to external influences
- LCZ5 – Ridge/elevated landscape: this LCZ is located to the north of the proposal and occupies the higher lands 10 metres above sea level. This LCZ defines the valley and presents a tree lined ridge (refer to **Photo 6-14**). Within this landscape the occasional dwelling can be found, set on a small rural holding. This LCZ has a moderate sensitivity to change due to external influences.



Photo 6-10 LCZ1 – Residential frontage along eastern edge of Cessnock Road (source: Tract, 2018)

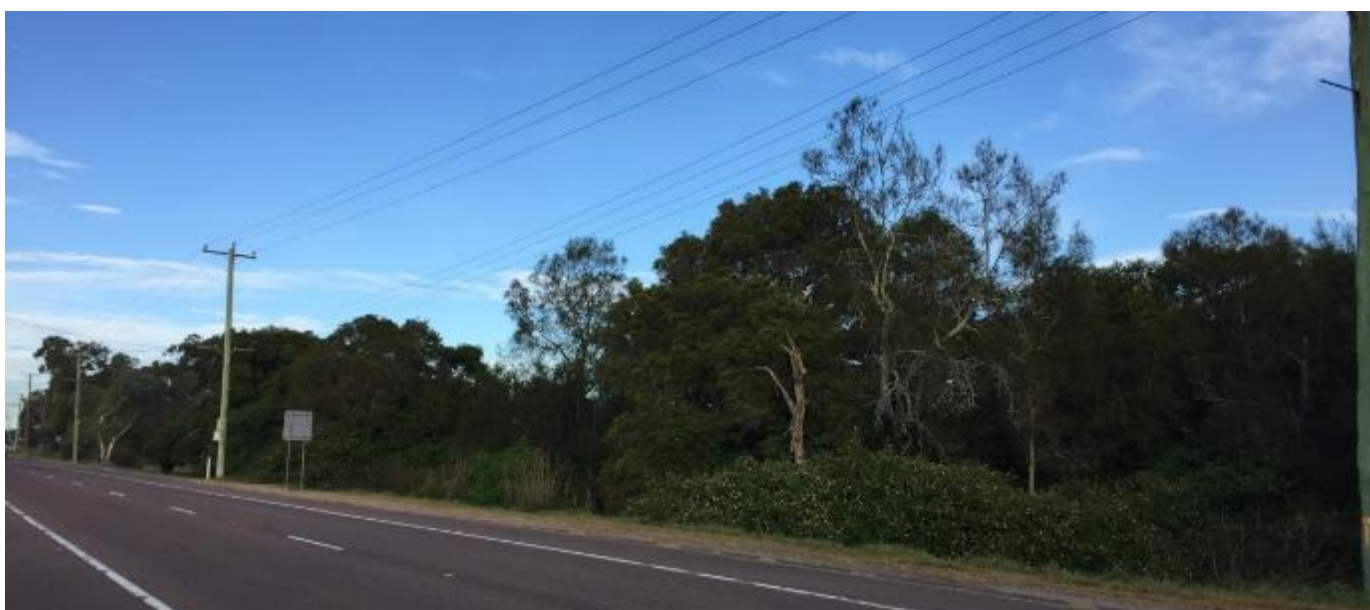


Photo 6-11 LCZ2 – Bushland landscape fronting western edge of Cessnock Road (source: Tract, 2018)



Photo 6-12 LCZ3 – Floodplain landscape (source: Tract, 2018)



Photo 6-13 LCZ4 – New subdivision landscape (source: Tract, 2018)



Photo 6-14 LCZ5 – Elevated ridge lands to the north of the proposal (source: Tract, 2018)

General visibility

The visual catchment of the proposal is well defined due to the topography of the site and clear barriers to sightlines, including vegetation and built forms.


The main viewers of the proposal would be users of Cessnock Road and residents and visitors of nearby properties.


6.8.3 Potential impacts

Construction

During construction, there would be impacts on visual amenity from the vegetation clearing and construction activities (such as earthworks and ancillary sites). These impacts would occur throughout the construction period. During construction, temporary lighting would be required at the ancillary sites and for night works. Particular attention would be given to design and siting of temporary lighting, to avoid light spill impacts to residences. These impacts would occur throughout construction. Visual amenity impacts from ancillary site use during construction are summarised in **Table 6.33** for VP3 and VP6. The impacts would be temporary, and mitigation measures to mitigate these visual impacts are summarised in **Section 6.8.4**.

Table 6.33 Visual impact assessment – construction

Impact		Comment	Photo of key viewpoints (Source: Google Street View)
Viewpoint 3 – View from the centre of Testers Hollow looking north			
Sensitivity	Low	<p>VP3 represents an open grassland landscape, set within the floodplain LCZ. VP3 provides a view across the proposed route to the north of the current road.</p> <p>One of the potential ancillary sites would be located to the west of the VP3. Residences are evident to the north-west of Cessnock Road on the ridge and would have a different sensitivity. Their view would look back towards the road from a residence. Given the distance from the route, it is anticipated this view could be considered to be of moderate sensitivity.</p> <p>The visual impact of the potential ancillary site is limited to the construction period after which it would be reinstated to a condition equivalent to the existing landscape. The visual impact over this period is considered to be low. The reverse of the view from the residence however has the potential to have a moderate impact.</p>	
Magnitude	Moderate		
Overall impact	Low to Moderate		

Impact		Comment	Photo of key viewpoints (Source: Google Street View)
Viewpoint 6 – Looking west from the intersection of Avery Lane and Cessnock Road			
Sensitivity	Low	<p>VP6 is located where the proposal ties into the existing road and is also the location of one of the potential ancillary sites.</p> <p>The ancillary site potentially introduces temporary structures, such as sheds and stockpiles up to three metres in height.</p> <p>The proposal results in the removal of the vegetation along the western verge and opens views to the adjoining bushland precinct.</p> <p>During construction, the impact of the potential ancillary site is considered to be Moderate. Following construction, the ancillary site would be restored to its existing condition as a minimum or otherwise agreed with the landowner. The route post construction would remain visible in front of what was the ancillary site as it ties in to the existing structure.</p>	
Magnitude	High		
Overall impact	Moderate		

Operation

Landscape character

The potential impacts of the proposal on landscape character during operation have been assessed for each LCZ with consideration of the zone's sensitivity to change and the magnitude of the proposed changes in that zone. The overall impact to landscape character is a combination of sensitivity and magnitude, as outlined in **Table 6.31**. Operational impacts of the proposal are summarised in **Table 6.34**.

Table 6.34 Potential impacts on landscape character zones

Character definition	Sensitivity	Magnitude	Summary
LCZ1 – residential landscape	Moderate	Negligible	Negligible
LCZ2 – bushland landscape	Low	Negligible	Negligible
LCZ3 – floodplain landscape	Moderate	Moderate	Moderate
LCZ4 – new subdivision landscape	Moderate	Negligible	Negligible
LCZ5 – ridge/elevated lands	Moderate	Low	Low to Moderate

Visual amenity



The potential impact of the proposal on visual amenity during operation was assessed for six VPs as outlined in **Table 6.32**. These impacts are summarised in **Table 6.35**.


The proposal would impact on visual amenity as follows:

- Four VPs have been assessed as having a moderate visual impact
- One VP as having a moderate impact
- One VP as having a negligible impact.


The overall magnitude of the proposal has been assessed as moderate. This reflects the establishment of a new alignment next to the existing alignment and Cessnock Road's overall increase in scale within the low lying setting of Testers Hollow.



Table 6.35 Visual impact assessment – operation

Impact		Comment	Photo of key viewpoints (Source: Google Street view)
Viewpoint 1 – Cessnock Road looking north from the southern end of the proposal			
Sensitivity	Moderate	VP1 is located at the northern tie in point for the proposal. Residential receivers are located to the east and bushland to the west. The proposal ties into the existing road with minimal changes to the road level and is anticipated to have minimal change.	
Magnitude	Negligible		
Overall impact	Negligible		
Viewpoint 2 – Cessnock Road looking west			
Sensitivity	Low	VP2 represents the open grasslands and creek line landscape of the floodplain at Testers Hollow, with road users being the main viewers. The main change in the VP in this section would include the proposal moving west of the existing alignment and being elevated by 1.5 metres. Removal of vegetation would be required and waterbodies next to the existing road would be filled by a new embankment.	
Magnitude	High		
Overall impact	Moderate		
Viewpoint 3 – View from the centre of Testers Hollow looking north			
Sensitivity	Low	VP3 represents an open grassland landscape, set within the floodplain LCZ, with road users being the main viewers. VP3 provides a view across the	
Magnitude	High		

Impact		Comment	Photo of key viewpoints (Source: Google Street view)
Overall impact	Moderate	proposed route to the north of the current road. The proposed route would be elevated above the existing Cessnock Road.	

