



Mulgoa Road upgrade Stage 2, 5A and 5B

Glenmore Parkway to Jeanette Street, Blaikie Road to Jamison Road and Jamison Road to Union Road

Review of Environmental Factors

Transport for NSW

Mulgoa Road upgrade Stage 2, 5A and 5B

Glenmore Parkway to Jeanette Street
Blaikie Road to Jamison Road
Jamison Road to Union Road

Review of Environmental Factors

Transport for NSW | March 2022

Prepared by Aurecon Australasia Pty Ltd and Transport for NSW

Transport for NSW Publication Number: 22.024

ISBN: 978-1-922549-68-6

Copyright: The concepts and information contained in this document are the property of Transport for NSW. Use or copying of this document in whole or in part without the written permission of Transport for NSW constitutes an infringement of copyright.

Document controls

Approval and authorisation

Title	Mulgoa Road - Glenmore Parkway to Jeanette Street, Blaikie Road to Jamison Road and Jamison Road to Union Road review of environmental factors
Accepted on behalf of Transport for NSW by:	Matthew Allen Senior Project Development Manager
Signed:	
Dated:	3/3/22

Document status

Document status	Date	Prepared by	Reviewed by
Draft 1	2 September 2021	MW, MC, JP	PF
Draft 2	29 October 2021	MW, MC	PF
Draft 3	14 January 2022	MW, MC	PF
Draft 4	28 January 2022	MW, MC	PF
Draft 5	16 February 2022	MW, MC	PF
Draft 6	1 March 2022	MW, MC	PF

Acknowledgement of Country

Transport for NSW acknowledges the Dharug, the traditional custodians of the land on which the Mulgoa Road upgrade is proposed. We pay our respects to their Elders, past and present and celebrate the diversity of Aboriginal peoples and their ongoing cultures and connections to the lands and waters of NSW. Many of the transport routes we use today – from rail lines, to roads, to water crossings – follow the traditional Songlines, trade routes and ceremonial paths in Country that our nation's First Peoples followed for tens of thousands of years.

Executive summary

The proposal

Transport for NSW (Transport) propose to upgrade about three kilometres of Mulgoa Road. The proposal involves the upgrade and widening across three separate stages:

- Stage 2 – Glenmore Parkway to Jeanette Street, Glenmore Park (about 850 metres)
- Stage 5A – Blaikie Road to Jamison Road, Penrith (about 1.2 kilometres)
- Stage 5B – Jamison Road to Union Road, Penrith (about one kilometre).

Mulgoa Road is an important arterial road connecting the Penrith community, including its central business district, with other parts of greater Sydney. The proposal is being undertaken to support expected growth in the area, improve road safety, reduce congestion and improve travel times.

Key features of the proposal include:

- An upgrade of Mulgoa Road to a six-lane divided road (three lanes in each direction) with a wide central median
- Upgrade of intersections at the roundabout at Glenmore Parkway, Spencer Street, Batt Street, Freedom Furniture site, Jamison Road, Panther Place, Retreat Drive/Ransley Street and Union Road
- Upgrade of local road accesses at Gibbes Street (including the removal of the Gibbes Street Service Road), Willoring Crescent, Stuart Street, Preston Street, McNaughton Street and Rodley Avenue
- New bridge structure over Surveyors Creek
- Reinstatement of bus stops along Mulgoa Road with provision for bus priority at key intersections
- Provision of a shared user path on the eastern side and pedestrian path on the western side of Mulgoa Road for the length of the proposal
- Drainage and flooding infrastructure upgrades
- Roadside furniture and street lighting
- Noise barriers
- Utility relocations
- Tree planting and landscaping
- Temporary establishment of up to four construction compound sites.

Need for the proposal

Mulgoa Road was first established as a parish road to support the local landowners and was constructed during the early 19th Century, as a typical rural road seen during this period.

Presently, Mulgoa Road is a key corridor within the Local Government Area (LGA) of Penrith and Western Sydney more broadly. It is a State arterial road and is one of two main access points from Penrith to the M4 Motorway.

The NSW Government has started planning for an upgrade of Mulgoa Road as part of a plan to progressively upgrade a number of major arterial roads in the Western Sydney region. It is anticipated that there would be considerable traffic growth in future years due to increased residential and commercial development in the Western Sydney growth centres and the Broader Western Sydney Employment Area.

The need for upgrades to Mulgoa Road has been identified in several NSW and local government strategic plans and policies. These include: *Premier's Priorities* (NSW Government, 2021a), *Future Transport Strategy 2056* (Transport, 2020b), *Greater Sydney*

Services and Infrastructure Plan (Greater Sydney Commission, 2018a), *Road Safety Plan 2021* (NSW Government, 2018b), *State Infrastructure Strategy* (NSW Government, 2018c), *Smart Cities Plan* (Commonwealth of Australia, 2016) and *Penrith City Strategy* (Penrith City Council, 2013).

These plans and strategies have a significant focus on increasing the connectivity of the local communities; decreasing congestion and the impacts of congestion; and moving towards a safer urban community for pedestrians, cyclists and motorists. The *Freight and Ports Plan 2018-2023* (Transport, 2018) places a focus on reducing the congestion from freight and reducing freight vehicle operation costs. The *Greater Sydney Region Plan – A Metropolis of Three Cities* (Greater Sydney Commission, 2018a) and the *Western City District Plan* (Greater Sydney Commission, 2018b) specifically focus on establishing the Western Parkland City as one of the three city centres of wider Sydney of which Penrith is at the centre of economic and social growth.

Proposal objectives

The objectives of the proposal are:

- Improve road user journey time reliability, reduce congestion and enhance freight productivity
- Plan for future urban and employment growth
- Provide a safer road environment for all road users
- Improve road user amenity, support public transport use and encourage active transport
- Minimise impacts to the local environment
- Maximise the project's value for money.

Statutory and planning framework

The proposal is for road and road infrastructure facilities and is to be carried out by Transport. It can therefore be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Development consent from council is not required. This REF fulfils Transport's obligation under Section 5.5 of the EP&A Act including to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

The proposal would not have significant impacts on matters of national environmental significance. Therefore, the proposal can be assessed under Division 5.1 of the EP&A Act and no further planning approval requirements would be triggered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or *Biodiversity Conservation Act 2016* (BC Act).

Community and stakeholder consultation

Initial community consultation was carried out in 2017. A preferred option for upgrading Glenmore Parkway, Penrith and Andrew Road, Penrith was displayed for community comment.

Transport for NSW carried out community consultation between March 2020 and September 2021, including providing community updates. Consultation with Penrith City Council and the State Emergency Services (SES) was undertaken in accordance with Clause 13 and 15 of the State Environmental Planning Policy (Infrastructure) (ISEPP) as the proposal would be located in flood liable land and would require excavation of council roads.

The key issues raised were related to the potential noise and vibration impacts and impacts to vegetation. These issues were considered in proposal design, selection of options and have been addressed in the REF.

Consultation was also undertaken with key Aboriginal stakeholders, specifically the Deerubbin Local Aboriginal Land Council (LALC), who were invited to participate in a field survey. A Deerubbin LALC Senior Aboriginal Cultural Heritage Officer participated in archaeological survey of the study area on 17 February 2021. Results of the survey and the proposed recommendations were discussed in the field, and no objections to the proposal were raised.

Options considered

Transport for NSW identified three options for the proposal including:

- Option 1: widening on the eastern side road between Glenmore Parkway and Jeanette/Factory Street, Glenmore Park for stage 2. Widening on the eastern side Mulgoa Road between Blaikie Road, and Union Road, Penrith for stage 5A and 5B.
- Option 2: widening on the western side of the road between Glenmore Parkway and Jeanette/Factory Street, Glenmore Park in stage 2. Widening on the western side of Mulgoa Road between Blaikie Road, and Union Road, Penrith in stage 5A and 5B.
- Option 3: do minimum.

These options were investigated and assessed with respect to the proposal objectives including constructability, socio-economic and environmental issues. To widen the road to the east of the existing road for stage 2 and to the east for stage 5A and 5B was selected as the preferred option. Option 1 proved to have the least constructability issues and had the least impact to property.

Environment impacts

The development of the proposal would have some adverse impacts during construction. There would also be longer-term positive and adverse impacts once the proposal is operating. These are summarised below.

Project benefits

The proposal has the potential for both regional and local benefits in the medium to longer term. The proposal would provide increased road capacity for the project traffic volumes along the network. Travel times would improve through reduced traffic congestion, improved access, better public transport facilities, and more efficient connectivity. Road safety would improve with the additional capacity and therefore reduce congestion as a result of the proposal.

With the proposal built and operating, the capacity and connectivity of Mulgoa Road would improve, bringing long-term benefits to commuters as well as freight operators. Pedestrian and cyclist facilities would be improved with the new section of shared user path between Blaikie Road and Preston Street providing an off-road route for cyclists and pedestrian connection. Public transport travelling through the proposal area may experience better movement and travel times due to the increased capacity on the road network.

Biodiversity

The proposal would impact a total of 0.79 hectares of native vegetation. Most of which is Cumberland River-Flat Forest and the remainder is Cumberland Shale Plains Woodland. In addition, 0.29 hectares of the planted vegetation (Cumberland Swamp Oak Riparian Forest) would be removed and 8.57 hectares of street trees, plantings and exotics would be removed.

Vegetation clearing associated with the proposal would remove threatened fauna habitat, including vegetation that is foraging and roosting habitat for the Little Lorikeet (*Glossopsitta pusilla*) and the Grey-Headed Flying-Fox (*Pteropus poliocephalus*). Parts of School House Creek, Surveyors Creek and their associated riparian areas would be directly impacted by the proposal.

Assessment of significance were undertaken for threatened ecological communities and threatened species likely to occur in the proposal area that are listed under the BC Act and EPBC Act. With appropriate safeguards, the proposal is unlikely to have a significant impact on any listed threatened species, populations or ecological communities.

Traffic and transport

During construction, access to all existing properties along Mulgoa Road would be maintained under a construction staging strategy developed by Transport for NSW and the construction contractor. However, there would be some temporary disruptions and diversions to traffic, pedestrians, cyclists, residents and business owners including reduced speed limits through construction zones, and due to the temporary adjustment of to some facilities.

With the proposal built and operating, the capacity of Mulgoa Road would improve, bringing long-term benefits to commuters. Despite substantial annual traffic growth predicated for the proposal area, congestion and travel times are predicted to improve as a result of the proposal. The proposal would provide an additional signalised pedestrian crossing at the Glenmore Parkway/Mulgoa Road intersection and this intersection would be converted from a roundabout to a signalised intersection.

Between 2014 and 2019, crash statistics indicated that most crashes occurred during fine weather conditions and mostly occurred during morning and evening peak periods, and during lunch time when there is higher traffic volume. Therefore, decreased congestion and traffic would likely decrease the number of crashes.

Safety for general traffic, pedestrians and cyclists would improve once the proposal is operational. This would encourage active transport. Additional bus infrastructure would be added to the network, encouraging public transport use.

Noise and vibration

During construction, 'Highly Intrusive' daytime noise impacts are predicted at the nearest residential receivers that are located along Mulgoa Road. The highest noise levels would be experienced during the 'utilities, early works and earthworks - peak' and 'road, pathway and intersection upgrades - peak' construction scenarios when noise intensive equipment, such as a concrete saw, is used close to residential receivers. However, for most work, the construction noise impacts would frequently be lower than predicted as the worst-case situation is typically only for short periods when noisy equipment is in use nearby.

The main potential source of vibration during construction would be vibratory rollers, which would be required during the 'road, pathway and intersection upgrades – peak' construction scenario. The assessment found that some receivers would be within the minimum working distance for cosmetic damage and/or the human comfort minimum working distance during the worst-case vibration scenario. Noise and vibration impacts during construction would be minimised and managed as far as feasible and reasonable in accordance with the *Construction Noise and Vibration Guidelines* (Roads and Maritime, 2016).

During operation, noise levels are predicted to increase the most for sensitive receivers along Mulgoa Road due to the increased expected traffic volumes. The operational noise modelling results show that 148 residential receivers and eight non-residential receivers would experience an exceedance of the adopted operational noise criteria during operation of the proposal. Most front-row residential receivers on Mulgoa Road are predicted to be

subject to acute noise levels, with the most noticeable difference in stage 2. However, many residential properties also have existing private fencing along the boundary with the road corridor, which would likely provide some degree of noise shielding. Therefore, the assessment results are considered conservative and the noise levels experienced at residential receivers are likely to be lower than predicted. To minimise operational noise impacts, noise mitigation measures would be considered including noise walls and at-property treatment for properties that still experience noise levels exceeding the adopted criteria.

Surface water and groundwater

Construction of the proposal has the potential to impact surface water through erosion, scouring of natural waterways, sedimentation and contamination. Direct impacts to surface water would occur during construction to School House Creek, Surveyors Creek, Racecourse Creek Channel and Showground Creek Channel. During construction there is a risk of construction materials being mobilised by overland flows into adjacent waterways during storm or flooding events.

There is the potential for interference with groundwater during construction activities. However, given the depth of groundwater and construction methodology proposed, groundwater is unlikely to be intercepted for most road construction activities. There is potential for groundwater to enter trenches during excavations required for utility adjustments, construction of drainage infrastructure and piling for construction of noise barriers and bridge structures. Potential groundwater contamination may result when construction activities intercept with the water table.

During operation, runoff from the proposal could potentially impact on local surface water quality by washing litter, debris and pollutants (such as hydrocarbons) from the road pavement into surrounding natural drainage lines and water courses. It is unlikely that the road's operation would impact on groundwater flow conditions or quality as the road alignment would be located above the main groundwater systems.

To protect water quality during operation the proposal includes gross pollutant traps and other passive stormwater water quality improvement features to reduce pollutant concentrations before stormwater is discharged to existing drainage lines.

Hydrology and flooding

During construction, there is potential for localised flooding impacts that would be associated with changes in local topography and the existing drainage patterns. A construction flood management plan would be developed to make sure that in the event of a flood, measures are in place to minimise any impacts during the construction of the proposal.

Mulgoa Road under existing conditions is regularly inundated by flooding. To ensure no adverse property impacts would result from the Proposal, the road is designed to match the flood immunity of the existing road. This means that at least one lane would be flood free during the a flooding event. Matched or improved flood immunity would be achieved for the entirety of the Proposal except for one location at Jamison Road Intersection. However, this location remains trafficable for two lanes up to the one per cent Annual Exceedance Probability (AEP).

The proposal would be designed so that it does not worsen flooding outcomes for any private properties in the proposal area or beyond the proposal area.

Contamination, landform, geology and soils

During construction, there is potential for soil erosion and the loss of topsoils.

Several sites in the vicinity of the proposal have been identified as having potential for ground contamination because of their historical use. For all sites, the risk was identified as

low and for other sites further investigation and assessment would be undertaken before construction to implement appropriate risk management measures.

Landscape, visual amenity and urban design

Visual and landscape impacts would occur during the proposal's construction and operation. Construction impacts would include a changed visual environment from construction plant, equipment, temporary compounds and stockpiles. Local landscapes would be altered by earthworks and vegetation clearing creating a wider road corridor, potentially changing sight lines and the relationship between the road corridor and surrounding land. In particular the removal of numerous established street trees for the proposal would alter the local amenity. However, this impact would be offset with landscaping and urban design measures. These measures would include planting diverse plant species along the road corridor, in riparian corridors and to screen where appropriate (such as the childcare centre). In some areas, trees would be planted to provide a 'boulevard' treatment while maintaining long vistas to the Blue Mountains escarpment.

Social and economic factors

The proposal has the potential for both regional and local benefits in the medium to longer term through reduced traffic congestion, improved access, better public transport facilities, and more efficient connectivity.

However, there would be adverse impacts during both construction and operation. These impacts would include:

- The potential for temporary changes to access at some properties to enable construction of the widened road corridor. Where temporary disruptions are required, alternative access would be identified in consultation with property owners. Temporary access requirements would be confirmed during detailed design and construction staging
- The temporary, partial and permanent acquisitions of land. Acquisitions would comprise entire properties and strips of land to facilitate the proposed road corridor widening. Most of these acquisitions would affect private land, but some Council owned land would also be affected.

Justification and conclusion

The proposed upgrade of Mulgoa Road is subject to assessment under Division 5.1 of the EP&A Act. This REF has examined, and taken into account to the fullest extent possible, all environmental matters affecting or likely to be affected by the proposal.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design and options assessment process. The proposal would meet the proposal objectives and need to improve the safety and congestion associated with Mulgoa Road.

The proposal is aligned with several strategic policies and government strategies such as *Future Transport Strategy 2056* (Transport, 2020b) and *Road Safety Plan 2021 – Towards Zero* (NSW Government, 2018b).

There would be some environmental impacts from the proposal. These have been avoided or minimised wherever possible through design and site-specific safeguards. The beneficial effects of improving safety and network reliability are considered to outweigh the mostly temporary adverse impacts and risks associated with the proposal.

Overall, the proposal is justified on the basis that it best meets the proposal objectives and results in long term benefits on reliability and safety that would outweigh potential adverse

impacts, which would mainly occur during construction. The proposal would not result in any significant long-term impacts on society, the biophysical environment or the local economy.

Display of the review of environmental factors

This REF is on display for comment between Monday 7 March and Sunday 3 April 2022. You can access the documents as pdf files on the Transport website at <https://nswroads.work/glenmorepkwyunionrd>.

It is noted that the COVID-19 Legislation Amendment (Emergency Measures) Bill 2020 has removed the requirement for physical displays of this REF. The public display of the proposal is also not planned to involve face-to-face consultation activities due to COVID-19 social distancing requirements.

How can I make a submission

To make a submission about this proposal, please send your written comments to:

Mail: Mulgoa Road upgrade
Transport for NSW
PO Box 973
Parramatta
NSW 2124

Email: mulgoaroadupgrade@transport.nsw.gov.au

Submissions must be received by Sunday 3 April 2022.

Submissions will be managed in accordance with the Transport for NSW Privacy Statement which can be found here <https://roads-waterways.transport.nsw.gov.au/about/access-to-information/my-privacy.html>.

What happens next

Transport will collate and consider the submissions received during public display of the REF.

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

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

Contents

1	Introduction	7
1.1	Proposal identification	7
1.2	Purpose of the report.....	10
2	Need and options considered	11
2.1	Strategic need for the proposal	11
2.2	Limitations of existing infrastructure	15
2.3	Proposal objectives and development criteria	16
2.4	Alternatives and options considered.....	17
2.5	Preferred option.....	20
3	Description of the proposal	21
3.1	The proposal.....	21
3.2	Design	25
3.3	Construction activities.....	41
3.4	Ancillary facilities	50
3.5	Public utility adjustment.....	55
3.6	Property acquisition	56
4	Statutory planning framework	63
4.1	Environmental Planning and Assessment Act 1979.....	63
4.2	Other relevant NSW legislation	68
4.3	Commonwealth legislation.....	71
4.4	Confirmation of statutory position	72
5	Consultation	73
5.1	Consultation strategy.....	73
5.2	Community involvement	73
5.3	Aboriginal community involvement.....	75
5.4	ISEPP consultation.....	76
5.5	Biodiversity working group.....	77
5.6	Government agency and stakeholder involvement	77
5.7	Ongoing or future consultation	78
6	Environmental assessment	79
6.1	Biodiversity	79
6.2	Traffic and transport	97
6.3	Noise and vibration.....	109
6.4	Hydrology and flooding.....	144
6.5	Surface water and groundwater	154
6.6	Aboriginal cultural heritage	167
6.7	Non-Aboriginal heritage.....	172
6.8	Contamination, landform, and soils	178
6.9	Air quality.....	189
6.10	Socio-economic.....	196
6.11	Landscape character and visual impacts	212
6.12	Other impacts	230
6.13	Cumulative impacts	234
7	Environmental management	240
7.1	Environmental management plans (or system)	240

7.2	Summary of safeguards and management measures.....	241
7.3	Licensing and approvals.....	264
8	Conclusion	265
8.1	Justification.....	265
8.2	Objects of the EP&A Act.....	266
8.3	Conclusion.....	269
9	Certification	270
10	References.....	271

Tables

Table 2-1:	Identified options analysis	18
Table 3-1	Summary of design criteria for the proposal.....	25
Table 3-2:	Engineering constraints for the proposal.....	27
Table 3-3:	Proposed bus facilities for the proposal	38
Table 3-4	Indicative construction activities for the proposal – early work.....	43
Table 3-5	Indicative construction activities for the proposal - main construction work	44
Table 3-6	Indicative plant and equipment required for construction of the proposal	46
Table 3-7	Cut and fill volumes	47
Table 3-8:	Indicative construction traffic volumes.....	49
Table 3-9:	Proposed property acquisition for partial acquisitions	56
Table 3-10:	Proposed full property acquisition	58
Table 4-1:	Consistency of this REF with the Penrith LEP land zones	64
Table 5-1:	Community engagement activities carried out for the proposal.....	73
Table 5-2:	Summary of issues raised by the community	74
Table 5-3:	Summary of Transport for NSW Procedure for Aboriginal Cultural Heritage Consultation and Investigation.....	75
Table 5-4:	Issues raised through ISEPP consultation	76
Table 5-5:	Issues raised through stakeholder consultation	77
Table 6-1:	PCTs within the proposal area	82
Table 6-2:	Threatened fauna likely to occur in the study area.....	87
Table 6-3:	Impacts on vegetation	89
Table 6-4:	Key threatening processes.....	90
Table 6-5:	Safeguards and management measures for impacts to biodiversity	93
Table 6-6:	Modelling Guidelines Level of Services for intersections	98
Table 6-7:	Total (all intersections along the entire Mulgoa Road/Castlereagh Road upgrade) Surveyed Volumes.....	100

Table 6-8: Summary of Crashed by Location and Severity in the entire Mulgoa Road/Castlereagh Road Study Area (July 2014 to July 2019)	101
Table 6-9: Glenmore Parkway/Mulgoa Road roundabout performance	104
Table 6-10: Scenarios modelled.....	104
Table 6-11: Overall annual traffic growth rates.....	105
Table 6-12: AM Intersection LoS	105
Table 6-13: PM Intersection LoS	106
Table 6-14: Safeguards and management measures for traffic and transport	106
Table 6-15: Construction scenarios.....	110
Table 6-16: Sensitive receiver noise catchment areas	111
Table 6-17: Background noise levels	114
Table 6-18: NML exceedance bands and corresponding CNVG perception categories.....	115
Table 6-19: Background monitoring criteria.....	115
Table 6-20: ICNG NMLs for ‘other sensitive’ receivers.....	116
Table 6-21: AS2107 NMLs for ‘other sensitive’ receivers.....	116
Table 6-22: RNP/NCG criteria for assessing construction traffic on public roads... ..	116
Table 6-23: Recommended minimum working distances from vibration intensive equipment	117
Table 6-24: NCG criteria for residential receivers	118
Table 6-25: NCG criteria for other sensitive receivers.....	119
Table 6-26: NML exceedance bands and corresponding key	120
Table 6-27: Predicted worst-case construction noise exceedances – residential receivers - daytime	121
Table 6-28: Predicted worst-case construction noise exceedances – residential receivers - evening	121
Table 6-29: Predicted worst-case construction noise exceedances – residential receivers - night.....	121
Table 6-30: Predicted number of highly noise affected residential receivers.....	129
Table 6-31: Overview of commercial/industrial and ‘other sensitive’ receiver NML exceedances: Number of receiver buildings affected	131
Table 6-32: Receivers eligible for consideration for ‘additional noise mitigation’	137
Table 6-33: Predicted change in maximum noise levels	139
Table 6-34: Noise mitigation options	140
Table 6-35: Safeguards and management measures for noise and vibration	141
Table 6-36: Safeguards and management measures for hydrology and flooding ..	152
Table 6-37: Summary of selected WQO and selected values	156

Table 6-38: Long term climate patterns (OEH 2015).....	157
Table 6-39 : Summary of Liverpool city council monitoring data at the rowing club	160
Table 6-40: Summary of Liverpool city council monitoring data at Tench Reserve	160
Table 6-41: Safeguards and management measures for surface water and groundwater	164
Table 6-42: Identified Aboriginal archaeological sites within the Aboriginal heritage study area	169
Table 6-43: Aboriginal heritage safeguards and management measures	171
Table 6-44: Listed non-Aboriginal heritage items	173
Table 6-45: Significance assessment – Jamisontown Uniting Church	175
Table 6-46: Archaeological impacts of construction	175
Table 6-47: Operation impacts to heritage items.....	176
Table 6-48: Non-Aboriginal heritage safeguards and management measures	176
Table 6-49: Key soil properties.....	179
Table 6-50: NSW EPA notified sites within proposal area.....	180
Table 6-51: Areas and contaminants of potential concern (Coffey 2016).....	181
Table 6-52: Potential construction impacts.....	185
Table 6-53: Safeguards and management measures for contamination, landform, geology and soils	186
Table 6-54: Change in projected peak hourly traffic volumes due to the proposal .	193
Table 6-55: Direct and indirect impacts on proposal	197
Table 6-56: Socio-economic safeguards and management measures	209
Table 6-57: Sensitivity and magnitude matrix.....	212
Table 6-58: Landscape character zones	214
Table 6-59: Summary of representative viewpoints for the proposal.....	217
Table 6-60: Landscape character impacts during operation of the proposal.....	220
Table 6-61: Visual viewpoint impacts during operation	223
Table 6-62: Landscape character and visual safeguards and management measures	227
Table 6-63: Other existing and potential environmental impacts.....	230
Table 6-64: Other impacts safeguards and management measures.....	232
Table 6-65: Past, present and future projects	236
Table 6-66: Cumulative impacts	239
Table 6-67: Cumulative impacts safeguards and management measures.....	239
Table 7-1: Summary of safeguards and management measures.....	241
Table 7-2: Summary of licensing and approvals required	264

Table 8-1: Consideration of objects of the EP&A Act for the proposal	266
----------------------------------------------------------------------------	-----

Figures

Figure 1.1: Location of the proposal	8
Figure 1.2: The proposal	9
Figure 3.1: Key features of the proposal between Glenmore Parkway and Jeanette Street.....	22
Figure 3.2: Key features of the proposal between Blaikie Road and Jamison Road	23
Figure 3.3: Key features of the proposal between Jamison Road and Union Road..	24
Figure 3.4: Typical cross sections of Mulgoa Road (between intersections) between Glenmore Parkway and Jeanette Street	26
Figure 3.5: Typical cross sections of Mulgoa Road (between intersections) between Blaikie Road and Jamison Road	26
Figure 3.6: Typical cross sections of Mulgoa Road (between intersections) between Jamison Road and Union Road	27
Figure 3.7: Indicative intersection layout at Glenmore Parkway	30
Figure 3.8: Indicative intersection layout at Spencer Street	31
Figure 3.9: Indicative intersection layout at Batt Street.....	32
Figure 3.10: Indicative intersection layout at Freedom Furniture.....	33
Figure 3.11: Indicative intersection layout at Jamison Road	34
Figure 3.12: Indicative intersection layout at Panthers Place.....	35
Figure 3.13: Indicative intersection layout at Retreat Drive/Ransley Street	36
Figure 3.14: Indicative intersection layout at Union Road.....	37
Figure 3.15: Proposed Surveyors Creek bridge.....	40
Figure 3.16: Proposed Surveyors Creek bridge elevation view	40
Figure 3.17: Proposed noise barrier locations.....	42
Figure 3.18: Ancillary facilities – compound site 1	51
Figure 3.19: Ancillary facilities – compound site 2	52
Figure 3.20: Ancillary facilities – compound site 3.....	53
Figure 3.21: Ancillary facilities – compound site 4	54
Figure 3.22: Proposed property acquisition Stage 2	60
Figure 3.23: Proposed property acquisition – Stage 5A.....	61
Figure 3.24: Proposed property acquisition – Stage 5B.....	62
Figure 4.1: Zoning	67
Figure 6.1: The Proposal with 50 metre buffer (study area)	80
Figure 6.2: PTA and AIA site locations.....	83

Figure 6.3: Threatened ecological communities	85
Figure 6.4: Groundwater Dependant Ecosystems	86
Figure 6.5: Key intersections along Mulgoa Road/Castlereagh Road corridor	98
Figure 6.6: Journey to Work Mode Share – Selected Travel Zones as Place of Residence	99
Figure 6.7: Journey to Work Mode Share – Selected Travel Zones as Place of Work	99
Figure 6.8: Temporary intersection option of Glenmore Parkway/Mulgoa Road intersection	102
Figure 6.9: Site plan, receivers and noise monitoring locations.....	113
Figure 6.10: Construction hours	114
Figure 6.11: Predicted impacts during ‘W.02 – Utilities, early works and earthworks – peak’ (Daytime).....	124
Figure 6.12: Predicted impacts during ‘W.03 – Utilities, early works and earthworks – typical’ (Daytime).....	125
Figure 6.13: Predicted impacts during ‘W.02 – Utilities, early works and earthworks – peak’ (Night-time)	126
Figure 6.14: Predicted impacts during ‘W.03 – Utilities, early works and earthworks – typical’ (Night-time)	127
Figure 6.15: Predicted impacts during ‘W.06 – Compound operation’ (Night-time)	128
Figure 6.16: Highly noise affected residential receivers (from any work scenario) .	130
Figure 6.17: Construction vibration assessment	133
Figure 6.18: Predicted operational noise levels with the proposal (daytime Scenario in 2036).....	135
Figure 6.19: Predicted change in operational noise from the proposal (daytime scenario in 2036).....	136
Figure 6.20: Receivers eligible for consideration of additional mitigation	138
Figure 6.21: Hydraulic model layout	145
Figure 6.22: Stage 2 - Overland flow path from sub-catchments – 1per cent AEP existing flood depth	147
Figure 6.23: 12 per cent AEP existing flood contained within Surveyors Creek.....	149
Figure 6.24: 2 per cent AEP existing flood breakout from Jamison Channel.....	149
Figure 6.25: 5 per cent AEP existing flood breakout from Showground Channel....	150
Figure 6.26: Surface Water and Groundwater assessment study areas	155
Figure 6.27: Range of total monthly rainfall and evaporation (1971-2019)	Error! Bookmark not defined.
Figure 6.28: Monthly maximum and minimum temperature ranges (1971-1989)....	157
Figure 6.29: Hydrological soil groups	159

Figure 6.30: Local catchment and surface water features	161
Figure 6.31: Nearby heritage items.....	174
Figure 6.32: Areas of potential contamination concern	182
Figure 6.33: Air quality proposal location	190
Figure 6.34: Identified air quality sensitive receptors	191
Figure 6.35: Direct study area and socio-economic study area	198
Figure 6.36: Social Infrastructure	202
Figure 6.37: Landscape character zones.....	213
Figure 6.38: Visual viewpoints.....	216
Figure 6.39: Mulgoa Road / Castlereagh Road corridor map.....	235

Appendices

Appendix A: Consideration of clause 171(2) factors and matters of national environmental significance and Commonwealth land	277
Appendix B: Statutory consultation checklists	282
Appendix C: Biodiversity Assessment Report	288
Appendix D: Traffic and Transport Impact Assessment	289
Appendix E: Noise and Vibration Impact Assessment	290
Appendix F: Hydrology and Flooding Assessment	291
Appendix G: Surface water and Groundwater Assessment	292
Appendix H: Aboriginal Heritage Assessment.....	293
Appendix I: Non-Aboriginal Heritage Assessment.....	294
Appendix J: Detailed Site Investigation	295
Appendix K: Air Quality Impact Assessment	296
Appendix L: Socio-economic Impact Assessment.....	297
Appendix M: Landscape Character and Visual Impact Assessment	298

1 Introduction

1.1 Proposal identification

Transport for NSW (Transport) propose to upgrade about three kilometres of Mulgoa Road. The proposal involves the upgrade and widening across three separate stages:

- Stage 2 – Glenmore Parkway to Jeanette Street, Glenmore Park (about 850 metres)
- Stage 5A – Blaikie Road to Jamison Road, Penrith (about 1.2 kilometres)
- Stage 5B – Jamison Road to Union Road, Penrith (about one kilometre).

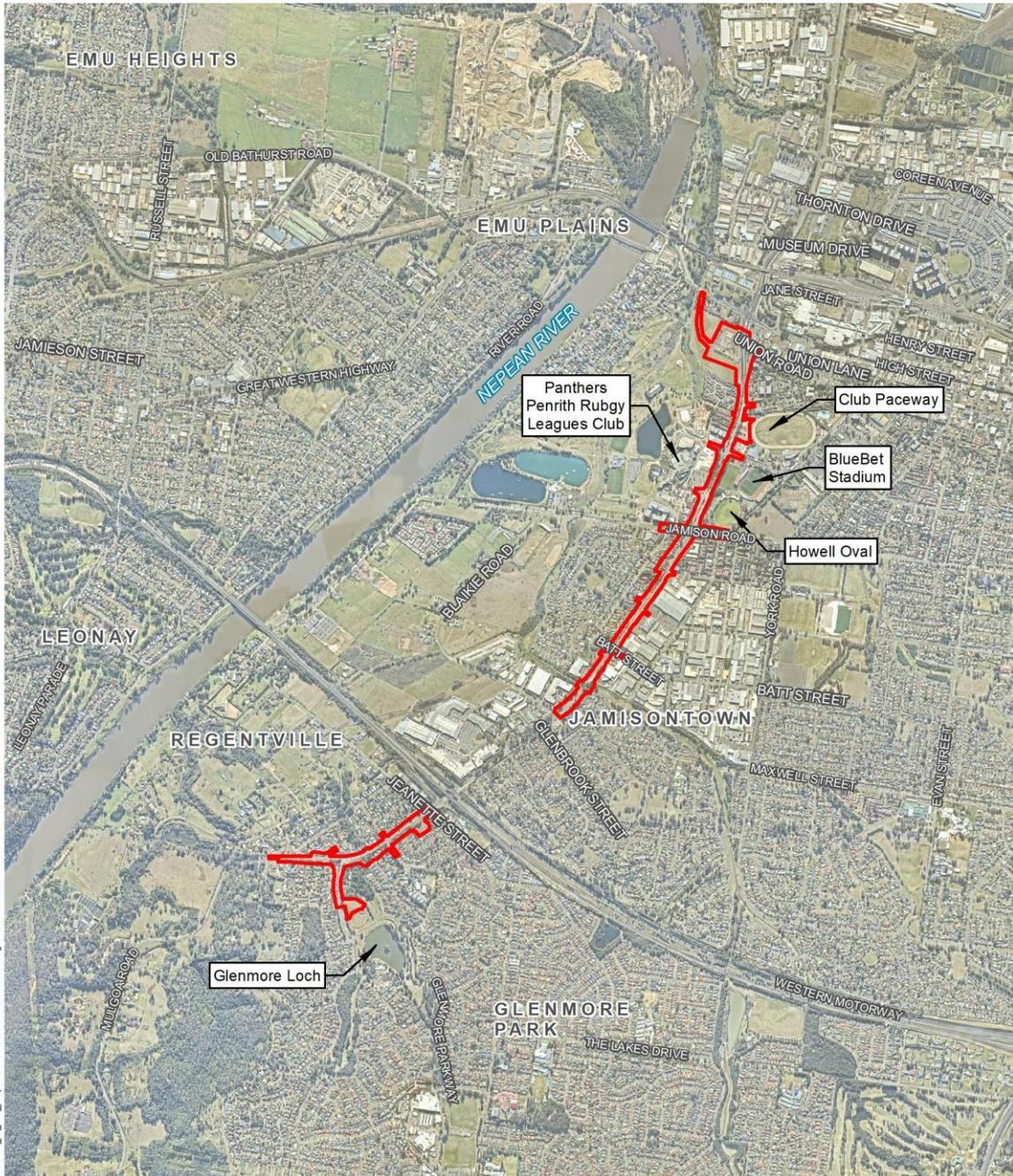
Mulgoa Road is an important arterial road connecting the Penrith community, including its central business district, with other parts of greater Sydney. The proposal is being undertaken to support expected growth in the area, improve road safety, reduce congestion and improve travel times.

Key features of the proposal include:

- An upgrade of Mulgoa Road to a six-lane divided road (three lanes in each direction) with a wide central median
- Upgrade of intersections at the roundabout at Glenmore Parkway, Spencer Street, Batt Street, Freedom Furniture site, Jamison Road, Panther Place, Retreat Drive/Ransley Street and Union Road
- Upgrade of local road accesses at Gibbes Street (including the removal of Gibbes Street Service Road), Willoring Crescent, Stuart Street, Preston Street, McNaughton Street and Rodley Avenue
- New bridge structure over Surveyors Creek
- Reinstatement of bus stops along Mulgoa Road with provision for bus priority at key intersections
- Provision of a shared user path on the eastern side and pedestrian path on the western side of Mulgoa Road for the length of the proposal
- Drainage and flooding infrastructure upgrades
- Roadside furniture and street lighting
- Noise barriers
- Utility relocations
- Tree planting and landscaping
- Temporary establishment of up to four construction compound sites.

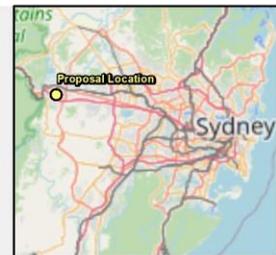
There are four potential ancillary construction facility sites that have been selected. Three of these are located on Mulgoa Road along the proposed construction work, while one is located on Glenmore Parkway, south of Mulgoa Road. Refer to Section 3.4 for more information.

Figure 1.1 provides an overview of the location of the proposal. Figure 1.2 identifies the key features of the proposal.

