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Jane Street and Mulgoa Road Infrastructure Upgrade

Review of Environmental Factors

October 2016



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Roads and Maritime Services

**Jane Street and Mulgoa Road
Infrastructure Upgrade
Review of Environmental Factors
October 2016**

Prepared by Arup
RMS 16.529

Executive summary

The proposal

Roads and Maritime Services (Roads and Maritime) propose to upgrade a section of the Mulgoa Road – Castlereagh Road corridor at Penrith, located within the western Sydney region of the Roads and Maritime network and the local government area (LGA) of Penrith.

The proposed Jane Street and Mulgoa Road Infrastructure Upgrade ('the proposal') is driven by existing road congestion and the anticipated population and employment growth in the region, including the North West Priority Land Release Area and the Western Sydney Employment Area. Roads and Maritime forecasts that by 2019 average traffic speeds could be less than half of the current posted speed limit for roads within the proposal area if the existing infrastructure is not upgraded.

The proposal includes:

- Widening Mulgoa Road - Castlereagh Road between Union Road to a point south of Museum Drive
- Upgrade and widening the Great Western Highway / Mulgoa Road / High Street intersection
- Upgrade of the Jane Street / Mulgoa Road - Castlereagh Road intersection
- Replacement of the existing railway bridge over Castlereagh Road
- Provision of a separated shared pedestrian and cycle pathway along the eastern side of Mulgoa Road - Castlereagh Road
- Tree planting and landscaping to match the vision for the whole of the Mulgoa Road corridor.

The Australian and NSW governments have jointly committed \$70 million to fund the proposal.

Construction of the proposal is anticipated to start in 2018 (subject to planning approval) and would be completed by mid-2020, weather permitting.

Need for the proposal

Mulgoa Road - Castlereagh Road is a regionally important traffic route for both the Penrith Central Business District (CBD) and the broader western Sydney region. This important stretch of road provides a north-south connection between Richmond and Wallacia and an east-west connection between the Penrith CBD and the Blue Mountains.

Population growth in western Sydney has placed pressure on the Jane Street / Mulgoa Road - Castlereagh Road and Mulgoa Road / High Street intersections. Considerable congestion is currently experienced during the morning and afternoon peak periods.

Penrith is a nominated regional centre which has been identified to accommodate future residential and employment growth. Without any improvement, future traffic congestion at the intersections would worsen, resulting in additional delays.

Proposal objectives

The key aim of the proposal is to improve traffic flow from Jane Street through to the Great Western Highway at High Street and to accommodate the anticipated growth in traffic in the Penrith LGA and surrounding regions.

Specifically the proposal objectives are to:

- Reduce congestion and delays at the Jane Street/ Mulgoa Road - Castlereagh Road and Great Western Highway / Mulgoa Road / High Street intersections during peak hours
- Provide improved road connections to better cater to the needs of road users
- Deliver infrastructure that provides effective network performance for at least a minimum of ten years after opening
- Promote sustainability initiatives, including:
 - Improved access to public transport, including buses
 - Strengthened integration with land use
 - Support economic growth of Penrith as a regional centre
 - Improve liveability
- Contribute to safe and effective pedestrian and cycling infrastructure between the Nepean River Bridge, Penrith Train Station and Penrith CBD that supports local and State Government initiatives for active transport
- Provide a safer road environment that reduces the frequency and severity of crashes
- Minimise impacts to the local environment.

Options considered

Two separate processes have been carried out to consider the available options as part of the proposal. This included investigation and selection of a preliminary road design option and the subsequent selection of a preferred bridge design option.

Thirteen options were considered to alleviate congestion in the area. These options ranged from changes to traffic arrangements through the Penrith CBD to more substantial changes requiring new road construction, a potential crossing at Peachtree Creek and widening of the existing railway underpass. Each option was assessed against a set of objectives and measures through a multi-criteria analysis (MCA) process. The preferred option was selected as it would offer the greatest improvement to north–south traffic movement through the corridor, which would result in the greatest improvement to the reliability and efficiency of the road network. Further, it would provide effective network performance to 2039 under the forecast traffic conditions.

Seven options for the upgrade of the existing railway bridge at Castlereagh Road were considered in consultation with key stakeholders including Transport for NSW, Sydney Trains and Penrith City Council. The options were further assessed against a set of weighted criteria to align with the priorities of Roads and Maritime. The preferred bridge option was selected as it would have relatively low impacts on Sydney Trains and low maintenance costs and environmental impacts.

Statutory and planning framework

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

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) also applies to the proposal. Clause 94 of ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent. However, consultation has been carried out with Penrith City Council and Sydney Trains in accordance with the requirements of ISEPP.

Community and stakeholder consultation

Consultation has been carried out with the community and a range of government and non-government stakeholders as part of the proposal.

Community consultation has been underway since 2014. In December 2014, community feedback was sought on the Preferred Option Report. Feedback was accepted until 17 February 2015 and all suggestions received during the consultation period were considered and investigated as part of the development of the concept design for the preferred option.

Stakeholder consultation has included consultation with Transport for NSW, Sydney Trains and Penrith City Council as part of design development, and Ambulance NSW, Lion Dairy, Westfield, the Museum of Fire and the Nepean District Tennis Association as part of the socio-economic study.

The Deerubbin Local Aboriginal Land Council (LALC) has also been engaged to assist with an Aboriginal cultural heritage survey carried out for the proposal. Representatives from the LALC attended a site investigation in November 2015 which recommended further assessment. In response, test excavations in the proposal area were undertaken in the presence of the Deerubbin LALC and the Murra Bidgee Mullangari Aboriginal Corporation in July 2016. The results of the test excavation concluded that no further Aboriginal consultation or archaeological assessment is required for the proposal.

Information about the project has been communicated via the project website and project updates and notifications. Feedback from the community and other stakeholders was considered in the development of the REF for this proposal. Roads and Maritime will continue to inform residents and stakeholders of the ongoing development of the proposal.

Environmental impacts

This REF has identified that the proposal has the potential to result in a number of impacts to the environment and surrounding community, including:

- Increased safety on Mulgoa Road – Castlereagh Road
- Increased future traffic capacity and travel times
- Improved efficiency of bus services
- Improved road drainage during rain events
- Disruption to traffic flow at the Jane Street / Mulgoa Road - Castlereagh Road and Great Western Highway / Mulgoa Road / High Street intersections during construction
- Disruption to passenger and freight rail services on the Western/Blue Mountains railway line during construction
- Removal of heritage fabric from the existing railway bridge crossing over Castlereagh Road
- Potential removal of sub-surface remains of the earlier road on High Street and Castlereagh Road, south of the Jane Street intersection
- Potential removal of any former structures along High Street
- Noise impacts to nearby residences during construction
- Permanent tree removal and landscaping impacts to Woodriff Gardens, Penrith City Council and Mulgoa Road (although this would be offset by replacement tree planting and landscaping to match the vision and strategy articulated for the whole of the Mulgoa Road corridor).

The safeguards and mitigation measures identified in this REF would help minimise the expected adverse impacts.

Justification and conclusion

The proposal would best address the Roads and Maritime objectives for Mulgoa Road – Castlereagh Road corridor by alleviating current congestion and accommodating future traffic growth. The proposal would also improve road user safety, and contribute to safe and effective pedestrian and cycling infrastructure between the Nepean River Bridge, Penrith Station and the Penrith CBD.

The proposal would result in some adverse impacts to the environment and surrounding community, such as increased noise during construction, which would be reduced through the implementation of mitigation measures during construction.

The proposal is justified on the basis that it would provide for improved network performance and can be approved by Roads and Maritime through Part 5 of the EP&A Act.

Display of the Review of Environmental Factors

This Review of Environmental Factors is on display for comment between 15 November and 16 December 2016. You can access the documents in the following ways:

Internet

The documents will be available as pdf files on the Roads and Maritime website at www.rms.nsw.gov.au/JaneStreetMulgoaRoad

Display

The review documents can be viewed at the following locations:

- Penrith City Library - 601 High Street, Penrith
- St Marys Library - 207 - 209 Queen Street, St Marys
- St Clair Library - Shop 12, St Clair Shopping Centre, Bennett Road and Endeavour Avenue, St Clair.

How can I make a submission?

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

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Matthew Allen

Postal and email address:
Jane Street and Mulgoa Road Infrastructure Upgrade
Roads and Maritime Services
PO Box 973
Parramatta CBD
NSW 2124
Janestreetandmulgoaroad@rms.nsw.gov.au

Telephone:
1800 733 084

Submissions must be received by 2pm on Friday 16 December 2016.

Privacy information

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

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

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

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

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

What happens next?

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

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

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

If you have any queries, please contact the Roads and Maritime project team on 1800 733 084.

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1 Introduction

1.1 Proposal identification

1.1.1 Background

Roads and Maritime Services (Roads and Maritime) propose to upgrade a section of the Mulgoa Road – Castlereagh Road corridor at Penrith, located within the Western Sydney region of the Roads and Maritime network and the local government area (LGA) of Penrith. The location of the proposal is shown on Figure 1-1.

The proposed Jane Street and Mulgoa Road Infrastructure Upgrade ('the proposal') involves widening the existing Mulgoa Road – Castlereagh Road carriageway between Union Road to a point south of Museum Drive and upgrading the existing traffic arrangements at the Jane Street / Mulgoa Road - Castlereagh Road and Great Western Highway / Mulgoa Road / High Street intersections. The proposal also includes the replacement of the existing railway bridge over Castlereagh Road.

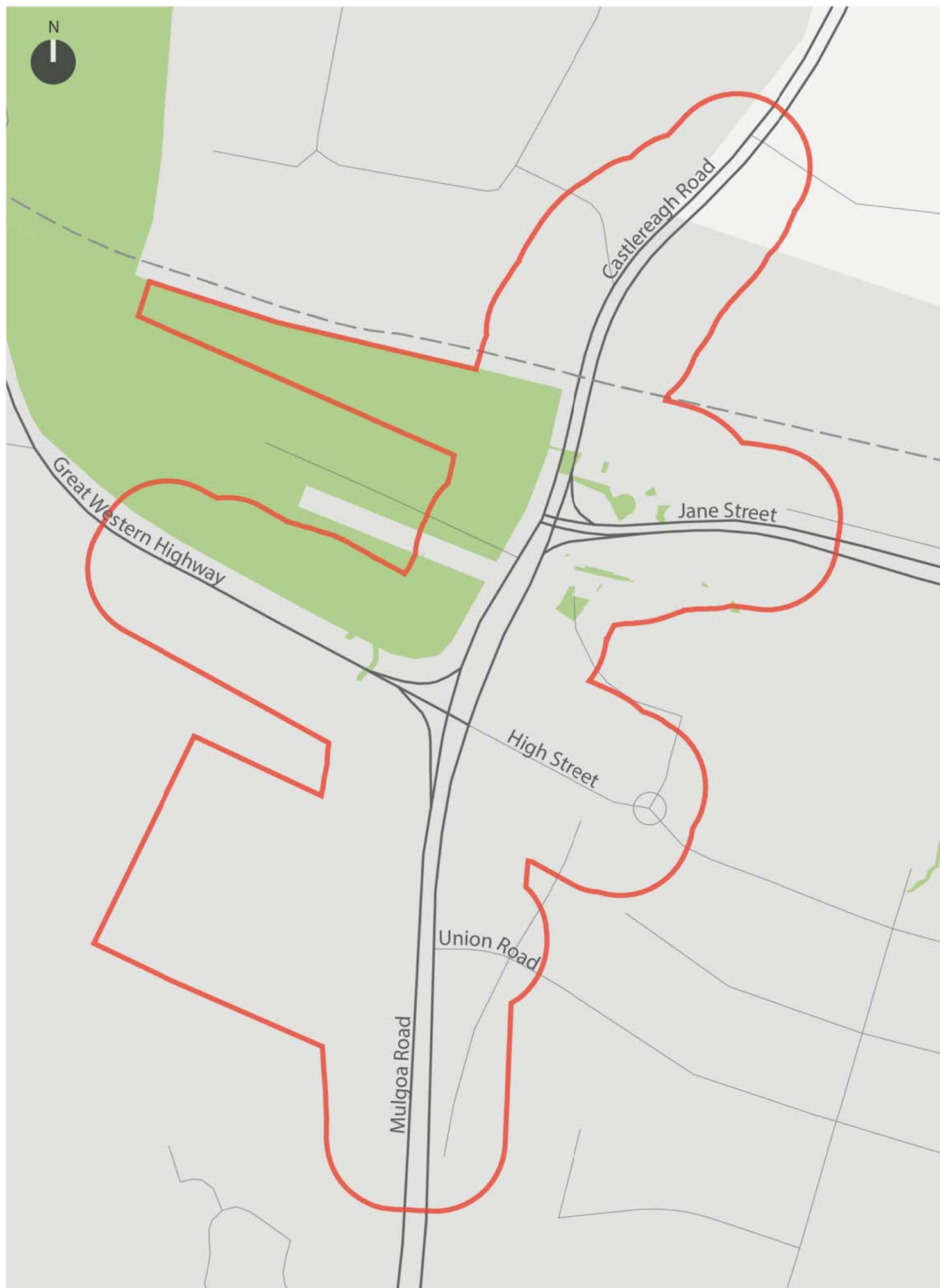
Mulgoa Road - Castlereagh Road is a regionally important traffic route for both the Penrith Central Business District (CBD) and the broader western Sydney region. This important stretch of road provides a north-south connection between Richmond and Wallacia and an east-west connection between the Penrith CBD and the Blue Mountains.

Population growth in Western Sydney has placed pressure on the Jane Street / Mulgoa Road - Castlereagh Road and Great Western Highway / Mulgoa Road / High Street intersections and considerable congestion is currently experienced during the morning and afternoon peak periods.

The proposal is driven by the existing road congestion and the anticipated population and local employment growth in the region, including the North West Growth Centre and Western Sydney Employment Area. Roads and Maritime forecasts that by 2019 average traffic speeds could be less than half of the current posted speed limit for roads within the proposal area if the existing infrastructure is not upgraded.

The proposal is located in an urban area that has developed in combination with the growth of the Penrith CBD and the wider region. The proposal area and surrounds is characterised by a mixture of civic, residential, recreational, industrial and commercial land uses. There is also a range of transport uses throughout the proposal area, including the Penrith Station, a number of public and private bus routes, and pedestrian and cycling infrastructure. Other features of note within the proposal area include Woodriff Gardens, the Nepean District Tennis Association, Peachtree Creek, Penrith Westfield shopping centre, Penrith City Council, and the Penrith Ambulance Station.

The proposal would be jointly funded by the Australian and NSW governments who have each committed \$35 million.



- State road
- Local road
- Rail line
- Proposal area
- Open space

Figure 1-1 Proposal Area

0 150m 300m

1.1.2 The proposal

The proposal includes the following key features:

- Widening Mulgoa Road - Castlereagh Road between Union Road to a point south of Museum Drive
- Upgrade of the Great Western Highway / Mulgoa Road / High Street intersection
- Upgrade of the Jane Street / Mulgoa Road - Castlereagh Road intersection
- Replacement of the existing railway bridge over Castlereagh Road
- Provision of a separated shared pedestrian and cycle pathway along the eastern side of Mulgoa Road - Castlereagh Road
- Tree planting and landscaping to match the vision for the whole of the Mulgoa Road corridor.

The proposal is described in more detail in Section 3 and shown in Figure 3-1.

Construction of the proposal would commence in 2018 (subject to planning approval) and would be completed by early-mid 2020, weather permitting.

1.1.3 The study area

The proposal is located adjacent to the Penrith CBD and is characterised by a mixture of civic, commercial, retail, residential, recreational, industrial and transport uses. The study area contains a number of local heritage items, active transport routes and a railway bridge over Castlereagh Road.

A study area has been identified for this Review of Environmental Factors (REF) and is shown in Figure 1-1. The study area generally comprises a 50 metre (m) wide buffer around the proposed road alignment, with adjustments to account for construction compounds and site access arrangements.

While this 50 m buffer was relevant for most of the environmental investigations, there were a number of specialist assessments that were based on survey areas that covered a wider area. For these investigations, different relevant survey areas were adopted. Details of the survey areas adopted for the environmental investigations are detailed in Section 6.

1.2 Purpose of the report

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

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

The description of the proposal and associated environmental impacts have been carried out in context of clause 228 of the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation), the *Threatened Species Conservation Act 1995* (TSC Act), the *Fisheries Management Act 1994* (FM Act), and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In doing so, the REF helps to fulfil the requirements of Section 111 of the EP&A Act that Roads and Maritime examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF will be considered when assessing:

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

2 Need and options considered

2.1 Strategic need for the proposal

2.1.1 Operational need

The Jane Street - Great Western Highway and Mulgoa Road - Castlereagh Road intersections currently experience traffic congestion during morning and afternoon peak times. A recent study found Mulgoa Road - Castlereagh Road is over capacity northbound and near capacity southbound during morning peak, and near capacity northbound and southbound during afternoon peak (Arcadis, 2016).

Average daily traffic (ADT) through the intersections comprise:

- Mulgoa Road – Castlereagh Road: 36,000 vehicles between Museum Drive and Jane Street on an average weekday
- Jane Street: 14,600 vehicles east of Station Street on an average weekday
- Great Western Highway: 31,000 vehicles west of Mulgoa Road on an average weekday.

Traffic volumes on these roads are about 18 to 21 per cent lower on an average weekend day than on an average weekday.

A more detailed analysis has been undertaken for Mulgoa Road – Castlereagh Road between Museum Drive and Union Road (Arcadis, 2016). The 2015 peak hour traffic volumes, volume to capacity ratios (VCRs) and average travel speeds for this section of road are presented in Table 2-1.

Table 2-1 Peak hour traffic volumes and average travel speeds for Mulgoa Road/Castlereagh Road (Arcadis, 2016)

Road section	AM peak						PM peak					
	Northbound			Southbound			Northbound			Southbound		
	Traffic volume	VCR	Travel speed	Traffic volume	VCR	Travel speed	Traffic volume	VCR	Travel speed	Traffic volume	VCR	Travel speed
Between Museum Drive and Union Road	1,824	1.01	15 km/h	1,523	0.85	13 km/h	1,559	0.87	16 km/h	1,589	0.88	13 km/h
	Over capacity			Near capacity			Near capacity			Near capacity		

Further, average daily traffic is expected to grow by an estimated 3.6 per cent per year between 2015 and 2026 and by 1.5 per cent per year between 2026 and 2036. On this basis, if there is no improvement to the capacity of Mulgoa Road - Castlereagh Road there is likely to be a reduction of the current level of service due to increased congestion, delays and queuing for peak periods (Arcadis, 2016).

It has been calculated that by 2020, both the Jane Street / Mulgoa Road - Castlereagh Road intersection and the Great Western Highway / Mulgoa Road / High Street intersection are expected to operate with a level of service defined as poor in the afternoon peak with average delays of

more than 70 seconds per vehicle. In the morning peak, these two intersections are expected to operate near or at their capacity with average delays between 43 to 70 seconds (Arcadis, 2016).

By 2036, the impacts of projected traffic growth would considerably worsen the operational performance at these intersections, with consequences for all traffic, including public transport and freight transport and those wishing to access the Penrith CBD as well as impacts to local amenity due to increased traffic, increased noise and reductions to localised air quality.

The proposal would:

- Reduce congestion and delays at the Jane Street / Mulgoa Road - Castlereagh Road and Great Western Highway / Mulgoa Road / High Street intersections during morning and afternoon peak times
- Deliver infrastructure that provides effective network performance for at least 10 years after opening
- Improve the efficiency of public transport services in the study area due to the provision of bus priorities ('queue jumps') at intersections
- Provide safe and effective pedestrian and cycling infrastructure
- Be compatible with the future proposed upgrade of Mulgoa Road.

2.1.2 Strategic setting

National Partnership Agreement on Land Transport Infrastructure Projects

In October 2014, the Australian Government entered into an agreement with the states and territories to jointly contribute to the development of a safe, sustainable national transport system that enhances the interconnectivity of corridors (networks) of significant economic opportunity across Australia. The Australian Government, together with the states and territories, determine which land-based transport infrastructure projects are funded under the agreement.

Under the National Partnership Agreement, the Jane Street and Mulgoa Road Infrastructure Upgrade was identified for funding by the Australian Government. This funding will be provided by the Investment Road and Rail Programme, which targets land transport projects that will deliver the highest benefits to the nation.

NSW State priorities

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

The primary aim of the proposal is to provide increased capacity through the Jane Street / Mulgoa Road - Castlereagh Road and Great Western Highway / Mulgoa Road / High Street intersections thereby, reducing current traffic congestion and catering for forecast transport growth. To this extent the proposal supports the growth and economic goals and the State's commitment to making better use of existing infrastructure.

A Plan for Growing Sydney

A Plan for Growing Sydney (PfGS) (Department of Planning & Environment, 2014) was released in December 2014 as the NSW Government's 20-year plan for the Sydney Metropolitan Area. It provides direction for Sydney's productivity, environmental management, and liveability and for the location of housing, employment, infrastructure and open space. The PfGS establishes a vision for Sydney as a strong global city, a great place to live.

The vision is supported by four goals:

- Goal 1: A competitive economy with world-class services and transport
- Goal 2: A city of housing choice with homes that meet our needs and lifestyles
- Goal 3: A great place to live with communities that are strong, healthy and well connected
- Goal 4: A sustainable and resilient city that protects the natural environment and has a balanced approach to the use of land and resources.

The PfGS also contains three planning principles that will guide how Sydney grows:

- Principle 1: Increasing housing choice around all centres through urban renewal in established areas
- Principle 2: Stronger economic development in strategic centres and transport gateways
- Principle 3: Connecting centres with a networked transport system.

The proposal would result in improved road transport connections to a nominated regional centre in the Sydney Metropolitan Region. The proposal would enhance economic development within the region by providing a stronger gateway to the Penrith CBD. Therefore the proposal is consistent with the PfGS.

NSW Long Term Transport Master Plan

The *NSW Long Term Transport Master Plan* (LTTMP) (Transport for NSW, 2012) presents the 20-year vision for the delivery of world-class public transport, roads and freight network to the State. The LTTMP also identifies planned and coordinated actions required to address current challenges and develop a more integrated transport system.

The LTTMP identifies Penrith as a regional city, a key urban centre and identifies its importance as a transport hub. Further, it outlines Penrith's capacity to grow over the long term as a jobs and services centre. The LTTMP highlights that car dependency is high in Penrith, with a resident travelling three times more kilometres by car than a resident of inner Sydney.

Greater Sydney, including Penrith, faces increasing congestion on motorway and arterial roads, particularly during peak periods. Easing congestion is a key objective of the LTTMP and it specifically outlines that action is required to improve busy interchanges including those in Penrith.

The proposal is consistent with the LTTMP by providing the necessary upgrades to alleviate congestion and improve capacity at these key intersections. The intersection with Jane Street also serves the Penrith railway station (Penrith station) and the associated transport interchange.

State Infrastructure Strategy

The NSW Government's *Rebuilding NSW: State Infrastructure Strategy 2014* (Rebuilding NSW) (NSW Government, 2014) sets out and commits to the State's infrastructure delivery and reform priorities. Rebuilding NSW is designed to complement the LTTMP.

Rebuilding NSW identifies the need for traffic management upgrades on urban roads in 2015-2016 and commits funding to the Urban Pinch Point Program managed by Roads and Maritime.

The proposal would reduce congestion and improve the efficiency of the road network in the area.

Mulgoa Road Corridor project

Roads and Maritime is proposing a 6.5 km upgrade and widening of Mulgoa Road - Castlereagh Road between Glenmore Parkway, Glenmore Park and Andrews Road, Penrith to support current and future traffic demands and expected growth in the area (Roads and Maritime, 2016a).

The aims of the Mulgoa Road Corridor project include:

- Manage congestion and delays along Mulgoa Road - Castlereagh Road during the morning and afternoon peaks
- Reduce travel times and lower transport costs
- Improve road safety for all users
- Support residential and employment growth and provide reliable network performance to support economic growth and productivity by providing road capacity for predicted 2036 traffic volumes
- Improve access for public transport
- Improve freight efficiency
- Provide safe and effective pedestrian and cycling infrastructure
- Improve urban design and visual aspects of the road corridor.

The proposal falls within the Mulgoa Road Corridor project perimeters. As such, the on-going planning and staging of the proposal and the Mulgoa Road Corridor project would be coordinated.

Nepean River Bridge

Roads and Maritime is planning to build a new pedestrian and cyclist bridge spanning the Nepean River between Penrith and Emu Plains. The new bridge would provide a safe crossing for pedestrians and cyclists over the Nepean River and improve connections to existing and future shared use paths. Construction of the bridge is expected to start in mid-late 2016 and take about two years to complete (Roads and Maritime, 2016b). The proposal would contribute to the safe and effective pedestrian and cycling infrastructure between the Penrith CBD and the Nepean River Bridge.

The proposal improves the pedestrian and cycle facilities along the Mulgoa Road - Castlereagh Road corridor and provides solutions that tie into existing share paths where possible. This includes recognising that the shared path has recently been upgraded along the Great Western Highway within the proposal area.

Riverlink Precinct

Designated as a key precinct in Penrith City Council's Development Control Plan 2014, the Riverlink Precinct aims to link the Penrith CBD to the Nepean River via a living, entertainment and working precinct. It has been designated SP3 (tourist) in the Local Environment Plan 2010. To date, the precinct exists via planning control only with Council acquiring selected properties within the precinct when they become available to buy. The precinct also includes a large parcel of vacant land that is known locally as the 'Carpenters site'.


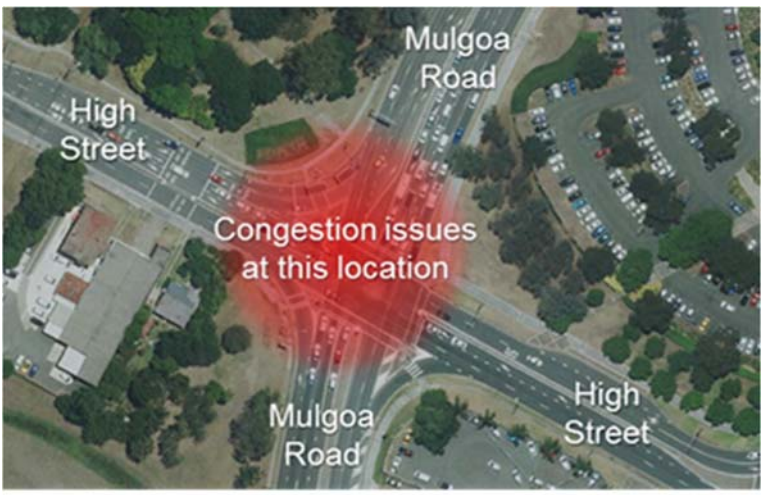

2.2 Existing road and infrastructure

The study area is located within a strategic corridor that connects Penrith with the Blue Mountains and beyond. The intersection of Jane Street, Mulgoa Road and Castlereagh Road provides access to the Penrith CBD, the Penrith Westfield shopping centre, Penrith station and transport interchange to the east and Woodriff Gardens, Peachtree Creek and the Nepean River to the west.

Jane Street is a four-lane arterial road that runs east-west through the Penrith CBD, extending about 600 m between Belmore Street and Castlereagh Road, parallel to the Western Railway Line. It connects to Mulgoa Road - Castlereagh Road via a signalised T-intersection.

The key roads and intersections within the study area are described in Table 2-2.

Table 2-2 Key intersections and features

Feature	Image
<p>Vehicles travelling west from Jane Street are required to turn left onto Mulgoa Road, travel 125 m and then turn right onto the Great Western Highway.</p> <p>This intersection arrangement and the connecting roads experience congestion, particularly during the morning and afternoon peak times.</p>	
<p>High Street runs east–west through the study area, connecting to the Great Western Highway. Although it connects the eastern and western sections of the Great Western Highway, High Street runs through Penrith CBD providing local access to the CBD and is heavily used by pedestrians. High Street generally has four lanes within the study area. This four lane configuration continues onto the Great Western Highway which reduces to two lanes (one in each direction) as it approaches Victoria Bridge.</p>	
<p>The T1 Western Line (train line) and Blue Mountains Line crosses over Castlereagh Road about 100 m north of the Jane Street intersection. At this location, Castlereagh Road comprises a two lane divided carriageway until Waterside Boulevard where it turns into a four lane carriageway. The speed limit for the road is 60 km/h.</p> <p>The current bridge structure is a three span open top steel deck bridge with a through girder central span. The total bridge length is approximately 30 m split into three spans of 3.5 m, 17.5 m and 9.5 m. The bridge provides a safe vertical clearance height of 4.4 m.</p>	

Feature	Image
<p>Mulgoa Road connects Penrith to Wallacia. The road is a four lane carriageway until Glenmore Parkway and turns in a two lane carriageway towards Wallacia. The speed limit for the road is mostly 60 km/h.</p>	 <p>The image is an aerial photograph of a suburban area. It shows a network of roads including Mulgoa Road, High Street, and Castlereagh Road. A railway line runs through the area, with a rail underbridge visible. The Victoria Bridge is located on the left side of the image. Two red starburst markers are placed on Mulgoa Road, one near the intersection with High Street and another further south. The surrounding area includes residential housing, green spaces, and some commercial buildings.</p>

The current traffic arrangements in the study area are described in Table 2-3.

Table 2-3 Current traffic arrangements

Intersection	Classification	Speed limit	Traffic control method	Road movements and restrictions
Jane Street	State Road	50 km/h	Signalised T-intersection at Mulgoa Road/ Castlereagh Road	Dedicated signalised left turn lanes southbound to Castlereagh Road and signalised right turn lanes northbound to Castlereagh Road.
Mulgoa Road	State Road	60 km/h	Signalised T-intersections at High Street and Jane Street, priority T-intersection at Union Road	Dedicated left turn lane to Great Western Highway, through lanes north to Castlereagh Road and signalised right turn provisions to High Street.
Castlereagh Road	State Road	60 km/h	Signalised T-intersections at Museum Drive and Jane Street	Dedicated left turn lane to Jane Street. Vehicles limited to 4.4m clearance under the railway bridge. At High Street, there are through lanes southbound onto Mulgoa Road, left turns onto High Street and right turn lanes onto High Street leading to the Great Western Highway heading west.
High Street (west) leading to the Great Western Highway	State Road	60 km/h	Signalised intersection at Mulgoa Road and High Street	Dedicated signalised left turn lanes to Castlereagh Road northbound, signalised right turn provisions to Mulgoa Road southbound and signalised through lanes to High Street.
High Street (east)	Local Road	50 km/h	Signalised intersection at Mulgoa Road and Great Western Highway	Dedicated signalised right turn lane to Mulgoa Road southbound, signalised right turn provisions to Mulgoa Road northbound, signalised through junction to Great Western Highway. B-double movements not permitted on High Street.

2.2.1 Pedestrian and cyclist facilities

The study area comprises pedestrian and cycling paths as part of Penrith City Council's active transport goals (Penrith City Council, 2013). Key pedestrian and cyclist facilities within the study area are described in the following sections and shown in Figure 2-1.

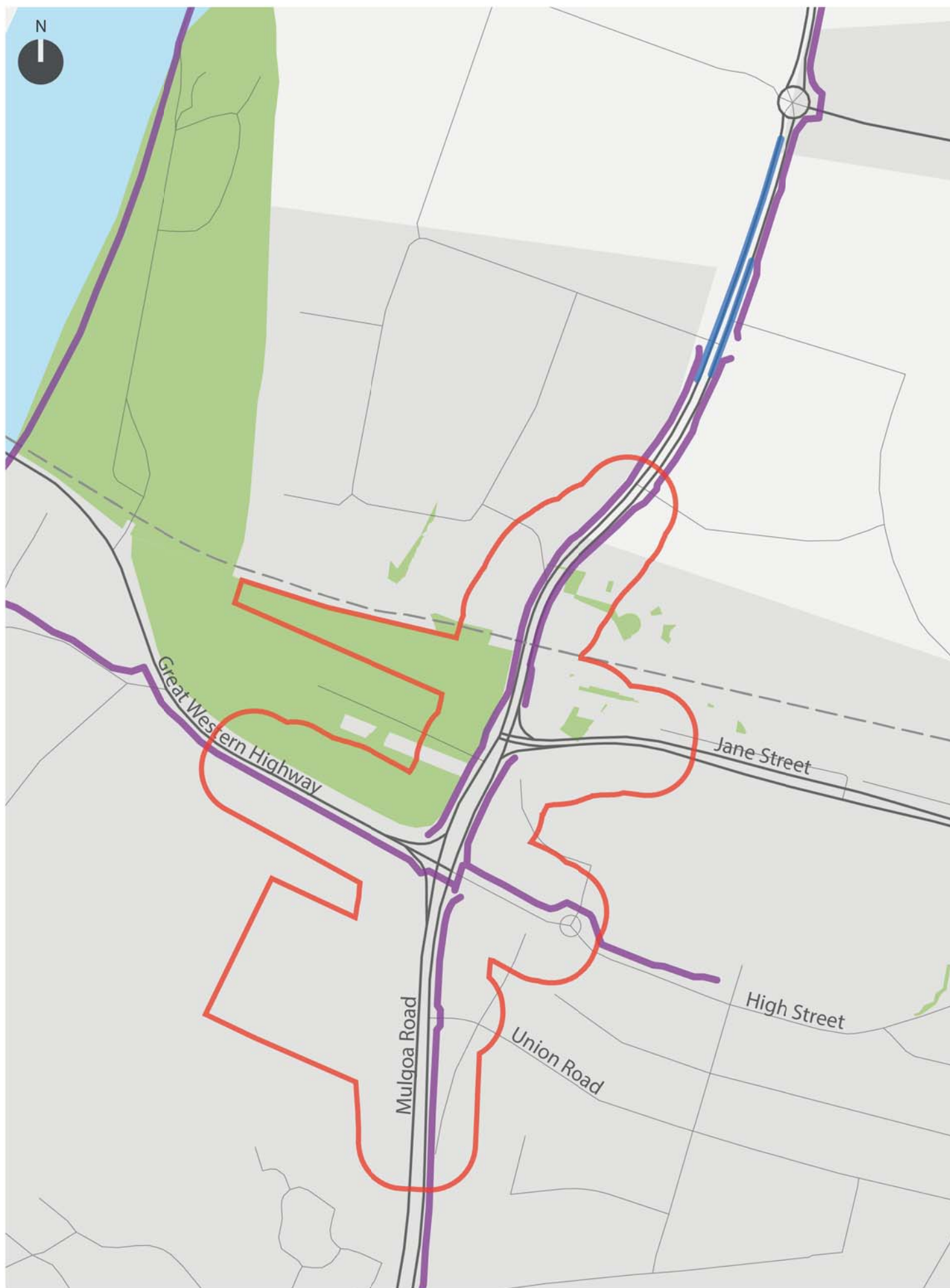
Pedestrian

There are currently pedestrian paths on both sides of Mulgoa Road, Castlereagh Road and Jane Street and a pedestrian path running along the westbound carriageway of the Great Western Highway - High Street. The paths within the study area vary in width and provide access to a number of community, recreational and commercial premises.

The existing pedestrian crossings at the High Street intersection provide access across all roads except for across Great Western Highway in the north - south direction. It is possible to cross Mulgoa Road - Castlereagh Road in two stages on the north side of the High Street intersection, and three stages on the south side. There is one zebra crossing spanning the southbound left turn lane from High Street. At the Jane Street intersection, pedestrians can cross Jane Street in three stages and Castlereagh Road in three stages from the north or two stages from the south. There is one zebra crossing spanning the eastbound right turn lane from Castlereagh Road.

Cycle

There are currently off-road shared cycle paths within the study area along Mulgoa Road - Castlereagh Road southbound between Museum Drive and Union Road and northbound between the Great Western Highway and Museum Drive, as well as westbound on the Great Western Highway and eastbound on High Street.



- | | | |
|------------|---------------|--------------------|
| State road | Proposal area | Shared Path |
| Local road | Open space | On-road cycle path |
| Rail line | Nepean River | |

Figure 2-1 Key pedestrian and cyclist facilities within the proposal area

0 200m 400m

2.2.2 Bus routes and services

The Penrith Transport Interchange (the Interchange) at Belmore Street facilitates a number of bus services which operate in the study area, with buses accessing the Interchange from Jane Street. The interchange is used by three bus operators (Busways, NightRide and the Blue Mountains Bus Company) for 26 bus routes. There are currently eight bus services that operate within the study area, including:

- Busways routes 673, 783 and 784 which operate along Mulgoa Road and Castlereagh Road and provide half hourly services in peak times.
- Blue Mountains Bus Company Services 688, 689, 690P, 691 and 1688 which travel from the Great Western Highway to the Interchange via High Street.

Sydney's Buses Future (Transport for NSW, 2013) also identifies a proposed new suburban bus route between Penrith and Rouse Hill which will potentially increase the number of buses running along Castlereagh Road.

In addition to these daily services the N70 NightRide bus operates between midnight and 4.30 am in place of trains between Town Hall and Penrith.

Bus priority lanes are currently provided on the Great Western Highway eastbound only.

2.2.3 Rail routes and services

Penrith Station is located to the north-east of the study area. The T1 Western Line (operated by Sydney Trains) and Blue Mountains Line (operated by NSW TrainLink) traverses the study area and facilitates the movement of people between Sydney and the Blue Mountains. Penrith Station is important for commuters accessing the Sydney Trains network. Around 53 per cent of workers who live in the Penrith LGA travel outside this area each day and around 10 per cent of people travelling to work use trains train each day. The T1 Western Line and Blue Mountains Line cross over Castlereagh Road via a railway bridge located about 100 m north of the Jane Street intersection.

The railway line also serves as a nationally important freight route currently connecting rail freight between Sydney and Adelaide. Additionally this railway line has been identified as a key linkage to the proposed Inland Rail route further to the west of NSW at Parkes.

The rail infrastructure at Penrith is also periodically used for yarding freight trains, although this use has diminished significantly over time. Enquiries would need to be made close to critical construction activities to minimise potential disruption to freight activity at this location.

2.2.4 Freight and heavy vehicles

Mulgoa Road - Castlereagh Road is the primary road freight route between Penrith, Jamisontown and Glenmore Park with up to 15 per cent of the total daily traffic comprising heavy vehicles. Jane Street and the Great Western Highway provide for freight movements between the Penrith CBD, the Blue Mountains and Central West. About nine per cent of total daily traffic on Jane Street and seven per cent of total daily traffic on the Great Western Highway (within the study area) is comprised of heavy vehicles. Within the proposal area, Jane Street, Mulgoa Road, Castlereagh Road and the Great Western Highway all accommodate 19-26 m B-double vehicles, however B-double movements are not permitted on High Street east. Jane Street, Mulgoa Road and the Great Western Highway are also approved routes for 4.6 m high vehicles; however 4.6 m high vehicles are currently restricted from Castlereagh Road, north of Jane Street.

2.3 Proposal objectives

The key aim of the proposal is to improve traffic flow from Jane Street through to the Great Western Highway at High Street and to accommodate the anticipated growth in traffic in the Penrith LGA and surrounding regions.

Specifically the proposal objectives are to:

- Reduce congestion and delays at the Jane Street/ Mulgoa Road - Castlereagh Road and Great Western Highway / Mulgoa Road / High Street intersections during peak hours
- Improve the arterial road connection that integrates with the existing road network to meet all road user needs on opening and into the future
- Deliver infrastructure that provides effective network performance for at least a minimum of ten years after opening
- Promote sustainability initiatives, including:
 - Improved access to public transport, including buses
 - Strengthened integration with land use
 - Support economic growth of Penrith as a regional centre
 - Improve liveability
- Contribute to safe and effective pedestrian and cycling infrastructure between the Nepean River Bridge, Penrith Train Station and Penrith CBD that supports local and State Government initiatives for active transport
- Provide a safer road environment that reduces the frequency and severity of crashes
- Minimise impacts to the local environment.

2.4 Alternatives and options considered

2.4.1 Introduction

Roads and Maritime has carried out two separate optioneering processes as part of the proposal. This includes the investigation and selection of a preliminary design as part of the *Jane Street Mulgoa Road Infrastructure Upgrade Preferred Option Report* (Roads and Maritime, 2014b), hereafter referred to as 'the Preferred Option Report', and the subsequent selection of a preferred strategic bridge design as part of the *Jane Street / Mulgoa Road Infrastructure Project, Penrith Strategic Bridge Options Design Report* (Arup, 2015), hereafter referred to as the 'Preferred Bridge Report'.

The proposal design assessed in this REF is based on the early concept design which is a combination of the original preferred preliminary design option (Option 12), the preferred design of the bridge (Option 5) and some design refinements. The alternatives and options considered in these reports are briefly discussed in the following section.

2.4.2 Methodology for selection of preferred option

Preliminary design options

Roads and Maritime investigated 13 preliminary design options for this proposal as part of the Preferred Options Report (Roads and Maritime, 2014b). Traffic analysis and multi-criteria analysis were carried out as part of the Preferred Options Report to identify a preferred option based on the objectives and measures outlined in Table 2-4.

Table 2-4 Objectives and measures used to evaluate preliminary design options

Theme	Objective	Measurable used to evaluate objective	Benefits realisation
Traffic congestion	Reduce congestion and delays at intersections during peak times	Travel time for all road users (including buses) at year of opening – measured by average delay and level of service at intersection	Reduction in congestion and delays to optimise reliability and efficiency of journeys in the area and improve customer experience
Road network	Improve the integration of the arterial road with the existing road network to meet all road user needs upon opening and into the future	Level of differentiation between regional and local traffic	Integration of road classes that does not reduce travel reliability and efficiency
Road planning	Deliver infrastructure that provides effective network performance for at least ten years after opening	Travel time for all road users (including buses) to 2029 – measured by average delay and level of service across the intersections	Provide efficient and consistent travel times through the section of the network to 2029
Sustainability	<ul style="list-style-type: none"> • Improve access to public transport • Strengthen integration with land use • Support economic growth of Penrith as a regional centre • Improve liveability 	<ul style="list-style-type: none"> • Level of access to public transport interchange • Level of access to Penrith CBD for all users • Efficiency of freight movements • Level of provision for pedestrians and cyclists (including safe and efficient routes and facilities) 	Road/transport network supports ongoing development of the city centre

Theme	Objective	Measurable used to evaluate objective	Benefits realisation
Active transport	Facilitate the provision of safe and effective pedestrian and cycling infrastructure within the proposal boundaries, between the Nepean River Bridge, Penrith Station and CBD that supports local and State government objectives for active transport	Level of provision for pedestrians and cyclists (including safe and efficient facilities)	Active transport provision is consistent with Government's direction in <i>Sydney's Walking Future</i> (Transport for NSW, 2013) and <i>Sydney's Cycling Future</i> (Transport for NSW, 2013). Footpaths and separated cycle ways support investment in the Nepean River Bridge and contribute to increase in walking and cycling trips in Penrith
Value for money	Provide the best outcomes within the budget allocation and to deliver a positive Benefit-Cost Ratio (BCR)	Value of BCR	Value for money for NSW community through provision of cost effective infrastructure within the allocated budget with a positive BCR
Safety	Provide a safer road environment that reduces the frequency and severity of crashes	Number of incidents and accidents	Safe travel for road users
Environment	Minimise impact to the local environment including no adverse flooding impact while improving opportunities to improve river access and enhance urban design	<ul style="list-style-type: none"> • Level of impact on adjoining infrastructure from flooding • Level of river access provided • Level of integration with surrounding environment 	Minimise the environmental impact of Roads and Maritime and Transport for NSW infrastructure delivery

Strategic bridge options

During the early development of the concept design, a strategic design review and options assessment was carried out for the proposed replacement of the railway bridge crossing over Castlereagh Road. This was carried out to further consider existing constraints and present several bridge design options to Sydney Trains. The strategic bridge options were investigated as part of the Preferred Bridge Report (Arup, 2015) based on the following criteria:

- Constructability – including the bridge structure and the road approaches
- Impact on Sydney Trains – including existing rail assets, future proofing, compliance with standard design requirements and maintenance
- Environmental impacts – including biodiversity, socio-economic, heritage, landscape and noise and vibration impacts
- Impact on the concept road design – including impacts on utilities, property acquisitions, clearance under the bridge, flooding and drainage
- Price.

These broad criteria were considered as they represent the attributes where the options can be differentiated. The criteria used during the analysis were also weighted as follows to align with the priorities of Roads and Maritime:

- Constructability – 20 per cent
- Impact on Sydney Trains – 25 per cent
- Environmental impacts – 10 per cent
- Impact on the concept road design – 25 per cent
- Price – 10 per cent.

2.4.3 Identified options

Preliminary design options

Thirteen initial options were identified and considered during an iterative design process for the preliminary design. Table 2-5 summarises the relevant design elements for the various options.

Table 2-5 Summary of the identified preliminary design options

Option	East/west extension of Jane Street	Additional through lanes on Castlereagh Road and rail underpass	Additional through lanes on Mulgoa Road	Grade separation	High Street intersection adjustment
1	Yes	Yes	No	No	Yes (minor)
2	Yes	Yes	No	No	Yes (major)
3	Yes	No	No	No	No
4	Yes	Yes	Yes		Yes (major)
5	No	No	No	No	No
6	Yes	Yes	No	No	Yes (minor)
7	No	Yes	No	No	Yes (minor)
8	Yes (one-way)	No	No	No	Yes (minor)
9	No	No	Yes	No	Yes (major)
10	No	No	No	Yes (North / South)	Yes (major)
11	Yes	No	Yes	Yes (East / West)	Yes (minor)
12	No	Yes	Yes	No	Yes (major)
13	No	No	Yes	Yes (Northbound only)	Yes (major)

Strategic bridge options

The identified strategic bridge options included:

- Option 1 – New superstructure, widen carriageway on the eastern side, retain western abutment and pier
- Option 2 – New superstructure, widen carriageway on the western side, retain eastern abutment and pier
- Option 3 – Retain western and central span, widen carriageway on the eastern side with new eastern span to match existing
- Option 4 – Retain eastern and central span, widen carriageway on the western side with new western span to match existing
- Option 5 – Build a new (longer) bridge adjacent to existing bridge and slide into place during a track possession
- Option 6 – Build a new bridge adjacent to existing bridge and slew the tracks with widened carriageway on the western side
- Option 7 – New flyover for the northbound carriageway over the rail corridor.

2.4.4 Analysis of options

The options identified were evaluated against the criteria identified in Section 2.4.2 and rated to determine which options would be taken forward for further consideration. Table 2-6 and Table 2-7 summarise the analysis for the preliminary design options and the strategic bridge options respectively.

Preliminary design options

Of the 13 options considered for the proposal, nine options were found to not offer adequate benefits in terms of reducing congestion and were subsequently discounted.

The remaining four options, Options 4, 9, 12 and 13, were taken through a detailed evaluation against all other proposal objectives (as listed in Section 2.3). The following key points were identified during the analysis:

- Option 4 would be the most expensive of the four shortlisted options, achieving the lowest cost benefit ratio and exceeding the project budget by \$8 million. This option also scored lowest on network planning and road planning and was considered to have the greatest potential for environmental impact, including landscape and visual amenity impacts at Woodriff Gardens, socio-economic and property impacts at the Nepean District Tennis Association, an increase in peak flood levels, and potentially higher noise and air quality impacts during construction
- Option 9 and Option 13 performed well against the objectives, however they scored lower than Option 12 which was identified as the best performing option.

Option 12 was preferred on the basis that it would result in the greatest improvement to the reliability and efficiency of the road network in the study area. Additionally, Option 12 would provide effective network performance to 2039 under forecast traffic conditions.

Strategic bridge options

As part of this assessment the key stakeholders including Transport for NSW, Sydney Trains and Penrith City Council were consulted regarding the options for replacing the bridge to identify any potential constraints and risks. Different site visits were carried out with utility providers to determine any risks associated with relocation/ protection of their assets.

During the analysis it became apparent that some of the strategic bridge options also affected the road geometry associated with the preliminary design. Therefore in some cases, the road layout and alignment was adjusted and refined to suit that strategic bridge option.

The following key points were identified during the analysis:

Option 5 scored highest as it would have a relatively low impact on Sydney Trains' operations as it could be slid into place during a track possession. It would also have the lowest maintenance costs compared to other options considered. Further it also scored well in terms of the road design and it had relatively low environmental impacts as there would be minimal change to biodiversity, heritage, landscape character and noise amenity. However, Option 5 performed poorly in terms of price and constructability.

- Despite being the most similar to the preferred preliminary design option, Option 1 scored the lowest. The low ranking came as a result of the relatively high impacts on Sydney Trains' operations associated with the relocation of the rail signalling, cabling route and associated infrastructure and required provision of alternative rail corridor access.
- All options are likely to result in some impacts on existing Sydney Trains assets and utilities, primarily located along the western side of the bridge. Constructability and impacts on Sydney Trains were the defining influences on the scoring of the options.

Table 2-6 Summary table of the analysis of the preliminary design options

Options	Reduce congestion	Road network	Road planning	Sustainability	Active transport	Value for money	Safety	Environment	Score	Rank
1	0	Did not offer adequate benefits in terms of reducing congestion on year of opening							0	7
2	4	Did not offer adequate benefits in terms of reducing congestion on year of opening							4	5
3	0	Did not offer adequate benefits in terms of reducing congestion on year of opening							0	7
4	8	7	3	6	6	1	5	1	37	4
5	2	Did not offer adequate benefits in terms of reducing congestion on year of opening							2	6
6	4	Did not offer adequate benefits in terms of reducing congestion on year of opening							4	5
7	0	Did not offer adequate benefits in terms of reducing congestion on year of opening							0	7
8	0	Did not offer adequate benefits in terms of reducing congestion on year of opening							0	7
9	8	6	6	8	5	6	5	7	51	2
10	4	Did not offer adequate benefits in terms of reducing congestion on year of opening							4	5
11	4	Did not offer adequate benefits in terms of reducing congestion on year of opening							4	5
12	8	9	8	9	5	5	5	6	55	1
13	8	5	3	6	4	8	5	5	44	3

Table 2-7 Summary table of the analysis of the strategic bridge options

Criteria (Weighting)	Price (20%)	Constructability (20%)	Impact on Sydney Trains (25%)	Environmental (10%)	Road design (25%)	Score	Rank
Option							
1	12%	9.3%	9.3%	5.7%	16%	52.3%	6
2	12.5%	6.7%	13.6%	6.0%	15%	53.7%	2
3	14.6%	9.3%	7.9%	5.3%	16%	53.1%	4
4	16.9%	8%	12.1%	5.7%	11%	53.7%	3
5	10.3%	5.3%	17.1	6.3%	15%	54.1%	1
6	10%	6.7%	14.3%	6%	11%	48%	7
7	8.7%	6.7%	18.6%	5%	14%	52.9%	5

2.5 Preferred option

Preliminary design option

Option 12 was selected as the preferred preliminary design option. This option included:

- An additional lane both north and south bound on Mulgoa Road - Castlereagh Road between Museum Drive and Union Road, increasing capacity for through traffic, while providing capacity for vehicles turning left onto Mulgoa Road from Jane Street and right onto the Great Western Highway
- A longer left-turn lane along Mulgoa Road for vehicles turning onto the Great Western Highway
- Upgrading the Mulgoa Road and High Street intersection to provide increased capacity
- Upgrading the T-intersection of Jane Street and Castlereagh Road/Mulgoa Road to provide increased capacity
- Widening the existing rail underpass to allow three lanes of traffic in each direction on Castlereagh Road and a left turn lane into Jane Street.