Viewpoint 4 – View looking south down Cessnock Road from the boundary of the proposal

Sensitivity	Moderate	<p>VP4 looks south from the toe of the elevated ridge to the north of Testers Hollow. VP4 provides an overview of the proposal as the road user travels south on Cessnock Road. Similar views, however, are experienced from adjoining residences located on the farm holdings. The passing road user would experience a low sensitivity to change, where the residential have been assessed as susceptible and sensitive to changes associated with the realignment of the road and assessed as moderate.</p> <p>The proposal is located in the mid-ground of the view, the route of the road is moved off the straight to the north and will see the removal of some of the trees which line the route. This would increase the overall visibility of the proposal.</p>	
Magnitude	Moderate		
Overall impact	Moderate		

Impact		Comment	Photo of key viewpoints (Source: Google Street view)
Viewpoint 5 – View looking south from, the elevated ridge from the northern boundary of the proposal			
Sensitivity	Moderate	VP5 looks south from the mid slope of the elevated ridge to the north of Testers Hollow, with the main viewer being a residential receiver. This VP provides an overview of the proposal which would be located in the mid ground of the VP. The overall impact of the proposal is considered to be moderate reflecting the sensitivity of the adjoining residential properties and proximity of the VP location to the actual route. The view of the residence itself is considered to experience a lower degree of impact due to the distance from the alignment and view angle which is at an oblique angle.	
Magnitude	Moderate		
Overall impact	Moderate		
Viewpoint 7 – View looking north east from William Tester Drive at edge of new subdivision			
Sensitivity	Moderate	VP7 looks north from the edge of the new residential estate. The VP provides interrupted views over 600 metres from the proposal. Viewers comprise users of a small playground, William Tester Drive and the houses that front William Tester Drive. The overall impact of the proposal is considered to be moderate to low reflecting the sensitivity of the adjoining residential and park users. It also considers the distance of the view location to the route, which minimises the impact.	
Magnitude	Low		
Overall impact	Moderate to low		

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

6.8.4 Safeguards and management measures

Safeguards and management measures for landscape character and visual impacts are presented in **Table 6.36**. Safeguards and management measures for visual impacts that are related to vegetation clearing are presented in **Section 6.1.4**.

Table 6.36 Safeguards and management measures – Landscape character and visual impacts

Impact	Environmental safeguards	Responsibility	Timing	Reference
Visual impact of ancillary sites	Ancillary sites, including construction areas and supporting facilities (such as storage compounds and offices) will be managed to minimise visual impacts, including avoiding temporary light spill into residences during night works.	Contractor	Construction	Core standard safeguard UD2
Visual impact during construction	<ul style="list-style-type: none"> • Revegetation will respond to existing vegetation community composition and landscape character using appropriate native species • Revegetation along the route will assist in defining the alignment and providing visual disconnection from former alignment • Clusters of tree planting will be provided within the route corridor to filter the visibility of the proposal from adjoining residential properties where possible • Night works and associated lighting will be limited to minimise light spill. 	Contractor	Construction	Additional safeguard

6.9 Socio-economic, property and land use

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

The study area for the assessment comprises those communities that may experience benefits and impacts from the proposal's construction and operation. It includes the Australian Bureau of Statistics (ABS) defined state suburbs of Clifftleigh and Gillieston Heights.

Benefits and impacts of the proposal's construction and operation may also be experienced by communities in the wider LGAs of Maitland City Council and Cessnock City Council. Potential impacts on these communities have also been considered where relevant.

The methodology for this socio-economic assessment is guided by the *Environmental Impact Assessment Practice Note: Socio-economic assessment* (EIA-N05) (Roads and Maritime, 2013). It involved:

- Analysing existing socio-economic conditions and values of the study area, including population, social infrastructure, and local businesses
- Identifying and assessing potential socio-economic impacts of the proposal's construction and operation, including on local amenity, access and connectivity, social infrastructure and local community values
- Identifying safeguards and management measures to mitigate or manage the identified impacts.

The description of the existing socio-economic environment principally draws on data and information from the ABS 2016 Census of Population and Housing. This is supplemented with data and information from the NSW government and Cessnock and Maitland City Councils, where relevant.

6.9.2 Existing environment

Regional profile

The southern part of the proposal is located within the suburb of Clifftleigh, within the Cessnock LGA. The LGA covers an area of about 1,950 square kilometres and is located about 120 kilometres north of Sydney and about 40 kilometres west of Newcastle.

Cessnock LGA comprises large areas of National Parks and State Forests; rural areas used for grazing, farming, forestry and viticulture. Cessnock is the administrative, retail and service centre for the Cessnock LGA with Kurri Kurri being an important secondary centre and industrial heart of the LGA. Local villages service the basic needs of more rural and outlying areas. Social infrastructure within the Cessnock LGA includes two hospitals, community health services, a range of childcare options, and aged care as well as numerous other community support services. Key features within the LGA include Watagans National Park, Werakata National Park, Yengo National Park, TAFE NSW Hunter Institute (Cessnock and Kurri Kurri Campuses), Cessnock District Hospital, Hunter Valley Zoo, and over 100 vineyards and wineries, particularly around Pokolbin located west of Cessnock.

The proposal is not located within the Maitland LGA however it is directly alongside the western boundary of the Maitland LGA. The Maitland LGA covers an area of about 396 square kilometres. Maitland is located on the alluvial flats of the Hunter and Paterson Rivers. Key economic activities include agriculture, tourism, mining, manufacturing, transport and construction. A number of residential developments are planned within the LGA over the next five years, including at Gillieston Heights and Louth Park near the proposal area (Remplan economy, 2018).

Key communities

At the 2016 Census, the combined study area of Cliftleigh and Gillieston Heights had a total population of 4,038 people, of which about 78 per cent of the population lived in Gillieston Heights.

Key population and demographic characteristics for the study area are shown in **Table 6.37**, along with information for NSW. Compared to NSW, communities in the study area are generally characterised by:

- Younger populations, with lower median ages, higher proportions of children aged 14 years or younger, and lower proportions of older people aged 65 years or over. Cliftleigh had a particularly young population, with proportions of children nearly double the NSW average
- Relatively low levels of diversity, with high proportions of people born in Australia and lower proportions of households that speak a non-English language at home
- Lower proportions of couple only families and higher proportions of families with children, particularly in Cliftleigh
- Levels of dwelling occupancy similar to or above the NSW average, high proportions of households that live in separate houses, and relatively low proportions of households that own their house outright
- Relatively high proportions of households that were renting, particularly in Cliftleigh. At the 2016 Census, 70.5 per cent of households in Cliftleigh reported to be renting, with most of these privately renting from a real estate agent
- Households that rely on private car for travel, with proportions of households with two or more cars, and people who travel to work by car, well above the NSW average.

Table 6.37 Key population and demographic characteristics, 2016

Characteristic	Cliftleigh State Suburb	Gillieston Heights State Suburb	NSW
Population and age			
Population	888	3,150	7,480,228
Median age (years)	24	29	38
14 years or younger (%)	35.6	25.9	18.5
15-64 years (%)	57.6	64.9	65.1
65 years or over (%)	6.6	9.4	16.2
Australian born (%)	85.8	88.3	65.5
Households where a non-English language is spoken (%)	5.2	6.2	26.5
Families and households			
Couple family without children (%)	25.6	34.7	36.6
Families with children (%)*	73.4	64.3	61.7
Total families	206	878	1,940,226
Housing			
Total private dwellings	278	1,185	3,059,599
Occupied private dwellings (%)	89.1	94.8	90.1
Separate houses (%)	100	85.1	66.4
Owned outright (%)	17.9	20.8	32.2

Characteristic	Cliftleigh State Suburb	Gillieston Heights State Suburb	NSW
Rented (%)	70.5	36.3	31.8
Median weekly rental costs (\$)	\$380	\$395	\$380
Transport			
Average motor vehicles per dwelling	2.1	2.0	1.7
Households with two or more vehicles	71.5	66.9	50.8
Travel to work by car (as driver or passenger)	77.9	83.9	64.6

Economic profile

Cessnock LGA has a long history of coal mining, manufacturing, construction, agriculture (e.g. grazing, poultry), viticulture and related tourism activities. Maitland LGA is the focus of a diversity of economic activities including agriculture, tourism, mining, manufacturing, transport and construction industries. Maitland has a rich range of natural resources such as coal and extractive mineral deposits as well as fertile agricultural land.