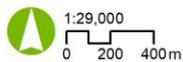


P:\GIS\Project-4\project4509813_Mulgoa_Road\MR_REF_Location_of_the_proposal.mxd\JOB No.120-10-21\Virgil Robinson\Rev 0

 REF proposal area



Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri

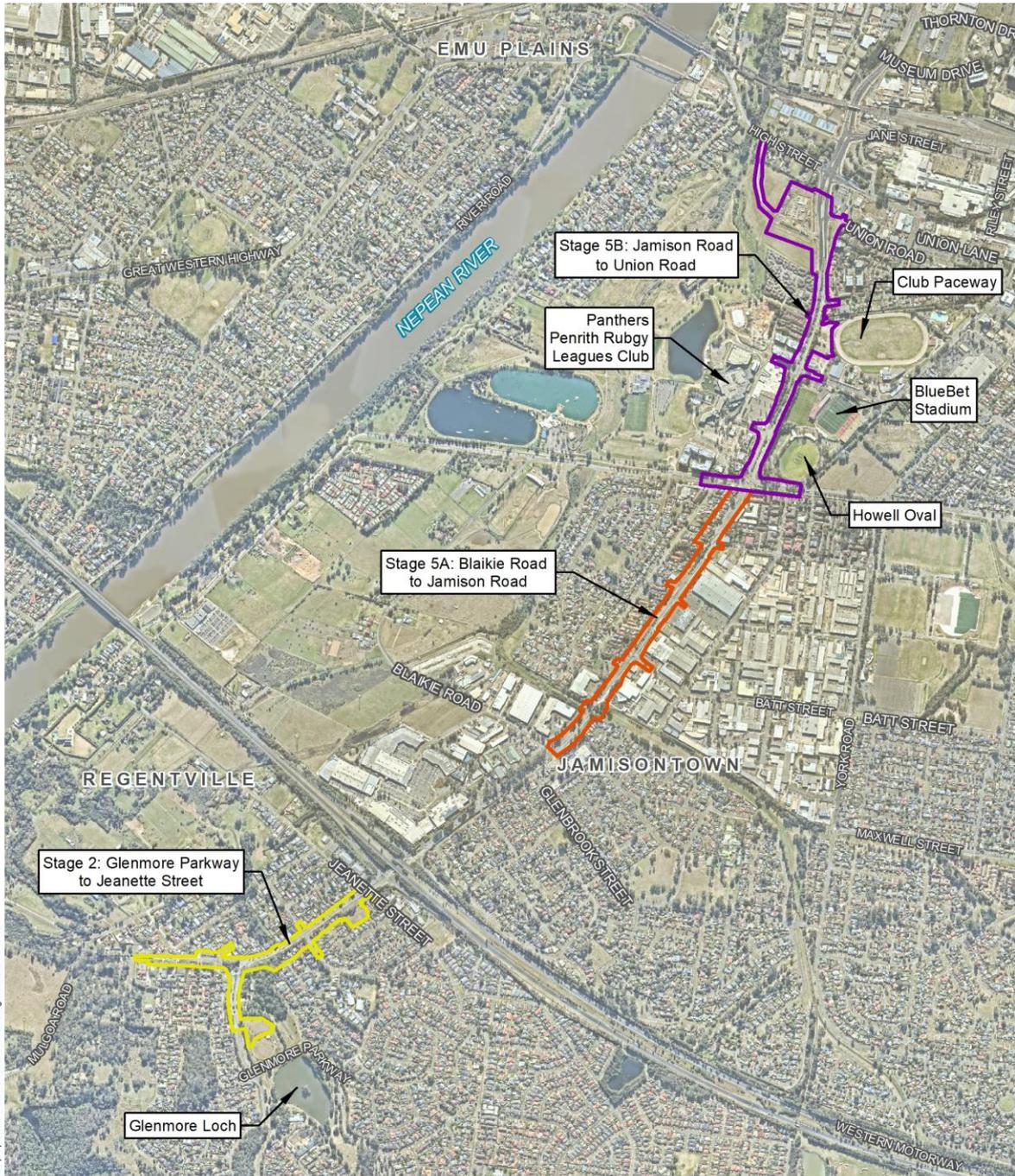


Projection: GDA 1994 MGA Zone 56

Mulgoa Road **Review of Environmental Factors**

Location of the proposal

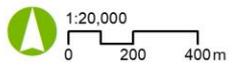
Figure 1-1: Location of the proposal



P:\GIS\Project-4\project509813_Mulgoa_Road\MR_REF_The proposal.mxd\LOB No.120-10-21\Virgil Robinson\Rev 0

- REF proposal area
- Stage 2
 - Stage 5A
 - Stage 5B

Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri



Projection: GDA 1994 MGA Zone 56

Figure 1-2: The proposal

1.2 Purpose of the report

This Review of Environmental Factors (REF) has been prepared by Aurecon Australasia Pty Ltd (Aurecon) on behalf of Transport. For the purposes of these works, Transport is the proponent and the determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

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

The description of the proposed work and assessment of associated environmental impacts has been undertaken in the context of clause 171 of the Environmental Planning and Assessment Regulation 2021, the factors in *Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979 (Is an EIS required? guidelines)* (DUAP, 1999), *Roads and Related Facilities EIS Guideline* (DUAP 1996), the *Biodiversity Conservation Act 2016* (BC Act), the *Fisheries Management Act 1994* (FM Act), and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In doing so, the REF helps to fulfil the requirements of Section 5.5 of the EP&A Act including that Transport for NSW examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Public Spaces under Division 5.2 of the EP&A Act
- The significance of any impact on threatened species as defined by the BC Act and/or FM Act, in section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report
- The significance of any impact on nationally listed biodiversity matters under the EPBC Act, including whether there is a real possibility that the activity may threaten long-term survival of these matters, and whether offsets are required and able to be secured
- The potential for the proposal to significantly impact any other matters of national environmental significance or the environment of Commonwealth land and the need, subject to the EPBC Act strategic assessment approval, to make a referral to the Australian Government Department of Agriculture, Water and 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 Premier's Priorities

The *Premier's Priorities* (NSW Government, 2021a) represent the NSW Government's commitment to making a difference in enhancing the quality of life of the people of NSW, with each priority set with an ambitious target. The key policy priorities for the NSW Government are:

- A strong economy
- Highest quality education
- Well-connected communities with quality local environments
- Putting customer at the centre of everything NSW Government does
- Breaking the cycle of disadvantage.

While the overall proposal is not specifically mentioned within the Premier's Priorities, the proposal supports the key policy priority of enhancing the people of NSW's quality of life through 'well connected communities with quality local environments.' The proposed widening of Mulgoa Road would help to alleviate congestion and improve travel time, allowing road users to move more effectively. The proposal would also improve connections and enhance safety for pedestrians and cyclists, improving transport options for the community.

2.1.2 Future Transport Strategy 2056

The *Future Transport 2056* (Future Transport Strategy) (Transport, 2020b) is an update of the NSW Government's *NSW Long Term Transport Master Plan*, providing an integrated vision for NSW through a suite of strategies and plans for transport developed alongside the *State Infrastructure Strategy* (SIS), *Greater Sydney Region Plan* and the Department of Planning and Environment's regional plans. The *Future Transport Strategy* outlines the 40-year vision, directions and outcomes framework for customer mobility in NSW, guiding investment over the longer term. The *Future Transport Strategy* outlines six state-wide outcomes to guide investment, policy and reform and service provision.

Within the *Future Transport Strategy*, a network issue to be addressed for the improvement, use and management of the network over the next 40 years is 'Optimising the network and better using existing infrastructure'. As part of this network issue, mitigating the costs and impacts of congestion is identified as a major focus for planning the future network. The proposal would help to alleviate congestion and improve travel time, aligning with the *Future Transport Strategy's* strategic objective to optimise the network and improve the use of existing infrastructure.

In addition, the *Future Transport Strategy* also discusses Transport's 'Movement and Place' framework. The overall proposal aligns with the framework through the objective to improve travel times and journey time reliability for all road users. The overall proposal would promote the Movement and Place framework through the provision of increased capacity at intersections and improved connectivity and safety for active transport users, contributing to the liveability of the community and local/regional road users.

2.1.3 Greater Sydney Services and Infrastructure Plan

The *Greater Sydney Services and Infrastructure Plan* (Services and Infrastructure Plan) (Greater Sydney Commission, 2018a) forms part of the Future Transport Strategy. The Services and Infrastructure Plan's overall transport vision for Greater Sydney has been developed to support the Greater Sydney City's vision for Greater Sydney as a "30 minute city", a metropolis of three cities, where people have access to jobs and services within 30 minutes by public transport. Mulgoa Road is an important corridor for the Western Parkland City connecting the Penrith community, including its central business district, with other parts of the Western Parkland City as well as the wider Sydney area.

The *Services and Infrastructure Plan* builds on the state-wide transport outcomes identified in the Future Transport Strategy, establishing specific outcomes that Transport's customers can expect and identifying the policy, service and infrastructure initiatives to achieve these.

The Future Transport State-wide Outcomes and Greater Sydney Transport Customer Outcomes are as follows:

- Customer focused – convenient and responsive to customer needs
- Successful places – sustaining and enhancing the liveability of our places
- A strong economy – connecting people and places in the growing city
- Safety and performance – safely, efficiently and reliably moving people and goods
- Accessible services – accessible for all customers
- Sustainability – makes the best use of available resources and assets.

The overall proposal would contribute to achieving these customer outcomes through improving travel efficiency and reliability, managing congestion and improving travel times along Mulgoa Road. The provision of new footpaths and the reinstatement of the shared user path would also provide accessible transport options for the community.

2.1.4 Freight and Ports Plan 2018 – 2023

In September 2018, Transport released the *Freight and Ports Plan 2018-2023* (FPP) as a supporting plan to the Future Transport Strategy. The FPP was released to provide a guide for the freight industry over a five-year period to make the long-term investments required to benefit the freight industry as well as the State's future growth (Transport, 2018). The main aim of the FPP is for the industry and government to work together to achieve the following objectives:

- Objective 1: Economic growth
- Objective 2: Efficiency, connectivity and access
- Objective 3: Capacity
- Objective 4: Safety
- Objective 5: Sustainability.

The overall proposal aligns closely with the objectives of the FPP through the upgrade of Mulgoa Road, increasing capacity, addressing existing congestion issues and accommodating growth. In doing so, the overall proposal would improve efficiency and provide better connectivity and access for the community and all road users. The FPP discusses the contribution that congestion makes to the cost of moving freight, especially given the high number of heavy vehicles that frequent Mulgoa Road. The overall proposal would aim to improve freight efficiency and reduce vehicle operating costs on the road network through the upgrade of Mulgoa Road.

2.1.5 Road Safety Plan 2021

The *Road Safety Plan 2021* (Road Safety Plan) (NSW Government, 2018b) was established to guide the improvement of road safety in NSW. The plan is based on consultation with the NSW community to identify trends and key issues that can be responded to. The international 'Safe System Approach' is adopted in the plan to achieve the NSW target of 'zero fatalities and serious injuries on our roads by 2056' (Transport, 2020b). The steps to achieving a safer system that align closely with the overall proposal include creating safer urban places and communities and building a safe future. Developing 'liveable and safe urban communities' is a priority area highlighted in the Road Safety Plan. Actions that are discussed to achieve this include exploring options to improve safety upgrades at intersections. Mulgoa Road has recorded several moderate and severe injuries within the proposal area. The overall proposal would upgrade Mulgoa Road including intersections to improve road safety outcomes for all road users, including motorists, pedestrians and cyclists. This would have benefits for current and future people living and travelling through the overall proposal area, contributing to the liveability of the community through the provision of safer infrastructure and connections.

2.1.6 State Infrastructure Strategy

The *State Infrastructure Strategy 2018-2038: Building Momentum* (SIS) outlines the NSW Government's 20-year strategic vision for infrastructure needs and priorities (Infrastructure NSW, 2018c). The SIS identifies policies and strategies needed to meet the needs of the growing NSW population and economy and especially to shift investment in infrastructure westwards.

The SIS recognises that different parts of NSW face different opportunities and needs, and sets geographic directions for infrastructure planning, investment and policy. The proposal is located within the Western Parkland City of Greater Sydney, an area facing infrastructure challenges such as poor connectivity. The SIS identifies the following responses to these challenges and opportunities, which are supported by the overall proposal:

- Improve intercity and intracity transport connections
- Improve intracity walking and cycling connections
- Improve connections to and within the emerging Western Parkland City area.

In addition to identifying infrastructure responses to geographic areas, the SIS also identifies transport-specific challenges and opportunities, which include:

- Addressing capacity constraints
- Improving productivity
- Improving road safety

The overall proposal would support these opportunities as it would:

- Result in significant improvements at intersections along Mulgoa Road.
- Increase travel efficiency for local road users by allowing for greater traffic capacity at key intersections
- Significantly impact road safety in the area due to increased intersection capacity and smoother operation of the network in general
- Improve freight access to surrounding area

In addition, the overall proposal in conjunction with other stages of the Mulgoa Road upgrade program would ease existing traffic congestion issues and improve freight access between Penrith and the M4 Motorway.

Further detail on the traffic impacts of the overall proposal is provided in Section 6.2.

2.1.7 Greater Sydney Region Plan – A Metropolis of Three Cities

The *Greater Sydney Region Plan: A Metropolis of Three Cities* (GSRP) outlines the vision to transform Greater Sydney into a metropolis of three cities:

- The established Eastern Harbour City – building on its recognised economic strength and addressing liveability and sustainability.
- The developing Central River City – investing in a wide variety of infrastructure and services and improving amenity.
- The emerging Western Parkland City – establishing the framework for the development and success of an emerging new city.

The proposal is located within the emerging Western Parkland City. The GSRP highlights the importance of providing infrastructure to support cities, while also having the ability to adapt to meet the needs of future growth. The proposal would contribute to meeting these objectives through upgrading infrastructure on Mulgoa Road. This would increase traffic efficiency for local road users and provide for future growth by allowing greater traffic capacity at key intersections.

One of the GSRP objectives also focuses on ensuring the freight and logistics network is competitive and efficient. It highlights the importance of locations surrounding key freight networks and ensuring they are not adversely impacted by traffic patterns and congestion. The upgrade of Mulgoa Road would contribute to achieving the GSRP objectives relating to freight and logistic networks through the provision of additional capacity in the direct study area. This would also benefit the community through decreasing traffic congestion on local roads, improving access within the neighbouring communities.

2.1.8 Western City District Plan

The *Western City District Plan* provides a 20-year plan to manage economic, social and environmental growth and achieve the 40-year vision, while enhancing Greater Sydney's liveability, productivity and sustainability into the future. It is a guide for implementing The *Greater Sydney Region Plan* at a district level and is a bridge between regional and local planning.

The proposal supports the following planning priorities within the Western City District Plan:

- Planning Priority W1 - Planning for a city supported by infrastructure
- Planning Priority W7 - Establishing the land use and transport structure to deliver a liveable, productive and sustainable Western Parkland City
- Planning Priority W10 - Maximising freight and logistics opportunities and planning and managing industrial and urban services land.

The overall proposal would support increased demand for capacity required for road users travelling through the overall proposal area to access other parts of western Sydney.

2.1.9 Smart Cities Plan

The *Smart Cities Plan* (Commonwealth of Australia, 2016) is a long-term strategy that aims to support the growth of Australian cities as further economic opportunities and challenges are presented. It includes three pillars – *Smart Investment, Smart Policy and Smart Technology* – to help ease pressures on housing affordability, access to jobs, the natural environment and traffic.

The proposal objectives align with those in the Smart Cities Plan through:

- Assisting the realisation of ‘30-minute Cities’ by reducing the travel time for residents accessing employment, essential services, schools and recreational facilities to within 30 minutes from home
- Investment in connecting outer suburbs to major cities, through improved connection to the M4 Motorway and wider Sydney, and reducing urban congestion along Mulgoa Road therefore improving opportunities for isolated communities.

2.1.10 Penrith City Strategy

The *Penrith City Council - City Strategy* provides a 20+ year plan and examines the long-term issues facing Penrith City and community, and sets out policy responses for each issue. Many of these issues, however, also affect the neighbouring councils, the broader Sydney region, and sometimes the state.

The proposal addresses the following goals outlined in the City Strategy:

- Transport and Access Goal T1 – An efficient and integrated public transport network that links Penrith City and the region.
- Transport and Access Goal T2 – An efficient and integrated public transport network within Penrith City that meets community travel needs for access to employment, centres, education and recreational facilities
- Transport and Access Goal T6 – An integrated shared pathway network that links Penrith City.
- Transport and Access Goal T7 – Shared pathways across Penrith City link public transport, schools, sporting facilities, community facilities, local centres and recreational areas
- Transport and Access Goal T12 – Improved road network efficiency and safety
- Transport and Access Goal T15 – Improved road and rail transport connections to the north and south of Penrith, neighbouring growth centres and the Central West, to support Penrith’s role as a regional hub servicing these areas.

The City Strategy highlights the importance of infrastructure improvements of arterial roads including Mulgoa Road.

2.2 Limitations of existing infrastructure

The existing Mulgoa Road is two lanes in each direction and is an important arterial road that connects Penrith to the M4 Motorway. It currently has the following limitations:

- Safety – a current safety risk exists for traffic during peak hour as there is a large volume of vehicles, including heavy vehicles using the road.

- Capacity – congestion during the peak hour periods is experienced along Mulgoa Road. This congestion has flow on effects on the performance of the broader road network. The morning and afternoon peak periods see traffic speeds of between 20 and 30km/h. Mulgoa Road in the proposal area is not expected to be able to accommodate future pressure on the road network as a result of population and employment growth in the area.
- Future development – the existing road corridor connects Penrith community with other parts of greater Sydney, however, will not be able to accommodate future development in the area. Mulgoa Road currently operates at capacity during peak periods and is unable to facilitate future development of the community and services in the region.

2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives

The objectives of the proposal include:

- Improve road user journey time reliability, reduce congestion and enhance freight productivity
- Plan for future urban and employment growth
- Provide a safer road environment for all road users
- Improve road user amenity, support public transport use and encourage active transport
- Minimise impacts to the local environment
- Maximise the project's value for money.

2.3.2 Development criteria

The development criteria for the proposal are:

- Minimise the impacts on existing traffic movements including pedestrians, vehicles, public transport, cyclists and disable persons
- Minimise property acquisitions
- Minimise environmental impacts
- Access to construction zones and compound sites
- Minimise utilities adjustments
- Achieve value for money
- Achieve constructability.

2.3.3 Urban design objectives

Urban design objectives for the proposal include:

- Recognise and enhance the road corridor for a variety of user groups and transport modes through appropriate landscape treatments with holistic and positive user experiences
- Fitting sensitively within the natural green setting
- Create a well-connected, safe and logical road corridor that reflects on positive aspects of the study areas physical and cultural setting including effective connectivity between existing transport systems

- Developing a design that minimises impacts to the surrounding green environment to demonstrate a sensitive construction methodology.

2.4 Alternatives and options considered

This section summarises the options that were considered for the proposal and details the justification as to why the preferred option was chosen.

2.4.1 Development of the corridor

Following ministerial announcement to upgrade the Mulgoa Road/Castlereagh Road corridor in 2015, Transport started investigating and developing several strategic corridor options. This process involved setting proposal and development objectives for upgrading the corridor, identifying potential options, and evaluating their relative value and benefits. A value management process was then used to compare more detailed section-specific widening options against development criteria set to help identify a preferred corridor option. These were based on the collection of site-specific information and input from key stakeholders.

2.4.2 Methodology for selection of the preferred option

The options evaluation process consisted of an initial strategic investigation that was completed to identify possible high-level solutions to improve safety and facilitate the population and employment growth of the area. Evaluation of the strategic options was undertaken against the proposal objectives and development criteria to determine preferred option. To support the options evaluation process, traffic modelling and analysis was undertaken.

2.4.3 Identified options

Several options were identified and assessed against the proposal objectives. These are detailed in Table 2-1.

Table 2-1: Identified options analysis

Option	Details	Advantages	Disadvantages
Option 1	<p>Stage 2 – widening on the eastern side of Mulgoa Road between Glenmore Parkway and Jeanette / Factory Street, Glenmore Park.</p> <p>Stage 5A and 5B – widening on the eastern side of Mulgoa Road between Blaikie Road, and Union Road, Penrith.</p>	<p>Stage 2 – would affect substantially fewer residential properties and would require less complex and costly relocations.</p> <p>Stage 5A and 5B – would impact fewer properties from Blaikie Road to Preston Street. From Preston Street to Union Road it would require less complex and costly utility relocations.</p>	<p>Stage 2 – would affect a larger amount of mapped Alluvial Woodland near School House Creek (which potentially corresponds to the NSW listed River-flat eucalypt forest endangered ecological community)</p> <p>Stage 5A and 5B – it would require more complex and costly utility relocations from Blaikie Road to Preston Street. From Preston Street to Union Road would have greater property impacts, would require full acquisition of the heritage listed Workman’s Cottages and would affect an area of Alluvial Woodland (which potentially corresponds to the NSW listed River-flat eucalypt forest endangered ecological community).</p>
Option 2	<p>Stage 2 – widening on the western side of Mulgoa Road between Glenmore Parkway and Jeanette / Factory Street, Glenmore Park.</p> <p>Stage 5A and 5B – widening on the western side of Mulgoa Road between Blaikie Road, and Union Road, Penrith.</p>	<p>Stage 2 – would affect a smaller amount of mapped Alluvial Woodland</p> <p>Stage 5A and 5B – would require less complex and costly utility relocations from Blaikie Road to Preston Street. From Preston Street to Union Road it would have fewer property impacts and would not affect mapped native vegetation communities.</p>	<p>Stage 2 – full acquisition of more residential properties, as well as short strip acquisition along Schoolhouse Creek. Would affect water main and Telstra infrastructure</p> <p>Stage 5A and 5B – would have greater property impacts from Blaikie Road to Preston Street.</p>

Option	Details	Advantages	Disadvantages
Option 3	It would involve no upgrade to Mulgoa Road along stage 2, 5A and 5B. As the proposal is to be delivered as part of a package of work, stage 0 and 1 of Mulgoa Road upgrade would be completed, as construction has already begun in these locations. As such, this option includes upgrades to Mulgoa Road at Jeanette Street to Blaikie Road, and Mulgoa Road at Union Road to Museum Drive.	Would minimise environmental impacts and impacts to property.	Would continue congestion and poor road safety along Mulgoa Road and surrounding road network. It does not account for future population and employment growth in the area.

2.5 Preferred option

Option 3 or the 'do minimum' option was considered but discarded as it does not address the identified needs of the area and would therefore only be preferred in circumstances where the costs and environmental impacts outweighed the identified benefits.

Stage 2 - After consideration of these factors, widening to the east (Option 1) was selected as the preferred option for this section. The large difference in property impacts was the main driver of the decision.

Stage 5A and 5B - After consideration of these factors, widening to the east (Option 1) was selected as the preferred option for this section from Blaikie Road to Preston Street. The difference in property impacts and fewer utility relocations were the main drivers of the decision. From Preston Street to Union Road, widening to the west (Option 2) was selected as the preferred option for this section. The difference in property impacts and the presence of mapped Alluvial Woodland to the east were the main drivers of the decision.

The preferred option for Stage 2, 5A and 5B is a combination of option 1 and 2 and includes the following:

- Widen the road from two to three lanes in each direction
- Upgrade intersections – including traffic light intersections at Glenmore Parkway
- Bus priority at intersections
- A separated path for pedestrian and cyclists on the eastern side of Mulgoa Road
- Footpath on the western side of Mulgoa Road
- Landscaping along the corridor.

This preferred option achieves the objectives and needs for developing the corridor and proposal to provide the needed increase in capacity to support future employment and population growth in the area. It also provides connected safe active transport options throughout.

3 Description of the proposal

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

3.1 The proposal

Transport propose to upgrade about two kilometres of Mulgoa Road. The proposal involves the upgrade and widening of Mulgoa Road across three separate stages:

- Stage 2 – Mulgoa Road upgrade between Glenmore Parkway and Jeanette Street, Glenmore Park (about 850 metres)
- Stage 5A – Mulgoa Road upgrade between Blaikie Road and Jamison Road, Penrith (about 1.2 kilometres)
- Stage 5B – Mulgoa Road upgrade between Jamison Road and Union Road, Penrith (about one kilometre).

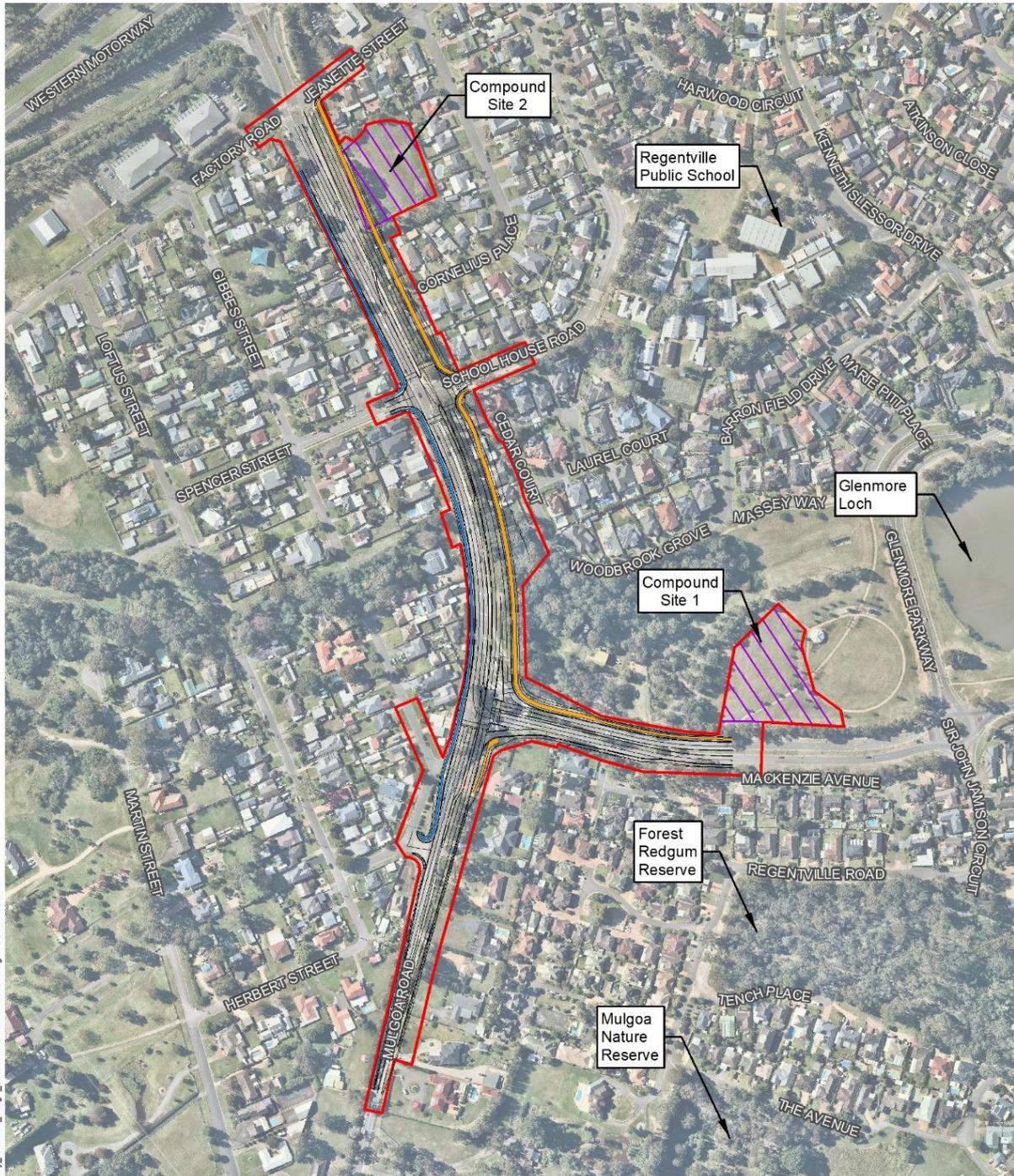
The proposal forms part of the 6.5-kilometre upgrade of the Mulgoa Road/Castlereagh Road corridor between Glenmore Parkway, Glenmore Park to Andrews Road, Penrith.

The proposal would involve widening Mulgoa Road from four lanes to six lanes (three lanes in each direction) divided with a central median. The proposal would also include changes and upgrades to existing intersections and new facilities for public transport, walking and cycling along Mulgoa Road.

Key features of the proposal would include:

- Upgrade of Mulgoa Road to a six-lane divided road (three lanes in each direction) with a wide central median
- Upgrade of intersections at the roundabout at Glenmore Parkway, Spencer Street, Batt Street, Freedom Furniture site, Jamison Road, Panther Place, Retreat Drive/Ransley Street and Union Road
- Upgrade of local road accesses at Gibbes Street (including the removal of Gibbes Street Service Road), Willoring Crescent, Stuart Street, Preston Street, McNaughton Street and Rodley Avenue
- New bridge structure over Surveyors Creek
- Reinstatement of bus stops along Mulgoa Road with provision for bus priority at key intersections
- Provision of a shared user path on the eastern side and pedestrian path on the western side of Mulgoa Road for the length of the proposal
- Temporary establishment of up to four construction compound sites
- Drainage and flooding infrastructure upgrades
- Roadside furniture and street lighting
- Noise barriers
- Utility relocations
- Tree planting and landscaping.

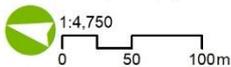
The key features are shown in Figure 3.1 to Figure 3.3.



P:\GIS\Project-4\project50813_Mulgoa_Road\MR_REF_Key_features_Stage_2.mxd\JOB No. 130-08-21\Virgil Robinson\Rev 0

- REF proposal area
- Concept design
- Footpath
- Shared path
- Compound site

Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri



Projection: GDA 1994 MGA Zone 56



Mulgoa Road Review of Environmental Factors

Key features of the proposal - Stage 2

Figure 3-1: Key features of the proposal between Glenmore Parkway and Jeanette Street

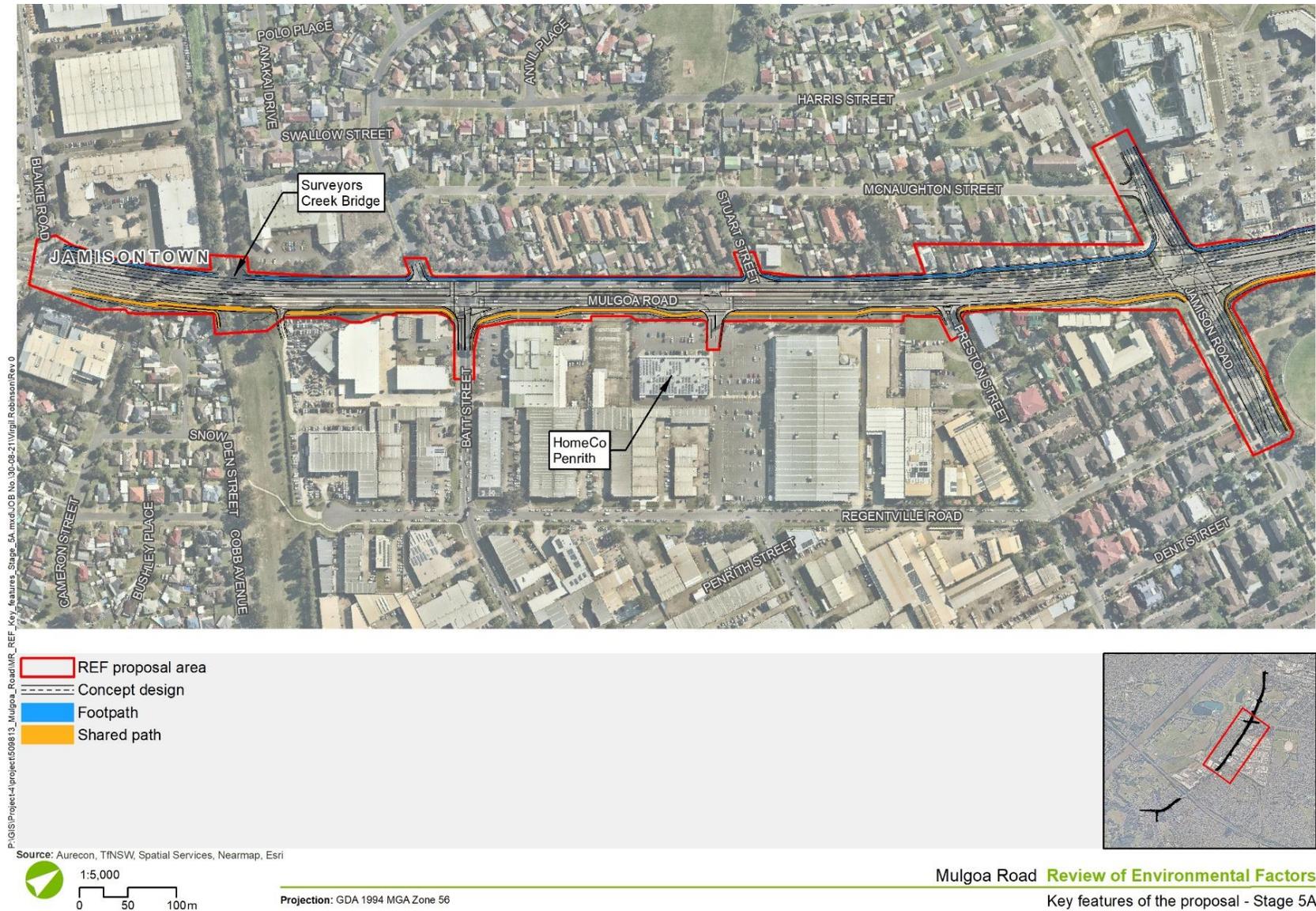


Figure 3-2: Key features of the proposal between Blaikie Road and Jamison Road

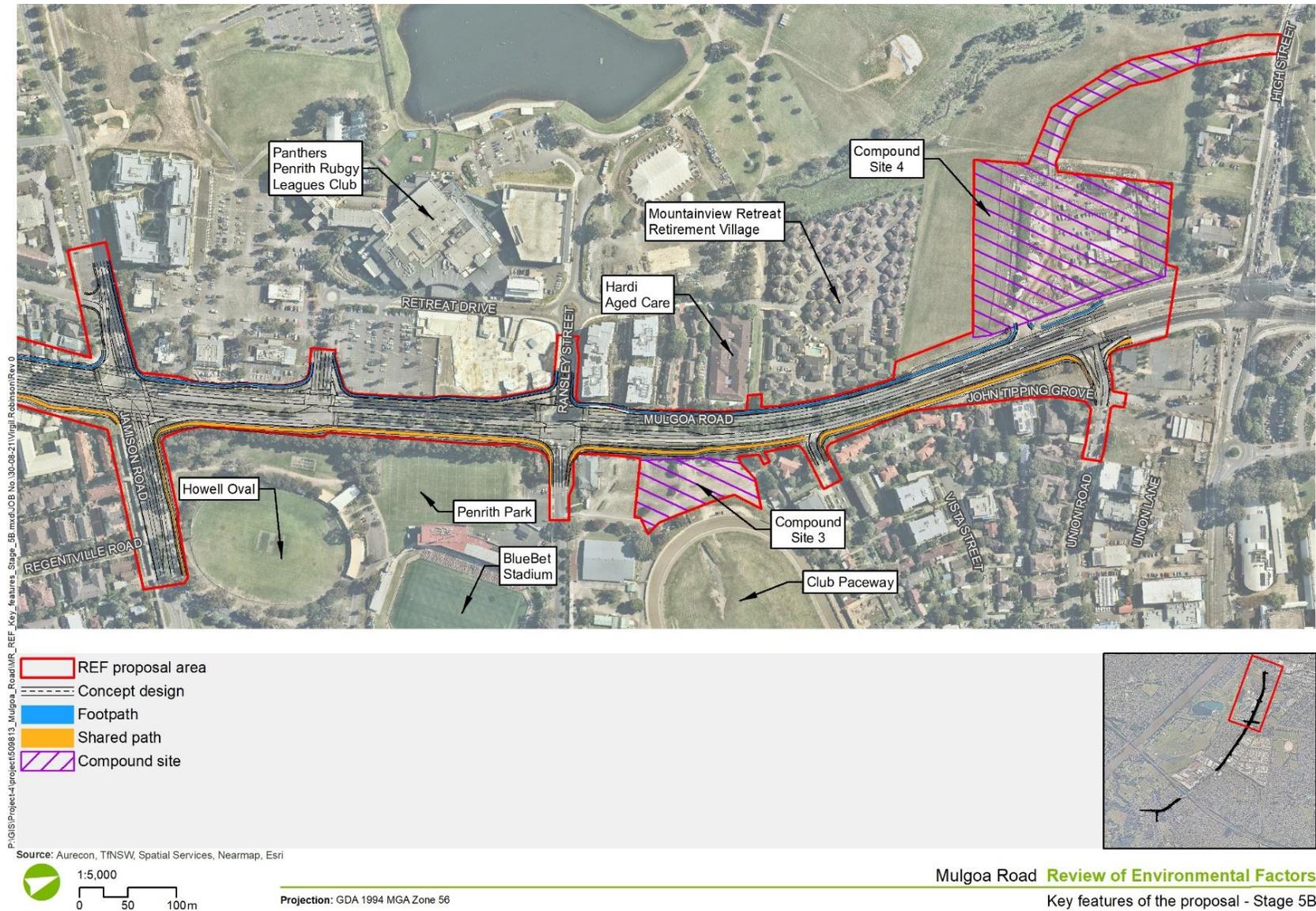


Figure 3-3: Key features of the proposal between Jamison Road and Union Road

3.2 Design

The concept design for the proposal is described below and would be further refined during detailed design due to ongoing design investigation and consideration of the environmental safeguards and management measures discussed in Section 6.

3.2.1 Design criteria

The proposal has been designed to NSW and Australian engineering, road safety, environmental and transport planning standards developed by Transport, Austroads and Standards Australia. These standards describe the criteria that should be adopted for specific road classifications and conditions. The criteria have been developed to ensure all roads are designed to be safe, effective, well-planned and easily maintained.