Strategic bridge option

Option 5 was selected as the preferred option for the bridge replacement. This option included:

- Building a new 36.5 m span bridge and replacing the existing bridge using a specialised method known as a bridge slide to minimise road and track closures during construction
- Provision of full width traffic lanes on Castlereagh Road at the bridge crossing, with three 3.5 m lanes in both directions and a 3.3 m left turn lane into Jane Street
- The provision of a 4.5 m separated path on the eastern side of Castlereagh Road.

2.6 Design refinements

The following refinements have been introduced since the optioneering stage:

- Bridge widening options were assessed as it was decided to widen on the western side rather than the eastern side due to the need to reduce the impact on Sydney trains assets
- Adopting a single span bridge and increasing the new bridge span from 36.5 m to 39 m (from centres of abutments)
- Amending the horizontal geometry of Castlereagh Road for the widening of the new bridge to the west
- Amending the vertical alignment of the new bridge to provide for the 70 km/h design speed
- Increasing the vertical clearance of the new bridge from existing 4.4 m to 4.6 m posted following consultation with Transport for NSW
- Super elevation applied to horizontal curves at the southern approach to the railway bridge to achieve the 70 km/h design speed
- Horizontal alignment modified to tie into the planning of the proposed Mulgoa Road/ Castlereagh Road Upgrade
- Bus priority ('queue-jump') lane added to the east and west bound movements at the High Street intersection following consultation with Transport for NSW
- Bus priority ('queue-jump') lane added to the right turn from Jane Street onto Castlereagh Road following consultation with Transport for NSW
- Left turn slip lane added to the southbound Mulgoa Road turn into High Street following consultation with Penrith City Council.

3 Description of the proposal

3.1 The proposal

The proposal comprises a widening of the existing road carriageway, upgrading the intersection traffic arrangements and replacing the railway bridge with a new bridge, thereby increasing capacity, alleviating congestion and improving traffic flow in the area.

The proposal includes the following key features:

- Widening the existing alignment on the western side of Mulgoa Road - Castlereagh Road between Union Road and a point south of Museum Drive to allow for six lanes of through traffic, a central median strip and auxiliary turning lanes at intersections
- Upgrade and widening of the Jane Street / Mulgoa Road - Castlereagh Road intersection and addition of a bus priority lane ('queue-jump') lane for buses turning right out of Jane Street onto Castlereagh Road
- Upgrade and widening of the Mulgoa Road / High Street intersection to allow for an additional eastbound lane and right turn lane out of High Street onto Mulgoa Road
- Replacement of the existing railway bridge over Castlereagh Road with a new 39 m single span concrete bridge using a specialised method known as a 'bridge slide'
- Installation of bridge protection beams on either side of Castlereagh Road as a safety mechanism for over-height vehicles on approach to the railway bridge
- Provision of a 4.5 m wide separated pedestrian and cycle pathway along the eastern side of Mulgoa Road - Castlereagh Road and safe crossings at the High Street and Jane Street intersections with Mulgoa Road - Castlereagh Road
- Relocation of underground utilities in the proposal area and improvement of local drainage
- Tree planting and landscaping to match the vision for the whole of the Mulgoa Road corridor
- Temporary establishment of up to three construction compound sites.

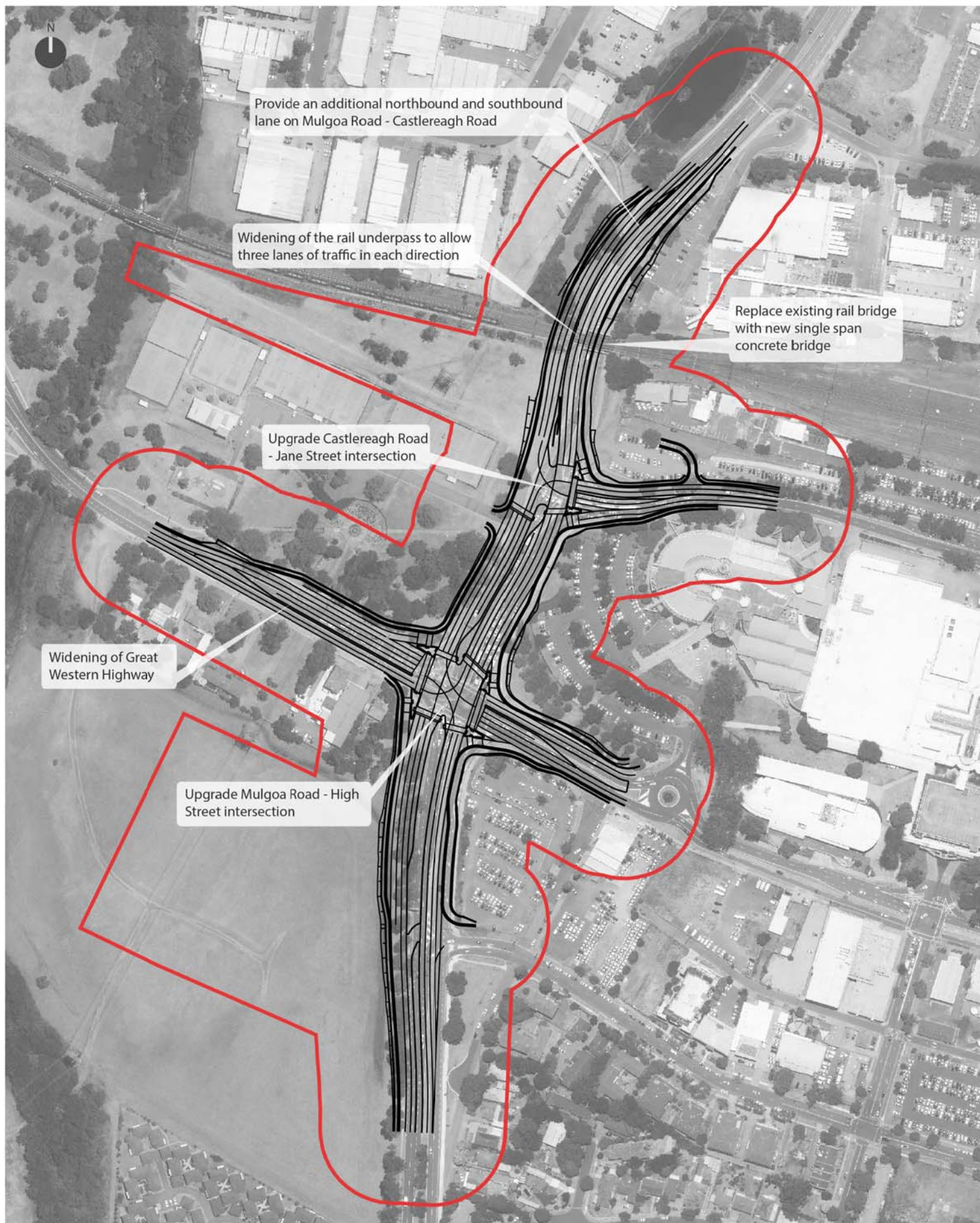
The concept design for the proposal is provided in Appendix A and the key features are shown in Figure 3-1.

Construction of the new rail bridge offline would require a number of rail possessions which will mostly have little or no impact to current traffic movements. However, demolition of the existing bridge and positioning of the new bridge would require a 2-5 day rail possession and full closure of Castlereagh Road (with the implementation of appropriate traffic diversions).

The rest of the project would be constructed under two broad impact zones:

- Mulgoa Road / High Street intersection
- Mulgoa Road - Castlereagh Road / Jane Street intersection.

The two zones may be constructed in parallel or separately, although it is expected that work at the Mulgoa Road / High Street intersection would be completed before work at the Mulgoa Road - Castlereagh Road / Jane Street intersection primarily due to the rail bridge works being a necessary pre-cursor to the Mulgoa Road / Castlereagh Road / Jane Street intersection works. Some activities, such as the relocation of underground utilities, may be completed as early works. The initial works / stage in both zones is relocation of services. Temporary pavement may be required during construction to smooth any level differences between the work stages.



— Proposal area
— Concept design

Figure 3-1 Key features of proposal



3.2 Design

3.2.1 Design criteria

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

Table 3-1 Key design criteria

Criteria	Jane Street and High Street (east)	Great Western Highway (High Street (west))	Castlereagh Road and Mulgoa Road	Local Roads – including Union Road
Design speed	60km/h	70km/h	70km/h	60km/h
Minimum Grade	0.3%	0.3%	0.3%	0.3%
Maximum Grade	6%	6%	6%	6%
Lane Width	3.5 m	3.5 m	3.5 m	3.5 m
Paths	Jane Street: 1.5 m footpath on the southern and northern sides High Street: 3.0 m shared path on the northern side and 1.5 m footpath on southern side	1.5 m path on the northern side	4.5 m separated path on the eastern side and a 2.0 m path on the western side	-
Design Vehicle	Jane Street: 26 m long B-double High Street: 14.5 m long standard bus	26 m long B-double	26 m long B-double	Union Road: 12.5 m single unit trailer
Hydraulic Standard	10 years	10 years	10 years	10 years

3.2.2 Engineering constraints

Key engineering constraints for the proposal include:

- The vertical height clearance restriction where Castlereagh Road passes under the rail line; the existing underpass is posted at 4.4m vertical clearance while the replacement bridge proposed in the concept design would be posted at 4.6 m vertical clearance (the allowable height limit for general access vehicles in the Road Transport (Vehicle Registration) Regulation 2007 is 4.3 m, however some heavy vehicles are permitted to operate at a height of up to 4.6 m).
- The low point of Castlereagh Road at the rail underpass which is subject to flooding; this is an issue addressed by the proposed and final designs
- The limited availability of land; adjacent land uses include Penrith City Council, the Lion Dairy and Drinks site, the Nepean District Tennis Association and the Penrith Ambulance station

- The water body and associated retaining wall opposite to the Castlereagh Road / Museum Drive intersection and the Penrith City Council and Lion Dairy and Drinks site car parks east of Mulgoa Road, which limits the horizontal road alignment
- Multiple utility services located adjacent to the current road alignments.

Constraints specific to the railway bridge (on the western side) include:

- Jemena high pressure gas main located on the western side of Castlereagh Road
- Optus fibre optic cables located on the western side of Castlereagh Road
- Telstra fibre optic cables located on the western side of Castlereagh Road
- Telstra copper cables located on the western side of Castlereagh Road
- Overflow car park and potential future car park located south west of the bridge site which would be impacted by the proposed road widening to the west
- The area to the west of Castlereagh Road that is currently owned by Penrith City Council; additional land would be required to extend the existing road reserve of Castlereagh Road further west.

Constraints specific to the railway bridge (on the eastern side) include:

- A rail crossover located within the railway reserve immediately east of the existing bridge
- Existing rail infrastructure, such as signalling and overhead wiring portal, are located immediately to the east of the existing bridge
- The existing public car park located south east of the bridge site
- The existing vehicular access to the rail corridor on both the north east and south east side of the bridge.

Alternative bridge design and road design solutions were considered during the concept design phase. The alternative solutions considered are presented in the Strategic Bridge Options Report (Arup, 2015). The preferred concept design requires the demolition of components of the existing bridge to a level 500 mm below the proposed finished ground level of the new bridge and replacing the existing bridge with a new 39 m single span concrete bridge.

The construction of this bridge requires a specialised method known as a bridge slide. The proposed construction method is detailed in Section 3.3. Although specialised skills would be required for construction, there are experienced construction companies within Australia with the capability to construct a bridge of this nature.

3.3 Construction activities

3.3.1 Work methodology

A constructability assessment undertaken for the concept design (Arup, 2016a) determined the proposal is constructible through a phasing that recognises the importance of maintaining traffic flows, access to the Penrith CBD and other key locations, and the need for coordination with the proposed railway bridge replacement over Castlereagh Road.

There remain a number of items which may impact proposed construction methodologies. Further constructability reviews would be undertaken during the Detailed Design stage with consultation from all relevant stakeholders. Future investigations regarding constructability would include:

- Further investigation of the extent of service adjustments including temporary provisions, cost of relocations and forecast relocation dates
- The extent of stormwater adjustments
- Rail possessions

- Road closures
- Property access requirements.

The key challenges for construction of this proposal include:

- The requirement for work in close proximity to high volumes of traffic
- The need to minimise impact on road traffic flows and the desire to maintain existing design speeds during construction
- Complexity around traffic movements and the need for various temporary traffic lane configurations during various construction activities
- The complexity introduced by the need to lower the existing pavement beneath the existing bridge.

Works associated with replacement of the rail bridge would be carried out before the main road works. The road works would be constructed in two broad impact zones:

- Mulgoa Road / High Street intersection
- Mulgoa Road - Castlereagh Road / Jane Street intersection.

The two zones may be constructed in parallel or separate of each other, although it is expected that work at the Mulgoa Road / High Street intersection would be completed before work at the Mulgoa Road - Castlereagh Road / Jane Street intersection primarily due to the rail bridge works being a necessary pre-cursor to the Mulgoa Road / Castlereagh Road / Jane Street intersection works.

Construction would be staged to meet the following conditions:

- Current number of turning lanes are maintained
- Current number of through lanes are maintained
- No reduction in existing lane widths.

The basic construction activities for the proposal would include:

Pre-construction works

- Undertake Phase 2 detailed site contamination investigation
- Finalisation and approval of the Construction Environmental Management Plan (CEMP)
- Establish construction site compounds, temporary equipment laydown areas and stockpile sites
- Establish construction site entry and exit points
- Establish construction environmental controls in accordance with the CEMP such as the installation of erosion and sediment controls and protection of utility corridors
- Installation of construction of fencing and screening where necessary
- Clearing and grubbing of vegetation
- Transport plant and equipment to the site.

General site activities — daily

- Establish temporary amenities and environment and safety controls
- Establish traffic management measures and detours as required
- Remove waste and clean-up site, including road sweeping
- Remove temporary traffic controls
- Remove temporary amenities and environment and safety controls
- Reopen traffic lanes (if closed).

Works associated with the new railway bridge

- Landscaping works on either side of the bridge to accommodate cranes and equipment
- Excavation of the existing rail abutments and boring under Castlereagh road
- Up to three track possessions, one of which will be up to five days in length for the bridge slide
- Establishment of working platforms
- Installation of temporary support structures
- Installation of abutments, sliding beams and decking
- Demolition of the existing superstructure elements
- Jacking and sliding new bridge into place
- Grouting of the new bridge and reconnection of railway lines
- Removal of temporary working platforms
- Dewatering of excavations throughout the works.

(See Section 3.3.2 for further details about construction of the replacement rail bridge).

Works associated with the road upgrade

- Relocation of existing utilities and stormwater
- Construction of temporary and permanent drainage connections, including two new main outlets to Peach Tree Creek
- Widening of roadway pavements (temporary and new permanent)
- Reconstruction of existing pavements
- Final surfacing and restorations
- Installation of road furniture and signage
- Landscaping.

Post-construction works

- Transport stockpiled waste and spoil to a licenced facility
- Clean up and decommissioning of the construction site compounds, temporary equipment laydown areas and stockpile sites
- Remove plant and equipment from site
- Remove construction environmental controls
- Reinstate the site, roadways and all property accesses.

3.3.2 Replacement railway bridge

Components of the existing bridge would be demolished and the existing bridge would be replaced with a new 39 m single span concrete bridge. Construction of this bridge would follow a specialised method known as a bridge slide, requiring the following construction sequence:

- Relocate existing utilities and services within the road corridor to a suitable location behind the western rail embankment
- Excavate areas on eastern and western rail embankments in preparation for bridge works
- First rail possession, shut down rail traffic
- Protect existing rail services on bridge by diverting under the road, or alternatively prop services during bridge sliding; method and timing to be discussed and developed further with Sydney Trains
- Bore under Castlereagh road on southern side of bridge for relocation of existing services
- Reinstate embankments and resume rail traffic
- Install piles and pile caps (outside of rail possession)
- Second rail possession, shut down rail traffic
- Extend walkway on south western approach to keep maintenance access open during construction works

- Excavate western rail embankment and install corrugated steel pipe for the western side sliding beam
- Excavate section of eastern rail embankment adjacent to bridge pier for the eastern side sliding beam
- Reinstall embankments and resume rail traffic
- Construct sliding beams, within pipe on western side and in excavated section on eastern side
- Construct abutment walls and superstructure including rail fasteners on the southern side of the existing bridge; these construction activities would take place supported on a temporary platform which is at a higher level than the final design level to achieve the 4.4 m minimum road clearance during construction
- Close Castlereagh Road and divert road traffic (completed as night works to reduce network impacts); a possible detour route is via Coreen Avenue - The Northern Road – Jane Street
- Install temporary bridge protection beams
- Install main girders and stitch pour
- Install cross girders and pour deck
- Lift bridge and remove supports
- Lower bridge onto sliding beam using jacks
- Conduct one metre trial slide
- Third rail possession, shut down road and rail traffic
- Demolish existing bridge
- Excavate rail embankments and remove steel pipe
- Slide new bridge into final position and grout into place
- Construct retaining walls, backfill behind the new abutments and install approach slabs
- Reinstall embankment and rail tracks and resume rail services.

3.3.3 Construction hours and duration

Construction is expected to commence in 2018 (subject to planning approval) and would be completed by mid-2020, weather permitting.

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

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

To minimise disruption to traffic and to reduce the duration of construction, some work would need to be undertaken outside of these hours. This includes the relocation of existing utilities and services under the road, some pavement works and construction of the railway bridge. For work required outside standard hours, reasonable and feasible work practices to minimise noise nuisance (nominally set at 5dBA above background noise levels) would be planned and implemented through a noise management plan. This would include notifying potentially affected residents and businesses. Other noise generating works outside standard construction hours would require justification in accordance with the ICNG and formal written consent by Roads and Maritime to modify the working hours set in the approved REF. For further details refer to Section 6.5 of this REF.

3.3.4 Plant and equipment

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

- Trucks for material and equipment deliveries
- Excavators and backhoes
- Jackhammers and compressors
- Skid-steer loader
- Forklifts
- Concrete trucks including bitumen sprayers and aggregate spreaders
- Petrol or electric powered concrete saw
- Screen boards (petrol driven)
- Petrol powered whacker plate compactor
- Drills
- Hand tools
- Elevated work platforms
- Lighting towers
- Generators
- Tip trucks
- Staff vehicles and light vehicles for transporting materials
- Rollers
- Scrapers
- Water Carts
- Graders
- Pulvi-mixers (Stabilisers)
- Loaders
- Backhoes
- Piling rigs
- Large cranes
- Underborers.

3.3.5 Earthworks

For most of the proposed construction works, the extent of earthworks would be limited to excavations for pavement widening and reconstruction. In these instances, cut and fill activities are likely to result in a small volume of excess material. Construction activities would generally proceed as follows:

- Strip topsoil and store material at proposed stockpile site
- Cut material through excavation and move to the fill areas as required for localised minor cut and fill operations
- Provide the appropriate base required for works associated with the road upgrade
- Dispose of excess excavated material in accordance with the standards.

However, for this proposal there are several activities that may generate larger volumes of earthworks that may need off-site disposal. These activities are:

- Substantial excavation on the northern and southern sides of the western rail abutment, and excavation of a portion of the existing abutment on the eastern side required to accommodate works associated with the bridge slide (as described in Section 3.3.2).

- The lowering of Castlereagh Road to provide sufficient clearance for the replacement bridge and to achieve the designated design speeds. This would generate volumes of spent asphalt and road-base.
- The widening of Castlereagh Road the western side from High Street to a point to a point south of Museum Drive which would generate material comprising topsoil, general fill and select fill.
- The lowering of Castlereagh Road under and either side of the railway bridge to alleviate an existing local flooding issue.
- Installation of a large underground stormwater drain to replace the existing underground facility. The stormwater drain is to be installed in the park adjacent to the railway reserve and run from Castlereagh Road to Peachtree Creek. The size of the stormwater drain would be such that it would generate a large volume of material, most of which would need to be removed from site and disposed of appropriately.

As noted in Section 6.10, there is the potential for some or all of the excavated cut material to be contaminated and therefore would require appropriate disposal.

It is expected that the total cut volume for the proposal would be around 12,800 m³ and the total fill volume would be around 5,500 m³. Note that these values do not include additional excavation required for pavement boxing. The surplus material generated by the proposal would comprise:

- Various sources of excavated earth fill
- Excavated pavements
- Demolished concrete
- Demolished bridge structure.

It is expected that there would be an excess of 7,300 m³ cut over fill and therefore soil would need to be removed from site. In all cases, the volume of fill that needs to be removed from site would be minimised. However, when surplus, the material would be removed from site for either re-use / recycling or disposal at an approved disposal site.

3.3.6 Source and quantity of materials

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

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

The bridge replacement and associated rail works would require:

- Bridge structure – concrete and girders, planks, precast concrete abutments for the proposed railway bridge structure
- Replacement rail to be direct fixed to the bridge structure
- Replacement signalling and communications

All road material would be purchased from Roads and Maritime registered suppliers, according to the Roads and Maritime specifications for the proposal. In sourcing materials, Roads and Maritime would use local suppliers as a priority, provided the materials sourced meet the specifications.

The relocation of existing utilities and services may require:

- Conduits, pits, cables and pipes

It is expected that these materials would be sourced and provided by the utility companies, who would undertake these works.

3.3.7 Traffic management and access

Site access

It is expected that up to 200 light vehicle and 200 heavy vehicle movements would occur each day during the peak construction period (during a typical working day). Parking for construction staff would be provided at the construction compound sites. However some construction personnel may need to utilise on-street parking in the vicinity of the site during works. Any expected traffic impacts have been assessed and would be managed in accordance with a proposal specific traffic management plan (TMP) and any road occupancy approvals.

Penrith City Council

Access to the Penrith City Council would be maintained throughout the construction period. Some works may require partial closure of the Mulgoa Road / High Street intersection limiting access to the Council car park from High Street, however it is recommended that these works be completed as night works. To maintain full access during this time, a temporary detour connection would be sign posted along Union Street, Worth Street and High Street for the duration of the proposed road closure.

Westfield Shopping Centre

Westfield Shopping Centre has a number of existing access and egress provisions. The proposed construction works may result in some temporary closures. However these are intended to be temporary closures mostly outside of normal business hours.

Sydney Trains rail access

Impacts on the Sydney Trains parking and access points would be kept to a minimum. It is proposed that the existing connectivity and parking provisions be maintained at the Castlereagh Road / Jane Street access points. Temporary closures of select accesses may be required and would be completed outside peak commute times. Maintenance accesses would be available outside of commute hours and in line with track possession dates.

Woodriff Gardens and Nepean District Tennis Association

The existing left in and left out (LILO) access at Mulgoa Road to the Nepean District Tennis Association would remain open during construction, providing entry and exit points to both the tennis facilities and the site compound during construction.

Car park at Mulgoa Road / High Street intersection

Access to the car park located south east of the Mulgoa Road / High Street intersection would be maintained at all times during construction, with the two primary access routes along High Street and Union Street. Works would be undertaken at night during the upgrade of these intersections so that access to parking is maintained throughout.

Penrith Ambulance Station

The Penrith Ambulance Station is proposed to be relocated by 2019. Access requirements during construction would need to be reviewed if the ambulance station is still in service at current location during this time. The proposed design includes pavement widening works across the existing property access point, which would need to be coordinated with the Ambulance Station. Temporary access provisions may be necessary to maintain access at all times.

Lion Dairy and Drinks

Truck access to the Lion Dairy and Drinks site would be maintained at all times during construction. This may require some diversion from the usual traffic routes at times, however this would be communicated with Lion Dairy and Drinks in advance.

Pedestrian and cycle connectivity

Connections for pedestrians and cyclists would be maintained throughout the construction period. Where active transport connections are temporarily removed or blocked an alternative connection would be provided. These connections would be as direct as possible. In general there is sufficient space within the existing road verges and adjacent to the proposed works to accommodate existing or temporary pedestrian and cycle facilities.

Traffic management

Any expected traffic impacts would be managed in accordance with a project specific traffic management plan (TMP) and any road occupancy approvals.

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

Heavy machinery would be transported to and from site predominantly during off peak hours to minimise road user delays due to turning movements.

Individual lane or full road closure on Mulgoa Road, Castlereagh Road, Jane Street, High Street and the Great Western Highway may be required at times to undertake construction work. Temporary lane closure would affect the flow of traffic accessing the Jane Street / Mulgoa Road – Castlereagh Road and Great Western Highway / Mulgoa Road / High Street intersections, however this would be short-term and would be undertaken during off-peak hours where possible to minimise impacts. Full road closures would be required and specific locations have been addressed above. However such closures would be temporary and are considered to be manageable and minor when undertaken outside of peak periods.

3.4 Ancillary facilities

A construction compound comprising a temporary equipment laydown and stockpile site is proposed to be established adjacent to the Nepean District Tennis Association. This is proposed as the main construction compound and would be of sufficient size to accommodate:

- Stockpiles and material laydown areas
- On-site construction buildings and worker facilities
- Temporary car parking.

This compound would also be used for the railway bridge works and bridge assembly. An appropriately located and designed hardstand would be needed for the crane and piling drill rigs required for the replacement bridge.

Laydown areas for reinforcement and formwork would be established adjacent the bridge site (south west corner). The girders would not be stored on site and would be lifted directly into place during night works.

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

Other supplementary compound sites may be established south west of High Street and Mulgoa Road on land known as the 'Carpenter site' and at the Lion Dairy and Drinks car park adjacent to Castlereagh Road.

These sites may be used for a range of construction activities, including (but not limited to) additional material stockpiling and material rehandling. The same security, traffic and environmental conditions would be provided at these sites as required for the compound adjacent to the Nepean District Tennis Association.

The proposed site accesses are:

Label	Location of Access Point	Details
1	Nepean District Tennis Association access off Mulgoa Road	Penrith City Council land
2	Carpenter site access off Mulgoa Road (south of High Street)	Penrith City Council land
3	Lion Dairy and Drinks car park access off Museum Drive	Roads and Maritime land (leased by Penrith City Council to Lion Dairy and Drinks)

A further material handling area is proposed at the southern end of the proposal, on the western side, with access off Mulgoa Road. This area may be used for stockpiling pavement excavation material from the road works.

The key construction facilities sites are shown on Figure 3-2.

Temporary ancillary facilities, such as amenities and clean-up sites, would be established within the road carriageway.

Waste would be removed from construction areas at the end of each day and disposed of at an appropriately licensed waste facility or temporarily stockpiled at the construction compound.

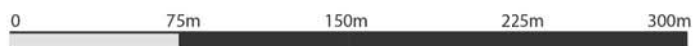
All reasonable efforts would be made to reuse excavated material on site during works. However, any unused excavated material would be classified, removed from site in skip bins or trucks and disposed of at an appropriately licensed waste disposal or recycling facility.

Further details regarding ancillary provisions for the project would be outlined in the project's Construction Environmental Management Plan (CEMP).



- Proposal area
- Concept design
- Ancillary facilities

Figure 3-2 Proposed location of ancillary facilities



3.5 Public utility adjustment

Given the urban character of the study area, there are a substantial number of above ground and underground utilities in the area.

A Utilities Strategy Report has been prepared (Arup, 2016b) and a number of utility adjustments identified. The affected utilities include:

- Sewerage – Penrith City Council
- Water supply – Sydney Water
- Stormwater drains – Penrith City Council
- Above and underground power and street lighting conduit – Endeavour Energy
- High pressure gas mains – Jemena
- Telecommunications cable and optic fibre – NBN, Telstra and Optus
- Traffic lights – Roads and Maritime.

Some of these utilities would need to be relocated as part of this proposal. The full extent of these works would require would not be known until further investigations are undertaken during construction. However, initial consultation has been undertaken with the public utility authorities which is detailed in Section 5 of this REF.

A major utility adjustment would be undertaken as part of the proposal to divert stormwater from the Penrith CBD and from the catchment of the railway bridge by way of a large stormwater outlet into Peachtree Creek. This outlet collects stormwater from the east of Peachtree Creek with stormwater pipes located between the Nepean District Tennis Association facilities and the rail line.

The relocation of each service (and stormwater) will require input from the relevant service authorities as the design progresses. The general intent is to relocate all impacted services, however the location route of each proposed service still needs to be agreed with the relevant service authority.

Some service relocations may require cable pulling activities from cable joint bays outside of the proposal area. These activities would be undertaken by the relevant service authority, and if required, the potential environmental impacts would be assessed separately, prior to work.

3.6 Property acquisition

Partial property acquisitions would be required to accommodate construction of the proposal. Details of the required property adjustments are provided in Table 3-2.

As well as the acquisitions associated with the property adjustments, easements and land-based agreements would be required for the public utilities and the temporary compounds. However, many of the services and service relocations would be located within the road reserve.

Construction access agreements would be required to allow the use of the land to accommodate the establishment of construction camps and laydown areas for the duration of the construction period. It is anticipated that these would be located within the land at the rear of the Nepean District Tennis Association that currently contains underground stormwater facilities and other infrastructure.

Roads and Maritime would undertake all property boundary adjustments and leasing arrangements in accordance with current Roads and Maritime guidelines.

Table 3-2 Property adjustments associated with the proposal

Current land use	DP	Lot	Full/ partial	Area (m ²)
Woodriff Gardens	DP1051278	5	Partial	2235
Nepean District Tennis Association	DP1051278	4	Partial	778
Parkland	DP739989	903	Partial	2231
Parkland with retention pond	DP866979	1	Partial	1958
Car park	DP218028	1	Partial	756
Penrith City Council chambers	DP1102232	1033	Partial	1883
Car park	DP717196	12	Partial	150
Car park	DP717196	13	Partial	158
Parkland	DP717196	18	Full	749
Agriculture	DP717196	10	Partial	6488
Parkland	DP808860	1	Partial	1119
Private residence	DP37702	6	Partial	31
Car park	DP731213	32/36	Partial	289
Construction Compounds (temporary)				
Parkland	DP739989	903	Partial	3011
Agriculture	DP717196	10	Partial	16354
Easements				
Parkland (Southern easement)	DP739989	903	Partial	3462
Parkland (Northern easement)	DP739989	903	Partial	1174

4 Statutory and planning framework

4.1 State Environmental Planning Policies

4.1.1 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 public road upgrade and is to be carried out by Roads and Maritime, it can be assessed under Part 5 of the *Environmental Planning and Assessment Act 1979*. Development consent from council is not required.

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

Part 2 of the ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Under the ISEPP, Roads and Maritime is required to undertake consultation with Penrith City Council regarding the capacity of the road network to absorb traffic generated during construction and impacts of the proposal on adjacent pedestrian and shared pathways during construction and local heritage items. Consultation undertaken under the ISEPP as part of the proposal is detailed in Section 5.4 of this REF.

4.1.2 State Environmental Planning Policy No. 19 – Bushland in Urban Areas

State Environmental Planning Policy No. 19 – Bushland in Urban Areas (SEPP 19) applies to all bushland within the Sydney metropolitan area that is zoned or reserved as public open space. The aim of SEPP 19 is to protect and preserve bushland for its natural heritage aesthetic, recreational, educational and scientific resource values.

Under Clause 6 of SEPP 19, a determining authority must not consent to development affecting bushland unless:

- a. It has made an assessment of the need to protect and preserve the bushland having regard to the aims of this Policy
- b. It is satisfied that the disturbance of the bushland is essential for a purpose in the public interest and no reasonable alternative is available to the disturbance of that bushland
- c. It is satisfied that the amount of bushland proposed to be disturbed is as little as possible and, where bushland is disturbed to allow construction work to be carried out, the bushland will be reinstated upon completion of that work as far as is possible.

SEPP 19 applies to bushland within the urban areas identified in Schedule 1 of the SEPP, which includes the Penrith LGA. Further, under the provisions of the Local Environmental Plan for the area, the study area includes land within the RE1 Public Recreation zone. Land within the RE1 zone includes the land on which the Nepean District Tennis Association have their tennis facility and the land between the tennis facility and the railway reserve.

A biodiversity assessment was completed for the proposal as part of this REF (see Section 6.11). This assessment concluded that vegetation impacted by the proposal is not commensurate with

structured native vegetation or bushland. As such, the proposal would not result in any impacts to existing urban bushland in the area.

4.1.3 Sydney Regional Environmental Plan No. 20 – Hawkesbury-Nepean River

The *Sydney Regional Environmental Plan No. 20 – Hawkesbury-Nepean River* (SREP 20) applies to land within the LGA of Penrith City Council (amongst other LGAs located within the Greater Metropolitan Region). The aim of SREP 20 is to protect the environment of the Hawkesbury-Nepean River system by ensuring that the impacts of future land uses are considered in a regional context.

Clause 4 of SREP 20 provides that the general planning considerations (set out in clause 5), as well as specific planning policies and related recommended strategies (set out in Clause 6) are applicable to proposed developments on land to which this plan applies, and must be taken into consideration:

- a. By a consent authority determining an application for consent to the carrying out of development on land to which this plan applies
- b. By a person, company, public authority or a company State owned corporation proposing to carry out development which does not require development consent.

The proposal is located within 500 m of the Nepean River and within the vicinity of Peachtree Creek, which forms part of the Hawkesbury-Nepean catchment area. As such, SREP 20 applies to land that would be affected by the proposal. As outlined in Section 6.4, the impact on Peachtree Creek would be marginal. As discussed, an existing stormwater drain with an outfall to Peachtree Creek would be replaced with a drain of greater dimension. The existing outfall arrangements and water quality measures would be adopted during the proposed work to manage any potential impacts to water quality (which would include the implementation of adequate erosion and sediment control measures).

4.2 Local Environmental Plans

4.2.1 Penrith Local Environmental Plan 2010

The proposal is located within the Penrith LGA. Development within the Penrith LGA is regulated by the *Penrith Local Environmental Plan 2010* (Penrith LEP). As shown in Figure 4-1, land directly affected by the proposal is zoned:

- B3 – Commercial
- B4 – Mixed Use
- IN1 – Industrial
- SP2 – Infrastructure
- SP3 – Tourist
- RE1 – Public Recreation.

Road development is permissible with consent within these zones; however, as outlined in Section 4.1.1, Clause 94 of ISEPP removes the requirement for development consent from councils.

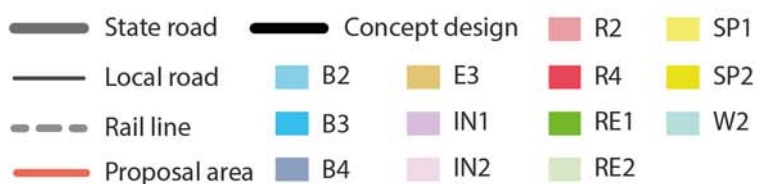
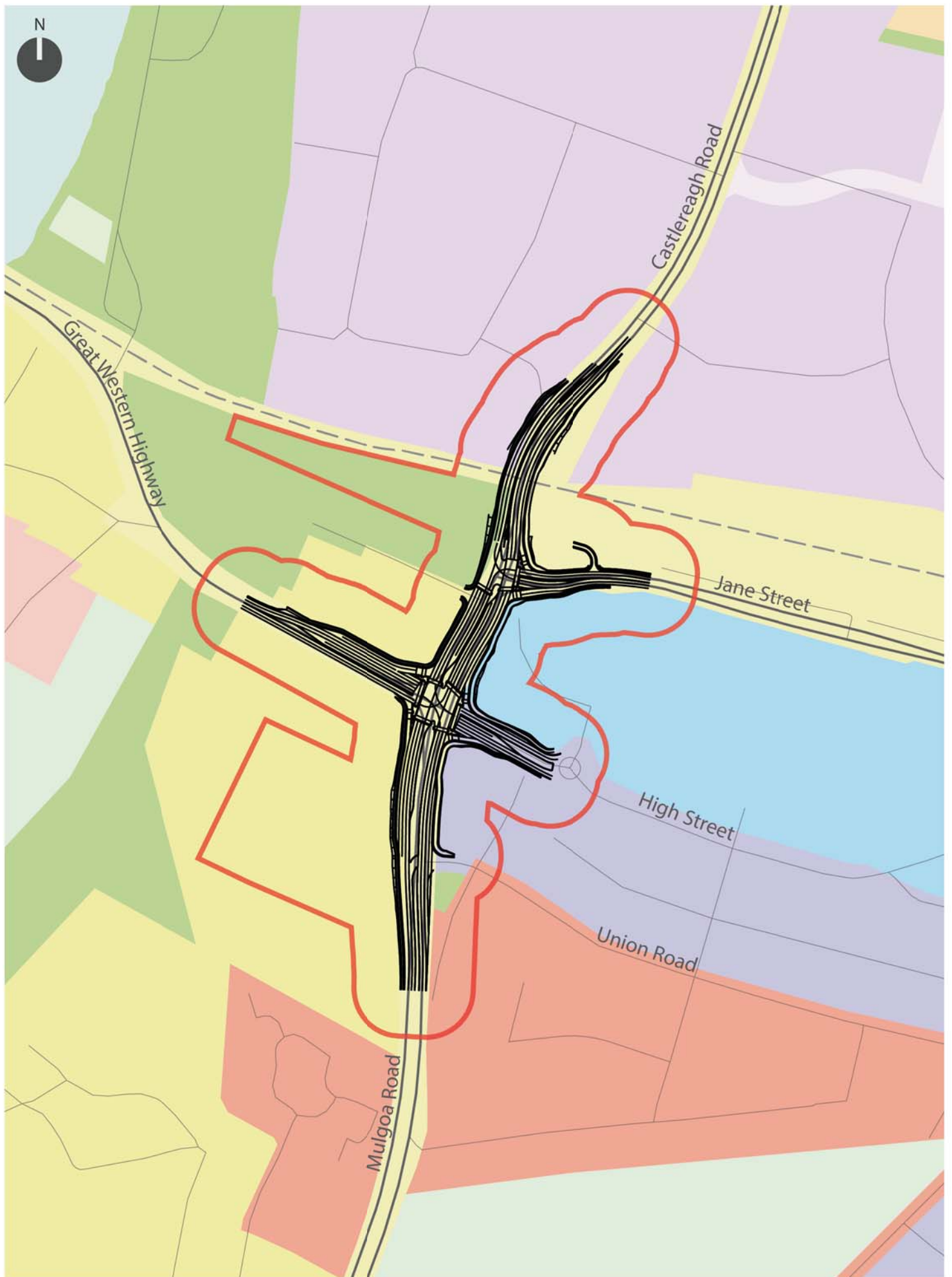


Figure 4-1 Zoning



4.3 Other relevant NSW legislation

4.3.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act), Environmental Planning and Assessment Regulation 2000 (EP&A Regulation) and environmental planning instruments (SEPPs and LEPs) provide the framework for the assessment of environmental impacts and approval of development in NSW. The following sections of the EP&A Act are of relevance to the proposal:

- Part 5 – applies to activities that are permissible without consent, and are generally undertaken by a public authority. Activities under Part 5 of the EP&A Act are assessed and determined by either a Minister or public authority – referred to as a determining authority.
- Part 5.1 – applies to development that is considered State significant infrastructure (SSI). The approval authority under Part 5.1 of the EP&A Act is the NSW Minister for Planning.

Under Section 111 of the EP&A Act, Roads and Maritime, as the determining authority for the purposes of Part 5 of the EP&A Act, must:

- Examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity, in accordance with Section 111 of the EP&A Act
- Establish whether or not an environmental impact statement (EIS), or a species impact statement (SIS), or both, are required for the activity, in accordance with Section 112 of the EP&A Act.

An EIS would be required for the proposal if Roads and Maritime considers that the proposal is likely to significantly affect the environment, including critical habitat or threatened species, populations or ecological communities and their habitats. Clause 228 of the EP&A Regulation contains a detailed list of factors that must be taken into account when assessing the impact of an activity on the environment.

Section 6 of this REF provides an assessment the proposal's environmental impact, while Appendix B considers the factors listed under clause 228 of the EP&A Regulation. Based on these assessments, Roads and Maritime has determined that the proposal would not have a significant impact and, thus, an EIS is not required. Therefore, the proposal is subject to assessment under Part 5 of the EP&A Act.

4.3.2 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) lists threatened species, populations and ecological communities in NSW and provides protection for them.

If a development proposal is likely to impact on a listed threatened species, population or ecological community, an assessment is required. Specifically, if a development proposal is likely to occur in an area where threatened species, population or ecological communities are present then a Seven Part Test would need to be carried out to determine if there would be any significant impacts. If significant impacts are likely to occur, then a Species Impact Statement (SIS) would be required and the Director-General of the Department of Premier and Cabinet's – Office of Environment (OEH) must provide approval for the proposal. In some cases, the Minister for the Environment would also need to be consulted.

As identified in Section 6.11, the proposal area does not contain suitable habitat for any listed threatened species or community and is unlikely to have a significant impact on any threatened species, populations or community listed under the TSC Act.

4.3.3 National Parks and Wildlife Act 1974

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

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

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

Potential Aboriginal heritage impacts in the proposal area have been assessed in accordance with the Roads and Maritime *Procedure for Aboriginal cultural heritage consultation and investigation* (the PACHCI). The Stage 2 PACHCI assessment recommended that based on the potential for the presence of subsurface stone artefacts within the proposal area, further investigation (including archaeological test excavation) and consultation with Aboriginal stakeholders should be undertaken in accordance with the Stage 3 of the PACHCI.

In accordance with Stage 3 of the PACHCI, test excavation was carried out in July 2016. No Aboriginal objects were recovered by the test excavation and it was concluded that the proposal area exhibits no archaeological potential. Therefore, no further Aboriginal archaeological assessment is required for the proposal and an AHIP is not required.

4.3.4 Heritage Act 1977

The NSW *Heritage Act 1977* (Heritage Act) provides for the conservation of non-Aboriginal heritage in NSW. The Heritage Act provides for protection of items of local, regional and state heritage significance and it is used to regulate development that may impact on the State's heritage assets. Development or activities cannot be carried out which may affect an item listed on the State Heritage Register without approval under Section 60 of the Heritage Act. As discussed in Section 6.3, there are a number of State listed heritage items in the vicinity of the proposal area, however none of these would be impacted by the proposal.

Under Section 170 of the Heritage Act, all government agencies must maintain a Heritage and Conservation Register that lists all heritage assets under their management and includes an assessment of the significance of each asset. Each agency must ensure that all items included in the Register are maintained with due diligence. There are two Section 170 items near to the proposal area as described in Section 6.3, however these items would not be impacted by the proposal.

Under Section 139 of the Heritage Act, approval is also required prior to the disturbance or excavation of land if it would, or is likely to, result in a relic being discovered, exposed or damaged. As discussed in Section 6.3, the proposal would require excavation along High Street which may result in removal of sub-surface remains of the earlier road in this area. An Excavation Permit for the proposal would therefore need to be lodged in accordance with Sections 139-140 of the Heritage Act.

4.3.5 Protection of the Environment Operations Act 1997

The NSW *Protection of the Environment Operations Act 1997* (POEO Act) is the key piece of legislation for environmental protection. The POEO Act also clearly outlines pollution offences relating to land, water, air and noise pollution and includes a duty to report pollution incidents. There is a broad allocation of responsibilities under the Act between the NSW Environment

Protection Authority (EPA), local councils and other public authorities. Relevant to the proposal, the EPA is the regulatory authority for:

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

Scheduled activities of relevance to the proposal comprise:

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

Under Schedule 1(35) of the POEO Act, an environment protection licence (EPL) is required for any road construction activities that result in the establishment of four or more traffic lanes, over a distance of at least three kilometres (in the metropolitan area). Considering this and the scope of work outlined in Section 3, the proposal is unlikely to be a scheduled activity under Schedule 1(35) of the POEO Act and is unlikely to need an EPL under this provision.

Under Schedule 1(33) of the POEO Act, an EPL is required for railway systems activities which includes the installation, on-site repair, on-site maintenance or on-site upgrading of track, including the construction or significant alteration of any ancillary works (where ancillary works includes earthworks, drainage works, track support, fencing and bridges). Given the scope of work required for replacement of the existing railway bridge, as described in Section 3.3.2, an EPL is likely to be required under this provision.

Under Schedule 1(19) of the POEO Act, an environment protection licence is required for any land-based extraction activities that involve the extraction, processing or storage of more than 30,000 tonnes per year of extractive materials. As outlined in Section 3.3.4, 12,800 m³ of material is anticipated to be excavated during construction of the proposal.

In accordance with Part 5.7 of the Act, the contractor would be required to notify the Environment Protection Agency (EPA), and each 'relevant authority' when a pollution incident occurs that causes or threatens material harm to the environment during construction. Potential pollution impacts from the proposal and the proposed management measures are discussed in Section 6 of this REF.

4.3.6 Waste Avoidance and Resource Recovery Act 2001

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

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

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

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

4.3.7 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) aims to conserve fish stocks, key habitats, threatened species, populations and ecological communities of fish and marine vegetation. It also aims to promote viable commercial fishing, aquaculture industries and recreational fishing.

While there is no Key Fish Habitat located within the study area, given the proximity of the Nepean River and Peachtree Creek, an evaluation for the potential for biota listed under the FM Act and significance assessment where appropriate was carried out as described in Section 6.11. There are unlikely to be any impact on biota listed under the FM Act.

4.3.8 Land Acquisition (Just Terms Compensation) Act 1991

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

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

Property acquisition required for the proposal would be confirmed through detailed design and in consultation with landowners. All property valuations and acquisitions would be carried out in accordance with the *RMS Land Acquisition Information Guide* (RMS 2012) and the Land Acquisition Act.

4.3.9 Contaminated Land Management Act 1997

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

As discussed in Section 6.10, the proposal area has not been declared as significantly contaminated under the CLM Act. However, should contaminants be identified on the site, an assessment would be carried out to determine if notification of the contamination under Section 60 of the CLM Act to the EPA is required. All remediation would be carried out in accordance with the CLM Act.

4.3.10 Water Management Act 2000

The *Water Management Act 2000* (WM Act) provides for the management of surface water and groundwater in NSW.

The proposal is located within the area of the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011. A water supply work approval in accordance with Section 92 of the WM Act may be required if groundwater needs to be extracted for dewatering purposes during construction of the proposal.

4.4 Commonwealth legislation

4.4.1 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 (NES) or the environment of Commonwealth land. The proposal's potential impact on these matters of NES is considered in Appendix B of the REF and summarised in the following sections.

An assessment has been undertaken to determine the potential impacts of the proposal on matters of national environmental significance (MNES) and Commonwealth land, including nationally listed threatened species, ecological communities and migratory species. The results of this assessment are contained at Appendix B (that considers the potential impacts of the proposal on MNES and Commonwealth land) and Section 6.11 which assesses potential impacts on nationally listed threatened species, ecological communities and migratory species.

Further to this assessment, the Australian Government has entered into an agreement with Roads and Maritime to undertake a strategic assessment of road and traffic management works assessed under Part 5 of the NSW EP&A Act with respect to:

- Nationally listed threatened species and ecological communities protected by Sections 18 and 18A of the EPBC Act
- Listed migratory species protected by Sections 20 and 20A of the EPBC Act.

However, given the urban character of the study area, the extent of disturbance that has occurred within the study area, and as a result of these assessments (as contained at Appendix B), it was concluded that there is unlikely to be a significant impact on relevant matters of national environmental significance. Accordingly, the proposal has not been referred to the Australian Government Department of the Environment.

4.5 Confirmation of statutory position

All relevant statutory planning instruments have been examined for the proposal. It is concluded that ISEPP operates to remove the development consent requirements, thereby permitting assessment of the proposal under Part 5 of the EP&A Act. The proponent and determining authority for the proposal is Roads and Maritime. The proposal is not a State Significant development and is not State Significant Infrastructure.

Under Section 111 of the EP&A Act, Roads and Maritime is obligated to undertake an environmental assessment as the proponent for the proposed work; this REF fulfils that obligation.

5 Stakeholder and community consultation

5.1 Overview of the consultation strategy

In the delivery of communications for the proposal, the project team aims to:

- Build a positive working relationship with the local community and key stakeholders
- Promptly investigate and, where possible, resolve issues affecting the community and stakeholders
- Minimise disruption to residents and businesses located near the proposal
- Proactively communicate to minimise impacts
- Meet the reasonable needs and desires of the community for information and consideration of their views.

Communication activities for the proposal have been (and will continue to be) underpinned by the following key objectives:

- Provide opportunities for stakeholders to be sufficiently informed about the project in a timely manner
- Provide two-way communication channels and personalised one-to-one contacts to encourage feedback
- Provide an open, accountable and transparent involvement process which demonstrates how the community and stakeholder input is considered
- Identify, track and address issues early to implement project controls which minimise further disruption.

Consultation tools that have been used to engage with stakeholders and the community include:

- Project web page, phone number, email and postal address
- Project display and community information sessions
- Media releases
- Email distribution of registered stakeholders
- Advertising.

Further detail on the consultation that has occurred with stakeholders and the community during the preparation of this REF is provided in the following sections. Ongoing and future consultation activities that would be undertaken, should Roads and Maritime determine to proceed with the proposal are also outlined.

5.2 Community involvement

Roads and Maritime has established a project website to provide the community with regular updates on the progress of the proposal. The website includes an outline of the proposal, work completed to date, relevant published documents, updates and announcements. This includes the Preferred Options Report and Community Consultation Report. Also available on this website is the project mailbox, where community members and stakeholders can contact the project team directly at any time.

The Preferred Option Report was released to the public on 12 December 2014 and feedback was accepted until 17 February 2015. As part of this Roads and Maritime prepared and distributed the following consultation material:

- A community update to approximately 8,000 households and businesses in the area
- An email to stakeholders who were already noted on Roads and Maritime's project consultation database
- Electronic signs were placed at the intersections of Mulgoa Road/High Street, Mulgoa Road/Jane Street and Castlereagh Road/Museum Drive between 12 January 2015 and 17 February 2015
- Display posters were set up at Penrith City Council and Penrith City Library and the Office of Local Member for Penrith, Stuart Ayres.

The purpose of the community consultation process was to:

- Inform the community of the project, options investigated and preferred option
- Seek comment, feedback, ideas and suggestions from the community to be considered when further developing the concept design for the preferred option
- Build a database of interested and concerned community members who Roads and Maritime can continue to engage with during the development of the proposal.

During the display period, twenty-three submissions covering a range of issues were received from members of the community who identified as local residents, commuters, or organisations. All suggestions received during the consultation period were considered and investigated as part of the development of the concept design for the preferred option. A summary of the issues raised and Roads and Maritime's response is included in the Roads and Maritime *Display of preferred option; Community Consultation Report*, May 2015 (refer Appendix C) and presented in Table 5-1. Several refinements have already been assessed and included in the concept design, including a left hand slip lane from Mulgoa Road onto High Street for motorists travelling south along Mulgoa Road.