Employment and income

Information on income and employment for the study area is provided in **Table 6.38** along with information for NSW. Compared to NSW, communities in the study area are generally characterised by:

- Households with median weekly incomes above the NSW average, particularly in Gillieston Heights. Personal incomes varied, with Cliftleigh reporting a median weekly personal income below the NSW average, and Gillieston Heights demonstrating personal income above the NSW average
- Higher than average rate of unemployment in Cliftleigh, with the proportion of people unemployed more than double the NSW average, and levels of unemployment in Gillieston Heights below NSW
- Industries of employment that reflect the importance of coal mining within the region, with both Cliftleigh and Gillieston Heights reporting coal mining within the top five industries of employment. Other important industries included aged care residential services in Cliftleigh, hospitals, takeaway food services, and supermarket and grocery stores.

Table 6.38 Employment and income

Characteristic	Cliftleigh State Suburb	Gillieston Heights State Suburb	NSW
Income			
Median weekly personal income (\$)	638	767	664
Median weekly household income (\$)	1,542	1,712	1,486
Employment			
Total labour force	343	1,630	3,605,872
Unemployment (%)	13.1	5.8	6.3

Characteristic	Cliftleigh State Suburb	Gillieston Heights State Suburb	NSW
Main industries of employment (top 5)	<ul style="list-style-type: none"> • Aged care residential services (8.4%) • Supermarket and grocery stores (6.5%) • Hospitals (excluding psychiatric hospitals) (6.1%) • Takeaway food services (5.1%) • Coal mining (4.7%) 	<ul style="list-style-type: none"> • Coal mining (8.2%) • Hospitals (excluding psychiatric hospitals) (4.4%) • Takeaway food services (3.2%) • Supermarket and grocery stores (2.9%) • Other social assistance services (2.5%) 	<ul style="list-style-type: none"> • Hospitals (excluding psychiatric hospitals) (3.5%) • Cafes and restaurants (2.4%) • Supermarket and grocery stores (2.2%) • Aged care residential services (2.0%) • Primary education (1.9%)

Business and industry

There are no local businesses located immediately next to the proposal. The nearest business is the Metro Petroleum service station, which is located about 650 metres south of the proposal area, at Main Road, Cliftleigh. The service station is accessed from the southbound lanes of Main Road, with access from northbound lanes restricted by a central median.

A number of businesses that serve the needs of local communities are also located at Gillieston Heights north of the proposal area and at Heddon Greta south of the proposal.

Social infrastructure

There is no social infrastructure located immediately next to the proposal. Social infrastructure that supports the needs of local communities, such as schools, hospitals, community centres and recreation uses are located in Gillieston Heights and Kurri Kurri. Regional level social infrastructure is also located in the towns of Cessnock and Maitland.

Community values

The character of the study area is undergoing change, with new residential developments recently completed or planned for areas surrounding the proposal area over the next five years.

A number of properties within or near to the proposal area have heritage and environmental conservation values. This includes the local heritage listed Collieries of the South Maitland Coalfields/Greta Coal Measures Group (refer to **Section 6.5**). The protection of these areas is likely to be important to local communities.

Well managed roads and improved road safety is important to communities in Maitland and Cessnock, with this identified during consultation for the Cessnock and Maitland community strategic plans. Cessnock Road provides important access for local and regional communities between Cessnock, Kurri Kurri and Maitland. The road is prone to flooding and has been closed a number of times during flooding events, resulting in some communities being inundated for extended periods (refer to **Section 2.1.1**).

Access and connectivity

Cessnock Road is an important regional transport link, connecting Kurri Kurri in the south to Maitland in the north. Cessnock Road also connects to the Hunter Expressway in the south, which connects Newcastle and the Upper Hunter region. Locally, Cessnock Road provides access to rural, residential and commercial properties and communities at Cliftleigh and Gillieston Heights. Through the proposal area, the road provides a single lane in each direction.

During flood events, the road is subject to flooding at Testers Hollow, impacting on access and connectivity for residents, commuters and regional freight traffic and resulting in some communities in Gillieston Heights being cut-off from road access (refer to **Section 2.1.1**).

Bus services for Transport for NSW travel through the proposal area, however, there are no bus stops located within the proposal area (refer to **Section 6.9.2**). The closest bus stops to the proposal area are located on either side of Cessnock Road about 100 metres to the south and about 250 metres to the north of the proposal area (refer to **Section 6.7.1**).

There are no dedicated pedestrian or cycle facilities in the proposal area, however Cessnock Road is identified as an on-road regional cycling route on the Cessnock City Council's *Cycling Strategy* (2016).

Land use

The proposal is located within land zoned on the Cessnock LEP (refer to **Section 4.1.2**). This includes land on either side of Cessnock Road which is primarily used for agricultural and grazing activities.

6.9.3 Potential impacts

Property

The proposal requires the partial acquisition of two properties for the realignment of Cessnock Road. This includes one privately owned property (Lot 232, DP1031555) and one property owned by Cessnock City Council (Lot 949, DP1223319) (refer to **Section 3.6**). During construction, additional land within each of these properties would also be temporarily leased for ancillary sites and stockpile sites (refer to **Section 3.6**). Following construction, land occupied by ancillary sites would not be required for the ongoing operation of the proposal and would be reinstated and returned to the landowner.

Land within the proposal area is located next to Cessnock Road and comprises rural residential land and land zoned by Cessnock City Council for public recreation. Properties would be acquired by Roads and Maritime in accordance with the provisions of the *Property Acquisition (Just Terms Compensation) Act 1991*.

No buildings were impacted by property acquisition for the proposal. Impacted infrastructure such as fencing, and driveways would be rebuilt and/or relocated as part of the proposal. Consultation would be conducted with the property owners before any impact to this infrastructure.

Construction

Land use

Construction of the proposal would have a direct impact on land zoned as E2 Environmental Conservation, RE1 Public Recreation, RU2 Rural Landscape and SP2 Infrastructure which is primarily used for agricultural and grazing activities. 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.

Local business

The proposal would not directly impact on local businesses.

As indicated in **Section 6.9.2**, the nearest business is the Metro Petroleum service station, which is located at Main Road, Cliftleigh, about 650 metres south of the proposal. Access to Cessnock Road would be maintained during construction and impacts on this business, including business access, is not expected.

Social infrastructure

As indicated above, acquisition of land for the proposal would impact on land zoned for public recreation. Temporary lease of land would also be required over a part of this land for use as an ancillary site. This

land is located along the frontage of property next to Cessnock Road and is not expected to impact on the recreation values of this land.

Potential impacts of construction on social infrastructure in the wider study area would mainly relate to temporary traffic delays and disruptions for residents accessing social infrastructure in surrounding suburbs and regional centres of Maitland, Kurri Kurri and Cessnock. These impacts are generally expected to be minor and would not impact on the use of these facilities.

Access for emergency vehicles would be maintained near to construction works, although there is potential for short-term access disruptions due to changes in road conditions near construction works. These impacts would be managed through ongoing engagement with emergency service providers.

Community values

During construction, temporary adverse amenity impacts may occur for residents closest to construction activities due to construction noise and dust. The number of residences near the proposed works are limited, although some residential and rural residential uses are located near works at the northern and southern extents of the proposal area.

Potential amenity impacts would be likely to have the greatest impact if works are required to occur at night. This has potential to disrupt sleep for some people, particularly given the existing low night-time noise and light environment of the proposal area. These impacts are generally expected to be minor in the context of the proposal as a whole given the small number of residences potentially impacted and the short-term duration of these works.

During construction, land within the Collieries of the South Maitland Coalfields heritage area would be temporarily used for a construction compound. This is not expected to impact on the heritage values of this place over the long-term. Further discussion about potential impacts on heritage values is provided in **Section 6.5**.

Construction of the proposal would require the removal of a small number of trees within the road reserve or adjoining areas. This may be a concern for some people and impact on community values relating to visual amenity along the roadway. Where tree removal is required, these areas would be rehabilitated, which would help to reduce potential visual impacts over time.

Potential impacts on community values during construction would be mitigated through the implementation of safeguards and management measures. These are described in **Section 6.9.4**.

Access and connectivity

During construction, potential impacts on local access and connectivity would generally be associated with increased construction traffic, including heavy vehicles near to construction works and temporary changes to road conditions, such as reduced speed limits, temporary lane closures and diversions, and temporary access changes. This may result in short-term delays and disruptions for some motorists and impact on perceptions of road safety for some road users.

Temporary delays and disruptions are described in **Section 6.7.2**.

Access to private properties and Avery Lane near to construction works would be maintained during construction. Where temporary changes are required, suitable access arrangements would be implemented in consultation with affected property owners.