Table 3-1 Summary of design criteria for the proposal

Aspect	Design criteria
Speed limit	<ul style="list-style-type: none"> Mulgoa Road (main carriageway) 60 kilometres per hour posted speed 70 kilometres per hour design speed.
Cross section (as shown in Figure 3.4 to Figure 3.6)	<ul style="list-style-type: none"> Mulgoa Road (main carriageway) – minimum design criteria: <ul style="list-style-type: none"> Three northbound and three southbound through lanes General lane width: 3.5 metres kerb side Median width at least 1.5 metres Left turn lane width: 3.5 metres Right turn lane width: 3.3 metres Minimum shared path width: 3.5 metres Minimum pedestrian path width: 2.0 metres Minimum bus bay width: 3.0 metres (northbound pedestrian path), 3.5 metres (southbound share path).
Design vehicle	<ul style="list-style-type: none"> Intersections at Mulgoa Road and Batt Street, Jamison Road and Ransley Street are designed for B-double vehicles up to 26 metres in length. Intersections at Mulgoa Road and Glenmore Parkway, Spencer Street/School House Road, Willoring Crescent, Freedom Furniture site, Stuart Street, Preston Street, Panthers Places, Rodley Avenue and Union Road are designed for long semi-trailers up to 19 metres in length.
Grade	Maximum grades of: <ul style="list-style-type: none"> 4 per cent for design speeds of 80 to 90 kilometres per hour 3 per cent for design speeds of 60 kilometres per hour.
Batter slope	Maximum 2H:1V cut batters Maximum 4H:1V fill batters.
Road surface	Asphalt.
Flood immunity	The range of flood events were considered including: <ul style="list-style-type: none"> 1 in 100-year ARI Probable Maximum Flood (PMF)

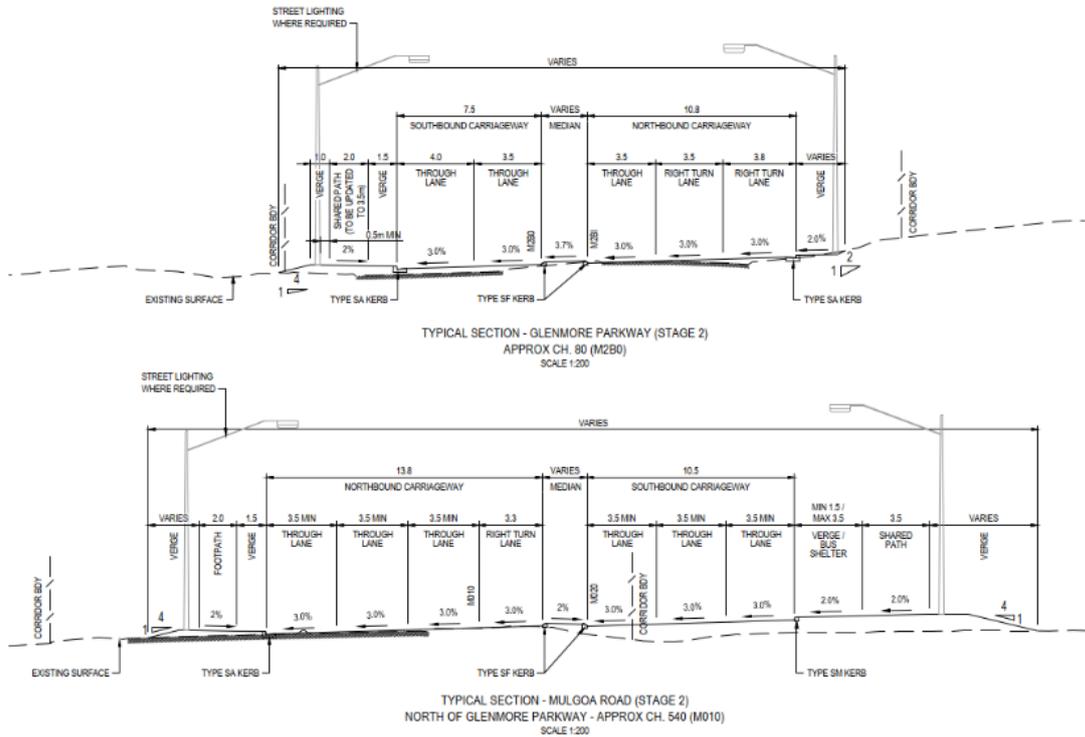


Figure 3-4: Typical cross sections of Mulgoa Road (between intersections) between Glenmore Parkway and Jeanette Street

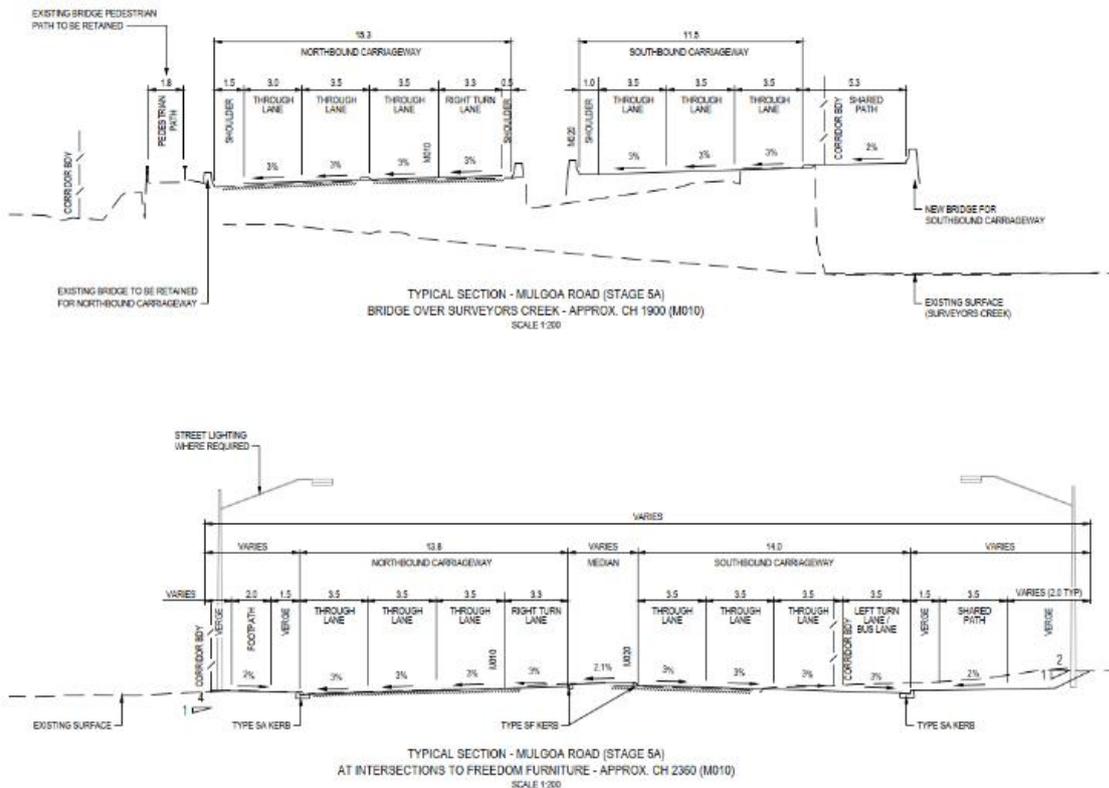


Figure 3-5: Typical cross sections of Mulgoa Road (between intersections) between Blaikie Road and Jamison Road

3.2.3 Major design features

Mulgoa Road main carriageway widening

Mulgoa Road would be widened to provide enough space for three lanes in each direction. The proposal would feature a wide raised central median along the length of the road to separate the northbound and southbound traffic lanes and provide pedestrian refuge at crossing locations.

The upgraded road alignment would offer enhanced drainage and flood immunity through improvements to road design and improved drainage features.

Intersection changes

The proposal involves changes to existing intersections with Mulgoa Road at Glenmore Parkway, Spencer Street, Batt Street, Freedom Furniture, Jamison Road, Panther Place, Retreat Drive/Ransley Street and Union Road.

Glenmore Parkway

The proposal would convert the existing three-leg roundabout at the Mulgoa Road intersection with Glenmore Parkway to a signalised T-intersection (refer to Figure 3.7) to provide:

- Left slip lanes to/from Glenmore Parkway
- A signalised pedestrian crossing
- Relocation of the existing bus stop on the northbound approach to the intersection.

Spencer Street

The proposal would upgrade the existing four-leg signalised intersection at Mulgoa Road and Spencer Street (refer to Figure 3.8) to provide:

- Three through lanes along Mulgoa Road and a dedicated right turn lane in each direction
- Two-stage signalised pedestrian crossings across Mulgoa Road
- Signalised pedestrian crossings across School House Road and Spencer Street
- A kerbside bus stop on the southbound departure side of the intersection.

Batt Street

The proposal would upgrade the existing signalised T-intersection at Mulgoa Road and Batt Street (refer to Figure 3.9) to provide:

- A signalised T-intersection with three through lanes along Mulgoa Road in each direction
- Dedicated northbound right turn lane in each direction and a southbound left slip lane
- A two-stage signalised pedestrian crossing across Mulgoa Road
- A single signalised pedestrian crossing across Batt Street
- A bus bay along Mulgoa Road on the southbound departure side of the intersection and a bus priority lane on the intersection approach
- An indented bus bay along Mulgoa Road north of the intersection in the northbound direction.

Freedom Furniture

The proposal would upgrade the existing signalised T-intersection at Mulgoa Road and Freedom Furniture (refer to Figure 3.10) to provide:

- A signalised T-intersection with three through lanes along Mulgoa Road in each direction
- Dedicated right turn lanes in each direction and a southbound left turn lane
- Two-stage signalised pedestrian crossing across Mulgoa Road
- A single signalised pedestrian crossing across the access to Freedom Furniture
- A bus bay on the southbound departure side of the intersection.

Jamison Road

The proposal would upgrade the existing four-leg signalised intersection at Mulgoa Road and Jamison Road (refer to Figure 3.11) to provide:

- A four-leg signalised intersection with three through lanes along Mulgoa Road, two eastbound through lanes and one westbound through lane.
- Bus priority lanes on the northbound and southbound approaches to the Intersection, next to the left slip lanes
- A single right turn on the northern leg and dual right turns on the other three legs
- A dual left slip lane from the eastern leg of Jamison Road onto Mulgoa Road southbound

Panther Place

The proposal would upgrade the existing signalised T-intersection at Mulgoa Road and Panther Place (refer to Figure 3.12) to provide:

- A signalised T-intersection with three through lanes along Mulgoa Road in each direction
- A dedicated southbound right turn lane into Panther Place and dual right turn lanes out of Panther Place onto Mulgoa Road.
- Entry and exit left slip lanes into and out of Panther Place.

Retreat Drive/Ransley Street

The proposal would upgrade the existing four-leg signalised intersection at Mulgoa Road and Retreat Drive/Ransley Street (refer to Figure 3.13) to provide:

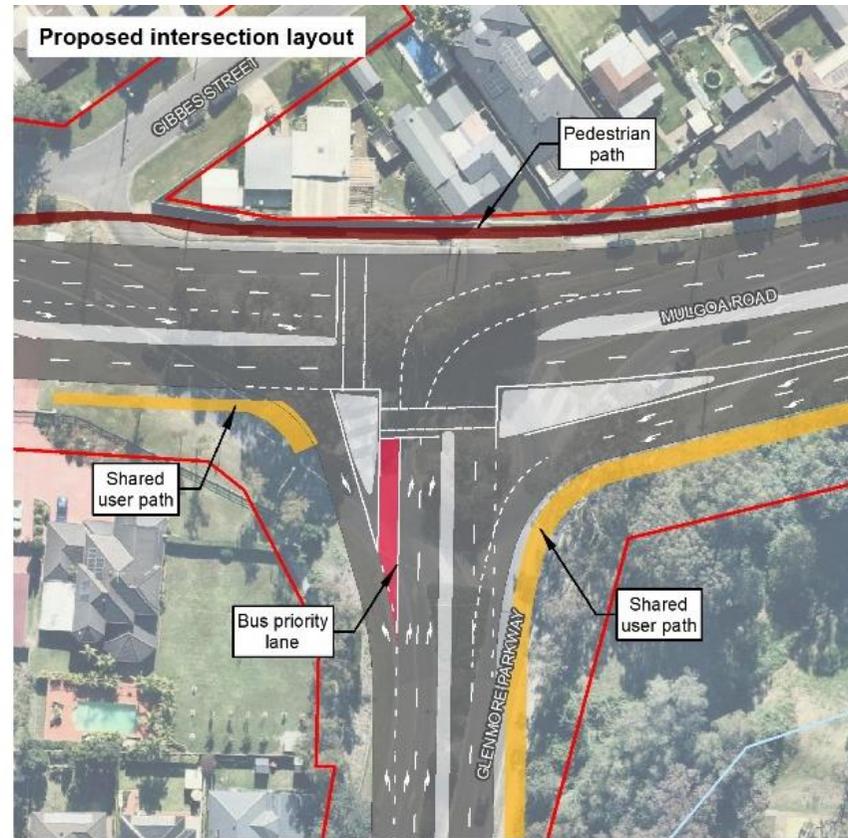
- A four-leg signalised intersection with three through lanes along Mulgoa Road
- Left slip lanes in each direction from Mulgoa Road onto Ransley Street/Retreat Drive.
- Departure side bus bays in each direction.

Union Road

The proposal would upgrade the existing unsignalised right turn at Mulgoa Road and Union Road (refer to Figure 3.14) to provide:

- Three through lanes and a dedicated right turn lane in each direction.
- Two-stage signalised pedestrian crossings on both the southern and northern legs
- Provisions on the western side of the intersection to facilitate future development.

The northern limit of the intersection ties in with the Jane Street and Mulgoa Road upgrade project.



- REF proposal area
- Road
- Median
- Bus priority lane
- Shared user path
- Pedestrian path
- Watercourse

Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri

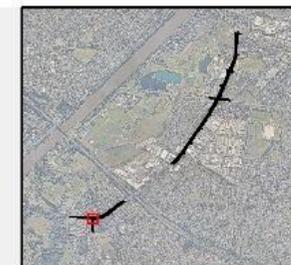
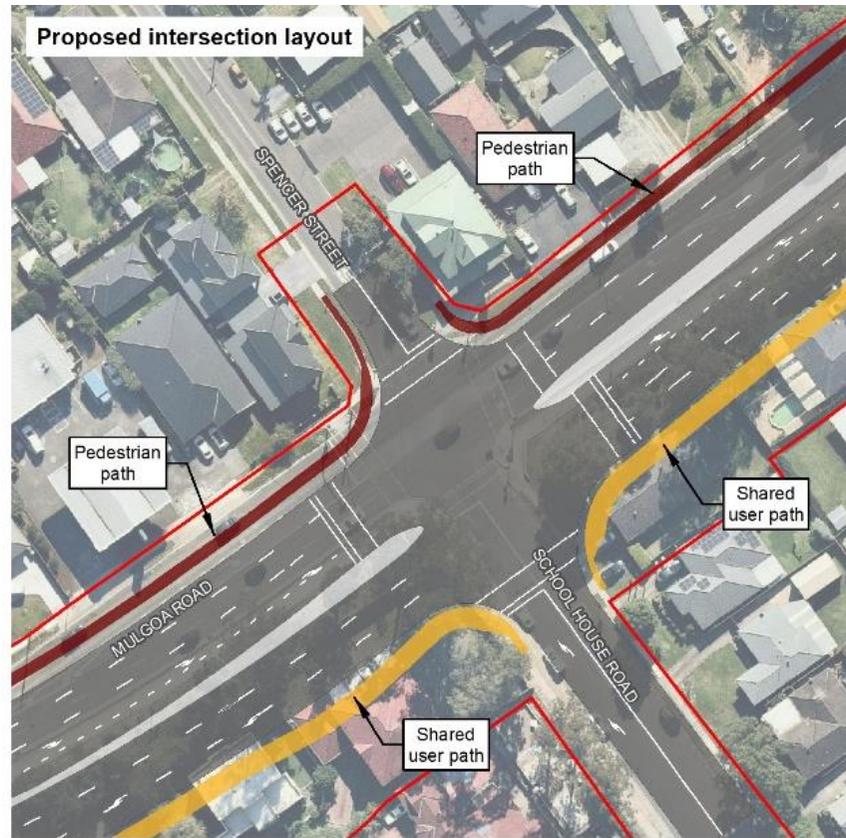


Figure 3-7: Indicative intersection layout at Glenmore Parkway

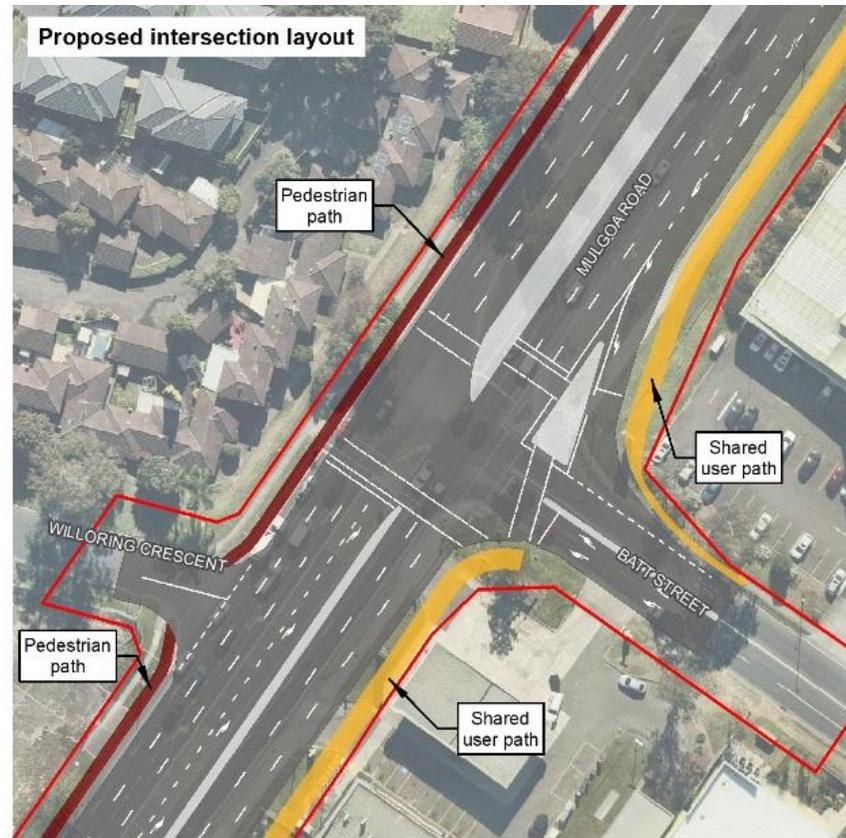


- REF proposal area
- Road
- Median
- Shared user path
- Pedestrian path



Source: Aurecon, TINSW, Spatial Services, Nearmap, Esri

Figure 3-8: Indicative intersection layout at Spencer Street

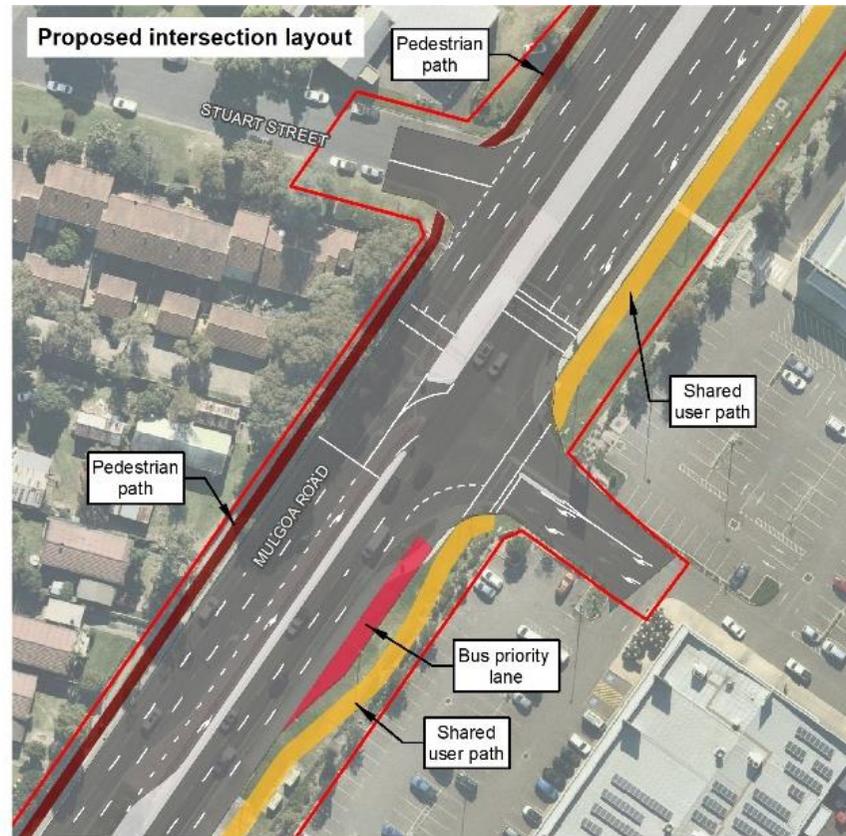
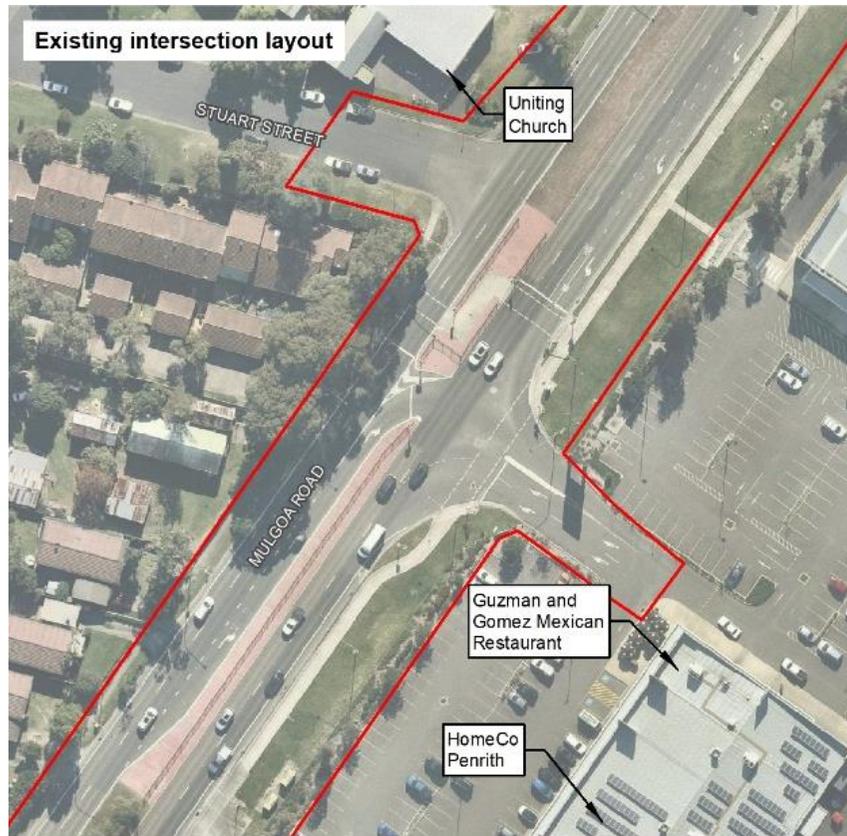


- REF proposal area
- Road
- Median
- Shared user path
- Pedestrian path

Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri



Figure 3-9: Indicative intersection layout at Batt Street

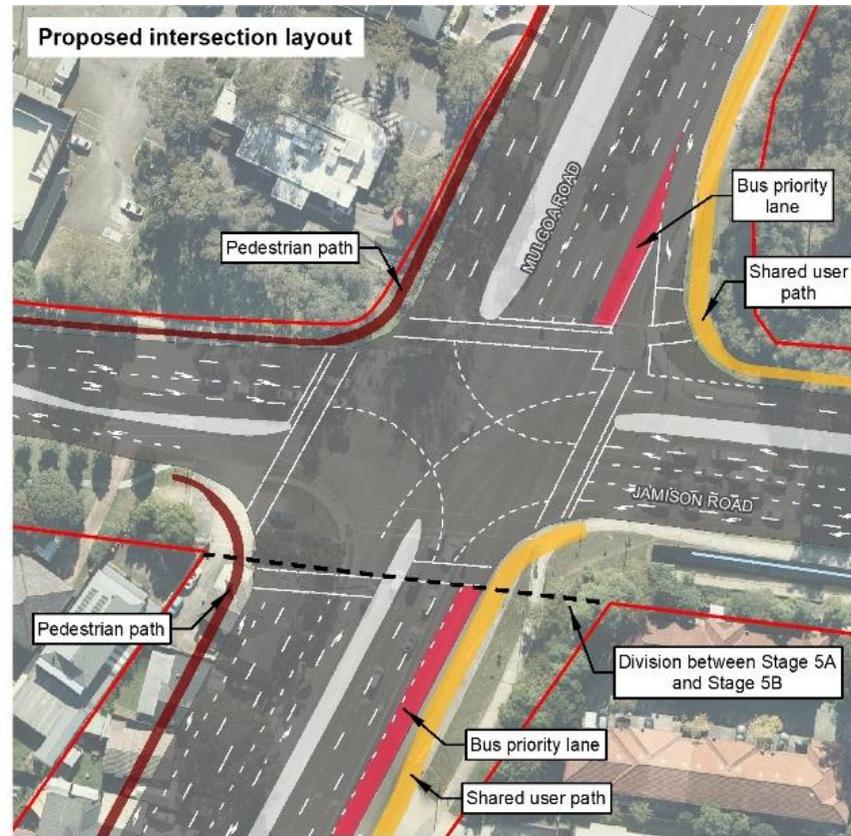
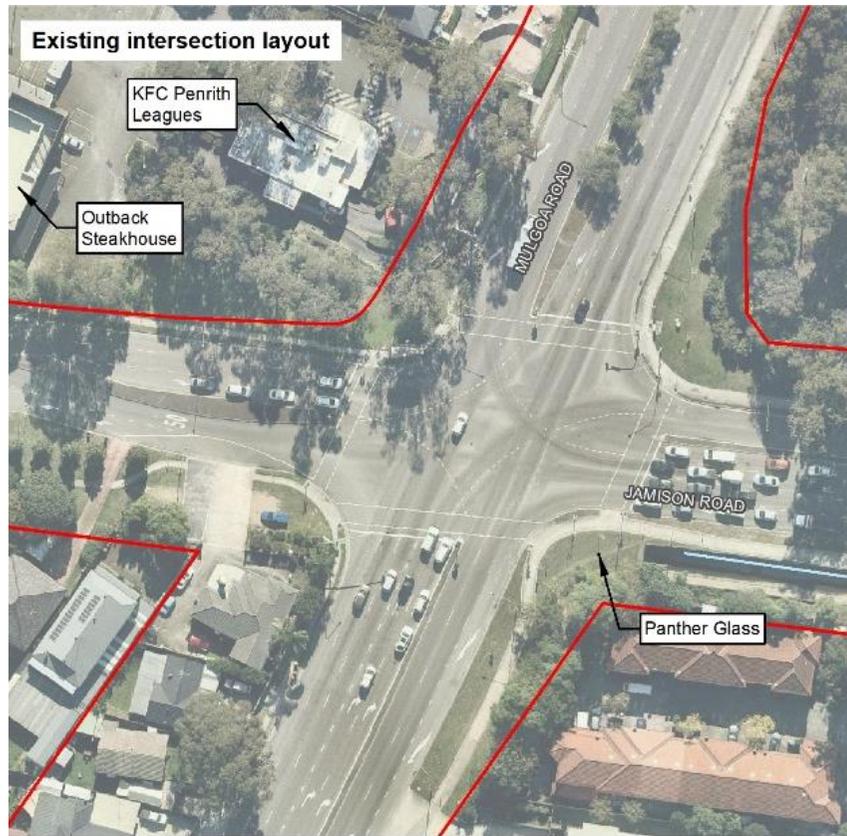


- REF proposal area
- Road
- Median
- Bus priority lane
- Shared user path
- Pedestrian path

Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri



Figure 3-10: Indicative intersection layout at Freedom Furniture



- REF proposal area
- Road
- Median
- Bus priority lane
- Shared user path
- Pedestrian path
- Watercourse

Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri

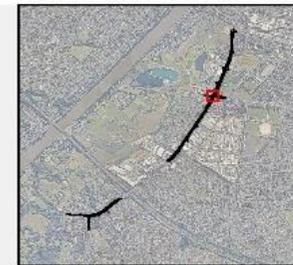
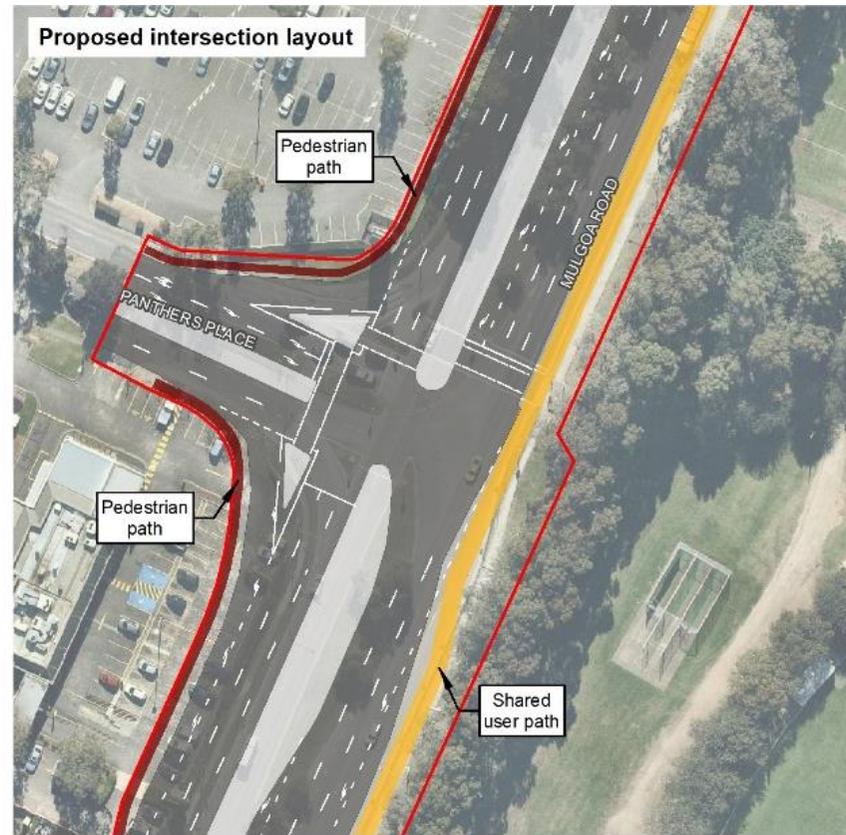
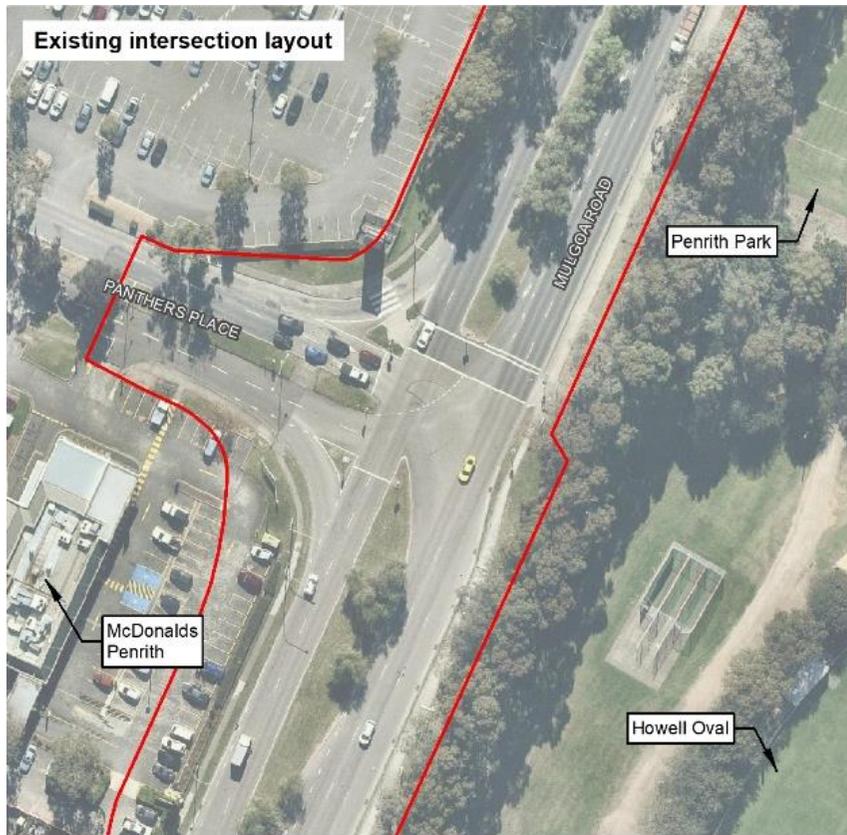


Figure 3-11: Indicative intersection layout at Jamison Road

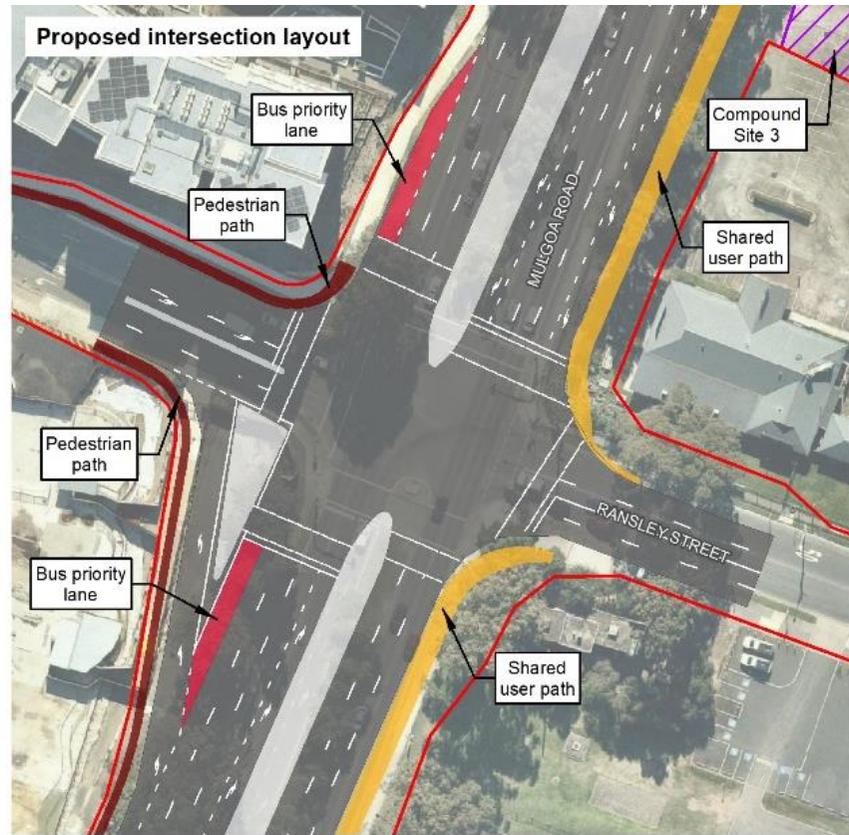


- REF proposal area
- Road
- Median
- Shared user path
- Pedestrian path

Source: Aurecon, TNSW, Spatial Services, Nearmap, Esri



Figure 3-12: Indicative intersection layout at Panthers Place



- REF proposal area
- Compound site
- Road
- Median
- Bus priority lane
- Shared user path
- Pedestrian path

Source: Aurecon, TINSW, Spatial Services, Nearmap, Esri



Figure 3-13: Indicative intersection layout at Retreat Drive/Ransley Street



Figure 3-14: Indicative intersection layout at Union Road

Changes to private property access

The proposal would require changes to private property access including:

- Stage 2
 - 331/DP869095 - Property access potentially to be adjusted due to installation of new utility connections
 - 91/C/DP1687 - Potential adjustment to fence due to retaining wall construction in road reserve
 - 92/C/DP1687 - Property access to Mulgoa Road be removed and reinstated on Gibbes Street, property adjustments to suit reconfiguration of access
 - 93/C/DP1687 - Rear property access to be removed, boundary fence to be removed and reinstated for utility relocations
 - 90/DP659734 - New driveway and turning head facility to be constructed within property, boundary fence to be removed and reinstated to suit new driveway
 - 3/DP227348 - Property access to be adjusted, garden to be removed and reinstated for utility relocations, boundary fence and letterbox to be removed and reinstated
 - 4/DP227348 - Property access to be adjusted, garden to be removed and reinstated for utility relocations, boundary fence and letterbox to be removed and reinstated
 - 871/DP1088705 - Property access to be adjusted, Garden to be removed and reinstated for utility relocations, Boundary fence to be removed and reinstated
 - 13/C/DP1687 - Property access to be adjusted
- Stage 5A
 - 41/A/DP1687 – Property access to be adjusted
 - 40/A/DP1687 – Property access to be adjusted
 - 33/DP774214 – Adjustment in road reserve only
 - 32/DP1119 – Adjustment in road reserve only
 - 250/DP600142 – Adjustment in road reserve only
 - /SP39546 – Adjustment in road reserve only
- Stage 5B
 - 10/DP871523 - Brick wall/fence to be removed/relocated, garden and vegetation to be removed/relocated
 - SP102064 - Temporary access for construction and utility connections due to works along footway
 - 2/DP827455 - Adjustment to garden for batter in one location.

The changed private property access arrangements would be confirmed during detailed design in consultation with the relevant landholders. For other properties affected by partial acquisition refer to Section 3.6.

Bus facilities

The proposal would provide bus facilities at key intersections along Mulgoa Road. These are summarised in Table 3-3.

Table 3-3: Proposed bus facilities for the proposal

Intersection with Mulgoa Road	Direction	Bus bay arrangement	Footpath width
Glenmore Parkway	Northbound	Approach side: Bus stop within kerbside lane	5.5 metres
Glenmore Parkway	Southbound	Departure side: Bus stop within kerbside lane	7.5 metres

Intersection with Mulgoa Road	Direction	Bus bay arrangement	Footpath width
Spencer Street	Northbound	Approach side: within kerbside lane	4.5 metres
School House Road	Southbound	Departure side: Bus stop within kerbside lane	7 metres
Jeanette Street (southern tie-in with stage 1)	Southbound	Departure side: Bus stop within kerbside lane	6 metres
Blaikie Road (northern tie-in with stage 1)	Northbound	Departure side: Indented bus stop	5 metres
Willoring Crescent	Northbound	Departure side: Bus stop within kerbside lane	5 metres
Batt Street	Southbound	Departure side: Bus stop within kerbside lane	6 metres
Freedom Furniture	Southbound	Approach side: Bus priority lane (within left turn lane) Departure side: Indented bus stop	7.5 metres
Stuart Street	Northbound	Departure side: Bus stop within kerbside lane	4.5 metres
Jamison Road	Southbound	Approach side: Bus priority lane Departure side: Indented bus stop	7.5 metres
Jamison Road	Northbound	Departure side: Bus stop within kerbside lane	4.5 metres
Jamison Road	Eastbound	Departure side: Indented bus stop	4 metres
Ransley Street	Northbound	Approach side: Bus priority lane Departure side: Indented bus stop	4 metres
Ransley Street	Southbound	Departure side: Bus stop within kerbside lane	5.5 metres
Mountain Retreat Retirement Village	Northbound	Existing kerbside bus stop to be relocated	3 metres
Union Road	Southbound	Departure side: Potential bus stop within kerbside lane	7 metres

Pedestrian and cyclist infrastructure

A shared user path would be provided on the eastern side of Mulgoa Road and pedestrian path would be provided on the western side of Mulgoa Road for the length of the proposal. The shared user path would generally be around 7 metres wide and the pedestrian footpath would generally be 4.5 metres wide. Localised widenings of the pedestrian and cyclist paths would be provided at the bus shelter locations as described in Table 3-3.

There would be no dedicated on-road cyclist provisions provided, although there is existing space for on road cyclists despite the presence of southbound shared user path.

Bridges

Surveyors Creek bridge

The proposal would include the duplication of the existing bridge across Surveyors Creek, adjacent to the existing bridge. The new bridge would be constructed adjacent to the existing bridge, that would remain in place. The new bridge would have a similar design and features to the existing bridge. It would comprise of three concrete cast-in-situ piles with a concrete deck slab. A throw screen would be provided between the two bridges. The proposed new bridge is shown in Figure 3.15 and Figure 3.16.