Table 5-1 Summary of community submissions

Issue	Issues raised	Roads and Maritime response (May 15)	Additional comments	Section of this REF where addressed (if relevant)
Access	Can the driveway access for the tennis courts be relocated to High Street?	It is acknowledged that relocation of the driveway for the Nepean Tennis courts may improve access to and from the tennis courts. As the project progresses to concept design, issues such as road design and property access will continue to be considered by the Roads and Maritime project team. Consultation with Nepean District Tennis Association and Penrith City will continue.	The current access arrangements at the Nepean Tennis courts would be maintained under the proposed design.	6.1
	Will access to properties be maintained during all stages of construction	A construction staging plan will be prepared during development of the concept design. Roads and Maritime will be working with Penrith City Council, the local community and property owners to ensure that vehicle and pedestrian movements can be maintained during construction.	Access to adjoining properties would be maintained throughout the construction period.	3.3.7
Biodiversity	What is the biodiversity value of the Peachtree Creek Crossing?	Peachtree Creek has been identified as a riparian corridor (vegetation along the creek line). Potential biodiversity impacts at the creek are yet to be assessed	There is only expected to be minor impacts to Peachtree Creek during construction, which would be managed through implementation of the safeguards	-

		as part of the Environmental Assessment which would be carried out during concept design for the preferred option.	and mitigation measures provided in this REF.	
Design	Requested a southbound left turn slip lane from Mulgoa Road to High Street.	In response to community and stakeholder feedback, the proposal will be refined to include a southbound left turn slip lane from Castlereagh Road/Mulgoa Road onto High Street.	A southbound left turn slip lane from Castlereagh Road/Mulgoa Road onto High Street forms part of the proposed design.	2.6
	Proposed an option for a tunnel under Woodriff Gardens to connect Victoria Bridge and Castlereagh Road.	<p>Roads and Maritime acknowledges that a tunnel interchange between Castlereagh Road and Victoria Bridge may improve the flow of traffic between Victoria Bridge and Castlereagh Road but would not be the best overall solution.</p> <p>Although this tunnel option was not assessed, Option 11 included an overpass between High Street and Jane Street. A tunnel option would be expected to demonstrate a similar function in alleviating traffic congestion but would be much more costly due to the high number of significant constraints in this area such as the location of utilities including high pressure gas mains, high voltage electricity towers, Penrith City Council drainage system and the flood</p>	The alternatives and options assessment for the proposal is outlined in Section 2.4 of this REF.	2.4

		<p>prone land classification of the area.</p> <p>The preferred option would improve the existing traffic congestion, which is largely a result of the high northbound and southbound traffic volumes on Mulgoa Road and Castlereagh Road.</p>		
	<p>Remove the tennis courts and Woodriff Gardens to provide an option that improves traffic flow and connection between Castlereagh Road and Victoria Bridge.</p>	<p>Roads and Maritime has assessed the movement of traffic throughout the project area, including options that require removal of the tennis courts and Woodriff Gardens. The assessment of traffic indicated that the north and southbound capacity on Mulgoa Road/Castlereagh Road is insufficient and results in extended queue lengths. Construction of a road through the tennis courts and Woodriff Gardens would not adequately resolve the existing congestion along Mulgoa Road and Castlereagh Road.</p> <p>The tennis courts and Woodriff Gardens represent important community facilities and open spaces close to the Penrith CBD and provide a connection to the Nepean River.</p>	<p>The alternatives and options assessment for the proposal is outlined in Section 2.4 of this REF.</p>	<p>2.4</p>

		For these reasons, a preferred option which leads to improved north and southbound traffic movement is proposed. The preferred option does not preclude a future extension of Jane Street if it is required.		
	Requested two northbound right turn lanes are provided into Jane Street from Mulgoa Road.	The preferred option includes two northbound right turn lanes from Mulgoa Road onto Jane Street.	Two northbound right turn lanes from Mulgoa Road onto Jane Street forms part of the proposed design.	3.1
	Dual eastbound right turn lanes be provided from High Street into Mulgoa Road.	The preferred option includes dual eastbound bound lanes from High Street across Mulgoa Road and one right turn lane onto Mulgoa Road. Further refinements can be investigated during concept design development, along with further analysis of existing and predicted future traffic volumes.	Two eastbound right turn lanes from High Street (Great Western Highway) onto Mulgoa Road forms part of the proposed design.	3.1
	Traffic lights requested at the High Street / Ladbury Avenue intersection and roundabout at the Bruce Neale Drive / High Street intersection.	Roads and Maritime acknowledges the difficulty of traffic entering High Street from Bruce Neale Drive and Ladbury Avenue during peak periods. The project team will investigate the operation of these intersections during the concept design stage. Any changes to the design would be included in the environmental assessment and displayed for community comment.	The High Street / Ladbury Avenue intersection and roundabout at the Bruce Neale Drive / High Street intersection are outside of the proposal scope.	-

	<p>Supported the concept of a Jane Street Extension.</p>	<p>Roads and Maritime investigated and assessed seven options (Options 1-4, 6, 8, 11) which extended Jane Street across Mulgoa Road/Castlereagh Road towards Victoria Bridge.</p> <p>The Jane Street Extension options provided improved travel times between Jane Street and High Street but did not address congestion and delays for north and southbound traffic.</p> <p>Based on origin to destination traffic surveys conducted in peak times, about 75% of southbound traffic turning right from Mulgoa Road onto High Street / Great Western Highway originates north of the rail underpass. The remaining 25% originate from Jane Street.</p> <p>A Jane Street extension would not provide a direct travel benefit for traffic travelling from north of the rail underpass, which is the majority of traffic.</p> <p>The preferred option would significantly improve north and southbound traffic flow through the High Street and Jane Street intersections without an extension</p>	<p>The alternatives and options assessment for the proposal is outlined in Section 2.4 of this REF.</p>	<p>2.4</p>
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		of Jane Street. The proposal would not preclude a future Jane Street extension if it is required.		
	Upgrade of Jane Street and Mulgoa Road be complementary to future proposals including Mulgoa Road upgrades and additional Nepean River crossings.	<p>The Jane Street and Mulgoa Road Infrastructure Upgrade would be planned to integrate with future upgrades along Mulgoa Road and Castlereagh Road.</p> <p>On 25 February 2015 the NSW Government announced funding for planning of further improvements to Mulgoa Road. Additional crossings of the Nepean River are outside the scope of this project and may be investigated as a separate project in the future.</p>	The proposal falls within the Mulgoa Road Corridor project and the on-going planning and staging of the proposal and the Mulgoa Road Corridor project will be coordinated.	2.1.2
	Improved capacity on Mulgoa Road between Jane Street and High Street.	<p>Roads and Maritime has assessed the movement of traffic throughout the project area. Congestion issues and associated delays were identified along Mulgoa Road/Castlereagh Road between the rail underpass and Union Street.</p> <p>Improved north and southbound capacity provided by the preferred option would reduce queue lengths and delays for the majority of traffic in this area. This would lead to increased opportunities for</p>	The proposed design includes the widening of Mulgoa Road - Castlereagh Road between Museum Drive and Union Road to allow for six through lanes and auxiliary lanes at intersections, increasing the capacity along this corridor.	3.1

		traffic to turn onto Jane Street and High Street. The preferred option offers improved capacity between Jane Street and High Street.		
	Construct a new road between Union Road and High Street to provide a 'G' turn movement which allows southbound traffic on Mulgoa Road to turn left into Union Road, left into the proposed new road, left onto High Street and through the Mulgoa Road/High Street intersection.	<p>This suggestion would require traffic to travel further and perform a 'G' turn movement. However, it may allow the Mulgoa Road/High Street intersection to operate more efficiently. Changes to local traffic movement would require further consultation with Penrith City Council.</p> <p>This suggestion will be considered further during the development of the concept design,</p>	The alternatives and options assessment for the proposal is outlined in Section 2.4 of this REF.	2.4
	Maintain the vehicle stopping bay in front of the Woodriff Gardens on High Street.	Widening of High Street in the eastbound direction would require the vehicle bay to be relocated. It is acknowledged the existing location of the vehicle bay is important to the use of Woodriff Gardens. Roads and Maritime would aim to maintain parking spaces for Woodriff Gardens during development of the concept design.	The proposed design removes the vehicle stopping bay in front of Woodriff Gardens to provide additional traffic storage leading up to the Mulgoa Road intersection.	-
Flooding	Upgrade and address the existing flooding at the rail underpass.	Roads and Maritime acknowledges the current flooding of the underpass. The proposed upgrade would minimise, avoid and/or mitigate flooding impacts.	The proposed design has considered the existing flooding issue at the rail underpass. Further options are being explored, such as pumping, as a method	6.4 and Appendix I

		The design of the road drainage would consider the flow of water in this area and drainage infrastructure would be upgraded as part of this proposal.	for improving current flooding performance.	
Heritage	Heritage status of the Penrith Ambulance Station.	Penrith Ambulance Station is listed by Penrith City Council on its Local Environment Plan as having local heritage significance. Potential heritage impacts to the Ambulance Station are yet to be assessed but would be evaluated as part of the environmental assessment which would be carried out as part of the concept design.	The potential heritage impacts on the Penrith Ambulance Station are discussed in Section 6.3 of this REF. There would be no impact to the 1936 building at the Penrith Ambulance Station, however some construction work may encroach into the neighbouring property.	6.3
Project Scope	Mulgoa Road be upgraded to a six lane corridor between Andrews Road and the M4 Motorway.	<p>The preferred option provides three lanes of traffic in each direction along Castlereagh Road/Mulgoa Road between Museum Drive and Union Street.</p> <p>The recently announced investigations for improvements to Mulgoa Road between Andrews Road and Glenmore Parkway would integrate with this proposal when constructed and provide increased capacity on Mulgoa Road to the M4 Motorway.</p> <p>The Jane Street and Mulgoa Road Infrastructure Upgrade would</p>	The proposal is for the upgrade of Mulgoa Road - Castlereagh Road between Museum Drive and Union Road. The proposal falls within the Mulgoa Road Corridor project, which is a 6.5 km upgrade and widening of Mulgoa Road - Castlereagh Road between Glenmore Parkway, Glenmore Park and Andrews Road.	2.1.2

		complement any future upgrades of Mulgoa Road and Castlereagh Road.		
	Provide additional lanes for traffic crossing the Nepean River.	An upgrade of the current crossing of the Nepean River is not part of the scope of this project. Roads and Maritime have identified that congestion at the intersections of Jane Street and High Street cause delays to north and southbound traffic on Castlereagh Road and Mulgoa Road. This project does not prevent additional bridge crossings being investigated and/or built across the Nepean River in the future.	Crossing the Nepean River is outside of the proposal scope.	
	Rail underpass be upgraded to address the existing congestion at the underpass.	The preferred option includes the upgrade of the rail underpass to accommodate seven traffic lanes with three northbound lanes, three southbound lanes and a southbound left turn lane onto Jane Street.	The proposed design includes replacement of the existing railway bridge to allow three lanes of traffic in each direction on Castlereagh Road and a left turn lane into Jane Street.	3.1
	Project maintain existing shared paths.	The proposal would maintain existing shared path connections.	The proposed design maintains the existing shared paths and separated paths in the proposal area.	-
Other	Timing and length of the consultation period.	Roads and Maritime acknowledges that the holiday period is inconvenient for some to consider and provide comment. In response to community and stakeholder feedback the	Roads and Maritime will try to avoid carrying out consultation during holiday periods. Any consultation carried out during holiday periods will be extended to give residents and stakeholders adequate time to provide comments.	-

		<p>consultation period was extended until 17 February 2015 to provide additional time for residents and stakeholders to provide comments.</p> <p>Three variable message signs were installed in the project area between 12 January 2015 and 17 February 2015 to improve community awareness of the Preferred Options Report.</p>		
	Werrington Arterial Road - Stage 1 upgrade should be extended north to the western rail line.	<p>The Werrington Arterial Road Stage 1 project has been developed to improve the connection between the Great Western Highway and M4 Motorway. More information regarding the project and any future stages of the project can be found on that project webpage at: http://www.rms.nsw.gov.au/project/sydney-west/werrington-arterial-road-stage-1/</p>	-	-
	Requested funding allocations to charities and community organisations be removed and reallocated to government projects.	This issue is outside the scope of this project or Roads and Maritime responsibility.	-	-
	Future development at the "Carpenter Site", south west of the Mulgoa Road/High Street intersection be considered.	Roads and Maritime considered future developments in the traffic analysis and their impact on the network into the future. Future	Investigations for access to the Carpenter site are being carried out in parallel to this proposal.	-

		<p>growth scenarios from the Bureau of Transport Statistics were used in the traffic analysis and included information from the Department of Planning and Environment and the Australian Bureau of Statistics on expected population growth in the area was used. Roads and Maritime would also assess future developments and access requirements as part of the concept design development and environmental assessment process.</p>		
Support for project	Expressed overall support for the project, or for specific elements of the project.	Roads and Maritime acknowledges this support.	-	-
Traffic Movement	Convert Jane Street to eastbound (one way) traffic flow, Station Street converted to southbound (one way) and High Street converted to (westbound) traffic flow.	<p>Conversion of Penrith CBD streets to one-way flow may provide improvements to the operation and flow of traffic, particularly at the Jane Street and Mulgoa Road and High Street and Mulgoa Road intersections. Significant changes to access and signposting would be required to implement such a proposal, particularly at the Penrith Interchange and Westfield's Shopping Centre.</p> <p>Early consultation with Penrith City Council indicated that this option was not preferred due to</p>	The alternatives and options assessment for the proposal is outlined in Section 2.4 of this REF.	2.4

		<p>traffic impacts on the Penrith CBD and is not aligned with the Penrith City Centre Plan to create a pedestrian friendly city centre.</p>		
	<p>Mulgoa Road/High Street and Mulgoa Road/Jane Street intersections be combined to operate as a single intersection.</p>	<p>Combining the intersections to operate as a single intersection would result in significant impacts to surrounding parcels of land, including developed sites. The combined intersection would contain five legs.</p> <p>This irregular intersection design would require each leg of the intersection to be phased independently to retain the existing movements between each road, which would be even more inefficient than the existing arrangement. Efficient operation of a five leg signalised intersection would require removal of some turn movements to allow the number of phases and phasing time to be reduced. For these reasons, a combined five leg intersection between Mulgoa Road, High Street and Jane Street would be less efficient than the preferred option.</p>	<p>The alternatives and options assessment for the proposal is outlined in Section 2.4 of this REF.</p>	<p>2.4</p>

Additional submissions and correspondence with the community outside of the consultation period has been documented in Table 5-2.

Table 5-2 Additional correspondence with the community

Issue	Issues raised	Roads and Maritime response	Additional comments	Section of this REF where addressed (if relevant)
Traffic	Project is a waste of money unless the bridge over the Nepean River can be widened for traffic or another duplicate bridge built because the biggest bank up of traffic is the cars turning toward Emu Plains which then holds up all cars going straight.	This suggestion has been noted and will be reviewed as we refine the scope of this project during the Concept design phase.	The alternatives and options assessment for the proposal is outlined in Section 2.4 of this REF.	2.4

5.3 Aboriginal community involvement

Aboriginal consultation has been carried out in accordance with the *Roads and Maritime Procedure for Aboriginal cultural heritage consultation and investigation* (PACHCI). During this consultation, a representative of the Deerubbin Local Aboriginal Land Council (LALC) was engaged to assist Artefact Heritage with an Aboriginal cultural heritage survey of the proposal area on 5 November 2015.

The survey informed the Aboriginal Archaeological Survey Report prepared by Artefact Heritage which is included in Appendix E. Further details of the survey findings are provided in Section 6.2 of this REF. The Deerubbin LALC also provided a summary of the site investigation which is included in Appendix F.

The aims of the survey and Aboriginal Archaeological Survey Report were to identify any Aboriginal sites or areas of potential archaeological deposit (PAD) in the study area and assess their archaeological significance. The report recommended that based on the potential for subsurface stone artefacts to be present within the proposal area, further investigation (including archaeological test excavation) and consultation be undertaken in accordance with the Stage 3 of the PACHCI. The Deerubbin LALC also recommended that further archaeological investigation is carried out prior to construction.

Kelleher Nightingale Consulting Pty Ltd (KNC) was engaged to undertake further consultation and assessment in accordance with Stage 3 of the PACHCI. A public advertisement was placed in regional and local newspapers to seek registration of Aboriginal parties interested in the proposal from 13 and 30 May 2016.

Test excavations were undertaken by KNC in July 2016 in the presence of registered Aboriginal stakeholders including representatives from the Deerubbin LALC and Murra Bidgee Mullangari Aboriginal Corporation. A report summarising the results of the test excavations is included in Appendix G. The results of the text excavation concluded that no further Aboriginal consultation or archaeological assessment is required for the proposal.

5.4 ISEPP consultation

Part 2 of ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Table 5-3 provides a list of the consultation requirements under clauses 13 – 16 of ISEPP.

Table 5-3 ISEPP consultation requirements

Clause	Issue	Potential impact	Authority	Consultation required
Council related infrastructure and services				
13(1)a	Stormwater	Substantial impact on the stormwater management services provided by council	Penrith City Council	No
13(1)b	Traffic	Traffic generation to an extent that will strain the existing road	Penrith City Council	No
13(1)c	Sewerage system	Connection to, or substantial impact on the capacity of, any part of a sewerage system	Penrith City Council	No
13(1)d	Water usage	Connection to, or use of a substantial volume of water from, any part of a water supply system	Penrith City Council	No
13(1)e	Temporary structures	Installation of a temporary structure on, or the enclosing of, a public place that is under a council's management or control that is likely to cause a disruption to pedestrian or vehicular traffic that is not minor or inconsequential	Penrith City Council	No
13(1)f	Road and footpath excavation	Excavation that is not minor or inconsequential of the surface of, or a footpath adjacent to, a road for which a council is the roads authority under the <i>Roads Act 1993</i> (if the public authority that is carrying out the development, or on whose behalf it is being carried out, is not responsible for the maintenance of the road or footpath)	Penrith City Council	Yes

Clause	Issue	Potential impact	Authority	Consultation required
Local heritage items				
14	Local heritage items	Impact that is not minor or inconsequential on a local heritage item (other than a local heritage item that is also a State heritage item) or a heritage conservation area	Penrith City Council	Yes
Flood liable land				
15	Flood liable land	Development on flood liable land that will change flood patterns other than to a minor extent	Penrith City Council	No
16(2)a	National parks and reserves	Development adjacent to land reserved under the <i>National Parks and Wildlife Act 1974</i>	Office of Environment and Heritage	No
16(2)b	Marine parks	Development adjacent to a marine park declared under the <i>Marine Parks Act 1997</i>	Marine Parks Authority	No
16(2)c	Aquatic reserves	Development adjacent to an aquatic reserve declared under the <i>Fisheries Management Act 1994</i>	Department of Primary Industries (Fisheries)	No
16(2)d	Sydney Harbour foreshore	Development in the foreshore area within the meaning of the <i>Sydney Harbour Foreshore Authority Act 1998</i>	Sydney Harbour Foreshore Authority	No
16(2)e	Navigable waters	Development comprising a fixed or floating structure in or over navigable waters	Roads and Maritime	No

Clause	Issue	Potential impact	Authority	Consultation required
16(2)F	Bushfire prone land	Development for the purposes of an educational establishment, health services facility, correctional centre or group home, or for residential purposes, in an area that is bush fire prone land (as defined by the Act)	Rural Fire Service	No

The proposal would trigger clauses 13(1)b, 13(1)f and 14 of ISEPP. Accordingly, a notification letter was issued to Penrith City Council on 15 June 2016 and is provided in Appendix C. The submission received from Penrith City Council is summarised in Table 5-4.

Table 5-4 ISEPP consultation summary

Issue	Response	Comments and section of this REF where addressed (if relevant)
Heritage	Council agrees with the recommendations of the Statement of Heritage Impact report as outlined in Section 7, pages 45 and 46.	Noted
Heritage	Council seeks to obtain copies of the archaeological management plan (AMP) once it is prepared, including the finalised report at end of on-site works.	Noted. A copy of the non-Aboriginal Heritage Management Plan (HMP) will be provided to Council following preparation.
Heritage	Trees proposed for the replaced trees in Woodriff Gardens - applicant to get the agreement of Council's landscape specialist.	Roads and Maritime has undertaken consultation with Council's landscape specialist regarding replacement trees in Woodriff Gardens.
Heritage	RMS to provide a copy of the Aboriginal heritage impact statement from Artefact Heritage to Council when the document has been completed.	Roads and Maritime have provided Council with a copy of the completed Aboriginal heritage assessment documents.

5.5 Government agency and stakeholder involvement

Ongoing consultation has been carried out with government agencies and other key stakeholders since the announcement of the proposal in September 2013. In general, this consultation has included:

- May to October 2014 – Initial consultation was undertaken with Penrith City Council regarding traffic modelling and design options to reduce congestion within the proposal area
- November 2014 to February 2015 – The preferred option was made available for public comment. Twenty-three submissions were received from stakeholders and the community during this period. (See Table 5-1 for a summary of these submissions)

August to October 2015 – As part of the Preferred Bridge Report for replacement of the existing railway bridge at Castlereagh Road, key stakeholders (Transport for NSW, Sydney Trains and Penrith City Council) were consulted to assist with the identification of potential constraints and risks associated with the replacement bridge. Utility providers (Telstra, Optus, Jemena and Sydney Water) were also consulted during this phase of work to determine any constraints and risks associated with relocating and protecting their assets

- October 2015 – The Preferred Option Report was presented to Penrith City Council to gather and incorporate comments on the proposed design. Local MPs were also been briefed on the proposal
- November 2015 – The following stakeholders were engaged as part of the socio-economic impact assessment to gather feedback on the draft concept design:
 - Ambulance NSW
 - Lion Dairy and Drinks
 - Nepean District Tennis Association
 - Museum of Fire
 - Westfield.

Additionally, as part of the development of the concept design and this REF there have also been on-going discussions with Penrith City Council and Sydney Trains.

A more detailed summary of the government agency and stakeholder consultation undertaken to-date is provided in Table 5-5 below.

Table 5-5 Summary of agency and stakeholder consultation

Date	Issued discussed / Stakeholder comments	Roads and Maritime response
Ambulance NSW		
November 2015	<p>Consultation was undertaken with Ambulance NSW to discuss development of the design and how the Penrith Ambulance Station's access requirements could be accommodated during construction and operation.</p> <p>Penrith Ambulance Station is currently the Sector office and operational facility. The operational facility will be moving to the new Paramedic Response Facility that is currently being built on High Street. This move is expected to happen in 2017. There is currently a traffic light override system for the station which allows ambulance drivers to override the traffic lights and operate their own light system in an emergency. Use of the override system has decreased as a result of the reclassification of Ambulance NSW call levels. However its operation is still vital for the high priority calls.</p>	<p>Access requirements for the Penrith Ambulance Station would be reviewed prior to construction based on whether the operational facility is still located at 668-672 High Street at the time of construction. Temporary access provisions may be necessary to maintain access for the station at all times. Roads and Maritime will continue to work with Ambulance NSW to ensure their access requirements are met. Section 3.3.7 of this REF discusses the proposed traffic management and access arrangements during construction.</p>

	Works either need to be programmed to avoid the operational station (i.e. to be undertaken after the move to High Street) or a suitable traffic management option needs to be put in place during works to replace the current override.	
Lion Dairy and Drinks		
November 2015	<p>A meeting was held with Lion Dairy and Drinks to discuss the 20% concept design.</p> <p>The main concerns of Lion Dairy and Drinks is the impacts during construction and the need to be able to maintain their operations. Impact to existing stormwater infrastructure at the site was also raised as a potential issue.</p>	Access to the Lion Dairy and Drinks site would be maintained at all times during construction. Section 3.3.7 of this REF discusses the proposed traffic management and access arrangements during construction. Works would not impact on the existing stormwater infrastructure at the Lion Dairy and Drinks site.
July 2016	<p>A meeting was held with Lion Dairy and Drinks to present the latest design and identify potential impacts to the site including the impact to business during road closures.</p> <p>Lion Dairy and Drinks advised that they have trucks entering and exiting the site 24/7 and the front car park has a delivery every day.</p> <p>Lion Dairy and Drinks requested regular (monthly) updates on the status of the proposal.</p>	<p>The final concept design has reduced impacts to the Lion Dairy and Drinks site access and car park. Detour routes would be provided during construction to allow access to the site be maintained at all times.</p> <p>Roads and Maritime will continue to liaise with Lion Dairy and Drinks regarding the proposal.</p>
Nepean District Tennis Association		
November 2015	<p>A meeting was held with Nepean District Tennis Association to discuss the 20% concept design.</p> <p>Existing access to the site was discussed and the Tennis Association were interested in any opportunities to improve this. They also requested that the proposed adjacent construction compound could be left to operate as an overflow car park on completion of construction.</p>	<p>The current access arrangements at the Nepean Tennis courts would be maintained under the proposed design.</p> <p>Retention of the compound site as an overflow car park for the Nepean District Tennis Association is outside of the scope for this proposal.</p>
Westfield Penrith		

November 2015	<p>A meeting was held with Westfield Penrith to discuss the 20% concept design.</p> <p>As it is one of the busiest trading times, Westfield would prefer that construction be avoided over the Christmas period (i.e for the whole month of December) if possible.</p>	<p>Construction is expected to commence in 2018 (subject to planning approval) and would be completed by mid-2020, weather permitting. Roads and Maritime will continue to work with Westfield to ensure traffic impacts are minimised during construction.</p>
Penrith City Council		
November 2015	<p>A meeting was held with Penrith City Council to discuss the 20% concept design and the potential impacts on Council infrastructure.</p> <p>The key areas Council is interested in include:</p> <ul style="list-style-type: none"> • retaining green space i.e. the green link from CBD to the river • Woodriff Gardens as the connector to the river • removal of the 'Penrith' sign at Woodriff Gardens • the Council car park ingress/egress, especially the proximity to the road and the construction methodology • property impacts • retaining the bus bay on High Street • the significant tree on High Street • the shared pathway provision and links to the new active transport bridge • pedestrian crossing times and trying to minimise/provide refuge • improving access to the tennis courts. 	<p>The proposed design would require removal of the 'Penrith' sign and mature trees along the southern and eastern boundaries at Woodriff Gardens. Some of this vegetation would be replaced following works. Mature vegetation adjacent to Woodriff Gardens would be retained to maintain the existing informal parkland character. The proposed path along the southern boundary of Woodriff Gardens would tie in to the existing path in Woodriff Gardens, which connects to the river. Penrith City Council advised in a subsequent meeting that they are currently considering a strategy around the relocation of the 'Penrith' sign. Landscape impacts as a result of the proposal have been discussed further in Section 6.6 of this REF.</p> <p>Access to the Penrith City Council will be maintained throughout the construction period. Some works would require partial closure of the Mulgoa Road - High Street intersection limiting access to the car park from High Street, however it is recommended that these works completed as night works. To maintain full access during this time, a temporary detour connection would be sign posted along Union Street, Worth Street and High Street for the duration of the proposed road closure. Section 3.3.7 of this REF discusses the proposed traffic management and access arrangements during construction.</p> <p>Impacts to property during construction would be temporary and minimised through implementation of the safeguards and management</p>

		<p>measures recommended in this REF. The property adjustments required to accommodate the proposed design are detailed in Section 3.6 of this REF. Roads and Maritime would continue to work with Penrith City Council to ensure all impacts to property are minimised.</p> <p>The existing bus bay on High Street would be retained, however would be relocated 150 m along High Street during construction.</p> <p>Council has advised that the tree on the corner of Mulgoa Road and High Street has no official listing. Roads and Maritime will endeavour to preserve this tree.</p> <p>The proposal would improve pedestrian and cycle facilities along the Mulgoa – Castlereagh Road Corridor and would provide suitable pedestrian and cycling infrastructure between the Penrith CBD and the Nepean River Bridge (see Section 2.1.2 of this REF).</p> <p>Pedestrian crossing times has been considered as part of the proposal. Staged pedestrian crossings are proposed on Mulgoa Road and Castlereagh Road at the following locations:</p> <ul style="list-style-type: none"> • Mulgoa Road – Castlereagh Road at the western approach to the Jane Street intersection • Mulgoa Road at the northern and southern approaches to the Western Highway / High Street intersection. <p>The current access arrangements at the Nepean Tennis courts would be maintained under the proposed design.</p>
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April 2016	<p>A meeting was held with Penrith City Council to discuss the draft Urban Design strategy for the proposal.</p> <p>Issues raised by Council were related to the species palette and needing to ensure consistency with the Mulgoa Road corridor, landscaping at both the Council car park and Lion Dairy and Drinks car park frontage.</p>	The issues raised by Council will be addressed in the Final Urban Design strategy.
July 2016	Roads and Maritime held a meeting with Penrith City Council to provide an update on the proposal.	Roads and Maritime will continue to liaise with Penrith City Council regarding the proposal.
Sydney Trains		
October 2015	Roads and Maritime presented the design options for the new rail bridge over Castlereagh Road to the Sydney Trains West Region configuration control board (CCB). Sydney Trains advised their preferred option was to widening the west side of the bridge to ensure there is enough room for signal & control system cable route.	Option 5 was selected as the preferred option for the bridge replacement (see Section 2.5 of this REF).
February 2016	Roads and Maritime presented the updated design for the new rail bridge to the Sydney Trains West Region CCB. Issues discussed included the bridge slide method, constructability issues and utility considerations.	All comments and issues discussed have been considered in the concept design.
March 2016	<p>Roads and Maritime presented the 20 per cent concept design for the new rail bridge to Sydney Trains.</p> <p>Sydney Trains advised that an overhead wiring upgrade project around the rail bridge is due to be completed in 2017 or 2018. As such, no overhead wiring structures should be placed on the new bridge structure.</p> <p>Sydney Trains advised they would prefer utilities currently located on the existing bridge to be relocated to an underbore under Castlereagh Road, rather than onto the new structure.</p> <p>Sydney Trains raised a concern over the length and size of the originally proposed bridge protection beam (up to 40 m long), and the considerable</p>	<p>Sydney Trains comments provided on the 20 per cent design were addressed in the 80 per cent design.</p> <p>No overhead wiring structures have been proposed for the new bridge structure.</p> <p>An underbore under Castlereagh Road has been proposed for the relocation of services currently located on the existing bridge.</p> <p>Bridge protection beams have now been proposed on either side of Castlereagh Road on approach to the bridge.</p>

	size beam & footings that will be required.	
March 2016	<p>A workshop was held with Sydney Trains to identify issues affecting design risk and safety and constructability of the new rail bridge.</p> <p>Constructability issues raised included:</p> <ul style="list-style-type: none"> • Rail possessions • The bridge slide methodology • Overhead transmission lines • Vertical and horizontal clearances • Utilities • Staging areas • Access. <p>Discussions based on risks identified the following issues for consideration:</p> <ul style="list-style-type: none"> • Rail possessions • Future provisions and operational risks • Existing bridge demolition and construction risks • Maintenance risks. 	All comments and issues discussed have been considered in the concept design.
April 2016	<p>A meeting was held with Sydney Trains to agree track possessions for the proposed bridge works including the relocation of services over the Main West Line at Penrith.</p> <p>Sydney Trains advised that most of the work associated with relocating the existing services could be undertaken outside of a weekend track possession. However if Required, a standard two-day weekend possession would be adequate to complete the works, including commissioning of the relocated services.</p> <p>Sydney Trains advised that a standard two-day weekend possession should be adequate for excavation of the embankment and installing the corrugated steel pipe.</p> <p>Sydney trains advised that a five-day possession to demolish existing bridge and slide new bridge into place may be possible during the 2019</p>	Roads and Maritime will continue to liaise with Sydney Trains regarding the proposed track possessions.

	<p>Christmas period. However this is to be discussed further at a later stage. Sydney Trains advised that freight train movement may not be an issue during this time as this is usually light in this period and provided adequate notice is given to freight services.</p>	
May 2016	<p>Roads and Maritime attended a meeting of the Sydney Trains West Region CCB. Roads and Maritime presented the 80% Concept Design and the location of the bridge protection beams away from bridge.</p> <p>The CCB requested that the final Concept Design be presented to the Sydney Trains General Manager level CCB.</p>	Roads and Maritime will present the final Concept Design to the Sydney Trains General Manager level CCB.
May 2016	<p>Roads and Maritime held a meeting with Sydney Trains to discuss utilities at the rail bridge that would require relocation. Sydney Trains confirmed their preference for underboring as having services away from the bridge is for a better outcome for future maintenance. All cable pits will need to be located within Sydney trains boundary.</p> <p>Sydney Trains are happy to share service conduits with utilities providers, as per the current arrangements. Some of the fibre connections may require around 4 km of cable pulling and there is a risk that the conduit route is already full.</p>	Detailed design of utilities will be carried out in consultation with Sydney Trains and other utility providers.
May 2016	<p>Roads and Maritime held a meeting with Sydney Trains to discuss constructability considerations for the replacement bridge. Issues raised include the width of the track centres and an assessment of the construction methods and rail possession times.</p>	Roads and Maritime will continue to liaise with Sydney Train regards design and construction of the replacement rail bridge.
Urban Apartments		
August 2015	<p>A meeting was held with Urban Apartments to discuss the proposed development of an eight storey apartment block at 652 & 652A High Street and 6 Mulgoa Road, and consideration of potential access.</p>	Roads and Maritime will further liaise with Urban Apartments in regards to the proposal as needed.

In addition to the above consultation, stakeholder workshops were held at the 20 per cent and 80 per cent concept design stages to consider the design risks and safety and constructability of the proposal. A brief summary of the workshops are provided in Table 5-6 below.

Table 5-6 Summary of design workshops

Date	Stakeholders	Key issues discussed
18 Feb 2016	<ul style="list-style-type: none"> • Transport for NSW • Department of Infrastructure and Regional Development • Penrith City Council • PCoC 	<ul style="list-style-type: none"> • Efficiency of the new rail bridge design • Construction of the new rail bridge • Potential for contamination in rail corridor • Project scope and tie-ins with the existing road corridor • Intersection upgrades • Design speed and alignment • Lane widths • Pedestrian and cycle paths • Connectivity and access • Parking • Buses • Drainage • Utilities
6 Jul 2016	<ul style="list-style-type: none"> • Sydney Trains • Penrith City Council 	<ul style="list-style-type: none"> • Utilities • Constructability • Pavement risks • Environmental impacts • Community impacts • Structures/ geotech • Drainage • Risks associated with rail corridor • Cumulative impacts • Operational and maintenance risks

5.6 Ongoing or future consultation

Roads and Maritime will continue to inform residents and stakeholders of the ongoing development of the proposal. This will be carried out using methods such as the distribution of community updates, emails to the stakeholder database, updates on the website and more.

This REF will also be placed on public display from 15 November to 16 December 2016 for the community and stakeholders to review and provide feedback. Information sessions will be held during this period.

Following public display of the REF, all comments received would be recorded and addressed in a Submissions Report. The Submissions Report will detail how each issue raised will be considered in finalising the proposal design. The Submissions Report will be made available to the public via the Roads and Maritime website. The community will be kept informed of any further changes to the proposal resulting from this and any future consultation process.

6 Environmental assessment

6.1 Traffic and access

A traffic and transport assessment for the proposal has been carried out by Arcadis. The report is attached as Appendix D and summarised below.

6.1.1 Existing environment

Regional and local context

Mulgoa Road - Castlereagh Road is a regionally important traffic route for both the Penrith CBD and the broader western Sydney region. This north-south road corridor provides access to and from Penrith, Glenmore Park, and Jamisontown. The Jane Street, High Street and Great Western Highway intersections with Mulgoa Road and Castlereagh Road provide a north-south connection between Richmond and Wallacia and an east-west connection between the Penrith CBD and the Blue Mountains. More detail about the existing road infrastructure in the proposal area is provided in in Section 2.2.

Road network and hierarchy

The key road categories in the region are identified in Figure 6-1 and stated as below:

- State Roads – Freeways / Motorways and Primary Arterials
- Regional Roads – Secondary or Sub Arterials
- Local Roads – Collector and Local access roads.

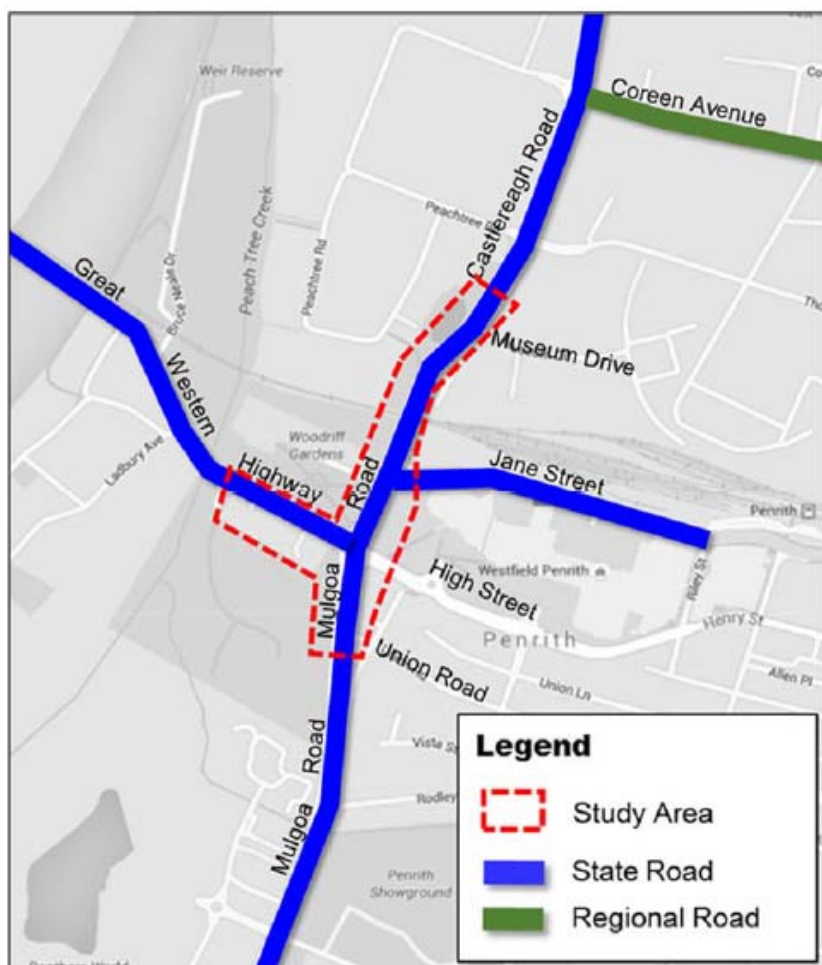


Figure 6-1 Existing road categories around the proposal area (Arcadis, 2016)

Note: Local roads are not highlighted on the map.

Mulgoa - Castlereagh Road, Jane Street, and the Great Western Highway are classified as State roads, High Street is classified as a local road.

The posted speed limits within the proposal area are 60 km/h on Mulgoa Road – Castlereagh Road and the Great Western Highway and 50 km/h on Jane Street and High Street.

There are traffic signals at the Castlereagh Road / Museum Drive, Jane Street / Mulgoa Road – Castlereagh Road and Great Western Highway / Mulgoa Road / High Street intersections, and a priority interstation at Mulgoa Road / Union Road.

Traffic and network performance

The current ADT volume within the study area comprises:

- **Mulgoa Road – Castlereagh Road:** 36,000 vehicles between Museum Drive and Jane Street on an average weekday
- **Jane Street:** 14,600 vehicles east of Station Street on an average weekday
- **Great Western Highway:** 31,000 vehicles west of Mulgoa Road on an average weekday.

Traffic volumes in the proposal area are about 18 to 21 per cent lower on an average weekend day than an average weekday (Arcadis, 2016).

During the AM and PM peak periods, considerable congestion is evident on Mulgoa Road – Castlereagh Road between Museum Drive and Union Road. The corridor is currently over capacity northbound and near capacity southbound during the morning peak, and near capacity northbound and southbound during the afternoon peak (see Table 2-1).

The average daily traffic is expected to grow by 3.6 per cent between 2015 and 2026, and 1.5 per cent between 2026 and 2036.

Commuter mode share

The work trips by mode of travel made within the proposal area are presented in Table 6-1.

Table 6-1 Daily work trips by mode (Arcadis, 2016)

Travel modes	Proposal area being “home” (i.e. outbound trips)		Proposal area being “workplace” (i.e. inbound trips)	
	No. of trips	Per cent of trips	No. of trips	Per cent of trips
Car (Driver)	390	51%	9,985	68%
Car (Passenger)	47	6%	975	7%
Train	146	19%	840	6%
Bus	15	2%	341	2%
Walking only	54	7%	219	1%
Other (ferry/ tram/ not stated)	19	3%	379	3%
Work from home	88	12%	1,945	13%
Total	759	100%	14,684	100%

Freight and heavy vehicles

Mulgoa Road – Castlereagh Road is the primary freight route between Penrith, Jamisontown and Glenmore Park with about 15 per cent of the total daily traffic comprising heavy vehicles. Jane Street and the Great Western Highway provides for freight movements between Penrith CBD, the Blue Mountains and Central West. About nine per cent of total daily traffic on Jane Street and seven per cent of total daily traffic on the Great Western Highway (within the proposal area) is comprised of heavy vehicles.

The railway line also serves as a nationally important freight route currently connecting rail freight between Sydney and Adelaide. Additionally this railway line has been identified as a key linkage to the proposed Inland Rail route further to the west of NSW at Parkes.

Within the proposal area, Jane Street, Mulgoa - Castlereagh Road and the Great Western Highway all accommodate 19-26 m B-double vehicles, however B-double movements are not permitted on High Street. Jane Street, Mulgoa Road and the Great Western Highway are also approved routes for 4.6 m high vehicles, however 4.6 m high vehicles are currently restricted from Castlereagh Road, north of Jane Street due to the 4.4m posted railway bridge over Castlereagh Road.

Public transport

Bus services

As discussed in Section 2.2.2, the Penrith Transport Interchange is used by three bus service operators (Busways, NightRide and Blue Mountains Bus Company). There are eight bus services that operate within the proposal area, including:

- Busways routes 673, 783 and 784 which operate along Mulgoa Road – Castlereagh Road and provide half hourly services in peak times
- Blue Mountains Bus Company Services 688, 689, 690P, 691 and 1688 which travel from the Great Western Highway to the Interchange via High Street.

The key bus routes within the proposal area are illustrated in Figure 6-2.



Figure 6-2 Existing bus routes around the proposal area (Arcadis, 2016)

In addition to these daily services the N70 NightRide bus operates between midnight and 4.30 am in place of trains between Town Hall and Penrith.

Train services

As discussed in Section 2.2.3, Penrith is a strategic location on the Sydney rail network that connects the western subregion with Sydney CBD, Parramatta and Blacktown to the east and Blue Mountains to the west. Penrith station is located on Jane Street about 800 m to the east of the Jane Street / Mulgoa Road Intersection.

Penrith station is serviced by two train lines, the T1 Western Line which connects Penrith to the east (Blacktown, Parramatta) and continues towards the Sydney CBD, and the Blue Mountains line which services suburbs west of Penrith up to Blue Mountains along with providing an express service between Penrith and the Sydney CBD. There is a high frequency of services indicating the importance of Penrith as a transport hub.

Active transport

As discussed in Section 2.2.1, a range of pedestrian and cycling infrastructure is provided within and around the proposal area. There are pedestrian paths on both sides of Mulgoa Road – Castlereagh Road and Jane Street and a pedestrian path running along the westbound carriageway of the Great Western Highway - High Street. The paths within the proposal area vary in width and provide access to a number of community, recreational and commercial premises. Most of the traffic signals have pedestrian facilities that enable pedestrians to cross safely.

There are also off-road separated cycle paths along Mulgoa Road – Castlereagh Road southbound between Museum Drive and Union Road and northbound between the Great Western Highway and Museum Drive, as well as westbound on the Great Western Highway and eastbound on High Street.

The pedestrian and cycle shared path network within the proposal area is shown in Figure 2-1.

Road safety

The road safety performance for various sections of Jane Street and Mulgoa Road – Castlereagh Road has been assessed using crash rates and casualty rates per 100 million-vehicle kilometres travelled (MVKT). Within the proposal area, there were an estimated 65 crashes per 100 MVKT and an estimated 20 casualty crashes per 100 MVKT (Arcadis, 2016). The majority of the crashes occurred at the intersections along the Mulgoa Road – Castlereagh Road corridor, between Union Road and Museum Drive.

6.1.2 Potential impacts

Construction

Traffic and network performance

Construction of the proposal would generate light vehicle, truck and heavy equipment movements to and from the site. The typical traffic generating activities would include construction staff travelling to and from site, delivery of plant, equipment and construction materials, and collection and disposal of waste not appropriate for reuse on-site. During construction, it is expected that up to 200 light vehicle and 200 heavy vehicle movements would occur each day during the peak construction period (during a typical working day). Access to the construction site and the construction compound would be via Mulgoa Road – Castlereagh Road. Parking for construction staff would be provided at the construction compound adjacent to the Nepean District Tennis Association. Some construction personnel may need to utilise on-street parking in the vicinity of the site during works, or the car park south-west of the Mulgoa Road / High Street intersection.

Individual lane or full road closure on Mulgoa Road, Castlereagh Road, Jane Street, High Street and the Great Western Highway may be required at times to undertake construction work. This would include the closure of the right turn lanes from Mulgoa Road onto Jane Street and Mulgoa Road onto Union Road. Temporary lane closures would affect the flow of traffic accessing the Jane Street / Mulgoa Road – Castlereagh Road and Great Western Highway / Mulgoa Road / High

Street intersections. However this would be short-term and would be carried out during off-peak hours where possible to minimise the impacts. Full road closure would impact the wider local road network due to traffic diversions. However this would be temporary and considered to be manageable and minor when carried out outside of peak periods.

Other impacts during construction include increased travel times due to reduced traffic flow around construction sites.

Customers of Westfield currently use the area proposed for the construction compound adjacent to the Nepean District Tennis Association as an overflow car park during peak shopping periods, including the Christmas and Boxing Day sales. During construction of the proposal this area would be unavailable for overflow parking, placing additional pressure on the permanent Westfield car parks and straining the local road network. Should construction of the railway bridge (under a rail possession) be planned for a peak shopping period, it is expected that lengthy delays would be experienced by users of the local road network.

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

Public transport

Construction of the bridge would require up to three track possessions each up to five days in length. This would disrupt rail services on the T1 Western Line (operated by Sydney Trains) and the Blue Mountains Line (operated by NSW TrainLink). Roads and Maritime would work closely with Sydney Trains in the planning of the track possessions and ensure that commuters and freight operators are adequately notified.

Bus travel times may be temporarily impacted during lane closures and construction activities; however the existing services would remain operational during construction.

Construction of the proposal would have **minor adverse** impact on public transport.

Active transport

The pedestrian and cycle paths would remain operational during construction period. Where active transport routes and connections are temporarily removed or blocked due to road closures an alternative would be provided. Wherever possible these connections would be as direct as possible. In general there is sufficient space in existing road verges and adjacent to the proposed works to accommodate existing or temporary pedestrian and cycle facilities.

As it would be difficult to provide cycle facilities with compliant standards (such as shared use paths) at all times during construction, a temporary signed cycle route connecting Great Western Highway and Jane Street may be a preferable temporary solution. A temporary cycle detour (identified through signage and linemarking) may be used to facilitate this connection via High Street to Riley Street. Cyclists travelling north – south along Mulgoa Road - Castlereagh Road would need to negotiate the temporary path facilities and as such the existing paths should be maintained wherever possible during construction with temporary paths providing a similar level of service and class of facility.

During the traffic switch to facilitate road widening under the railway bridge, the construction staging would maintain the existing footpath on the eastern side of Castlereagh Road and install a temporary path when the existing facility is removed. However, road lanes and pedestrian paths would be closed for short periods of time during select activities, such as when the replacement bridge is slid into position. It is anticipated that all such events would be scheduled as night works to minimise potential disruption.

Construction of the proposal would have **negligible** impact on active transport.

Property access

Access to all properties would generally be maintained during construction. Access for emergency vehicles would be provided at all times and specific routes would be confirmed and detailed in the TMP.

Construction of the railway bridge would require the full closure of Castlereagh Road on either side of the bridge for up to five days. During this time, access to properties would be maintained and a temporary detour route likely via Jane Street, Richmond Road and Coreen Road (or Andrew Road for trucks and over-sized vehicles) would be established for the duration of the road closure.

Other works may require partial closure of the Mulgoa Road / High Street intersection limiting access to the Council car park and the car park located south east of Mulgoa Road / High Street intersection. These works would be staged so access is maintained at all times and completed as night works where possible. To maintain access, a temporary detour likely via Union Street, Worth Street and High Street would be established for the duration of the road closure.

Construction of the proposal would have **minor adverse** impact on property access.

Operation

Traffic and network performance

The proposal would improve reliability of journey times, particularly during peak travel periods within the proposal area. The widening of Mulgoa Road – Castlereagh Road to six lanes would increase capacity of the corridor and support population and employment growth.

The future operational performance as a result of the proposal has been determined at the Jane Street / Mulgoa Road – Castlereagh Road and Great Western Highway / Mulgoa Road / High intersections considering the post upgrade conditions.

The Jane Street / Mulgoa Road – Castlereagh Road intersection is currently operating at a level of service where average delays per vehicle greater than 70 seconds can be experienced during peak times. This means the intersection is operating at, near or over capacity.

The proposal would improve the traffic capacity to the levels shown in Table 6-2.

Table 6-2 Forecast level of service at the Jane Street / Mulgoa Road – Castlereagh Road intersection (Arcadis, 2016)

Road section	Forecast delays (seconds)					
	2020		2026		2036	
	AM	PM	AM	PM	AM	PM
Jane Street/ Mulgoa Road –Castlereagh Road intersection	23	27	24	31	32	49
	Good operation with acceptable delays and spare capacity	Good operation with acceptable delays and spare capacity	Good operation with acceptable delays and spare capacity	Satisfactory operation	Satisfactory operation	Near capacity

The Great Western Highway / Mulgoa Road / High Street intersection is currently operating at a level of service where average delays per vehicle between 57 and more than 70 seconds can be experienced during peak times. This means the intersection is operating at over capacity. The proposal would improve the traffic capacity to the levels shown in Table 6-3.

Table 6-3 Forecast level of service at the Jane Street/ Mulgoa Road –Castlereagh Road intersection (Arcadis, 2016)

Road section	Forecast delays (seconds)					
	2020		2026		2036	
	AM	PM	AM	PM	AM	PM
Great Western Highway / High Street / Mulgoa Road	42	50	42	47	49	47
	Satisfactory operation	Near capacity	Satisfactory operation	Near capacity	Near capacity	Near capacity

In summary, the proposal would have a positive impact on traffic and network performance during operation.

Road safety

The improvement to the level of service and delays experienced at the intersections as a result of the proposal would potentially reduce the ‘stop-start’ travel conditions and improve road safety along the Mulgoa Road – Castlereagh Road corridor. The likelihood of crashes would also be reduced at the intersections with the provision of deceleration / slip lanes.

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

Public transport

All existing bus routes and services within the proposal area would be retained. The proposal is expected to provide for more efficient operation of bus services at High Street and Jane Street traffic signals associated with the provision of bus priority (‘queue jump’) lanes.

The proposal is anticipated to have a **positive** impact on bus services during operation. The proposal would have a **negligible** impact on the existing train services during operation.

Active transport

Provision for a shared path has also been adopted in the design upgrades. A 4.5 m wide separated path replaces the existing 3 m wide route along Mulgoa Road – Castlereagh Road. A 1.5 m wide shared path would be retained along Jane Street, the north side of High Street (west of intersection with Mulgoa Road) and on the west side of Castlereagh Road and Mulgoa Road.

Staged pedestrian crossings are also proposed on Mulgoa Road - Castlereagh Road where the crossing exceeds 25m in length at the following locations:

- Mulgoa Road – Castlereagh Road at the western approach to the Jane Street intersection
- Mulgoa Road at the northern and southern approaches to the Great Western Highway / High Street intersection.

The proposal would have a **negligible** impact on the active transport during operation.