Operation

Land use

Operation of the proposal would have a direct impact on land zoned as E2 Environmental Conservation, RE1 Public Recreation, RU2 Rural Landscape, which would be changed to road infrastructure and corridor (SP2 Infrastructure). This impact is considered to be minor due to the small areas to be acquired, and their location directly 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.

Local business

The proposal would reduce the duration of road closures in future flood events and maintain access to regional businesses for employees and customers. It would also improve travel time and reliability for freight and commercial vehicles during these flood events.

Social infrastructure

As indicated in the section above, acquisition of land for the proposal would impact on land zoned for public recreation. Operation of the proposal is not expected to impact on the long-term use of this land.

Community values

Operation of the proposal is not expected to result in significant changes to traffic noise or amenity of properties along the proposal area.

Access and connectivity

The proposal would improve the road network and road safety by reducing flooding and improving access reliability along Cessnock Road and site distance improvement on Avery Lane. This would have positive impacts on residents, businesses, visitors and supporting continued travel, access and connectivity during flood events for employment, services and facilities and reducing potential for some communities becoming inundated during flood events. In particular, the proposal would improve access for local and regional residents, visitors, freight and emergency services, and reduce delays and disruptions experienced by motorists during flood events. As indicated in **Section 6.9.2**, the need for well managed roads and improved road safety is important to communities in Maitland and Cessnock LGAs. The proposal would support community values relating to road safety.

There are no dedicated pedestrian or cycle facilities included in the proposal, however the proposal would improve active transport infrastructure by providing a wider road with consistent two metre-wide shoulders for cyclist use. This is consistent with Cessnock City Council's *Cycling Strategy* (2016), which identifies Cessnock Road as a designated regional on-road cycling route.

During operation, access would be unchanged to private properties near to the proposal. Improved connectivity and travel reliability would also impact positively on public transport access and emergency services access and response during flood events, allowing these services to continue to operate through the proposal area during flood events up to the five per cent AEP event.

Productivity savings and reduced costs

As discussed in **Section 2.1.1**, the proposal would reduce the frequency and duration of road closures caused by flooding at Testers Hollow. This would result in a number of productivity savings including:

- Reduced trip diversion costs. Currently, road users are forced to take diversions resulting in increased travel times, increased vehicle operating costs and increased congestion for other users of alternative routes. The proposal would reduce these costs
- Improved economic output/income. Loss of connectivity (particularly when suburbs are inundated or when accessibility is limited) results in a loss of industry output and income loss when workers are unable to reach work. The proposal would improve connectivity and accessibility along Cessnock Road in certain flood events
- Reduction of maintenance and traffic management costs. Cessnock Road currently requires repair and rehabilitation more frequently than roads that are elevated. The proposal would reduce repair costs due to flooding-induced damage to the road surface, pavement and embankment.

6.9.4 Safeguards and management measures

Safeguards and management measures for socio-economic, property and land use are presented in **Table 6.39**.

Table 6.39 Safeguards and management measures – Socio-economic, property and land use

Impact	Environmental safeguards	Responsibility	Timing	Reference
Consultation	<p>A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum):</p> <ul style="list-style-type: none"> • Mechanisms to provide details and timing of proposed activities to affected residents, business owners and commuters including changed traffic and access conditions and amenity impacts • Mechanisms to provide details about proposed changes to emergency services and managers of surrounding community facilities • Contact name and number for complaints. <p>The CP will be prepared in accordance with Roads and Maritime Community Engagement and Communications Manual (2012).</p>	Contractor	Pre-construction	<p>Core standard safeguard SE1</p> <p>Section 3.7 of QA G36 <i>Environment Protection</i></p>
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
Access and connectivity	Consultation will be carried out during construction with relevant public transport providers regarding the timing, duration and likely impact of construction activities.	Contractor	Construction	Additional safeguard

6.10 Other impacts

6.10.1 Existing environment and potential impacts

An assessment of air quality and greenhouse gas and waste and resource use impacts is provided in **Table 6.40**.

Table 6.40 Assessment of other impacts

Environmental factor	Existing environment	Potential impacts
Air quality and greenhouse gas	<p>Several rural and/or residential properties are located within 500 m to 1 km of the proposal.</p> <p>DPIE operates a series of air quality monitoring stations across NSW. One station is located at Beresfield, which is the closest station to the proposal area, about 13 km to the east of the proposal. The air quality index (AQI) measure, a metric developed by the former OEH, was used to provide an indication of the overall quality of air at a location compared with agreed standards. Data sourced from the station at Beresfield show that the air quality in the region is generally 'good', with occasional instances of 'poor' or worse conditions that are generally the result of regional-scale natural events (eg dust storms, bushfires).</p> <p>Local air quality near the proposal is likely to be influenced by local sources including traffic along Cessnock Road, as well as regional influences arising from agricultural activities and mining and industry within the Lower Hunter. The main air pollutants from motor vehicles and trains include oxides of nitrogen (NO_x) including nitrogen dioxide (NO₂), carbon monoxide (CO) and fine particulate matter (PM₁₀ and PM_{2.5}, ie particulate matter with aerodynamic diameters of less than 10 and 2.5 microns respectively).</p>	<p>Increases in local dust (including particulate matter) presents the highest air quality-related risk to the nearby receivers around the proposal. Without proper management, dust has the potential to cause human health (eg eye irritation, respiratory issues) and nuisance (eg dust soiling, visibility) impacts.</p> <p>The risk of particulate matter generation is highest during construction where emissions would arise during vegetation clearing and site establishment activities, demolition works, excavation, compaction of materials and construction of the new corridor. Establishment of the preload embankment above the existing road for 6 to 12 months; the storage and handling of soils; as well as wind-erosion of exposed surfaces.</p> <p>Owing to its proximity to surrounding receivers, height and duration of use, the preload embankment presents a higher risk of air quality impacts. It is expected that some of physical control measures (ie covering or sealing using a tackifier) or a higher level of management controls (eg more frequent inspections, watering and review of the suitability of operations) would be required and would be developed in the SWMP by the construction contractor.</p>

Environmental factor	Existing environment	Potential impacts
	<p>Data for PM₁₀, PM_{2.5} and NO₂ from the Beresfield monitoring station, and CO from OEH's Newcastle station collected in 2018 are listed below:</p> <ul style="list-style-type: none"> • PM₁₀, 24-hour averaged: 149 µg/m³ (maximum), 37 µg/m³ (95th percentile), with eight exceedances of 50 µg/m³ • PM₁₀, annually averaged: 21.6 µg/m³ • PM_{2.5}, 24-hour averaged: 25 µg/m³ (maximum), 15 µg/m³ (95th percentile) • PM_{2.5}, annually averaged: 8.7 µg/m³ • NO₂, annually averaged: 18 µg/m³ • NO₂, maximum 1-hour averaged: 82 µg/m³ • CO 1-hour averaged: 0.9 mg/m³ • CO 8-hour averaged: 0.4 mg/m³ <p>Comparing these values with the impact assessment criteria contained in the 'Approved Methods for Modelling and Assessment of Air Pollutants in NSW' (Approved Methods), (Environment Protection Authority [EPA], 2016) indicates that PM₁₀ concentrations occasionally exceed 24-hour averaged limit of 50 µg/m³, with the 2018 95th percentile (number exceeded 95 % of the time, to account for occasional natural regional events) concentration below this limit. The 24-hour averaged PM_{2.5} was measured to approach but did not exceed the 25 µg/m³ impact assessment criteria. Annually averaged PM₁₀ concentrations were measured to be around three µg/m³ below the 25 µg/m³ limit, with PM_{2.5} concentrations already measured above the 25 µg/m³ criterion. Concentrations of NO₂ and CO were measured to be well below the EPA's applicable limits from the Approved Methods.</p> <p>These observations indicate that the identified receivers around the proposal would be most sensitive to increases in particulate</p>	<p>There is the potential for other air quality-related impacts during construction including exhaust fumes associated with the combustion of fossil fuels in construction machinery; as well as potential odours and airborne hazardous substances during the excavation of soils.</p>

Environmental factor	Existing environment	Potential impacts
Waste and resource use	<p>matter concentrations, which have the highest potential to occur during construction.</p> <p>The existing road within the proposal area generates minimal waste. Waste sources are limited to roadside litter, some waste material from clearing roadside drainage features and green waste from the maintenance of roadside vegetation.</p>	<p>Construction would generate waste streams typical of road construction, including:</p> <ul style="list-style-type: none"> • Green waste from cleared vegetation • Construction wastes created from the replacement of old bridges structures and surplus excavated materials • Excess fill material from any excavation of soils and fill embankments during construction • Oil, grease and other liquid wastes from the maintenance of construction plant and equipment • General wastes and sewage from the potable ablutions and first aid facilities • Waste from maintaining plant and equipment, including liquid wastes • Packaging materials from items delivered to site, such as pallets, crates, cartons, plastics and wrapping materials • Potential contaminated material unearthed during construction (refer to Section 6.6). <p>All waste would be managed in accordance with Roads and Maritime guidelines and disposed of by a licensed contractor to an appropriately licensed facility.</p> <p>The waste associated with the operation of the proposal would not be expected to change from the existing environment. The quantities of each type of waste would be confirmed before construction. As indicated in Section 3.3.5 and Section 6.6 contaminated soils and materials may also be disturbed during construction works.</p>

6.10.2 Safeguards and management measures

Safeguards and management measures for other environmental impacts are presented in **Table 6.41**.