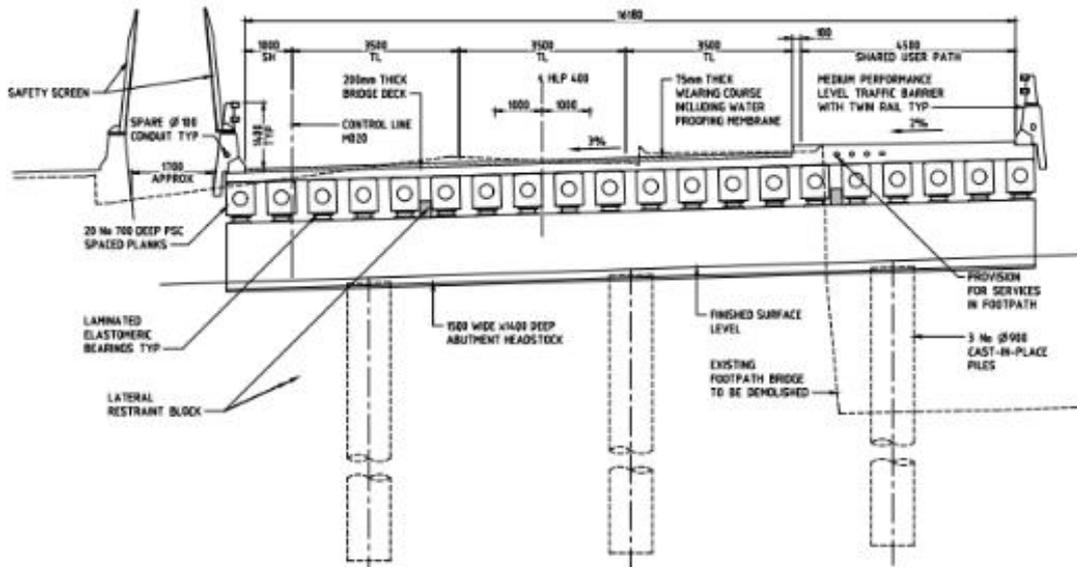


Figure 3-15: Proposed Surveyors Creek bridge

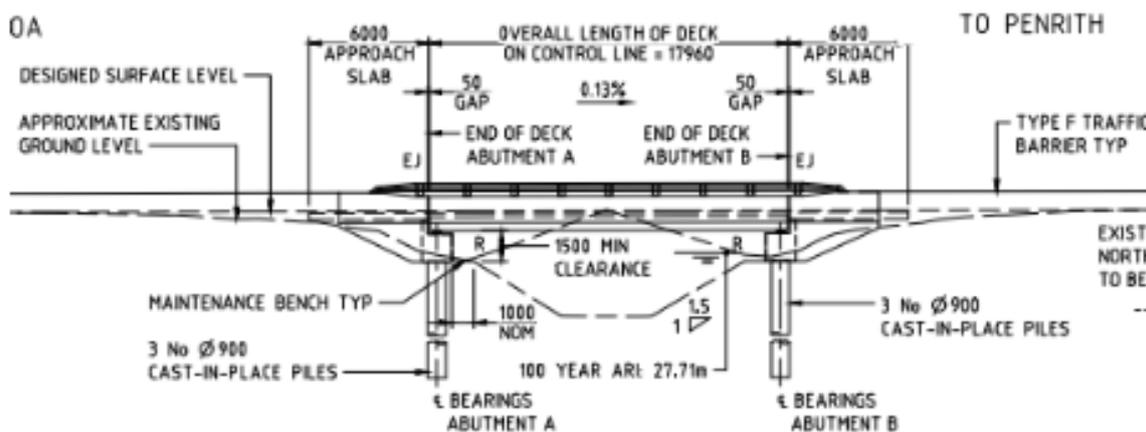


Figure 3-16: Proposed Surveyors Creek bridge elevation view

Road drainage infrastructure

The proposal would include the following road drainage infrastructure:

- Pavement drains which would run along length of the road and are designed to remove water from the road surface as quickly as possible. This would include a system of pits and pipes within the median and kerb of the road.

- Replacement and extension of three existing culverts structures which transfer water under the road.
- Water quality and stormwater treatment measures would include:
 - Water quality basins
 - Grass swales
 - Gross pollutant traps
- Scour protection at culverts and channels to prevent erosion resulting from the flow of water.

The road drainage infrastructure and road alignment would be designed to provide flood immunity for Mulgoa Road during a 1 per cent AEP flood event.

Noise barriers

Noise walls would be provided as part of the proposal to mitigate noise impacts in some areas. However, the design of the noise walls would be confirmed during detailed design including consideration of different noise wall alignment options. The alignment options would be developed considering the need to balance traffic noise reduction, flood risk, visual impacts and other design constraints such as underground utilities.

The noise wall design development would also consider opportunities to incorporate heritage interpretation and urban design features such as clear panels, colour, art and graphics to help with navigation and improve aesthetics. Proposed locations for these barriers are illustrated in Figure 3.17.

Supporting infrastructure

The proposal would include supporting road infrastructure, lighting, signage and street future, which would be confirmed during detailed design. Supporting infrastructure would be likely to include:

- Landscaping in the road verges and medians
- Safety barriers
- Traffic control signals at signalised intersections
- Intelligent transport system infrastructure including traffic monitoring units, closed circuit TV cameras, variable message signs and associated utilities
- Guide, regulatory and warning signs for road users
- Line marking, retroreflective raised pavement markers and coloured pavements for bus priority lanes
- Roadside furniture to support public and active transport
- Street lighting.

3.3 Construction activities

This section summarises the likely method, staging, work hours, plant and equipment and associated activities for construction of the proposal. The proposal would be built under Transport for NSW construction specifications under an approved construction environmental management plan (CEMP).

The actual work methods applied may vary from the description provided in this section due to the identification of additional engineering constraints, ongoing design refinements, feedback from community and stakeholder consultation and contractor requirements and limitations. As such, the final construction activities and their sequencing would be confirmed during detailed design and outlined in the CEMP.

3.3.1 Work methodology

The construction strategy for the proposal has been designed in several stages to allow Mulgoa Road to remain operational during construction and to minimise traffic impacts. It is likely that stage 2 of the upgrade (Glenmore Parkway to Jeanette Street) would be completed separately to stage 5A and 5B of the upgrade (Blaikie Road to Jamison Road and Jamison Road to Union Road). Stage 5A and 5B would likely be constructed together.

The main construction stages would include:

- Early work – during this stage, the utility relocations, preparation and site establishment activities that are required to be completed before the start of the main construction activities would be carried out
- Main construction work for stage 2 (Glenmore Parkway to Jeanette Street) would comprise:
 - Stage A – during this stage, Mulgoa Road would remain in its existing arrangement and the proposed southbound carriageway would be constructed offline behind safety barriers.
 - Stage B – during this stage, Mulgoa Road would operate in a temporary contraflow arrangement using the new southbound carriageway (constructed in stage A), and the new proposed northbound carriageway would be constructed.
 - Stage C – during this stage, Mulgoa Road would be configured to one lane in each direction using the new northbound and southbound carriageways to allow incomplete sections of the proposal to be finished.
- Main construction work for stage 5A and 5B (Blaikie Road to Jamison Road and Jamison Road to Union Road):
 - Stage A – during this stage, Mulgoa Road would remain in its existing arrangement and temporary barriers and deflection zones would be set up.
 - Stage B – during this stage, Mulgoa Road would operate in a temporary contraflow arrangement using the southbound carriageway, and the new northbound carriageway would be constructed.
 - Stage C – during this stage, traffic would be shifted onto the new pavement constructed during stage A and B, and the future southbound carriageway would be constructed.
 - Stage D – during this stage, Mulgoa Road would be configured onto the pavements on either side in each direction to allow work on medians to be completed.

Table 3-4 summarises the likely construction activities that would be carried out during the early work stage. Table 3-5 summarises the likely construction activities that would be carried out during the main construction stages.

Table 3-4 Indicative construction activities for the proposal – early work

Activity	Associated work
Site establishment and environmental protection	<ul style="list-style-type: none"> • Install temporary erosion and sediment controls • Clear and grub vegetation for utilities, fencing and access tracks and site compounds • Install temporary fencing around site boundaries and mark any no-go areas • Install traffic management controls including any road closures and diversions

Activity	Associated work
	<ul style="list-style-type: none"> Establish site compounds and stockpile areas Install noise mitigation measures and safeguards Establish waste management areas including for disposal and stockpiling of potentially contaminated materials
Early utility adjustments (including water, electricity, optical fibre and gas main infrastructure)	<ul style="list-style-type: none"> Protect utilities that would remain in place Adjust and relocate existing utilities through a combination of trench excavation, underboring, pipeline and conduit installation Tie-in new utilities to existing utilities Commission and test new utilities Backfill and restore ground surfaces, as required
Other early work	<ul style="list-style-type: none"> Construct noise barriers Install permanent property boundary fencing Establish temporary pavement and access tracks Complete minor property adjustment works
Rehabilitation and demobilisation	<ul style="list-style-type: none"> Partially demobilise and remove temporary construction facilities Remove environmental, safety and traffic controls Clean up the site and dispose of waste materials.

Table 3-5 Indicative construction activities for the proposal - main construction work

Activity	Associated work
Site establishment and environmental protection]	<ul style="list-style-type: none"> Install temporary erosion and sediment controls Install temporary fencing around site boundaries and mark any no-go areas Install traffic management controls including any road closures and diversions Establish site compounds and stockpile areas Install temporary water quality control
Remaining utility adjustments	<ul style="list-style-type: none"> Protect utilities that would remain in place Adjust and relocate existing utilities through a combination of trench excavation, underboring, pipeline and conduit installation Tie-in new utilities to existing utilities Commission and test new utilities Backfill and restore ground surfaces, as required
Earthworks	<ul style="list-style-type: none"> Clear and grub vegetation Strip and stockpile topsoil in stages Excavate cuttings Place material to create fill embankments Grade and compact areas Prepare geotechnical foundations Prepare batter treatments Dispose of unsuitable and/or surplus excavated material
Drainage and water quality upgrades	<ul style="list-style-type: none"> Install temporary drainage diversions Install/extend culverts and pavement drains Install scour protection Install permanent water quality measures
Road, pathway and intersection upgrades	<ul style="list-style-type: none"> Mill off top layer of asphaltic concrete in sections of existing road Prepare pavement base and sub-base Lay and compact new pavement layers Apply asphalt concrete road surface seal
Supporting infrastructure and finishing work	<ul style="list-style-type: none"> Install safety barriers Install kerbs, gutters and final median adjustments Install urban design features and landscaping

Activity	Associated work
	<ul style="list-style-type: none"> • Install line marking, signs and guideposts • Paint bus priority lanes and shared path features • Install street lighting • Install traffic signals
Rehabilitation and demobilisation	<ul style="list-style-type: none"> • Rehabilitate disturbed areas • Remobilise and remove temporary construction facilities • Remove temporary environmental, safety and traffic controls • Clean up the site and dispose of waste materials.

3.3.2 Construction workforce

Construction of the proposal is likely to require up to 200 construction workers. The number of construction workers at any one time would vary depending on the stage of construction and the final construction methodology that would be developed during detailed design.

3.3.3 Construction hours and duration

It is anticipated that construction of the proposal would start in 2024 and take about 30 months to complete, subject to approvals, funding and weather. The early work stage of construction would take about nine months to complete. The main construction stage would take about 21 months to complete.

Construction would largely be carried out in accordance with the standard construction working hours defined by the *Interim Construction Noise Guideline (ICNG)* (DECC, 2009). These are:

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

Out of normal hours (night work and weekend work) would be undertaken:

- Monday to Thursday: 8:00am to 5:00am
- Friday (night) to Saturday (morning): 8:00pm to 8:00am
- Sunday (night) 6:00pm to 5:00am
- Public holidays: no regular work except when approved by Transport Management Centre (TMC) and Transport

At the time of writing this REF, the Environmental Planning and Assessment (*COVID-19 Development – Infrastructure Construction Work Days No.2*) Order 2020 is in place under section 10.17 of the EP&A Act to facilitate social distancing by spreading infrastructure construction work over more days in a week. This Ministerial Order came into effect on 8 April 2020 and allows development for public infrastructure projects to be carried out on Saturdays, Sundays and public holidays, providing the proposed work:

- Is limited to the standard working hours for weekdays (i.e. 7.00 am to 6.00 pm)
- Does not involve high noise generating work such as rock breaking, rock hammering, sheet piling, pile driving or similar activities
- Takes all feasible and reasonable measures to minimise noise.

Construction activities that may result in traffic restrictions are likely to be carried out outside of standard construction working hours during night-time periods to minimise disruption to traffic and provide a safer working environment for construction workers. The following work is likely to be carried out as night work, some with short term lane closures:

- Installation of temporary concrete traffic safety barriers to provide separation between road users and construction areas
- New pavement construction (temporary and permanent)
- Deliveries of oversized materials or equipment.

All construction work, including work outside of standard working hours, would be carried out in accordance with:

- The allowable hours defined in the Environmental Protection Licence (EPL) issued by the NSW Environmental Protection Authority (EPA) for the proposal (refer to Section 7.3)
- Road Occupancy Licence (ROL) conditions from the relevant roads authority, if required due to work planned on a public road (refer to Section 7.3)
- The ICNG (DECC, 2009) and Construction Noise and Vibration Guideline (CNVG; Roads and Maritime, 2016) to minimise potential noise impacts, including community notification prior to work outside standard construction working hours.
- The provisions of the Environmental Planning and Assessment (COVID-19 Development – Infrastructure Construction Work Days) Order 2020, if still in force during construction, or another order amending these measures.

3.3.4 Plant and equipment

The plant and equipment needed to build the proposal would be typical of any road construction project and would vary depending on the construction activity being carried out. Table 3-6 indicates the plant and equipment that is likely to be used during construction of the proposal. However, the exact requirements would be finalised by the construction contractor once they are selected.

Table 3-6 Indicative plant and equipment required for construction of the proposal

Activity	Plant and equipment
Site establishment and environmental protection	<ul style="list-style-type: none"> • Site office, site shed and amenities • Light and heavy vehicles • Generator • Handheld tools
Utility adjustments, other early work, earthworks and drainage upgrades	<ul style="list-style-type: none"> • Light and heavy vehicles • Excavator • Concrete truck • Generator • Handheld tools • Trench compaction equipment • Crane
Road, pathway and intersection upgrades	<ul style="list-style-type: none"> • Asphalt profiling machine • Asphalt paver • Vibratory roller • Excavator • Grader • Light and heavy vehicles • Generators

Activity	Plant and equipment
Supporting infrastructure and finishing work	<ul style="list-style-type: none"> • Line marking truck • Hand tools • Light vehicles
Rehabilitation and demobilisation	<ul style="list-style-type: none"> • Light and heavy vehicles • Crane • Hand tools

3.3.5 Earthworks

Earthworks generally involve the creation of elevated areas from placement of fill material or lower areas from removal of material (cuts). The proposal would require earthworks along some sections of Mulgoa Road to widen the road and intersections and adjust the level and slope of the road to improve drainage and flood immunity. Earthworks would also be required to construct the drainage infrastructure and relocate the existing utilities. Table 3-7 shows the quantities of material to be excavated. It is estimated that about 52,000 tonnes of material would be extracted.

Table 3-7 Cut and fill volumes

Stage	Removal of material from site (m ³)	Cut vs fill volumes (m ³)
2	9,621	2,633
5A	10,516	3,310
5B	8,726	5,682
Total	28,863	11,625

Excavated materials would be managed and stored (stockpiled) in accordance with the mitigation measures outlined in this report (refer to Section 7.2). Movement of materials between work sites may be required from cutting to fill locations and embankment areas. As there is expected to be an excess of fill material needed during construction of the proposal, additional suitable material would need to be imported to the site from beyond the proposal area. The final earthwork volumes and locations would be confirmed during detailed design.

The ability to reuse excavated material for fill material would depend on its physical and chemical properties. Some of the excavated material is proposed to be reused on-site for the new road sections, where suitable. Uncontaminated material that is not suitable for use as structural fill material could be used to line the utility trenches or in areas of landscaping.

If soil containing asbestos or other hazardous materials is encountered, the contaminated material may be encapsulated through on-site capping and/or containment in accordance with relevant guidelines and legislation (refer to Section 6.8.4). Material unsuitable for construction use and requiring disposal would need to be transported offsite by a licensed contractor for disposal at a licensed waste management facility, subject to testing and classification in accordance with the *Waste Classification Guidelines* (DECCW, 2014).

3.3.6 Source and quantity of materials

Various standard construction materials that are readily available within NSW would be needed to build the proposal. The indicative resources and materials needed to build the proposal (in addition to the imported fill) would include:

- Natural resources such as aggregates and sand for use in concrete
- Pavement materials including heavily bound sub-base and asphalt concrete
- Manufactured items, including steel and precast components to build the kerbing, stormwater infrastructure, urban design features and other road infrastructure
- Water for dust suppression and concrete
- Relatively small quantities of additional materials such as paint, oils and fuels.

Wherever possible, materials would be sourced from commercial suppliers in nearby areas. Fill material would be imported from a suitably licensed nearby quarry or other viable sources such as nearby infrastructure projects with excess clean excavated material.

3.3.7 Traffic management and access

Temporary traffic arrangements and controls

As discussed in Section 3.3.1, the construction of the proposal would be staged through establishment of alternate traffic arrangements that would facilitate at least one lane of traffic in each direction to allow Mulgoa Road to remain operational throughout construction.

In most cases, the construction staging would create work zones behind safety barriers where construction work can be completed safely and during standard construction working hours to avoid the need for lane closures. Where this is not feasible, construction work would be carried out outside of peak traffic periods using temporary traffic management arrangements, such as night-time and weekend lane closures, and traffic controls to divert or detour vehicles onto the surrounding road network around the worksite for short periods. Section 3.3.3 outlines the construction work that would likely be carried out as night work with short term lane closures.

Access

Local road access would be maintained throughout construction. The construction of the upgraded intersections would be managed through traffic control so that access is always maintained.

The staging strategy was developed with consideration given to allow for continued property access. This would involve the use of sub-staging and the potential of temporary surfaces or realignment of property accesses where feasible, however in areas with more constraints, use of expedited pavement profiles in front of property accesses would be considered.

Emergency services access along Mulgoa Road would be retained throughout construction. The contractor would consult with emergency services before

Pedestrian and cycling facilities would be maintained throughout construction. Facilities may be required to be combined to enable construction to occur on one side of the road, however the aim is to match existing and provide like-for-like provisions during each stage of the contractor's preferred staging strategy. As a construction zone would generally be established on one side of the road at any point in time, it is expected that minimum and only temporary adjustments / facilities may be required throughout construction.

Bus routes through the site would be unchanged. Bus stops would remain at existing locations throughout construction where possible. Temporary bus stops may have to put in place at some locations where the works do not allow for the retention of existing bus stops or the use of new bus stops.

Construction traffic

The proposal would generate light and heavy vehicle movements associated with the delivery or removal of construction materials, equipment, and construction worker movements to and from the proposal area. Table 3-8 summarises the expected construction traffic volumes associated with building the proposal.

Table 3-8: Indicative construction traffic volumes

Vehicle type	Average number of vehicles per day	Maximum number of vehicles per day	Typical movement pattern
Heavy vehicles	100	200	Spaced throughout the day
Light vehicles	100	200	Spaced throughout the day, with a peak at the beginning and end of construction shifts associated with construction worker movements
Oversized vehicles	0	4	Irregular movements as required

Haulage routes

Haulage routes describe the roads that the construction traffic and delivery vehicles would use to enter and leave the proposal area. Transporting material and equipment to and from the construction work zones would typically be via the M4 and the Great Western Motorway. Intra-project haulage and movement of construction personnel would occur between the potential construction compounds located on Glenmore Parkway in stage 2, adjacent the paceway in stage 5B and Carpenters Site in stage 5B. Most of the haulage would occur during standard construction hours and therefore increase vehicle movements along Mulgoa Road and other arterial roads.

The intention is for the reuse of excavated material as much as possible. On site material production can be considered to minimise transportation distance when moving material and minimise impact to road users. The contractor would undertake detailed mass and earthworks planning that considers minimising road user delays.

Parking

The construction contractor would provide enough off-road parking within the ancillary facilities and proposal construction areas to reduce the need for construction workers parking on surrounding local roads.

3.4 Ancillary facilities

Several compound sites would be needed for offices and amenities and to store equipment, machinery and vehicles needed to build the proposal. Four potential compound sites have been identified for the proposal (refer to Figure 3.18 to Figure 3.21).

Compound site 1 would be located in the northern portion of community parklands associated with the Glenmore Loch on 1 Lot 201/DP1027600. The site is bound by Glenmore Parkway to the south and west, parkland to the north and School House Creek to the east. The site would be accessed directly from Glenmore Parkway (refer to Figure 3.18).

Compound site 2 would be located on Lot 111/DP260265. The site is currently used as a construction ancillary facility by Transport for NSW for the upgrade of the adjacent stage 1 upgrade of Mulgoa Road. The site is bounded by residential properties to the east, south and west and Mulgoa Road to the north. The site would be accessed from Mulgoa Road using 'left in, left out' access arrangements (refer to Figure 3.19).

Compound site 3 would be located to the west of the Paceway (Anëldriva Park) on Lot 12/DP1176987. The site is located on cleared land to the north and asphalt car parking areas to the south next to the Hogs Breath Café. The site would provide access to Mulgoa Road via Ransley Street. A temporary signalised traffic light would be installed to facilitate construction traffic movements from compound site 3 onto Ransley Street (refer to Figure 3.20).

Compound site 4 would be located on cleared land on Lot 10/DP717196. The site is currently in use as a construction compound site for the Jane Street and Mulgoa Road upgrade project. The site would be accessed via High Street (Great Western Highway) to the north (refer to Figure 3.21).

The location of compound sites for the proposal have been selected with consideration of the following criteria, where feasible and practicable:

- At least 40 metres away from the nearest waterway
- Of low ecological and heritage conservation significance
- At least 100 metres away from residential dwellings and other land uses that may be sensitive to noise
- On relatively level ground

Compound site facilities may include portable buildings with amenities such as construction worker lunch facilities and toilets, bulk materials storage, secure and bunded storage areas for site materials, including fuel and chemicals, office space, and associated parking. The specific requirements for each site would depend on the stage of construction, the construction activities the site is required to support and any site-specific mitigation measures that would be implemented.

Each compound site would be securely fenced with temporary fencing. Signage would be erected advising the public of access restrictions. Stockpiles would be managed in accordance with the *QA Specification R44 – Earthworks* (RMS, 2011).

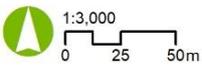
Upon completion of construction, the temporary compound sites, work areas, stockpiles, rubbish and materials would be removed from the proposal area. The compound sites would then be rehabilitated in consultation with the relevant property owner.

The contractor would finalise the layout and requirements of the compound sites as well as any other stockpile sites, laydown areas or ancillary facilities identified to be required during detailed design. Any additional or revised ancillary facilities proposed by the contractor would be discussed with Transport for NSW's Environment Manager to determine if any additional environmental assessment is required.



- REF proposal area
- Compound site

Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri



Projection: GDA 1994 MGA Zone 56

Mulgoa Road **Review of Environmental Factors**

Ancillary facilities - Compound Site 1

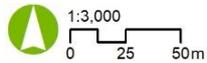
Figure 3-18: Ancillary facilities – compound site 1



P:\GIS\Project-4\project\509813_Mulgoa_Road\MR_REF_Ancillary_facilities_compound_site_2.mxd\JOB No.130-08-21\Virgil.Robinson\Rev 0

- REF proposal area
- Compound site

Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri

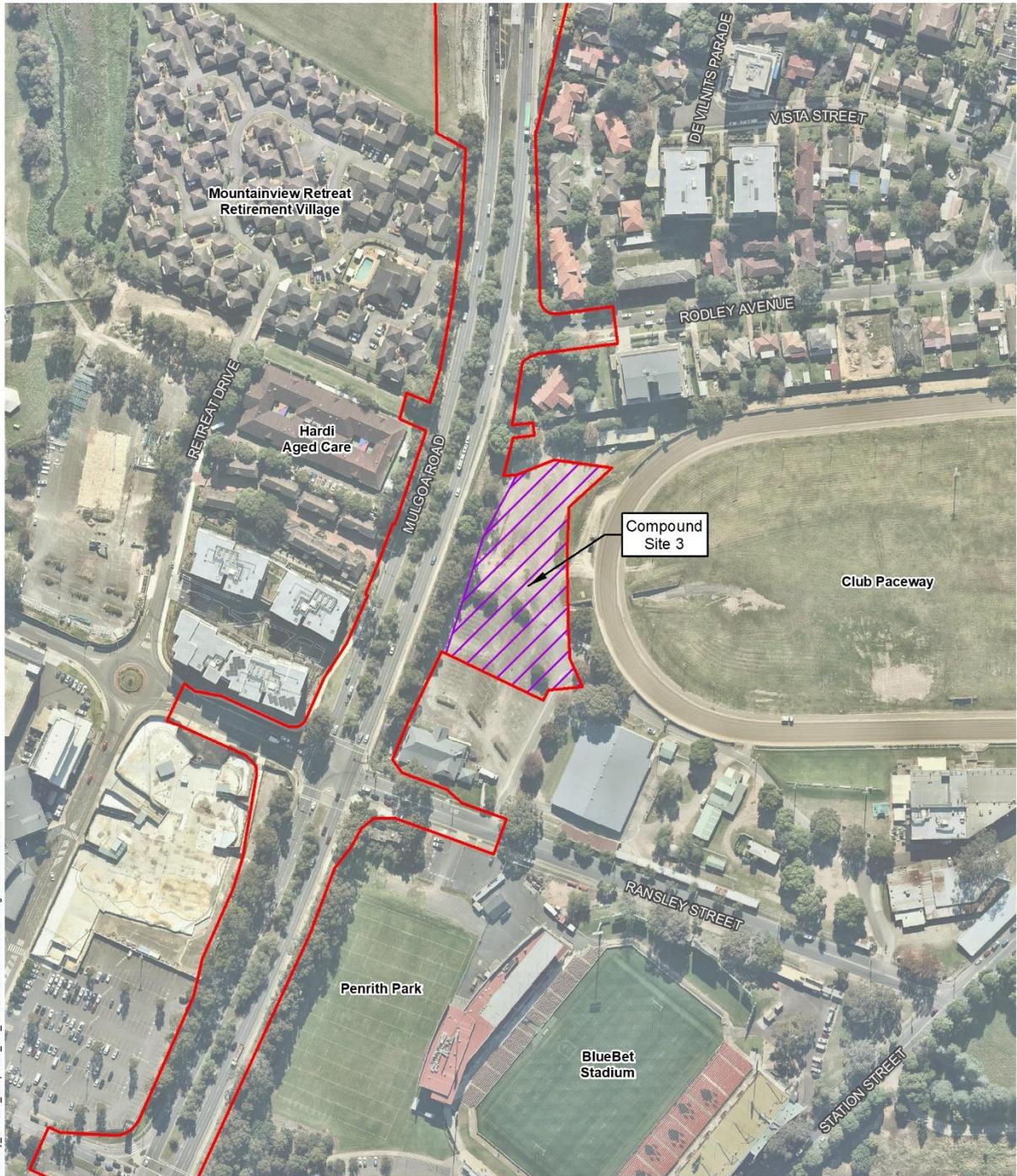


Projection: GDA 1994 MGA Zone 56

Mulgoa Road **Review of Environmental Factors**

Ancillary facilities - Compound Site 2

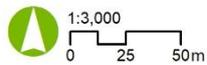
Figure 3-19: Ancillary facilities – compound site 2



- REF proposal area
- Compound site

P:\GIS\Project-4\project\509813_Mulgoa_Road\MR_REF_Ancillary_facilities_compound_site_3.mxd\JOB No 130-08-21\Virgil Robinson\Rev 0

Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri



Projection: GDA 1994 MGA Zone 56

Mulgoa Road **Review of Environmental Factors**

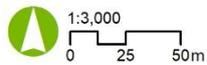
Ancillary facilities - Compound Site 3

Figure 3-20: Ancillary facilities – compound site 3



- REF proposal area
- Compound site

Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri



Projection: GDA 1994 MGA Zone 56

Mulgoa Road **Review of Environmental Factors**

Ancillary facilities - Compound Site 4

Figure 3-21: Ancillary facilities – compound site 4

3.5 Public utility adjustment

Several major utilities have been identified within the proposal area that would require adjustment and/or relocation during construction. The relevant utility providers have been consulted and would continue to be consulted during detailed design and construction regarding the proposed relocation and/or protection of utilities within the proposal area. The major utility adjustments required are described in this section.

3.5.1 Electricity supply

The proposal would require relocation of existing overhead and underground powerlines owned by Endeavour Energy along Glenmore Parkway and Mulgoa Road. The proposal would also require relocation of existing streetlights, two existing substations located on Mulgoa Road located in stage 5A and one in stage 5B.

3.5.2 Gas

In stage 2, the existing gas main would need to be relocated into the new verge between Glenmore Parkway and Jeanette Street. In stage 5A and 5B existing gas mains would require relocation behind the new verge on Mulgoa Road.

3.5.3 Telecommunications

The proposal would require relocation of existing Telstra conduits. These would be located on the eastern side of Mulgoa Road in stage 2 from southern tie-in in the south to Jeanette Street. Relocating ducts on the northern verge of Glenmore Parkway to the eastern tie in would also be required. In stage 5A and 5B, ducts would need to be relocated on the western side of Mulgoa Road. Stage 5B would also require relocation of Telstra ducts at the intersection of Panthers Place and Mulgoa Road. These also carry optic fibre cables owned by other telecommunication providers including NBN and Optus. The strategy for relocation of the Telstra conduits and associated optic fibre cables would be confirmed during detailed design through further consultation and coordination with the utility providers.

Traffic Control Signals (TCS) would need to be upgraded for existing intersections and new infrastructure provided for all new intersections.

3.5.4 Water and sewer

The proposal would require relocation of several existing water mains owned by Sydney Water. These include the following:

- Stage 2: DN100 and DN150 on the western side of Mulgoa Road
- Stage 5A: DN150 on the western side of Mulgoa Road and DN300 on the eastern side
- Stage 5B: DN100, including two existing fire booster assemblies that service Penrith Panthers.

Generally, the existing main sewer main would be maintained in their current locations with some protection and manhole level adjustment in isolated locations. Ongoing maintenance requirements for water and sewer assets would be considered during detailed design in consultation with Sydney Water.

3.6 Property acquisition

Transport would need to acquire land as well as temporarily lease or negotiate access for additional land during construction of the proposal. Table 3-9, Table 3-10 and Figure 3.22 to Figure 3.24 outline the proposed property acquisition for the proposal. Partial and permanent acquisitions of land would be required from a total of 58 properties. 35 of these are partial acquisitions and 23 are full acquisitions. 18 temporary acquisitions are also proposed. These acquisition numbers relate to each lot and DP, however some properties cross multiple lots and therefore it does not reflect the number of owners impacted. The final land purchase and leasing requirements would be confirmed during detailed design. All property acquisition would be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*.

Table 3-9: Proposed property acquisition for partial acquisitions

Description	Total area to be acquired (m ²)	Acquisition type	Current owner	Lot and DP	Land use zone (LEP)
Private residence	620	Partial	Private	332/DP869095	E3 Environmental Management
Private residence	508	Partial	Private	62/DP845288	E4 Environmental Living
Private residence	518	Partial	Private	63/DP845288	E4 Environmental Living
Private residence	557	Partial	Private	64/DP845288	E4 Environmental Living
Private residence	882	Partial	Private	17/DP1066390	E4 Environmental Living
Private residence	884	Partial	Private	18/DP1066390	E4 Environmental Living
Private residence	647	Partial	Private	11/DP1040374	E4 Environmental Living
Commercial property	664	Partial	Sydney Water Corporation	1/DP839433	SP2 Infrastructure
Recreational park	2327	Partial	Penrith City Council	201/DP1027600	RE1 Public Recreation
Recreational park	6992	Partial	The Council of The City of Penrith	111/DP260265	RE1 Public Recreation
Private residence	168	Partial	Private	109/DP260265	R2 Low Density Residential
Recreational park	1215	Partial	The Council of The City of Penrith	101/DP1058901	RE1 Public Recreation
Commercial property	905	Partial	Private	100/DP1058901	B5 Business Development
Commercial property	660	Partial	Private	1/DP1243160	B5 Business Development
Commercial property	413	Partial	Private	1/DP778772	B5 Business Development

Description	Total area to be acquired (m ²)	Acquisition type	Current owner	Lot and DP	Land use zone (LEP)
Commercial property	198	Partial	Private	1/DP785186	B5 Business Development
Commercial property	588	Partial	Private	100/DP1230336	B5 Business Development
Commercial property	142	Partial	Private	200/DP1230338	B5 Business Development
Commercial property	77	Partial	Private	3/24/DP1965	B5 Business Development
Commercial property	79	Partial	Private	2/24/DP1965	B5 Business Development
Commercial property	103	Partial	Private	1/24/DP1965	B5 Business Development
Private residence	87	Partial	Private	/SP85382	R4 High Density Residential
Recreational park	586	Partial	The Council of the City of Penrith	23/DP711070	RE1 Public Recreation
Private residence	10	Partial	Private	21/A/DP1687	R3 Medium Density Residential
Private residence	26	Partial	Private	20/DP654021	R3 Medium Density Residential
Private residence	38	Partial	Private	19/DP654020	R3 Medium Density Residential
Private residence	96	Partial	Private	/SP48875	R3 Medium Density Residential
Private residence	58	Partial	Private	16/DP658131	R3 Medium Density Residential
Commercial property	2562	Partial	Private	2/DP1241942	SP3 Tourist
Recreational park	253	Partial	Water Board	1/DP773983	RE1 Public Recreation
Culvert	3252	Partial	Private	12/DP1176987	RE2 Private Recreation
Commercial property	190	Partial	Private	1/DP878675	SP3 Tourist
Private residence	48	Partial	Private	/SP47433	R4 High Density Residential
Private residence	711	Partial	Private	/SP34212	R4 High Density Residential
Council	9117	Partial	The Council of the city of Penrith	10/DP717196	SP2 Infrastructure

Table 3-10: Proposed full property acquisition

Description	Total area to be acquired (m ²)	Acquisition type	Current Owner	Lot and DP	Land use zone (LEP)
Private residence	928	Full	Private	22/DP1051616	R2 Low Density Residential
Private residence	744	Full	Private	23/DP1051616	R2 Low Density Residential
Private residence	769	Full	Private	24/DP1051616	R2 Low Density Residential
Private residence	1049	Full	Private	25/DP1051616	R2 Low Density Residential
Private residence	793	Full	Private	1/DP260503	R2 Low Density Residential
Private residence	628	Full	Private	40/DP260503	R2 Low Density Residential
Private residence	651	Full	Private	41/DP260503	R2 Low Density Residential
Private residence	520	Full	Private	15/DP658130	R3 Medium Density Residential
Private residence	521	Full	Private	14/DP658129	R3 Medium Density Residential
Private residence	521	Full	Private	13/DP658128	R3 Medium Density Residential
Private residence	522	Full	Private	12/DP658127	R3 Medium Density Residential
Private residence	523	Full	Private	11/A/DP1687	R3 Medium Density Residential
Private residence	523	Full	Private	1/DP247856	R3 Medium Density Residential
Private residence	521	Full	Private	90/DP837526	R3 Medium Density Residential
Private residence	515	Full	Private	8/A/DP1687	R3 Medium Density Residential
Private residence	508	Full	Private	1/DP772554	R3 Medium Density Residential

Description	Total area to be acquired (m ²)	Acquisition type	Current Owner	Lot and DP	Land use zone (LEP)
Private residence	497	Full	Private	6/A/DP1687	R3 Medium Density Residential
Private residence	477	Full	Private	4/DP129473	R3 Medium Density Residential
Private residence	457	Full	Private	1/DP247854	R3 Medium Density Residential
Private residence	433	Full	Private	3/A/DP1687	R3 Medium Density Residential
Private residence	399	Full	Private	2/DP129473	R3 Medium Density Residential
Private residence	558	Full	Private	1/DP129473	R3 Medium Density Residential
Recreational Park	941	Full	The Council of the City of Penrith	37/DP731213	RE1 Public Recreation

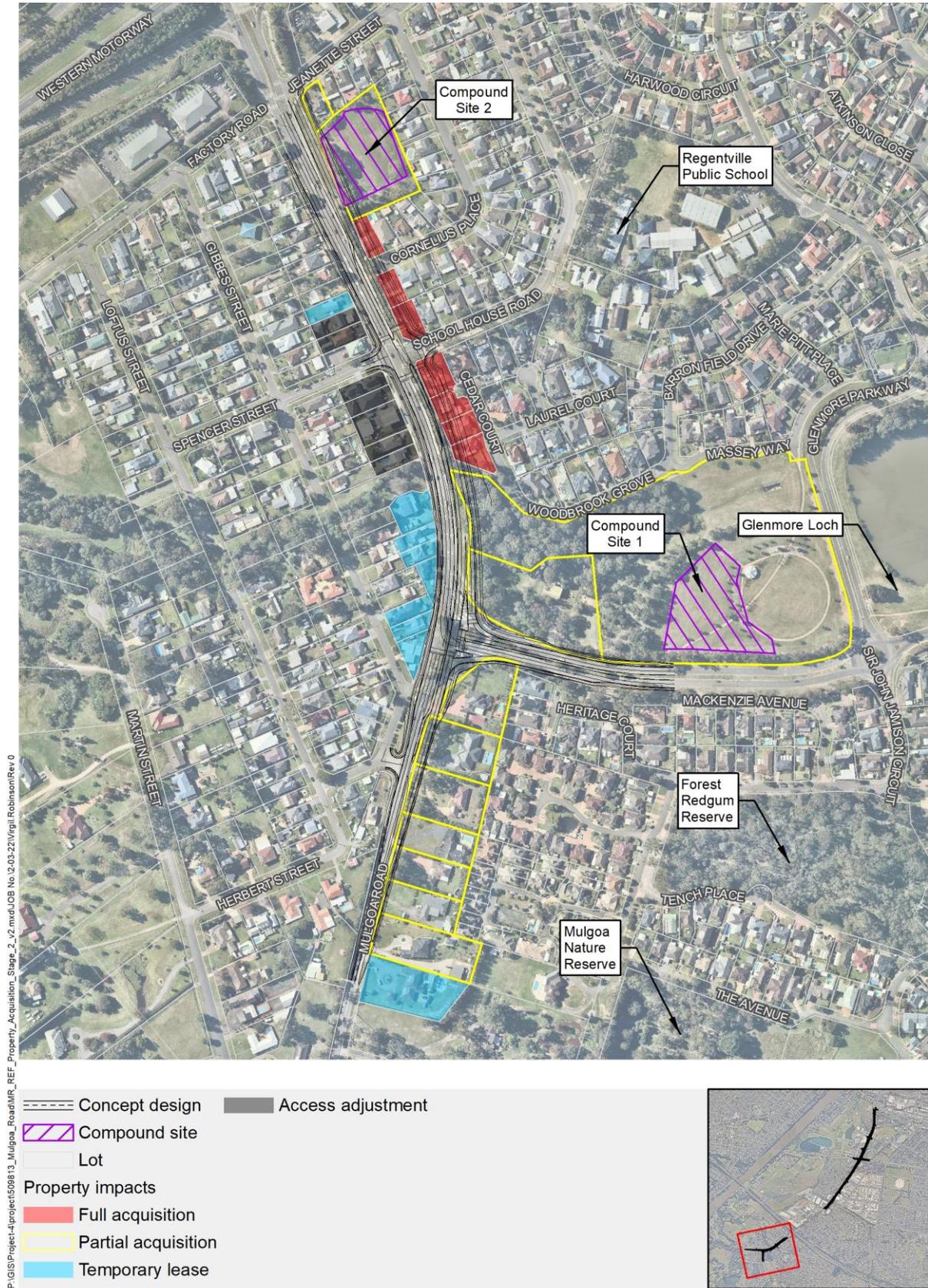


Figure 3-22: Proposed property acquisition Stage 2



P:\GIS\Project-1\project\50813_Mulgoa_Road\MR_REF_Property_Acquisition_Stage_5A_v2.mxd JOB No. 02-03-22\Virgil Robinson\Rev 0

- Concept design
- Lot
- Property impacts
- Full acquisition
- Partial acquisition
- Temporary acquisition
- Access adjustment

Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri



Projection: GDA 1994 MGA Zone 56



Mulgoa Road **Review of Environmental Factors**

Proposed property acquisition - Stage 5A

Figure 3-23: Proposed property acquisition – Stage 5A



Figure 3-24: Proposed property acquisition – Stage 5B

4 Statutory planning framework

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

4.1 Environmental Planning and Assessment Act 1979

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Infrastructure) 2007

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

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

As the proposal is for a road and is to be carried out by Transport for NSW it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979*. Development consent from council is not required.

The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974* and does not require development consent or approval under State Environmental Planning Policy (Coastal Management) 2018, State Environmental Planning Policy (State and Regional Development) 2011 or State Environmental Planning Policy (State Significant Precincts) 2005.