Property access

The current adjacent property accesses would be maintained by the proposed design. It is anticipated that around 20-25 spaces would be impacted at the car park currently used by Lion Dairy and Drinks and the Museum of Fire. However these spaces would be relocated where possible (likely to the north of the Lion Dairy and Drinks main building) to achieve a zero net loss of parking.

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

6.1.3 Safeguards and management measures

The safeguards and mitigation measures detailed in Table 6-4 would be implemented to minimise the impacts of the proposal on traffic and access.

Table 6-4 Environmental safeguards for traffic and access

Impact	Environmental safeguards	Responsibility	Timing
Disruptions to traffic and transport	<u>T1</u> <ul style="list-style-type: none">A TMP would be prepared and implemented in accordance with the Roads and Maritime Traffic control at worksites manual (Version 4), Australian Standard 1742.3 Manual of uniform traffic control devices, and instruction from the Transport Management Centre.	Contractor/ Site Manager	Pre-construction
Changed transport and access conditions	<u>T2</u> <ul style="list-style-type: none">Road users, rail commuters, local residents, pedestrians and cyclists would be informed in advance of changed conditions, including any likely disruptions to access.	Project Manager and consultation team	Pre-construction and construction
Disruptions to traffic and transport	<u>T3</u> <ul style="list-style-type: none">Real-time information would be made available through temporary Variable Message Signs (VMS), the Live Traffic and 131 500 websites, and the media.	Project Manager/ Site Manager	Construction
Disruptions to traffic and transport	<u>T4</u> <ul style="list-style-type: none">Materials would be managed to minimise the number of haulage and delivery vehicles required on site.	Site Manager	Construction

Impact	Environmental safeguards	Responsibility	Timing
Disruptions to traffic and transport	<u>T5</u> <ul style="list-style-type: none"> The designated site access points and haulage routes would be used. 	Site Manager	Construction
Transport conditions	<u>T6</u> <ul style="list-style-type: none"> Affected areas would be restored to a condition equivalent to that which existed prior to the commencement of the work. 	Site Manager	Post-construction

6.2 Aboriginal heritage

An Aboriginal cultural heritage survey was carried out by Artefact Heritage for the proposal. The full report is attached as Appendix E and summarised below. This report was prepared in accordance with the OEH *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales 2010* and Stage 2 of the Roads and Maritime *Procedure for Aboriginal cultural heritage consultation and investigation* (PACHCI).

A representative of the Deerubbin Local Aboriginal Land Council (LALC) was engaged to assist with the Aboriginal cultural heritage survey. A summary of the site investigation as provided by the Deerubbin LALC is included in Appendix F.

The survey area for the purposes of the Aboriginal cultural heritage assessment is identified in Figure 6-3. The survey area was initially based on the 20 per cent concept design and later revised to reflect the 100 per cent concept design. The survey area also captures the areas proposed to be used as construction compounds.



Figure 6-3 Aboriginal heritage survey area (Source: Artefact)

6.2.1 Existing environment

The survey area is located in the Penrith LGA, in the Parishes of Castlereagh and Mulgoa, County of Cumberland and within the boundaries of the Deerubbin LALC. Evidence suggests that there has been a focus of past Aboriginal occupation in the area, potentially dating back to the late Pleistocene period, over 10,000 years ago. The eastern part of the survey area is likely to have been favoured over the western part as it is at a slightly higher elevation and less affected by flooding from the Nepean River and Peachtree Creek.

There are no registered Aboriginal objects or places within the survey area and the site walkover did not identify any Aboriginal objects of note. It is likely that historical development and occupation has resulted in the destruction of some archaeological evidence of past Aboriginal occupation in the area. The underlying geology is the Richmond Soil Landscape and the soil profile is particularly deep in the survey area.

Evidence indicates that the upper soil profile has been entirely removed at the rail underpass over Castlereagh Road. As such there is considered to be no archaeological potential in this area and this is also likely to be the case for the Penrith CBD (which is understood to have a basement and stormwater basin), the railway bridge over Peachtree Creek and Mulgoa Road realignment, all of which required deep excavation during their construction.

Ground disturbance across the remainder of the survey area does not appear to have affected the full depth of the upper soil profile. Alluvium of the Richmond Soil Landscape survives to various degrees including in situ topsoil in some sections. In other sections of the survey area, the upper soil profile has been truncated, removing the topsoil and presumably the upper part of the underlying alluvial deposit to various degrees.

The Stage 2 assessment therefore considered it likely that archaeological remains would be present in the survey area consisting largely, or entirely, of stone artefacts. To the west, densities were expected to be lower and the context more disturbed. Remains could date back to the late Pleistocene period, however evidence from the later Holocene occupation is likely to have been subject to greater levels of historical disturbance as they are higher in the profile.

The presence of archaeological remains was considered likely and therefore an area of potential archaeological deposit (PAD) was identified across much of the survey area, as illustrated in Figure 6-4. The PAD was not considered to be continuous, as deep excavation (e.g. for subsurface service corridors) may have removed the deposit from some discrete sections within the area. The nature of the PAD was assessed based on documentary evidence only as there had been no observed surface expressions of the PAD and/or subsurface investigations at this time.



Figure 6-4 Potential archaeological deposit within the survey area (Source: Artefact)

6.2.2 Potential impacts

Construction

Construction of the proposal would require excavation, however the exact depth and extent of excavation is currently unknown. A maximum excavation depth of up to one metre has been assumed, with the exception of the replacement bridge which would require excavation of up to 3.5 m below current ground level.

Given the existing conditions and the absence of archaeological potential, any excavation in the immediate vicinity of the Castlereagh Road underpass and the Penrith CBD is unlikely to impact on Aboriginal heritage. It is probable that preceding excavation has removed any archaeological deposits from these locations. As such, construction of the proposal in these areas would have **negligible** impact on Aboriginal heritage.

Excavation alongside the existing road corridor was first thought likely to result in removal of archaeological deposits from the upper soil profile. The extent of impact would be dependent on the depth of excavation and it would be likely that only the upper part of the PAD (alluvium

overlying gravel) would be disturbed at these locations. However, to make a more definite assessment of the nature and significance of the PAD, it was recommended that formal Aboriginal community consultation and an Aboriginal cultural heritage assessment be carried out in accordance with Stage 3 PACHCI.

Roads and Maritime engaged KNC to undertake archaeological test excavations in accordance with the Office of Environment and Heritage (OEH) *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (OEH, 2010) and Stage 3 of the PACHCI. The full test excavation results can be found in Appendix G.

The survey area for the Stage 3 assessment is shown in Figure 6-5. The location of proposed ancillary facilities, including site compounds, stockpiles and plant storage areas were also considered during the Stage 3 assessment.



Figure 6-5 Stage 3 survey area (Source: KNC)

Test excavation was carried out by KNC in July 2016 in accordance with the OEH Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales. The aim of the test excavation program was to determine the presence/absence of the PAD as identified during the Stage 2 PACHCI assessment. The test excavation methodology was designed to focus on areas that had been subject to lower levels of historical disturbance and where no geotechnical data was

available. Three general test areas were selected. The full test excavation methodology can be found in Appendix G.

During the test excavation, the majority of the area previously assessed as PAD was found to be heavily disturbed with no archaeological potential and no potential for intact deposits. No Aboriginal objects were recovered by the test excavation.

It was concluded that the proposal area does not represent an area of Potential Archaeological Deposit and contains no known Aboriginal objects or sites. The archaeological (scientific) significance of the proposal area was assessed as low. It is therefore reasonable to assume that the proposal would not harm any Aboriginal objects and would have no impact Aboriginal cultural heritage impact.

As such, the proposal would have a **negligible** impact on Aboriginal heritage.

Operation

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

6.2.3 Safeguards and management measures

The safeguards and mitigation measures detailed in Table 6-5 would be implemented to minimise the impacts of the proposal on Aboriginal heritage.

Table 6-5 Environmental safeguards for Aboriginal heritage

Impact	Environmental safeguards	Responsibility	Timing
Unexpected finds	<u>AH1</u> The Standard Management Procedure – <i>Unexpected Heritage Items</i> must be followed in the event that a known or potential Aboriginal object(s), including skeletal remains, is found during construction. This applies where Roads and Maritime does not have approval to disturb the object(s) or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place. Work may only recommence once the requirements of that Procedure have been satisfied.	Site Manager	Construction

6.3 Non-Aboriginal heritage

A Statement of Heritage Impact was prepared for the proposal by Artefact Heritage. The Statement of Heritage Impact is attached as Appendix H and summarised below.

The survey area for the purposes of the non-Aboriginal heritage assessment is identified in Figure 6-6.



Figure 6-6 Non-Aboriginal heritage survey area (Source: Artefact)

6.3.1 Existing environment

Overview

Generally, the survey area consists of paved roads and car parks, landscaped grassed fields, residential and commercial structures. This comprises highly modified landforms throughout and underground disturbance related to underground services.

No sites within or in the vicinity of the survey area are included on the World, Commonwealth or National Heritage Lists. Additionally there are no listed heritage conservation areas or archaeological sites within or in the vicinity of the survey area.

Statutory listed Items

There are a number of items listed heritage items within the vicinity of the survey area as illustrated in Table 6-6. This includes items protected under the powers of the Heritage Act on the State Heritage Register (SHR) and Section 170 Register as well as locally listed items protected under the powers of the Penrith LEP and items on non-statutory heritage registers.

Table 6-6 Non-Aboriginal heritage items within and in the vicinity of the survey area

Item	Address	Location	Listing
Penrith Railway Station Group	Railway land, Jane Street, Penrith (Lot 31 DP1086586)	Within	Penrith LEP (Item 188)
(Former) Station masters house	Jane Street, Penrith (Lot 31 DP1086586)	Within ¹	Penrith LEP (Item 187)
Penrith Ambulance Station	668-672 High Street, Penrith (Lot 12 DP37829)	Within	Penrith LEP (Item 256)
Peachtree Creek Bridge	Peachtree Creek, Penrith	In the vicinity 20 m to the west	Penrith LEP (Item 257)
			Section 170 Roads and Maritime Register
(Former) Penrith Power Station	1 Museum Drive, Penrith (Lot 1 DP1010950)	In the vicinity 50 m to the north-east	Penrith LEP (Item 259)
Power Station	Castlereagh Road, Penrith	In the vicinity 55 m to the north-east	Register of the National Trust (S9335)
Museum of Fire	Castlereagh Road, Penrith	In the vicinity 55 m to the east	Register of the National Estate (ID 17328)
Fire and Rescue NSW Heritage Fleet	Museum Drive, Penrith	In the vicinity (as part of Museum of Fire)	SHR (Item no. 01902)
Shand Mason 7 inch Manual Fire Engine (1869)	1 Museum Drive, Penrith	In the vicinity (as part of Museum of Fire)	SHR (Item no. 01898)
NSW Fire Brigades No 10 Vehicle Number Plates	Castlereagh Road, Penrith	In the vicinity (as part of Museum of Fire)	SHR (Item no. 01519)
Ahrens Fox PS2 Fire Engine (1929)	1 Museum Drive, Penrith	In the vicinity (as part of Museum of Fire)	SHR (Item no. 01717)
Shand Mason Curricule Ladders (1898)	1 Museum Drive, Penrith	In the vicinity (as part of Museum of Fire)	SHR (Item no. 01899)
Dennis Big Fire Engine (1939)	1 Museum Drive, Penrith	In the vicinity(as part of Museum of Fire)	SHR (Item no. 01718)
Shand Mason Fire Engine (1891)	Museum Drive, Penrith	In the vicinity (as part of Museum of Fire)	SHR (Item no. 01716)

¹ Lot is within the survey area; however, the building itself is outside of the survey area

Item	Address	Location	Listing
Edward Smith Headquarters Switchboard (1909)	1 Museum Drive, Penrith	In the vicinity (as part of Museum of Fire)	SHR (Item no. 01901)
Ford 21W Fire Brigade Mobile Canteen (1942)	1 Museum Drive, Penrith	In the vicinity (as part of Museum of Fire)	SHR (Item no. 01900)
Penrith Railway Station Group	Great Western Railway, Penrith	In the vicinity 225 m to the north-east	SHR (Item no. 01222)
Penrith Railway Station Group and Residence	Station Street, Penrith	In the vicinity 225 m to the south-west	Section 170 RailCorp Register

Accordingly, there are three listed heritage items within the survey area (Penrith Railway Station, Penrith Ambulance Station and the (Former) Station masters house) and one immediately adjacent (Peachtree Creek Bridge), as illustrated in Figure 6-7. Of the 14 listed heritage items, four relate to the Penrith Railway Station Group and 12 relate to the former Power Station (now the Museum of Fire) and items in the collection.

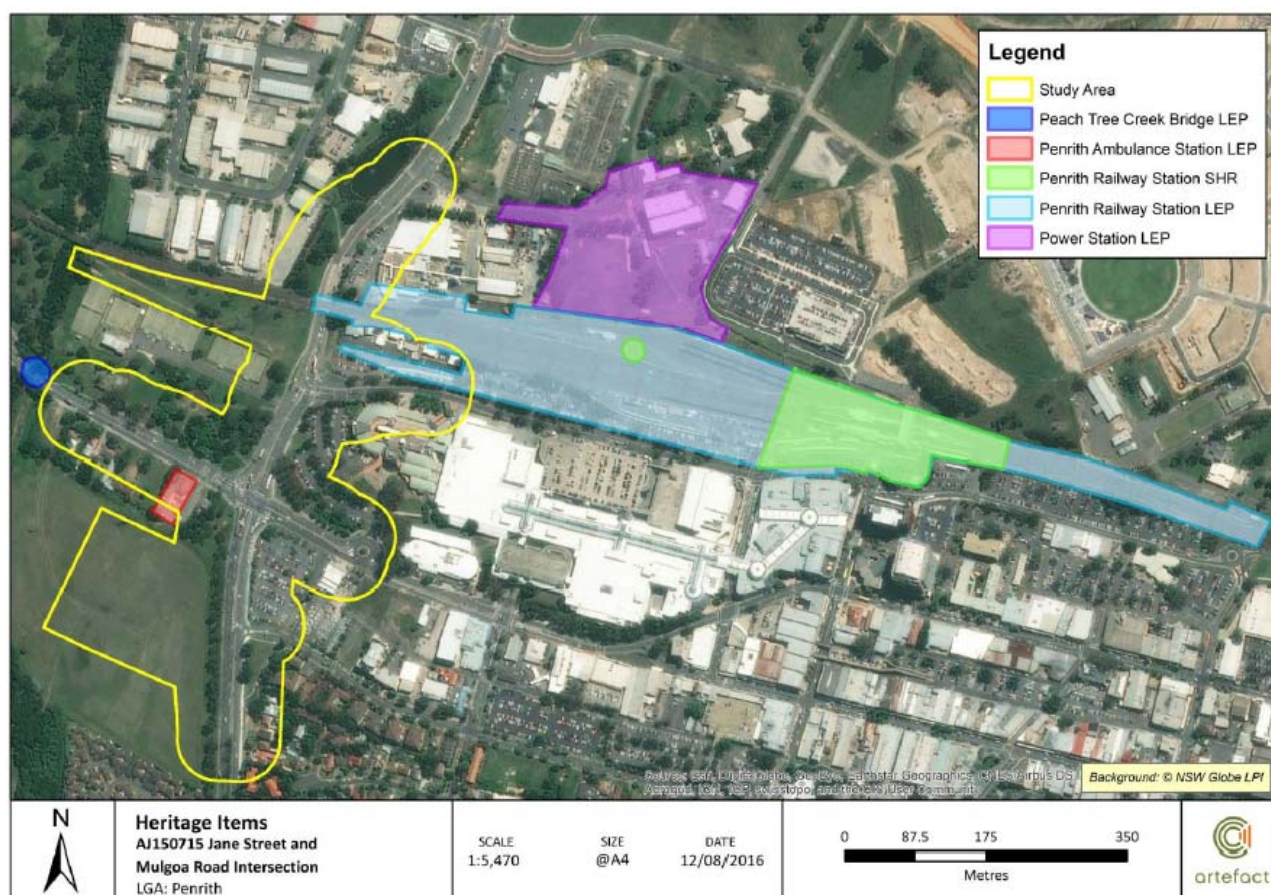


Figure 6-7 Listed heritage items within and in the vicinity of the proposal area (Source: Artefact)

Penrith Railway Station

There are four statutory heritage listings associated with Penrith Railway Station. The listings covering the station buildings and platforms and the turntable are outside of the survey area, to the

east. The location of the (Former) Station Master's house under the Penrith LEP is included in Lot 31 DP 1086586, which extends into the survey area. However, it is a discrete item located on Belmore Street that is not actually located within the proposal area.

The listing for the Penrith Railway Station Group under the Penrith LEP covers Lot 31 DP 1086586 which extends into the survey area. That part of the curtilage within the survey area includes:

- A section of the Lion Dairy and Drinks site, to the north of the railway line, on the eastern side of Castlereagh Road.
- A section of the car park between Jane Street and the railway line, on the eastern side of Castlereagh Road. It is likely that this area represents part of the former open drainage channel.
- A section of the rail corridor itself, including the railway bridge that passes over Castlereagh Road. This section of the railway line was rebuilt in the early 1960s, as part of the construction of the underpass. Further work may have subsequently been carried out when the underpass was widened.

This item is considered to be of local heritage significance. It follows the original rail alignment, as constructed in the early 1860s and duplicated in the 1880s. However, this section of the railway line was rebuilt in the 1960s to accommodate local traffic conditions.

Penrith Ambulance Station

Penrith Ambulance Station is also located within the survey area at 668-672 High Street. The listing for this item under the Penrith LEP consists of Lot 12 DP 37829, which includes the original 1936 ambulance station building. The operational property for ambulance services includes the adjacent lot to the east (Lot 7 DP 37702) which includes a late-twentieth century structure.

Penrith Ambulance Station is of local heritage significance. It is associated with Fredrick Jones, a prominent local identity, the development of the town as a regional centre in the mid-twentieth century and the provision of ambulance services to the local population. The main structure and associated elements, which date to the establishment in 1936, demonstrate stylistic and functional elements which relate to the history of this type of building.

Peachtree Creek Bridge

Peachtree Creek Bridge extends from High Street across Peachtree Creek and is located immediately to the west of the survey area. There has been a crossing in this general location since the construction of the road in 1811, and documentary evidence indicates that there was a bridge at this location from at least 1833. The current bridge may date back to 1920, although modifications and additions have been made since then. Peachtree Creek Bridge is of local heritage significance.

Non listed items

Woodriff Gardens have been identified as a non-listed item of heritage significance within the survey area. The exact date of the establishment has not been determined, but it is estimated around 1970. The proximity of the Penrith Civic Centre (to the east) and Penrith Ambulance Station (to the south) means that they contribute to form an important component of the local character. The establishment of a park in this location was considered appropriate as an 'entrance to the city' and Woodriff Gardens was named in recognition of one of the earliest local non-Aboriginal families. The park and adjoining tennis facilities were planned and developed in partnership with the Nepean District Tennis Association, and it is possible that the Penrith Apex Club was also involved.

Woodriff Gardens are considered to be of local heritage significance as part of a civic precinct situated on the two main roads through the town. Although they are relatively modern, the creation of this type of formal garden is characteristic of the historical development of NSW towns in the mid to late twentieth century.

Historic archaeological potential / remains

High Street

High Street has been identified as an area of historical archaeological potential within the survey area. Constructed as part of the Great Western Road around 1811, the road has been subject to significant upgrade work (including widening and resurfacing) during which earlier road remains have been uncovered. This indicates the potential for surviving remains within the High Street road corridor. Potential remains may include earlier road pavements and sub-base layers, and culverts and/or bridges where the road passed across two small watercourses.

High Street is of local heritage significance, due to its role in the early development of the town of Penrith, on the road from Sydney to the Blue Mountains across the Nepean River. Additionally, the alignment is of state significance, as it was once part of the alignment of the Great Western Road, one of the earliest routes through the colony. Such remains would be of state significance as they relate to one of the major early colonial transport routes.

Castlereagh Road

Castlereagh Road has historically been a relatively minor route which dates to the early nineteenth century. Remains of the road (dating to the period before the realignment in 1960) such as earlier road pavements and sub-base layers, could survive along with the former alignment to the east.

Such potential remains would be of local significance, as they relate to an early regional network, connecting small settlements and properties to the major routes. Investigation of the remains would provide information relating to the construction and use of the road that is not available from documentary sources. These potential remains are considered to be works, rather than relics as defined by the Heritage Act.

Former alignment of Mulgoa Road, on the present line of John Tipping Grove

Similarly to Castlereagh Road, Mulgoa Road has historically been a minor route which dates to the early nineteenth century. Remains of the road dating to the period before the realignment in 1986 could survive in the present John Tipping Grove road corridor. Such remains would consist of earlier road pavements and sub-base layers.

Such potential remains would be of local significance, as they relate to an early regional network, connecting small settlements and properties to the major routes. Investigation of the remains would provide information on construction and road uses that is not available from documentary sources. These potential remains are considered to be works, rather than relics as defined by the Heritage Act.

Former structures along High Street

Documentary evidence indicates that a number of structures (that are no longer in extant) have been located along each side of High Street. Any remaining structures are likely to have been impacted by earthworks carried out for the widening of High Street and Castlereagh Road, the realignment of Mulgoa Road, and the construction of the nearby car parks. However, ground disturbance does not appear to have been as substantial alongside High Street to the west of Castlereagh Road. It is considered that archaeological remains relating to the occupation of this area in the mid to late nineteenth century may survive.

Remains may survive, although they are likely to have been impacted to various degrees by subsequent development, in particular road work. The remains would be of local heritage significance, associated with the early commercial and residential development of the town.

Light industrial area and RAAF base

Between Jane Street and High Street, to the east of Castlereagh Road a light industrial area and an RAAF base was developed and occupied in the mid to late twentieth century. The construction of the Penrith Civic Centre is expected to have significantly impacted on associated remains,

however fragmentary remains may be present in areas of shallower excavation (such as the car park).

Due to the late date of this occupation, the documentary record is relatively rich, and material remains would not be expected to provide substantial additional historical information. As such, any potential archaeological remains associated with this area are therefore not considered to be of heritage significance.

6.3.2 Potential impacts

Construction

Penrith Railway Station

The proposal would involve replacement of the existing railway bridge over Castlereagh Road. Fabric dating back to the 1960s would be removed as part of the work; however, the key components of the station group including the station buildings, Station Master's residence and turntable would not be impacted. Construction of the replacement railway bridge would enable continued rail operations along the original alignment established in the 1860s.

Construction of the proposal would have a **moderate adverse** impact on this item.

Penrith Ambulance Station

Construction would not directly impact on the curtilage of the property or the fabric associated with the original 1936 building. Construction would encroach into the northern boundary of the neighbouring property (Lot 7 DP37702). This neighbouring property represents the operational property for ambulance services which is part of the Penrith Ambulance Station. As such, construction activities would temporarily impact on the setting of the original 1936 building.

Construction of the proposal would have a **minor adverse** impact on this item.

Peachtree Creek Bridge

Construction of the proposal would not involve work that may impact on the Peachtree Creek Bridge. As such there would be a **negligible** impact on Peachtree Creek Bridge during construction.

Woodriff Gardens

Construction would encroach along the High Street and Castlereagh Road boundaries of Woodriff Gardens. Specifically, the widening of Mulgoa Road would require the removal of the garden bed at the intersection, including the plantings that form 'PENRITH'. Additionally there may need to be trees removed near the boundary of Woodriff Gardens.

Construction of the proposal would have a **moderate adverse** impact on Woodriff Gardens.

Historical archaeological potential / remains

At present the extent of excavation required within the present day High Street is not known; however, it has been assumed that partial excavation would be required in this area. This may result in the removal of sub-surface remains of the earlier road. As such, construction of the proposal would have a **moderate adverse** impact on this item.

Similarly, partial excavation has been assumed for Castlereagh Road. Any excavation along the original alignment, to the south of the Jane Street intersection, may result in removal of any remains of the earlier road within this area. As such, construction of the proposal would result in a **moderate adverse** impact on this item.

There would be negligible impact to the former alignment of Mulgoa Road as there would be no construction activities along John Tipping Grove.

The proposal would require excavation along the north and south of High Street which may result in removal of any former structures in this area. These archaeological remains are likely to be more discrete and the proposal therefore has the potential to remove them in their entirety. An Excavation Permit should therefore be lodged in accordance with Sections 139-140 of the Heritage Act. Construction of the proposal would therefore have a **major adverse** impact on this item.

Operation

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

6.3.3 Safeguards and management measures

The safeguards and mitigation measures detailed in Table 6-7 would be implemented to minimise the impacts of the proposal on non-Aboriginal heritage.

Table 6-7 Environmental safeguards for non-Aboriginal heritage

Impact	Environmental safeguards	Responsibility	Timing
Heritage impacts during construction	<p><u>NAH1</u> A non-Aboriginal Heritage Management Plan (HMP) would be prepared and implemented as part of the CEMP.</p> <p>It would provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to non-Aboriginal heritage. The HMP would be prepared in consultation with the Office of Environment and Heritage. The HMP would give effect to any management measures contained in any non-Aboriginal heritage assessment carried out for the project and include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> • details of investigations completed or planned to be carried out and any associated approvals required • mapping of areas of non-Aboriginal heritage value and identification of protection measures to be applied during construction • procedures to be implemented if previously unidentified non-Aboriginal relics or heritage items are discovered during construction, in accordance with the Roads and Maritime <i>Standard Management Procedure – Unexpected</i> 	Project Manager	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
	<i>Archaeological Finds</i> an induction program for construction personnel on the management of non-Aboriginal heritage values.		
Unexpected finds during construction	<u>NAH2</u> Should any heritage items, archaeological remains or potential relics of non-Aboriginal origin be encountered, then construction work that might affect or damage the material must cease and notification provided to the relevant Roads and Maritime officer identified in the Roads and Maritime <i>Standard Management Procedure – Unexpected Archaeological Finds</i> . Work may only re-commence once the requirements of that Procedure have been satisfied.	Site Manager	Construction
Heritage impacts during construction	<u>NAH3</u> All personnel working on-site would receive training to ensure awareness of requirements of the non-Aboriginal Heritage Management Plan and relevant statutory responsibilities. Site-specific training would be given to personnel when working in the vicinity of identified non-Aboriginal heritage items.	Site Manager	Pre-construction
Protection of heritage values	<u>NAH4</u> The protection of areas of identified non-Aboriginal cultural heritage values that are to be retained such as the Penrith Ambulance Station would occur in accordance with the adopted non-Aboriginal Heritage Management Plan.	Site Manager	Construction
Protection of heritage values	<u>NAH5</u> Consistent with any specific requirements of the approved non-Aboriginal Heritage Management Plan and/or any exemptions, exceptions or excavation permits issued by the Office of Environment and	Project Manager	Construction

Impact	Environmental safeguards	Responsibility	Timing
	Heritage, salvage of non-Aboriginal cultural heritage material would be carried out.		
Protection and recording of heritage values	<u>NAH6</u> An archival recording would be prepared of the railway bridge and Woodriff Gardens prior to any work being carried out that affects the item. The recording would be prepared in accordance with guidelines published by the Office of Environment and Heritage.	Project Manager	Construction

6.4 Water quality, hydrology and flooding

A hydrology and hydraulic impact assessment was carried out for the proposal as part of this REF. The report is attached as Appendix I and is summarised below.

6.4.1 Existing environment

Overview

The proposal area is located in the Nepean River sub-catchment of the Hawkesbury-Nepean catchment. There are a number of water bodies within and in proximity to the proposal area and subsurface drainage is evident throughout.

Peachtree Creek flows from south to north through the west of the proposal area and joins the Nepean River about 500 m to the north of the proposal area. The Great Western Highway crosses Peachtree Creek within the proposal area whilst Boundary Creek flows from east to west about 500 – 600 m north of the proposal area and joins the Nepean River at the same point as Peachtree Creek. Additionally, there is one dam located to the north west of Castlereagh Road opposite Museum Drive.

Water quality

Hydrological and sediment regimes have been dramatically altered for water bodies in the vicinity of the proposal area due to vegetation clearance and increasing urbanisation which impacts on water quality. The quality of surface runoff into the nearby creeks is impacted by the build-up of contaminants on the road surface including hydrocarbons, fuel additives and lubricants whilst stormwater from urban areas reduces water quality.

Urban and industrial areas in the sub-catchment as well as stormwater, agriculture, mining and water extraction have had adverse effects on the Nepean River. As such, there are 11 weirs on the river that regulate natural flows, creating a series of 'weir lakes' rather than a free flowing river.

Observations of Peachtree Creek during the biodiversity as outlined in Section 6.11.1 illustrated low-moderate water quality attributable to human influence which has contributed to poor flow, barriers for aquatic movement, erosion and disturbance to riparian vegetation.

Hydrology

Local catchment

Heavy rainfall in the Penrith CBD results in characteristic overland flow within the proposal area, hereafter referred to as the local catchment scenario. This scenario illustrates an overland flow

path originating from the south-east catchments, traversing the Mulgoa Road and Great Western Highway intersection and continuing across the tennis facilities before discharging to Peachtree Creek. At the railway bridge, floodwaters up to about 2.5 m in depth can be expected for the 1 in 100 year Average Recurrence Interval (ARI) flood event. There is a 375 mm diameter pipe on the northern side of the railway line that provides the only discharge point for the trapped water at this sag point.

Mainstream

The mainstream flooding scenario (i.e. flooding from the Nepean River) results in more extensive flooding than the local catchment scenario. Specifically, it results in overtopping the eastern banks of Peachtree Creek during the 1 in 100 year ARI flood event. Overtopping floodwaters from Peachtree Creek traverse the tennis facilities before flowing downstream under the railway bridge and entering the industrial area to the north.

Flooding

Overview

Flooding is therefore common in the area and as illustrated in Figure 6-8 to Figure 6-10. Some properties along Ladbury Avenue are affected by flooding from Peachtree Creek for events as frequent as the 1 in 5 year ARI flood event (for the local catchment scenario) and flood affectation of the properties is significantly worse for the mainstream flooding scenario.

Local catchment

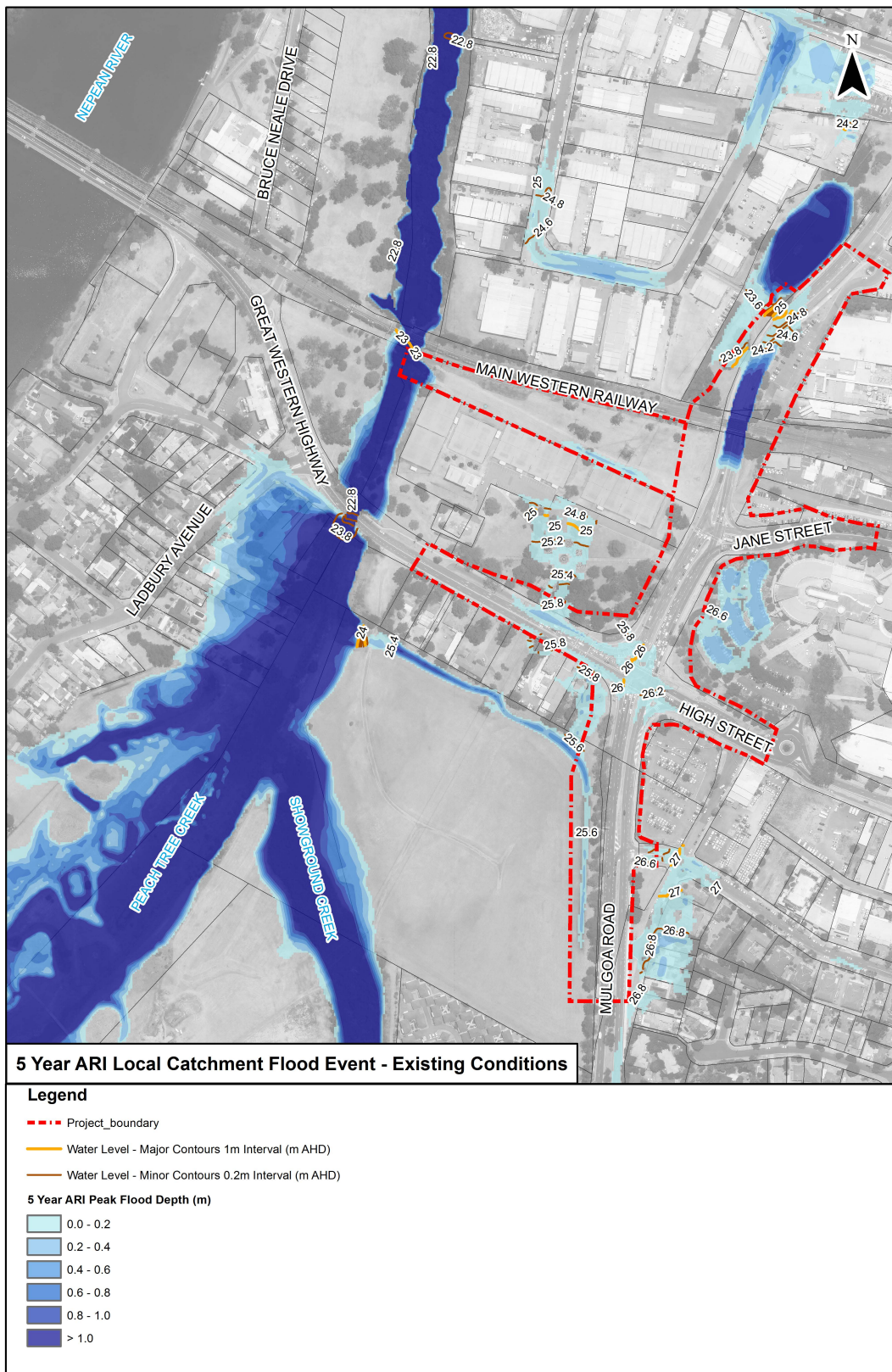


Figure 6-8 Existing conditions for the 1 in 5 year flood event for the local catchment scenario

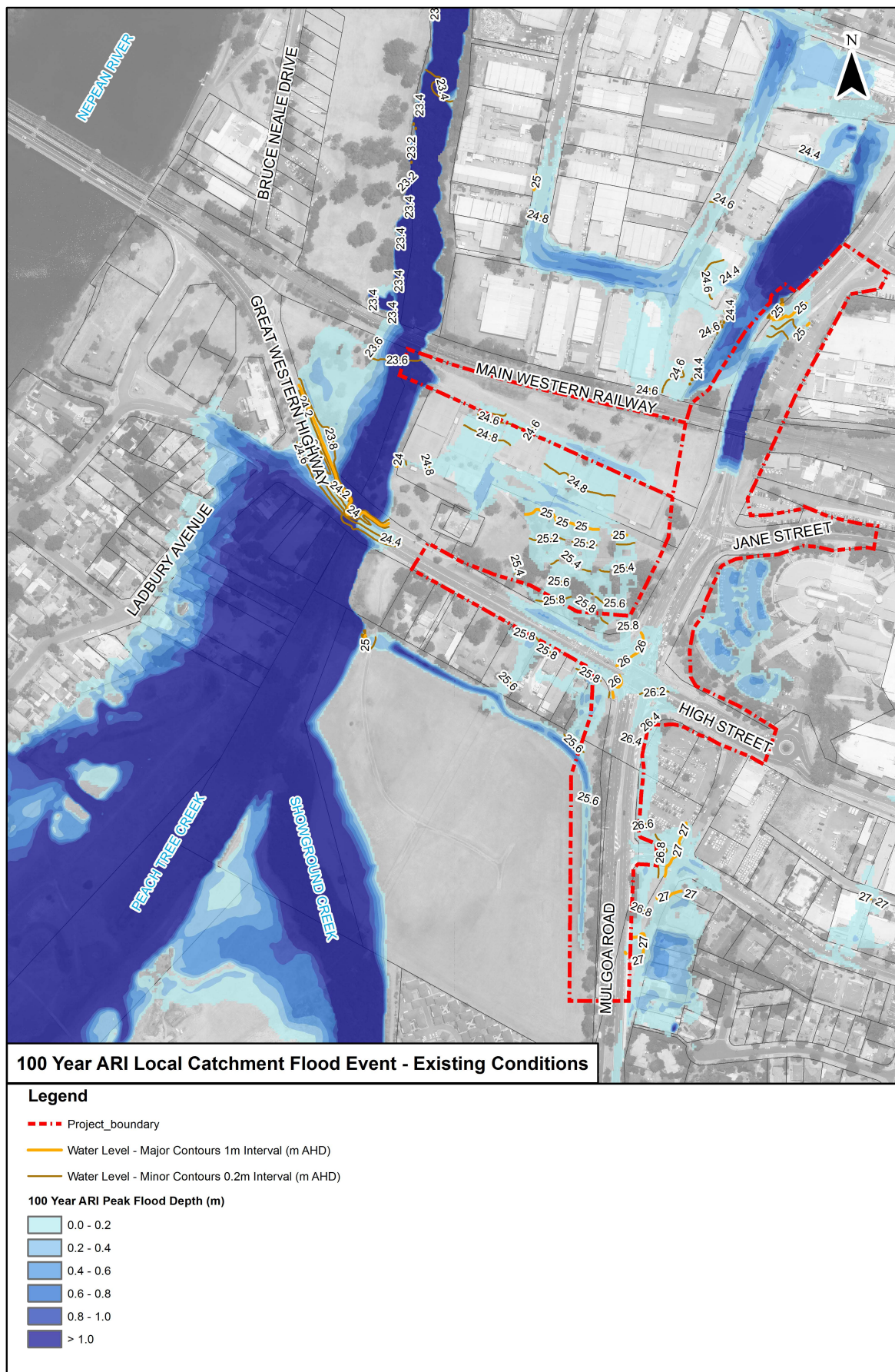


Figure 6-9 Existing conditions for the 1 in 100 year flood event for the local catchment scenario

Mainstream

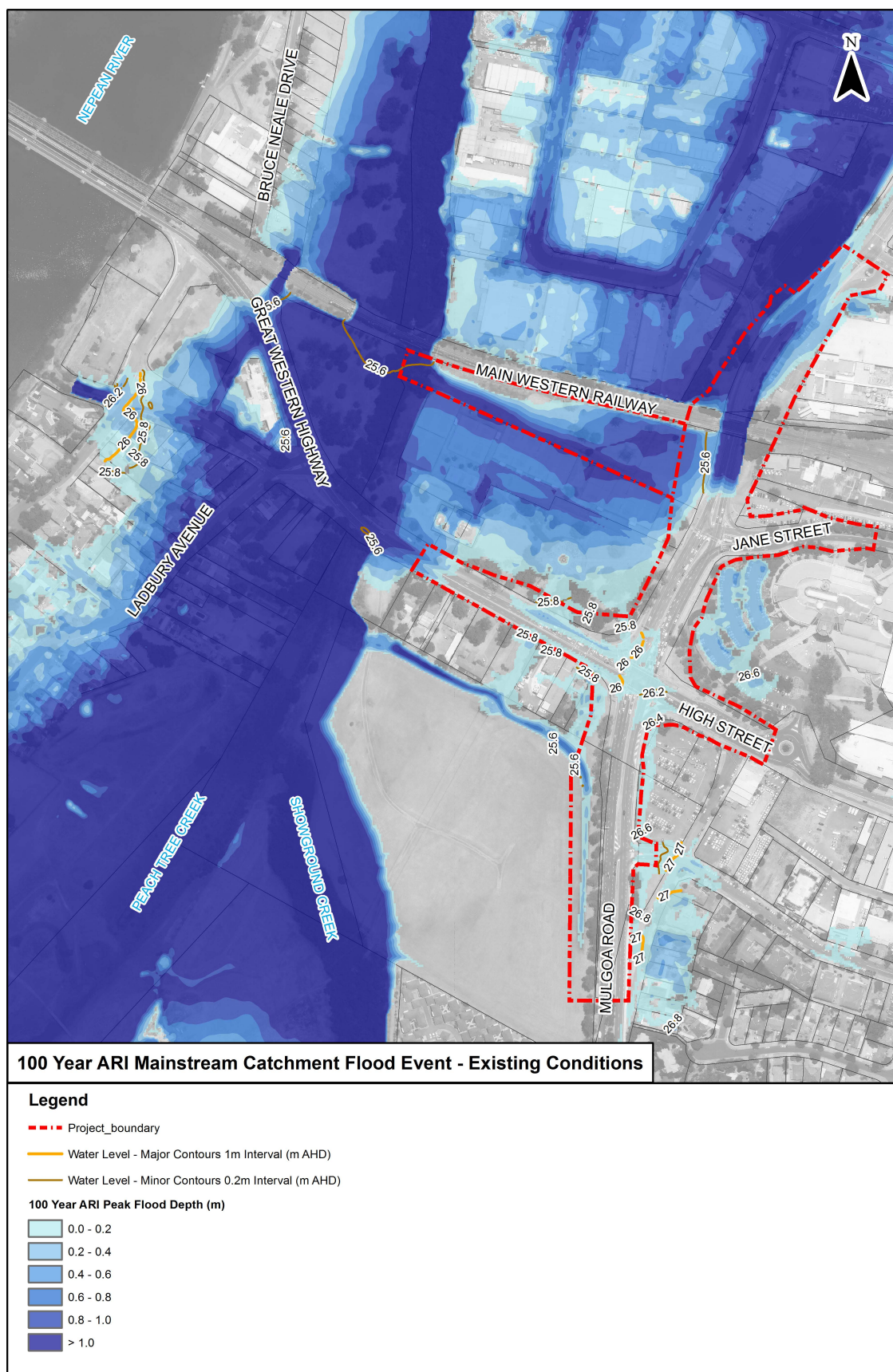


Figure 6-10 Existing conditions for the 1 in 100 year flood event for the mainstream scenario

6.4.2 Potential impacts

Construction

Water quality

Construction of the proposal has the potential to impact on water quality due to erosion and sedimentation, particularly during heavy rainfall events. Proposed earthworks (as described in Section 3.3) include excavation, particularly in the vicinity of the railway bridge which contains a stormwater outlet to Peachtree Creek. The stormwater outlet is proposed to be relocated to the southern side of the railway line as well as the addition of another stormwater outlet. Both of these would flow into Peachtree Creek. Water quality should be appropriately managed through the implementation of safeguard measures.

During earthworks top soil is stripped back and soil material is exposed creating the potential for erosion, runoff and sedimentation during heavy rainfall events. There is a risk that water bodies and the nearby dam to the north of the bridge could become polluted by sediment runoff and construction waste; however, this is expected to be appropriately managed through the implementation of safeguard measures.

As such, the impact of the proposal on water quality is **minor adverse** during construction.

Hydrology

Construction of the proposal would have a **negligible** impact on the flow paths and existing hydrology within the proposal area during construction as appropriate safeguards measures would be implemented.

Flooding

The installation of drainage would be carried out in a staged manner as described in Section 3.3 to account for the potential for flood risk and ensure that the stormwater outlets would remain open throughout construction. Further appropriate mitigation measures would be installed to account for the hydrological patterns and potential for flooding, particularly around the railway bridge.

Construction of the proposal would therefore have a **low adverse** impact on flooding.

Operation

Water quality

As part of the proposal, the existing stormwater drain with an outfall to Peachtree Creek would be replaced with a drain of greater dimension. The existing outfall arrangements and water quality measures would be adopted to manage any potential impacts to water quality.

Hydrology

Changes to the peak flows are found to be negligible for the local catchment scenario and vary up to around seven per cent for the 1 in 100 year ARI flood event in the mainstream scenario. Slightly increased flows would be evident through the Bruce Neale Drive underpass and reduced flows would be expected through Peachtree Creek at the railway bridge and Castlereagh Road underpass. It can be concluded that the proposal would not affect flow distribution in the local catchment scenario whilst widening the railway underpass on Castlereagh Road would not significantly alter flow distribution on the floodplain.

Replacement of the existing stormwater drain with an outfall to Peachtree Creek with a drain of greater dimension may change the volumes of water and speed of water flow being discharged into the creek, leading to changed hydrology and increased turbidity. However these changes are expected to be minor and as discussed in Section 6.11, the ecological values of Peachtree Creek are considered low.

As such, the proposal would have a **negligible** impact on hydrology during operation.

Flooding

Flood modelling was carried out to determine the impact of the proposal on peak flows for the 1 in 100 year ARI event for the local catchment and mainstream scenarios. As noted above, changes to peak flows would be negligible for the local catchment scenario and minor for the mainstream scenario.

Local catchment

Due to the lowering of the design road surface level and widening of the railway bridge it can be seen in Figure 6-11 that there is a decrease in the peak flood levels for the 1 in 100 year flood event at this location compared to existing conditions. Further, there is negligible change to the flood affectation of properties as a result of the proposal.

As such, operation of the proposal would have a **negligible** impact on flooding for the local catchment scenario.

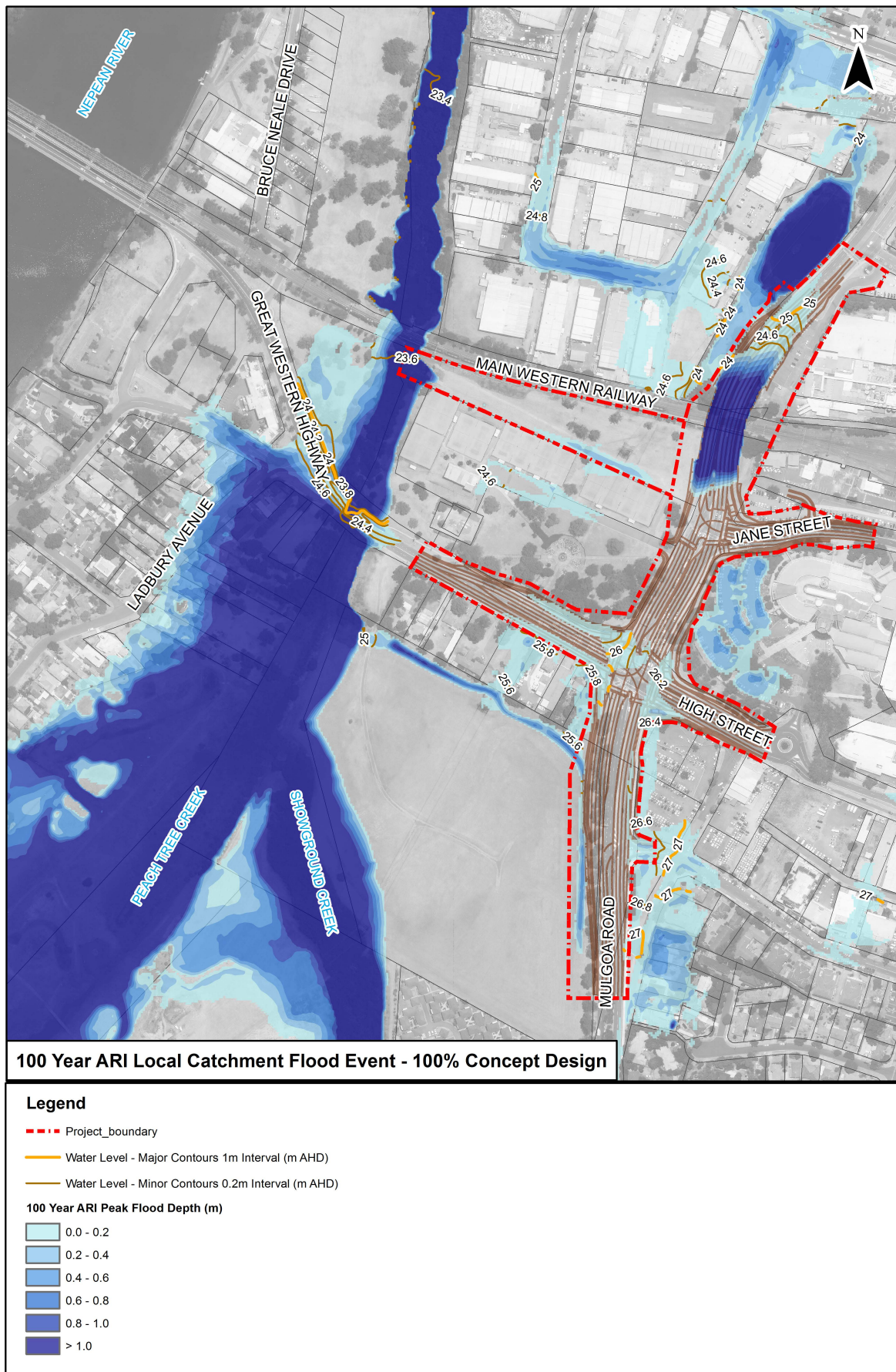


Figure 6-11 Modelled conditions for the 1 in 100 year flood event for the local catchment scenario

Mainstream

A slight increase in the peak flood levels (up to a maximum of 0.03 m) was evident for the 1 in 100 year ARI flood event. Without mitigation, this would result in overtopping the banks of the Peachtree Creek and spreading into the immediate surrounds, therefore marginally expanding the extent of flooding as illustrated in Figure 6-12. Appropriate safeguard measures and minor regrading work would therefore be incorporated into the detailed design, therefore resulting in a minimal impact on existing flood behaviour.

Operation of the proposal would have a **minor adverse** impact on flooding for the mainstream scenario.

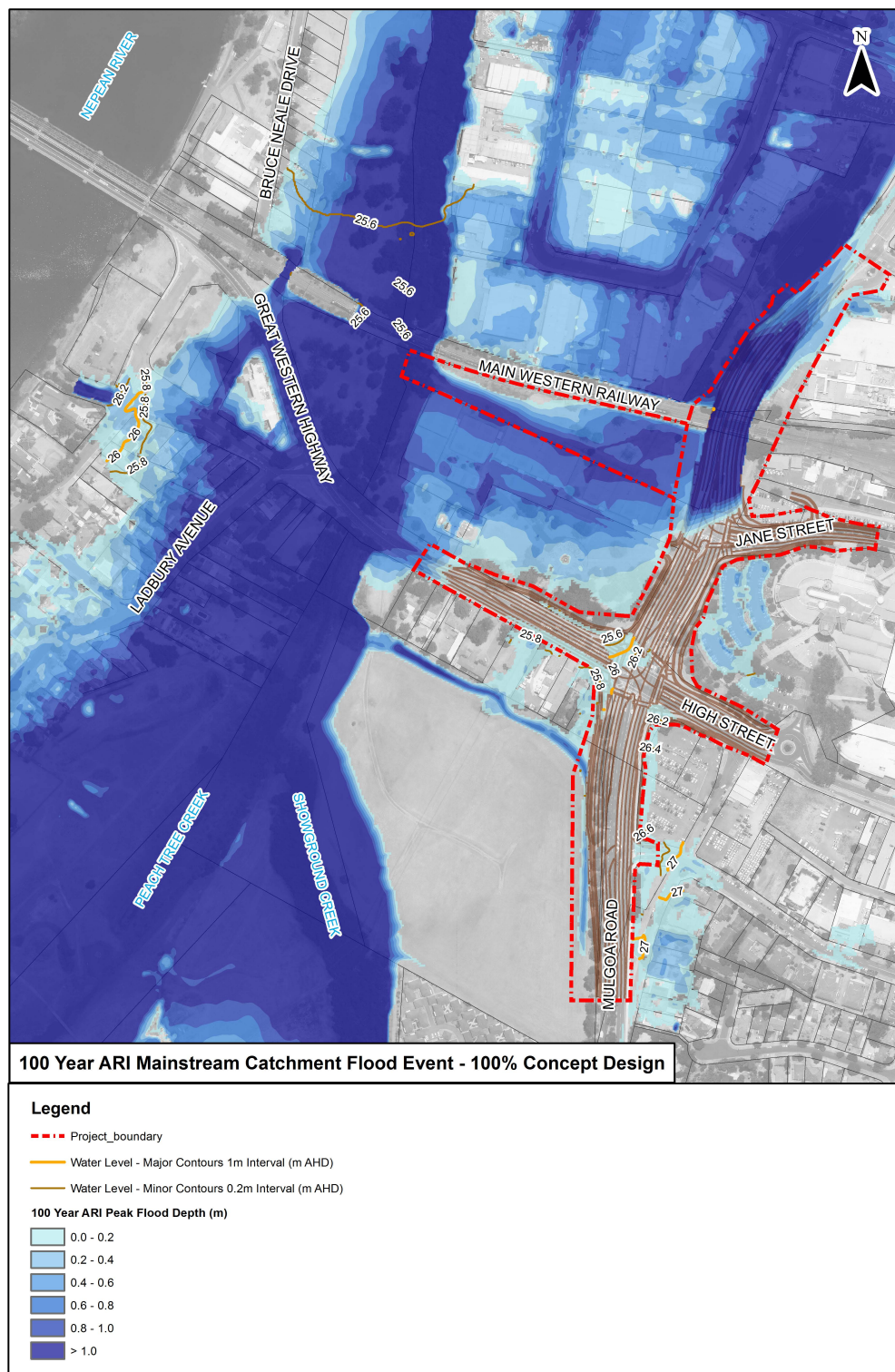


Figure 6-12 Modelled conditions for the 1 in 100 year flood event for the mainstream scenario

6.4.3 Safeguards and management measures

The safeguards and mitigation measures detailed in Table 6-8 would be implemented to minimise the impacts of the proposal on traffic and access.