Table 6.41 Safeguards and management measures - Other environmental impacts

Impact	Environmental safeguards	Responsibility	Timing	Reference
Air quality	<p>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:</p> <ul style="list-style-type: none"> • Potential sources of air pollution (including the preload embankment) • Air quality management objectives consistent with any relevant published EPA and/or OEH guidelines • Mitigation and suppression measures to be implemented • Methods to manage work during strong winds or other adverse weather conditions • A progressive rehabilitation strategy for exposed surfaces. 	Contactor	Pre-construction	Section 4.4 of QA G36 <i>Environment Protection</i>
Impacts on air quality during construction	<p>During construction, the following measures will be considered and implemented where possible:</p> <ul style="list-style-type: none"> • Plant and equipment will be switched off when not in use • Vehicles, plant and construction equipment will be appropriately sized for the task and properly maintained so as to achieve optimum fuel efficiency • Apply watering to exposed areas, haulage routes and stockpiled materials as identified to be required, and in preparation for windy conditions • Cover stockpiled materials if not to be used for extended periods • Regularly review local meteorological conditions and scale back or suspend activities as necessary during inclement (ie, dry, windy) conditions • Remove debris from plant and vehicles prior to entering the existing road network, and apply street sweeping as necessary to remove any tracked materials from the site. 	Construction contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Generation of construction waste	<p>A Waste Management Plan (WMP) 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"> • Measures to avoid and minimise waste associated with the proposal • Classification of wastes generated by the proposal and management options (re-use, recycle, stockpile, disposal) • Classification of wastes received from off-site for use in the proposal and management options • Identifying any statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions • Procedures for storage, transport and disposal • Monitoring, record keeping and reporting, including any documentation management obligations arising from resource recovery exemptions. <p>The Plan will be prepared taking into account the Roads and Maritime Environmental Procedure - Management of Wastes on Roads and Maritime Services Land and relevant Roads and Maritime Waste Fact Sheets, as well as the adopting the Resources Management Hierarchy principles of the WARR Act.</p>	Contactor	Pre- construction	Section 4.2 of QA G36 Environment Protection
Utilities	<p>Before construction:</p> <ul style="list-style-type: none"> • The location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners • If the scope or location of proposed utility relocation works falls outside of the assessed proposal scope and footprint, further assessment may need to be carried out. 	Contactor	Pre-construction	Core standard safeguard U1

6.11 Cumulative impacts

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

6.11.1 Study area

The study area includes the Maitland and Cessnock LGAs. The assessment of cumulative impacts has considered other developments or activities that are under way now or are likely to commence during the proposal's scheduled construction timeframe within the study area. Construction of the proposal is anticipated to start in 2020 and be completed in 2022.

6.11.2 Methodology

Locally occurring developments that could interact with the proposal were identified through a desktop search of publicly available information on the Department of Planning, Industry and Environment's major project register, Maitland City Council and Cessnock City Council websites. The desktop search was carried out on 5 October 2018 and on 10 July 2019. Developments, such as minor alterations to dwellings, were not included due to the limited nature and extent of the developments and, therefore, minimal interaction with the proposal.

6.11.3 Other projects and developments

No developments were identified that would have the potential to overlap with the proposal.

7. Environmental management

This chapter describes how the proposal will be managed to reduce potential environmental impacts throughout pre-construction planning, 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 before construction are also listed.

7.1 Environmental management plans

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 applied during the construction and operation of the proposal.

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

The CEMP will be prepared before construction of the proposal and must be reviewed and certified by the Roads and Maritime Environment Officer, Hunter region, before 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 applied 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 Summary of safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
GEN1	General - minimise environmental impacts during construction	<p>A CEMP will be prepared and submitted for review and endorsement of the Roads and Maritime Environment Manager before commencement of the activity.</p> <p>As a minimum, the CEMP will address the following:</p> <ul style="list-style-type: none"> • Any requirements associated with statutory approvals • Details of how the project will implement the identified safeguards outlined in the REF • Issue-specific environmental management plans • Roles and responsibilities • Communication requirements • Induction and training requirements • Procedures for monitoring and evaluating environmental performance, and for corrective action • Reporting requirements and record-keeping • Procedures for emergency, incident and hazard management • Procedures for audit and review. <p>The endorsed CEMP will be implemented during the undertaking of the activity.</p>	Contractor / Roads and Maritime project manager	Pre-construction	Core standard safeguard GEN1

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
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 before commencement of the activity.	Contractor / Roads and Maritime project manager	Pre-construction	Core standard safeguard GEN2
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"> • Areas of Aboriginal heritage sensitivity • Aboriginal heritage management including unexpected finds procedures • Threatened species habitat and EEC. 	Contractor / Roads and Maritime project manager	Pre-construction	Core standard safeguard GEN3
GEN4	General – environmental awareness	<p>Standard construction hours:</p> <ul style="list-style-type: none"> • Monday to Friday 7.00 am to 6.00 pm • Saturdays 8.00 am to 1.00 pm • No construction on Sundays or public holidays. <p>Works outside standard construction hours (including those detailed within this REF) will be carried out in accordance with the management and mitigation measures detailed within the Noise and Vibration Management Plan.</p>	Contractor	Construction	Core standard safeguard GEN4
GEN5	General – environmental awareness	The Roads and Maritime Project Manager will notify the Roads and Maritime Environment Manager at least five business days before the start of the activity. The notification will include a copy of any local community notification carried out (GEN2).	Contractor	Pre-construction	Additional safeguard GEN7

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity					
B-1	Biodiversity	<p>A Flora and Fauna Management Plan will be prepared in accordance with Roads and Maritime's Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RTA, 2011) and implemented as part of the CEMP. It will include, but not be limited to:</p> <ul style="list-style-type: none"> • Plans showing areas to be cleared and areas to be protected (including hollow-bearing and habitat trees), including exclusion zones, protected habitat features and revegetation areas and identified on site construction drawings and during construction staff induction • Vegetation and habitat to be cleared and retained to be identified and protected by suitable fencing, signage or markings • Hygiene protocols to manage weeds, pest species and pathogens • Protocols for vegetation removal • Protocols for working in waterways • Protocols for unexpected finds procedure for threatened species or ecological communities not identified in assessed int eh REF • Requirements set out in the Landscape Guideline (RTA, 2008) • Pre-clearing survey requirements • Procedures addressing relevant matters specified in the Policy and guidelines for fish habitat conservation and management (DPI Fisheries, 2013) • Protocols to re-establish native vegetation. 	Contractor	Pre-construction	<p>Core standard safeguard B1</p> <p>Section 4.8 of QA G36 <i>Environment Protection</i></p>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
B-2	Minimise risks to native flora and fauna during construction	In accordance with the Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects (RTA, 2011) a pre-construction check of native flora and fauna species and habitat will be carried out.)	Contractor	Construction	Core standard safeguard B2
B-3	Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated prior to construction and implemented where practicable and feasible.	Contractor	Pre-construction	Core standard safeguard B3
B-4	Protect native flora and fauna, minimise edge effects and avoid inadvertent impacts	All personnel working on site will receive training to ensure awareness of requirements of the Flora and Fauna Management Plan and relevant statutory responsibilities. Site-specific training will be given to personnel when working in the vicinity of areas of identified biodiversity value that are to be protected.	Contractor	Construction	Core standard safeguard B4
B-5	Temporary obstruction to fish	Temporary obstruction of fish passage may require a NSW Fisheries Permit, subject to assessment by the Department of Planning, Industry and Environment.	Contractor	Construction	Additional standard safeguard B8
B-6	Removal of juvenile <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	Thirty-five <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> would be planted in a suitable location to replace those removed by the proposal.	Contractor	Construction	Additional safeguard
B-7	Stockpiles, plant and ancillary sites	No-go areas will be delineated in accordance with the Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects (RTA, 2011) and the Flora and Fauna Management Plan.	Contractor	Construction	Additional standard safeguard B10
B-8	Fauna handling	Safe fauna handling will be consistent with the Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects, and any specific requirements of the approved Flora and Fauna Management Plan.	Contractor	Construction	Additional safeguard B11