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

Sydney Regional Environmental Plan No 20 – Hawkesbury-Nepean River (No 2 – 1997)

The *Sydney Regional Environmental Plan No 20 – Hawkesbury-Nepean River (No 2 – 1997)* (SREP 20) serves to protect the environment of the Hawkesbury-Nepean River system by ensuring the impacts of the future land uses are considered in a regional context. This plan uses a combined approach to achieve this aim through the application of general planning considerations, specific planning policies and recommended strategies, as well as the imposition of specific development controls.

The proposal is around 500 metres outside of land mapped under SREP 20. However, it does have potential to indirectly impact the river system as Peach Tree Creek intersects the proposal area and flows into the Nepean River. Therefore, this plan has been considered in this REF for its relevance in the regional context.

State Environmental Planning Policy (Western Sydney Aerotropolis) 2020

State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 commenced on 1 October 2020 and provides development controls for the Western Sydney Aerotropolis. The land application map for this SEPP shows that it does not cover the proposal area and as such, the development controls outlined in this SEPP are not applicable to the proposal.

However, application of this SEPP would contribute to future economic growth and development in the area to the south of the proposal. The likely growth in traffic volumes, would potentially be contributed to as a result of the development of the Western Sydney Aerotropolis. This growth has been considered and supports the need for the proposal (refer to Section 6.13.3).

State Environmental Planning Policy (Western Sydney Employment Area) 2009

The State Environmental Planning Policy (Western Sydney Employment Area) 2009 (WSEA SEPP) aims to protect and enhance the land within the Western Sydney Employment Area for employment purposes. This SEPP establishes planning and development standards for the Western Sydney Employment Area, which would be controlled in accordance with a master plan and development control plans for the area.

Referring to the WSEA SEPP Land Application Map, the proposal is located over nine kilometres from land to which this policy applies to. While the WSEA SEPP does not directly relate to the proposal, the SEPP supports the project objectives by promoting economic development, creating employment and environmental conservation in the region.

4.1.2 Local Environmental Plan

Penrith Local Environmental Plan 2010

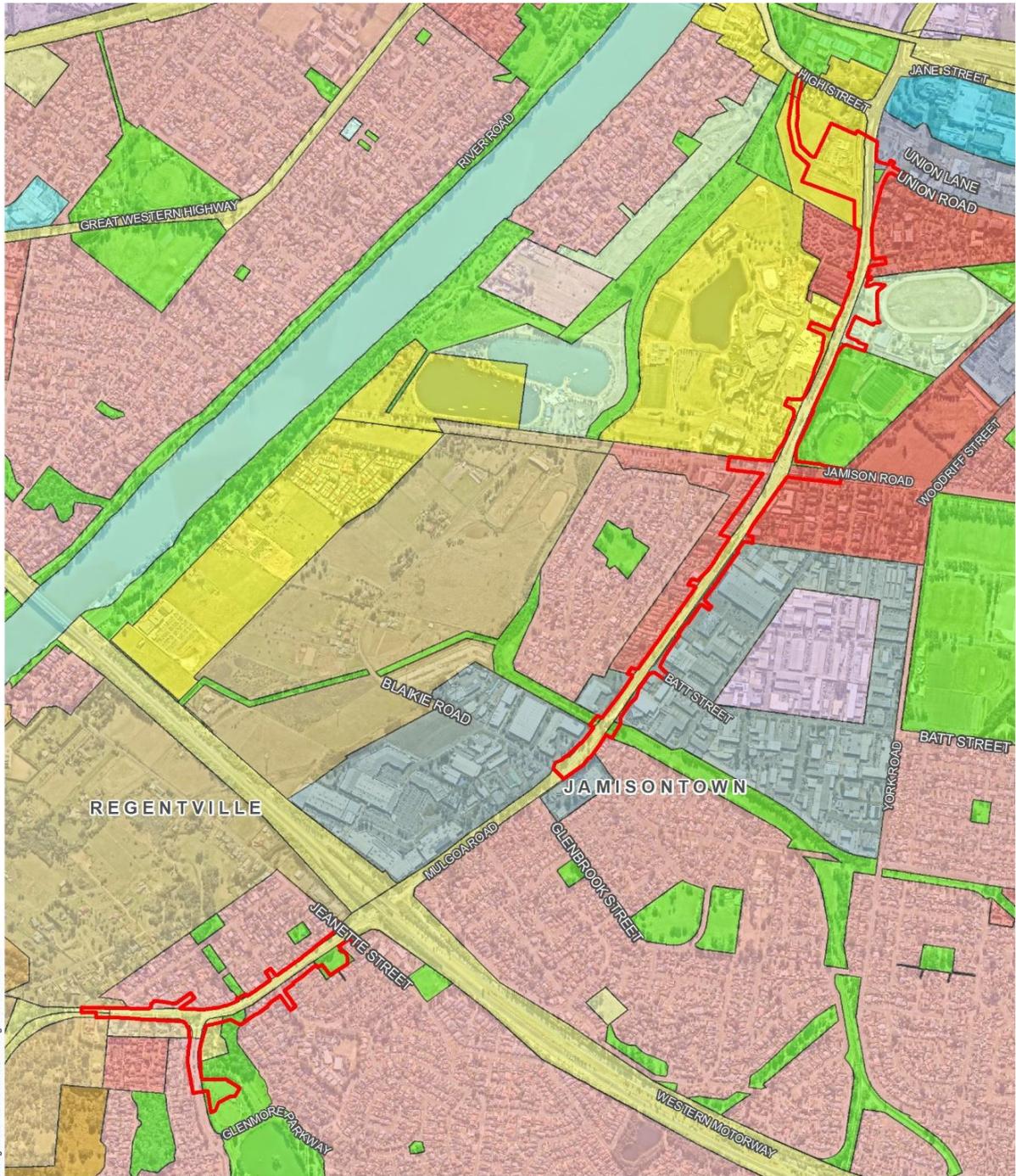
The proposal is within the Penrith City Council LGA to which the *Penrith Local Environmental Plan (LEP) 2010* applies. Table 4-1 outlines the consistency of the proposal with the objectives of these zoning regulations. Figure 4.1 illustrates the relevant zones.

Table 4-1: Consistency of this REF with the Penrith LEP land zones

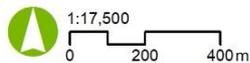
Zone	Objectives of zone	Consistency of proposal with objectives
R2: Low Density Residential	<p>To provide for the housing needs of the community within a low density residential environment.</p> <p>To enable other land uses that provide facilities or services to meet the day to day needs of residents.</p> <p>To promote the desired future character by ensuring that development reflects features or qualities of traditional detached dwelling houses that are surrounded by private gardens.</p> <p>To enhance the essential character and identity of established residential areas.</p> <p>To ensure a high level of residential amenity is achieved and maintained.</p>	<p>The proposal would be consistent with the objective of this zone by improving the conditions and accessibility of the road network surrounding the residential area. Residents would have improved access to amenities such as public transport and a more effective shared use road.</p>
R3: Medium Density Residential	<p>To provide for the housing needs of the community within a medium density residential environment.</p> <p>To provide a variety of housing types within a medium density residential environment.</p>	<p>The proposal would be consistent with the objective of this zone by improving the conditions and accessibility of the road network surrounding the residential area. Residents would have improved access to amenities such as public transport and a more effective shared use road.</p>

Zone	Objectives of zone	Consistency of proposal with objectives
	<p>To enable other land uses that provide facilities or services to meet the day to day needs of residents.</p> <p>To provide for a concentration of housing with access to services and facilities.</p> <p>To enhance the essential character and identity of established residential areas.</p> <p>To ensure that a high level of residential amenity is achieved and maintained.</p> <p>To ensure that development reflects the desired future character and dwelling densities of the area.</p>	<p>The higher density of development in this zone would align with the proposal aim to improve road capacity to cater for population and employment growth.</p>
R4: High Density Residential	<p>To provide for the housing needs of the community within a high density residential environment.</p> <p>To provide a variety of housing types within a high density residential environment.</p> <p>To enable other land uses that provide facilities or services to meet the day to day needs of residents.</p> <p>To ensure that a high level of residential amenity is achieved and maintained.</p> <p>To encourage the provision of affordable housing.</p> <p>To ensure that development reflects the desired future character and dwelling densities of the area.</p>	<p>The proposal would be consistent with the objective of this zone by improving the conditions and accessibility of the road network surrounding the residential area. Residents would have better access to amenities such as public transport and a more effective shared use road.</p> <p>The higher density of development in this zone would align with the proposal aim to improve road capacity to cater for population and employment growth.</p>
RE1: Public Recreation	<p>To enable land to be used for public open space or recreational purposes.</p> <p>To provide a range of recreational settings and activities and compatible land uses.</p> <p>To protect and enhance the natural environment for recreational purposes.</p> <p>To ensure that development is secondary and complementary to the use of land as public open space, and enhances public use, and access to, the open space.</p> <p>To provide land for the development of services and facilities by public authorities for the benefit of the community.</p>	<p>The proposal has been designed to minimise impacts on the natural environment and impacts to biodiversity have been assessed in this REF (as detailed in Section 6.1).</p> <p>The reduction in traffic congestion and delays along Mulgoa Road would improve access to surrounding public open spaces. Added footpaths and cycling paths would also increase accessibility to these public spaces and enhance the community's potential use for the space.</p>
RE2: Private Recreation	<p>To enable land to be used for private open space or recreational purposes.</p> <p>To provide a range of recreational settings and activities and compatible land uses.</p>	<p>The proposal has been designed to minimise impacts on the natural environment and impacts to biodiversity have been assessed in</p>

Zone	Objectives of zone	Consistency of proposal with objectives
	To protect and enhance the natural environment for recreational purposes.	this REF (as detailed in Section 6.1). The reduction in traffic congestion and delays along Mulgoa Road would improve access to surrounding private open spaces.
SP2: Infrastructure	To provide for infrastructure and related uses. To prevent development that is not compatible with or that may detract from the provision of infrastructure.	The proposal would be consistent with the objectives of this zone as it is road infrastructure.
SP3: Tourist	To provide for a variety of tourist-oriented development and related uses. To provide for diverse tourist and visitor accommodation and activities that are compatible with the promotion of tourism in Penrith. To create an appropriate scale that maintains important views to and from the Nepean River as well as to the Blue Mountains escarpment, while also improving important connections to the Penrith City Centre and the Nepean River.	The proposal would be consistent with providing for tourist-orientated activities as it aims to allow for ease of access to surrounding points of interests via the road network. As Mulgoa Road connects the surrounding growth areas of Western Sydney, the greater accessibility to surrounding amenities from the road upgrade would increase the potential for more tourist activities in Penrith.
B5: Business Development	To enable a mix of business and warehouse uses, and specialised retail premises that require a large floor area, in locations that are close to, and that support the viability of, centres. To maintain the economic strength of centres in Penrith by limiting the retailing of food, groceries and clothing.	By facilitating the movement of goods and trucks along the major road, local businesses the proposal would help meet the increasing demands of business in the area. This would in turn maintain the economic strength of centres in Penrith and allow for the support of local businesses. Access to local businesses would generally be improved by the proposal.



Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri



Projection: GDA 1994 MGA Zone 56

Mulgoa Road Review of Environmental Factors

Zoning

Figure 4-1: Zoning

4.2 Other relevant NSW legislation

4.2.1 Roads Act 1993

The *Roads Act 1993* (Roads Act) governs the use and development along public roads, including the procedures for the opening and closing of a public road and granting the function of carrying out road work on roads under Transport authority.

Under Section 71 of the Roads Act, Transport may carry out road work on Mulgoa Road as it is the roads authority of this public road. Transport must provide a notice of the road widening to the Minister and the public to identify the plan and allow for public submissions to be made in response to the proposal (Division 2).

4.2.2 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) aims to protect, restore and enhance the quality of the environment in NSW through ecologically sustainable development. It also serves to protect the degradation of the environment through reducing pollution and managing the storage, treatment and disposal of harmful wastes.

Schedule 1, Clause 35 applies to the proposal as a construction of roads, including the widening or rerouting of the existing Mulgoa Road. The proposal is listed as a main road under the Roads Act and aims to upgrade Mulgoa Road to four or more traffic lanes, however the length is less than three kilometres. It is estimated that about 52,000 tonnes of material would be excavated, however this quantity would be confirmed prior to construction. Depending on the final excavation quantity the proposal may meet the requirements of and be considered a scheduled activity under the POEO Act, due to the potential to exceed the excavated material threshold trigger as specified in Schedule 1, Clause 35.

4.2.3 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) provides for the identification, conservation and protection of items of State and local heritage significance. These items can be in relation to a place, work, relic, moveable object or precinct, including those that may not be immediately obvious (such as undiscovered archaeological remains).

Under Section 57(1) of the Heritage Act, approval is required for any development in relation to the land on which the heritage item is situated or may be impacted by. Local heritage items, “The “Workmen’s cottages” (item number 094), listed under the Penrith LEP, are located along Mulgoa Road.

The earthworks and disturbance of land during construction have the potential to discover, move or damage a relic (found or unfound). Under Section 139, these relics are protected from these impacts and an excavation permit is required for these works. In addition, mitigation measures recommended following a heritage assessment would be implemented to prevent harm to any items of heritage significance (further detailed in Section in 6.7).

4.2.4 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides for the conservation of natural landforms, biodiversity and ecosystems. In addition, the NPW Act aims to conserve the cultural value within the landscape, including places, objects and features of Aboriginal people.

An Aboriginal archaeological survey report assesses the potential impacts the proposal may have on known items or sites of Aboriginal heritage (further detailed in Section 6.6).

4.2.5 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) repeals the *Threatened Species Conservation Act 1995* for the maintenance of a healthy and productive natural environment at a state scale. The BC Act aims to conserve biodiversity in the context of the present and future climate with the principles of ecologically sustainable development. It sets out the framework for assessing and offsetting environmental impacts from proposed developments.

To comply with the BC Act, a Biodiversity Assessment Report (BAR) was prepared for the proposal in accordance with the requirements set out in the Biodiversity Assessment Method (BAM) (refer to Section 6.1). The BAM outlines the assessment of biodiversity values by an accredited assessor and provides guidance on how impacts to biodiversity can be avoided and minimised. The BAR also provides detail on any biodiversity offset obligations that may be required by the proposed development. The assessments of significance on biodiversity impacts as a result of the proposal are detailed in Section 6.1. These found that the proposal is unlikely to have a significant impact on threatened species or threatened ecological communities.

4.2.6 Water Management Act 2000

The *Water Management Act 2000* (WM Act) provides for the sustainable management and protection of water sources in NSW.

The WM Act specifies the requirements of access licences to take water within a specified water management area or water source under specific conditions. In addition, water use approvals are required for the use of water for a particular purpose at a particular location. This includes a water supply work approval which authorises its holder to construct and use a specified water supply work such as a channel. Any work that diverts floodwaters would require a flood work approval. Finally, to carry out work in a watercourse or within 40 metres of the bank of a river, lake or estuary, a controlled activity approval is required.

The proposal is within 40 metres of and involves the construction of a new bridge structure over Surveyors Creek. In addition, the proposal is also located within 40 metres of School House Creek. However, under Subdivision 4 Clause 41 of the *Water Management (General) Regulation 2018*, Transport is exempt from the requirements of a controlled activity approval as it is a public authority. The proposal is not expected to involve any water taking activities, require the use of natural sources or involve work that would divert floodwaters.

As the construction of the proposal would not require deep excavations, groundwater aquifers are not likely to be impacted or require dewatering.

As such, no further water access licences or approvals are required for the proposal under the WM Act.

4.2.7 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) aims to conserve, develop and share fishery resources for NSW. It provides for the conservation of threatened species, populations and ecological communities of fish and marine vegetation, as well as key fish habitats.

Part 7 of the FM Act specifies that a permit may be required for works that involve the dredging or reclamation of land of which the FM Act protects.

School House Creek is classified as a key fish habitat and is located towards the south-western end of the proposal, within stage 2. However, as the proposal is not expected to have a direct impact to this creek, no permits under the FM Act are required to be obtained for the proposal.

4.2.8 Biosecurity Act 2015

The *Biosecurity Act 2015* provides a framework for the prevention, elimination and minimisation of biosecurity risks such as pests, diseases and contaminants. Transport has a biosecurity duty to manage the risk posed by weeds within land that they occupy.

A total of 33 weed species were recorded within the proposal area. Measures to manage and reduce the risk of these weeds spreading during construction and operation, in accordance with this Act, are discussed in Section 6.1.

4.2.9 Waste Avoidance and Resource Recovery Act 2001

The *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) aims to reduce environmental harm through implementing resource management options to encourage the most efficient use of resources. The options are ranked in a hierarchy, where the most preferred option is to avoid unnecessary resource consumption before resource recovery and then finally disposal.

Waste generated during the construction and operation of the proposal would be managed in accordance with the WARR Act and the resource management options hierarchy. This includes any required classification, treatment and disposal of any waste that poses environmental or human risk.

4.2.10 Crown Land Management Act 2016 and Crown Land Legislation Amendment Act 2017

The *Crown Land Management Act 2016* and *Crown Land Legislation Amendment Act 2017* set out the requirements for ownership, use and management of Crown Land. They describe the permissions and authorisation needed when planning the development of activities on Crown Land. They also include provisions relating to specific controls and restrictions on the development of Crown Land for Division 5.1 activities. The *Crown Land Management Act 2016* also describes the process for the acquisition of Crown Land.

The proposal area includes small sections of land mapped as Crown Land alongside Mulgoa Road in between Jamison Road and Ransley Street. Transport would need to secure the required lease and/or land acquisition in accordance with these Acts before starting work on Crown Land and for ongoing ownership of the road corridor during operation.

4.2.11 Local Government Act 1993

The *Local Government Act 1993* outlines the legal framework, responsibilities and powers of local government within NSW. The proposal is located within the Penrith City LGA. The *Local Government Act 1993* establishes two classifications for council owned and managed land: operational land and community land. The proposal area includes areas classified as community land, with some grassed areas east of Mulgoa Road that would be impacted by the proposed noise wall, batters, culverts and swales. Division 2 of the Act outlines several procedures and restrictions regarding the use and management of community land. Transport will continue to consult with Penrith City Council regarding council owned land and assets (including the areas classified as community land). The design for the proposal will also be refined during detailed design to minimise impacts on community land, where possible.

4.2.12 Native Title Act 1993

The *Native Title Act 1993* recognises and protects native title. The Act covers actions affecting native title and the processes for determining whether native title exists and compensation for actions affecting native title. It establishes the Native Title Registrar, the National Native Title Tribunal, the Register of Native Title Claims and the Register of Indigenous Land Use Agreements, and the National Native Title Register. Under the Act, a future act includes proposed public infrastructure on land or waters that affects native title rights or interest.

A search of the Native Title Tribunal Native Title Vision website was carried out on 24 August 2021, with no Native Title holders/claimants identified.

4.2.13 Land Acquisition (Just Terms Compensation) Act 1991

The Land Acquisition (Just Terms Compensation) Act 1991 was developed to ensure just terms for owners of land that is acquired by an authority of the State when land is not available for public sale. The Act promotes the requirement for compensation to be no less than the market value of the land at the date of acquisition.

Some property acquisition from government agencies, the Crown and private landholders would be required for the proposal. This would be required to accommodate the permanent aspects of the proposal including the widened road and associated infrastructure. All land acquisitions would be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*. Property acquisition requirements for the proposal are discussed in Section 3.6.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) a referral is required to the Australian Government for proposed actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land. These are considered in Appendix C and Section 6.1 of the REF.

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

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

Findings – matters of national environmental significance

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

Findings – nationally listed biodiversity matters (where the strategic assessment applies)

The assessment of the proposal's impact on nationally listed threatened species, endangered ecological communities and migratory species found that there is unlikely to be a significant impact on relevant matters of national environmental significance. Section 7 of the REF describes the safeguards and management measures to be applied.

4.4 Confirmation of statutory position

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

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

- Carried out consultation with Penrith City Council and the SES in accordance with ISEPP (refer to Section 5) due to the proposal being located on flood liable land and requiring development of council roads
- Identified the requirement to obtain various licences and approvals in accordance with NSW legislation prior to construction as summarised in Section 7.3.

5 Consultation

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

5.1 Consultation strategy

Transport for NSW has prepared a Community and Stakeholder Engagement Plan (CSEP) to guide communications and consultation activities for the proposal. The consultation approach for the proposal aims to:

- Provide regular and targeted information to build awareness about the Mulgoa Road / Castlereagh Road corridor upgrade and the likely impacts and benefits of the project
- Ensure community and stakeholder feedback is continuously fed into the proposal's development and used to understand and effectively assess impacts
- Provide clear direction to the community and stakeholders about whether we are providing information or seeking feedback so that expectations are clear at all stages of engagement
- Ensure community and stakeholder views are continuously fed into the project's development and used to understand and effectively assess impacts
- Collaborate with government agencies and local councils to ensure a whole-of government approach and consistent key messages
- Provide clear guidance to the community and stakeholders about when we are seeking feedback and on exactly what aspects we are taking comments on.

5.2 Community involvement

5.2.1 Overview of community engagement activities

Table 5-1: Community engagement activities carried out for the proposal

Activity	Summary
Project website	The proposal Mulgoa Road upgrade website (https://roads-waterways.transport.nsw.gov.au/projects/mulgoa-rd-castlereagh-rd/index.html) provides the latest information.
Community updates	Three community updates have been released via the project website and letter box drop. These updates are for the wider Mulgoa Road upgrade project and are summarised in Table 5-2.
Media release	A media release on the progress on planning work for Mulgoa Road upgrade was published on 21 September 2020.
Notifications	Notifications for investigation work was sent to the community in October and December 2020, and March and September 2021.
Door knock	Doorknocking has taken place from 2017 to 2021 for property and noise impacts, noise logger installation and investigation work.
Letter to property owners	Letters have been sent out to property owners from 2017 to 2021 to discuss property impacts and investigation work.

Activity	Summary
One on one meetings with property owners	One on one meetings have been held with property owners that may be directly affected by the proposal at their request between 2016 and 2021.
Toll free community enquiry number	A dedicated toll-free 1800 telephone number (1800 733 084) has been created to receive and respond to enquiries from the community and interested stakeholders on the proposal.
Project email address	A dedicated email address (mulgoaroadupgrade@transport.nsw.gov.au) has been created to receive and respond to enquiries from the community and interested stakeholders.
Community consultation	Three community information sessions took place in September 2018 for the REF display of Mulgoa Road upgrade, Jamisontown. A preferred option for upgrading Glenmore Parkway, Penrith and Andrew Road, Penrith was displayed for community comment in 2017.

5.2.2 Issues raised by the community

Table 5-2 summarises the community engagement activities carried out to date for the proposal. It is noted that the consultation approach for the proposal to date has largely avoided face-to-face consultation due to the COVID-19 restrictions and social distancing requirements.

Table 5-2: Summary of issues raised by the community

Activity	Summary	Issues raised
Community update – March 2020	<p>Community update informing the community of the plan to widen and upgrade the Mulgoa Road / Castlereagh Road corridor in Penrith. This community update was issued for another section of the Mulgoa Road Upgrade that is adjacent to the proposal. This update included:</p> <ul style="list-style-type: none"> • Jeanette St to Blaikie Road has received planning approval • A collated submissions report summarises the recommended option and respond to the feedback from 2018 round of consultation is being prepared. • Construction is ongoing on Union Road at Museum Drive • The rail bridge over Castlereagh Road has been completed. <p>The update also identified proposed staging for the upgrade.</p>	Any impacts to the Greygum trees identified as an issue of concern for some members of the community
Community update – October 2020	Day and night investigation work notifications, for work on Mulgoa Road between Glenmore Parkway to Jeanette Street and Blaikie Road to Union Road (October 2020). This community update was issued for another section of the Mulgoa Road Upgrade that is adjacent to the proposal.	Potential noise and vibration impacts to residential receivers during construction.

Activity	Summary	Issues raised
	The notification identifies work schedules, potential impacts, traffic changes and contact details of Transport representatives.	
Community Update – December 2020	Day and night investigation work notifications, for work on Mulgoa Road between Glenmore Parkway and Union Road (January 2021). This community update was issued for another section of the Mulgoa Road Upgrade that is adjacent to the proposal. The notification identifies work schedules, potential impacts, traffic changes and contact details of Transport representatives.	Potential noise and vibration impacts to residential receivers.
Business survey – while REF is on display	A business survey will be carried out to understand the context of the businesses near the proposal. The survey will provide insight into the requirements of businesses closest to and in the vicinity of the proposal to determine what the potential impacts would be during construction and operation.	Issues raised in this survey will be addressed in the submissions report for this proposal.

5.3 Aboriginal community involvement

The potential Aboriginal heritage impacts of the proposal have been considered in accordance with the requirements of Transport for NSW's *Procedure for Cultural Heritage Consultation and Investigation* (PACHCI) (Roads and Maritime 2011). Table 5-3 summarises the stages outlined in the PACHCI.

Table 5-3: Summary of Transport for NSW Procedure for Aboriginal Cultural Heritage Consultation and Investigation

Stage	Description
Stage 1	Initial Transport for NSW assessment
Stage 2	Site survey and further assessment
Stage 3	Formal consultation and preparation of a cultural heritage assessment report
Stage 4	Implement environmental impact assessment recommendations

Stage 1 and 2 of the PACHI have been completed for the proposal. Consultation to identify interested key Aboriginal stakeholders was undertaken, identifying the Deerubbin Local Aboriginal Land Council (LALC), who were invited by to participate in the field survey, in accordance with stage 2 of the PACHCI. Deerubbin LALC Senior Aboriginal Cultural Heritage Officer Steven Randall participated in archaeological survey of the study area on 17 February 2021.

Information provided by the fieldwork participants during the field survey has been integrated into the assessment, where appropriate, and letter from the Deerubbin LALC outlining the results of the survey (refer to Appendix I). The results of the survey and the proposed recommendations were discussed in the field, and no objections were raised.

5.4 ISEPP consultation

Clause 94 of the ISEPP provides that “development on behalf of a public authority for the purpose of a road or road infrastructure facilities may be carried out without consent” providing that certain key parties are consulted and/or notified about the work.

Penrith City Council has been consulted due to the proposal requiring excavation of council roads and being located on flood liable land, as per the requirements of clauses 13 and 15A of ISEPP. The State Emergency Service (SES) have also been consulted about the proposal as per the requirements of clause 15AA of ISEPP.

Issues that have been raised as a result of this consultation are outlined below in Table 5-4.

Table 5-4: Issues raised through ISEPP consultation

Agency	Issue raised	Response/where addressed in REF
Penrith City Council	Changes to access and the road network and potential safety issues arising	Section 6.2 describes the traffic and transport impacts including any changes to access and safety.
	Flooding concerns due to widening of the road	Section 6.4 describes the potential flood impacts and outlines the improvement in flood immunity along the road corridor during operation.
	Potential noise and vibration impacts to nearby sensitive receptors, including residential dwellings	Section 6.3 describes the noise and vibration impacts expected during construction and operation.
	The role of Glenmore Park as green corridor and public access	Section 6.10 describes the community use of the area and the values.
	Emergency service access to be maintained at Jeanette Street	Section 6.2 describes the traffic and transport impacts, and addresses how emergency service access would be maintained throughout construction and operation of the proposal.
	Potential impacts to buildings, properties as a result of the design	Section 6.10 describes the socio-economic impacts. Section 3.3 and 3.6 details the access changes and acquisitions.
	Crown land acquisition flagged as a major risk item	Section 6.10 describes the socio-economic impacts. Section 3.5.1 details acquisitions.
	Potential visual amenity impacts resulting from construction for example: vegetation removal, construction of noise walls, and investigations	Section 6.11 describes the potential visual impact during construction and operation.
	Potential biodiversity impacts	Section 6.1 describes the potential biodiversity impacts, and details there is not likely to be a significant impact.
Potential air quality impacts	Section 6.12 describes the air quality impacts, and details there is not likely to be a significant impact.	

Agency	Issue raised	Response/where addressed in REF
	Potential for waterway impacts and request for specific mitigation measures in relation to this	Section 6.5 describes the impacts to surface water and groundwater. This section also provides specific mitigation and management measures.
	Protection of shared use path as an important link through the proposal area, given it's listing within the Penrith Accessible Trails Hierarchy Strategy	Section 6.10 describes the community use and values of the area. This section also provides specific mitigation and management measures.
SES	Emergency vehicle access to the road during construction. Request to be notified if significant delays on the roads are expected.	This chapter describes the ongoing and future consultation for the proposal.

5.5 Biodiversity working group

A biodiversity working group was established for the entire Mulgoa Road Upgrade. This group was created in response to the community concern of the impact to biodiversity in the area. The group includes members from local businesses, with representatives from the following present at four meetings held for stages 2, 5A and 5B:

- Mulgoa Landcare Group
- NSW National Parks and Wildlife Service
- Penrith CBD Corporation
- Penrith Panthers
- Mountview Retirement Village
- Penrith Paceway
- Western Sydney University
- Land Council
- Transport for NSW
- Aurecon
- SMEC

Discussions included opportunities to provide benefits to the local ecology including seed collection, tree hollow collection, relocation of tree sections, replanting of seedlings, opportunities for land to provide biodiversity offsets for the three stages discussed. Feedback from the biodiversity sessions will be considered in the design process.

5.6 Government agency and stakeholder involvement

Various government agencies and stakeholders have been consulted about the proposal, including:

- Penrith City Council
- Utility providers including Sydney Water, Jemena, Telstra, NBN, Optus and Endeavour Energy.

Issues that have been raised as a result of consultation with these agencies and stakeholders are outlined below in Table 5-5.

Table 5-5: Issues raised through stakeholder consultation

Agency	Issue raised	Response/where addressed in REF
Utility providers	The issues raised were related to design options for planned relocation and/or protection of utilities.	Utility providers have been consulted regarding impacts to existing utilities near the proposal. This has included consideration of whether utilities may need to be relocated or protected and any ongoing access requirements.
Penrith City Council	Issue raised by Penrith City Council as part of ISEPP consultation are outlined in Section 5.4.	These outcomes are outlined in Section 5.4.

5.7 Ongoing or future consultation

Transport for NSW would continue to consult the community and relevant stakeholders during the design and construction of the proposal.

5.7.1 Consultation during the public display of the REF

Transport for NSW is committed to continue the engagement of the community and stakeholders throughout the development of the proposal. The REF will be placed on public display and comments invited. Consultation activities during this display period would include:

- Community update distributed to the community and stakeholders inviting feedback on the REF
- Online community information sessions
- Advertisement in local newspapers
- Geo-targeted social media posts

5.7.2 Consultation following the public display of the REF

Following the public display period, Transport for NSW will collate and consider the submissions received then determine whether the proposal should proceed as described in the REF, or whether any changes are required. A submissions report would be published which would respond to the comments received. The submissions report would be made available to the public via the Transport for NSW website. The community would be informed of any major design changes that are required to address concerns raised in submissions.

Following determination, the community would continue to be updated about the progress of construction and provided notification of any road closures or night works in advance of the works occurring. Direct consultation would continue with affected landholders and stakeholders.

A Communication Plan would be developed and implemented by the construction contractor to manager consultation during the construction stage of the proposal.

6 Environmental assessment

6.1 Biodiversity

This section describes the potential biodiversity impacts associated with the proposal. The impact assessment is informed by the biodiversity assessment report (BAR) provided in Appendix C (Aurecon, 2021).

6.1.1 Methodology

Study area

The study area used during the biodiversity assessment includes a 50 metre buffer around the proposal area (refer to Figure 6.1). Although surveys were focused on the proposal area, this buffer provided context of the connectivity and condition of the native vegetation present, which informed the impact assessment for the proposal.

Background research

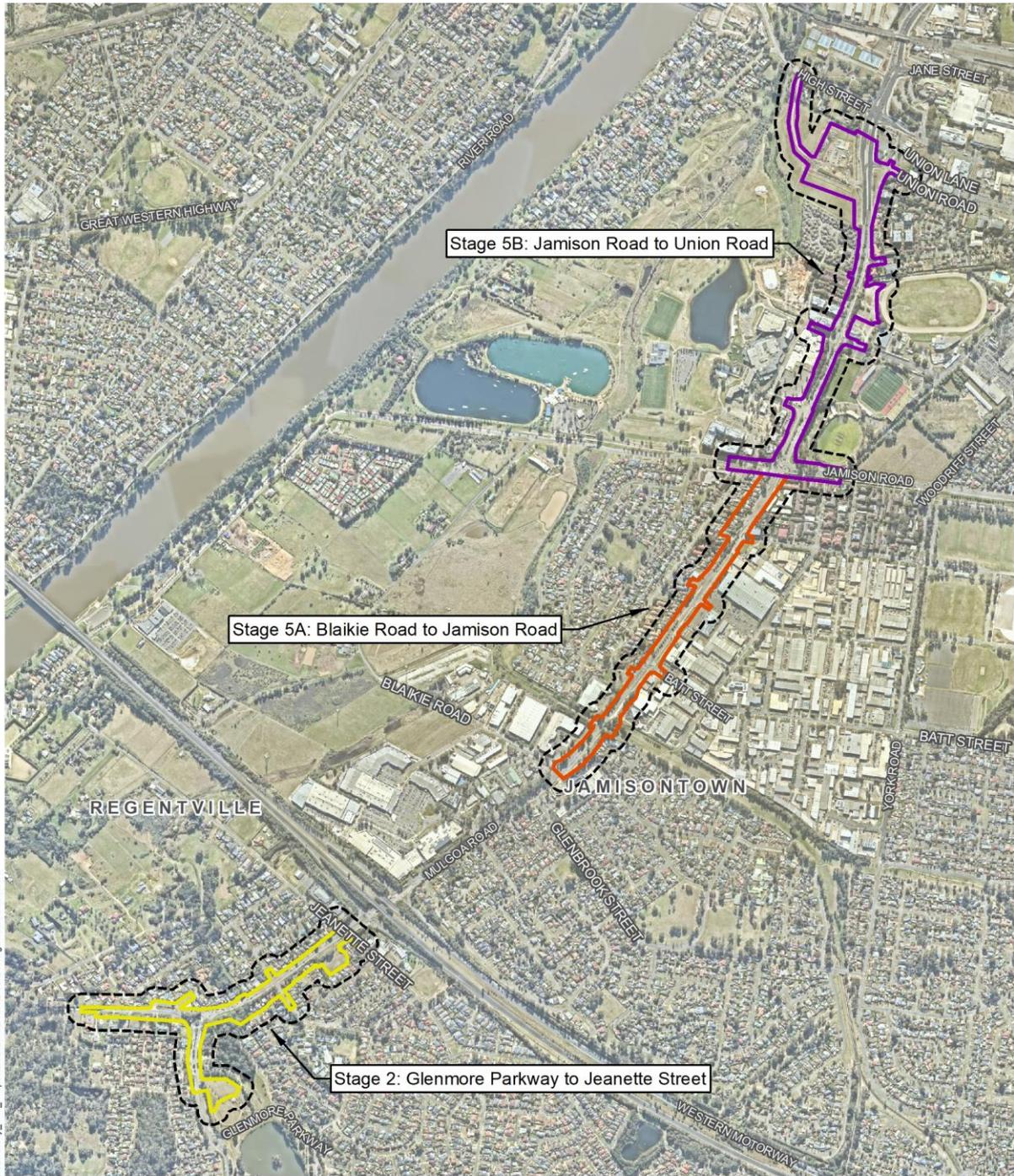
A desktop investigation was undertaken to identify and review the presence and-likelihood of occurrence of threatened ecological communities (TECs), threatened species fauna and flora species, as well as areas of outstanding biodiversity value. These informed the planning for the field survey and identified the likely ecological groups present in the area.

The database searches included:

- Fauna and flora records databases such as BioNet Atlas, OEH vegetation Information System database and the Vegetation Types Database
- NSW Government's Sharing and Enabling Environmental Data (SEED) datasets
- OEH Biodiversity Values Map
- DPI Fisheries Fish Records Viewer
- DPI WeedWise
- DPI Key Fish Habitat Maps
- EPBC Protection Matters Search Tool (PMST) for Matters of National Environmental Significance (MNES)
- Atlas of Groundwater Dependent Ecosystems (GDE).

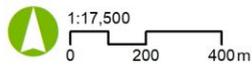
Habitat assessment

A habitat assessment was prepared to determine the likelihood of occurrence of threatened species, populations and community in a 10 kilometre radius of the proposal area. Tests of significance were conducted for the threatened species and communities identified with the relevant legislation and guidelines.



- Study area
- REF proposal area
- Stage 2
- Stage 5A
- Stage 5B

Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri



Projection: GDA 1994 MGA Zone 56

Figure 6-1: The Proposal with 50 metre buffer (study area)

Field survey

A field survey was conducted on 23 and 24 November 2020 to ground truth results from the habitat assessments and confirm presence of the communities identified in the database searches. Onsite weather conditions were generally warm and sunny.

This survey included:

- A random meander for a general flora inventory
- Inspection of plant community types (PCTs) to confirm and update existing PCT mapping through conducting vegetation plots in accordance with the Biodiversity Assessment Methodology (BAM)
- Comprehensive searches of suitable habitat for threatened fauna and flora species
- Opportunistic survey of all fauna based on visual, aural or habitat inspections
- Recording the occurrence and extent of weed species
- Targeted survey for Cumberland Plain Land Snail (*Meridolum corneovirens*)
- Targeted anabat survey for Southern Myotis Bat (*Myotis Macropus*)
- Rapid assessment at School House Creek and Surveyors Creek.

Vegetation surveys

Flora species lists were compiled for all native and where possible exotic flora. Native vegetation community boundaries and exotic assemblages were confirmed and delineated during field surveys using aerial imagery. Remnant and planted native vegetation were identified, classified accordingly to the NSW PCTs. Two plot-base floristic surveys were undertaken and consisted of a nested 20 x 50 metre quadrat in accordance with Section 5 of Biodiversity Assessment Method 2020.

Targeted flora and fauna surveys

Targeted flora surveys were undertaken for 15 threatened flora species in accordance with *Surveying threatened plants and their habitats* (DPIE, 2020b) that were considered to have a moderate or higher likelihood of occurring within the study area. Targeted surveys searched areas of suitable habitat within the study area for the candidate threatened flora.

Targeted orchid surveys were completed on 27 October 2021 utilising Parallel Field Traverse sampling method in areas of suitable habitat. It is noted that the surveys were completed during a week when threatened Orchid species such as the Sydney Plains Greenhood (*Pterostylis saxicola*) were known to be in flower at other sites within South west Sydney.

Initial fauna surveys consisted of habitat assessments and visual inspections of habitat features (such as tracks, scats and other traces). All fauna were recorded along with habitat features relevant for the species life cycle. Targeted surveys were carried out for the Cumberland Plain Land Snail (*Meridolum corneovirens*) in the remnant vegetation surrounding School House Creek. Eight species of microbats have a moderate or higher likelihood of occurring in the study area. Targeted anabat surveys were required for the Southern Myotis bat (*Myotis macropus*) at School House Creek.

Aquatic surveys

Three creeks occur within the study area and each was assessed for habitat features in accordance with the NSW DPI (Fisheries) document *Policy and Guidelines for fish habitat conservation and management* (2013). Waterway habitat assessment was undertaken and included:

- Ecosystem type
- Dimensions of waterway and depth of water

- Flow characteristics and hydrological features of aquatic habitat
- Bed substrate
- Habitat features
- Existing infrastructure and barriers to fish movement
- Width and species composition of riparian vegetation including the type of vegetation present
- Water quality.