Table 6-8 Environmental safeguards for water quality, flooding and hydrology

Impact	Environmental safeguards	Responsibility	Timing
Water quality impacts during construction	<u>W1</u> A Soil and Water Management Plan (SWMP) would be prepared in accordance with QA Specification G38 and implemented as part of the CEMP. The SWMP would identify all reasonably foreseeable risks relating to soil erosion and water pollution associated with undertaking the activity, and describe how these risks would be managed and minimised during construction. That would include arrangements for managing pollution risks associated with spillage or contamination on the site and adjoining areas, and monitoring during and post-construction.	Project Manager	Pre-construction
Water quality impacts during construction	<u>W2</u> A site specific Erosion and Sediment Control Plan (ESCP) would be prepared and included in the SWMP and CEMP. The ESCP would identify detailed measures and controls to be applied to minimise erosion and sediment control risks including, but not necessarily limited to: runoff, diversion and drainage points; sediment basins and sumps; scour protection; check dams, fencing and swales; and staged implementation arrangements. The ESCP would also include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.	Project Manager	Pre-construction
Minimise risks to water quality during construction	<u>W3</u> Consistent with any specific requirements of the approved	Site Manager	Construction

Impact	Environmental safeguards	Responsibility	Timing
	<p>SWMP, control measures would be implemented to minimise risks associated with erosion and sedimentation and entry of materials to drainage lines and waterways. That would include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> • sediment management devices, such as sediment fencing, straw bales or sand bags • measures to divert or capture and filter water prior to discharge, such as drainage channels and first flush • scour protection and energy dissipaters at locations of high erosion risk • installation of measures at work entry and exit points to minimise movement of material onto adjoining roads, such as rumble grids or wheel wash bays • appropriate location and storage of construction materials, fuels and chemicals, including bunding where appropriate. 		

6.5 Noise and vibration

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

6.5.1 Existing environment

A number of noise and vibration sensitive receivers are currently located within the proposal area, including:

- Residential receivers in the south western and south eastern corners of the proposal area
- Community and cultural receivers to the east of the proposal area, including the Penrith City Council, Penrith City Library and the Joan Sutherland Performing Arts Centre
- Rowing and tennis facilities to the west of the proposal area (active recreation receivers)
- Woodriff Gardens park (passive recreation).

The existing land use within the proposal area to the north of the railway line is predominantly industrial and therefore is not considered noise-sensitive to road traffic noise under the *NSW Road Noise Policy* (RNP). As such, operational noise impacts on receivers located north of the rail line have not been considered in this REF. However, these receivers may be considered noise-sensitive for construction noise and therefore have been included in the construction noise impact assessment in Section 6.5.4.

Future residential development is also being planned within the proposal area which could increase the number of sensitive receivers. These receivers would be located to the north-east of the proposal area. However, the impact of the proposal on these receivers would be considered as part of the planning controls for the residential development and hence impacts to future development falls out of the scope of this REF.

Existing transport noise sources in the proposal area include:

- Road traffic noise along the Great Western Highway-High Street and Mulgoa Road-Castlereagh Road
- Rail noise from the railway line.

Noise from road traffic is the dominant noise source at the residential receivers within the proposal area.

Figure 6-13 shows the locations of the existing noise sensitive receivers and the main noise sources within the proposal area.

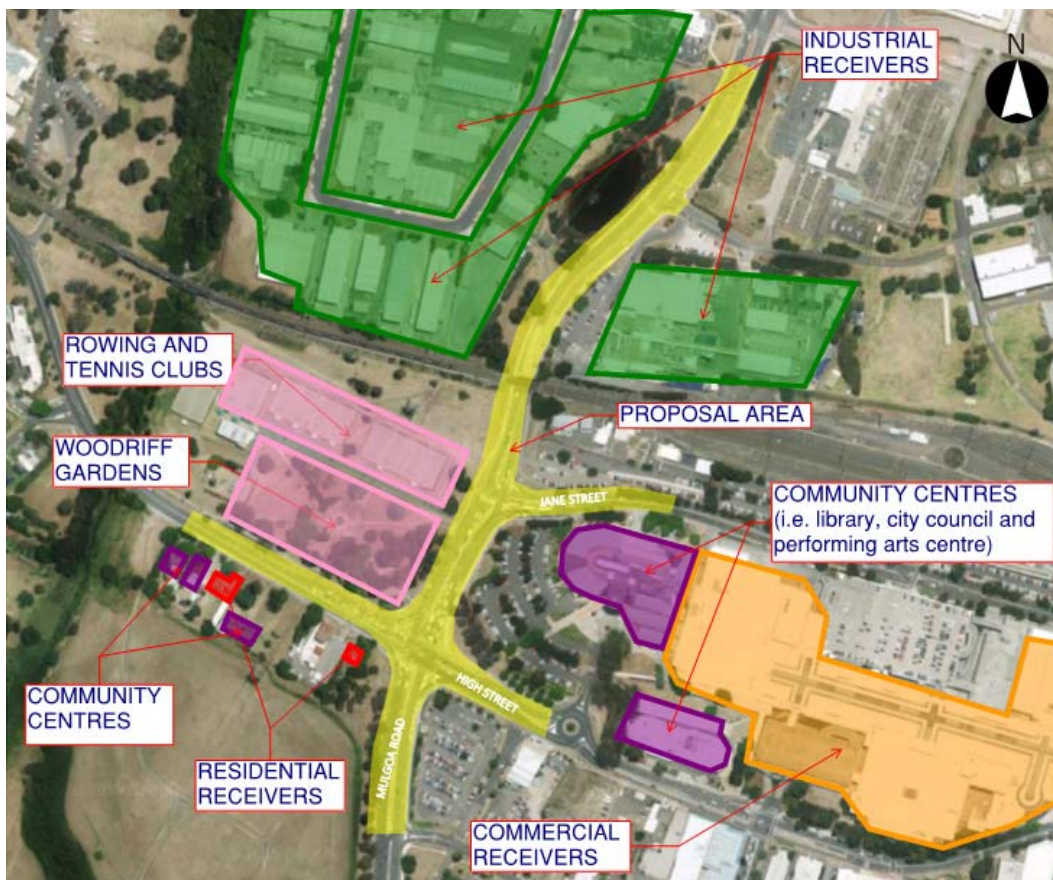


Figure 6-13 Location of noise and vibration sensitive receivers and main sources of noise around the proposal area

Noise monitoring

Unattended noise monitoring was conducted by Arup for seven consecutive days between Thursday 26 November 2015 and Thursday 3 December 2015. Noise loggers were set up at:

- 682 Jane Street, Penrith
- 57 Mulgoa Road, Penrith.

The noise monitoring locations were selected so that each logger was only exposed to noise levels from one road segment, allowing each segment to be calibrated by itself and verified in the acoustic model.

The results of the unattended noise monitoring were used to characterise the existing ambient noise environment. Background noise levels (L_{Aeq} – A-weighted equivalent noise levels) and rating background levels (RBLs) determined for the proposal are summarised in Table 6-9.

Table 6-9 Existing average road traffic noise levels

ID	Location	Distance to Nearest Road Kerb	Distance to Nearest Residential Receiver	Day (7am-10pm), dB		Night (10pm-7am), dB	
				$L_{Aeq,(15\text{ hour})}$	RBL	$L_{Aeq,(9\text{ hour})}$	RBL
U1	682 Jane Street, Penrith	5 m	15 m	71	55	66	38
U2	57 Mulgoa Road, Penrith	4 m	12 m	70	47	66	33

The unattended noise measurements were supplemented by a 15-minute attended noise level measurement at each noise logger on commencement and completion of the logging period for the purposes of verification.

Attended noise level measurements were also carried out at:

- Woodriff Gardens/Penrith City Council (measuring contribution from segment between Jane Street and High Street)
- West of Mulgoa Road within the open area opposite John Tipping Grove (measuring segment south of High Street, for comparison with 57 Mulgoa Road logger data)
- 666 High Street (nearest residential noise sensitive receiver).

The results of the attended noise measures are summarised in Table 6-10 and Table 6-11.

Table 6-10 Simultaneous short term noise survey summary at opposite sides of road segment north of intersection between High Street and Mulgoa Road

ID	Location	Distance to Nearest Road Kerb	Distance to Nearest Residential Receiver	Date/Time	$L_{Aeq, 30min}$	$L_{A90, 30min}$	$L_{A10, 30min}$	$L_{A1, 30min}$
A1	Woodriff Gardens	4 m	N/A	26-11-15 14:30	72	62	74	82
				03-12-15 11:00	71	61	74	80
A2	Penrith Civic Centre	8 m	N/A	26-11-15 14:30	68	61	70	78

ID	Location	Distance to Nearest Road Kerb	Distance to Nearest Residential Receiver	Date/ Time	L _{Aeq} , 30min	L _{A90} , 30min	L _{A10} , 30min	L _{A1} , 30min
	Penrith Civic Centre	4 m	N/A	03-12-15 11:00	72	60	73	81

Table 6-11 Short term noise survey summary at additional locations

ID	Location	Distance to Nearest Road Kerb	Distance to Nearest Residential Receiver	Date/ Time	L _{Aeq} , 30min	L _{A90} , 30min	L _{A10} , 30min	L _{A1} , 30min
A3	Open area opposite John Tipping Grove	7 m	N/A	26-11-15 15:00	71	62	73	79
				03-12-15 11:45	69	59	72	78
A4	666 High Street, Penrith	6 m	16 m	03-12-15 11:45	70	62	73	79

The location of the attended and unattended noise measurements are shown in Figure 6-14.



Figure 6-14 Attended and unattended noise measurement locations

6.5.2 Policy setting

The following noise and vibration impact assessment has been carried out in accordance with:

- *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*, Australian Standard AS2436, 2010
- *Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise*, British Standards BS5228-1:2009 + A1, 2014
- *NSW Road Noise Policy*, Department of Environment, Climate Change and Water NSW, March 2011
- *Guide to Evaluation of Human Exposure to Vibration in Buildings (Part 1: Vibration Sources Other Than Blasting)*, British Standard BS 6472-1, June 2008
- *Evaluation and Measurement for Vibration in Buildings (Part 2: Guide to Damage Levels From Groundborne Vibration)*, British Standard BS7385-2, November 1993
- *Structural Vibration - Effects of Vibration on Structures*, German Standard DIN 4150-3, February 1999
- *NSW Interim Construction Noise Guideline*, Department of Environment, Climate Change and Water NSW, July 2009
- *NSW Industrial Noise Policy*, Environment Protection Authority, January 2000
- *NSW Road Noise Policy*, Department of Environment, Climate Change and Water NSW, March 2011
- *Noise Criteria Guideline*, NSW Roads and Maritime Services, April 2015

- *Noise Mitigation Guideline*, NSW Roads and Maritime Services, April 2015
- *Assessing Vibration: A Technical Guideline*, Department of Environment and Conservation, February 2006.

6.5.3 Criteria

Construction noise

Residences

The ICNG establishes a “noise affected” and “highly noise affected” criteria to determine the noise management requirements necessary to minimise construction noise impacts on residential receivers. The construction noise criteria for residential receivers is summarised in Table 6-12.

Table 6-12 Construction noise criteria for residential receivers

Period	Management level criteria $L_{Aeq, (15 \text{ min})}$	Management requirements
Recommended standard hours: Monday to Friday (7am to 6pm) Saturday (8am to 1pm)	Noise affected RBL + 10 dB	<ul style="list-style-type: none"> • Apply all feasible and reasonable work practices to meet the affected level • Inform all potentially impacted residents of the nature of the work to be carried out, the expected noise levels, duration and contact details
	Highly noise affected 75 dB(A)	<ul style="list-style-type: none"> • The relevant authority may require respite periods by restricting the hours that very noisy activities can occur
Outside recommended standard hours	Noise affected RBL + 5 dB	<ul style="list-style-type: none"> • The relevant authority may request strong justification to carry out work outside of standard hours • Apply all feasible and reasonable work practices to meet the affected level • Negotiate with the community if the criteria is not met

Other sensitive land uses

The ICNG also provides recommended noise levels for sensitive land uses other than residential receivers. These recommended limits are summarised in Table 6-13.

Table 6-13 Recommended construction noise limits for non-residential sensitive receivers

Sensitive Land Use	Management level, $L_{Aeq, 15 \text{ min}}$ (applies when properties are being used)
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)

Sensitive Land Use	Management level, $L_{Aeq,15min}$ (applies when properties are being used)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dB(A)
Community centres	Internal noise levels 45 dB(A) (based on the Maximum internal noise level for Reading Areas in public libraries in AS2107)

Internal noise limits have been converted to external noise limits (for noise prediction) by assuming:

- For the Joan Sutherland Performing Arts Centre, an external noise criteria of 70 dB(A) derived from:
 - a satisfactory internal noise level of 25 dB(A),
 - a façade loss of 20 dB(A) and,
 - 25 dB(A) loss from sound propagating across the Foyer to the performance spaces
- An external noise criteria of 75 dB(A) for the Penrith City Library building, derived from:
 - a maximum internal noise level of 45 dB(A) for reading areas
 - 30 dB(A) façade loss based on the observable building construction.

Commercial and industrial premises

The ICNG also gives recommended management measures for commercial (e.g. offices, retail outlets) and industrial premises:

- Commercial premises: external $L_{Aeq,15minute}$ 70 dB(A)
- Industrial premises: external $L_{Aeq,15minute}$ 75 dB(A)

Operational noise

The noise criteria for residential and non-residential receivers is established in Roads and Maritime's Noise Criteria Guideline (NCG). The relevant noise criteria for the proposal is shown in Table 6-14.

Table 6-14 Road traffic noise assessment criteria for residential and non-residential land uses

Type of project/ land use	Assessment Criteria – dB(A)	
	Day (7am-10pm)	Night (10pm-7am)
Existing residences affected by noise from redevelopment of existing freeways/ arterial/ sub-arterial roads	$L_{Aeq, (15 \text{ hour})}$ 60 (external)	$L_{Aeq, (9 \text{ hour})}$ 55 (external)
Open space (active use ¹)	$L_{Aeq, (15 \text{ hour})}$ 60 (external) when in use	–
Open space (passive use ²)	$L_{Aeq, (15 \text{ hour})}$ 55 (external) when in use	–

¹ Active recreation is characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion.

² Passive recreation is characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, e.g. playing chess, reading.

Vibration

Human comfort and amenity

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

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

The recommended vibration limits for maintaining human comfort in residences and other relevant receiver types for continuous/impulsive and intermittent vibration are provided in Table 6-15 and Table 6-16.

Table 6-15 Preferred and maximum weighted root-mean-square (rms) values for continuous and impulsive vibration acceleration (m/s^2) 1-80 Hz

Type of project/ land use	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axes	z-axis	x- and y-axes
Continuous Vibration					
Residences	Daytime 0700-2200	0.010	0.0071	0.020	0.014
	Night-time 2200-0700	0.007	0.005	0.014	0.010
Impulsive Vibration					
Residences	Daytime 0700-2200	0.30	0.21	0.60	0.42
	Night-time 2200-0700	0.10	0.071	0.20	0.14

Table 6-16 Acceptable vibration dose values for intermittent vibration ($\text{m/s}^{1.75}$)

Location	Daytime 0700-2200		Night-time 2200-0700	
	Preferred value	Maximum value	Preferred values	Maximum value
Residences	0.20	0.40	0.13	0.26

Building damage

Part 2 of British Standard *BS 7385:2 – Evaluation and measurement for vibration in buildings-Part 2: Guide to damage levels from groundborne vibration* gives specific guidance on the levels of vibration below which building structures are considered to be at minimal risk. Limits to the acceptable levels of vibration on the foundations of a building as proposed in the standard are listed in Table 6-17.

Table 6-17 Transient vibration guide values for cosmetic damage

Category	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
2) Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s @ 4 Hz increasing to 20 mm/s @ 15 Hz	20 mm/s @ 15 Hz increasing to 50 mm/s @ 40 Hz and above

German Standard *DIN 4150:3 – Structural vibration, Part 3: Effects of vibration on structures* (1999) also provides guidelines for short-term and steady state structural vibration for varying types of buildings. The limits for short-term vibration in buildings of varying sensitivities are listed in Table 6-18.

Table 6-18 Guideline values of vibration velocity for evaluating the effects of short-term vibration

	Vibration Velocity, v_i , in mm/s			
	Foundation			Plane of floor of uppermost full storey
Structural type	1 Hz to 10 Hz	10 to 50 Hz	50 to 100 Hz	Frequency mixture
Dwellings or similar	5	5 to 15	15 to 20	15

The guidelines state that:

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

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

6.5.4 Potential impacts

Construction noise

A construction noise assessment was carried out in accordance with the ICNG. The following major construction activities were modelled:

- Construction compounds (including stockpiling)
- Utility relocation
- Road construction (including earthworks, drainage work and road surfacing)
- Bridgework (including piling)
- Finishing works.

Noise impacts from construction activities were modelled based on the typical construction equipment (see Section 3.3.4) and the derived sound power levels for each activity. Table 6-19 provides a summary of the highest predicted noise levels for each activity at each category of noise receiver. Time periods where construction noise would exceed the management level are denoted in bold. Exceedances of the Highly Noise Affected Level at residences have been shaded.

Table 6-19 Construction noise calculations

Activity	Receiver	Predicted Construction Noise Level dB L _{Aeq,adj,15min}	Noise Limits dB(A)		
			Day	Evening	Night
Site Compounds	Arts centre	56	70	-	-
	Library	58	75	-	-
	Gardens	61	60*	-	-
	Tennis club	68	65*	-	-
	Residential (High Street)	56	65	56	43
	Residential (Mulgoa Road)	57	57	50	38
Site Compounds	Residential (Retirement Village)	60	57	50	38
Utility relocation	Arts centre	69	70	-	-
	Library	71	75	-	-
	Gardens	74	60*	-	-
	Tennis club	81	65*	-	-
	Residential (High Street)	73	65	56	43
	Residential (Mulgoa Road)	70	57	50	38
	Residential (Retirement Village)	66	57	50	38
Pavement Removal	Arts centre	79	70	-	-
	Library	85	75	-	-
	Gardens	82	60*	-	-
	Tennis club	77	65*	-	-
	Residential (High Street)	88	65	56	43
	Residential (Mulgoa Road)	74	57	50	38
	Residential (Retirement Village)	67	57	50	38

Activity	Receiver	Predicted Construction Noise Level dB L _{Aeq,adj,15min}	Noise Limits dB(A)		
			Day	Evening	Night
Earthworks	Arts centre	68	70	-	-
	Library	74	75	-	-
	Gardens	71	60*	-	-
	Tennis club	66	65*	-	-
	Residential (High Street)	77	65	56	43
	Residential (Mulgoa Road)	63	57	50	38
	Residential (Retirement Village)	58	57	50	38
Pavement Works	Arts centre	70	70	-	-
	Library	76	75	-	-
	Gardens	73	60*	-	-
	Tennis club	68	65*	-	-
	Residential (High Street)	79	65	56	43
	Residential (Mulgoa Road)	65	57	50	38
	Residential (Retirement Village)	58	57	50	38
Bridgeworks (Hammer Piling)	Arts centre	63	70	-	-
	Library	70	75	-	-
	Gardens	67	60*	-	-
	Tennis club	74	65*	-	-
	Residential (High Street)	61	65	56	43
	Residential (Mulgoa Road)	59	57	50	38
	Residential (Retirement Village)	55	57	50	38

Activity	Receiver	Predicted Construction Noise Level dB L _{Aeq,adj,15min}	Noise Limits dB(A)		
			Day	Evening	Night
Finishing Works	Arts centre	65	70	-	-
	Library	71	75	-	-
	Gardens	68	60*	-	-
	Library	63	65*	-	-
	Residential (High Street)	74	65	56	43
	Residential (Mulgoa Road)	60	57	50	38
	Residential (Retirement Village)	55	57	50	38

* Noise limit only applies when area is in use

The initial construction noise predictions indicate that construction noise impacts are expected for the following activities:

- Bridge works outside of hours.
- Any daytime, evening or night works in the vicinity (within about 100 m) of residential premises
- Any works in the vicinity (within about 150 m) of the Jane Sutherland Performing Arts Centre
- Any works in the vicinity (within about 100 m) of Woodriff Gardens.

For the loudest activities (e.g. pavement removal) the Highly Noise Affected Level will likely be exceeded when the source is in the immediate vicinity of residences (e.g. immediately in front of the residence). This would be expected to occur for receivers on High Street when works are conducted west of the on High Street intersection. Noise levels at other times would be significantly reduced due to the increased source-receiver distance – e.g. when the source is located on Mulgoa Road construction noise levels at most High Street receivers would reduce by around 15-20 dB(A).

Work carried out during night time hours also has the potential for sleep disturbance. Based on indicative predictions, it is expected that the following activities may cause sleep disturbance impacts and would require more-detailed assessment prior to construction:

- Utility relocation (in the vicinity of residential receivers)
- Road construction (in the vicinity of residential receivers)
- Finishing works (in the vicinity of residential receivers).

Bridgeworks are located sufficiently far (more than 300 m) from residential receivers that sleep disturbance impacts are unlikely, however a screening assessment should be conducted once the proposed construction methodology and equipment has been finalised.

Indicative maps showing the expected maximum areas of construction noise impacts for the proposal are presented in Appendix J.

The impact of the proposal on noise amenity is likely to be **moderate adverse** during construction.

It should be noted that the construction contractor would refine construction methods to minimise the construction noise and sleep disturbance impacts upon noise sensitive receivers adjacent to the proposal area, and would be required to prepare a detailed construction noise and vibration management plan as part of the construction process. Initial construction noise mitigation and management measures have been developed for the proposal and have been provided in Section 6.5.5 of this REF.

Operational noise

Road traffic noise levels have been predicted for residential receivers and other sensitive land uses along the existing and proposed alignment for two future time periods:

- The year of opening (2019)
- 10 years after opening (2029 – the 'design year').

These time periods were based on the original project program, which has since been revised for an opening year of 2020.

It is not expected that traffic volumes from 2019 to 2020 would increase considerably, with the per cent of heavy vehicles also expected to be similar. This means that the noise levels in 2020 would be similar to the 2019 noise levels presented below (an increase no more than 0.5 dB may occur which is considered to be negligible.) Similarly, the difference between 2029 traffic volumes (used for the noise modelling) and 2030 traffic volumes is not expected to change significantly, with no considerable change to the number of heavy vehicles expected in that period either. Again, this would result in a negligible increase in noise levels (less than 0.5 dB) compared to the predicted 2029 noise levels. The extent of noise mitigation suggested in accordance with the assessment below would not change with this negligible increase in noise levels. Noise levels for the opening and design years would be re-evaluated during the detailed design stage.

Two scenarios have also been considered:

- Without the proposal – termed the 'no-build' scenario
- With the proposal – termed the 'build' scenario.

The predicted noise levels at individual receivers are presented in Table 6-20.

The applicable noise criteria have been determined for each property individually based on the requirements of the NCG.

Table 6-20 Predicted road traffic noise levels

Receiver ID	Façade	Floor	NCG criteria, dB(A)		Year of opening 'No Build' scenario dB(A)		Year of opening 'Build' scenario dB(A)		Design year 'No Build' scenario dB(A)		Design year 'Build' scenario dB(A)		Is the NMG criteria exceeded?		Change in noise level dB(A)			
															Year opening		Design year	
			Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
1 De Vilnits Parade	North-west	G	60	55	54	50	55	50	55	50	55	51			0.2	0.2	0.5	0.7
2 De Vilnits Parade	North-west	G	60	55	55	51	55	51	56	51	56	52			0.2	0.2	0.6	0.7
3 De Vilnits Parade	North-west	G	60	55	56	51	56	51	56	52	57	52			0.2	0.2	0.5	0.7
		1	60	55	58	53	58	53	58	54	59	54			0.1	0.2	0.6	0.7
4 De Vilnits Parade	North-west	G	60	55	52	46	52	47	52	47	53	48			0.1	0.1	0.4	0.6
		1	60	55	54	49	54	49	54	49	55	50			0.1	0.1	0.4	0.6
5 De Vilnits Parade	North-west	G	60	55	51	47	52	47	52	47	52	48			0.1	0.2	0.5	0.6
		1	60	55	53	49	54	49	54	49	54	50			0.1	0.1	0.5	0.6
6 De Vilnits Parade	West	G	60	55	52	48	53	48	53	48	53	49			0.1	0.1	0.5	0.6
		1	60	55	54	50	54	50	55	50	55	51			0.1	0.1	0.5	0.6

Receiver ID	Façade	Floor	NCG criteria, dB(A)		Year of opening 'No Build' scenario dB(A)		Year of opening 'Build' scenario dB(A)		Design year 'No Build' scenario dB(A)		Design year 'Build' scenario dB(A)		Is the NMG criteria exceeded?		Change in noise level dB(A)			
															Year opening		Design year	
			Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
4 John Tipping Grove	West	G	60	55	66	61	66	62	67	62	67	63	Y	Y	0.1	0.1	0.4	0.6
		1	60	55	67	63	67	63	68	63	68	64	Y	Y	0.1	0.1	0.5	0.6
	North	G	60	55	62	57	62	57	62	58	63	58	Y	Y	-0.1	-0.1	0.3	0.4
		1	60	55	63	58	63	58	63	59	64	59	Y	Y	-0.1	-0.1	0.3	0.4
	South	G	60	55	57	53	58	53	58	54	59	54			0.1	0.1	0.5	0.6
		1	60	55	59	54	59	55	59	55	60	56		Y	0.1	0.1	0.5	0.6
6-8 John Tipping Grove	West	G	60	55	67	62	67	62	67	63	68	63	Y	Y	0.1	0.2	0.5	0.7
		1	60	55	68	64	68	64	69	64	69	65	Y	Y	0.1	0.1	0.5	0.6
		2	60	55	69	64	69	64	69	65	70	65	Y	Y	0.1	0.1	0.5	0.6
		3	60	55	69	65	69	65	70	65	70	66	Y	Y	0.1	0.1	0.5	0.6
		4	60	55	69	65	69	65	70	65	70	66	Y	Y	0.1	0.1	0.5	0.6
		5	60	55	69	65	69	65	70	65	70	66	Y	Y	0.1	0.1	0.4	0.6

Receiver ID	Façade	Floor	NCG criteria, dB(A)		Year of opening 'No Build' scenario dB(A)		Year of opening 'Build' scenario dB(A)		Design year 'No Build' scenario dB(A)		Design year 'Build' scenario dB(A)		Is the NMG criteria exceeded?		Change in noise level dB(A)			
															Year opening		Design year	
			Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
6-8 John Tipping Grove	North	G	60	55	58	53	58	53	58	54	59	54			0.1	0.1	0.5	0.6
		1	60	55	59	55	59	55	60	55	60	56		Y	0.0	0.1	0.5	0.6
		2	60	55	62	57	62	57	62	57	63	58	Y	Y	0.0	0.0	0.4	0.5
		3	60	55	64	59	64	59	65	60	65	60	Y	Y	-0.1	0.0	0.3	0.5
		4	60	55	64	60	64	60	65	60	65	61	Y	Y	0.0	-0.1	0.3	0.4
		5	60	55	65	60	65	60	65	60	66	61	Y	Y	-0.1	0.0	0.3	0.5
	South	G	60	55	59	54	59	55	59	55	60	56		Y	0.2	0.2	0.5	0.7
		1	60	55	62	57	62	57	62	58	63	58	Y	Y	0.1	0.1	0.6	0.6
		2	60	55	64	59	64	59	64	60	65	60	Y	Y	0.2	0.1	0.6	0.6
		3	60	55	65	60	65	60	65	61	66	61	Y	Y	0.2	0.2	0.5	0.7
		4	60	55	65	61	66	61	66	61	66	62	Y	Y	0.2	0.2	0.5	0.7
		5	60	55	66	61	66	61	66	62	67	62	Y	Y	0.2	0.1	0.5	0.6

Receiver ID	Façade	Floor	NCG criteria, dB(A)		Year of opening 'No Build' scenario dB(A)		Year of opening 'Build' scenario dB(A)		Design year 'No Build' scenario dB(A)		Design year 'Build' scenario dB(A)		Is the NMG criteria exceeded?		Change in noise level dB(A)			
															Year opening		Design year	
			Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
10 John Tipping Grove	West	G	60	55	67	63	68	63	68	64	68	64	Y	Y	0.1	0.1	0.5	0.6
	North	G	60	55	62	58	62	58	63	58	63	59	Y	Y	0.1	0.2	0.6	0.7
	South	G	60	55	63	58	63	58	63	59	64	60	Y	Y	0.1	0.1	0.6	0.7
12 John Tipping Grove	West	G	60	55	69	64	69	65	69	65	70	66	Y	Y	0.2	0.2	0.4	0.3
		1	60	55	70	66	70	66	71	66	71	67	Y	Y	0.2	0.1	0.4	0.4
	North	G	60	55	62	58	62	58	63	58	63	59	Y	Y	0.2	0.2	0.3	0.3
		1	60	55	64	60	64	60	65	60	65	61	Y	Y	0.2	0.1	0.4	0.4
	South	G	60	55	66	61	66	62	66	62	67	63	Y	Y	0.1	0.1	0.4	0.3
		1	60	55	67	62	67	63	67	63	68	64	Y	Y	0.2	0.2	0.4	0.3
14 John Tipping Grove	West	G	60	55	67	63	67	63	68	63	68	64	Y	Y	0.1	0.1	0.6	0.8
	North	G	60	55	59	54	59	54	59	55	60	55			0.1	0.1	0.6	0.7
	South	G	60	55	62	57	62	57	62	58	63	58	Y	Y	0.1	0.1	0.5	0.7

Receiver ID	Façade	Floor	NCG criteria, dB(A)		Year of opening 'No Build' scenario dB(A)		Year of opening 'Build' scenario dB(A)		Design year 'No Build' scenario dB(A)		Design year 'Build' scenario dB(A)		Is the NMG criteria exceeded?		Change in noise level dB(A)			
															Year opening		Design year	
			Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
16 John Tipping Grove	West	G	60	55	70	66	71	66	71	66	71	67	Y	Y	0.1	0.1	0.6	0.7
	North	G	60	55	66	62	66	62	67	62	67	63	Y	Y	0.2	0.2	0.6	0.7
	South	G	60	55	63	59	64	59	64	59	64	60	Y	Y	0.2	0.1	0.6	0.7
60 Union Road	North	G	60	55	54	47	54	47	54	48	55	48			0.0	0.1	0.3	0.4
		1	60	55	55	48	55	49	55	49	56	49			0.1	0.1	0.3	0.4
64 Union Road	North	G	60	55	54	48	54	48	54	48	55	49			0.1	0.1	0.4	0.5
68 Union Road (East building)	North	G	60	55	54	47	54	48	54	48	55	48			0.1	0.1	0.3	0.5
		1	60	55	55	49	55	49	56	49	56	50			0.0	0.1	0.3	0.4
		2	60	55	56	49	56	50	56	50	57	50			0.0	0.1	0.3	0.4
68 Union Road (West building)	North	G	60	55	54	48	54	48	55	48	55	49			0.1	0.2	0.3	0.5
		1	60	55	55	49	55	49	56	50	56	50			0.1	0.1	0.3	0.5
		2	60	55	56	50	56	50	57	51	57	51			0.1	0.2	0.4	0.6

Receiver ID	Façade	Floor	NCG criteria, dB(A)		Year of opening 'No Build' scenario dB(A)		Year of opening 'Build' scenario dB(A)		Design year 'No Build' scenario dB(A)		Design year 'Build' scenario dB(A)		Is the NMG criteria exceeded?		Change in noise level dB(A)			
															Year opening		Design year	
			Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
72-76 Union Road (West building)	North	G	60	55	55	49	55	49	55	49	55	50			-0.1	-0.1	0.1	0.2
		1	60	55	56	51	56	51	57	51	57	51			0.0	0.0	0.2	0.4
		2	60	55	57	52	57	52	58	52	58	53			0.0	0.0	0.2	0.4
72-76 Union Street (East building)	North	G	60	55	55	48	55	48	55	49	55	50			-0.1	-0.1	0.1	0.2
78 Union Road	North	G	60	55	56	51	56	50	56	51	57	51			-0.1	-0.2	0.2	0.3
		1	60	55	58	53	58	53	59	53	59	53			-0.1	0.0	0.2	0.3
		2	60	55	59	54	59	54	60	54	60	55			0.0	0.0	0.3	0.4
82 Union Road (East building)	North	G	60	55	57	52	57	52	58	53	58	53			0.0	0.1	0.3	0.5
82 Union Road (South building)	North	G	60	55	52	47	52	47	53	48	53	48			0.1	0.1	0.4	0.5

Receiver ID	Façade	Floor	NCG criteria, dB(A)		Year of opening 'No Build' scenario dB(A)		Year of opening 'Build' scenario dB(A)		Design year 'No Build' scenario dB(A)		Design year 'Build' scenario dB(A)		Is the NMG criteria exceeded?		Change in noise level dB(A)			
															Year opening		Design year	
			Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
82 Union Road (West building)	North	G	60	55	59	53	59	53	59	54	59	54			-0.1	-0.1	0.2	0.3
83-85 Union Road	West	G	60	55	61	56	61	56	62	56	62	57	Y	Y	0.1	0.2	0.4	0.6
		1	60	55	62	57	62	57	63	58	63	58	Y	Y	0.1	0.1	0.4	0.5
		2	60	55	63	57	63	58	63	58	64	59	Y	Y	0.2	0.2	0.5	0.6
		3	60	55	63	58	63	58	64	58	64	59	Y	Y	0.2	0.2	0.4	0.6
		4	60	55	63	58	64	58	64	59	64	59	Y	Y	0.1	0.1	0.4	0.6
		5	60	55	64	58	64	59	64	59	65	59	Y	Y	0.1	0.1	0.4	0.5
		6	60	55	64	59	64	59	65	59	65	60	Y	Y	0.1	0.1	0.4	0.6
		7	60	55	64	59	64	59	65	60	65	60	Y	Y	0.1	0.1	0.4	0.6
		8	60	55	65	59	65	59	65	60	65	60	Y	Y	0.1	0.1	0.4	0.6

Receiver ID	Façade	Floor	NCG criteria, dB(A)		Year of opening 'No Build' scenario dB(A)		Year of opening 'Build' scenario dB(A)		Design year 'No Build' scenario dB(A)		Design year 'Build' scenario dB(A)		Is the NMG criteria exceeded?		Change in noise level dB(A)			
															Year opening		Design year	
			Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
83-85 Union Road	South	G	60	55	54	49	54	49	54	50	55	50			0.1	0.2	0.5	0.7
		1	60	55	54	50	55	50	55	51	56	51			0.1	0.1	0.5	0.6
		2	60	55	55	51	55	51	56	51	56	52			0.1	0.1	0.6	0.7
		3	60	55	56	51	56	52	56	52	57	53			0.1	0.1	0.5	0.6
		4	60	55	57	52	57	52	57	53	58	53			0.2	0.1	0.5	0.6
		5	60	55	57	53	57	53	58	53	58	54			0.2	0.1	0.5	0.6
		6	60	55	58	53	58	54	59	54	59	55			0.2	0.2	0.5	0.7
		7	60	55	59	54	59	54	59	55	60	55			0.1	0.1	0.6	0.7
		8	60	55	59	55	59	55	60	55	60	56		Y	0.1	0.1	0.5	0.6

Receiver ID	Façade	Floor	NCG criteria, dB(A)		Year of opening 'No Build' scenario dB(A)		Year of opening 'Build' scenario dB(A)		Design year 'No Build' scenario dB(A)		Design year 'Build' scenario dB(A)		Is the NMG criteria exceeded?		Change in noise level dB(A)			
															Year opening		Design year	
			Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
83-85 Union Road	North	G	60	55	54	49	54	49	54	50	55	50	Y		0.0	0.0	0.2	0.3
		1	60	55	54	50	55	50	55	51	56	51	Y	Y	0.0	0.0	0.2	0.3
		2	60	55	55	51	55	51	56	51	56	52	Y	Y	0.0	0.0	0.2	0.3
		3	60	55	56	51	56	52	56	52	57	53	Y	Y	0.0	0.1	0.2	0.3
		4	60	55	57	52	57	52	57	53	58	53	Y	Y	-0.1	0.0	0.2	0.3
		5	60	55	57	53	57	53	58	53	58	54	Y	Y	0.0	0.0	0.2	0.2
		6	60	55	58	53	58	54	59	54	59	55	Y	Y	0.0	0.0	0.2	0.3
		7	60	55	59	54	59	54	59	55	60	55	Y	Y	-0.1	0.0	0.1	0.3
		8	60	55	59	55	59	55	60	55	60	56	Y	Y	-0.1	-0.1	0.1	0.2
86 Union Road	West	G	60	55	64	59	64	59	65	60	65	60	Y	Y	0.1	0.1	0.5	0.6
		1	60	55	65	60	65	61	66	61	66	61	Y	Y	0.1	0.1	0.4	0.5
		2	60	55	66	61	66	61	66	62	67	62	Y	Y	0.0	0.1	0.4	0.5
	North	G	60	55	61	56	61	56	62	57	62	57	Y	Y	-0.1	-0.1	0.3	0.4
		1	60	55	62	57	62	57	63	58	63	58	Y	Y	-0.1	0.0	0.2	0.4
		2	60	55	63	58	63	58	63	58	63	58	Y	Y	-0.1	-0.1	0.2	0.4

Receiver ID	Façade	Floor	NCG criteria, dB(A)		Year of opening 'No Build' scenario dB(A)		Year of opening 'Build' scenario dB(A)		Design year 'No Build' scenario dB(A)		Design year 'Build' scenario dB(A)		Is the NMG criteria exceeded?		Change in noise level dB(A)			
															Year opening		Design year	
			Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
666 High Street	East	G	60	55	69	64	69	65	69	65	70	66	Y	Y	0.5	0.5	0.9	0.9
	North	G	60	55	70	65	70	65	70	65	70	65	Y	Y	-0.1	0.0	0.1	0.2
680 High Street	North	G	60	55	64	59	64	59	64	59	64	59	Y	Y	-0.2	-0.1	0.0	0.0
		1	60	55	65	60	65	60	65	60	65	60	Y	Y	-0.2	0.0	-0.1	0.0
682 High Street	North	G	60	55	70	66	70	65	71	65	70	65	Y	Y	-0.3	-0.4	-0.2	-0.2
684 High Street	North	G	60	55	70	66	70	66	71	65	71	65	Y	Y	0.0	0.0	0.0	0.1
686 High Street	North	G	60	55	70	65	70	65	70	65	70	65	Y	Y	0.2	0.2	0.2	0.2
Mountain View Retreat (North-west buildings only)	North	G	60	55	57	52	58	53	58	53	58	54			0.1	0.2	0.5	0.7

Note: 6-8 John Tipping Grove and 83 Union Street are recently-constructed (or under-construction) residential buildings. See overleaf for a discussion of noise mitigation at these receivers.

According to Roads and Maritime's Noise Mitigation Guideline (NMG), the need for noise mitigation is required to be assessed once noise has been minimised by feasible and reasonable methods during the corridor planning and road design stages.

Residual exceedances of the NCG criteria would occur at the following properties:

- Receivers on High Street west of Mulgoa Road
- Receivers facing or exposed to Mulgoa Road, including 82 Union Street, 83 Union Street, 86 Union Street and receivers on John Tipping Grove.

The NMG provides three triggers for determining whether a receiver should be considered for provision of noise mitigation:

1. If the predicted 'build' noise level exceeds the NCG controlling criteria and the project causes an increase of greater than 2 dB(A) [Build – No Build]
2. If the predicted 'build' noise level exceeds the cumulative limit (5 dB above the NCG controlling criteria), and the project significantly contributes to the overall noise level (a contribution of 2.1 dB(A) or greater to the overall noise level)
3. If the contribution from the project is "acute" ($>65 \text{ dB } L_{Aeq,15hr}$ or $>60 \text{ dB } L_{Aeq,9hr}$), even if the overall noise level at the receiver is dominated by a non-project road segment.

Considering these triggers:

- Properties on High Street west of Mulgoa Road would qualify for noise mitigation because noise levels at the Year of Opening and Design Year exceed the cumulative noise limit, and the project road segments contribute at least 2.0 dB(A) to the overall noise level
- Properties on John Tipping Grove and at the western end of Union Road would qualify for noise mitigation because noise levels at the Year of Opening and Design Year exceed the cumulative noise limit, and the project road segments contribute at least 2.0 dB(A) to the overall noise level.

6-8 John Tipping Grove and 83-85 Union Road, which are residential buildings either currently under construction or recently completed, are predicted to experience an exceedance of the cumulative noise levels. However, given that the proposal would only result in a negligible ($<1 \text{ dB}$) increase in noise levels at these receivers, it is reasonable to assume that the build design for these receivers would have been based on the existing exceedance of the cumulative noise limit.

A search of Penrith City Council's Development Application register for these sites shows no specific clauses for controlling noise intrusion from traffic noise, with only a reference to the Penrith Development Control Plan, which does require an acoustic assessment to be conducted. However, no acoustic reports for these developments are publically available. Hence it is unclear if the façades of these buildings have been designed to control existing noise exposure.

Because the segment of Mulgoa Road that is the dominant noise emission segment has an ADT of fewer than 40,000 vehicles, these projects would not have been automatically required to comply with the recommendations of ISEPP. In these circumstances, provision of noise mitigation for these receivers may not be considered reasonable and so these receivers have been marked as provisional for noise mitigation in the list below.

It is the intention of the RNP to provide a feasible and reasonable noise mitigation approach to prevent noise sensitive receivers with an existing high noise level from remaining well above the criterion, including cases where the noise level did not significantly increase relative to the 'no-build' year.

It is only considered reasonable to provide noise mitigation measures in the form of quieter pavement surfaces, noise mounds or noise walls for cases where there are four or more closely spaced receivers.

For isolated receivers or small groups of receivers, at-property mitigation measures may be considered subject to feasible and reasonable assessment.

The only area with a group of four or more closely-spaced receivers qualifying for mitigation that are not accessed directly from a road segment that is part of the proposal is John Tipping Grove. However, because of insufficient space between Mulgoa Road and the cul-de-sac at the southern end of John Tipping Grove (at the narrowest point the pedestrian/cycle path occupies the full width of the available space between Mulgoa Road and John Tipping Grove), a noise barrier is not considered “feasible and reasonable” for the receivers on John Tipping Grove. This is because the effective length of the noise barrier to the point where it would not be effective at providing significant noise reduction to all properties at John Tipping Grove would be restricted. A noise barrier that only provides a significant noise reduction to one or two properties would not normally be considered reasonable under the NMG, although could potentially be considered in this instance during detailed design as part of a combination of property-based treatments and a noise barrier.

This means that at-property noise mitigation strategies are the only “feasible and reasonable” strategies for the majority of receivers affected by the proposal. This could include both architectural treatment of the building façade and/or the provision of ‘property fence’ type localised noise barriers. A summary of the recommended at-property noise mitigation measures are provided in Section 6.5.5.

Under the provisions of the NMG, the following noise sensitive receivers would qualify for consideration of “feasible and reasonable” at-property noise mitigation measures as a result of the proposal:

- 680 High Street
- 682 High Street
- 686 High Street
- 688 High Street
- 4 John Tipping Grove
- 6-8 John Tipping Grove*
- 10 John Tipping Grove
- 12 John Tipping Grove
- 14 John Tipping Grove
- 83-85 Union Road
- 86 Union Road.

Given the small changes to the existing noise levels, the impact of the proposal on noise amenity in the proposal area would be a **minor adverse** impact during operation.

It should be noted that an assessment of the existing likely impacts of sleep disturbance on residents was also made in terms of likely maximum noise levels from current road traffic, the extent to which these maximum noise levels exceed the ambient level, and the expected number of noise events from road traffic during the night. The assessment showed that existing sleep disturbance impacts are expected to occur.

Night time noise levels in the immediate vicinity of the proposal are unlikely to change significantly, however the number of maximum noise level events at night time may increase due to increased traffic flow capacity. However, any additional noise events are not expected to have a prominent impact given the existing night time noise level exposure. Further, the receivers that would be most-exposed for sleep disturbance impacts already qualify for noise mitigation as a result of the proposal and hence these mitigation measures would likely provide some benefit for sleep disturbance at these receivers.

Construction vibration

The main sources of construction vibration would include:

- Excavation
- Grading of existing roadways
- Vibratory compacting of new road surfaces.

A screening calculation has been carried out for the vibration impact at the performance spaces at the Joan Sutherland Performing Arts Centre which is considered the most sensitive vibration receiver. The screening calculation predicted no significant groundborne noise impacts to the performance space.

The *Construction Noise Strategy* (TCA, 2011) also provides recommended safe working distances for vibration intensive plant. These are based on international standards and are provided in Table 6-21.

Table 6-21 Recommended safe working distances for vibration intensive plant

Plant Item	Rating / description	Safe Working Distance	
		Cosmetic damage	Human response
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	15 m to 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	100 m
	> 300 kN (> 18 tonnes)	25 m	100 m
Small Hydraulic Hammer	(300 kg – 5 to 12t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	20 m
Pile Boring	≤ 800 mm	2 m (nominal)	N/A
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure

Note: More stringent conditions may apply to heritage or other sensitive structures

Mitigation would therefore need to be considered where sensitive receivers are located closer to the construction work than these 'safe working distances'.

The vibrational impact of the proposal during construction is considered **minor adverse**.

6.5.5 Safeguards and management measures

The safeguards and mitigation measures detailed in Table 6-22 would be implemented to minimise the impacts of the proposal on noise and vibration.

Table 6-22 Environmental safeguards for noise and vibration

Impact	Environmental safeguards	Responsibility	Timing
Construction noise	<p><u>NV1</u> A Noise and Vibration Management Plan (NVMP) would be prepared as part of the CEMP. The NVMP would be prepared in accordance with the ICNG and would identify:</p> <ul style="list-style-type: none"> • all potential significant noise and vibration generating activities associated with the activity • measures to be implemented during construction to minimise noise and vibration impacts, such as restrictions on working hours, staging, placement and operation of work compounds, parking and storage areas, temporary noise barriers, haul road maintenance, and controlling the location and use of vibration generating equipment • feasible and reasonable mitigation measures to be implemented • a monitoring program to assess performance against relevant noise and vibration criteria • arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • contingency measures to be implemented in the event of non-compliance with noise and vibration criteria. 	Project Manager	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
Construction noise	<u>NV2</u> <ul style="list-style-type: none"> The majority of works would be carried out during standard working hours (i.e. 7am – 6pm Monday to Friday, 8am – 1pm Saturdays). Any work that is performed outside normal work hours or on a Sunday or public holiday would minimise noise impacts in accordance with Roads and Maritime's <i>Environmental Noise Management Manual Practice Note 7 – Roadworks Outside of Normal Working Hours</i> and the ICNG. 	Site Manager	Construction
Construction noise	<u>NV3</u> <ul style="list-style-type: none"> Construction personnel would be made familiar with the potential for noise and vibration impacts upon local residents and encouraged to take all practical and reasonable measures to minimise noise during the course of their activities. 	Site Manager	Construction
Construction noise	<u>NV4</u> <ul style="list-style-type: none"> Where practical, the layout and positioning of noise-producing plant and activities at each work site would be optimised to minimise noise emission levels. 	Site Manager	Construction
Construction noise	<u>NV5</u> <ul style="list-style-type: none"> Where practical, equipment would be selected to minimise noise emissions. Equipment would be fitted with appropriate noise control equipment and be in good working order. 	Site Manager	Construction

Impact	Environmental safeguards	Responsibility	Timing
Construction noise	<u>NV6</u> <ul style="list-style-type: none"> Where possible, non-“beeper” reversing movement alarms would be used such as broadband (non-tonal) alarms or ambient noise-sensing alarms. Work sites would also be designing the site to reduce the need for reversing, potentially minimising the use of reversing beepers. 	Site Manager	Construction
Construction noise	<u>NV7</u> <ul style="list-style-type: none"> Vehicles, plant and equipment would be regularly inspected and maintained to avoid increased noise levels from rattling hatches, loose fittings etc. 	Site Manager	Construction
Construction noise	<u>NV8</u> <ul style="list-style-type: none"> All vehicles, plant and equipment would be shut off when not in use. 	Site Manager	Construction
Construction noise	<u>NV9</u> <ul style="list-style-type: none"> Resilient damping material would be fitted on bin trucks to minimise noise impacts from the loading of materials on trucks. 	Site Manager	Construction
Construction noise	<u>NV10</u> <ul style="list-style-type: none"> If feasible and reasonable, localised temporary acoustic hoardings/screens would be installed in proximity to high noise generating activities. Hoardings/screens would be located as close to the noise source as possible, and would be an appropriate height as structurally feasible to minimise noise emissions. 	Site Manager	Construction
Construction noise	<u>NV11</u> <ul style="list-style-type: none"> If piling is proposed for bridgework, nearby residents should be consulted regarding the intended activities associated with the piling process. 	Project Manager and consultation team	Pre-construction and construction

Impact	Environmental safeguards	Responsibility	Timing
Construction noise	<u>NV12</u> <ul style="list-style-type: none"> Measures to reduce the impact of percussive piling activities should be considered, including: <ul style="list-style-type: none"> Using a resilient pad (dolly) between pile and hammer head Enclosing the hammer head in a temporary acoustic shroud Alternatively, rotary bored or vibro-piling may be used where consistent with the type of pile used and restrictions on soil disturbance. 	Site Manager	Construction
Construction noise	<u>NV13</u> <ul style="list-style-type: none"> A sleep disturbance assessment should be carried out prior to construction for any planned out of hours work. The sleep disturbance assessment should consider the absolute noise level of the activity, the degree of above the existing ambient noise level, and the number of individual noisy events likely to occur per night. 	Project Manager	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
Operational noise	<p><u>NV14</u></p> <ul style="list-style-type: none"> Architectural treatment should be considered for the residential found to be in exceedance of the Roads and Maritime NCG noise levels and the 'acute' noise levels. The number of properties requiring architectural treatment should be refined and confirmed following approval of the proposal and after detailed design is developed. Architectural treatment to be implemented should be agreed with the individual property owners and carried out in accordance with the Roads and Maritime NMG. <p>Architectural noise treatments may include one or a combination of the following:</p> <ul style="list-style-type: none"> The installation of courtyard screen walls Fresh air ventilation systems that meet building code of Australia requirements with the windows and doors shut. Upgraded windows and glazing and solid core doors on exposed facades of substantial structures only (i.e. masonry or insulated weather board cladding with sealed underfloor) Upgrading window and doors seals and appropriately treating sub-floor ventilation The sealing of wall vents The sealing of the underfloor below the bearers The sealing of eaves. 	Roads and Maritime	Operation

Impact	Environmental safeguards	Responsibility	Timing
Construction vibration	<u>NV15</u> <ul style="list-style-type: none"> The recommended safe working distances for vibration intensive plant should be considered during construction planning. Mitigation may be required where sensitive receivers are located closer to the construction work than the safe working distances. 	Project Manager	Construction

6.6 Landscape and visual

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

6.6.1 Existing environment

Overview

The key features that contribute to landscape character and visual amenity in the vicinity of the proposal area are outlined in Figure 6-15. Topography within and around the proposal area is generally flat with localised man-made variations created by the railway bridge and bridges over the nearby creeks and there are a number of water bodies and natural features in the proposal area as discussed previously.