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
Noise and vibration					
NV-1	Noise and vibration	<p>A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP and updated regularly to account for changes in the noise and vibration issues and strategies. The NVMP will generally follow the approach in the Interim Construction Noise Guideline (ICNG) (DECC, 2009) and identify:</p> <ul style="list-style-type: none"> • All potential significant noise and vibration generating activities associated with the proposal • Feasible and reasonable mitigation measures from the CNVG (Roads and Maritime, 2016) to be implemented • Receivers that require additional mitigation (as listed in Table 4-6 of Appendix I) • Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria. 	Contactor	Pre-construction	<p>Core standard safeguard NV1</p> <p>Section 4.6 of QA G36 <i>Environment Protection</i></p>
NV-2	Noise and vibration	<p>All sensitive receivers (local residents) likely to be affected will be notified at least five days before 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"> • The proposal • The construction period and construction hours • Contact information for project management staff • Complaint and incident reporting • How to obtain further information. 	Contactor	Pre-construction	Core standard safeguard NV2
Hydrology and flooding					
HF-1	Soil and water	A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion	Contractor	Pre-construction	Core standard safeguard SW1

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		and water pollution (including expelled groundwater) and describe how these risks will be addressed during construction.			Section 2.1 of QA G38 Soil and Water Management
HF-2	Soil and water	<ul style="list-style-type: none"> A site specific Erosion and Sediment Control Plan (ESCP) will be prepared and implemented as part of the SWMP The plan will include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather. 	Contractor	Pre-construction	Core standard safeguard SW2 Section 2.2 of QA G38 Soil and Water Management
HF-3	Contaminants entering receiving environments during construction	Control measures to minimise the risk of water pollution will be included in the ESCP. The following measures will be included to limit sediment and other contaminants entering receiving waterways: <ul style="list-style-type: none"> All fuels, chemicals, and liquids will be stored at least 50 metres away from any waterway and stored in an impervious bunded area within the compound site Plant and maintenance machinery will be refuelled in impervious bunded areas at least 40 m from waterways Run-off from ancillary sites will be controlled and treated before discharging into downstream waterways Vehicle washdowns and/or concrete truck washouts would be carried out within a designated bunded area of an impervious surface or carried out off-site. Vehicle movements will be restricted to designated pathways and hardstand areas Areas that will be exposed for extended periods, such as car parks and main access roads, will be stabilised where feasible. 	Construction contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
HF-4	Extraction of water	Non potable water sources (including the potential for water extraction from the Hunter River) would be investigated during pre-construction to minimise reliance on potable water where feasible. Any water extraction would occur only after consultation with the Department of Planning, Industry and Environment (who now manages the functions of the NSW Office of Water), and acquisition of associated permits and approvals, if required.	Roads and Maritime / Construction contractor	Pre-construction / Construction	Additional safeguard
HF-5	Flood management for the construction site	A Flood Management Plan will be prepared before construction. This plan will include: <ul style="list-style-type: none"> Review and coordination with existing local flood plans and evacuation procedures Flood emergency preparation, response, and recovery measures which will implemented during construction Procedure for daily review of the Bureau of Meteorology website Site protection measures to be implemented before and in the event of flooding. 	Construction contractor	Pre-construction / Construction	Additional safeguard
HF-6	Potentially acidic groundwater expelled by preload embankment	A water sampling and management regime will be implemented as part of the SWMP to mitigate against water quality impacts arising from the temporary release of potentially acidic groundwater. The water sampling regime will include monitoring of water quality before construction to provide a baseline .	Construction contractor	Pre-construction	Additional safeguard
Aboriginal heritage					
AH-1	Impacts to Aboriginal heritage	An AHIP for harm to TH-AS-001 and TH-PAD-001 will be required before potential impact to Aboriginal heritage. The AHIP application will include the following as detailed in the ACHAR (refer to Appendix E):	Roads and Maritime	Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> • A methodology for further archaeological salvage excavation of TH-PAD-001 outside of the proposed exclusion zone, in consultation with the RAPs • A proposal for surface collection of artefacts for TH-AS-001 by RAPs • Care and control for the recovered assemblage • Harm without salvage for all objects in the proposal outside of the existing recorded Aboriginal sites. 			
AH-2	Aboriginal heritage	An Aboriginal Heritage Management Plan (AHMP) will be prepared in accordance with the Procedure for Aboriginal cultural heritage consultation and investigation (Roads and Maritime, 2012) and Standard Management Procedure - Unexpected Heritage Items (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. The AHMP will be prepared in consultation with all relevant Aboriginal groups.	Contactor	Pre-construction	Section 4.9 of QA G36 <i>Environment Protection</i>
AH-3	Aboriginal heritage – unexpected finds	The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Roads and Maritime does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place. Work will only re-commence once the requirements of that procedure have been satisfied.	Contactor	Pre-construction	Section 4.9 of QA G36 <i>Environment Protection</i>
AH-4	Minimise risks to Aboriginal cultural heritage during construction	All personnel working on site will receive training to ensure awareness of requirements of the AHMP and relevant statutory responsibilities. Site-specific training will be given to personnel when working in the vicinity of identified Aboriginal heritage items.	Contractor	Pre-construction	Additional standard safeguard AH3

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
AH-5	Aboriginal heritage	An exclusion zone in the area of high archaeological sensitivity within TH-PAD-001 will be identified and fenced off before construction (as shown in the ACHAR (refer to Appendix E)).	Contactor	Construction	Additional safeguard
AH-6	Additional Aboriginal heritage impacts	Any further impacts proposed beyond those assessed in this REF or beyond the boundary of the assessed areas would be subject to further assessment including consultation with Aboriginal stakeholders.	Roads and Maritime	Construction	Additional safeguard
Non-Aboriginal heritage					
NAH-1	Non-Aboriginal heritage	<ul style="list-style-type: none"> The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered Work will only re-commence once the requirements of that procedure have been satisfied. 	Contactor	Construction	Section 4.10 of QA G36 <i>Environment Protection</i>
NAH-2	Non- Aboriginal heritage	Non-Aboriginal heritage awareness training will be provided for all contractors and personnel before 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
Topography, geology, soils and contamination					
SC-1	Accidental spill	A site specific emergency spill plan will be developed and include spill management. 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	Pre-construction	Section 4.3 of QA G36 Environment Protection

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SC-2	Acid sulfate	An Acid Sulfate Materials Management Plan will be prepared and implemented as part of the CEMP. The Plan will be prepared in accordance with the Guidelines for the Management of Acid Sulfate Materials (RTA, 2005) and Acid Sulfate Soils Management Advisory committee guidelines .	Construction contractor	Pre-construction	Additional safeguard
SC-3	Stockpile management	Stockpiles will be designed, established, operated and decommissioned in accordance with the Roads and Maritime Stockpile Site Management Guideline 2015.	Construction contractor	Construction	Additional standard safeguard
SC-4	Soil stabilisation and restoration	<p>The rehabilitation of disturbed areas will be carried out progressively as construction stages are completed, and in accordance with:</p> <ul style="list-style-type: none"> • Landcom's Managing Urban Stormwater: Soils and Construction series • RTA Landscape Guideline <p>Roads and Maritimes' Guideline for Batter Stabilisation Using Vegetation (2015).</p>	Construction contractor	Construction	Additional standard safeguard
SC-5	Asbestos containing material	<p>Waste management of contaminated land will be incorporated as part of the CEMP.</p> <p>The Managing asbestos in or on soil (WorkCover NSW, 2014) and the Guideline for the Management of Contamination (Roads and Maritime, 2013), will be adopted to manage surface soils and fill material impacted by asbestos</p>	Construction contractor	Pre-construction/ Construction	Additional safeguard
SC-6	Asbestos containing material and other contaminated	An 'unexpected finds' protocol will be prepared as part of the CEMP to plan for and accommodate potential ACM waste during construction. Any 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.	Construction contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
Traffic and transport					
TT-1	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 Traffic Control at Work Sites Manual and QA Specification G10 Control of Traffic. The TMP will include:</p> <ul style="list-style-type: none"> • Confirmation of haulage routes • Measures to maintain access to local roads and properties • Site specific traffic control measures (including signage) to manage and regulate traffic movement • Measures to maintain pedestrian and cyclist access • Requirements and methods to consult and inform the local community of impacts on the local road network • Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads • A response plan for any construction traffic incident • Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic • Monitoring, review and amendment mechanisms. 	Contractor	Pre-construction	Section 4.8 of QA G36 <i>Environment Protection</i>
TT-2	Property access - during construction	<p>Access to properties will be maintained during construction. Where that is not feasible, temporary alternative access arrangements will be provided following consultation with affected landowners and the relevant local road authority. Any disruptions to property access and traffic will be notified to landowners at least five days prior in accordance with the relevant community consultation processes outlined in the TMP.</p>	Roads and Maritime and Construction Contractor	Construction	Additional standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
TT-3	Reduce speeds, traffic delays and disruptions during construction	Road users and local communities will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.	Roads and Maritime and Construction Contractor	Construction	Additional standard safeguard
TT-4	Impacts to the regional road network	The most disruptive work (such as work that requires lane closures) will be carried out at night to minimise potential impacts on the regional road network.	Roads and Maritime and Construction Contractor	Construction	Additional safeguard
Landscape character and visual impacts					
LC-1	Visual impact of ancillary sites	Ancillary sites, including construction areas and supporting facilities (such as storage compounds and offices) will be managed to minimise visual impacts, including avoiding temporary light spill into residences during night works.	Contractor	Construction	Core standard safeguard UD2
LC-2	Visual impact during construction	<ul style="list-style-type: none"> Revegetation will respond to existing vegetation community composition and landscape character using appropriate native species Revegetation along the route will assist in defining the alignment and providing visual disconnection from former alignment Clusters of tree planting will be provided within the route corridor to filter the visibility of the proposal from adjoining residential properties where possible Night works and associated lighting will be limited to minimise light spill. 	Contractor	Construction	Additional safeguard
Socio-economic, property and land use					
SE-1	Consultation	A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum):	Contractor	Pre-construction	Core standard safeguard SE1