Arborist survey

A Preliminary Tree Assessment (PTA) and an Arboricultural Impact Assessment (AIA) was prepared to identify the trees within the proposal area and to determine the impact on the trees (see appendix C).

The PTA assessed the current overall health and condition of the subject trees. The significance of the trees was evaluated and their suitability for retention was assessed to be high, medium or low retention value. A total of 873 trees were inspected in September and October 2021. The subject trees were assessed in accordance with a stage one visual tree assessment (Mattheck and Breloer, 1994). The two site locations for the assessments are shown in Figure 6.2.

The AIA identified the trees to be removed, retained or transplanted, and determined the likely impacts on trees to be retained.

6.1.2 Existing environment

Plant community types

The PCTs identified from Cumberland Plain West mapping and identified during the site visit within the study area are listed in Table 6-1. Two TECs were found to be associated with these:

- Cumberland Plain Woodland in the Sydney Basin Bioregion listed as critically endangered under the BC Act and EPBC Act
- River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions listed as endangered under the BC Act and critically endangered under the EPBC Act.

In addition, three exotic, planted and non-local native vegetation communities were identified.

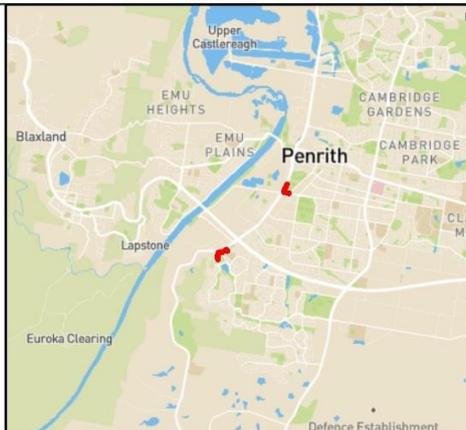
Table 6-1: PCTs within the proposal area

Plant community type (PCT)	Vegetation zone	Patch size (ha)	TEC BC Act	TEC EPBC Act
PCT 849 Cumberland Shale Plains Woodland	Grey Box – Forest Red Gum grassy woodland moderate	0.58	Yes	Yes
PCT 835 Cumberland River-Flat Forest	Forest Red Gum – Rough-barked Apple grassy woodland moderate	0.93	Yes	Yes
Planted PCT 1800 Cumberland Swamp Oak Riparian Forest	Swamp Oak open forest revegetation	0.29	No	No



Field Map

 Study Area



0 100 200 400
Metres

Datum/Projection:
GDA 1994 MGA Zone 56
Project: 18987-SC Date: 10/25/2021



Figure 6-2: PTA and AIA site locations

Threatened Ecological Communities

Two PCTs recorded within the proposal area (PCT 849 and PCT 835) are consistent with TECs under the BC Act, while the planted Swamp oak open forest (PCT 1800) is not considered to meet the definition of a TEC.

PCT 849 Cumberland Shale Plains Woodland is listed as a Critically Endangered Ecological Community (CEEC) under BC Act. Despite significant disturbances, the vegetation of PCT 849 Cumberland Shale Plains Woodland recorded in the proposal contains the primary canopy species listed within the determination and occupies the known landscape position and geology.

PCT 835 Cumberland River-Flat Forest is listed under the BC Act as an Endangered Ecological Community (EEC). The TEC and its associated vegetation species is predominantly seen around creek lines as is common for coastal floodplains. The vegetation species present is highly influenced by the water in the environment. As a result of a history of clearing, fire and low site quality, the vegetation may vary from tall open forests or woodlands to one with a more reduced, scattered tree canopy.

Extensive earthworks and other disturbances occurred in the area that may have previously naturally contained the Cumberland Swamp Oak Riparian Forest. It is considered that the Swamp Oaks that now occur in this location have been planted as part of the channelisation work and it is therefore not a naturally occurring community. For the purposes of this assessment, it is not considered to meet the definition of Swamp Oak Flood Plain Forest TEC.

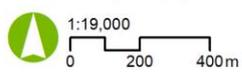
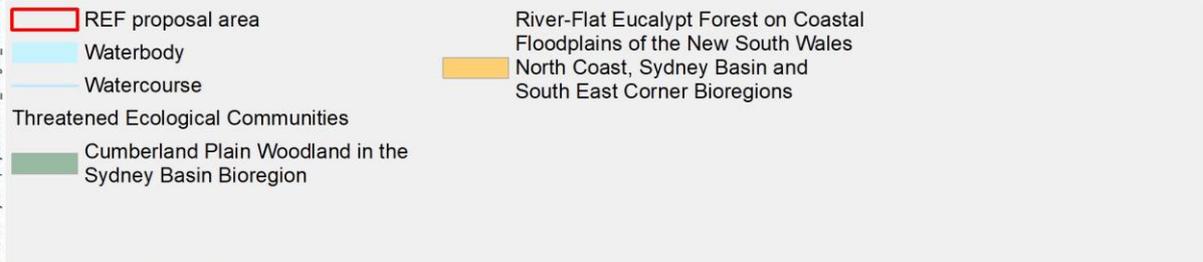
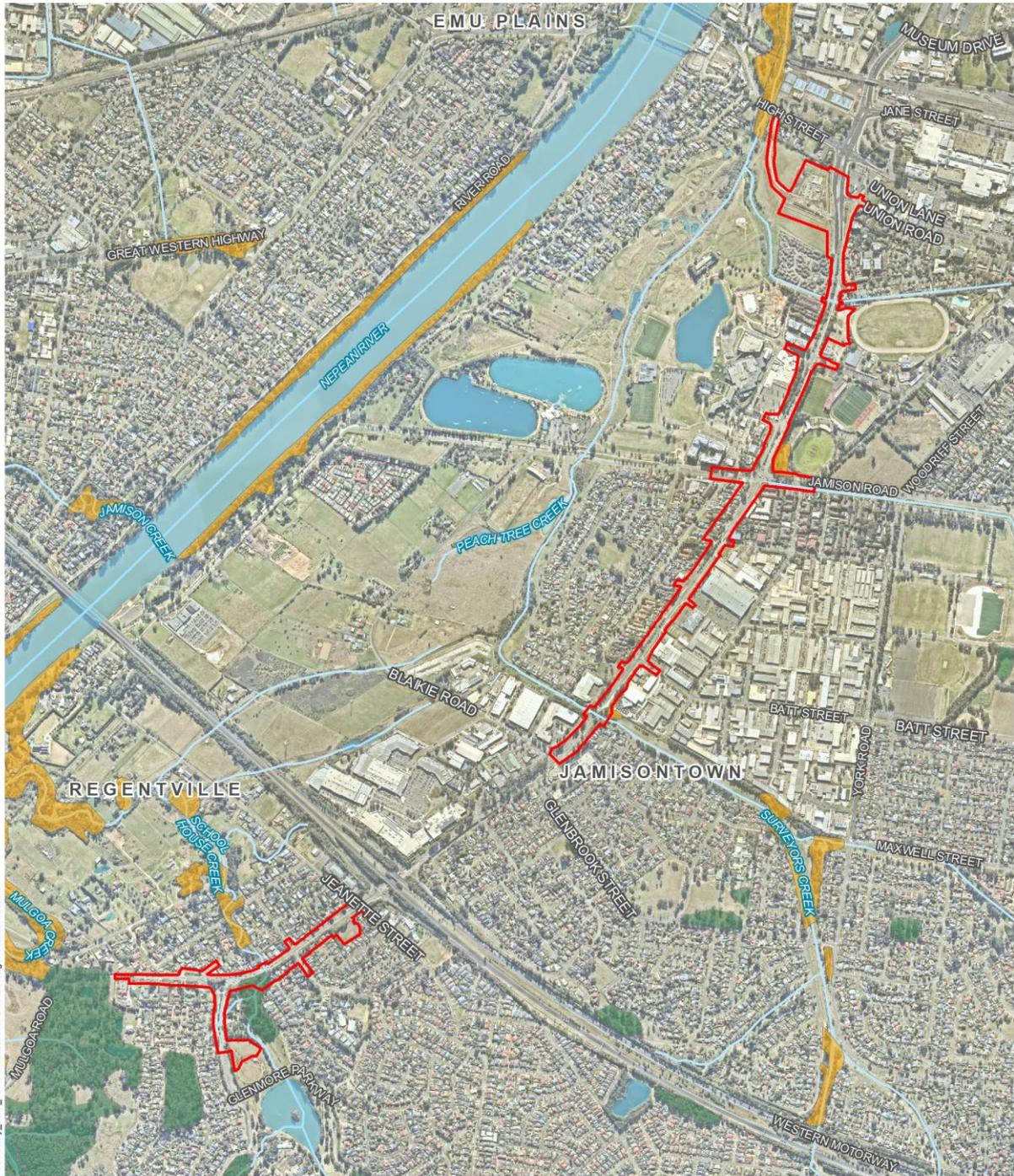
Figure 6.3 shows the extent of these TECs within the proposal area. Further detail of these communities is found in Appendix C.

High threat exotic and priority weeds

33 priority weeds declared for the Penrith LGA and High Threat Exotic (HTE) weeds were recorded within the proposal. These priority weeds and their associated duties under the Biosecurity Act 2015 are listed in Appendix C.

Groundwater dependent ecosystems

The groundwater dependent ecosystems (GDE) Atlas shows a number of terrestrial GDEs within the study area. These are associated with the areas of remnant native vegetation, which are represented by the areas of Cumberland River-Flat Forest and Cumberland Shale Plains Woodland (refer to Figure 6.4).



Projection: GDA 1994 MGA Zone 56

Figure 6-3: Threatened ecological communities

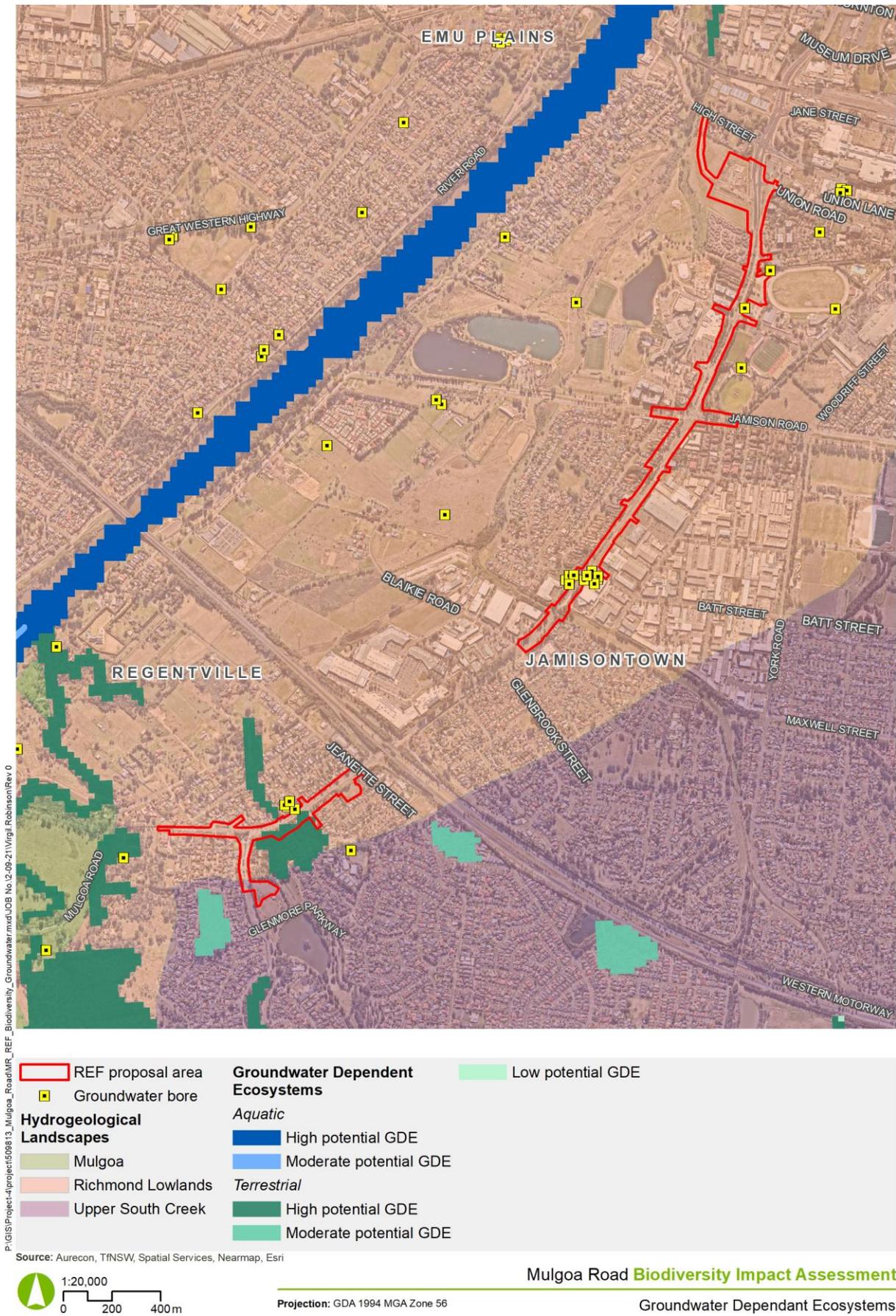


Figure 6-4: Groundwater Dependant Ecosystems

Threatened flora

No threatened flora species were recorded during surveys.

Threatened fauna

The desktop investigation found 58 threatened fauna species listed under the BC Act within 10 kilometres of the proposal. Two of these species, the Little Lorikeet and the Southern Myotis Bat, are recorded within the proposal area and 37 species have a moderate or higher likelihood of occurring within the proposal area. Table 6-2 summarises these results.

Table 6-2: Threatened fauna likely to occur in the study area

Scientific name	Common name	BC Act status	Potential occurrence (Moderate, High, Recorded)
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	Moderate
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	V	Moderate
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	Moderate
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	Moderate
<i>Chthonicola sagittata</i>	Speckled Warbler	V	Moderate
<i>Circus assimilis</i>	Spotted Harrier	V	Moderate
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V	Moderate
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	Moderate
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	Moderate
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	Recorded
<i>Grantiella picta</i>	Painted Honeyeater	V	Moderate
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V	Moderate
<i>Hieraaetus morphnoides</i>	Little Eagle	V	Moderate
<i>Hirundapus caudacutus</i>	White-throated Needle-tail	n/a	Moderate
<i>Ixobrychus flavicollis</i>	Black Bittern	V	Moderate
<i>Lathamus discolor</i>	Swift Parrot	CE	Moderate
<i>Lophoictinia isura</i>	Square-tailed Kite	V	Moderate
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	V	Moderate
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V	Moderate
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	E	Moderate
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V	Moderate
<i>Miniopterus australis</i>	Little Bent-winged Bat	V	Moderate
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V	Moderate
<i>Myotis macropus</i>	Southern Myotis	V	Moderate

Scientific name	Common name	BC Act status	Potential occurrence (Moderate, High, Recorded)
<i>Neophema pulchella</i>	Turquoise Parrot	V	Moderate
<i>Ninox connivens</i>	Barking Owl	V	Moderate
<i>Ninox strenua</i>	Powerful Owl	V	Moderate
<i>Pandion cristatus</i>	Eastern Osprey	V	Moderate
<i>Petroica boodang</i>	Scarlet Robin	V	Moderate
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	Moderate
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	Moderate
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	Moderate
<i>Stagonopleura guttata</i>	Diamond Firetail	V	Moderate
<i>Tyto novaehollandiae</i>	Masked Owl	V	Moderate
<i>Tyto tenebricosa</i>	Sooty Owl	V	Moderate

Note: V – vulnerable, E – endangered, CE – critically endangered

Aquatic results

Mulgoa Road intersects the School House Creek, Surveyors Creek and an unnamed creek. There has been extensive disturbance to the creeks and associated vegetation. No aquatic fauna was observed within the three creeklines. None of the creeks within the study area meet the thresholds for Key Fish Habitat under the *Policy and guidelines for fish habitat conservation and management* (DPI, 2013) as the unnamed creek and School House Creek are first and second order creeks; and Surveyors Creek is a concrete-lined channel. School House Creek had abundance of aquatic and terrestrial vegetation, while Surveyors Creek and the unnamed creek are highly degraded and channelised. All creeks were flowing at the time of survey. No threatened species are considered to have a moderate or higher likelihood of occurring within the creek lines of the study area.

Areas of outstanding biodiversity value

No areas of outstanding biodiversity value occur within the study area.

Wildlife connectivity corridors

School House and Surveyors Creeks are important corridors for wildlife. Vegetation near School House creek has potential habitat for the Swift Parrot, while habitat within these corridors includes two hollow bearing trees, dense understorey and leaf litter, woody debris and flowing water within the channel. In the wider proposal area there are eleven hollow bearing trees, of which five are identified for removal within the proposal area. However, it has been severely degraded from human encroachment and run-off. Currently, the corridors are only likely to provide habitat for common fauna species such as birds, microbats and some mammals such as Ringtail Possums. Four species of bat were recorded in School House Creek drainage line during anabat survey.

The existing Mulgoa Road has created a barrier to fauna movement for many years. Therefore, it is likely only highly mobile fauna species use these corridors.

Habitat and fauna are connected to the Nepean River and Blue Mountains National Park as the three creek lines within the proposal extend, with fragmented vegetation, through to the Nepean river system. These riparian corridors are important features for maintaining resident and migratory fauna populations as they connect to the Nepean River and Blue Mountains National Park.

6.1.3 Potential impacts

Construction

Removal of vegetation

The proposal would impact upon a total of 0.79 hectares of native vegetation comprising 0.66 hectares of PCT 835 Cumberland River-Flat Forest and 0.13 hectares of PCT 849 Cumberland Shale Plains Woodland (refer to Table 6-3). In addition, 0.29 hectares of the planted vegetation, which is classified as PCT 1800, would be removed and a total of 8.57 hectares of street trees, plantings and exotics would also be removed. This is summarised in Table 6-3.

Table 6-3: Impacts on vegetation

Plant Community Type (PCT)	Status (BC Act)	Status (EPBC Act)	Proposal area (ha)
PCT 849 Cumberland Shale Plains Woodland	CEEC	CEEC	0.13
PCT 835 Cumberland River-Flat Forest	EEC	CEEC	0.66
PCT 1800 Cumberland Swamp Oak Riparian Forest	N/a	N/a	0.29
Street trees, revegetation areas and exotics	N/a	N/a	8.57

Note: CEEC – Critically Endangered Ecological Community, EEC – Endangered Ecological Community

Removal of trees

A total of 307 trees are expected to be removed from the proposal area of which 100 would be removed from site 1 and 207 would be removed from site 2 (refer to Figure 6.2). Of these, 35 trees were assessed as having high retention value, 139 are considered medium retention value and 133 are considered low retention value. The Proposal would have a medium impact on an additional 7 trees but they would be retained subject to further investigation and mitigation measures. The Proposal would have a low impact on a further 38 trees but these trees would be retained. The location of these trees are shown in Figures 15 to 20 in the AIA (appended in Appendix C). Between site 1 and site 2, a total of 559 trees are proposed to be retained. The removal of trees would be further investigated in detailed design.

Removal of threatened fauna species habitat

The study area is highly disturbed with over 95 per cent of native vegetation previously removed. In remnant and planted native vegetation important habitat features are present (e.g. hollow bearing trees, dense leaf litter, fallen woody debris, dense shrub layer and aquatic habitat). Vegetation clearing associated with the proposal would remove an additional 8.57 hectares of potential threatened species habitat in the form of exotic plantings, gardens and revegetation areas. Five hollow bearing trees are identified for removal within the proposal area.

Thirty seven threatened species have a moderate or higher likelihood of occurring within the proposal area. The removal of 0.79 hectares of native vegetation is potential foraging habitat for these 37 species. Targeted surveys were completed and no Cumberland Plain Land Snail (*Meridolum corneovirens*) were recorded, while one Southern Myotis bat (*Myotis Macropus*) was recorded. The Grey-headed Flying Fox (*Pteropus poliocephalus*) has been previously recorded and therefore may forage in the proposal area. There was one incidental sighting of a Little Lorikeet (*Glossopsitta pusilla*) adjacent to the PCT 849 remnant on the corner of Mulgoa Road and Jamison Road.

Outside of native vegetation remnants, fauna habitat is largely suited to mobile species using the area for foraging and roosting. The proposal includes the removal of some non-local native and non-native vegetation that is important foraging and roosting habitat for fauna (including the Little Lorikeet (*Glossopsitta pusilla*) and the Grey-Headed Flying-Fox (*Pteropus poliocephalus*)). No planted eucalypts within the proposal area contained hollows.

Removal of threatened flora

No threatened flora species were located within the proposal area during field surveys.

Key threatening processes

The key threatening processes considered to have a moderate to very high likelihood of impacting native flora, fauna and vegetation communities in the short to medium term are outlined in Table 6-4.

Table 6-4: Key threatening processes

Key threatening process	Impact on biodiversity	Risk
Clearing of native vegetation	The proposal would clear 0.79 ha of native vegetation.	Very High
Invasion and establishment of exotic vines and scramblers	The disturbance from clearing native vegetation would encourage aggressive vine growth along within riparian corridor of School House Creek and Surveyors Creek.	High
Invasion of native plant communities by exotic perennial grasses	The disturbance from earthworks and clearing native vegetation would further encourage aggressive perennial grass growth.	Very high
Invasion of native plant communities by African Olive	African Olive, an invasive perennial woody weed is likely to increase its dominance on native vegetation following disturbance.	Moderate
Invasion, establishment and spread of Lantana	Lantana, an invasive perennial woody weed is highly likely to increase its dominance on native vegetation following disturbance.	High
Loss of Hollow bearing Trees	Very high likelihood of further decline in hollow bearing trees due to road widening.	Very high

Aquatic impacts

To widen culverts, some parts of School House Creek and Surveyors Creek would be directly impacted by the proposal. Up to 0.95 hectares of riparian areas would be impacted by the proposal. The existing riparian creeks have already been disturbed and only provide limited potential habitat for common riparian species. Management measures would be implemented to minimise potential impacts.

None of the creeks within the study area meet the thresholds for Key Fish Habitat under the *Policy and guidelines for fish habitat conservation and management* (DPI, 2013).

Injury and mortality to fauna

Fauna injury or death has potential to occur during construction when vegetation clearing is carried out. The extent of this impact would be proportionate to the extent of vegetation that is cleared. Fauna may become trapped in or may choose to shelter in machinery that is stored overnight. There is potential for these animals to become injured when the machinery is in use. A pre-clearance survey would be undertaken to minimise the potential impacts to fauna. Management measures would be implemented to minimise potential impacts.

Matters of National Significance

The EPBC Act protected matters search identified 11 TECs, 49 threatened species and 16 migratory species that could possibly occur in the study area. Of those, the proposal may impact upon, or have a moderate or higher likelihood of impacting upon the following:

- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest, listed as critically endangered under the EPBC Act
- Coastal floodplain eucalypt forest of eastern Australia, listed as critically endangered under the EPBC Act
- Grey-headed Flying-fox (*Pteropus poliocephalus*) listed as vulnerable under the EPBC Act
- Regent Honeyeater (*Anthochaera phrygia*) listed as critically endangered under the EPBC Act
- Swift Parrot (*Lathamus discolor*) listed as critically endangered under the EPBC Act
- Large-eared Pied Bat (*Chalinolobus dwyeri*) listed as vulnerable under the EPBC Act
- Australasian Bittern (*Botaurus poiciloptilus*) listed as endangered under the EPBC Act
- White-throated Needletail (*Hirundapus caudacutus*) listed as vulnerable under the EPBC Act
- Painted Honeyeater (*Grantiella picta*) listed as vulnerable under the EPBC Act
- Black-faced Monarch (*Monarcha melanopsis*) listed as a migratory species under the EPBC Act.

Cumulative impacts

There are multiple projects within the Cumberland Plain that impact upon threatened species, ecological communities, habitats and key threatening processes. These projects are the Mamre Road widening works, Western Sydney Airport, The Northern Road upgrade (Glenmore Parkway to Jamison Road), and Sydney Metro Railway (Western Sydney Airport to Western Line). The expected construction impacts of these projects are clearing of remnant native vegetation, removal of threatened species and habitat, changes to natural drainage and increase in heavy vehicle movements.

Operation

Wildlife connectivity within the proposal is restricted to the riparian corridors. They link, though discontinuous, vegetation and aquatic habitats to the Nepean River and Blue Mountains National Park. The proposal area is mostly urbanised and contains highly mobile fauna, therefore they are unlikely to face significant impact from the proposal.

Vegetation clearing would not create any new fragments however, the distance between fragments would increase. Impacts such as edge effects, increased vehicle noise, streetlights and canopy gaps are likely to occur. Fauna movements and migrations may be further reduced in the study area as the quality of the habitat is impacted.

Soil disturbance and vegetation clearing from machine work may result in increase in the invasion and further spread of exotic flora throughout native vegetation patches. Importation of soils also increases risk of spread of pathogens. Given the highly modified urban environment the works associated with proposal are unlikely to result in additional pests in the proposal area.

Groundwater dependent ecosystems

The removal of vegetation would impact on PCT 849 which is a GDE. It is unlikely the proposal would result in substantial changes to the hydrology of the GDE given the road already crosses the areas of GDEs mapped.

Cumulative impacts

There are multiple projects within the Cumberland Plain that impact upon threatened species, ecological communities, habitats and key threatening processes. These projects are the Mamre Road widening works, Western Sydney Airport, The Northern Road upgrade (Glenmore Parkway to Jamison Road), and Sydney Metro Railway (Western Sydney Airport to Western Line). Increased traffic movements, increased lighting and noise, increased in air and road traffic, and impacts to wildlife are expected operational impacts as a result of these projects.

Conclusion on significance of impacts

The proposal is not likely to significantly impact threatened species or ecological communities or their habitats, within the meaning of the *Biodiversity Conservation Act 2016* or *Fisheries Management Act 1994* and therefore a Species Impact Statement or Biodiversity Development Assessment Report is not required.

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

6.1.4 Safeguards and management measures

Table 6-5 describes the proposed safeguards that would be introduced to manage the potential impacts on biodiversity. Other safeguards and management measures that would address indirect biodiversity impacts are identified in Sections 6.5.5, 6.8.4, 6.10.4 and 6.11.4.

Table 6-5: Safeguards and management measures for impacts to biodiversity

Impact	Environmental safeguards	Responsibility	Timing	Reference
B1 - biodiversity	<p>A Flora and Fauna Management Plan would be prepared in accordance with Transport for NSW 's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</i> (RTA, 2011) and implemented as part of the CEMP. It would include, but not be limited to:</p> <ul style="list-style-type: none"> Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas Requirements set out in the <i>Landscape Guideline</i> (RTA, 2008) Pre-clearing survey requirements Procedures for unexpected threatened species finds and fauna handling Procedures addressing relevant matters specified in the <i>Policy and guidelines for fish habitat conservation and management</i> (DPI Fisheries, 2013) Protocols to manage weeds and pathogens. 	Contractor	Pre-construction Construction	Standard safeguard
B2 - biodiversity	Measures to further avoid and/or minimise the construction footprint and native vegetation and/or habitat removal would be investigated during detailed design and implemented, where practicable and feasible.	Contacto	Detailed design Pre-construction	Additional safeguard
B3 – removal of vegetation	Pre-clearing surveys would be undertaken in accordance with <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)	Contractor	Pre-construction	Additional safeguard
B4 – removal of vegetation	Vegetation removal would be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
B5 – removal of vegetation	<p>Native vegetation would be re-established in accordance with <i>Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)</i>.</p> <p>Preference to revegetate disturbed areas to former TEC using all structural layers and species native to the community.</p> <p>Accredited bush regenerators would implement native revegetation in accordance with PCT mapping within the Biodiversity Assessment Report (Aurecon 2021)</p>	Transport Contractor	Construction Post-construction	Additional safeguard
B6 – unexpected species finds	<p>The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)</i> if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.</p>	Contractor	Construction	Additional safeguard
B7 – biodiversity impacts to School House and Surveyors Creek	<p>A restoration plan would be developed to mitigate clearing and fragmentation, improve the condition of the riparian vegetation along School House and Surveyors Creek within and adjacent to the proposal area.</p> <p>The restoration plan would focus upon removing high threat exotics and revegetation using province-sourced plants belonging to PCT 835 Cumberland River-Flat Forest.</p> <p>The restoration plan would form an Appendix to the Operational Flora and Fauna Management Plan or Operation Environmental Management Plan (OEMP).</p>	Transport Contractor	Operation	Additional safeguard
B8 – impact to TECs	<p>Clearing limits and exclusion zones within TECs would be installed before commencing work.</p> <p>These areas are to be physically delineated e.g. flagging tape, etc and signposted to inform personnel of environmental significance.</p>	Contractor	Pre-construction Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
B9 – habitat removal	<p>Habitat removal would be minimised through detailed design.</p> <p>Exclusion zones would be implemented around hollow bearing trees that have been identified for retention.</p> <p>Installation of nesting boxes for hollows removed in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).</p>	Transport Contractor	Detailed design	Additional safeguard
B10 – habitat removal	<p>Habitat would be replaced or re-instated in accordance with <i>Guide 5: Re-use of woody debris and bushrock</i> and <i>Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).</p> <p>Consideration should be given to the reuse of salvaged hollows and timber removed trees to be incorporated into the design of nest boxes where possible.</p> <p>The incorporation of microbat habitat into culverts and bridges should be considered during detailed design.</p>	Transport Contractor	Construction	Additional safeguard
B11 - aquatic habitat impacts	<p>Aquatic habitat would be protected in accordance with <i>Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) and <i>Section 3.3.2 Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013</i> (DPI (Fisheries NSW) 2013).</p>	Contractor	Detailed design Pre-construction Construction	Additional safeguard
B12 – aquatic habitat impacts	<p>Structures within and around the waterways including drainage outlets, bridge works and culverts, should be designed to consider biodiversity principles and minimise erosion and sedimentation issues and prevent substantial changes in flow rates that may impact both the immediate area and downstream features. See <i>Why do fish need to cross the road?</i> (Fairfull and</p>	Designer	Detailed design	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	Witheridge, 2003) for potential design considerations.			
B13 - groundwater dependent ecosystems	Interruptions to water flows associated with groundwater dependent ecosystems would be minimised through detailed design.	Transport Contractor	Detailed design	Additional safeguard
B14 - changes to hydrology	Changes to existing surface water flows would be minimised through detailed design.	Transport Contractor	Detailed design	Additional safeguard
B15 - fragmentation of identified habitat corridors	Fauna connectivity measures will be considered in detailed design in accordance with the Wildlife Connectivity Guidelines for Road Projects (RTA 2011). Any connectivity measures implemented would be designed in consultation with an experienced ecologist.	Transport Contractor	Detailed design Construction Post-construction	Additional safeguard
B16 – edge effects on adjacent native vegetation and habitat	Exclusion zones would be set up at the limit of clearing in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Transport	Post construction	Additional safeguard
B17 - light	Shading and artificial light impacts would be minimised through detailed design.	Contractor	Detailed design	Additional safeguard
B18 – tree removal	Trees to be retained should be appropriately protected in accordance with the tree protection measures outlined in the Arborist Impact Assessment, including but not limited to signage and fencing for tree protection zones.	Transport Contractor	Pre-construction	Additional safeguard

6.1.5 Biodiversity offsets

In accordance with the Transport for NSW Biodiversity Offset Guidelines (RMS, 2016), offsets are required for:

- Clearing Cumberland Plain Shale Woodlands
- Clearing Shale-Gravel Transition Forest
- Clearing Coastal floodplain eucalypt forest
- Clearing more than one hectare of NSW listed threatened species habitat
- Clearing Southern Myotis habitat.

The BAM-C was used to calculate offset requirements for the impact for this proposal. A total of 19 ecosystem credits and 18 species credits are required to offset the biodiversity impacts of the proposal. These credits are:

- 16 credits for PCT 835
- 3 credits for PCT 849
- 18 credits for Southern Myotis.

6.2 Traffic and transport

This section describes the potential traffic and transport impacts associated with the proposal. This section is informed by the traffic and transport assessment, prepared by SMEC, which is provided in Appendix D.

6.2.1 Methodology

The methodology for the traffic and transport assessment included:

- Reviewing the key features of the design and the indicative construction methodology
- Reviewing the existing transport conditions, including key intersections, traffic data, land uses, population and employment, public transport, pedestrian and cyclist data, and crash analysis, crash severity index.
- Developing a base case model for the traffic data
- Assessing future traffic demand impact by modelling forecast traffic for different scenarios
- Identifying the interactions between all proposed road upgrade stages along Mulgoa Road between Andrews Road and Glenmore Parkway
- Recommending safeguards and mitigation measures to manage the identified impacts.

Due to the COVID-19 pandemic travel restrictions in 2020 and 2021 site visits were limited. To understand the existing conditions, traffic counts were undertaken using video footage and Google Traffic data for the entire Mulgoa Road/Castlereagh Road corridor.

Where traffic surveys could be conducted, they were compared to historical data to review the effects of COVID-19.

6.2.2 Existing environment

Key Intersections

Stage 2 has two key intersections and 5A and 5B have five key intersections. These intersections include:

- Stage 2:
 - Glenmore Parkway / Mulgoa Road – roundabout
 - Spencer Street / School House Road / Mulgoa Road – signalised intersection.
- Stage 5A and 5B:
 - Blaikie Road / Mulgoa Road – signalised intersection
 - Batt Street / Mulgoa Road – signalised intersection
 - Jamison Road / Mulgoa Road – signalised intersection
 - Ransley Street / Mulgoa Road – signalised intersection
 - Panthers Place / Mulgoa Road – signalised intersection.

Figure 6.5 shows the key intersections and their control type for the Mulgoa Road study area.

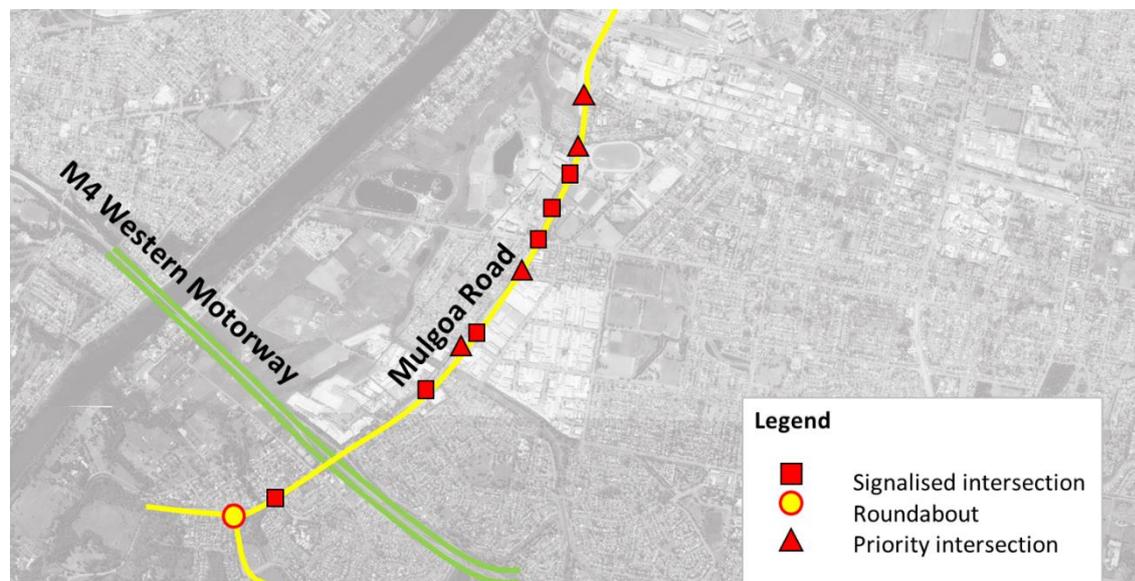


Figure 6-5: Key intersections along Mulgoa Road/Castlereagh Road corridor

Intersection performance

Level of Service (LoS) is the standard measure used to assess the operational performance of intersections. The LoS criteria are defined in Table 6-6.

Table 6-6: Modelling Guidelines Level of Services for intersections

LOS	Average delay per Vehicle (seconds/ vehicle)	Traffic Signals, Roundabout
A	<14	Good operation
B	15 to 28	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Operating near capacity
E	57 to 70	At capacity, at signals, incidents will cause excessive delays Roundabouts requires other control mode
F	>70	Unsatisfactory with excessive queuing

Modes of travel

A majority of commuters travel by car to and from the study area for work (Bureau of Statistics, 2011). Most people use a private vehicle to travel to their job from selected travel zones with 66 percent driving themselves or being a private car passenger. A total of 16 percent use public transport. Only two percent of workers walk to their work. A total of 12 percent of workers worked at home or did not travel to work on the census survey day. This is shown in Figure 6.6.

Most people use a private vehicle to travel to the study area to work with 67 percent driving themselves or being a private car passenger. Only nine percent of workers travel by public transport with seven percent arriving by train and two percent arriving by bus. This indicates that employees may not have direct access to public transport and/ or there is a good supply of parking available to employees at their destination/workplace. This is shown in Figure 6.7.

As there is a high percent of residents that use private car as their main mode of transport, future population and employment growth in the area will only increase pressure on the road network in and surrounding the study area. This highlights the need for a road upgrade along the key corridor.