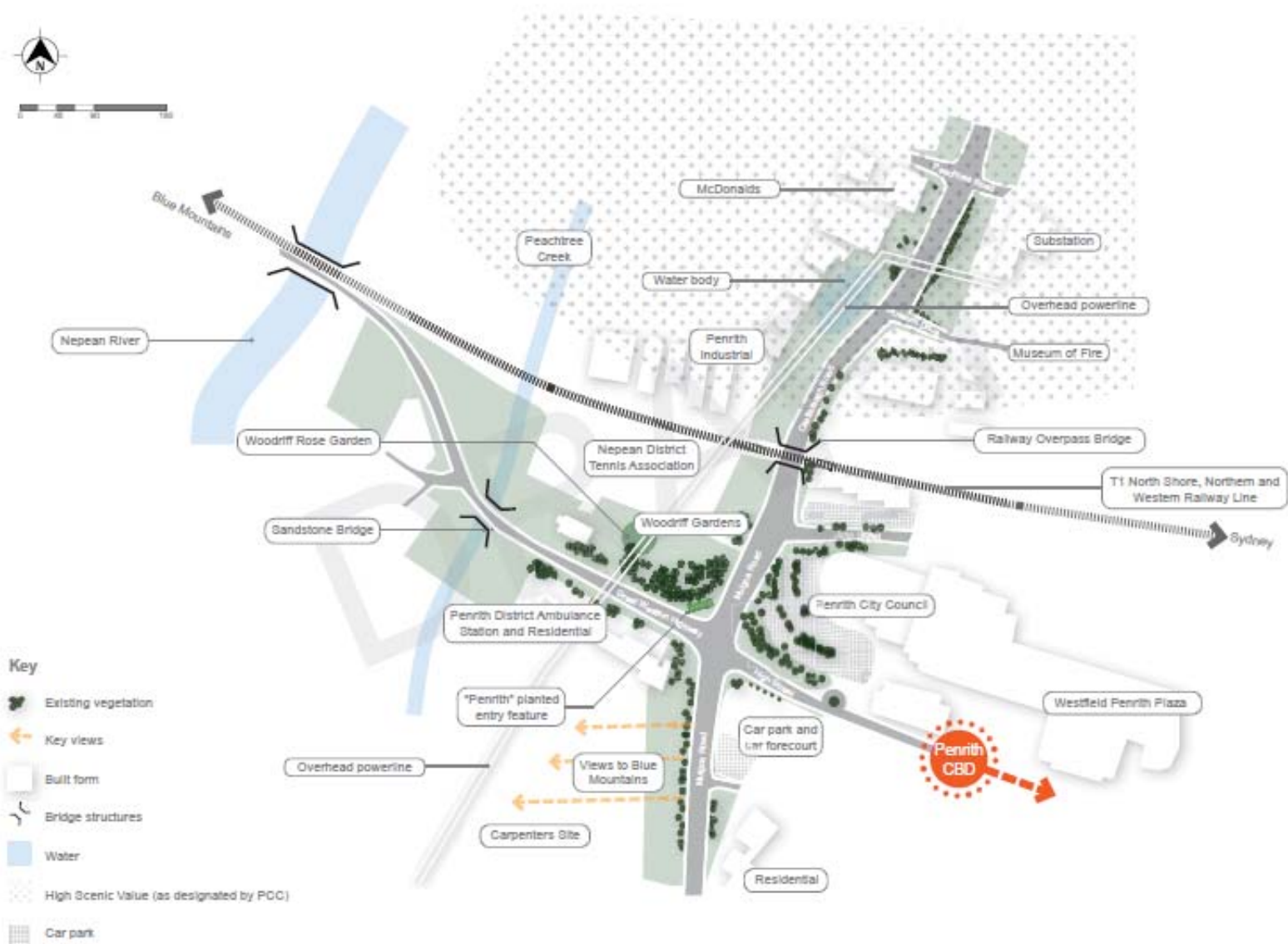


Figure 6-15 Existing landscape and visual conditions

Landscape

Key features that contribute to the landscape character and make the built, natural and cultural aspects of the proposal area unique include:

- Penrith City Council located at the intersection of Jane Street and Mulgoa Road and includes a car park at the western edge
- Mulgoa Road / High Street intersection is a major gateway to the Penrith CBD with a planted garden bed on the north-western verge
- Mulgoa Road – Castlereagh Road contains a mix of uses and runs on the western edge of the Cumberland Plain with views of the Blue Mountains to the west
- Peachtree Creek runs in a north-south direction, adjacent to Woodriff Gardens and the adjoining tennis facilities
- High Street provides the main pedestrian and vehicular connection to the Nepean River and proposed Nepean River Bridge from the CBD via the “Great River Walk”. It generally comprises a mix of residential and special uses
- Great Western Highway comprises a mix of residential and special uses. Mulgoa Road comprises a mix of civic, open space, industrial and car yard uses
- Penrith Station and the Ambulance Station along Great Western Highway have heritage significance
- Woodriff Gardens includes a Rose Garden where weddings have been previously performed, but less so in recent years due to the noisy road environment of Mulgoa Road
- Remnant vegetation scattered throughout the proposal area and informal parkland character, extending from Peachtree Creek along the western edge of the Penrith CBD
- Generally flat topography with localised man-made variations created by the underpass of the Western Railway Line.

The key features have facilitated the establishment of six landscape character zones (LCZs). Each LCZ has been defined to illustrate an area of distinct and consistent character within and around the proposal area. The landscape character zones (see Figure 6-16) and contributing characteristics are summarised as follows:

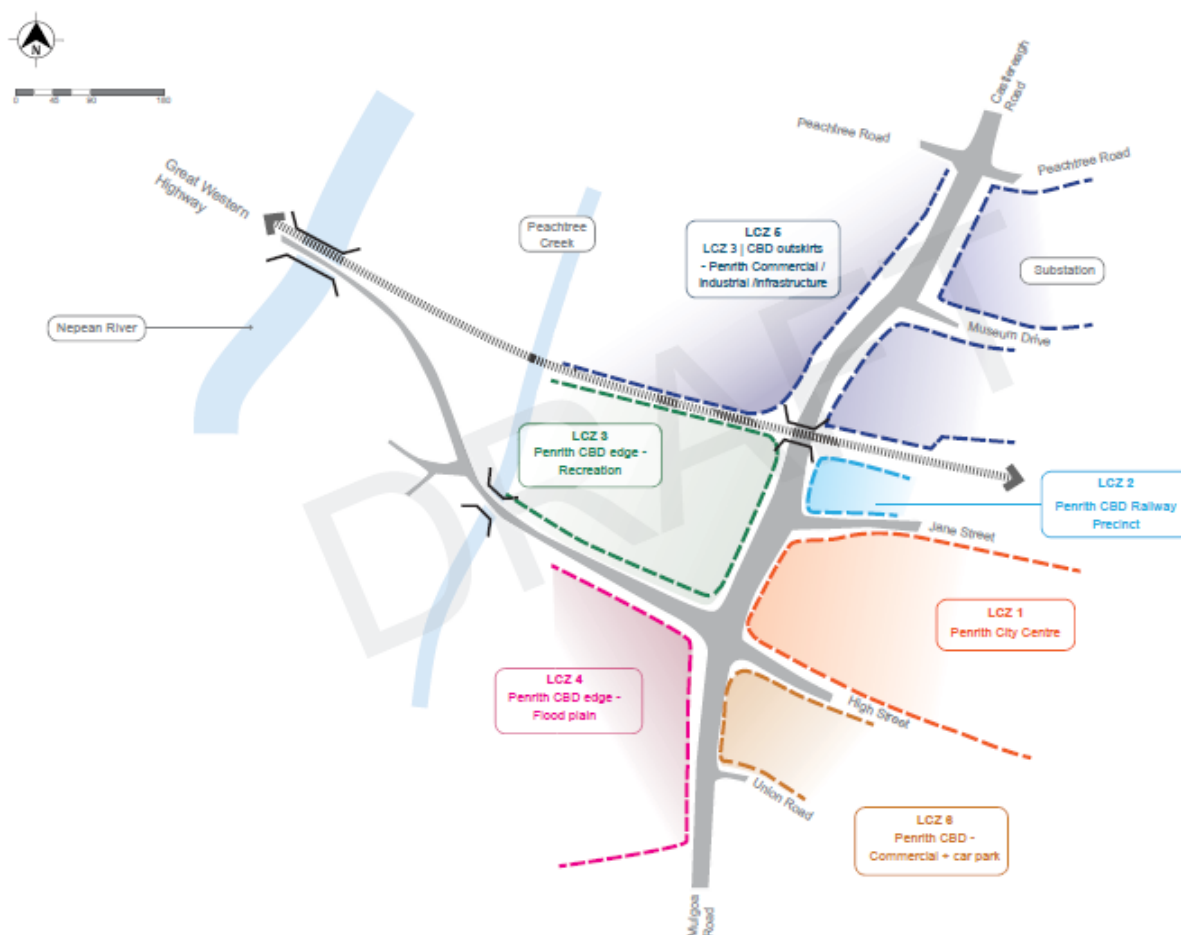


Figure 6-16 Landscape character zones

LCZ 1 - Penrith City Centre

- Penrith City Council buildings are dominant in views from Castlereagh Road, filtered by roadside boundary planting
- Penrith City Council is bound by car parking to the west, enclosed by mature vegetation with avenue planting to the south adjacent to High Street and to the north along Jane Street.

LCZ 2 - Penrith CBD Railway Precinct

- This area consists of railway and commuter car parks with railway services buildings. There is limited provision for landscape amenity such as street trees or landscape verges.

LCZ 3 - Penrith CBD Edge – Recreation

- The Nepean District Tennis Association tennis facilities and Woodriff Gardens provide a soft landscape boundary to Penrith with a planted entry statement at High Street - Mulgoa Road intersection
- Woodriff Gardens features a Rose Garden. The tennis courts provide a district and local recreational facility.

LCZ 4 - Penrith CBD edge - Flood plain

- The south western extent of the proposal area is marked by Peachtree Creek floodplain
- The absence of development allows clear open views from Mulgoa Road to the Blue Mountains to the west
- The northern extent of this character area comprises residential properties and the Ambulance Station, a registered heritage building.

LCZ 5 - Penrith CBD outskirts - Commercial / Industrial /infrastructure

- Large single storey linear warehouse buildings surrounded by hardstand car parks. Limited provision for landscape amenity such as street trees or landscape verges
- High voltage power lines and transmission towers are dominant in views from Castlereagh Road to industrial development to the west
- Mature vegetation filters views towards the ground level infrastructure and storage areas.

LCZ 6 - Penrith CBD - Commercial + car park

- This zone comprises a car yard and car park
- Limited landscape or verges within the road corridor
- Mature tree at the High Street and Mulgoa Road corner.

Visual

The area is of high visual amenity attributable to a number of features in the region including Woodriff Gardens, Penrith City Council Chambers, Peachtree Creek, Nepean River and heritage items such as the Railway Station and the Penrith Ambulance Station. In their Development Control, Plan Penrith City Council have identified scenic and landscape values, visual amenity and visual sensitivity. This is associated with the following key features:

- All land to the north of the railway line has been designated to be of high value
- Significant views to the Blue Mountains are apparent to the west from High Street and Mulgoa Road, particularly at the intersection of these two roads
- High voltage powerlines dominate views to the west with power lines converging at the substation to the north of Museum Drive
- The railway bridge that passes over Castlereagh Road is a locally listed heritage structure that connects with the 'entry point' to the CBD around the intersection.

A visual envelope has been identified to illustrate the visual catchment of the proposal area and generally describe where directional views towards the proposal are possible. The visual envelope and viewpoints within in are illustrated in Figure 6-17. Specifically the following 7 viewpoints have been identified as there is the potential for visual impacts:

- Viewpoint 1 - Penrith Commercial / industrial park
- Viewpoint 2 - Nepean District Tennis Association
- Viewpoint 3 - Jane Street
- Viewpoint 4 - Penrith City Council office
- Viewpoint 5 - Woodriff Gardens
- Viewpoint 6 - Great Western Highway residential
- Viewpoint 7 - Mulgoa Road.



Figure 6-17 Visual envelope and viewpoints

6.6.2 Potential impacts

Construction

Landscape

Construction would have an adverse impact across all of the LCZs, the magnitude of which is influenced by the sensitivity of each LCZ. A description of impacts by LCZ is provided in Table 6-23.

The landscape impacts are minor to moderate adverse during construction, reflecting the highly modified nature of the proposal area. More moderate impacts are evident around the key intersections and the railway bridge, particularly where adjoining land use is recreational, residential or has heritage significance.

Table 6-23 Landscape impacts during construction

Landscape character zone	Sensitivity	Comment	Impact
LCZ 1 – Penrith City Centre	Moderate	<ul style="list-style-type: none"> • Land acquisition at Council car park • Removal of some vegetation along Jane Street and High Street • Widening of the existing road corridor and intersection • Presence of ancillary facilities within the road carriageway. 	Moderate adverse
LCZ 2 – Penrith CBD Railway Precinct	Low	<ul style="list-style-type: none"> • Demolition, removal and replacement of the existing railway bridge requiring temporary presence of sliding beams and working platforms • Localised earthworks and installation of services in the vicinity of the railway bridge • Localised vegetation removal along Castlereagh Road and either side of railway bridge • Lowering of Castlereagh Road under the railway bridge. 	Moderate – low adverse
LCZ 3 – Penrith CBD Edge - Recreation	High	<ul style="list-style-type: none"> • Construction compounds and laydown areas adjacent to the Nepean District Tennis Association • Land acquisition at Woodriff Gardens and removal of the planted entry statement • Widening of the existing road corridor and intersections • Presence of ancillary facilities within the road carriageway • Removal of mature parkland trees along the southern and eastern boundary of this character area. 	Moderate – high adverse
LCZ 4 – Penrith CBD Edge – Flood plain	High	<ul style="list-style-type: none"> • Removal of mature vegetation to the west of Mulgoa Road • Widening of the High Street intersection encroaching into the eastern corner of this character area • Localised earthworks to the eastern western edge of Mulgoa • Road, encroaching into the eastern corner of this character area • Potential stockpiling site located to the west of Mulgoa Road opposite Union Road. 	Moderate – high adverse

Landscape character zone	Sensitivity	Comment	Impact
LCZ 5 – Penrith CBD outskirts – Commercial / industrial / infrastructure	Low	<ul style="list-style-type: none"> • Demolition, removal and replacement of the existing railway bridge • Widening of Castlereagh Road approximately 20m to west, encroaching in to the Penrith Industrial site with localised removal of existing vegetation. 	Low adverse
LCZ 6 – Penrith CBD – commercial + car park	Low	<ul style="list-style-type: none"> • Widening of existing road corridor and intersections • Localised earthworks to the eastern edge of Mulgoa Road within the existing road corridor boundary • Minor encroachment in to the tree canopy of a mature tree on the High Street and Mulgoa Road corner • Potential pruning of tree on the corner of High Street and Mulgoa Road. 	Low adverse

Visual

Construction would have an adverse impact across all of the viewpoints during construction, the magnitude of which is influenced by the sensitivity of each viewpoint. A description of impacts by viewpoint is provided in Table 6-24.

The visual impacts are minor to moderate adverse during construction, reflecting the highly modified nature of the proposal area and limited. More moderate impacts are found where viewpoints focus towards the Blue Mountains, heritage and recreational areas.

Table 6-24 Visual impacts during construction

Viewpoint	Sensitivity	Comments	Impact
Viewpoint 1 - Penrith Commercial / industrial park	Low	Works along the road corridor and the demolition, removal and replacement of the railway bridge may obstruct views	Moderate adverse
Viewpoint 2 - Nepean District Tennis Association	Moderate	Presence of the construction compound, erection of fencing and the demolition, removal and replacement of the railway bridge may obstruct views	Moderate adverse
Viewpoint 3 - Jane Street	Low	Widening of the road corridor and presence of ancillary facilities within the road carriageway may alter views	Minor adverse

Viewpoint	Sensitivity	Comments	Impact
Viewpoint 4 - Penrith City Council office	Moderate	Widening of the road corridor and intersections, presence of ancillary facilities within the road carriageway and removal of vegetation may alter and obstruct views	Moderate adverse
Viewpoint 5 - Woodriff Gardens	Moderate	Widening of the road corridor and intersections, presence of ancillary facilities within the road carriageway and removal of vegetation may alter and obstruct views	Moderate adverse
Viewpoint 6 - Great Western Highway residential	Moderate	Widening of the road corridor and intersections, presence of ancillary facilities within the road carriageway and removal of vegetation may alter and obstruct views towards the Blue Mountains. . Night works may cause light spill onto nearby residential properties.	Moderate adverse
Viewpoint 7 - Mulgoa Road	Moderate	Presence of stockpiling sites may alter views	Minor adverse

Operation

Landscape

During operation the proposal would have a negligible – beneficial impact across the LCZs as the urban design strategy (see Appendix K) has identified a design response that integrates the proposal with the existing landscape. A description of impacts by LCZ is provided in Table 6-25.

Table 6-25 Landscape impacts during operation

Landscape character zone	Sensitivity	Comments	Impact
LCZ 1 – Penrith City Centre	Moderate	<ul style="list-style-type: none"> • Mature vegetation along High Street and Jane Street would be retained and planting may be provided to replace localised vegetation lost during construction • Introduction of a 4.5m separated path to the western boundary of Penrith City Council • Introduction of improved pedestrian crossing at High Street and Jane Street intersections. 	Beneficial

Landscape character zone	Sensitivity	Comments	Impact
LCZ 2 – Penrith CBD Railway Precinct	Low	<ul style="list-style-type: none"> • New railway bridge and retaining walls would be provided at Castlereagh Road. The retaining walls and bridge would be designed together to be sympathetic to the existing environment and enhance the sense of arrival and departure from the Penrith CBD • Existing mature vegetation would be retained where possible, but some localised vegetation may be removed along Castlereagh Road adjacent to the railway bridge. Some informal tree planting may be provided along Castlereagh Road to screen traffic and provide shade for footpath users • Planting may also be provided within the road median to enhance the approach to the new bridge • A 4.5m wide separated path would be provided to the east of Castlereagh Road. 	Beneficial
LCZ 3 – Penrith CBD Edge - Recreation	High	<ul style="list-style-type: none"> • New railway bridge and retaining walls would be provided at Castlereagh Road. The retaining walls and bridge would be designed together to be sympathetic to the existing environment and enhance the sense of arrival and departure from the Penrith CBD • A 1.5 m footpath would be provided to the west of Castlereagh Road • The planted entry statement at Woodriff Gardens would be removed. Mature parkland trees along the Great Western Highway and Castlereagh Road would be retained where possible, but some localised vegetation may be need to be removed. Replacement tree planting may be provided to re-establish the mature landscaped boundary • Planting may also be provided within the road median to enhance the approach to the new bridge. 	Negligible

Landscape character zone	Sensitivity	Comments	Impact
LCZ 4 – Penrith CBD Edge – Flood plain	High	<ul style="list-style-type: none"> Removed mature vegetation to the west of Mulgoa Road may be replaced by a boulevard of trees. Planting may be provided in the central road median. 	Negligible
LCZ 5 – Penrith CBD outskirts – Commercial / industrial / infrastructure	Low	<ul style="list-style-type: none"> New railway bridge and retaining walls would be provided at Castlereagh Road. The retaining walls and bridge would be designed together to be sympathetic to the existing environment and enhance the sense of arrival and departure from the Penrith CBD A 1.5 m footpath would be provided to the west of Castlereagh Road Existing mature vegetation would be retained where possible, but some localised vegetation may be removed along Castlereagh Road. Some informal tree planting may be provided along Castlereagh Road to screen traffic and provide shade for footpath users. 	Negligible
LCZ 6 – Penrith CBD – commercial + car park	Low	<ul style="list-style-type: none"> A 4.5m wide separated path would be provided to the east of Mulgoa Road. A boulevard of trees may be incorporated into the road median and some informal tree planting may be provided to the east of Mulgoa Road alongside the shared path. 	Beneficial

Visual

The proposal would change the existing views at each of the viewpoints during operation. A description of the changes and the potential impact is provided in Table 6-26 overleaf.

Table 6-26 Visual impacts during operation

Viewpoint	Sensitivity	Comments	Impact
Viewpoint 1 - Penrith Commercial / industrial park	Low	The potential visual changes include widening of the road corridor, localised vegetation removal, and the introduction of new structures such as the replacement rail bridge, retaining walls and bridge protection beams. These would be offset where possible by tree planting to filter views from the road corridor and designing the retaining walls and bridge together to enhance the sense of arrival and departure from the Penrith CBD.	Moderate-low
Viewpoint 2 - Nepean District Tennis Association	Moderate	The potential visual changes include widening of the road corridor, changes to Woodriff Gardens, localised vegetation removal, and the introduction of new structures such as the replacement rail bridge, retaining walls and bridge protection beams. These would be offset where possible by tree planting to filter views from the road corridor and designing the retaining walls and bridge together to enhance the sense of arrival and departure from the Penrith CBD.	Moderate-high
Viewpoint 3 - Jane Street	Low	The potential visual changes include the removal of mature trees to the south of Jane Street and increase of the scale and dominance of the road corridor. These would be offset by replacement tree planting to re-establish the mature landscaped boundary to Penrith City Council and provide trees along the footpath.	Moderate-low
Viewpoint 4 - Penrith City Council office	Moderate	The potential visual changes include widening of the road corridor and localised vegetation removal. These would be offset by replacement tree planting to re-establish the mature landscaped boundary to Penrith City Council and provide trees at pedestrian crossing points and on traffic islands.	Moderate

Viewpoint 5 - Woodriff Gardens	Moderate	The potential visual changes include widening of the road corridor, changes to Woodriff Gardens and vegetation removal along the Great Western Highway impacting the parkland character, and removal of the planned entry statement. These would be offset by replacement tree planting to re-establish the parkland character and to provide trees at pedestrian crossing points and on traffic islands and the potential installation of a new gateway feature to assist with redefining the arrival and departure to Penrith CBD.	Moderate
Viewpoint 6 - Great Western Highway residential	Moderate	The potential visual changes include widening of the road corridor, changes to Woodriff Gardens and vegetation removal along Castlereagh Road. These would be offset by native tree planting at the boundary of Woodriff Gardens to re-establish the parkland edge, native tree planting to the boundary of the Penrith City Council car park to re-establish the mature landscape, and the potential installation of a new gateway feature to assist with redefining the arrival and departure to Penrith CBD.	Moderate
Viewpoint 7 - Mulgoa Road	Moderate	The potential visual changes include widening of the road corridor, and removal of mature vegetation along the west of Mulgoa Road. These would be offset by providing clusters of native to the western boundary of Mulgoa Road to establish the framed views out towards the Blue Mountains, providing an avenue of trees in the central median to connect with the wider Mulgoa Road urban strategy, and providing localised planting to provide trees at pedestrian crossing points and on traffic islands.	Moderate

6.6.3 Safeguards and management measures

The safeguards and mitigation measures detailed in Table 6-27 would be implemented to minimise the impacts of the proposal on landscape and visual.

Table 6-27 Environmental safeguards for landscape and visual

Impact	Environmental safeguards	Responsibility	Timing
Visual impacts during construction	<u>LV1</u> Project work sites, including construction areas and supporting facilities (such as storage compounds and offices) must be managed to minimise visual impacts, including appropriate storage of equipment, parking, stockpile screening and arrangements for the storage and removal of rubbish and waste materials.	Site manager	Construction
Temporary lighting	<u>LV2</u> Temporary site lighting must be installed and operated in accordance with <i>AS4282:1997 Control of the Obtrusive Effect of Outdoor Lighting</i> .	Site manager	Construction
Urban design	<u>UD1</u> The Urban Design Strategy for the proposal should be reviewed during the final detailed project design and implemented as part of the CEMP.	Project manager and site manager	Detailed design and construction
Retaining walls and bridge design	<u>UD2</u> The retaining walls and replacement rail bridge should be designed together to enhance the sense of arrival and departure from the Penrith CBD.	Project manager	Detailed design
Landscape management	<u>UD3</u> A Landscape Management Plan to ensure cost effective and consistent management of landscape works should be developed in consultation with Penrith City Council and implemented during construction. The plan will be prepared in accordance with the RTA <i>Landscape guideline</i> .	Project manager and site manager	Pre-construction and construction

6.7 Socio-economic

A socio-economic impact assessment was carried out for the proposal as part of this REF. The report is attached as Appendix L and is summarised below. The report has been prepared in accordance with the Roads and Maritime *Environmental Impact Assessment Practice Note: Socio-economic assessment (EIA-N05)*.

The socio-economic assessment should be considered in the context of other relevant assessments which consider traffic and access (Section 6.1), heritage (Sections 6.2 and 6.3), land use (Section 6.8) and amenity associated with noise and vibration, landscape and visual, biodiversity and air quality (Sections 6.5, 6.6, 6.11 and 6.12 respectively).

A number of geographic areas have been considered as part of the socio-economic assessment to characterise, and compare and contrast, the social and economic environment as illustrated in Figure 6-18. These include:

- Study area – defined as the area where the proposal is planned to occur. Australian Bureau of Statistics (ABS) Mesh Blocks have been used to provide population and dwelling counts within the study area.
- Study area and surrounds – defined as a compilation of seven ABS Statistical Area Level 1 census collection areas that approximate the study area and its immediate surrounds.
- LGA – defined by the ABS as the Penrith LGA.
- State – defined by the ABS as the State of NSW. This area is used for comparative purposes only.



Proposal area
 Mesh block areas
 Study Area

Figure 6-18 Socio-economic study areas

6.7.1 Existing environment

Demographics

The demographic profile of the study area and its surrounds are generally comparable to the broader LGA, with the exception of the following:

- Lower percentage of children and higher percentage of elderly residents (over 65 years) than the broader LGA. This is likely due to the presence of the Mountain View Aged Care facility and Retirement Village in close proximity to the study area.
- Lower percentage of detached, separate houses than the broader LGA and higher percentage of flats/apartments in the LGA in comparison to the State average. This is likely due to the closeness of the Penrith CBD where higher density development is encouraged and the

presence of the Mountain View aged care/retirement facility which is unit/villa based development.

- Smaller average household size than the broader LGA average. This is likely linked to the higher density dwelling types and the presence of the aged care/retirement facility.
- Slightly lower average number of motor vehicles than the broader LGA average. This is again likely linked to the higher density dwelling types, location of the study area near major rail and bus facilities and the location of the aged care/retirement facility.

Community values

There is also a range of social infrastructure and items of social value within the study area and surrounds that serves local communities including:

Social infrastructure and employment centres

- Penrith Ambulance Station – Listed heritage item and operational ambulance station to south-west of the Great Western Highway – Mulgoa Road intersection
- Sinclair Motors site – Operational car yard and service centre located on the south-east corner of the Great Western Highway and Mulgoa Road
- Civic Centre – Operational offices for Council and library located on Mulgoa Road between High Street and Jane Street (accessed from the High Street roundabout)
- Westfield Penrith – Shopping complex located to the east of the Civic Centre between High Street and Jane Street
- Lion Dairy and Drinks – Milk processing and manufacturing facility to the north-east of the railway bridge which operates 24/7
- Penrith CBD – Main activity centre of the LGA to the east
- Mountain View Aged Care and Residential Village – Aged care facility located on Mulgoa Road to the west of Rodley Avenue.

Open and recreational spaces

- Woodriff Gardens – Recreational gardens adjacent to the north-west of the Mulgoa Road – Great Western Highway intersection
- Nepean District Tennis Association – Tennis facilities adjacent to Woodriff Gardens
- Nepean River – Significant waterway for the region to the west providing amenity, cultural, recreational and environmental value for the community

Cultural and entertainment spaces

- Joan Sutherland Performing Arts Centre – Penrith's premiere cultural facility is located between the Civic Centre and the Westfield complex
- Museum of Fire – Community museum focused on firefighting memorabilia and education people on fire safety to the north-west of the site, adjacent to the Lion Dairy and Drinks site
- Riverlink Precinct – Living, working and entertainment precinct to the south-west
- Penrith Panthers Precinct – Range of dining, event and activity facilities in an entertainment area and nearby sports stadium to the south
- Penrith Showgrounds – Event and market space used for a range of activities annually including racing, markets and the Penrith Show.

Transport infrastructure

- Rail services– The rail corridor for the T1 Western Line (operated by Sydney Trains) and Blue Mountains Line (operated by NSW TrainLink) runs through the study area. This corridor is generally located to the north of Jane Street and crosses over Castlereagh Road via the railway bridge
- Active transport infrastructure – Range of shared pathways and footpaths within and around the site to facilitate cycling and walking

- Car parking – Range of formal and informal parking within the Penrith CBD and adjacent to Penrith station and Woodriff Gardens
- Bus stops – There are a number of bus stops within and around the site to facilitate public transport movements including those at the Penrith Transport Interchange on Belmore Street
- Note – Please refer to Section 2.2 for further details on existing transport infrastructure.

Economic profile

Generally the economic characteristics of the study area and surrounds indicate lower than average income and housing costs in comparison to the LGA. Further analysis of the Socio-Economic Indexes for Areas (SEIFA) and the Index of Socio-economic Advantage and Disadvantage (IRSAD) summarises different aspects of the socio-economic conditions of the local communities. SEIFA provides a general measure of socio-economic status based on a set of Census data from such as income, educational attainment, unemployment and dwellings without motor vehicles. IRSAD is one index used as part of the SEIFA measure which includes both relative advantage and disadvantage measures. The SEIFA IRSAD index varies in close proximity to the study area with various pockets of relative advantage and disadvantage evident in Figure 6-19.

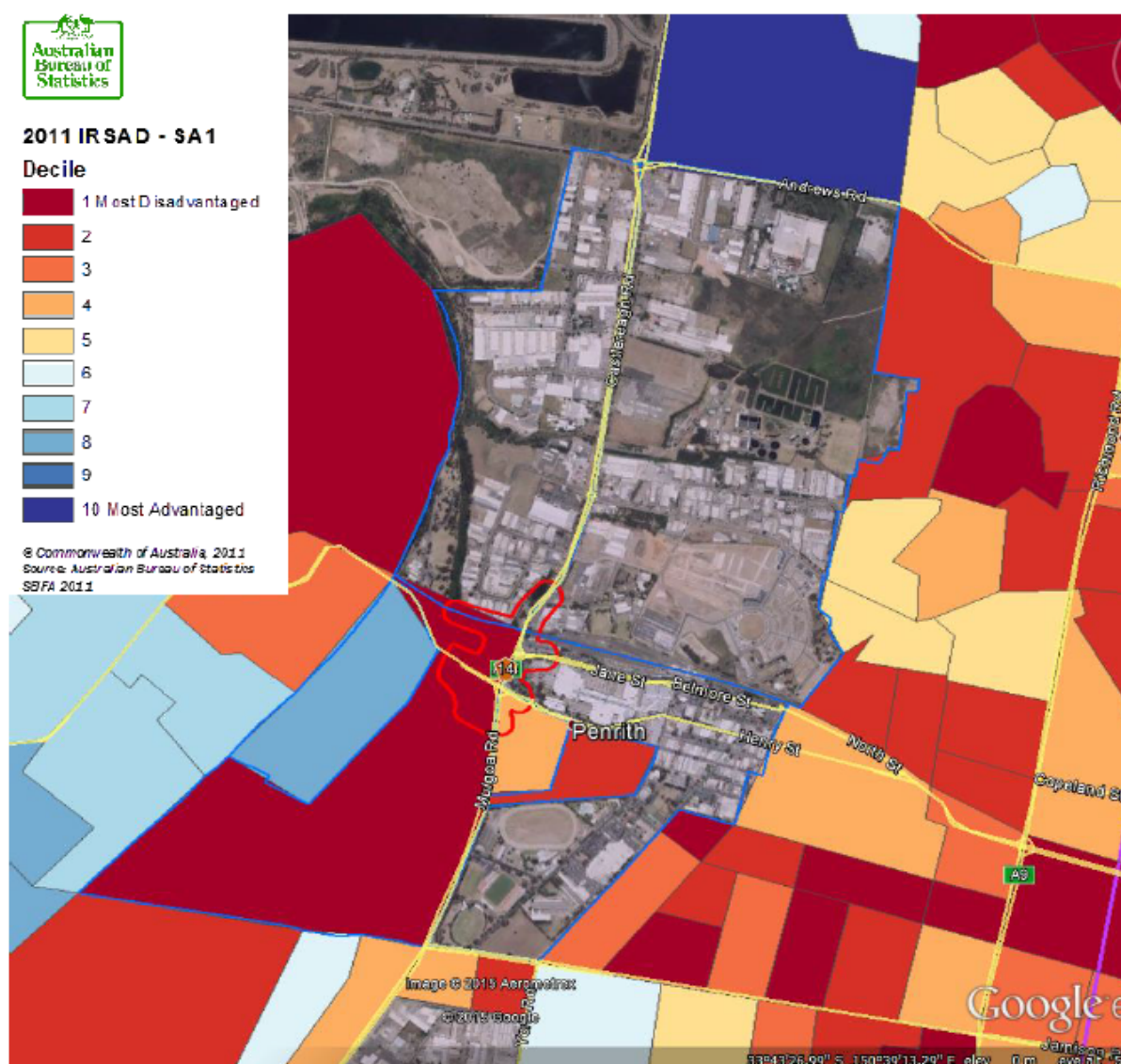


Figure 6-19 Index of Socio-economic Advantage and Disadvantage in the study area and surrounds

There is an area of relative advantage (8th decile) to the west of the study area located along the Nepean River alongside an area of relative disadvantage (1st decile). SEIFA in this area is likely influenced by the presence of the aged care and retirement facilities in this area. To the east of Mulgoa Road there are areas of relative disadvantage (2nd and 4th decile). Other areas in the study area and surrounds have such low populations that the SEIFA in these areas does not provide an accurate indicator of socio-economic status. This was evident in areas to the north of the study area that do not have resident populations, therefore SEIFA is not available for these areas.

With regards to employment indicators, there is about 72 jobs for every 100 employed residents in 2013/14 representing an increase from previous years. Unemployment is generally similar in comparison to the national average and a downward trend was evident in recent months (up to June 2015). Key industries in the LGA are manufacturing (12 per cent employment), retail (11 per cent employment), health care and social assistance (10 per cent employment) and construction (nine per cent employment).

Agriculture, forestry and fishing accounted for 560 jobs in the Penrith LGA at the time of the 2011 Census and the Lion Dairy and Drinks site is in close proximity to the site. Lion Dairy and Drinks produce, market and distribute milk beverages, cheese, yoghurt, juice and soy. Milk is sourced from 160 farmers from the central west to the southern downs.

Travel behaviour and costs

As previously noted, Mulgoa Road - Castlereagh Road is an important commuter, freight and bus route and traffic demand associated with the specific routes is discussed in detail in Section 6.1.

A number of indicators have been used to quantify the 'cost' of vehicle operation (number of stops), road use travel time and crashes. The traffic modelling in the traffic assessment (Appendix D) indicates that vehicles currently stop 37,325 times (2015 base case) with an average of 2.14 stops per vehicle during the peak PM period. The cost of operating a vehicle per stop has been calculated at \$0.15 per stop, equating to a cost of around \$5,600 each day during this peak hour. Without any changes to the intersections, by 2036 the number of stops is expected to increase to 135,121, with an average of 7.77 stops per vehicle equating to a cost of around \$20,300 each day during this peak hour.

Travel time costs has been valued in Vehicle Hours Travelled (VHT). It has been calculated that each VHT costs \$30.44. In 2015 total trip time during the PM peak hour has been calculated at 1,183 VHT, equating to a cost of \$36,000 each day during this peak hour. Without any changes to the intersections, by 2036 the total trip time during the PM peak is expected to increase to 3,368 VHT, equating to a cost of around \$102,500 each day during this peak hour.

Given that the residents of Penrith are relatively dependent on cars and access to the CBD is predominantly by motor vehicle, drivers need to find somewhere to park when they visit the area. As such car parks are a dominant feature of the Penrith CBD, particularly on its fringes, highlighting this dependence. The Council car park, Westfield Penrith and Union Street car parks provide formal car park spaces in the local area. There are also a number of future development sites that are currently used as temporary car parks, but these car parks will be displaced when development starts on these sites. It appears that Council staff and those visiting the Civic Centre, as well as Westfield shoppers, are large users of car parking in the vicinity of the study area.

As previously noted in relation to active transport, sections of shared pathway are provided within the study area along the Great Western Highway, High Street, Mulgoa Road and - Castlereagh Road and Jane Street to encourage cycling and walking. There are also off-road separated cycle paths along Mulgoa Road – Castlereagh Road, the Great Western Highway and Museum Drive. Pedestrian and cycle access in the study area is encouraged, evidenced by the provision of shared pathways and sealed footpaths throughout. That said, crossing the roads within the site is a barrier as it takes a relatively long time to cross due to the number of road sections that need to be crossed and the time for each signal sequence.

6.7.2 Potential impacts

Construction

Demographic profile

The proposal would have no direct impact on the demographic profile of the study area and/or surrounds as the proposal does not affect any residential properties. However, it is worth noting that there are a number of potentially vulnerable groups in the study area and surrounds including the elderly and those residences without vehicles that use the study area for transport.

The impact of the proposal on the demographic profile would be **negligible** during construction.

Community values

The proposal would not impact the community's overall vision for Penrith during construction; however, it is likely that there would be some temporary impacts.

During construction it would be more difficult to move through the site which provides access to major roads and a number of businesses and community facilities. As such construction would disrupt the movement of people and cause some level of frustration, reducing community values and amenity.

Land would be acquired prior to construction to undertake the proposal. One property (within the road reserve) would be fully acquired and 12 properties would be partially acquired as illustrated in Figure 6-20. None of these properties are currently used for residential purposes and they are currently owned by Council, Endeavour Energy and a private developer. Roads and Maritime would undertake all acquisitions prior to construction in accordance with current guidelines including Roads and Maritime Services *Land Acquisition Information Guide* and *the Land Acquisition (Just Terms Compensation) Act 1991*. There would also be three parcels of land temporarily acquired to accommodate ancillary facilities during construction as described in Section 3.4

Further, the removal of trees and vegetation around the area to make way for construction activities may also cause concern for some people in relation to community values associated with green space, recreation and environmental protection. Specific impacts to community values during construction would be as outlined in Table 6-28.

The impact of the proposal on community values would be **medium adverse** during construction and appropriately managed through the safeguard measures outlined in Section 6.7.3.



- Proposal area
- Concept design
- Property acquisitions

Figure 6-20 Property acquisitions required as part of the proposal



Table 6-28 Potential impacts to community values during construction

Social infrastructure / value	Details of impact
<i>Social infrastructure and employment centres</i>	
Penrith Ambulance Station	Access and egress would be maintained at all times, however construction activities would impact the road layout and facilities and as such have the potential to impact emergency response times.
Sinclair Motors site	A small area of land (approximately 150m ²) would be acquired from the Sinclair Motors future development site located on the corner of High Street and Mulgoa Road to allow for the expansion of the road footprint.
Penrith City Council	A 1,038m ² portion of land would be acquired to at the edge of the car park allow for the expansion of the road footprint.
	Impact to/removal of trees along the edge of the car park
	Loss of a small number of car parking spaces from the car park
	Access may be impacted during night works, however this will be agreed in advance with Council
Westfield Penrith	Access and egress issues exacerbated by construction related traffic, particularly during peak trading times. Customers of Westfield currently use the area proposed for the construction compound adjacent to the Nepean District Tennis Association as an overflow car park during peak shopping periods, including the Christmas and Boxing Day sales. During construction of the proposal this area would be unavailable for overflow parking, placing additional pressure on the permanent Westfield car parks and straining the local road network.
Lion Dairy and Drinks	Disruption to operations due to construction – access related issues for trucks and workers.
	Changes to car park and access arrangements during construction.
Penrith CBD	People using services and businesses within the CBD may be impacted by construction related traffic impacts.

Social infrastructure / value	Details of impact
Mountain View Aged Care and Residential Village	Residents including the elderly may be impacted by changes to the footpaths during construction, thus impeding their access to services and infrastructure in the Penrith CBD.
<i>Open and recreational spaces</i>	
Woodriff Gardens	Around 2,832m ² of land would be acquired on the south-east corner impacting open space, visual amenity and use of Woodriff Gardens. This would reduce the provision of open space area but it would not impact on the overall function as a passive recreation and open space.
	Loss of Penrith entry statement.
	Potential description to operation as changes are made to the driveway, however access would be maintained at all times unless otherwise agreed in advance.
Nepean District Tennis Association	Around 1,675m ² of land would be acquired on the eastern portion of the site to allow for the expansion of the road footprint. This grass/gravel roadside area is currently used as an informal car park.
	Potential description to operation as changes are made to the driveway, however access would be maintained at all times unless otherwise agreed in advance.
Nepean River	Potential impacts on access to Nepean River
<i>Cultural and entertainment spaces</i>	
Joan Sutherland Performing Arts Centre	Impact to patrons due to construction related congestion when trying to access the facility
Museum of Fire	Impact to facility access, especially relevant during one of the major annual events
Riverlink / Penrith Panthers Precinct	Traffic congestions associated with construction work

Social infrastructure / value	Details of impact
Penrith Showgrounds	Traffic congestion due to construction work
Transport infrastructure - Details of impacts on transport infrastructure are provided in Section 6.1	

Economic profile

Construction for the proposal would not have a direct impact on the economic profile of the study area or its surrounds. The proposal footprint does not impact any existing residential or business properties and does not require any changes to where people live or work. Construction of the proposal may provide additional employment opportunities associated with the demand for highly skilled construction staff to undertake the work. This would be negligible in the context of the economic profile of the area.

There would be no direct tourism and recreation related impacts are expected as a result of the proposal, though it is noted that construction related traffic impacts may impact visitors in and around the proposal area.

The impact of the proposal on the economic profile would be **negligible** during construction.

Travel behaviour and costs

The proposal would have temporary impacts on travel behaviour and costs during the staged construction period. During this time traffic control measures would be in place to reduce speeds, control stoppages and provide detours. There would also be times where complete shut downs of sections of road would take place, such as replacement of the railway bridge. This disruption would affect the accessibility and amenity of commuters, local residents, heavy vehicle operators, public transport users and active transport users for the duration of construction.

Increased stoppages and diversions would also increase the travel time costs temporarily. As such safeguard measures would be required to mitigate potential impacts.

The impact of the proposal on transport and access would be **medium adverse** during construction.

Operation

Demographic profile

Similarly to construction, the impact of the proposal on the demographic profile would be negligible during operation as there would be no displacements and/or impacts on residences.

Community values

The proposal aligns with a number of the key values outlined in the Penrith Community Plan including 'we can get around the city', 'we plan for future growth' and 'we care for our environment' and would improve access to social infrastructure and items of value. Additionally, the proposal would help people to efficiently move through this busy road corridor and improve overall amenity. Roads and intersections in the area would be larger in scale and 'busyness' would increase, however this would be addressed through the landscape and urban design elements as described in Section 6.6. Green spaces around the road corridor would also be reinstated and replanted as far as reasonably possible so that the area continues to provide a 'green' visual link to the Nepean River and proposed Nepean River Bridge.

The impact of the proposal on community values would be **beneficial** during operation.

Economic profile

Operation of the proposal would not have any direct impact on the socio-economic environment, industries or employment opportunities in the area. It is anticipated that around 20-25 spaces would be impacted at the car park currently used by Lion Dairy and Drinks and the Museum of Fire. However these spaces would be relocated where possible (likely to the north of the Lion Dairy and Drinks main building) to achieve a zero net loss of parking. Indirectly, the proposal may provide some benefits to local business and industry in the form of improved access to and through the local area. No tourism and recreation related impacts are expected as a result of the operation of the proposal.

The impact of the proposal on the economic profile would be **negligible** during operation.

Travel behaviour and costs

Operation of the proposal would reduce congestion and facilitate more efficient movement on the road network and improving access and road safety. Specifically, improved travel time associated with the operation of the streamlined road network would reduce the costs associated with transport congestion and travel speeds. Once operational, road user benefit for the 30 year post construction period has been valued at \$913 million (2015 dollars) in reduced travel time, vehicle stops and crash benefits.

The impact of the proposal on transport and access would be **beneficial** during operation.

6.7.3 Safeguards and management measures

The safeguards and mitigation measures detailed in Table 6-29 would be implemented to minimise the impacts of the proposal on socio-economic conditions. Additional mitigation measures including those outlined for traffic and access, land use and landscape and visual are also of relevance to socio-economic but they are discussed separately within those sections.

Table 6-29 Environmental safeguards for socio-economic

Impact	Environmental safeguards	Responsibility	Timing
Ongoing engagement	<p><u>SE1</u> A Communication Plan (CP) would be prepared and implemented as part of the CEMP to ensure provision of timely and accurate information to the community during construction. The CP would include (as a minimum):</p> <ul style="list-style-type: none">mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditionscontact name and number for complaints. <p>The CP would be prepared in accordance with the Roads and Maritime <i>Community Involvement and Communications Resource Manual</i>.</p>	Project Manager and consultation team	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
Emergency access	<p><u>SE2</u> Access for emergency vehicles would be maintained at all times during construction. Any site-specific requirements would be determined in consultation with the relevant emergency services agency. Specifically, access must be maintained for Penrith Ambulance Station while the station is operational in its current location via signals or traffic controllers. This must be integrated into traffic management planning which must also incorporate actions for allowing ambulances to quickly move through the area. Where possible, work in the vicinity of the Penrith Ambulance Station should occur later in the construction program to allow time for the operational facility to move – this would remove this issue.</p>	Project Manager and consultation team	Pre-construction and construction
Residential access	<p><u>SE3</u> Consultation would be carried out with potentially affected residences prior to the commencement of and during work in accordance with the RTA's <i>Community Involvement and Communications Resource Manual</i>. Consultation would include but not limited to door knocks, newsletters or letter box drops providing information on the proposed work, working hours and a contact name and number for more information or to register complaints.</p>	Project Manager and consultation team	Pre-construction and construction

Impact	Environmental safeguards	Responsibility	Timing
Commercial access	<p><u>SE4</u></p> <p>Consultation would be carried out with all affected property owners and businesses during detailed design and construction to develop and implement measures to mitigate impacts on land use viability, infrastructure and severance.</p> <p>Consultation with local businesses would identify appropriate management strategies to avoid or minimise impacts on access and operations. This would include consideration of measures such as additional signage and alternative access arrangements. Specific discussions would include:</p> <ul style="list-style-type: none"> • Consultation with Council around urban design treatments to repair and provide another entry statement in consultation at Woodriff Gardens • Engagement with the Nepean and District Tennis Association to investigate opportunities to improve access/egress from the Nepean District Tennis Association facility. • Discussion with Council about the best way to make good the car park area and landscape design to investigate re-provision of vegetation in this area • Development of suitable detour route to Lion Dairy and Drinks trucks during construction • Explore phasing of traffic lights around Westfield to determine if this may assist with access/egress from the centre during construction. 	Project Manager and consultation team	Pre-construction and construction

Impact	Environmental safeguards	Responsibility	Timing
Construction impacts on amenity and social cohesion	<u>SE5</u> Disruptions to property access and traffic would be notified to landowners at least five days in advance in accordance with the relevant community consultation processes outlined in the Traffic Management Plan.	Project Manager and consultation team	Construction

6.8 Land use

6.8.1 Existing environment

The proposal area is located in an urban area that has developed in combination with the growth of the Penrith CBD and wider region. The vicinity of the proposal area is characterised by a mixture of residential (to the south), recreational (to the west), industrial (to the north) and commercial and retail (to the east). There is also a range of transport uses throughout the proposal area.

As discussed in Section 4.2.1, the Penrith LEP outlines the designated land use zones within the LGA. The designated land use zones within the proposal area are:

- B3 – Commercial
- B4 – Mixed Use
- IN1 – Industrial
- SP2 – Infrastructure
- SP3 – Tourist
- RE1 – Public Recreation.

The commercial area includes the Westfield shopping centre, adjoining Civic Centre and High Street to the south-east. The industrial area to the north incorporates the Lion Dairy and Drinks site, Museum of Fire, Power Station and industrial estate on Peachtree Road whilst the public recreation and tourist area incorporates the Nepean District Tennis Association and Woodriff Gardens (to the west) and parklands (to the south-west) respectively. There are also a number of utility service corridors traversing the proposal area as discussed in Section 2.2.

6.8.2 Potential impacts

Construction

During construction, three parcels of land would be required temporarily to accommodate the ancillary facilities (including construction compounds, stockpile areas and temporary infrastructure) as described in Section 3.4. The temporary acquisition of land would result in temporary changes to land use and impacts on land owned by Roads and Maritime and land to be temporarily leased from Penrith City Council for the duration of the construction period.

The key land use impacts associated with the provision of ancillary facilities would include:

- Temporary changes to land use in the open spaces to the west of Mulgoa Road – Castlereagh Road
- Potential land disturbance to open space due to activities such as site establishment, vegetation removal, earth moving and machinery storage
- Installation of appropriate fencing (to protect surrounding properties) and temporary access tracks which may create severance and impact on land connectivity

- Ceasing the current Roads and Maritime lease on their road reserve for the current car park to the north-east of the Jane Street – Castlereagh Road intersection.

The temporary impacts associated with the ancillary facilities would be managed through the implementation of appropriate safeguard measures and as such, the impact of the ancillary facilities associated with the proposal would be **minor adverse**.

Additionally, the proposal would impact on local infrastructure and utilities including electricity transmission lines, earthing lines, optic fibres, high pressure gas lines, water supply and sewerage infrastructure. This may require adjustment of some existing service corridors and/or the implementation of protection measures at the commencement of construction. No impacts on infrastructure or utilities are expected outside of the proposal area and appropriate safeguard measures would be put in place. As such, the proposal would have a **minor adverse** impact on land uses during construction.