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> • Mechanisms to provide details and timing of proposed activities to affected residents, business owners and commuters including changed traffic and access conditions and amenity impacts • Mechanisms to provide details about proposed changes to emergency services and managers of surrounding community facilities • Contact name and number for complaints. <p>The CP will be prepared in accordance with Roads and Maritime Community Engagement and Communications Manual (2012).</p>			Section 3.7 of QA G36 <i>Environment Protection</i>
SE-2	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
SE-3	Access and connectivity	Consultation will be carried out during construction with relevant public transport providers regarding the timing, duration and likely impact of construction activities.	Contractor	Construction	Additional safeguard
Other impacts					
OI-1	Air quality	<p>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:</p> <ul style="list-style-type: none"> • Potential sources of air pollution (including the preload embankment) • Air quality management objectives consistent with any relevant published EPA and/or OEH guidelines • Mitigation and suppression measures to be implemented • Methods to manage work during strong winds or other adverse weather conditions • A progressive rehabilitation strategy for exposed surfaces. 	Contractor	Pre-construction	Section 4.4 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
OI-2	Impacts on air quality during construction	<p>During construction, the following measures will be considered and implemented where possible:</p> <ul style="list-style-type: none"> • Plant and equipment will be switched off when not in use • Vehicles, plant and construction equipment will be appropriately sized for the task and properly maintained so as to achieve optimum fuel efficiency • Materials will be delivered with full loads and will come from local suppliers, where possible • Energy efficiency and related carbon emissions will be considered when selecting vehicles and equipment • Apply watering to exposed areas, haulage routes and stockpiled materials as identified to be required, and in preparation for windy conditions • Cover stockpiled materials if not to be used for extended periods • Regularly review local meteorological conditions and scale back or suspend activities as necessary during inclement (ie, dry, windy) conditions • Remove debris from plant and vehicles prior to entering the existing road network, and apply street sweeping as necessary to remove any tracked materials from the site. 	Construction contractor	Construction	Additional safeguard
OI-3	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"> • Measures to avoid and minimise waste associated with the proposal • Classification of wastes generated by the proposal and management options (re-use, recycle, stockpile, disposal) • Classification of wastes received from off-site for use in the proposal and management options 	Contractor	Pre-construction	Section 4.2 of QA G36 Environment Protection

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> Identifying any statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions Procedures for storage, transport and disposal Monitoring, record keeping and reporting, including any documentation management obligations arising from resource recovery exemptions. <p>The Plan will be prepared taking into account the Roads and Maritime Environmental Procedure - Management of Wastes on Roads and Maritime Services Land and relevant Roads and Maritime Waste Fact Sheets, as well as the adopting the Resources Management Hierarchy principles of the WARR Act.</p>			
OI-4	Utilities	<p>Before construction:</p> <ul style="list-style-type: none"> The location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners If the scope or location of proposed utility relocation works falls outside of the assessed proposal scope and footprint, further assessment may need to be carried out. 	Contactors	Pre-construction	Core standard safeguard U1

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

Instrument	Requirement	Timing
<i>Fisheries Management Act 1994</i>	Approval for dredging and reclamation work from the Department of Planning, Industry and Environment (former NSW Department of Primary Industries) from the Minister.	Prior to start of activity
<i>Fisheries Management Act 1994</i>	Permit to obstruct the free passage of fish (temporary or permanent) from the Minister for Regional New South Wales, Industry and Trade (formerly the Minister for Primary Industries).	Prior to start of activity
<i>Heritage Act 1977</i> (s139(4))	Excavation Permit Exemption Notification Form from the Department of Planning, Industry and Environment (formerly the NSW Heritage Division).	Prior to start of the activity.
<i>National Parks and Wildlife Act 1974</i> (s90)	Aboriginal heritage impact permit from the Department of Planning, Industry and Environment (formerly the OEH).	Prior to start of the activity.
<i>Roads Act 1993</i>	A road occupancy licence would need to be obtained as necessary prior to construction commencing.	Prior to start of the activity.

8. Conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

8.1 Justification

Cessnock Road provides an important connection between the New England Highway and the Hunter Expressway. In doing so, Cessnock Road provides access to jobs, schools and services for the people of Maitland, Heddon Greta, Kurri Kurri and surrounding communities.

Cessnock Road at Testers Hollow is affected by flooding and is overtopped by flood waters during events equivalent to, and in excess of, the 20 per cent AEP. The flood road closures places substantial economic and social costs on the local community and Roads and Maritime, with the main costs being trip diversion costs, loss of economic output/income, high maintenance and traffic management and delays to emergency services. The proposal has been developed to reduce the current flooding issue.

While there would be some environmental impacts as a consequence of the proposal such as temporary traffic delays, amenity impacts, vegetation clearing, impacts to Aboriginal heritage and partial property acquisitions, they have been avoided or minimised wherever possible through design and site-specific safeguards. The benefits of improving flood immunity 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 minor loss of amenity for residents, motorists and others who live near the proposal and those who visit the proposal on a regular basis during construction.

However, the long-term effect would be an overall social benefit, by reducing the frequency and duration of road closures in future flood events by increasing flood immunity along this section of Cessnock Road.

8.1.2 Biophysical factors

Construction of the proposal would require clearing of native vegetation (about 1.56 hectares) and about 0.01 hectares of planted exotic/non-indigenous vegetation. Habitat that would be impacted by the removal of this vegetation is generally limited to foraging habitat due to its disturbed nature (refer to **Section 6.1**).

The proposal would also result in the removal of about 35 juvenile planted *Eucalyptus parramattensis* subsp. *decadens* trees which were planted as an offset for the construction of the residential subdivision in Cliftleigh. Assessments under the BC Act and EPBC Act have been undertaken and are provided in **Appendix I**. The removal of up to 35 juvenile planted *Eucalyptus parramattensis* subsp. *decadens* trees is unlikely to result in a significant impact to this species.

The proposal would directly impact all of TH-AS-001 and some of TH-PAD-001. Roads and Maritime would seek an Aboriginal heritage impact permit (AHIP) under part 6 of the *National Parks and Wildlife Act 1974* (refer to **Section 6.4.4**). As part of the AHIP application process, an exclusion zone within TH-PAD-001 and a procedure for salvage of Aboriginal heritage would be proposed to mitigate some of the proposal's impact.

8.1.3 Economic factors

The proposal would require partial property acquisition next to the existing Cessnock Road. This has minimised impacts on the surrounding rural land uses as much as possible.

The proposal would deliver long-term economic benefits by improving connectivity with the New England Highway and Hunter Expressway and reducing the duration of road closures during future flood events.

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 raise the height of Cessnock Road at Testers Hollow to provide a more reliable connection during certain flood events. The proposal would reduce the frequency and duration of road closures and maintain connectivity in certain future flood events.