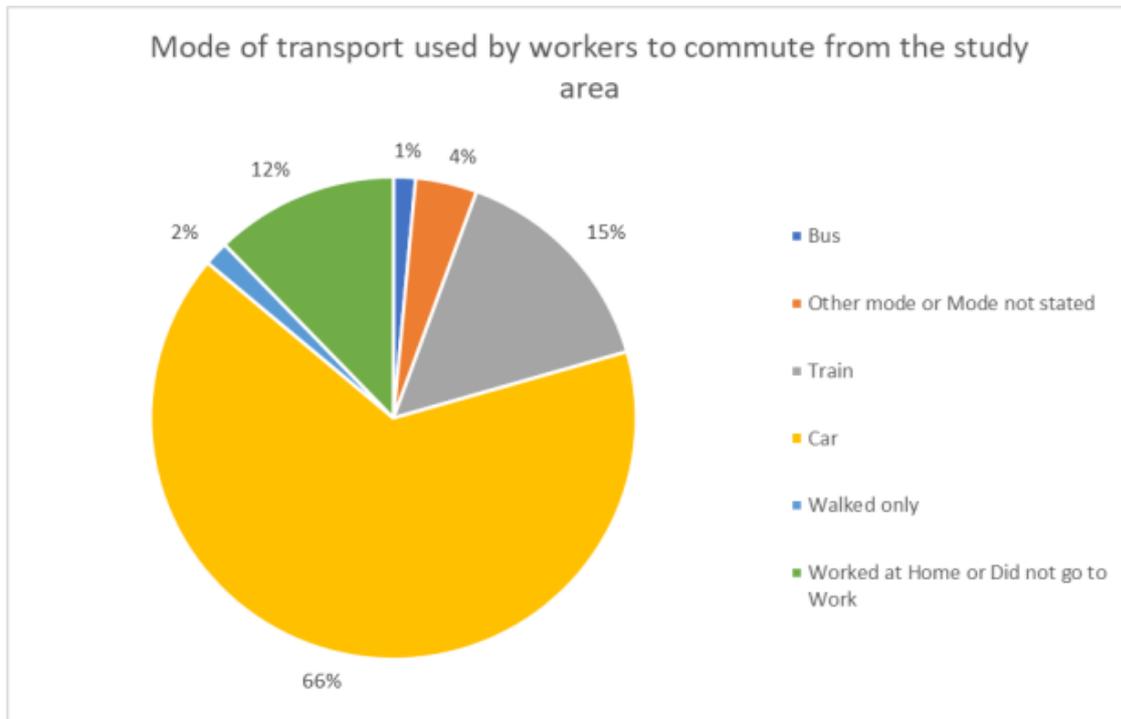


Figure 6-6: Journey to Work Mode Share – Selected Travel Zones as Place of Residence

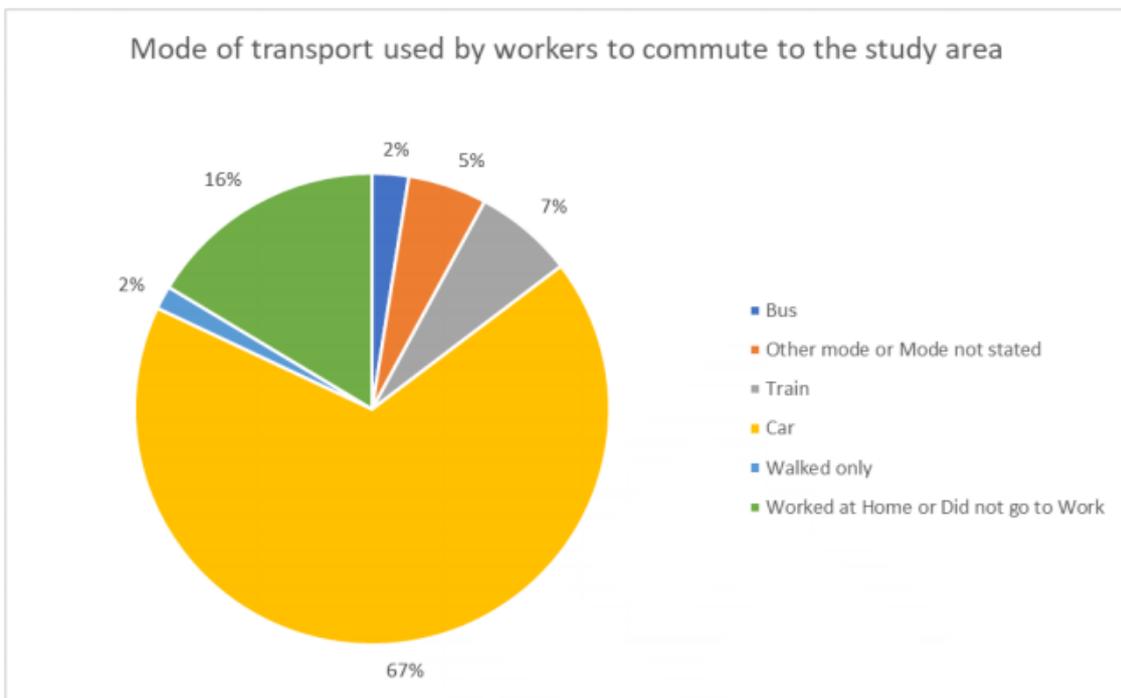


Figure 6-7: Journey to Work Mode Share – Selected Travel Zones as Place of Work

Public transport

Several bus routes operate along the study area. The Busways services 795, 797, 799 and 781 all travel along Mulgoa Road between the Mulgoa Road at Spencer Street/School House Road bus stops in stage 2 and the Mulgoa Road after Stuart Street/Preston Street bus stops in stage 5A. The Blue Mountains Bus Company also services the study area.

Across the entire Mulgoa Road/Castlereagh Road corridor upgrade there are about 24 bus stops with 16 of them on Mulgoa Road between Glenmore Parkway and Jamison Road.

Active transport

Stage 2, 5A and 5B currently has an off-road shared user path for cyclists and pedestrians. West of Glenmore Parkway, within stage 2, there is no pedestrian or cycle facilities. For the majority of stage 5A, between Blaikie Road and Preston Street, there is an on-road cycle lane within the shoulder, as well as an off-road shared user path. The rest of stage 2 and 5A and all of stage 5B has a southbound shared user path and a northbound footpath.

Traffic data and analysis

Table 6-7 shows the total traffic volumes during peak periods. In the AM peak, the second hour has higher total traffic volumes by about 20 per cent when compared to the first hour. The PM peak has relatively flat overall traffic volume profiles between the first and the second hour. The data shows that there is about 24 per cent more traffic using the network during the PM peak than the two-hour AM peak period.

Table 6-7: Total (all intersections along the entire Mulgoa Road/Castlereagh Road upgrade) Surveyed Volumes

Time Period	Number of light vehicles	Number of heavy vehicles	Total number of vehicles
7:00-8:00am	8,885	547	9,432
8:00-9:00am	10,814	539	11,353
4:00-5:00pm	12,732	341	13,073
5:00-6:00pm	12,523	183	12,706

A survey of turn counts conducted across the AM and PM peaks shows that the majority of turns onto side roads across the network do not exceed 100 vehicles per hour.

Road Safety

A total of 98 crashes occurred along the proposal area in the five-year period from July 2014 to July 2019. Table 6-8 summarises these crashed by location and severity. It was noted that most crashes occurred during fine weather conditions and data shows that most crashes occurred during morning and evening peak periods, and during lunch time when there is higher traffic volume.

Table 6-8: Summary of Crashed by Location and Severity in the entire Mulgoa Road/Castlereagh Road Study Area (July 2014 to July 2019)

Location	Serious Injury	Moderate Injury	Minor/ Other Injury	Uncategorised Injury	Non-casualty (towaway)	Total
Union Road to Jamison Road	9	8	6	0	7	30
Jamison Road to M4 Western Motorway	3	16	26	0	12	57
M4 Western Motorway to Glenmore Parkway	1	5	1	1	3	11

The most common crash was rear end crashes along Mulgoa Road, and this is an indication that congestion may present a significant safety issue. Constant changes in average speed, due to congestion, particularly during peak commute hours, can create a 'start and stop' driving environment for motorists. This increases the likelihood of rear end collisions during periods of congestion when there may be relatively little headway between vehicles.

Mulgoa Road has a higher crash rate than both Sydney and NSW state. It is likely that safety would continue to deteriorate along Mulgoa Road for all road users, with congestion one of the key contributing factors to crashes along the road corridor.

6.2.3 Potential impacts

Construction

Public and active transport

Access for pedestrians and cyclists would be maintained during construction. In some work areas, detours and alternative temporary pathways around construction areas may be required to safely maintain access for pedestrians. Safety barriers would separate users from the construction zone, to provide safe passage during construction.

There are minimal impacts expected to bus routes along the proposal area. Most bus stops would be retained during construction, including pedestrian and cyclist access. However temporary adjustments may be required during certain construction activities. Consideration would be given to gaps in traffic barriers and access through construction zones to ensure adequate access to the bus stops is maintained.

Traffic management strategies would be implemented to appropriately manage changes during construction, including alternate access, detours, and/or controlling pedestrian and heavy vehicle construction movements using traffic controllers or temporary signals.

Traffic movements

Transporting material and equipment to and from the construction work zones along Mulgoa Road would be via the M4 Motorway for Mulgoa Road stage 2 works. Stage 5A and 5B work would use the M4 Motorway and the Great Western Highway to minimise the need or usage of additional turnaround facilities and, if required, there may be the potential to use Jamison Road roundabouts for turnaround movements.

Haulage traffic would increase heavy vehicle movements along Mulgoa Road and nearby intersections, which may impact road users and residents along the route. Most haulage vehicle movements would occur within standard construction hours. It is expected that the use of local roads by construction vehicles would be minimal.

The management of roadwork speed limits and zoning would be in accordance with the Transport 'Traffic Control at Work Sites' manual and the Transport NSW Speed Zoning Guidelines. The speed limit would remain 60 kilometres per hour, in line with existing conditions.

Temporary traffic arrangements

All existing intersections would be maintained for each long-term construction stage. This would ensure all existing lanes are maintained. It is expected that short-term traffic management, such as nightworks, may be required for construction at critical areas within intersections where long-term closure would restrict turning movements.

Temporary roadways and detours

Throughout stages 5A and 5B the existing level of lane capacity and connectivity would be maintained.

A temporary arrangement at the Glenmore Parkway/Mulgoa Road roundabout would be required in stage 2. The roundabout would be replaced by a signalised intersection as shown in Figure 6.8.

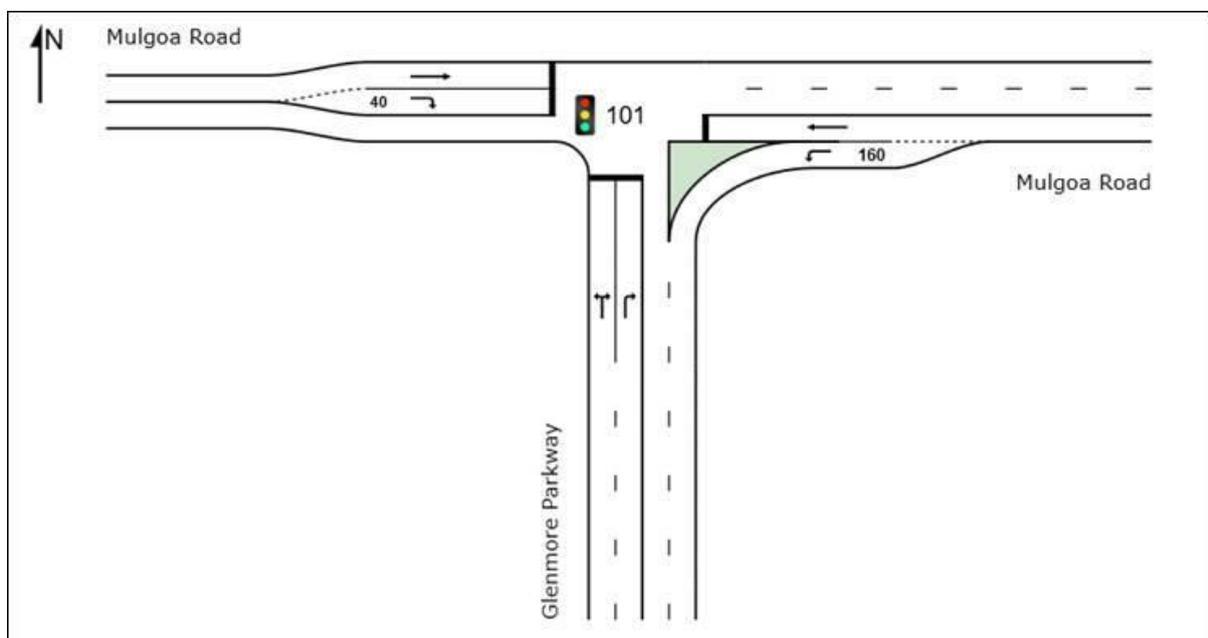


Figure 6-8: Temporary intersection option of Glenmore Parkway/Mulgoa Road intersection

Construction work along Mulgoa Road would be done behind barriers as much as possible and therefore minimising impact on traffic. Most of the bridgeworks and structures can be constructed behind temporary traffic barriers and therefore should have minimal impact on traffic. In particular the construction of the new southbound bridge over Surveyors Creek would be constructed fully offline to the existing road bridge.

Road users would be informed of journey changes through a communications strategy which would include:

- Community information brochures
- Advertising in all forms of the media; Use of Variable Message Signs (VMSs) on the roadside
- Traffic management controls including advisory, directional, warning and regulatory signage.

Vehicle movements and work-related delays

The construction activities that may cause work related delays for drivers include:

- Construction of transverse drainage
- Installation of utility crossings
- Construction of signalised intersections
- Pavement demolition
- Pavement construction.

These construction activities cause short-term increases in vehicle numbers, delays or increased travel time for motorists. These short-term impacts would be minimised by:

- Implementing live traffic control to allow partial road closures
- Installing and maintaining advisory, directional and regulatory signage, line marking and pavement markings
- Maintaining existing speed limits or the relevant safe road work speed limits
- Managing construction vehicular traffic so that:
 - Plant and equipment arrive outside peak traffic flow periods
 - Start and finish of work is scheduled outside of peak traffic periods
 - All vehicles entering and leaving compound and ancillary sites do so in accordance with the Construction Traffic Management Plan.

Impacts on emergency services

Access would be maintained for emergency services along Mulgoa Road during construction, where feasible. The contractor would inform the relevant authorities of any change to traffic conditions that would impact access prior to these works being undertaken.

The Regentville Fire and Rescue NSW Fire Station and Regentville Rural Fire Bridge station are located on Jeanette Street, adjacent to stage 2. Access from Jeanette Street onto Mulgoa Road would be maintained at all times for emergency access. Where work would be occurring at the Mulgoa Road / Jeanette Street intersection, an alternative access for emergency vehicles to Mulgoa Road would be via School House Road, with at least one of these accesses open to emergency vehicles at all times.

Network performance

The upgrade works would be planned to ensure road user delays and adverse impacts are minimised. This would include minimising disruption to the traffic flow and maintaining access where feasible. It is expected that the network performance loss would be negligible during construction as the proposed construction stages allow for the road network capacity to remain the same as existing conditions.

In stage 2, the Glenmore Parkway/Mulgoa Road roundabout would be replaced by a signalised intersection. Traffic analysis for this upgrade has been considered for the temporary configuration proposed during construction of the new intersection. Traffic would improve for the AM peak and have adverse impacts in the PM peak as outlined in Table 6-9.

Table 6-9: Glenmore Parkway/Mulgoa Road roundabout performance

Scenario	Time	Performance
Current arrangement	AM Peak	LoS D
	PM Peak	LoS A
During construction (temporary arrangement)	AM Peak	LoS C
	PM Peak	LoS B

Operation

Active and public transport

The proposal would result in improved safety and connectivity for pedestrians and cyclists. The existing shared pedestrian cycle path would be maintained along Mulgoa Road between Jane Street and Glenmore Parkway. An additional signalised pedestrian crossing would be provided at the Glenmore Parkway/Mulgoa Road intersection as it is changed from a roundabout to a signalised intersection.

During operation of the proposal additional bus infrastructure would be added to the network. New bus stops would be located along Mulgoa Road near the intersections with the following roads and buildings:

- Glenmore Parkway (north and southbound)
- Spencer Street
- Schoolhouse Road
- Factory Road
- Jeanette Street
- Blaikie Road
- Willoring Crescent
- Batt Street
- Freedom Furniture
- Stuart Street
- Jamison Road.

Road safety

The safety for general traffic is expected to improve once the proposal is operational. The upgrade would provide additional capacity and therefore reduce congestion, which has been identified as a contributing factor to the poor road safety in the proposal area.

Network performance

Several traffic modelling scenarios have been tested to understand the network performance with and without the proposed road upgrade. These modelled scenarios are defined in Table 6-10.

Table 6-10: Scenarios modelled

Year	Modelled Scenario
2031	Do minimum (without proposal)
2031	Proposal (with proposal)
2041	Do minimum (without proposal)
2041	Proposal (with proposal)

The expected overall network average annual traffic growth rates compared to when the data was sourced in 2019 for the 2-hour peaks are shown in Table 6-11. This data has been used to assess the future network performance.

Table 6-11: Overall annual traffic growth rates

Scenario	2019-2031		2032-2041	
	AM	PM	AM	PM
Overall network demand growth per annum	1.8%	1.3%	1.7%	1.3%

The congestion and travel times are expected to improve from the existing condition and provide improved conditions than those in the 'do minimum' scenario for 2031 and 2041. Operation of the proposal improves the LoS for key intersections including Jamison Road and Glenmore Parkway during the AM peak period, and Panther Place, Jamison Road, Spencer Street and Glenmore Parkway during the PM peak period models. The proposal would provide additional capacity to the network and would be able to cater for future growth. Table 6-12 outlines the AM intersection LoS and Table 6-13 outlines the PM intersection LoS.

Table 6-12: AM Intersection LoS

Intersection	2031 Do minimum	2031 Proposal	2041 Do minimum	2041 Proposal
Mulgoa Road Union Road	A	A	A	A
Mulgoa Road Rodley Avenue	A	A	A	A
Mulgoa Road Retreat Drive	B	B	C	B
Mulgoa Road Panther Place	A	A	A	A
Mulgoa Road Jamison Road	D	C	D	C
Mulgoa Road Batt Street	B	B	B	B
Mulgoa Road Willoring Crescent	A	A	A	A
Mulgoa Road Blaikie Road	A	A	A	A
Mulgoa Road Spencer Street	B	B	B	B
Glenmore Parkway Mulgoa Road	F	B	F	B

Table 6-13: PM Intersection LoS

Intersection	2031 Do minimum	2031 Proposal	2041 Do minimum	2041 Proposal
Mulgoa Road Union Road	A	A	C	C
Mulgoa Road Rodley Avenue	A	A	B	B
Mulgoa Road Retreat Drive	C	B	E	C
Mulgoa Road Panther Place	A	A	B	A
Mulgoa Road Jamison Road	D	C	F	D
Mulgoa Road Batt Street	B	B	B	B
Mulgoa Road Willoring Crescent	A	A	A	A
Mulgoa Road Blaikie Road	B	B	B	B
Mulgoa Road Spencer Street	B	A	B	A
Glenmore Parkway Mulgoa Road	B	B	E	B

6.2.4 Safeguards and management measures

Table 6-14 describes the proposed safeguards that would be introduced to manage the potential impacts on traffic and Transport.

Table 6-14: Safeguards and management measures for traffic and transport

Impact	Environmental safeguards	Responsibility	Timing	Reference
TT1 - traffic and transport	<p>A Traffic Management Plan (TMP) would be prepared and implemented as part of the CEMP. The TMP would be prepared in accordance with the Roads and Maritime <i>Traffic Control at Work Sites Manual</i> (RTA, 2010) and <i>QA Specification G10 Control of Traffic</i> (Roads and Maritime, 2008). The TMP would include:</p> <ul style="list-style-type: none"> • Confirmation of haulage routes • Measures to maintain access to local roads and properties • Site specific traffic control measures (including signage) to manage and regulate traffic movement • Measures to maintain pedestrian and cyclist access • Requirements and methods to consult and inform the local community of impacts on the local road network 	Contractor	Construction	Standard safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> • Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads. • A response plan for any construction traffic incident • Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic • Monitoring, review and amendment mechanisms. 			
TT2 – compound site management	Ancillary facility sites would be securely fenced with fencing maintained to ensure continual site security.	Contractor	Pre-construction Construction	Additional safeguard
TT3 – compound site management	Boundary screening would need to be erected around ancillary facility sites that are adjacent to sensitive receivers for the duration of construction, unless otherwise agreed with Council and affect residents, businesses and landowners.	Contractor	Pre-construction Construction	Additional safeguard
TT4 - compound site management	Signage on fencing or hoardings surrounding construction ancillary facilities must identify the project and have a project telephone number, postal address and email address. Signage must be available before the commencement of work and for the duration of construction.	Transport Contractor	Construction	Additional safeguard
TT5 – compound site management	Upon construction completion, temporary compound sites, work areas and established stockpiles, would be safely disassembled with the site cleared of all rubbish and site restored to its previous condition.	Transport Contractor	Construction	Additional safeguard
TT6 – Bus routes	Relevant bus route operators would be notified of the proposed works and timing of works.	Contractor	Pre-construction	Additional safeguard
TT7 – bus routes	Temporary bus furniture and bus signage would need to be installed to accommodate for temporary route changes, where relevant.	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
TT8 – cyclist and pedestrian safety	<p>The TMP would investigate the opportunity to maintain cyclist and pedestrian routes in areas that would not be impacted by construction activities.</p> <p>Where routes cannot be maintained, route diversions are to be communicated to local cyclist groups, the local community local community and to specialist groups (ie local cycling groups/forums).</p> <p>Where route diversions cannot be accommodated, traffic control would be implemented to facilitate traffic flow.</p>	Contractor	Construction	Additional safeguard
TT9 – local roads used for haulage	Council must be consulted for any additional local roads that are proposed to be used for haulage of spoil and fill. Use of these roads cannot be undertaken until Council has been consulted.	Transport Contractor	Pre-construction Construction	Additional safeguard
TT10 – heavy vehicles haulage impacting roads	<p>Before any local road is used by a heavy vehicle for the purposes of construction of the project, a Road Dilapidation Report must be prepared.</p> <p>A copy of the Road Dilapidation Report must be provided to Council before the road is used by heavy vehicles associated or required by the project.</p>	Transport Contractor	Pre-construction	Additional safeguard

6.3 Noise and vibration

This section describes the potential noise and vibration impacts associated with the proposal. This section is informed by the noise and vibration assessment (SLR, 2021) which is provided in Appendix E.

6.3.1 Methodology

The methodology for the noise and vibration assessment involved:

- Identifying the noise and vibration assessment study area and associated sensitive receivers
- Measuring the existing background noise levels at five noise monitoring locations
- Carrying out traffic count surveys to calibrate the existing road traffic noise models
- Grouping sensitive receivers that are located at similar distances from noise generating activities into noise catchment areas (NCA)
- Describing the existing noise environment for each NCA
- Defining relevant assessment criteria to assess noise and vibration impacts
- Identifying 'realistic worst-case' construction scenarios and representative plant and equipment for each scenario
- Predicting and assessing construction noise levels for the construction scenarios using noise modelling software in accordance with the Interim Construction Noise Guideline (ICNG) (DECC, 2009) and Construction Noise and Vibration Guideline (CNVG; Roads and Maritime, 2016)
- Calculating and assessing construction vibration using source vibration levels and minimum working distances in accordance with relevant guidelines
- Assessing the predicted operational road traffic noise levels using noise modelling software in accordance with the Road Noise Policy (DECCW, 2011)
- Recommending safeguards and management measures to be implemented to minimise noise and vibration impacts during construction and operation of the proposal, with reference to the CNVG and Noise Mitigation Guideline (NMG) (Roads and Maritime, 2015).

Noise monitoring

Noise monitoring was undertaken to determine the existing background noise environment near the proposal. Unattended noise monitoring was completed in the proposal area during October 2020. The noise monitoring locations (refer to Figure 6.9) were chosen to be representative of the different noise catchment areas surrounding the proposal. The noise monitoring equipment continuously measured existing noise levels in 15-minute periods during the daytime, evening and night-time. Traffic count surveys were carried out alongside the long-term unattended noise monitoring surveys to calibrate the road traffic noise volumes.

Short-term attended noise monitoring was also completed at each monitoring location. The attended measurements allow the contributions of the various noise sources at each location to be determined.

Construction noise and vibration assessment model and scenarios

Construction noise at sensitive receivers was modelled using SoundPLAN V8 software. Seven construction scenarios were developed for the purpose of the noise modelling to provide 'realistic worst-case' activity sequences for different construction activities. These scenarios are listed in Table 6-15.

Table 6-15: Construction scenarios

Scenario ID	Scenario
W.01	Site establishment and demobilisation
W.02	Utilities, early works and earthworks – peak
W.03	Utilities, early works and earthworks – typical
W.04	Road and intersection upgrades – peak
W.05	Road and intersection upgrades – typical
W.06	Compound operation
W.07	Finishing work

The scenarios represent one possible way that the proposal could be constructed and may not necessarily be the same methodology that the contractor engaged to construct the proposal would use. The final construction methodology (including the full plant and equipment list) and the expected construction noise levels would be confirmed during detailed design. These scenarios are discussed in detail in Section 4.1 of Appendix E to the REF.

Some construction activities have been separated into ‘peak’ and ‘typical’ work scenarios. ‘Peak’ work describes the noisiest stages of construction when noise intensive equipment, such as concrete saws, are in use. While ‘peak’ work would be required at certain times in most locations, it is expected this work would only last for relatively short periods of the overall work duration. ‘Typical’ work describes noise from construction activities when noise intensive equipment is generally not in use.

The assessment has considered potential noise impacts from work during standard working hours for all scenarios as well as during evening and night-time periods for scenarios W.02, W.03, W.04, W.05 and W.06. Refer to Section 3.3.3 for more information on the proposed construction hours.

Operational noise assessment model and scenarios

A noise model has been used to predict noise levels from the operation of the proposal to the surrounding receivers. The noise model used the CoRTN algorithm in SoundPLAN V8 software. Various inputs and parameters were applied to the model including local terrain, surrounding buildings, typical vehicle speeds, traffic volumes, vehicle types and road surfaces (refer Section 4.5.4 in Appendix E to the REF).

The operational study area has been defined as 600 metres from the centre of the outside lanes of the proposal, as required by the Noise Criteria Guideline (NCG) (Roads and Maritime, 2015). Roads where design or engineering changes are proposed as part of the proposal are considered as ‘project’ roads. Existing roads with no upgrades or work occurring are considered ‘non-project’ roads. All major roads in the proposal area have been modelled together with major roads on the surrounding road network to determine the contributions from ‘project’ and ‘non-project’ roads at individual receivers, as required by the NCG. Project and non-project roads are shown in Appendix D of the noise and vibration assessment included in Appendix E to the REF.

The NCG requires transition zones to be applied at the point where road categories change from ‘new’ to ‘redeveloped’ to provide a smooth transition in noise criteria. Transition zones are not applicable to this proposal as the operational road traffic criteria is entirely ‘redeveloped’.

Operational traffic noise levels were modelled for the following scenarios:

- Year of opening (2026) without the proposal ('no build')
- Year of opening (2026) with the proposal ('build')
- 10 years after opening (2036) without the proposal ('no build')
- 10 years after opening (2036) with the proposal ('build').

The noise model was validated using the measured road traffic volumes and background noise measurements in the proposal area. Based on the comparison of measured and predicted road traffic noise levels, the model was considered to perform as expected and was deemed valid for predicting road traffic noise levels for the proposal. Refer to Section 4.5.5 in Appendix E to the REF for further details.

6.3.2 Existing environment

Noise catchment areas and sensitive receivers

The work areas are close to residential receivers along Mulgoa Road. Nine NCAs have been identified surrounding the proposal, with each representing an area that contains a group of receivers that may be similarly affected by noise from the proposal. This reflects the different land uses and existing background noise levels within and surrounding the proposal area. The NCAs for the proposal are shown in Figure 6.9 and are described in Table 6-16. A comprehensive list of 'other sensitive' receivers (non-residential) identified within the study area is provided in Section 2.1 of Appendix E to the REF.

Table 6-16: Sensitive receiver noise catchment areas

Area	Minimum distance ¹	Description of the area
NCA01	<10m	NCA01 covers sensitive receivers in Regentville, north-west of Glenmore Parkway and Mulgoa Road. The receivers in this area consist of childcare centres, a place of worship and outdoor recreation areas.
NCA02	<10m	NCA02 covers sensitive receivers west of Glenmore Parkway and consist of an educational facility and outdoor recreation areas.
NCA03	30m	NCA03 covers sensitive receivers west of Mulgoa Road, between the M4 Motorway and Surveyors Creek, and consists of commercial properties, with a hotel.
NCA04	<10m	NCA04 covers sensitive receivers east of Mulgoa Road, between the M4 Motorway and Surveyors Creek. The receivers in this area consist of educational facilities, childcare centres and outdoor recreational areas.
NCA05	<10m	NCA05 covers sensitive receivers east of Mulgoa Road, between Surveyors Creek and Jamison Road. The receivers in this area consist of outdoor recreational areas and residents.
NCA06	<10m	NCA06 covers sensitive receivers west of Mulgoa Road, between Surveyors Creek and Jamison Road. The receivers in this area consist of a childcare centre, place of worship and residents.
NCA07	<10m	NCA07 covers sensitive receivers east of Mulgoa Road, between Jamison Road and Union Road. The receivers in this area consist of commercial properties such as hotels and outdoor recreational areas.

Area	Minimum distance ¹	Description of the area
NCA08	300m	NCA08 covers sensitive receivers east of Mulgoa Road along the Nepean River. The receivers in this area consist of childcare centres and outdoor recreational areas.
NCA09	<10m	NCA09 covers sensitive receivers west of Mulgoa Road, between Jamison Road and Union Road. The receivers in this area consist of commercial properties and outdoor recreational areas.

¹) Approximate minimum distance from the proposed work to the nearest receiver building in each NCA

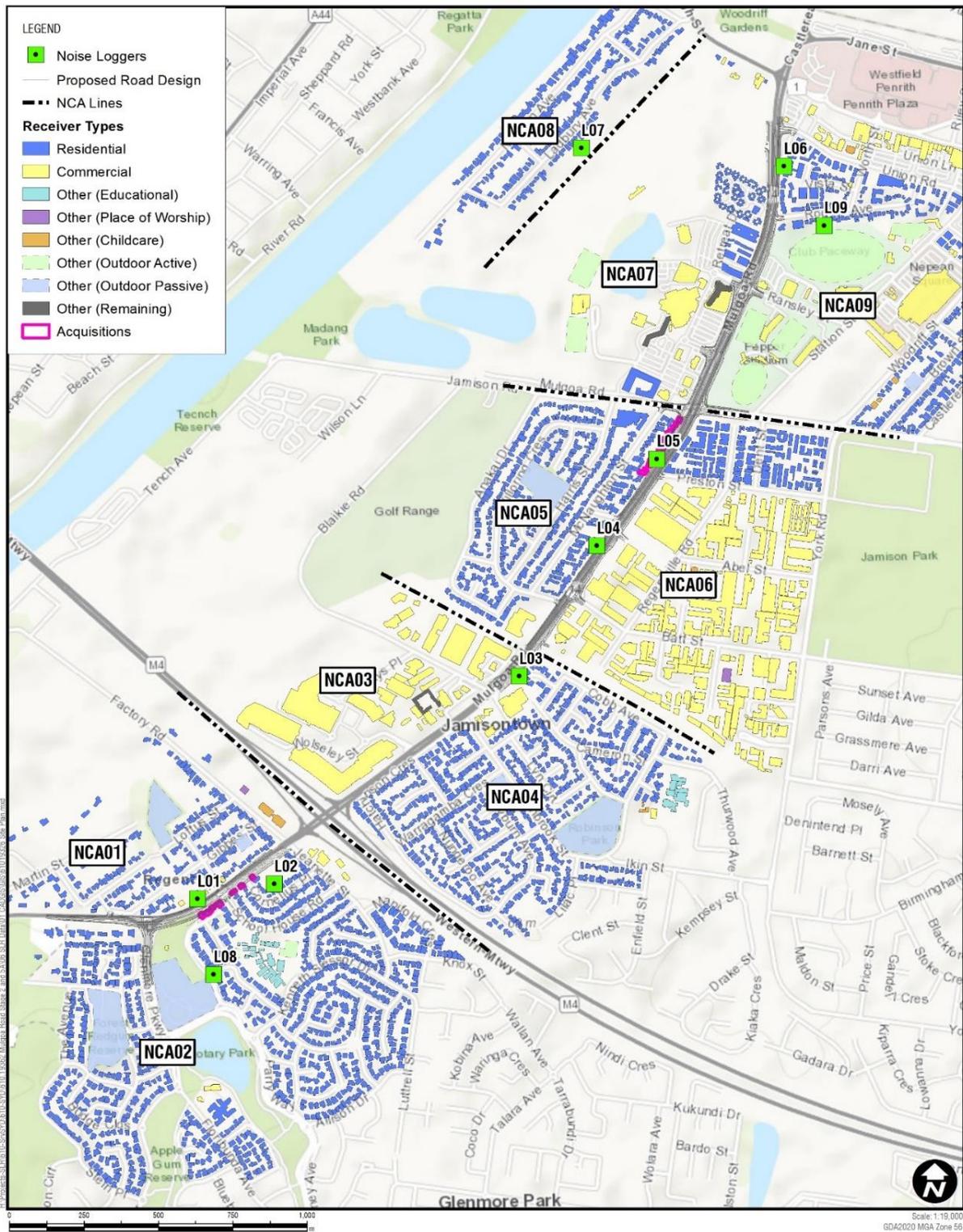


Figure 6-9: Site plan, receivers and noise monitoring locations

Background noise levels

Existing noise levels in the proposal area are generally dominated by road traffic noise from the M4 Motorway, Mulgoa Road and Jamison Road. The noise monitoring results of the existing noise levels are summarised in Table 6-17. The background noise levels are represented as 'rating background noise levels' (RBLs) which refer to the median value of background noise levels measures across the monitoring period, the 'L_{Aeq}'.

Table 6-17: Background noise levels

Noise monitoring station ID	Address	Day (L _{Aeq})	Evening (L _{Aeq})	Night (L _{Aeq})
L01	42 Mulgoa Road, Regentville	59	52	37
L02	13 Cornelius Place, Regentville	46	45	33
L03	5 Fairfield Place, Jamisontown	55	52	43
L04	157 Mulgoa Road, Jamisontown	57	49	34
L05	12 John Tipping Grove, Penrith	51	46	37
L06	58 Ladbury Avenue, Penrith	38	38	36
L07	5 Massey Way, Glenmore Park	45	44	40
L08	40 Rodley Avenue, Penrith	40	40	38

6.3.3 Criteria

Construction

Construction noise assessment periods

The time periods that were adopted in the assessment are derived from the ICNG and summarised in Figure 6.10.

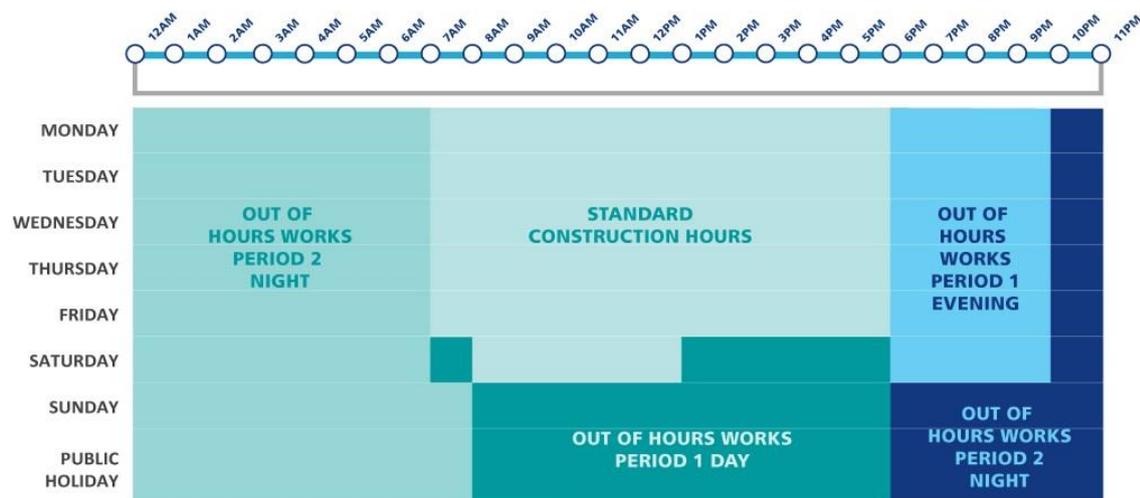


Figure 6-10: Construction hours

Note 1: Taken from the Transport for NSW Construction Noise and Vibration Strategy.

Note 2: Standard Construction Hours are Monday to Friday 7 am to 6 pm and Saturdays from 8 am to 1 pm, as defined in the ICNG.

Note 3: Work outside of Standard Construction Hours is defined as ‘Out-of-Hours Work’ (OOHW) and can be divided into two periods of sensitivity. OOHW Period 1 which relates to evening (and weekend daytime) work, and OOHW Period 2 which relates to night-time (and weekend evening) work.

Note 4: These hours do not reflect the amendments to construction hours as a result of COVID-19 as detailed in Section 3.3.3.

Construction noise criteria

The ICNG requires project-specific Noise Management Levels (NMLs) to be established for noise-affected receivers. The residential NMLs for the proposal have been determined based on the RBLs as defined in the Noise Policy for Industry (NPfI; NSW EPA, 2017) plus an additional allowance of 10 dBA during the standard work hours and 5 dBA outside of standard hours. Noise impacts that exceed the NMLs have been assessed using the perception categories taken from the CNVG as per Table 6-18.

Table 6-18: NML exceedance bands and corresponding CNVG perception categories

CNVG perception categories	Daytime – standard construction hours NML exceedance	Out of hours periods NML exceedance
Noticeable	Applicable for construction noise levels of 5-10 dBA above RBL	1 to 5 dBA
Clearly audible	1 to 10 dBA	6 to 15 dBA
Moderately intrusive	11 dBA to 20 dBA	16 dBA to 25 dBA
Highly intrusive	>20 dBA	>25 dBA

The ICNG also states that where construction noise levels are above 75 dBA at residential receivers during standard hours, they are considered ‘highly noise affected’ and require additional consideration in terms of noise mitigation and management measures.

Maximum noise levels generated by road traffic noise have the potential to cause disturbance to sleep. Residential sleep disturbance screening criteria has been established for each NCA and are provided in Table 6-19.

Table 6-19: Background monitoring criteria

NCA	Representative background monitoring location	Noise management level ($L_{Aeq(15\text{minute})}$ – dBA)				Sleep disturbance screening criteria (RBL +15 dBA)
		Standard construction (RBL +10dBA)	Out of hours (RBL +5 dBA)			
			Daytime	Daytime	Evening	
NCA01	L01	69	64	57	42	52
NCA02	L02	56	51	50	38	48
NCA03	L03	65	60	57	48	58
NCA04	L04	65	60	57	48	58
NCA05	L05	67	62	54	39	49
NCA06	L05	67	62	54	39	49
NCA07	L06	61	56	51	42	52
NCA08	L07	48	43	43	41	51
NCA09	L07	61	56	51	42	52

Note: Daytime out of hours is 7 am to 8 pm and 1 pm to 6 pm on Saturday, and 8 am to 6 pm on Sunday and public holidays.

NMLs for 'other sensitive' receivers have been determined using the ICNG and are presented in Table 6-20. The ICNG references *AS2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors* for criteria for 'other sensitive' receivers that are not listed in the guideline, which are presented in Table 6-20 and Table 6-21.

Table 6-20: ICNG NMLs for 'other sensitive' receivers

Land use	NML $L_{Aeq(15minute)}$
Classrooms at schools and other education institutions	Internal noise level 45 dBA
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants)	External noise level 65 dBA
Passive recreation areas (characterised by recreational activities that generate little noise and where benefits are compromised by external noise intrusion)	External noise level 60 dBA
Commercial	External noise level 70 dBA

Note: As the noise model predicts external noise levels, it has been conservatively assumed that all schools and places of worship have openable windows and external noise levels are 10 dBA higher than the corresponding internal level, which is representative of windows being partially open to provide ventilation.

Table 6-21: AS2107 NMLs for 'other sensitive' receivers

Use	Period	AS2107 classification	Noise management level $L_{Aeq(15minute)}$
Hotel	Daytime and evening	Bars and lounges	Internal noise level 50 dBA
Hotel	Night-time	Sleeping Areas: - Hotels near major road	Internal noise level 40 dBA
Childcare Centre	Daytime	n/a	Internal noise level 40 dBA

Note: These receivers are assumed to have openable windows with a 10 dBA reduction for external to internal noise levels.

Construction traffic noise

The potential impacts from construction traffic associated with the proposal when travelling on public roads are assessed under the NSW EPA *Road Noise Policy (RNP)* (DECCW, 2011) and CNVG. An initial screening test was first applied to evaluate whether existing road traffic noise levels were expected to increase by more than 2.0 dBA because of construction traffic. Where this was considered likely, further assessment was required using the RNP and NCG (refer to Table 6-22).