There would also be a range of potential land use related amenity impacts (as outlined in the other section of this REF), particularly for owners, occupants and operators of properties.

Operation

The proposal would require some property acquisition in order to accommodate the widened road corridor (see Table 3-2 and Figure 6-20). As a result it is expected that this land would be rezoned to SP2 – Infrastructure under the Penrith LEP. This would result in a small reduction of land zoned B3 – Commercial, B4 – Mixed Use, SP3 – Tourist and RE1 – Public Recreation. These impacts would be offset by the increased future capacity and improved travel times that the corridor would experience as a result of the proposed upgrade. As such, the proposal would have a **negligible** impact on land uses during operation.

6.8.3 Safeguards and management measures

The safeguards and mitigation measures detailed in Table 6-30 would be implemented to minimise the impacts of the proposal on land use.

Table 6-30 Environmental safeguards for land use

Impact	Environmental safeguards	Responsibility	Timing
Temporary leasing	<u>LU1</u> Temporary leasing arrangements would be managed and setup at the earliest stage possible in the project and all land owners would be consulted in accordance with the standard consultation measures.	Project Manager	Pre-construction
Utility work	<u>LU2</u> Prior to the commencement of utility work, consultation would occur with identified persons and organisations that may be adversely affected by service disruptions (such as businesses, educational or medical facilities) to determine any special requirements or alternative service arrangements.	Project Manager	Pre-construction

6.9 Soils and geology

6.9.1 Existing environment

Landform

The region is generally slightly undulating land as it is on the fringe of the Penrith Basin. Mulgoa Road is approximately 600 m to the south-east of the Nepean River and 300 m to the south-east of Peachtree Creek whilst that portion of the Castlereagh Road to the north of the rail corridor is within the Water and Resources Commission hundred year flood zone. The proposal area is generally flat between 24 m Australian Height Datum (AHD) and 26 m AHD.

Geology and Soils

Overview

As noted in Section 6.2.1, the proposal area is underlain by the Richmond Alluvial Soil Landscape and the Cranbrook Formation. The Richmond Alluvial landscape comprises quaternary alluvium consisting of sand, silt and gravels derived from sandstone and shale. The Cranbrook Formation comprises quaternary alluvial deposits of gravel, silt, sand and clay and is expected to be underlain by shale bedrock.

Subsurface profile

The geotechnical investigation has determined a subsurface profile comprising superficial fill overlying alluvial clays, gravels, sands and shale bedrock as illustrated in Table 6-31.

Table 6-31 Summary of subsurface strata encountered during boreholes and pavement cores during the geotechnical investigation

Material	Top of Strata	
	Below Ground level (m)	Reduced level (metres AHD)
Strata encountered in boreholes		
Fill and topsoil	0	24.9 – 26.8
Alluvial clay and sandy clay	0.45 – 2.9	22 – 25.9
Alluvial gravel and sand	2.7 – 4.5	20.7 – 22.8
Shale	10.7 – 12.6	13.4 – 14.3
Strata encountered in pavement cores		
Fill and topsoil	0	23.7 – 26.8
Alluvial clay and sandy clay	0.27 – 0.7	29.3 – 26
Alluvial gravel and sand	0.15 – 1.2	24.4 – 26.6
Shale	1.4 – 2.8	21.4 – 25.4

Summary of boreholes

Surficial fill was encountered up to a depth of 2.9 m and generally the fill materials were considered to be variable and uncontrolled. Alluvial clays and sandy clays were encountered underlying the fill and were generally yellow to orange brown or grey, of variable plasticity and stiff to very stiff consistency.

The alluvial clays were underlain by gravels and sands. The profile predominately comprised gravel that was brown, red brown and yellow brown, fine to coarse grained and rounded to sub-angular with some cobble and sand layers were typically fine to medium grained. These materials were found to be of medium dense to very dense consistency and did not appear to increase in strength with depth.

Shale bedrock encountered was grey to dark grey and found to be low to high strength. Due to the drilling method, very limited information was obtained on the properties of the bedrock; however, the rock level was assessed to be relatively constant between the different borehole locations.

Summary of pavement cores

Existing asphaltic concrete or concrete pavements including the road surface, basecourse and sub-basecourse were encountered up to a depth of 0.41 m. Inferred old pavements were also encountered in some locations; however, no information was supplied regarding the condition of the existing pavements.

Fill was evident up to a depth of 2.9 m and variable in condition including gravel, clay and sand. Testing indicates that the fill is of a firm or loose consistency throughout. This was underlain by natural alluvial soils including clay, sandy clay, sand, silty sand and sandy silt. The clays were of firm to very stiff consistency and sands were of very loose to medium dense consistency.

Acid sulfate soils

The CSIRO Atlas of Australian Acid Sulfate Soils identifies the site as 'acid sulfate soils in inland lakes, waterways, wetlands and riparian zones'; however, the Office of Environment and Heritage NSW Acid Sulfate Soils Risk Data does not cover the proposal area.

The geotechnical investigation confirmed that there is no acid sulfate risk for the proposal area.

Salinity

The *Penrith City Development Control Plan 2014* states some areas of the LGA are affected by high levels of salinity. According to the Department of Planning and Environment's *Salinity Potential in Western Sydney*, salinity potential for the proposal area is moderate.

Groundwater

Groundwater was also evident around 5.6 to 6 m below the existing surface levels during the geotechnical investigation.

6.9.2 Potential impacts

Construction

Landform

Construction of the proposal would have **negligible** impact on the landform of the proposal area as there are no alterations proposed to the topography.

Geology and Soils

As outlined in Section 3.3, construction of the proposal would involve the stripping of topsoil and excavation. Excavation would be required up to a depth of about 3.5 m below current ground level around the railway bridge. Additional excavation would also be required for pavement reconstruction and other minor work around the proposal area up to a depth of about 1 metre. Excavations over 1.5 m in depth may also require the formation of temporary and permanent batter slopes to stabilise the excavation sidewalls. Based on the identified subsurface profile, excavation is anticipated to extend through fill and alluvial clays, sands and gravels. Bedrock would not be encountered during the excavation. Appropriate safeguard measures would be outlined to manage potential impacts from excavation. As such, excavation activities would have a **minor adverse** impact on the subsurface profile of soils and geology.

Additionally piling activities would be required as part of the foundations for the replacement railway bridge crossing over Castlereagh Road. These piles would be founded within the bedrock and account for constraints such as variability in the size and strength of material encountered including clay to gravel and cobble sized material. Appropriate safeguard measures would be outlined to manage potential impacts from piling. Piling would therefore have a **minor adverse** impact on the subsurface profile of soils and geology.

Other construction activities that may impact on soils and geology include the ground disturbance associated with the clearing of vegetation and stripping of topsoils, movement of vehicles across soft or stripped ground and stockpiling activities at construction compounds. Such activities would be controlled through safeguard measures outlined in the CEMP and as such construction would have a **minor adverse** impact on soils and geology.

Acid sulfate soils

Given that there are no Acid Sulfate Soils in proximity to the proposal area, there would be **negligible** impact.

Salinity

Excavation within the proposal area would occur in moderate salinity areas. Construction activities would not impact on salinity levels; however, salinity has the potential to damage foundations of infrastructure including roads and bridges and would need to be managed accordingly through the safeguard measures.

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

Groundwater

Given the high water table (5.65 to 6.5 m below the existing ground levels) and the proposed depth of excavation required for works related to replacement of the existing railway bridge and road works under the railway bridge, there is the potential for groundwater ingress during construction. Excavation at the rail embankments in preparation for the replacement bridge works is expected to reach depths of RL 20.683 (where the existing ground level is around RL 19.94). Local excavation in this area would be minimised to avoid ingress where possible, however it is expected that excavation and piling (specifically the pile sockets which are to be founded in the shale bedrock) would encounter some groundwater seepage. As such, dewatering activities are likely to be required. These would need to be carried out in accordance with the provisions of the WM Act, including obtaining the relevant licences/permits. Further safeguards and management measures are listed in Table 6-32 and potential contamination impacts are discussed separately in Section 6.10.2.

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

Operation

During operation (following the completion of the proposed stabilisation and revegetation), there would be negligible impact on landform, geology and soils, acid sulfate soil, salinity and groundwater.

6.9.3 Safeguards and management measures

The safeguards and mitigation measures detailed in Table 6-32 would be implemented to minimise the impacts of the proposal on soils and geology.

Table 6-32 Environmental safeguards for soils and geology

Impact	Environmental safeguards	Responsibility	Timing
Soil impacts	<u>SG1</u> A Soil Management Plan would be prepared in accordance with <i>QA Specification G38</i> and implemented as part of the CEMP. The SWMP would identify all reasonably foreseeable risks relating to subsurface impacts and pollution associated with undertaking the activity, and describe how these risks would be managed and minimised during construction. That would include arrangements for managing pollution risks associated with spillage or soil contamination on the site and adjoining areas, and monitoring during and post-construction.	Project Manager	Pre-construction
Spoil and stockpile management	<u>SG2</u> A Spoil and Fill Management Plan (SFMP) would be prepared and implemented as part of the CEMP. The SFMP would identify the locations of spoil and fill stockpiles, sources of imported fill, and methods to re-use or dispose of excess or unsuitable spoil material including estimated volumes and disposal sites.	Project Manager	Pre-construction
Groundwater impacts	<u>SG3</u> In addition to the implementation of general erosion, sediment and water quality control safeguards (outlined in Section 0), any sediment basins, stockpiles, washdowns, batch plants, refuelling and chemical storage sites would be lined and/or bunded if they are located within 50 m of a shallow groundwater source.	Site Manager	Construction
Groundwater interaction	<u>SG4</u> Where groundwater is intercepted during construction works, such as around the replacement railway bridge, management measures to minimise potential adverse	Site Manager	Construction

Impact	Environmental safeguards	Responsibility	Timing
	<p>impacts would be implemented in accordance with the RTA <i>Technical Guideline: Environmental management of construction site dewatering</i>. These may include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> options to collect and store groundwater to enable recharge of the water table (such as via grassed swales) where recharge is not appropriate or feasible, discharging groundwater to the surface water drainage system following appropriate treatment to ensure discharged water is of sufficient quality. <p>Prior to any dewatering activities being carried out, an approval must first be obtained in accordance with Section 92 of the WM Act.</p>		
Management of topsoil	<p><u>SG5</u> Topsoil would be stockpiled in cleared or disturbed areas and managed in accordance with the RTA <i>Stockpile Site Management Guideline</i> until it is removed from the construction site and disposed of an appropriately licensed facility.</p>	Site Manager	Construction
Soil stabilisation	<p><u>SG6</u> The rehabilitation of disturbed areas would 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 Roads and Maritime <i>Guideline for Batter Stabilisation Using Vegetation</i>. 	Site Manager	Construction
Construction of batter during excavation	<p><u>SG7</u> Batters would be designed and constructed to minimise risk or exposure, instability and erosion,</p>	Site Manager	Construction

Impact	Environmental safeguards	Responsibility	Timing
	and to support long-term, on-going best practice management, in accordance with the Roads and Maritime <i>Guideline for Batter Stabilisation Using Vegetation</i> .		

6.10 Contamination

6.10.1 Existing environment

A Phase 1 investigation was undertaken in accordance with the Guidelines for Consultants Reporting on Contaminated Sites (NSW Office of Environment & Heritage, 2011). The report is attached as Appendix M and is summarised below. The study area for the investigation was determined by the extent of properties directly impacted by the proposal as defined by the required property adjustments as well as the location of the proposed replacement stormwater drain between Castlereagh Road and an outfall to Peachtree Creek.

The investigation included:

- A description of the existing land uses and major infrastructure
- Preparation of a history of the area
- A review of historic aerial photos
- Searches of available data bases
- Identification of possible contamination sources and potential off-site effects
- Recommended further actions.

From the analysis of historic aerial photos, there is ample evidence to indicate potential sources of contaminated material in the form of:

- Locations where there is evidence that the landform has been reprofiled
- Previous land uses that may have resulted in site contamination
- Potentially contaminating public utilities

Sites of interest from a potential contaminated land perspective included:

- The railway reserve, specifically the embankment and abutments associated with the existing railway bridge
- The park between the Nepean District Tennis Association and the railway reserve that will allow augmentation to the stormwater infrastructure (Lot 903 DP739989) and which has previously been filled in association with previous infrastructure works
- The car park associated with the Penrith City Council offices, which was previously the location of mixed industrial land uses
- The land known as the Carpenters Site (Lot 10 DP717196) which has been filled and reprofiled
- Known locations of asbestos infrastructure
- Other potential sources of contamination including lead paint on the existing railway bridge.

Following the Phase 1 investigation, it is recommended that a Phase 2 investigation be undertaken for the railway abutments associated with the existing railway bridge and embankments west of Castlereagh Road (on the land between the railway reserve and the tennis facility). This recommendation is made on the basis of the age of the development, the extent of filling that may have occurred, the extent of excavation that will be required on the western side of Castlereagh

Road as well as the proximity of the railway embankment to the location of the proposed stormwater infrastructure between Castlereagh Road and Peachtree Creek.

6.10.2 Potential impacts

Construction

Construction activities, specifically earthworks and subsurface excavation create the potential for exposing contaminants of concern to human health (excavation workers and people occupying the land in the vicinity) and contaminants of concern to soils, geology and water bodies. There is a high likelihood that contaminants would be encountered during works, particularly around the rail corridor.

There is also the potential to encounter small-scale uncontrolled dumping of materials across the site during the construction phase. This may contain asbestos or other contaminated material. As well, some existing infrastructure that will be encountered during construction is made of asbestos-based material and will need to be managed and disposed of appropriately. Where it is necessary to remove asbestos cement, the use of licensed contractors will be required for the removal, safe storage and transport and disposal of asbestos material in accordance with NSW EP&A regulations.

There is also the potential to encounter coal tars of concern during excavation of pavement material. Where encountered, the appropriate testing, handling and disposal of contaminated material will be required in accordance with RMS policy.

Provided contaminants and materials containing asbestos are appropriately managed through the implementation of safeguard measures, construction of the proposal would have a **minor adverse** impact on contamination.

Small quantities of fuels or other hazardous substances may be stored at the site during construction, particularly to serve construction machinery and as a result here is the potential for spills of contaminants. This could result in localised contamination within the proposal area or potentially cause the contamination of nearby water courses, soils and geology. Bunding and other appropriate mitigation measures would reduce the risk of accidental spillages and/or discharge during construction and as such they only represent a **minor adverse** impact.

Operation

During operation, appropriate drainage and rehabilitation would have been completed and as such the potential impact of the proposal on contamination is **negligible**.

6.10.3 Safeguards and management measures

The safeguards and mitigation measures detailed in Table 6-33 would be implemented to minimise the impacts of the proposal on the contamination.

Table 6-33 Environmental safeguards for contamination

Impact	Environmental safeguards	Responsibility	Timing
Construction contamination	<u>C1</u> A Contaminated Land Management Plan (CLMP) would be prepared and implemented as part of the CEMP for any areas of existing contaminated land or to address land contamination likely to be caused by the activity. The CLMP would be prepared in	Project Manager	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
	<p>accordance with relevant requirements of the Roads and Maritime <i>Guideline for the Management of Contamination</i> and, as a minimum address the following matters:</p> <ul style="list-style-type: none"> control measures to divert surface runoff away from the contaminated land capture and manage of any surface runoff contaminated by exposure to the contaminated land further investigations required to determine the extent, concentration and type of contamination, as identified in the detailed site investigation (Phase 2) manage the remediation and subsequent validation of the contaminated land, including any certification required measures to ensure the safety of site personnel and local communities during construction. 		
Contaminant exposure during construction	<p><u>C2</u></p> <p>If contaminated areas are encountered during construction, appropriate control measures would be implemented to manage the immediate risks of contamination, such as the diversion of surface runoff, capture of any contaminated runoff or temporary capping. All other work that may impact on the contaminated area would cease until the nature of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Environment Manager and/or EPA.</p>	Site Manager	Construction
Emergency spills	<p><u>C3</u></p> <p>A site specific emergency spill plan would be developed, and include spill management measures in accordance with the Roads and Maritime <i>Code of</i></p>	Project Manager / Site Manager	Construction

Impact	Environmental safeguards	Responsibility	Timing
	<i>Practice for Water Management</i> and relevant EPA guidelines. The plan would address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).		

6.11 Biodiversity

A flora and fauna assessment was carried out for the proposal by Environmental Property Services (EPS). The report is attached as Appendix N and summarised below.

The survey area for the purposes of the flora and fauna assessment is as illustrated in Figure 6-21. It should be noted that this survey area was based on the proposal area for the 20 per cent concept design which has since been updated for the final concept design (see Figure 1-1). EPS has confirmed that the following assessment is consistent with the updated proposal area.

6.11.1 Existing environment

Overview

Prior to undertaking field investigations, searches of relevant databases were completed to identify the diversity of flora and fauna known to occur, or potentially occur in the area. No threatened species records were located within the study area, likely due to the highly urbanised nature and lack of true remnant native habitats. Additionally a review of the Native Vegetation Maps of the Cumberland Plain (NPWS, 2002) revealed that the entire survey area is mapped as not containing any intact or disturbed remnant vegetation.

Site surveys were also completed on 15 September 2015 in the areas identified in Figure 6-21 in accordance with the DEC *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft* and the Roads and Maritime *Environmental Impact Assessment Practice Note: Biodiversity Assessment*.



Figure 6-21 Biodiversity survey locations (Source: Environmental Property Services)

As such the site surveys were subdivided into the following areas:

- Section A – the area to the west of Castlereagh Road between the intersections of Jane Street and Museum Drive
- Section B – the area to the east of Castlereagh Road between the intersections of Jane Street and Museum Drive
- Section C – the area around Jane Street and its intersection on the eastern side of Castlereagh Road
- Section D – the area around High Street and its intersection with the eastern side of Castlereagh Road
- Section E – the area south of High Street, along the eastern side of Castlereagh Road
- Section F – the area on eastern side of Castlereagh Road between Union Road and High Street
- Section G – the area on the south-west corner of Castlereagh Road and High Street
- Section H – the area along the southern side of High Street, between Peachtree Creek and Castlereagh Road
- Section I – the area along the northern side of High Street, between Peachtree Creek and Castlereagh Road
- Section J – the area between High Street and the rail corridor on the west side of Castlereagh Road
- Section K – the area along the rail corridor between Castlereagh Road in the east, to the western side of Peachtree Creek –Note, the majority of the areas along the northern side of the rail corridor were not accessible due to being private land
- Sections M, N and S – riparian zones along Peachtree Creek.

Evidence suggests that the survey area is likely only to include common species and primarily provide habitat for common species of fauna adapted to highly urbanised environments. No endangered ecological communities under the TSC Act or EPBC Act occur within the survey area

and no threatened species, populations or ecological communities under the TSC Act or EPBC Act were considered likely to substantially rely on the habitats within the survey area.

It is therefore considered that neither a Referral to the Department of the Environment under the EPBC Act and a Species Impact Statement under the TSC Act is required for the proposal.

Flora

Section A

Vegetation on the western side of Castlereagh Road consisted primarily of scattered trees, managed parkland grasses and some semi-aquatic and aquatic vegetation fringing the dam opposite Museum Drive. Tree species included mostly native species as well as a mixture of exotic tree species. Native species included *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus botryoides* (Bangalay), *Corymbia maculata* (Spotted Gum), *Casuarina cunninghamiana* (River She-oak) and *Melaleuca linariifolia* (Flax-leaved Paperbark).

The southern end contained mostly no understorey with some garden plantings in a managed grassland dominated by *Pennisetum clandestinum* (Kikuyu). The northern end contained a very sparse understorey including some *Bursaria spinosa* (Blackthorn) and a mixture of exotic species.

The dam contained mostly open water with *Juncus acutus subsp. acutus* (Spiny Rush) forming clumps and fringing vegetation in limited areas; however, generally there was no significant fringing vegetation.

Section B

Vegetation on the eastern side of Castlereagh Road consisted of garden beds and roadside weeds consisting of mostly exotic shrubs and small trees including *Ligustrum lucidum* (Large-leaved Privet) and *Olea europaea subsp. cuspidata* (African Olive) as well as *Jacaranda mimosifolia* (Jacaranda) and the native *Bursaria spinosa* (Blackthorn) shrub. Ground cover is partly managed and dominated by Kikuyu. One specimen of *Corymbia maculata* (Spotted Gum) was also observed in a garden bed.

Section C

Vegetation around Jane Street consisted of garden beds containing scattered shrubs and lines of planted street trees including *Eucalyptus microcorys* (Tallowwood) and some smaller areas of *Jacaranda mimosifolia* (Jacaranda). Ground cover outside the garden beds is primarily managed areas of Kikuyu.

Section D

Vegetation on the northern side of High Street is similar to Section C and consists of garden beds containing scattered shrubs and lines of street trees including Eucalyptus trees and *Jacaranda mimosifolia* (Jacaranda), ground cover is managed and dominated by Kikuyu.

Additionally, the vegetation on the southern side of High Street contains a line of *Syagrus romanzoffiana* (Cocos Palm) and a large specimen of *Castanospermum australe* (Black Bean) on the corner within the car yard.

Section E

Vegetation consisted of street trees with a managed ground cover of mostly Kikuyu. Figs (*Ficus sp.*) were also evident north of Union Road and London Plane Tree (*Platanus x acerifolia*) to the south of Union Road.

Section F

Vegetation along this eastern section of Castlereagh Road is mostly planted native trees including, *Eucalyptus sideroxylon* (Mugga Ironbark), *Corymbia maculata* (Spotted Gum), *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus microcorys* (Tallowwood) with a managed Kikuyu

dominated ground cover. Additionally there was a small drain running to the west of the street trees containing a mixture of weeds, semi-aquatic and aquatic vegetation.

Section G

Vegetation on the south-west corner of Castlereagh Road and High Street consisted of scattered exotic trees with a managed Kikuyu dominated ground cover dominated and some dense areas of shrub and ground cover weeds including, *Ligustrum lucidum* (Large-leaved Privet) and *Tradescantia fluminensis* (Wandering Creeper).

Section H

Vegetation on the southern side of High Street consisted of native and exotic trees and gardens within private land, with a managed Kikuyu dominated ground cover dominated. Tree species included, *Cinnamomum camphora* (Camphor Laurel) and *Eucalyptus botryoides* (Bangalay).

Section I

Parkland vegetation along the northern side of High Street consisted of garden beds and a mixture of native and exotic trees including *Eucalyptus sideroxylon* (Mugga Ironbark), *Corymbia maculata* (Spotted Gum), *Eucalyptus botryoides* (Bangalay), *Cinnamomum camphora* (Camphor Laurel), *Jacaranda mimosifolia* (Jacaranda) and *Ficus macrophylla* (Morton Bay Fig) with a managed Kikuyu dominated ground cover.

Section J

Vegetation between High Street and the rail corridor included three specimens of *Eucalyptus tereticornis* (Forest Red Gum) and managed Kikuyu dominated ground cover.

Section K

The vegetation along the rail corridor consisted of scattered trees and Kikuyu dominated managed grassland with some denser shrub areas including *Bursaria spinosa* (Blackthorn) within garden beds along the edge of the rail corridor. A variety of weed species were also observed along the southern side of the rail corridor, including *Lantana camara* (Lantana).

Section M, N and S

Peachtree Creek had very dense areas of mostly exotic trees and shrubs forming approximately 3-4 m of vegetation on each bank adjoined by managed grassland. Exotic tree, shrub and groundcover species observed included, *Cinnamomum camphora* (Camphor Laurel), *Ligustrum lucidum* (Large-leaved Privet), *Ligustrum sinense* (Small-leaved Privet), *Pennisetum clandestinum* (Kikuyu) and *Tradescantia fluminensis* (Wandering Creeper).

An area of the creek on the southern side of the rail corridor contained a dense area of emergent aquatic vegetation dominated by *Typha orientalis* (Broadleaf Cumbungi).

Fauna

There was relatively little fauna observed within the survey area. One bird, *Anas superciliosa* (Pacific Black Duck) was recorded in the dam opposite Museum Drive within Section A of the survey area.

Habitat

Five hollowing bearing trees which provide potential nesting and roosting habitat for a range of fauna species, such as birds, micro-bats and arboreal mammals as well as a number of flowering trees and shrubs throughout the site that could be used for foraging were recorded within the survey area.

Within Section A there were two hollow bearing trees (*Eucalyptus botryoides*) on the northern side of the dam opposite Museum Drive. Additionally the dam is likely to contain active nests of common aquatic bird species such as the Pacific Black Duck, although none were observed. The

water in the dam was discoloured and odour was evident indicating that a moderate level of nutrient runoff is being captured by the dam and that the quality of the water is not likely to be high.

It is likely that a large specimen of Black Bean located on private property in Section D may contain hollows suitable for nesting and roosting fauna; however, this could not be accessed during the survey. The small drain in Section F is also likely to provide suitable habitat for common amphibian and other common fauna species. Additionally the dense shrub area in Section G may provide protective habitat for a range of common fauna species.

Two hollow bearing trees (*Eucalyptus botryoides*) were observed at 680 High Street within Section F whilst the other hollow bearing tree (*Corymbia maculate* – Spotted Gum) was observed within Section G. Observations of the hollow indicate that it is likely to be in use, most probably by common possum species; however, there was no evidence of specific inhabiting species observed.

Peachtree Creek may provide potential foraging habitat for a variety of fauna species, such as aquatic birds and common reptiles as well as potential breeding and foraging habitat for common amphibians. Dense areas of shrubs may also provide some protective and nesting habitat for a range of fauna species. Additionally a riparian assessment of Peachtree Creek is provided in Table 6-34.

Table 6-34 Riparian assessment of Peachtree Creek

Assessment criteria	Section N	Section M	Section S	Southern end (above the weir)
Dimensions of waterway (metres)	8	6	6	4
Depth of water (centimetres)	30-50	>100	50	30
Flow characteristics	Slow	No flow	No flow	Moderate flow
Bed substrate	Mus	Not visible	Not visible	Mud
Habitat features	Eroded banks Some emergent vegetation	Eroded banks No emergent vegetation	Eroded banks No emergent vegetation	Eroded banks No emergent vegetation
Existing infrastructure / barriers to fish movement	No Large weir present about 30 m to the north	No	Yes Small weir present	Yes Small weir present
Visual assessment of water quality	Brown colour Moderate quality	Brown colour Low-moderate quality	Brown colour	Brown colour

6.11.2 Potential impacts

Construction

Direct impacts

Construction of the proposal is not likely to require the removal of any of the hollow bearing trees within the survey area, however management measures have been included (see Section 6.11.3) to ensure the proper protection measures are taken should any trees with hollows need to be removed. It is also unlikely that construction of proposal would significantly impact on any of the common species and habitats evident within the survey area. The ground cover proposed to be removed would be relatively thin sections along the road corridor.

The direct impact of the proposal is biodiversity during construction would be **minor adverse**.

Indirect impacts

Ground cover, once disturbed, creates the potential for the spread of weeds. The spread of weeds would be managed by implementing appropriate safeguard measures.

Although unlikely given their proximity to the construction work, sedimentation of Peachtree Creek and the dam may result from vegetation removal and earthworks. This work has the potential to lead to the deposition of sediment and erosion of the channel, impacting on water quality during periods of low flow. As such, sedimentation has the potential to affect aquatic and riparian flora and fauna. Potential impacts from sedimentation would also be managed by implementing safeguards to minimise erosion.

Potential accidental spills of contaminants such as fuel or chemicals could also impact on aquatic fauna and flora during periods of flow. Due to the limited extent of the work required in the vicinity of creek and the implementation of spill control measures during construction, potential for adverse impacts on water quality is considered to be low.

The indirect impact of the proposal is biodiversity during construction would be **minor adverse**.

Operation

Operation of the proposal would not have any further impact on biodiversity.

6.11.3 Safeguards and management measures

The safeguards and mitigation measures detailed in Table 6-35 would be implemented to minimise the impacts of the proposal on biodiversity.

Table 6-35 Environmental safeguards for biodiversity

Impact	Environmental safeguards	Responsibility	Timing
Construction impacts on biodiversity	<u>BD1</u> A Flora and Fauna Management Plan (FFMP) would be prepared and implemented as part of the CEMP. It would address terrestrial and aquatic matters and include, but not necessarily be limited to: a) plans showing areas to be cleared and areas to be protected, including exclusion zones and protected habitat features (e.g. hollow-bearing	Project Manager	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
	<p>trees), and areas for rehabilitation or re-establishment of native vegetation;</p> <p>b) requirements set out in the <i>RTA Landscape Guideline</i>;</p> <p>c) procedures addressing relevant matters specified in the <i>Biodiversity Guidelines – Protecting and managing biodiversity on RTA projects</i> including but not limited to:</p> <ul style="list-style-type: none"> • pre-clearing, including the outcomes of final flora and fauna species checks, establishment of exclusion zones and on-ground identification of specific habitat features to be retained (such as hollow-bearing trees) • vegetation clearing and bushrock removal, including staged habitat removal and any specified seasonal limits on clearing activities • fauna handling and unexpected threatened species finds • rehabilitation, revegetation, re-use of soils, woody debris and bushrock, and other habitat management actions • weed and pathogen management <p>d) procedures addressing relevant matters specified in the <i>NSW DPI (Fisheries) Policy and guidelines for fish habitat conservation and management</i></p>		
Biodiversity impacts from the design of the proposal	<p><u>BD2</u></p> <p>Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal would be considered during the detailed design stage and implemented where practicable and feasible. Measures to avoid and minimise impacts should be prioritised in the following order:</p> <p>a) critical habitat</p> <p>b) threatened species, endangered ecological</p>	Design team	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
	<p>communities or their habitat</p> <p>c) native vegetation and habitat supporting flora and fauna connectivity and/or that supports other environmental objectives such as protecting water quality, hydrology or erosion and sediment controls</p> <p>d) native vegetation of higher quality condition</p> <p>e) other native vegetation</p>		
Construction impacts on biodiversity	<p><u>BD3</u></p> <p>All personnel working on-site would receive training to ensure awareness of requirements of the FFMP and relevant statutory responsibilities. Site-specific training would be given to personnel when working in the vicinity of areas of identified biodiversity value that are to be protected.</p>	Site Manager	Pre-construction
Biodiversity finds during construction	<p><u>BD4</u></p> <p>Consistent with <i>the Biodiversity Guidelines – Protecting and managing biodiversity on RTA projects</i>, and any specific requirements of the approved FFMP, an unexpected finds procedure would be implemented in the event that a threatened species or ecological community that had not been identified and assessed by the REF is unexpectedly encountered during the construction process.</p>	Site Manager	Construction
Impacts of weeds and pests on biodiversity	<p><u>BD5</u></p> <p>Consistent with the <i>Biodiversity Guidelines – Protecting and managing biodiversity on RTA projects</i>, and any specific requirements of the approved FFMP, management arrangements would be implemented to manage environmental risks associated with weeds, pest species and pathogens. As a minimum that would include:</p>	Site Manager	Construction

Impact	Environmental safeguards	Responsibility	Timing
	<ul style="list-style-type: none"> completion of a site weed assessment and, if necessary based on the assessment outcomes, a weed management plan implementation of appropriate weed control methods and weed disposal implementation of appropriate hygiene protocols where there are potential or known pathogen risks. 		
Habitat and community rehabilitation	<u>BD6</u> Consistent with the <i>Biodiversity Guidelines – Protecting and managing biodiversity on RTA projects</i> , the <i>RTA Landscape Guideline</i> , and any specific requirements and locations identified in the approved Flora and Fauna Management Plan, habitat management actions would be implemented post-construction, including rehabilitation, re-vegetation, re-use of soil, woody debris and bushrock.	Site Manager	Post-construction

6.12 Air quality

6.12.1 Existing environment

The proposal area is located within a predominantly urban setting to the west of Penrith CBD. A review of the National Pollution Inventory database has identified one pollutant source at the Lion Dairy and Drinks site (listed as National Foods Milk Penrith at 2257 – 2265 Castlereagh Road).

Other facilities within two kilometres of the proposal area include:

- Boral Emu Plains Quarry at 1 Railway Street
- Caltex Energy Penrith Depot at 153 Coreen Avenue
- Penrith Sewage Treatment Plant at 2175 Castlereagh Road.

Collectively these facilities reported emissions from different substances including:

- Total volatile organic compounds
- Carbon monoxide
- Oxides of nitrogen
- Ammonia
- Sulphur dioxide.
- Toluene
- Xylenes

- Benzene
- Ethylbenzene.

Exhaust emissions from light and heavy vehicles travelling on the road network would also influence the existing environment within the proposal area and accordingly, air quality within the vicinity of the proposal area is considered to be moderate.

Potentially sensitive receptors within and around the proposal area include:

- Residential properties to the south and west of the proposal area adjacent to the Great Western Highway and Mulgoa Road
- Mountain View Aged Care Facility and Retirement Village to the site of the proposal are on Mulgoa Road
- Woodriff Gardens and the Nepean District Tennis Association to the west of the Jane Street – Mulgoa Road intersection.

6.12.2 Potential impacts

Construction

There is the potential for dust generation associated with the following construction activities:

- Stripping of topsoil
- Clearing of vegetation
- Earthworks
- Stockpiling
- Transport and handling of soils and materials
- Traffic movements on unpaved roads.

Those activities would be associated with dust generation and potential amenity impacts on nearby sensitive receptors. Dust generation would occur temporarily and be exacerbated during dry and windy conditions, particularly on hot days. Potential impacts would be minimised through the implementation of safeguard measures. As such, the proposal would have **minor adverse** impact on dust generation during construction.

Exhaust emissions from construction plant, machinery and vehicles would also generate emissions that could impact on air quality and amenity for local residents. Such emissions (including carbon monoxide, carbon dioxide, oxides of nitrogen, sulphur dioxide and non-combustible hydrocarbons) are associated with the combustion of fossil fuels during vehicle movement and the operation of on-site plant and construction machinery. It is expected that all construction vehicles, plant and machinery would be operated in accordance with the manufacturer guidelines and therefore associated emissions and air quality impacts would be negligible in the context of existing vehicular movements in the region. The proposal would therefore have **minor adverse** impact on emissions and ambient air quality during construction.

There would also be the potential for odour associated with the construction of the road pavement, specifically during the application of asphalt and line-marking. Again, this would be temporary in nature and minimised through the implementation of safeguard measures. The proposal would therefore have **minor adverse** impact on odour during construction.

Operation

Operation of the proposal would be similar to those currently in place in the proposal area. The proposal may lead to a reduction in congestion and queuing time; however, this would be negligible in the context of existing conditions. As such, the proposal would have a **negligible** impact on air quality during operation.

6.12.3 Safeguards and management measures

The safeguards and mitigation measures detailed in Table 6-36 would be implemented to minimise the impacts of the proposal on air quality.

Table 6-36 Environmental safeguards for air quality

Impact	Environmental safeguards	Responsibility	Timing
Air quality impacts during construction	<p><u>AQ1</u> An Air Quality Management Plan (AQMP) would be prepared and implemented as part of the CEMP. The AQMP would identify:</p> <ul style="list-style-type: none"> • potential sources of air pollution (such as dust, vehicles transporting waste, plant and equipment) during construction • air quality management objectives consistent with any relevant published EPA and/or OEH guidelines • mitigation and suppression measures to be implemented, such as spraying or covering exposed surfaces, provision of vehicle clean down areas, covering of loads, street cleaning, use of dust screens, maintenance of plant in accordance with manufacturer's instructions • methods to manage work during strong winds or other adverse weather conditions • a progressive rehabilitation strategy for exposed surfaces • a monitoring program to assess compliance with the identified objectives, and developed in accordance with any relevant published EPA and/or OEH guidelines • community notification and complaint handling procedures 	Project Manager	Pre-construction
Impacts on sensitive receptors	<p><u>AQ2</u> All sensitive receivers (e.g. Residences, the Mountain View Aged Care Facility) likely to be affected must be notified at least five days prior to commencement of any work associated with the activity that may have an adverse</p>	Project Manager	Pre-construction and construction

Impact	Environmental safeguards	Responsibility	Timing
	impact on local air quality. The notification must include details of: the project; construction period and construction hours; any recommended measures that can be implemented (e.g. window closure, staying indoors, etc.), contact information for project management staff; complaint and incident reporting; and how to obtain further information.		
Air quality impacts during construction	AQ3 All personnel working on-site would receive training to ensure awareness of requirements of the AQMP. Site-specific training would be given to personnel when working in the vicinity of sensitive receivers.	Site Manager	Pre-construction
Air quality impacts during construction	<u>AQ4</u> Consistent with the approved AQMP mitigation and suppression measures would be implemented to protect local air quality.	Site Manager	Construction

6.13 Resource use and waste management

6.13.1 Existing environment

The proposal area encompasses an existing road network and pedestrian facilities which have minimum waste generation and resource use. A site visit identified that there are some waste bins in the area to serve pedestrians using the footpaths.

6.13.2 Policy setting

The safe storage, handling, transport, recovery and disposal of waste is governed by the POEO Act and the Waste Regulation (see Section 4.3.6). Generators of waste are responsible for the correct classification of the waste they produce in accordance with the EPA *Waste Classification Guidelines Part 1: Classifying waste* (the Waste Classification Guidelines). A waste register is required to ensure that legislative requirements are met.

The WARR Act provides a framework for considering resource management (see Section 4.3.7) and is given effect by the NSW Waste Reduction and Purchasing Policy (WRAPP). Under the WRAPP Reporting Guidelines, agencies are required to give priority to buying materials with recycled content, when it is cost and performance competitive to do so (OEH, 2016). Their plans must set out how the agency would reduce waste and increase purchases of recycled products, with baseline and performance data on:

- Total quantities of wastes being generated and recycled
- Total quantities of recycled content materials being purchased.

Roads and Maritime contractors are required to propose recycled-content materials where they are cost and performance competitive and are the environmental equivalent (or better) than non-recycled alternatives. Specific materials that are targeted for reuse or recycling in the Roads and Maritime *Environmental Sustainability Strategy* that are specifically relevant to this proposal are included in Table 6-37.

Table 6-37 Targeted wastes for reuse

Targeted wastes	Recover target
Asphalt removal and replacement	Recover 95% of all asphalt for reuse
Concrete pavement and infill areas	Recover 76% of concrete for reuse
Waste steel from traffic control devices, including signage and electrical infrastructure	Recover 76% of steel for reuse
Waste aggregate	Recover 76% of aggregate for reuse
Virgin excavated natural materials (VENM)	Recover 95% of all VENM for reuse

The Roads and Maritime *Re-use of waste off-site: Waste Fact Sheet 9* outlines the potential off-site re-uses for typical wastes from Roads and Maritime construction projects. These re-use opportunities do not require environmental licensing from the EPA, provided that all conditions for off-site re-use are met.

The Roads and Maritime *Management of Wastes on Roads and Maritime Services Land* procedure was developed in 2014 to minimise the risks of construction wastes on Roads and Maritime land. The procedure includes best practice and contingency planning for construction wastes on sites, benchmark pre-construction site assessments to establish the condition of a Roads and Maritime owned site prior to hand over to a construction contractor, and a post-construction site condition assessment guide to verify that no unauthorised wastes remain on a site post-construction.

6.13.3 Potential impacts

Construction

Waste

Construction activities have the potential to generate waste, some of which would be able to be reused or recycled. The key construction activities that would generate waste include:

- Removal of the existing railway bridge
- Excavation for road widening and utility adjustment
- Pavement removal and resurfacing
- Concreting for pedestrian/shared pathway construction
- Green waste from vegetation removal
- General demolition waste.

Construction waste may also consist of small quantities of oils and paints from machinery and line markings, synthetic materials, paper and office waste associated with project management activities and general waste from on-site staff. It is anticipated that waste would be removed from construction areas at the end of each day and disposed of at an appropriately licensed waste facility or temporarily stockpiled at the construction compound.

It is expected that there would be an excess of 7,300 m³ cut over fill and thus soil is likely to be removed from site. During construction all reasonable efforts would be made to reuse excavated

material on site and any unused excavated material would be classified, removed from site in skip bins or trucks and disposed of at an appropriately licensed waste disposal or recycling facility.

Construction waste could have potential impacts in terms of:

- Volumes of waste generated on-site
- Volumes of waste sent to landfill from the inadequate collection, classification and disposal of waste
- Contamination of soil, surface water and groundwater from inadequate waste handling
- Amenity impacts from odour and increases in vermin from inappropriate general waste storage and disposal.

The potential impact of the proposal on waste management would be **minor adverse** during construction and managed through the implementation of safeguard measures.

Resource use

Construction of the proposal would also require the use of a number of resources, including but not limited to:

- Petroleum based products such as bitumen and asphalt
- Concrete
- Steel
- Select fill
- Water
- Resources associated with the operation of construction machinery, and motor vehicles.

Supply constraints are not expected and the proposal would not affect any resources in short supply.

Roads and Maritime adopt the principles of the waste management hierarchy to encourage the efficient use of resource, reuse and recycling where possible to reduce cost and environmental harm and divert waste from landfill in accordance with the principles of ESD. Through the implementation of mitigation measures and procedures to achieve these principles, the proposal would therefore have a **minor adverse** impact on resource use during construction.

Operation

Operational aspects of the proposal would be similar to those currently in place with regards to resource use and waste management. There would be limited volumes of waste generated and minimal resources used and the primary source of waste would be from road users. The proposal would therefore have a **negligible** impact on resource use and waste management during operation.

6.13.4 Safeguards and management measures

The safeguards and mitigation measures detailed in Table 6-38 would be implemented to minimise the impacts of the proposal on resource use and waste management.

Table 6-38 Environmental safeguards for resource use and waste management

Impact	Environmental safeguards	Responsibility	Timing
Construction waste	<p><u>WMRU1</u> A Waste Management Plan (WMP) would be prepared and implemented as part of the CEMP. It would provide specific guidance on measures and controls to be implemented to support minimising the amount of waste produced and appropriately handle and dispose of unavoidable waste. It would also address the importation of waste to the site for use in undertaking the project. The WMP would give effect to any management measures contained in any waste assessment carried out for the project and include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> • measures to avoid and minimise waste associated with the project • classification of wastes generated by the project and management options (re-use, recycle, stockpile, disposal) • classification of wastes received from off-site for use in the project and management options • identifying any statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions • procedures for storage, transport and disposal • monitoring, record keeping and reporting, including any documentation management obligations arising from resource recovery exemptions. <p>The WMP would be prepared taking into account the Roads and Maritime <i>Environmental Procedure – Management of Wastes on Roads and Maritime Services Land</i> and relevant</p>	Project Manager	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
	Roads and Maritime Waste Fact Sheets.		
Construction waste	<u>WMRU2</u> Waste would be classified in accordance with the methods and specifications of the NSW EPA Waste Classification Guidelines 2014.	Site Manager	Construction
Construction green waste	<u>WMRU3</u> Any trees to be removed shall be reused as millable timber wherever practicable. Other vegetated material from native species shall be mulched and re-use on-site for landscaping or rehabilitation purposes if consistent with the approved FFMP for the project. Weed species, or vegetation not considered appropriate for re-use on-site, would be removed and disposed of to an appropriately licenced facility.	Site Manager	Construction
Construction waste management	<u>WMRU4</u> After considering the outcomes of relevant information that becomes available during construction, appropriate measures would be implemented to address identified deficiencies or undertake actions needed to address waste related impacts. If necessary, the Waste Management Plan would be reviewed and updated to include any additional measures.	Site Manager	Construction
Post-construction waste	<u>WMRU5</u> A post-construction land assessment must be carried out to determine the suitability for hand-back to the landowner. The assessment is to be prepared in accordance with the Roads and Maritime <i>Environmental Procedure – Management of Wastes on Roads and Maritime Services</i>	Site Manager	Construction

Impact	Environmental safeguards	Responsibility	Timing
	<i>Land.</i> Where the land is privately owned, a copy of the assessment would be provided to the landowner.		

6.14 Climate change

6.14.1 Existing environment

The existing climate within the vicinity of the proposal area is characterised by warm summers and mild winters with rainfall throughout the year, as illustrated in Figure 6-22. Climate change generally refers to the warming temperatures and altered climate conditions associated with the increased concentration of greenhouse gases in the atmosphere. It is now generally accepted that the release of certain gases including, most notably carbon dioxide and methane, exacerbates climate change. These gases are collectively referred to as 'greenhouse gases'. As outlined in Section 6.12.1, there are a number of facilities in the vicinity of the proposal area which emit greenhouse gases.

Evidence of climate change includes bushfires are common in the wider region, particularly towards the Blue Mountains and flooding is common within the proposal area as previously discussed in Section 6.4.

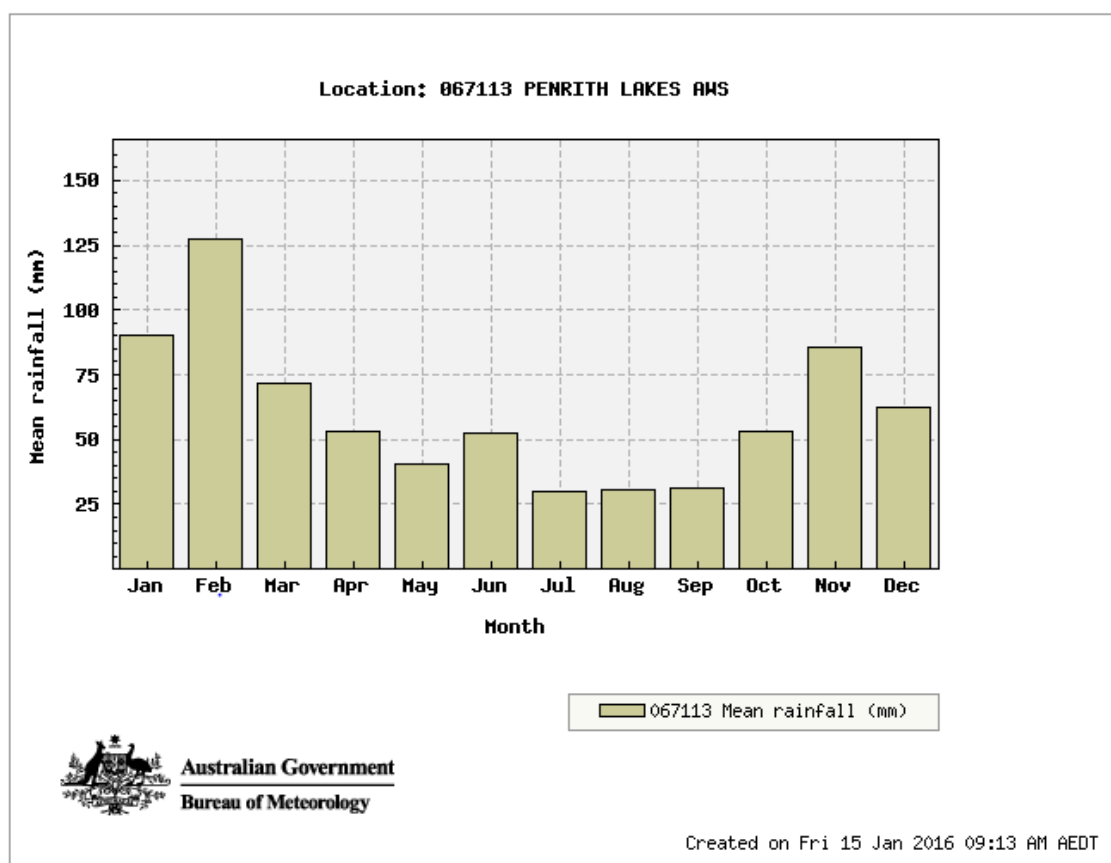


Figure 6-22 Mean rainfall (millimetres) 2005 –2015 (Source: Bureau of Meteorology)

The highest average temperature recorded by the Bureau of Meteorology at the Penrith Lakes AWS is 30.8 degrees Celsius (as illustrated in Figure 6-23) and the lowest average minimum temperature is 5.4 degrees Celsius (as illustrated in Figure 6-24).

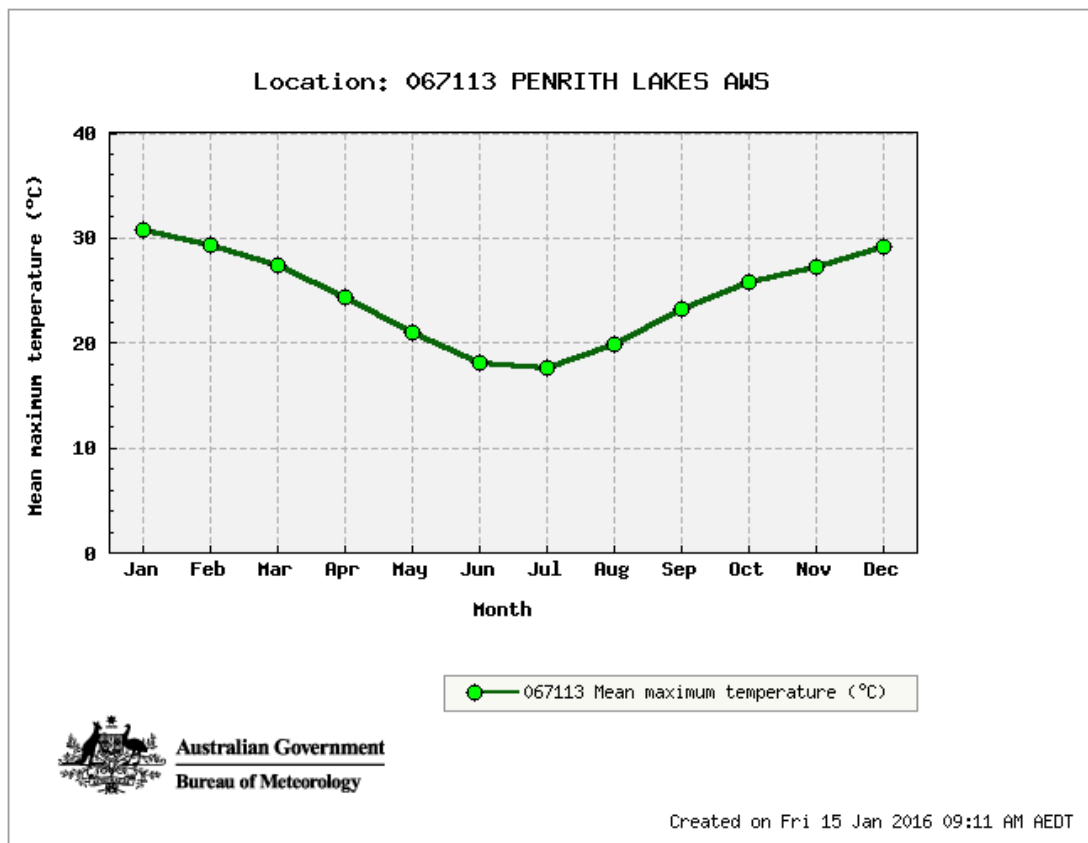


Figure 6-23 Mean maximum temperature (degrees Celsius) 2005 – 2015 (Source: Bureau of Meteorology)

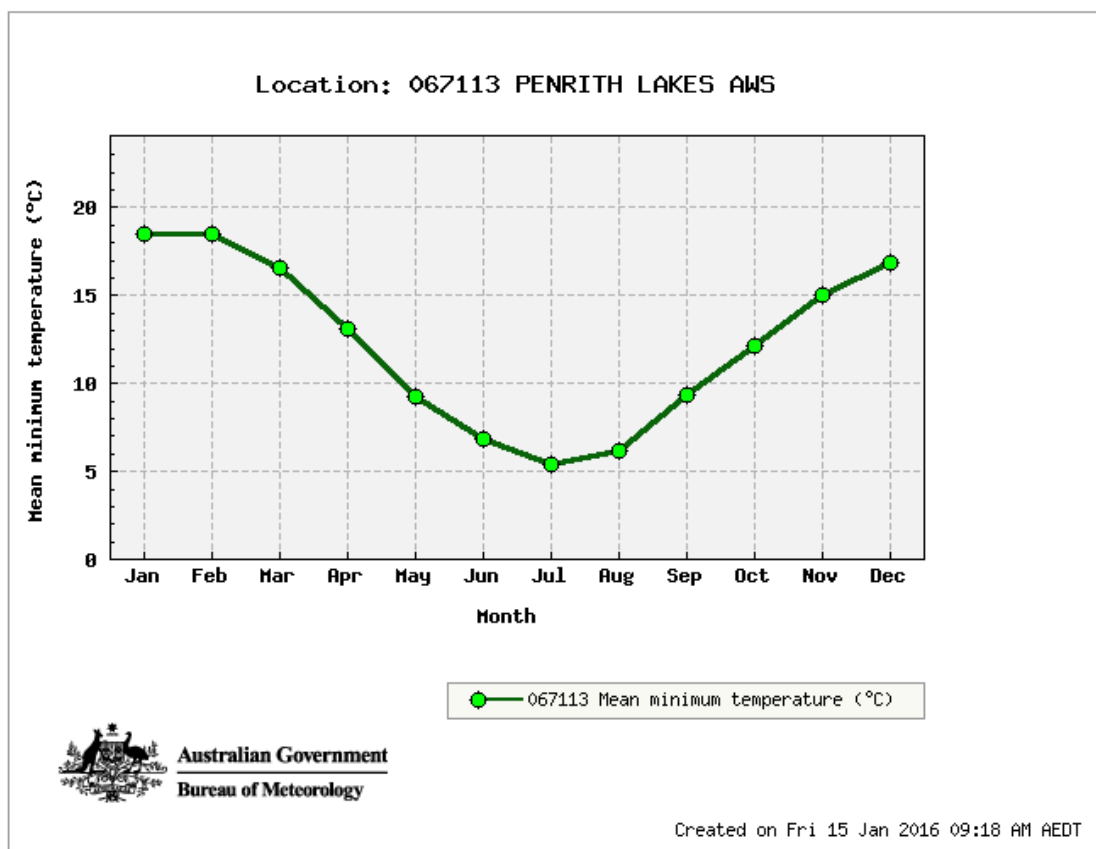


Figure 6-24 Mean minimum temperature (degrees Celsius) 2005 – 2015 (Source: Bureau of Meteorology)

6.14.2 Potential impacts

Climate change has the potential to both impact on the proposal and be impacted by the proposal.