Although the proposal would result in some short-term impacts on amenity, accessibility and transport efficiency during construction, 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 improve the social and economic welfare of the community by improving flood immunity of Cessnock Road. This would reduce the duration of road closures in future flood events and increase connectivity between local communities.</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 other 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.	<p>Ecologically sustainable development is considered in Sections 8.2.1 to 8.2.4. In summary the proposal:</p> <ul style="list-style-type: none"> • Would minimise environmental impact as a result of its smaller footprint (conservation of biological and ecological diversity) • Would benefit future generations by addressing the flood immunity of Cessnock Road at Testers Hollow (intergenerational equity) • Has considered environmental and social issues in the option process and incorporated the value upon environmental resources (improved valuation, pricing and incentive mechanisms).
1.3(c) To promote the orderly and economic use and development of land.	<p>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 flood immunity of Cessnock Road and reduce the duration and likelihood of road closures in future flood events.</p>
1.3(d) To promote the delivery and maintenance of affordable housing.	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.	<p>Impacts to native animals and plants, including threatened species, populations and ecological communities and their habitats were considered in Section 6.1.</p> <p>The proposal would potentially impact on up to 1.56 ha of native vegetation and 0.01 ha of planted exotic/non-indigenous vegetation. Assessments of significance carried out as part of the <i>Biodiversity Assessment Report</i> (Jacobs, 2018b) (refer to Section 6.1) found that the proposal is unlikely to have a significant impact to any threatened species, population or ecological communities. Safeguards and management measures would be implemented to manage impacts to biodiversity and cleared areas would be appropriately revegetated at the completion of works.</p>
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	<p>The proposal seeks to avoid impacts on built and cultural heritage, and where impacts are unavoidable, has carried out an assessment to identify potential impacts and mitigation measures to ameliorate these impacts. Impacts and relevant to non-Aboriginal heritage and</p>

Object	Comment
	Aboriginal heritage impacts have been considered in Section 6.4 and 6.5 .
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 proposal.
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 to date and proposed is outlined in Chapter 5 .

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 would benefit future generations by addressing the low flood immunity of Cessnock Road at Testers Hollow. While the proposal would have some adverse impacts, they are not considered to be of a nature 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 road with a low flood immunity, subject to flooding impacts in events greater than the 50 per cent AEP.

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 Cessnock Road and nearby agricultural activities. However, remnant areas of native vegetation and associated habitats remain next to the existing road.

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

8.2.4 Improved valuation, pricing and incentive mechanisms

This principle is defined as:

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

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

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

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

8.3 Conclusion

The proposed Cessnock Road upgrade at Testers Hollow 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, biodiversity stewardship sites under the BC Act, wilderness areas, areas of outstanding value, impacts on threatened species and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the Federal EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the proposal objectives but would still result in some impacts on biodiversity, noise, Aboriginal heritage and traffic. Safeguards and management measures as detailed in this REF would mitigate or minimise these expected impacts. The proposal would improve the flood immunity of Cessnock Road at Testers Hollow and reduce the potential for road closures as a result of future flooding events. On balance the proposal is considered justified and the following conclusions are made.

Significance of impact under NSW legislation

The proposal is not likely 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 and Public Spaces under Division 5.2 of the EP&A Act. A Biodiversity Development Assessment Report or Species Impact Statement is not required. The proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from council is not required.

Significance of impact under Australian legislation

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

9. Certification

This review of environmental factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.



Vivira Samuel

Senior Environmental Planner

Jacobs

Date: 18 July 2019

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



Damien Grace

Project Development Manager

Hunter Region

Date: 18 July 2019

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Terms and acronyms used in this REF

Term / Acronym	Description
AADT	average annual daily traffic
ABS	Australian Bureau of Statistics
AEP	Annual Exceedance Probability, the likelihood of a flood event occurring in any one year, where the probability is expressed as a percentage
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal heritage impact permit
AHMP	Aboriginal Heritage Management Plan
AQMP	Air Quality Management Plan
ARI	Annual Recurrence Interval
ASRIS	Australian Soil Resource Information System
ASS	acid sulfate soil
BAM	Biodiversity Assessment Methodology
BAR	Biodiversity Assessment Report
BC Act	<i>Biodiversity Conservation Act 2016</i>
BDAR	Biodiversity Development Assessment Report
CEMP	Construction Environmental Management Plan
CHL	Commonwealth Heritage List
CNE	Construction Noise Estimator
CNVG	Construction Noise and Vibration Guideline
DICL	ductile iron cement lined
DPI	NSW Department of Primary Industries, now part of the NSW Department of Planning, Industry and Environment
DPE	NSW Department of Planning and Environment, now part of the NSW Department of Planning, Industry and Environment
EBPC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ENMM	Environmental Noise Management Manual
EPA	Environmental Protection Agency
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW). Provides the legislative framework for land use planning and development assessment in NSW

Term / Acronym	Description
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.
Flood immunity	The level at which a road or structure becomes inundated
FM Act	<i>Fisheries Management Act 1994 (NSW)</i>
Friable asbestos	Refers to asbestos-containing materials that are generally quite loose, when dry and can be easily reduced to powder by hand. These materials usually contain high levels of asbestos (up to 100% in some cases) loosely held in the material. These asbestos fibres can be easily released into the air.
Heritage Act	<i>Heritage Act 1977 (NSW)</i>
GDE	Groundwater dependent ecosystems
ICNG	Interim Construction Noise Guideline
INSW	Infrastructure NSW
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
L _{A10}	The L _{A10} level is the noise level which is exceeded for 10 per cent of the sample period. During the sample period, the noise level is below the L _{A10} level for 90 per cent of the time. The L _{A10} is a common noise descriptor for environmental noise and road traffic noise.
L _{A90}	The L _{A90} level is the noise level which is exceeded for 90 per cent of the sample period. During the sample period, the noise level is below the L _{A90} level for 10 per cent of the time. The measure is commonly referred to as the background noise level.
L _{Aeq}	The equivalent continuous sound level (L _{Aeq}) is the average energy of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.
L _{Amax}	The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.
LALC	Local Aboriginal Land Council
LEP	Local environmental plan. A type of planning instrument made under Part 3 of the EP&A Act.
LGA	Local government area
MCA	Multi-criteria analysis
MNES	Matters of National Environmental significance under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
NAHMP	A Non-Aboriginal Heritage Management Plan
NCA	Noise catchment area

Term / Acronym	Description
NCG	Noise Criteria Guideline
NHL	National Heritage List
NMG	Noise Mitigation Guideline
NML	Noise Management Level. Project specific criteria used to assess the level of impacts at a receiver location. This is derived from the existing background noise levels at representative monitoring locations.
NMVG	Noise Model Validation Guideline
NPWS	National Parks and Wildlife Services.
NPW Act	<i>National Parks and Wildlife Act 1974</i>
NSW	New South Wales
NTAR	National Trust of Australia (NSW) list
NVMP	Noise and Vibration Management Plan
OEH	Office of Environment and Heritage. Its functions are now being performed by the NSW Department of Planning, Industry and Environment.
OOHW	Out of hours work
PACHCI	Procedure for Aboriginal Cultural Heritage Consultation and Investigation
PAD	Potential archaeological deposits
PCT	Plant community type
PMF	Probable Maximum Flood. Largest flood could conceivably occur at a particular location, which defines the extent of flood prone lane (the floodplain).
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
PPV	Peak particle velocity
QA Specifications	Specifications developed by Roads and Maritime Services for use with road work and bridge work contracts let by Roads and Maritime Services.
RBL	Rating background level
REF	Review of Environmental Factors
RL	Relative level
RNE	Register of the National Estate
RNP	Road Noise Policy
RMS	Roads and Maritime Services
Roads Act	<i>Roads Act 1993</i>
ROL	Road Occupancy License
SEPP	State Environmental Planning Policy
SHI	State Heritage Inventory

Term / Acronym	Description
SHR	State heritage Register
SIS	Species impact statement
Study area	This encompasses the proposal and the area that may be indirectly impacted by the proposal, and may differ for each environmental factor.
SWMP	Soil and Water Management Plan
TEC	Threatened ecological community
TMP	Traffic management plan
UPVC	Unplasticised polyvinyl chloride
VDV	Vibration dose values
VIS	Vegetation Information System
VMS	Variable message signs
VMW	Value Management Workshop
WARR Act	<i>Waste Avoidance and Resource Recovery Act 2001</i>
Water land	Land submerged by water (whether permanently or intermittently)
WHL	World Heritage List
Whole of life	Costs associated with the total construction, operation and maintenance costs of the road over its lifespan
WHS	Work health and safety
WMP	Waste Management Plan



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Customer feedback
Roads and Maritime
Locked Bag 928,
North Sydney NSW 2059

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