Construction

Impacts of the proposal on climate change

Construction of the proposal would include the release of the following greenhouse gases which has the potential for impacts on the climate:

- Carbon may be embedded in many of the materials used during construction including the bridge structures, reinforced concrete, drainage and pavements. There are also various greenhouse gas emissions associated with the extraction and production of materials used in the construction of the road
- Carbon dioxide and nitrous oxide would be generated from fossil fuel combustion in plant and vehicles used for construction activities, disposal and the transport of materials
- Methane would be released from landfilling any carbon based waste, and potentially from fugitive emissions during the use of natural gas.

In the context of the local industrial emissions, this would have a negligible impact on atmospheric conditions (as described in Section 6.12.1) and potential impacts would be managed through the implementation of safeguard measures.

Construction of the proposal would therefore have a **negligible** impact on climate change during construction.

Impacts of climate change on the proposal

Climatic factors would not constrain construction of the proposal except during adverse or extreme weather conditions such as heatwaves, prolonged heavy rain or very high winds which are becoming more frequent as a result of climate change. As such the following potential impacts of climate change on the proposal have been identified:

- Increasing temperatures would reduce work capacity and increase the risk of heat stress for site workers
- Heatwaves associated with climate change have the capacity to delay construction, for example increased temperatures can interfere with the laying of asphalt or concrete
- Climate change increases the frequency and intensity of extreme events which has the capacity to disrupt construction activities. Intense rainfall creates the delay in piling and excavation activities whilst dry, hot weather is conducive to bushfires and the generation of dust
- Increased rainfall creates the potential for flooding particularly around the replacement railway bridge and this could result in inundation, overtopping of the water bodies, erosion risks and associated sediment loss.

Operation

Impacts of the proposal on climate change

The primary source of climate change impacts during the proposal would be greenhouse emissions associated with fossil fuelled vehicles using the proposal. As discussed in Section 6.1, vehicle numbers using the network are increasing; however, the proposal would improve traffic flow, reduce congestion thus minimise impacts on climate change. To understand the full effects of the proposal, a detailed greenhouse gas assessment would need to be carried out. However, given the existing conditions, the impact of the proposal on climate change is **negligible** during operation.

Impacts of climate change on the proposal

It is unlikely that climatic factors would impact on operation of the proposal in any way different to those climate change impacts currently experienced. As such, the impact of climate change on the proposal is **negligible** during operation.

6.14.3 Safeguards and management measures

The safeguards and mitigation measures detailed in Table 6-39 would be implemented to minimise the impacts of the proposal on climate change and impacts of climate change on the proposal.

Table 6-39 Environmental safeguards for climate change

Impact	Environmental safeguards	Responsibility	Timing
Construction climate change impacts	<p>CC1</p> <p>Specific measures would be outlined in the CEMP to ensure that construction minimises any potential impacts on or from climate change including:</p> <ul style="list-style-type: none">• Energy efficiency and related carbon emissions would be considered during the development of construction methodologies, procurement of low carbon alternatives and the selection of efficient plant vehicles, and equipment.• Plant, vehicles and machinery must be operated efficiently in accordance with the manufacturers guidelines to ensure optimal performance and be switched off when not in use• Procedures would be set out for the management of extreme events including flooding, heatwaves and bushfires.	Project Manager	Pre-construction

6.15 Cumulative impacts

Cumulative impacts could be experienced if construction or operation of the project coincided with construction or operation of other local development, such as other road upgrades, public work or private development.

A desktop review of the major project register on the Department of Planning and Environment's website completed on 23 August 2016 confirmed there are no recently approved major projects within the Penrith LGA.

The Penrith City Council website identifies Development Applications (DAs) recently determined within the LGA, including major developments and Council infrastructure maintenance work.

Recently approved DAs nearby to the site include:

- Fit-Out & Use as Small Bar – 542 High Street, Penrith (DA16/0467)
- Fit-Out & Use as Pet Grooming Business & Retailing of Pet Supplies – 15 / 566 High, Penrith (DA16/0322)
- Fit-Out & Use as Hog's Breath Cafe – 127 - 141 Station Street, Penrith (DA16/0219)

The Penrith City Council website should be reviewed before commencement of construction to properly understand potential cumulative impacts.

The proposal forms part of the wider Mulgoa Road Corridor project, which would be constructed at a later date. Other key future developments in the area include the Nepean River Bridge, the Penrith Lakes Scheme, and the Riverlink Precinct.

6.15.1 Potential impacts

Construction

Cumulative impacts could occur during construction as a result of the proposal and other local development being carried out in parallel. However, this would be temporary and environmental safeguards and management measures would be implemented as appropriate.

The key cumulative impacts during construction could include:

- Increased construction vehicle traffic on local roads causing congestion and delays
- Cumulative air and noise impacts associated with multiple construction work
- Temporary changes to the visual amenity of the area.

The severity of potential cumulative impacts would vary between locations and would generally be dependent on the types of work being carried out, the timing and duration of the work relative to each other, the distance between the work and the receivers and the sensitivity of the receiver.

Sydney Trains is likely to carry out scheduled track work during construction of the proposal. During track work, Sydney Trains operate rail replacement bus services. Combined with additional vehicular movements from construction traffic, these bus services have the potential to result in local cumulative traffic impacts. During this time, rail customers and motorists would temporarily experience additional travel times and the reliability of the replacement bus services may be affected by traffic congestion

When combined with potential noise impacts of concurrent construction work in the area, cumulative noise levels in the proposal area may result in exceedance of the noise criteria (see Section 6.5) and result in reduced local amenity. During work, reasonable and feasible measures to manage noise levels in exceedance of the criteria would be carried out where practicable to minimise all noise impacts.

For residents and motorists in the area, coinciding construction activities in the may also result in a lower visual amenity and air quality environment during work. These impacts would be short-term and can be justified by the long-term, positive impacts of the proposal. Further, the safeguards and management measures recommended are expected to effectively manage potential cumulative visual amenity and air quality impacts.

Operation

The proposal, combined with the wider road upgrade scheme would result in cumulative benefits for the Mulgoa Road – Castlereagh Road corridor and locality through increased capacity of the road network, improved traffic flow and journey times, improved road safety, improved efficiency of bus services, and improved pedestrian/cyclist facilities.

However, cumulatively the road upgrades would also result in localised increases in traffic noise and air pollution within the region. Noise impacts would be addressed during design on a project-by-project basis to minimise impacts on sensitive receivers and further managed through project noise management plans. Air quality would also be addressed on a project-by-project basis.

6.15.2 Safeguards and management measures

The safeguards and mitigation measures detailed in Table 6-40 would be implemented to minimise potential cumulative impacts of the proposal combined with other local development.

Table 6-40 Environmental safeguards for cumulative impacts

Impact	Environmental safeguards	Responsibility	Timing
Cumulative impacts	<u>CU1</u> <ul style="list-style-type: none"> Cumulative impacts would be incorporated into the traffic management plan and the noise and vibration management plan. 	Project Manager	Pre-construction and construction
Cumulative impacts	<u>CU2</u> <ul style="list-style-type: none"> Management measures within the CEMP would be reviewed in response to any complaints received. 	Project Manager	Construction

6.16 Summary of beneficial effects

The proposal would provide the following benefits during construction and operational phases:

Construction

- Potential to generate jobs.

Operation

- Increase safety on Mulgoa Road – Castlereagh Road
- Increase future traffic capacity and travel times
- Improved efficiency of bus services
- Improved drainage during rain events
- Improved connectivity and accessibility.

6.17 Summary of adverse effects

The proposal would have the following adverse impacts during construction and operational phases:

Construction

- Disruption to traffic flow at the Jane Street / Mulgoa Road – Castlereagh Road and Great Western Highway / Mulgoa Road/ High Street intersections
- Disruption to rail services on the T1 Western Line (operated by Sydney Trains) and Blue Mountains Line (NSW TrainLink) and disruption to freight operations
- Removal of heritage fabric from the existing railway bridge crossing over Castlereagh Road
- Potential removal of sub-surface remains of the earlier road on High Street and Castlereagh Road, south of the Jane Street intersection

- Potential removal of any former structures along High Street
- Noise exceedances, particularly in the vicinity of residential premises along High Street to the West of the intersection with Mulgoa Road and at the Jane Sutherland Performing Arts Centre
- Impacts to social infrastructure and values during construction.

Operation

- Permanent tree removal and landscaping at Woodriff Gardens (although this would be offset by replacement tree planting and landscaping to match the vision and strategy articulated for the whole of the Mulgoa Road corridor)
- Increase of the scale and dominance of the road corridor.

7 Environmental management

7.1 Environmental management plans (or system)

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

A Project Environmental Management Plan (PEMP) and a CEMP would be prepared to describe safeguards and management measures identified. These plans would provide a framework for establishing how these measures would be implemented and who would be responsible for their implementation.

The plans would be prepared prior to construction of the proposal and must be reviewed and certified by the Roads and Maritime Environment Officer, Sydney West, prior to the commencement of any on-site work. The CEMP would be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP and PEMP would be developed in accordance with the specifications set out in the *QA Specification G36 – Environmental Protection (Management System)*, *QA Specification G38 – Soil and Water Management (Soil and Water Plan)* and *QA Specification G10 – Traffic Management*.

7.2 Summary of safeguards and management measures

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

Table 7-1: Summary of site specific environmental safeguards

No.	Impact	Environmental safeguards	Responsibility	Timing
G1	General	<p>All environmental safeguards must be incorporated within the following:</p> <ul style="list-style-type: none"> • Project Environmental Management Plan • Detailed design stage • Contract specifications for the proposal • Contractor's Environmental Management Plan 	Project Manager	Pre-construction
G2	General	<ul style="list-style-type: none"> • A risk assessment must be carried out on the proposal in accordance with the Roads and Maritime Services Project Pack and PMS risk assessment procedures to determine an audit and inspection program for the work. The recommendations of the risk assessment are to be implemented. • A review of the risk assessment must be carried out after the initial audit or inspection to evaluate if the level of risk chosen for the project is appropriate. • Any work resulting from the proposal and as covered by the REF may be subject to environmental audit(s) and/or inspection(s) at any time during their duration. 	Project Manager and regional environmental staff	<p>Pre-construction</p> <p>After first audit</p>
G3	General	<ul style="list-style-type: none"> • The environmental contract specification G36 must be forwarded to the Roads and Maritime Services Environment Manager Western Sydney region for review at least 10 working days prior to the tender stage. • A contractual hold point must be maintained until the CEMP is reviewed by the Roads and Maritime Services Environment Manager Western Sydney region. 	Project Manager	Pre-construction
G4	General	<ul style="list-style-type: none"> • The Roads and Maritime Services Project Manager/ Site Manager must notify the Roads and Maritime Services Environment Officer Western Sydney region at least five working days prior to work commencing. 	Project Manager/ Site Manager	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
G5	General	<ul style="list-style-type: none"> All businesses and residences likely to be affected by the proposed work must be notified at least five working days prior to the commencement of the proposed activities. 	Project Manager	Pre-construction
G6	General	<ul style="list-style-type: none"> Environmental awareness training must be provided, by the contractor, to all field personnel and subcontractors. 	Contractor/ Site Manager	Pre-construction and during construction as required.
T1	Traffic and transport	<ul style="list-style-type: none"> A TMP would be prepared and implemented in accordance with the Roads and Maritime Traffic control at worksites manual (Version 4), Australian Standard 1742.3 Manual of uniform traffic control devices, and instruction from the Transport Management Centre. 	Contractor/ Site Manager	Pre-construction
T2	Traffic and transport	<ul style="list-style-type: none"> Road users, rail commuters, local residents, pedestrians and cyclists would be informed in advance of changed conditions, including any likely disruptions to access. 	Project Manager and consultation team	Pre-construction and construction
T3	Traffic and transport	<ul style="list-style-type: none"> Real-time information would be made available through temporary Variable Message Signs (VMS), the Live Traffic and 131 500 websites, and the media. 	Project Manager/ Site Manager	Construction
T4	Traffic and transport	<ul style="list-style-type: none"> Materials would be managed to minimise the number of haulage and delivery vehicles required on site. 	Site Manager	Construction
T5	Traffic and transport	<ul style="list-style-type: none"> The designated site access points and haulage routes would be used. 	Site Manager	Construction
T6	Traffic and transport	<ul style="list-style-type: none"> Affected areas would be restored to a condition equivalent to that which existed prior to the commencement of the work 	Site Manager	Post-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
AH1	Aboriginal Heritage	<ul style="list-style-type: none"> The Standard Management Procedure – <i>Unexpected Heritage Items</i> must be followed in the event that a known or potential Aboriginal object(s), including skeletal remains, is found during construction. This applies where Roads and Maritime does not have approval to disturb the object(s) or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place. Work may only re-commence once the requirements of that Procedure have been satisfied. 	Site Manager	Construction
NAH1	Non-Aboriginal Heritage	<p>A non-Aboriginal Heritage Management Plan (HMP) would be prepared and implemented as part of the CEMP.</p> <p>It would provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to non-Aboriginal heritage. The HMP would be prepared in consultation with the Office of Environment and Heritage. The HMP would give effect to any management measures contained in any non-Aboriginal heritage assessment carried out for the project and include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> details of investigations completed or planned to be carried out and any associated approvals required mapping of areas of non-Aboriginal heritage value and identification of protection measures to be applied during construction procedures to be implemented if previously unidentified non-Aboriginal relics or heritage items are discovered during construction, in accordance with the Roads and Maritime <i>Standard Management Procedure – Unexpected Archaeological Finds</i> an induction program for construction personnel on the management of non-Aboriginal heritage values. 	Project Manager	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
NAH2	Non-Aboriginal Heritage	<ul style="list-style-type: none"> Should any heritage items, archaeological remains or potential relics of non-Aboriginal origin be encountered, then construction work that might affect or damage the material must cease and notification provided to the relevant Roads and Maritime officer identified in the Roads and Maritime <i>Standard Management Procedure – Unexpected Archaeological Finds</i>. Work may only re-commence once the requirements of that Procedure have been satisfied. 	Site Manager	Construction
NAH3	Non-Aboriginal Heritage	<ul style="list-style-type: none"> All personnel working on-site would receive training to ensure awareness of requirements of the non-Aboriginal Heritage Management Plan and relevant statutory responsibilities. Site-specific training would be given to personnel when working in the vicinity of identified non-Aboriginal heritage items. 	Site Manager	Pre-construction
NAH4	Non-Aboriginal Heritage	<ul style="list-style-type: none"> The protection of areas of identified non-Aboriginal cultural heritage values that are to be retained such as the Penrith Ambulance Station would occur in accordance with the adopted non-Aboriginal Heritage Management Plan 	Site Manager	Construction
NAH5	Non-Aboriginal Heritage	<ul style="list-style-type: none"> Consistent with any specific requirements of the approved non-Aboriginal Heritage Management Plan and/or any exemptions, exceptions or excavation permits issued by the Office of Environment and Heritage, salvage of non-Aboriginal cultural heritage material would be carried out. 	Project Manager	Construction
NAH6	Non-Aboriginal Heritage	<ul style="list-style-type: none"> An archival recording would be prepared of the railway bridge and Woodriff Gardens prior to any work being carried out that affects the item. The recording would be prepared in accordance with guidelines published by the Office of Environment and Heritage. 	Project manager	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
W1	Water quality, hydrology and flooding	<ul style="list-style-type: none"> A Soil and Water Management Plan (SWMP) would be prepared in accordance with QA Specification G38 and implemented as part of the CEMP. The SWMP would identify all reasonably foreseeable risks relating to soil erosion and water pollution associated with undertaking the activity, and describe how these risks would be managed and minimised during construction. That would include arrangements for managing pollution risks associated with spillage or contamination on the site and adjoining areas, and monitoring during and post-construction. 	Project Manager	Pre-construction
W2	Water quality, hydrology and flooding	<ul style="list-style-type: none"> A site specific Erosion and Sediment Control Plan (ESCP) would be prepared and included in the SWMP and CEMP. The ESCP would identify detailed measures and controls to be applied to minimise erosion and sediment control risks including, but not necessarily limited to: runoff, diversion and drainage points; sediment basins and sumps; scour protection; check dams, fencing and swales; and staged implementation arrangements . The ESCP would also include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather. 	Project Manager	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
W3	Water quality, hydrology and flooding	<p>Consistent with any specific requirements of the approved SWMP, control measures would be implemented to minimise risks associated with erosion and sedimentation and entry of materials to drainage lines and waterways. That would include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> • sediment management devices, such as fencing, hay bales or sand bags • measures to divert or capture and filter water prior to discharge, such as drainage channels and first flush and sediment basins • scour protection and energy dissipaters at locations of high erosion risk • installation of measures at work entry and exit points to minimise movement of material onto adjoining roads, such as rumble grids or wheel wash bays • appropriate location and storage of construction materials, fuels and chemicals, including bunding where appropriate. 	Site Manager	Construction
NV1	Noise and vibration	<p>A Noise and Vibration Management Plan (NVMP) would be prepared as part of the CEMP. The NVMP would be prepared in accordance with the ICNG and would identify:</p> <ul style="list-style-type: none"> • all potential significant noise and vibration generating activities associated with the activity • measures to be implemented during construction to minimise noise and vibration impacts, such as restrictions on working hours, staging, placement and operation of work compounds, parking and storage areas, temporary noise barriers, haul road maintenance, and controlling the location and use of vibration generating equipment • feasible and reasonable mitigation measures to be implemented • a monitoring program to assess performance against relevant noise and vibration criteria • arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • contingency measures to be implemented in the event of non-compliance with noise and vibration criteria. 	Project Manager	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
NV2	Noise and vibration	<ul style="list-style-type: none"> The majority of works would be carried out during standard working hours (i.e. 7am – 6pm Monday to Friday, 8am – 1pm Saturdays). Any work that is performed outside normal work hours or on a Sunday or public holiday would minimise noise impacts in accordance with Roads and Maritime's <i>Environmental Noise Management Manual Practice Note 7 – Roadworks Outside of Normal Working Hours</i> and the ICNG. 	Site Manager	Construction
NV3	Noise and vibration	<ul style="list-style-type: none"> Construction personnel would be made familiar with the potential for noise and vibration impacts upon local residents and encouraged to take all practical and reasonable measures to minimise noise during the course of their activities. 	Site Manager	Construction
NV4	Noise and vibration	<ul style="list-style-type: none"> Where practical, the layout and positioning of noise-producing plant and activities at each work site would be optimised to minimise noise emission levels. 	Site Manager	Construction
NV5	Noise and vibration	<ul style="list-style-type: none"> Where practical, equipment would be selected to minimise noise emissions. Equipment would be fitted with appropriate noise control equipment and be in good working order. 	Site Manager	Construction
NV6	Noise and vibration	<ul style="list-style-type: none"> Where possible, non-“beeper” reversing movement alarms would be used such as broadband (non-tonal) alarms or ambient noise-sensing alarms. Work sites would also be designing the site to reduce the need for reversing, potentially minimising the use of reversing beepers. 	Site Manager	Construction
NV7	Noise and vibration	<ul style="list-style-type: none"> Vehicles, plant and equipment would be regularly inspected and maintained to avoid increased noise levels from rattling hatches, loose fittings etc. 	Site Manager	Construction
NV8	Noise and vibration	<ul style="list-style-type: none"> All vehicles, plant and equipment would be shut off when not in use. 	Site Manager	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
NV9	Noise and vibration	<ul style="list-style-type: none"> Resilient damping material would be fitted on bin trucks to minimise noise impacts from the loading of materials on trucks. 	Site Manager	Construction
NV10	Noise and vibration	<ul style="list-style-type: none"> If feasible and reasonable, localised temporary acoustic hoardings/screens would be installed in proximity to high noise generating activities. Hoardings/screens would be located as close to the noise source as possible, and would be an appropriate height as structurally feasible to minimise noise emissions 	Site Manager	Construction
NV11	Noise and vibration	<ul style="list-style-type: none"> If piling is proposed for bridgework, nearby residents should be consulted regarding the intended activities associated with the piling process. 	Project Manager and consultation team	Pre-construction and construction
NV12	Noise and vibration	<ul style="list-style-type: none"> Measures to reduce the impact of percussive piling activities should be considered, including: <ul style="list-style-type: none"> Using a resilient pad (dolly) between pile and hammer head Enclosing the hammer head in a temporary acoustic shroud Alternatively, rotary bored or vibro-piling may be used where consistent with the type of pile used and restrictions on soil disturbance. 	Site Manager	Construction
NV13	Noise and vibration	<ul style="list-style-type: none"> A sleep disturbance assessment should be carried out prior to construction for any planned out of hours work. The sleep disturbance assessment should consider the absolute noise level of the activity, the degree of above the existing ambient noise level, and the number of individual noisy events likely to occur per night. 	Project Manager	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
NV14	Noise and vibration	<ul style="list-style-type: none"> Architectural treatment should be considered for the residential found to be in exceedance of the Roads and Maritime NCG noise levels and the 'acute' noise levels. The number of properties requiring architectural treatment should be refined and confirmed following approval of the proposal and after detailed design is developed. Architectural treatment to be implemented should be agreed with the individual property owners and carried out in accordance with the Roads and Maritime NMG. Architectural noise treatments may include one or a combination of the following: <ul style="list-style-type: none"> The installation of courtyard screen walls Fresh air ventilation systems that meet building code of Australia requirements with the windows and doors shut. Upgraded windows and glazing and solid core doors on exposed facades of substantial structures only (i.e. masonry or insulated weather board cladding with sealed underfloor) Upgrading window and doors seals and appropriately treating sub-floor ventilation The sealing of wall vents The sealing of the underfloor below the bearers The sealing of eaves. 		
LV1	Landscape and visual	<ul style="list-style-type: none"> Project work sites, including construction areas and supporting facilities (such as storage compounds and offices) must be managed to minimise visual impacts, including appropriate storage of equipment, parking, stockpile screening and arrangements for the storage and removal of rubbish and waste materials. 	Site manager	Construction
LV2	Landscape and visual	<ul style="list-style-type: none"> Temporary site lighting must be installed and operated in accordance with <i>AS4282:1997 Control of the Obtrusive Effect of Outdoor Lighting</i>. 	Site manager	Construction
UD1	Urban design	<ul style="list-style-type: none"> The Urban Design Strategy for the proposal should be reviewed during the final detailed project design and implemented as part of the CEMP. 	Project manager and site manager	Detailed design and construction

No.	Impact	Environmental safeguards	Responsibility	Timing
UD2	Urban design	<ul style="list-style-type: none"> The retaining walls and replacement rail bridge should be designed together to enhance the sense of arrival and departure from the Penrith CBD. 	Project manager	Detailed design
UD3	Urban design	<ul style="list-style-type: none"> A Landscape Management Plan to ensure cost effective and consistent management of landscape works should be developed in consultation with Penrith City Council and implemented during construction. The plan will be prepared in accordance with the RTA <i>Landscape guideline</i>. 	Project manager and site manager	Pre-construction and construction
SE1	Socio-economic	<p>A Communication Plan (CP) would be prepared and implemented as part of the CEMP to ensure provision of timely and accurate information to the community during construction. The CP would include (as a minimum):</p> <ul style="list-style-type: none"> mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions contact name and number for complaints. <p>The CP would be prepared in accordance with the Roads and Maritime <i>Community Involvement and Communications Resource Manual</i>.</p>	Project Manager and consultation team	Pre-construction
SE2	Socio-economic	<ul style="list-style-type: none"> Access for emergency vehicles would be maintained at all times during construction. Any site-specific requirements would be determined in consultation with the relevant emergency services agency. Specifically, access must be maintained for Penrith Ambulance Station while the station is operational in its current location via signals or traffic controllers. This must be integrated into traffic management planning which must also incorporate actions for allowing ambulances to quickly move through the area. Where possible, work in the vicinity of the Penrith Ambulance Station should occur later in the construction program to allow time for the operational facility to move – this would remove this issue. 	Project Manager and consultation team	Pre-construction and construction

No.	Impact	Environmental safeguards	Responsibility	Timing
SE3	Socio-economic	<ul style="list-style-type: none"> Consultation would be carried out with potentially affected residences prior to the commencement of and during work in accordance with the RTA's <i>Community Involvement and Communications Resource Manual</i>. Consultation would include but not limited to door knocks, newsletters or letter box drops providing information on the proposed work, working hours and a contact name and number for more information or to register complaints. 	Project Manager and consultation team	Pre-construction and construction
SE4	Socio-economic	<p>Consultation would be carried out with all affected property owners and businesses during detailed design and construction to develop and implement measures to mitigate impacts on land use viability, infrastructure and severance. Consultation with local businesses would identify appropriate management strategies to avoid or minimise impacts on access and operations. This would include consideration of measures such as additional signage and alternative access arrangements. Specific discussions would include:</p> <ul style="list-style-type: none"> Consultation with Council around urban design treatments to repair and provide another entry statement in consultation at Woodriff Gardens Engagement with the Nepean and District Tennis Association to investigate opportunities to improve access/egress from the Nepean District Tennis Association facility. Discussion with Council about the best way to make good the car park area and landscape design to investigate re-provision of vegetation in this area Development of suitable detour route for Lion Dairy and Drinks trucks during construction Explore phasing of traffic lights around Westfield to determine if this may assist with access/egress from the centre during construction 	Project Manager and consultation team	Pre-construction and construction
SE5	Socio-economic	<ul style="list-style-type: none"> Disruptions to property access and traffic would be notified to landowners at least five days in advance in accordance with the relevant community consultation processes outlined in the TMP. 	Project Manager and consultation team	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
LU1	Land-use	<ul style="list-style-type: none"> Temporary leasing arrangements would be managed and setup at the earliest stage possible in the project and all land owners would be consulted in accordance with the standard consultation measures. 	Project Manager	Pre-construction
LU2	Land-use	<ul style="list-style-type: none"> Prior to the commencement of utility work, consultation would occur with identified persons and organisations that may be adversely affected by service disruptions (such as businesses, educational or medical facilities) to determine any special requirements or alternative service arrangements. 	Project Manager	Pre-construction
SG1	Soils and geology	<ul style="list-style-type: none"> A Soil Management Plan would be prepared in accordance with QA <i>Specification G38</i> and implemented as part of the CEMP. The SWMP would identify all reasonably foreseeable risks relating to subsurface impacts and pollution associated with undertaking the activity, and describe how these risks would be managed and minimised during construction. That would include arrangements for managing pollution risks associated with spillage or soil contamination on the site and adjoining areas, and monitoring during and post-construction. 	Project Manager	Pre-construction
SG2	Soils and geology	<ul style="list-style-type: none"> A Spoil and Fill Management Plan (SFMP) would be prepared and implemented as part of the CEMP. The SFMP would identify the locations of spoil and fill stockpiles, sources of imported fill, and methods to re-use or dispose of excess or unsuitable spoil material including estimated volumes and disposal sites. 	Project Manager	Pre-construction
SG3	Soils and geology	<ul style="list-style-type: none"> In addition to the implementation of general erosion, sediment and water quality control safeguards (outlined in Section 0), any sediment basins, stockpiles, washdowns, batch plants, refuelling and chemical storage sites would be lined and/or bunded if they are located within 50 m of a shallow groundwater source. 	Site Manager	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
SG4	Soils and geology	<p>Where groundwater is intercepted during construction works, such as around the replacement railway bridge, management measures to minimise potential adverse impacts would be implemented in accordance with the <i>RTA Technical Guideline: Environmental management of construction site dewatering</i>. These may include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> • options to collect and store groundwater to enable recharge of the water table (such as via grassed swales) • where recharge is not appropriate or feasible, discharging groundwater to the surface water drainage system following • appropriate treatment to ensure discharged water is of sufficient quality. • Prior to any dewatering activities being carried out, an approval must first be obtained in accordance with Section 92 of the WM Act. 	Site Manager	Construction
SG5	Soils and geology	<ul style="list-style-type: none"> • Topsoil would be stockpiled in cleared or disturbed areas and managed in accordance with the <i>RTA Stockpile Site Management Guideline</i> until it is removed from the construction site and disposed of an appropriately licensed facility. 	Site Manager	Construction
SG6	Soils and geology	<p>The rehabilitation of disturbed areas would 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 • Roads and Maritime Guideline for Batter Stabilisation Using Vegetation. 	Site Manager	Construction
SG7	Soils and geology	<ul style="list-style-type: none"> • Batters would be designed and constructed to minimise risk or exposure, instability and erosion, and to support long-term, on-going best practice management, in accordance with the <i>Roads and Maritime Guideline for Batter Stabilisation Using Vegetation</i>. 	Site Manager	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
C1	Contamination	<p>A Contaminated Land Management Plan (CLMP) would be prepared and implemented as part of the CEMP for any areas of existing contaminated land or to address land contamination likely to be caused by the activity. The CLMP would be prepared in accordance with relevant requirements of the Roads and Maritime <i>Guideline for the Management of Contamination</i> and, as a minimum address the following matters:</p> <ul style="list-style-type: none"> • control measures to divert surface runoff away from the contaminated land • capture and manage of any surface runoff contaminated by exposure to the contaminated land • further investigations required to determine the extent, concentration and type of contamination, as identified in the detailed site investigation (Phase 2) • manage the remediation and subsequent validation of the contaminated land, including any certification required • measures to ensure the safety of site personnel and local communities during construction. 	Project Manager	Pre-construction
C2	Contamination	<ul style="list-style-type: none"> • If contaminated areas are encountered during construction, appropriate control measures would be implemented to manage the immediate risks of contamination, such as the diversion of surface runoff, capture of any contaminated runoff or temporary capping. • All other work that may impact on the contaminated area would cease until the nature of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Environment Manager and/or EPA. 	Site Manager	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
C3	Contamination	<ul style="list-style-type: none"> A site specific emergency spill plan would be developed, and include spill management measures in accordance with the <i>Roads and Maritime Code of Practice for Water Management</i> and relevant EPA guidelines. The plan would address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers). 	Project Manager / Site Manager	Construction
BD1	Biodiversity	<p>A Flora and Fauna Management Plan (FFMP) would be prepared and implemented as part of the CEMP. It would address terrestrial and aquatic matters and include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> (a) plans showing areas to be cleared and areas to be protected, including exclusion zones and protected habitat features (e.g. hollow-bearing trees), and areas for rehabilitation or re-establishment of native vegetation; (b) requirements set out in the <i>RTA Landscape Guideline</i>; (c) procedures addressing relevant matters specified in the <i>Biodiversity Guidelines – Protecting and managing biodiversity on RTA projects</i> including but not limited to: <ul style="list-style-type: none"> pre-clearing, including the outcomes of final flora and fauna species checks, establishment of exclusion zones and on-ground identification of specific habitat features to be retained (such as hollow-bearing trees) vegetation clearing and bushrock removal, including staged habitat removal and any specified seasonal limits on clearing activities fauna handling and unexpected threatened species finds rehabilitation, revegetation, re-use of soils, woody debris and bushrock, and other habitat management actions weed and pathogen management (d) procedures addressing relevant matters specified in the NSW DPI (Fisheries) <i>Policy and guidelines for fish habitat conservation and management</i>. 	Project Manager	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
BD2	Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal would be considered during the detailed design stage and implemented where practicable and feasible. Measures to avoid and minimise impacts should be prioritised in the following order: (a) critical habitat (b) threatened species, endangered ecological communities or their habitat (c) native vegetation and habitat supporting flora and fauna connectivity and/or that supports other environmental objectives such as protecting water quality, hydrology or erosion and sediment controls (d) native vegetation of higher quality condition (e) other native vegetation.	Design team	Pre-construction
BD3	Biodiversity	<ul style="list-style-type: none"> All personnel working on-site would receive training to ensure awareness of requirements of the FFMP and relevant statutory responsibilities. Site-specific training would be given to personnel when working in the vicinity of areas of identified biodiversity value that are to be protected. 	Site Manager	Pre-construction
BD4	Biodiversity	<ul style="list-style-type: none"> Consistent with <i>the Biodiversity Guidelines – Protecting and managing biodiversity on RTA projects</i>, and any specific requirements of the approved FFMP, an unexpected finds procedure would be implemented in the event that a threatened species or ecological community that had not been identified and assessed by the REF is unexpectedly encountered during the construction process. 	Site Manager	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
BD5	Biodiversity	<p>Consistent with the <i>Biodiversity Guidelines – Protecting and managing biodiversity on RTA projects</i>, and any specific requirements of the approved FFMP, management arrangements would be implemented to manage environmental risks associated with weeds, pest species and pathogens. As a minimum that would include:</p> <ul style="list-style-type: none"> • completion of a site weed assessment and, if necessary based on the assessment outcomes, a weed management plan • implementation of appropriate weed control methods and weed disposal • implementation of appropriate hygiene protocols where there are potential or known pathogen risks. 	Site Manager	Construction
BD6	Biodiversity	<ul style="list-style-type: none"> • Consistent with the <i>Biodiversity Guidelines – Protecting and managing biodiversity on RTA projects</i>, the <i>RTA Landscape Guideline</i>, and any specific requirements and locations identified in the approved Flora and Fauna Management Plan, habitat management actions would be implemented post-construction, including rehabilitation, re-vegetation, re-use of soil, woody debris and bushrock. 	Site Manager	Post-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
AQ1	Air quality	<p>An Air Quality Management Plan (AQMP) would be prepared and implemented as part of the CEMP. The AQMP would identify:</p> <ul style="list-style-type: none"> • potential sources of air pollution (such as dust, vehicles transporting waste, plant and equipment) during construction • air quality management objectives consistent with any relevant published EPA and/or OEH guidelines • mitigation and suppression measures to be implemented, such as spraying or covering exposed surfaces, provision of vehicle clean down areas, covering of loads, street cleaning, use of dust screens, maintenance of plant in accordance with manufacturer's instructions • methods to manage work during strong winds or other adverse weather conditions • a progressive rehabilitation strategy for exposed surfaces • a monitoring program to assess compliance with the identified objectives, and developed in accordance with any relevant published EPA and/or OEH guidelines • community notification and complaint handling procedures 	Site Manager	Pre-construction
AQ2	Air quality	<ul style="list-style-type: none"> • All sensitive receivers (e.g. Residences, the Mountain View Aged Care Facility) likely to be affected must be notified at least five days prior to commencement of any work associated with the activity that may have an adverse impact on local air quality. The notification must include details of: the project; construction period and construction hours; any recommended measures that can be implemented (e.g. window closure, staying indoors, etc), contact information for project management staff; complaint and incident reporting; and how to obtain further information. 	Project Manager	Pre-construction and construction
AQ3	Air quality	<ul style="list-style-type: none"> • All personnel working on-site would receive training to ensure awareness of requirements of the AQMP. Site-specific training would be given to personnel when working in the vicinity of sensitive receivers. 	Site Manager	Pre-construction
AQ4	Air quality	<ul style="list-style-type: none"> • Consistent with the approved AQMP mitigation and suppression measures would be implemented to protect local air quality. 	Site Manager	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
WMRU1	Waste and resource management	<p>A Waste Management Plan (WMP) would be prepared and implemented as part of the CEMP. It would provide specific guidance on measures and controls to be implemented to support minimising the amount of waste produced and appropriately handle and dispose of unavoidable waste. It would also address the importation of waste to the site for use in undertaking the project.</p> <p>The WMP would give effect to any management measures contained in any waste assessment carried out for the project and include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> • measures to avoid and minimise waste associated with the project • classification of wastes generated by the project and management options (re-use, recycle, stockpile, disposal) • classification of wastes received from off-site for use in the project and management options • identifying any statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions • procedures for storage, transport and disposal • monitoring, record keeping and reporting, including any documentation management obligations arising from resource recovery exemptions. • The WMP would be prepared taking into account the Roads and Maritime <i>Environmental Procedure – Management of Wastes on Roads and Maritime Services Land</i> and relevant Roads and Maritime Waste Fact Sheets. 	Project Manager	Pre-construction
WMRU2	Waste and resource management	<ul style="list-style-type: none"> • Waste would be classified in accordance with the methods and specifications of the Waste Classification Guidelines. 	Site Manager	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
WMRU3	Waste and resource management	<ul style="list-style-type: none"> Any trees to be removed shall be reused as millable timber wherever practicable. Other vegetated material from native species shall be mulched and re-use on-site for landscaping or rehabilitation purposes if consistent with the approved FFMP for the project. Weed species, or vegetation not considered appropriate for re-use on-site, would be removed and disposed of to an appropriately licenced facility. 	Site Manager	Construction
WMRU4	Waste and resource management	<ul style="list-style-type: none"> After considering the outcomes of relevant information that becomes available during construction, appropriate measures would be implemented to address identified deficiencies or undertake actions needed to address waste related impacts. If necessary, the Waste Management Plan would be reviewed and updated to include any additional measures. 	Site Manager	Construction
WMRU5	Waste and resource management	<ul style="list-style-type: none"> A post-construction land assessment must be carried out to determine the suitability for hand-back to the landowner. The assessment is to be prepared in accordance with the Roads and Maritime <i>Environmental Procedure – Management of Wastes on Roads and Maritime Services Land</i>. Where the land is privately owned, a copy of the assessment would be provided to the landowner. 	Site Manager	Construction
CC1	Climate Change	<p>Specific measures would be outlined in the CEMP to ensure that construction minimises any potential impacts on or from climate change including:</p> <ul style="list-style-type: none"> Energy efficiency and related carbon emissions would be considered during the development of construction methodologies, procurement of low carbon alternatives and the selection of efficient plant vehicles, and equipment. Plant, vehicles and machinery must be operated efficiently in accordance with the manufacturers guidelines to ensure optimal performance and be switched off when not in use Procedures would be set out for the management of extreme events including flooding, heatwaves and bushfires. 	Project Manager	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
CU1	Cumulative impacts	<ul style="list-style-type: none"> Cumulative impacts would be incorporated into the traffic management plan and the noise and vibration management plan. 	Project Manager	Pre-construction and construction
CU2	Cumulative impacts	<ul style="list-style-type: none"> Management measures within the CEMP would be reviewed in response to any complaints received. 	Project Manager	Construction

7.3 Licensing and approvals

Licenses and approvals as outlined in Table 7-2 would be required prior to the commencement of construction.

Table 7-2: Summary of licensing and approval required

Requirement	Timing
Excavation Permit in accordance with Sections 139-140 of the Heritage Act.	Prior to the commencement of the work.
Water supply work approval in accordance with Section 92 of the WM Act if groundwater needs to be extracted for dewatering purposes during construction.	Prior to the commencement of the work.
Under the NPW Act, an AHIP is required prior to the harm of any Aboriginal objects.	Prior to the commencement of the work
EPL in accordance with Schedule 1(33) of the POEO Act for activities associated with the replacement of the existing railway bridge	Prior to the commencement of the work

8 Conclusion

8.1 Justification

The proposal has been developed through a robust options assessment process for both the road design and the proposed new railway bridge crossing over Castlereagh Road. The options assessment for the road design considered thirteen options, including a 'do nothing' option, and the preferred option was selected because it would best meet the eight desirable project objectives and measures. Seven strategic bridge options were considered as part of the proposal and the preferred bridge option was selected as it would best meet the four key criteria.

The proposal would:

- Reduce congestion and delays at the Jane Street / Mulgoa Road – Castlereagh Road and Great Western Highway / Mulgoa Road/ High Street intersections during peak hours
- Improve the arterial road connection that integrates with the existing road network to meet all road user needs on opening and into the future
- Deliver infrastructure that provides effective network performance for at least a minimum of ten years after opening
- Promote sustainability initiatives, including:
 - Improved access to public transport, including buses
 - Strengthened integration with land use
 - Support economic growth of Penrith as a regional centre
 - Improve liveability
- Improve access to public transport including buses, at the Penrith station rail and bus interchange
- Improve the level of access to the Penrith CBD for all users
- Support economic growth of Penrith as a regional centre through improved freight movements and road user connections
- Contribute to safe and effective pedestrian and cycling infrastructure, between the Nepean River Bridge, Penrith station and Penrith CBD, to support local and State Government initiatives for active transport.

The proposal would result in some adverse impacts to the local environment during construction, including disruption to traffic flow and rail services on the T1 Western Line (operated by Sydney Trains) and the Blue Mountains Line (operated by NSW TrainLink), removal of heritage fabric from the existing railway bridge, removal of trees and impacts to Woodriff Gardens, air and noise emissions and reduced visual amenity. However, the mitigation measures provided in this REF would help to reduce these expected impacts.

Overall the proposal is justified on the basis that it would help reduce existing congestion and delays experienced at the Jane Street / Mulgoa Road – Castlereagh Road and Great Western Highway / Mulgoa Road/ High Street intersections and provide for effective network performance in consideration of future traffic forecasts.

8.2 Objects of the EP&A Act

Table 8-1 Objects of the EP&A Act

Object	Comment
5(a)(i) To encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.	The proposal encourages proper management, development and conservation of the natural and artificial resources within the proposal area and surrounding land. Furthermore the proposal would improve social and economic welfare of the community through improvements to road safety and user efficiencies.
5(a)(ii) To encourage the promotion and co-ordination of the orderly economic use and development of land.	The proposal promotes the orderly economic use and development of the land within the proposal area.
5(a)(iii) To encourage the protection, provision and co-ordination of communication and utility services.	The proposal promotes the protection of services within the proposal area.
5(a)(iv) To encourage the provision of land for public purposes.	Not relevant to the proposal
5(a)(v) To encourage the provision and co-ordination of community services and facilities.	Not relevant to the proposal
5(a)(vi) To encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.	This REF identifies safeguards and management measures to mitigate potential environmental impacts, including biodiversity within the proposal area as outlined in Section 6.11.
5(a)(vii) To encourage ecologically sustainable development.	Ecologically sustainable development is considered in Sections 8.2.1 – 8.2.4 below.
5(a)(viii) To encourage the provision and maintenance of affordable housing.	Not relevant to the proposal
5(b) To promote the sharing of the responsibility for environmental planning between different levels of government in the State.	Not relevant to the proposal
5(c) To provide increased opportunity for public involvement and participation in environmental planning and assessment.	Community and stakeholder consultation for the proposal is described in Section 5.

8.2.1 The precautionary principle

The precautionary principle refers to the principle that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

This REF has been prepared using the precautionary principle and appropriate mitigation measures are outlined to address all potential impacts (Section 6) identified for the proposal.

8.2.2 Intergenerational equity

Intergenerational equity refers to the principle that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

The proposal would not impact on the health, diversity and productivity of the local environment or communities in a way that would disadvantage future generations.

8.2.3 Conservation of biological diversity and ecological integrity

This means conserving the diversity of flora and fauna and the health and sustainability of ecosystems.

A biodiversity assessment was carried out to consider potential impacts and develop appropriate mitigation measures adopted as outlined in Section 6.11.

8.2.4 Improved valuation, pricing and incentive mechanisms

This means integrating long-term and short-term economic, environmental, social and fairness considerations into decision-making. This principle requires that environmental assets should be appropriately valued.

The REF has examined the potential environmental outcomes of the proposal and where necessary, Roads and Maritime has adopted mitigation measures to address the potential impacts of the proposal. In doing so, Roads and Maritime accept the increase in capital and operating costs. This represents an appropriate valuation of environmental resources and effective use of financial resources.

8.3 Conclusion

The proposal is subject to assessment under Part 5 of the EP&A Act. This REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity. This has included consideration of conservation agreements and plans of management under the NPW Act, joint management and biobanking agreements under the TSC Act, wilderness areas, critical habitat, impacts on threatened species, populations and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the Federal EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in impacts to local traffic flow, heritage, air and noise amenity and social infrastructure during construction. Mitigation measures as detailed in this REF would reduce these expected impacts. The proposal would also improve traffic capacity, travel times and road safety at the Jane Street / Mulgoa Road – Castlereagh Road and Great Western Highway / Mulgoa Road/ High Street intersections, improve the efficiency of bus services and provide for better connectivity and accessibility in the area. On balance the proposal is considered justified and the following conclusions are made:

1. Significant impact to the environment

The environmental impacts of the proposal are not likely to be significant and therefore it is not necessary for an environmental impact statement to be prepared and approval to be sought for the proposal from the Minister for Planning under Part 5.1 of the EP&A Act.

2. Significant impact to NSW listed biodiversity matters

The proposal is not likely to significantly affect threatened species, populations or ecological communities or their habitats, within the meaning of the *Threatened Species*

Conservation Act 1995 or *Fisheries Management Act 1994* and therefore a Species Impact Statement is not required.

3. Significant impact to nationally listed biodiversity matters

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

4. Commonwealth land and other matters of national environmental significance

The proposal does not significantly affect Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999* and a referral to the Federal Department of the Environment is not required.

The proposal is not likely to significantly affect other matters of national environmental significance, within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999* and a referral to the Federal Department of the Environment is not required.

9 Certification

This review of environmental factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.



Leah Howell
Senior Environment and Sustainability Consultant
Arup
Date: 31/10/16.

I have examined this review of environmental factors and the certification by Leah Howell and accept the Review of Environmental Factors on behalf of Roads and Maritime Services.



Matthew Allen
A/Senior Project Development Manager
Roads and Maritime Services Western Sydney Program Office
Date: 31/10/16.

10 References

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Terms and acronyms used in this REF

ABS	Australian Bureau of Statistics
ACHA	Roads and Maritime Aboriginal Cultural Heritage Advisor
ADT	Average daily traffic
AHD	Australian Height Datum
AHIP	Aboriginal Heritage Impact Permit
AHMP	Aboriginal Heritage Management Plan
AM	Morning
AQMP	Air Quality Management Plan
ARI	Average Recurrence Interval
CBD	Central Business District
CEMP	Construction environmental management plan
CLM Act	<i>Contaminated Land Management Act 1997</i>
CLMP	Contaminated Land Management Plan
CP	Communication Plan
DAs	Development Applications
dB	Decibel
ENMM	Environmental Noise Management Manual
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPA	Environment Protection Agency
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ESCP	Erosion and sediment control plan
ESD	Ecologically sustainable development
FFMP	Flora and Fauna Management Plan
FM Act	<i>Fisheries Management Act 1994</i>
Heritage Act	<i>Heritage Act 1977</i>
HMP	Non-Aboriginal Heritage Management Plan
ICNG	<i>Interim Construction Noise Guideline</i>

ISEPP	State Environmental Planning Policy (Infrastructure) 2007
ISEPP	<i>State Environmental Planning Policy (Infrastructure) 2007</i>
LALC	Local Aboriginal Land Council
Land Acquisition Act	<i>Land Acquisition (Just Terms Compensation) Act 1991</i>
LEP	Local Environmental Plan.
LGA	Local government area
LTMP	<i>NSW Long Term Transport Master Plan</i>
MNES	Matters of national environmental significance
MVKT	Million-vehicle kilometres travelled
NCG	Noise Construction Guideline
NMG	Noise Mitigation Guideline
NPW Act	<i>National Parks and Wildlife Act 1974</i>
NSW 2021	<i>NSW 2021: A Plan to Make NSW Number One</i>
NVMP	Noise and Vibration Management Plan
OEH	Office of Environment
PACHCI	<i>Procedure for Aboriginal cultural heritage consultation and investigation</i>
PAD	Potential archaeological deposit
PEMP	Project Environmental Management Plan
<i>Penrith Local Environmental Plan 2010</i>	Penrith LEP
PfGS	<i>A Plan for Growing Sydney</i>
PM	Afternoon
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
The waste regulation	Protection of the Environment Operations (Waste) Regulation 2005
RBLs	Rating background levels
Rebuilding NSW	<i>Rebuilding NSW: State Infrastructure Strategy 2014</i>
REF	Review of Environmental Factors
rms	root-mean-square
RNP	<i>NSW Road Noise Policy</i>
Roads Act	<i>Roads Act 1993</i>

Roads and Maritime	Roads and Maritime Services
ROL	Road occupancy licence
SEIFA	Socio-Economic Indexes for Areas
SEPP	State Environmental Planning Policy
SEPP 19	State Environmental Planning Policy No 19 – Bushland in Urban Areas
SEPP 55	<i>State Environmental Planning Policy No.55 Remediation of Land</i>
SHR	State Heritage Register
SIS	Species Impact Statement
SREP 20	<i>Sydney Regional Environmental Plan No.20 – Hawkesbury-Nepean River</i>
SWMP	Soil and Water Management Plan
The Interchange	Penrith Transport Interchange
TMP	Traffic management plan
TSC Act	<i>Threatened Species Conservation Act 1995</i>
VCRs	Volume to capacity ratios
VDV	Vibration dose value
VHT	Vehicle Hours Travelled
WARR Act	<i>Waste Avoidance and Resource Recovery Act 2001</i>
WM Act	<i>Water Management Act 2000</i>
WMP	Waste Management Plan



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