Table 6-22: RNP/NCG criteria for assessing construction traffic on public roads

Road category	Type of project/land use	Assessment criteria (dBA)	
		Daytime (7am – 10pm)	Night-time (10pm – 7am)
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments.	$L_{Aeq(15hour)}$ 60 (external)	$L_{Aeq(9hour)}$ 55 (external)

Road category	Type of project/land use	Assessment criteria (dBA)	
		Daytime (7am – 10pm)	Night-time (10pm – 7am)
Local roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments.	L _{Aeq(1hour)} 55 (external)	L _{Aeq(1hour)} 50 (external)

Construction vibration

Construction vibration impacts have been assessed using the CNVG minimum working distances for human comfort, building contents and structural/cosmetic damage.

Human comfort vibration

People can sometimes perceive vibration impacts when vibration generating construction work is located close to occupied areas and buildings. The EPA's *Assessing Vibration: a technical guideline* (DEC, 2006) was used to determine the criteria for intermittent vibration based on the Vibration Dose Value (VDV).

Structural damage criteria

If vibration from construction works is sufficiently high, it can cause cosmetic damage to structural elements of affected buildings. Industry standard cosmetic damage vibration limits are specified in British Standard *BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2* (BS 7385; BSI, 1993) and German Standard *DIN 4150: Part 3-2016 Structural vibration – Effects of vibration on structures* (DIN 4150; Deutsches Institute fur Normung, 1999).

Heritage listed buildings and structures should be considered on a case-by-case basis but as noted in BS 7385 should not be assumed to be more sensitive to vibration, unless structurally unsound. Where a heritage building is deemed to be sensitive, the more stringent DIN 4150 Group 3 guideline values can be applied.

Minimum working distances for vibration intensive work

Minimum working distances for typical vibration intensive construction equipment are provided in the CNVG and are shown in Table 6-23. The minimum working distances are for both human comfort (from the NSW EPA Vibration Guideline) and cosmetic damage (from BS 7385 and DIN 4150). They suggest that where work is further from receivers than the quoted minimum distances then impacts are not considered likely.

Table 6-23: Recommended minimum working distances from vibration intensive equipment

Plant item	Rating/description	Minimum distance		
		Cosmetic damage		Human response (NSW EPA Guideline)
		Residential and light commercial (BS 7385)	Heritage items (DIN 4150, Group 3)	
Vibratory roller	<50 kN (1–2 tonne)	5 m	11 m	15 m to 20 m
	<100 kN (2–4 tonne)	6 m	13 m	20 m
	<200 kN (4–6 tonne)	12 m	15 m	40 m

Plant item	Rating/description	Minimum distance		
		Cosmetic damage		Human response (NSW EPA Guideline)
		Residential and light commercial (BS 7385)	Heritage items (DIN 4150, Group 3)	
	<300 kN (7–13 tonne)	15 m	31 m	100 m
	>300 kN (13–18 tonne)	20 m	40 m	100 m
	>300 kN (>18 tonne)	25 m	50 m	100 m
Small hydraulic hammer	300 kg (5 to 12 tonne excavator)	2 m	5 m	7 m
Medium hydraulic hammer	900 kg (12 to 18 tonne excavator)	7 m	15 m	23 m
Large hydraulic hammer	1,600 kg (18 to 34 tonne excavator)	22 m	44 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	5 m to 40 m	20 m
Piling rig – bored	≤ 800 mm	2 m (nominal)	5 m	4 m
Jackhammer	Hand-held	1 m (nominal)	3 m	2 m

More information about construction vibration criteria can be found in Section 3.1.4 of the noise and vibration assessment included in Appendix E to the REF.

Operations

Operational noise

The RNP (DECCW, 2011) is used to assess and manage potential noise impacts from new and redeveloped road projects. This assessment is undertaken with guidance from the NCG (Roads and Maritime, 2015), which is Transport’s interpretation of the RNP and provides a consistent approach to identifying road noise criteria for infrastructure projects.

The NCG criteria for residential receivers are shown in Table 6-24 and the NCG criteria for ‘other sensitive’ receivers are shown in Table 6-25. The NCG does not consider commercial and industrial receivers as being sensitive to operational road traffic noise impacts.

Table 6-24: NCG criteria for residential receivers

Road category	Type of project/land use	Assessment criteria (dBA)	
		Daytime (7am – 10pm)	Night-time (10pm – 7am)
Freeway/arterial/sub-arterial roads	2. Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial roads.	L _{Aeq(15 hour)} 60 (external)	L _{Aeq(9 hour)} 55 (external)
	6. Existing residences affected by increases in traffic noise of 12 dBA or more from redevelopment of existing freeway/arterial/sub-arterial roads.	Between L _{Aeq(15hour)} 42-60 (external)	Between L _{Aeq(9hour)} 42-55 (external)

Road category	Type of project/land use	Assessment criteria (dBA)	
		Daytime (7am – 10pm)	Night-time (10pm – 7am)
Local roads	8. Existing residences affected by noise from redevelopment of existing local roads.	L _{Aeq} (1 hour) 55 (external)	L _{Aeq} (1 hour) 50 (external)

Table 6-25: NCG criteria for other sensitive receivers

Existing sensitive land use	Assessment criteria (dBA)	
	Daytime (7am – 10pm)	Daytime (7am – 10pm)
1. School classrooms	L _{Aeq} (1 hour) 40 (internal)	-
2. Hospital wards	L _{Aeq} (1 hour) 35 (internal)	L _{Aeq} (1 hour) 35 (internal)
3. Places of worship	L _{Aeq} (1 hour) 40 (internal)	L _{Aeq} (1 hour) 40 (internal)
4. Open space (active use)	L _{Aeq} (15 hour) 60 (external)	-
5. Open space (passive use)	L _{Aeq} (15 hour) 55 (external)	-
6. Childcare facilities	Sleeping rooms L _{Aeq} (1 hour) 35 (internal) Indoor play areas L _{Aeq} (1 hour) 40 (internal) Outdoor play areas L _{Aeq} (1 hour) 55 (internal)	-
7. Aged care facilities	-	-

Note: refer to Section 3.2.1 of Appendix E in the REF for further detail.

The NMG provides guidance to control road traffic noise and describes the principles to be applied when reviewing noise mitigation for predicted exceedances of the adopted NCG criteria.

The NMG provides three triggers where receivers may qualify for considerations of 'additional noise mitigation':

- **Trigger 1** – the predicted noise level with the proposal exceeds the NCG controlling criterion and the noise level increase due to the proposal (i.e. the noise predictions for with the proposal minus without the proposal) is greater than 2 dBA
- **Trigger 2** – the predicted noise level with the proposal is 5 dBA or more above the NCG controlling criterion (i.e. exceeds the cumulative limit) and the receiver is significantly influenced by project road noise, regardless of the incremental impact of the proposal
- **Trigger 3** – the noise level contribution from the road project is acute (daytime L_{Aeq}(15hour) 65 dBA or higher, or night-time L_{Aeq}(9hour) 60 dBA or higher) even if noise levels are controlled by a non-project road.

The eligibility of receivers for consideration of 'additional noise mitigation' is determined before mitigation measures such as low noise pavement and noise barriers are included. The requirement for the proposal is to provide feasible and reasonable additional mitigation to eligible receivers with the aim of meeting the NCG controlling criterion.

Maximum noise level

The RNP and *Environmental Noise Management Manual* (ENMM) (Roads and Traffic Authority, 2001) both require a maximum noise level assessment to be undertaken for new and redeveloped road infrastructure projects. Its purpose is to determine where maximum noise levels are likely to change because of a proposal.

The maximum noise level assessment included an evaluation of the number and distribution of night-time events in accordance with the ENMM. A maximum noise level event is defined as being any pass-by where:

- The maximum noise level of the event is greater than 65 dBA L_{AFmax}

and

- The $L_{AFmax} - L_{Aeq(1hour)}$ is greater than or equal to 15 dBA.

6.3.4 Potential impacts

Construction

Residential receivers

A summary of the predicted construction noise impacts in each NCA for residential receivers for daytime, evening and night is shown in Table 6-27 – 6-18. The key to these exceedances are summarised in Table 6-26. These show the predicted worst-case construction noise exceedances for each construction scenario during standard daytime hours, evening out-of-hours and night-time out-of-hours work periods, respectively.

The predicted construction noise impacts are presented for the residential receivers within each NCA that have the potential to be the most affected by construction noise from the proposal. Receivers which are further away from the work and/or shielded from view would likely experience lower noise levels and impacts.

For most work, the construction noise impacts would frequently be lower than predicted as the worst-case situation is typically only for short periods when noisy equipment is in use nearby.

Table 6-26: NML exceedance bands and corresponding key

CNVG perception categories	Symbol	NML exceedance – daytime – standard construction hours	NML exceedance – out of hours periods
Noticeable	N	>1	1 to 5 dBA
Clearly Audible	CA	1 to 10 dBA	6 to 15 dBA
Moderately Intrusive	MI	11 to 20 dBA	16 to 25 dBA
Highly Intrusive	HI	>20 dBA	>25 dBA
No work expected during this period	N/a	-	-

Table 6-27: Predicted worst-case construction noise exceedances – residential receivers - daytime

ID	Scenario	NCA01	NCA02	NCA03	NCA04	NCA05	NCA06	NCA07	NCA08	NCA09
W.01	Site establishment and demobilisation	CA	HI	-	MI	MI	CA	MI	-	MI
W.02	Utilities, early works and earthworks - peak	MI	HI	-	HI	HI	MI	HI	CA	HI
W.03	Utilities, early works and earthworks - typical	CA	MI	-	CA	CA	CA	MI	-	MI
W.04	Road and intersection upgrade – peak	HI	HI	-	HI	HI	HI	HI	CA	HI
W.05	Road and intersection upgrade – typical	CA	HI	-	CA	CA	CA	MI	-	MI
W.06	Compound operation	-	MI	-	-	-	-	-	CA	CA
W.07	Finishing work	CA	MI	-	CA	CA	CA	MI	-	MI

Table 6-28: Predicted worst-case construction noise exceedances – residential receivers - evening

ID	Scenario	NCA01	NCA02	NCA03	NCA04	NCA05	NCA06	NCA07	NCA08	NCA09
W.02	Utilities, early works and earthworks - peak	HI	HI	-	HI	HI	HI	HI	CA	HI
W.03	Utilities, early works and earthworks - typical	MI	MI	-	CA	MI	MI	MI	-	MI
W.04	Road and intersection upgrade – peak	HI	HI	-	HI	HI	HI	HI	CA	HI
W.05	Road and intersection upgrade – typical	MI	HI	-	MI	MI	MI	MI	-	MI
W.06	Compound operation	N	MI	-	-	-	-	CA	CA	CA

Note: 'W.01 Site establishment and demobilisation' and 'W.07 Finishing work' were not included in table as no work is expected during these periods.

Table 6-29: Predicted worst-case construction noise exceedances – residential receivers - night

ID	Scenario	NCA01	NCA02	NCA03	NCA04	NCA05	NCA06	NCA07	NCA08	NCA09
W.02	Utilities, early works and earthworks - peak	HI	HI	-	HI	HI	HI	HI	CA	HI
W.03	Utilities, early works and earthworks - typical	HI	HI	-	MI	HI	HI	HI	-	HI

ID	Scenario	NCA01	NCA02	NCA03	NCA04	NCA05	NCA06	NCA07	NCA08	NCA09
W.04	Road and intersection upgrade – peak	HI	HI	-	HI	HI	HI	HI	CA	HI
W.05	Road and intersection upgrade – typical	HI	HI	-	HI	HI	HI	HI	-	HI
W.06	Compound operation	MI	HI	-	-	-	N	MI	CA	MI

Note: ‘W.01 Site establishment and demobilisation’ and ‘W.07 Finishing work’ were not included in table as no work is expected during these periods.

The assessment for the most affected residential receivers in each NCA during the worst-case impacts shows that:

- The highest noise levels and impacts would be experienced by adjacent residential receivers when construction work is nearby. Where receivers are further away the predicted noise impacts are lower.
- The highest noise impacts are expected to occur when noise intensive equipment is being used such as chainsaws, chippers, concrete saws or rockbreakers. These items of equipment would only, however, be required occasionally and would be unlikely to be in use for long periods of time.
- The noise impacts during the daytime are predicted to be ‘highly intrusive’ at the nearest receivers in several NCAs during some of the noisier scenarios, including W.01, W.02, W.04 and W.05.
- Only certain work would be completed during the night-time. The night-time impacts are expected to be ‘highly intrusive’ when noisy work is being completed near to receivers.
- For most scenarios, the noisiest work would only be required for a relatively short period of the work shift. Noise levels and impacts at other times would be much lower than the worst-case levels predicted.
- The worst-case predicted noise levels are likely to be Highly Noise Affected (i.e. ≥ 75 dBA) for the front-row of residential receivers on Mulgoa Road when noisy work, such as work involving a concrete saw, is being completed nearby.

All receiver types

The impacts presented in the following scenarios are based on all equipment working at the same time. There would frequently be periods when construction noise levels are much lower than the worst-case levels predicted and there would be times when no equipment is in use and no impacts occur.

The highest daytime construction noise impacts are predicted during ‘W.02 – Utilities, early works and earthworks – peak’ when noise intensive equipment such as a concrete saw is in use. ‘Utilities, early works and earthworks’ has been assumed to occur anywhere within the proposal area and would include work associated with utilities, installing fencing and establishing access.

Figure 6.11 shows that the front-row residential receivers are predicted to have ‘highly intrusive’ worst-case daytime impacts when noise intensive work is being completed nearby as part of ‘W.02 – Utilities, early works and earthworks – peak’. Residential receivers on the rows further back are predicted to experience much lower worst-case daytime noise levels.

Figure 6.12 shows that when noise intensive equipment is not in use as part of 'W.03 – Utilities, early works and earthworks – typical', the worst-case noise impacts are substantially reduced. Front-row residential receivers are expected to experience 'moderately intrusive' or 'clearly audible' impacts when work is nearby.

Certain construction activities that may result in traffic restrictions are likely to be carried out during the night-time to minimise disruption to traffic and provide a safer working environment for construction workers. Noise intensive equipment such as concrete saws may be required at times during out of hours work.

The highest night-time construction noise impacts are predicted during '*W.02 – Utilities, early works and earthworks – peak*' when noise intensive equipment such as a concrete saw is in use.

The following figures show that the predicted noise impacts during night-time work are more widespread than the daytime scenarios, which is due to lower NMLs during this period.

Figure 6.13 shows work scenario '*W.02 – Utilities, early works and earthworks – peak*' when noise intensive equipment such as a concrete saw is being used. Residential receivers near the works on Mulgoa Road are predicted to have 'highly intrusive' worst-case night-time impacts when noisy equipment is being used, with more distant receivers generally having 'moderately intrusive' or 'clearly audible' worst-case impacts.

When noise intensive equipment is not being using as part of 'W.03 – Utilities, early works and earthworks – typical', the impacts shown in Figure 6.14 are substantially reduced, however, the front-row receivers are predicted to still experience 'highly intrusive' worst-case night-time noise levels.

The predicted night-time noise impacts during 'W.06 – Compound operation' are reduced further relative to scenarios W.02 and W.03 (shown in Figure 6.15). Residential receivers surrounding the compounds are predicted to be impacted.

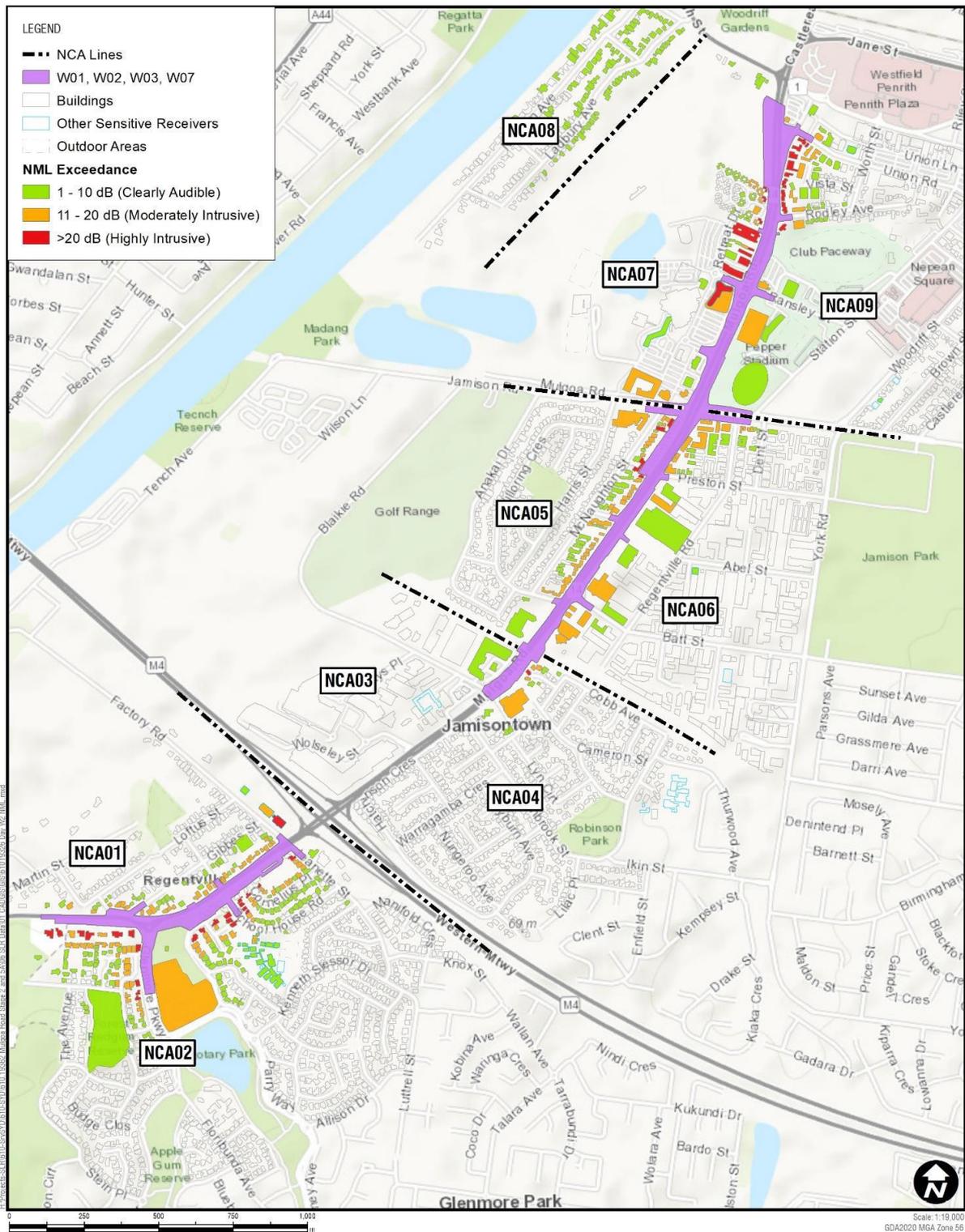


Figure 6-11: Predicted impacts during 'W.02 – Utilities, early works and earthworks – peak' (Daytime)

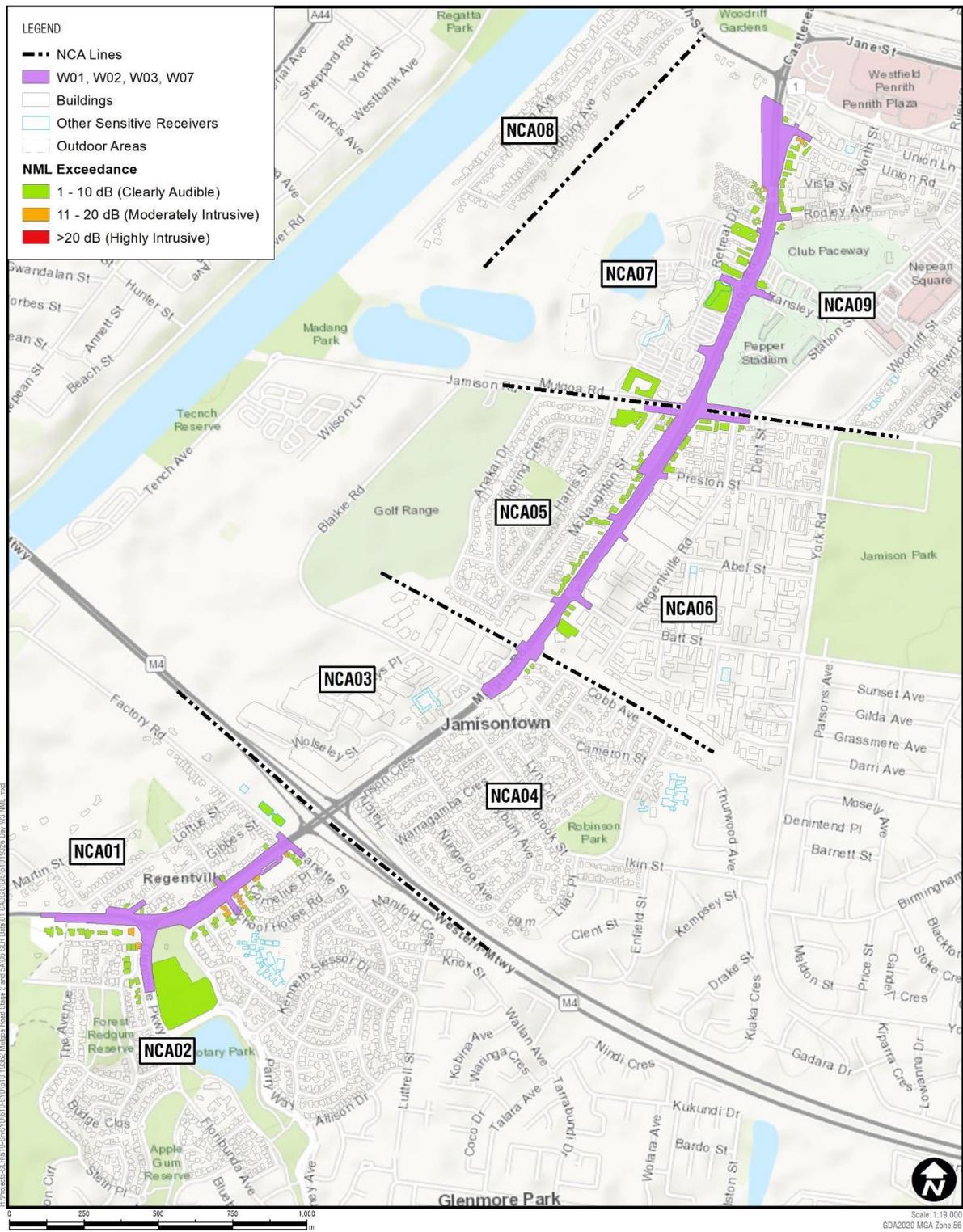


Figure 6-12: Predicted impacts during 'W.03 – Utilities, early works and earthworks – typical' (Daytime)

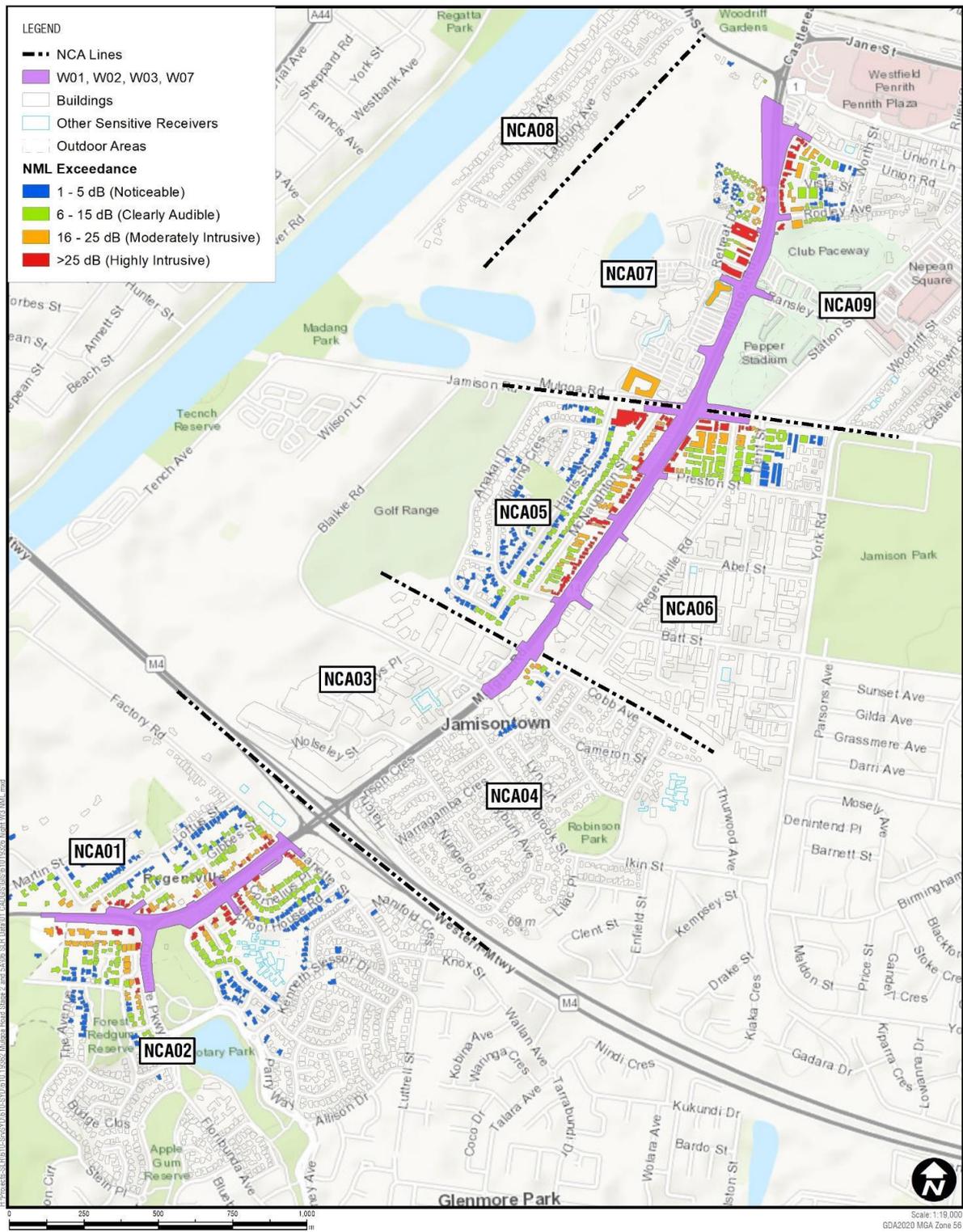


Figure 6-14: Predicted impacts during 'W.03 – Utilities, early works and earthworks – typical' (Night-time)

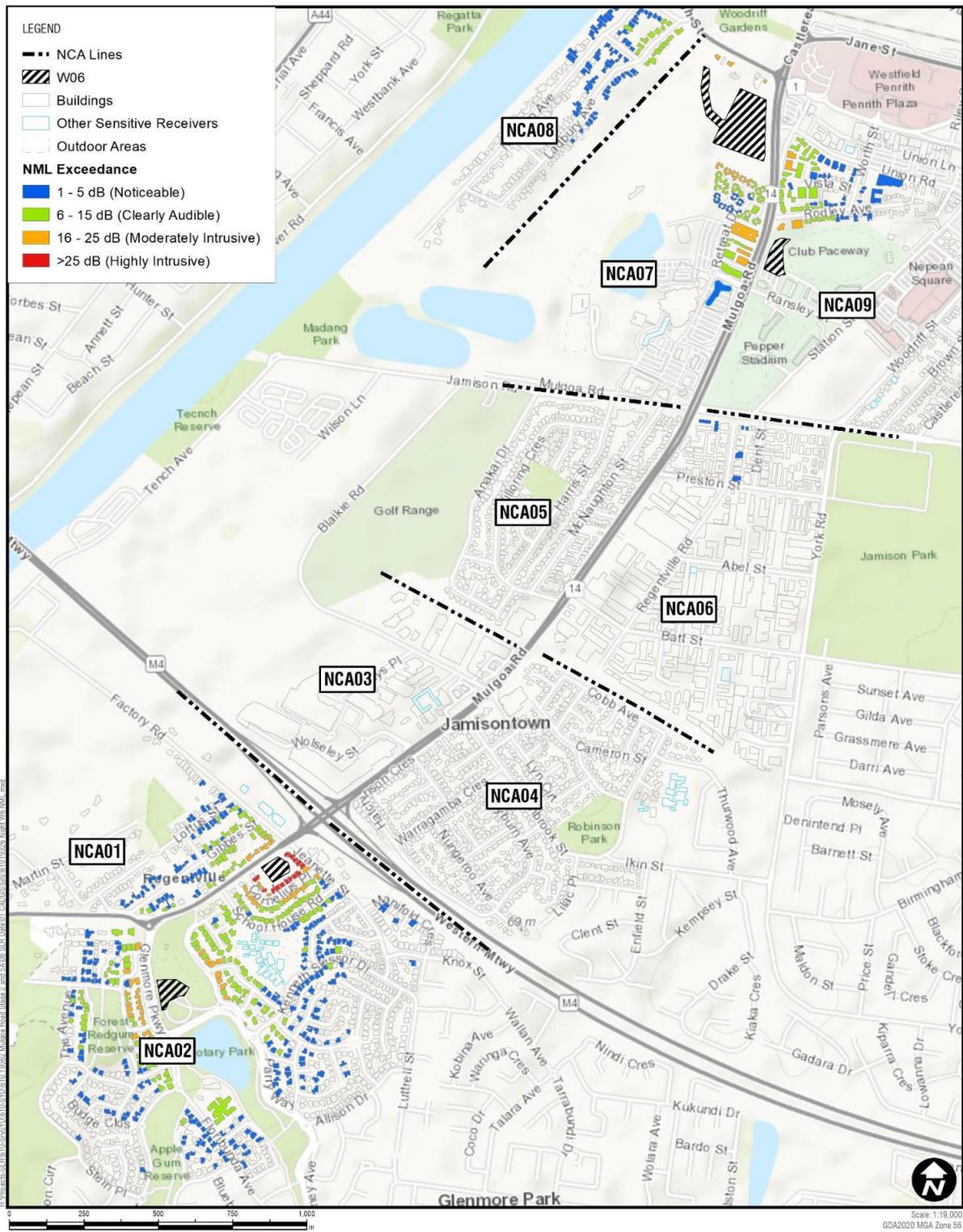


Figure 6-15: Predicted impacts during 'W.06 – Compound operation' (Night-time)

Highly noise affected residential receivers and sleep disturbance

Residential receivers that are subject to noise levels of 75 dBA or greater are considered highly noise affected by the ICNG. Receivers can be highly noise affected when noisy work occurs close to residents. Front-row residential receivers on Mulgoa Road are predicted to be Highly Noise Affected when noise intensive work is being carried out nearby. The highest noise levels would only likely be apparent for relatively short periods. The residential receivers which may be highly noise affected during the worst-case impacts from the proposal are shown in Table 6-30 and Figure 6.16.

Table 6-30: Predicted number of highly noise affected residential receivers

ID	Scenario	NCA01	NCA02	NCA03	NCA04	NCA05	NCA06	NCA07	NCA08	NCA09
W.01	Site establishment and demobilisation	4	5	-	1	6	6	1	-	3
W.02	Utilities, early works and earthworks - peak	36	32	-	4	44	17	15	-	14
W.03	Utilities, early works and earthworks - typical	-	1	-	-	-	-	-	-	-
W.04	Road and intersection upgrades - peak	36	18	-	4	32	13	14	-	12
W.05	Road and intersection upgrades - typical	4	1	-	-	1	3	-	-	-
W.06	Compound operation	-	-	-	-	-	-	-	-	-
W.07	Finishing work	-	3	-	-	1	-	1	-	-

A sleep disturbance screening assessment has been undertaken for the construction work. The sleep disturbance screening criterion is likely to be exceeded when night work occurs near residential receivers. The receivers which would potentially be affected by sleep disturbance impacts are generally the same receivers where night-time impacts have been predicted.

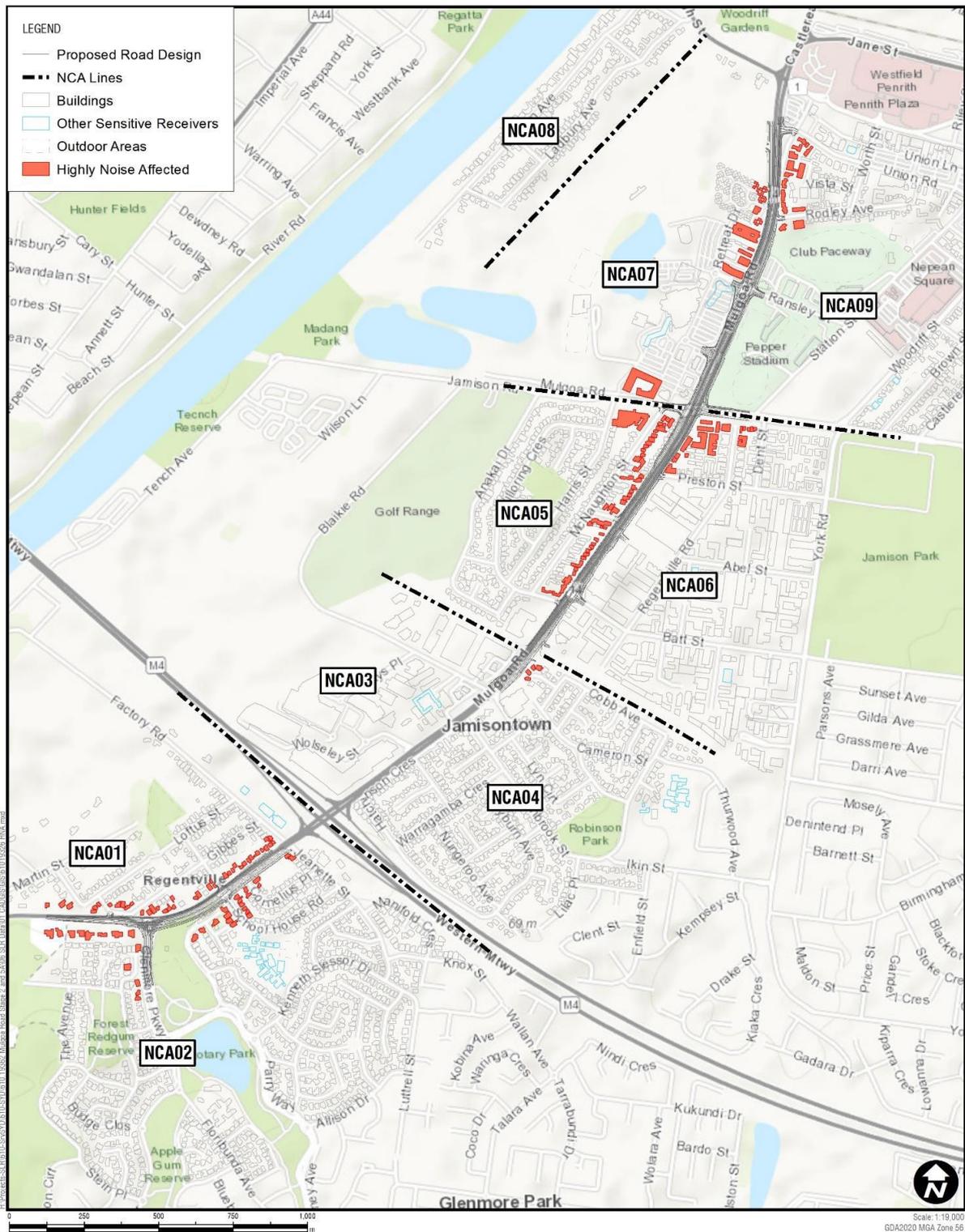


Figure 6-16: Highly noise affected residential receivers (from any work scenario)

Commercial/industrial and ‘other sensitive’ receivers

A summary of the predicted construction noise impacts in each NCA for commercial/industrial and ‘other sensitive’ receivers is presented in Table 6-31. The assessment of commercial/industrial and ‘other sensitive’ receivers shows ‘highly intrusive’ or ‘moderately intrusive’ worst-case impacts are predicted at the nearest ‘other sensitive’ and commercial receivers when noisy work is nearby.

Table 6-31: Overview of commercial/industrial and ‘other sensitive’ receiver NML exceedances: Number of receiver buildings affected

ID	Scenario	Place of worship – when in use	Outdoor areas – daytime	Hotel – daytime	Education – daytime	Childcare centre – when in use	Commercial/ industrial – when in use
W.01	Site establishment and demobilisation	-	Clearly audible: 1	Moderately intrusive: 1	Clearly audible: 1	Clearly audible: 1 Moderately intrusive: 1	Clearly audible: 14
W.02	Utilities, early works and earthworks - peak	Clearly audible: 1	Clearly audible: 1 Moderately intrusive: 1	Clearly audible: 1 Highly intrusive: 1	Clearly audible: 5 Moderately intrusive: 1	Clearly audible: 3 Moderately intrusive: 1 Highly intrusive: 1	Clearly audible: 22 Moderately intrusive: 17
W.03	Utilities, early works and earthworks - typical	-	-	Clearly audible: 1	-	Clearly audible: 2	Clearly audible: 7
W.04	Road and intersection upgrade – peak	Clearly audible: 1	Clearly audible: 1 Moderately intrusive: 1	Clearly audible: 1 Highly intrusive: 1	Clearly audible: 6	Clearly audible: 1 Moderately intrusive: 2	Clearly audible: 15 Moderately intrusive: 13 Highly intrusive: 1
W.05	Road and intersection upgrade – typical	-	Clearly audible: 1	Clearly audible: 1	-	Clearly audible: 1	Clearly audible: 9
W.06	Compound operation	-	-	-	-	Clearly audible: 1	-
W.07	Finishing work	-	-	Clearly audible: 1	-	Clearly audible: 2	Clearly audible: 8

Construction vibration

Vibration offset distances for the vibration intensive equipment required to complete the work have been determined from the CNVG minimum working distances for cosmetic damage and human response. Figure 6.17 shows the buildings with the determined minimum working distances.

The figure shows that front-row receivers on Mulgoa Road are likely to be within the minimum working distance for cosmetic damage and mitigation would need to be considered. Buildings in other parts of the study area are generally sufficiently distant to be outside the minimum distance.

Certain receivers in the study area are also within the human comfort minimum working distance and occupants of affected buildings may be able to perceive vibration impacts at times when vibration intensive equipment is in use. These impacts would likely only be apparent for relatively short durations.

Workmens' Cottages is located within five metres of the proposed road works, at 56–62 Mulgoa Road, Jamisontown. This is within the cosmetic damage minimum working distance for a vibratory roller.

Cumulative impacts

There is potential for cumulative construction impacts from multiple construction activities being completed in different areas of the proposal. Since the construction scenarios required for various stages of the proposal would generally require similar items of equipment, concurrent construction work being completed near to a particular area could increase the worst-case noise levels in this report by around 3 dBA.

The likelihood of worst-case noise levels being generated by two different work activities at the same time is considered low and rather than increase construction noise levels, the impact of concurrent work would generally be a limited to a potential increase in the duration, and annoyance, of noise impacts on the affected receivers.

Construction traffic noise assessment

Construction related traffic has the potential to temporarily increase road traffic noise levels at receivers that are near to haulage routes. However, the proposal would require relatively low numbers of construction traffic compared to the high existing volumes on major roads in the area. As such, the potential increase in noise due to construction traffic would be negligible (i.e. less than 0.1 dBA) and is not expected to result in any noticeable traffic noise impacts.

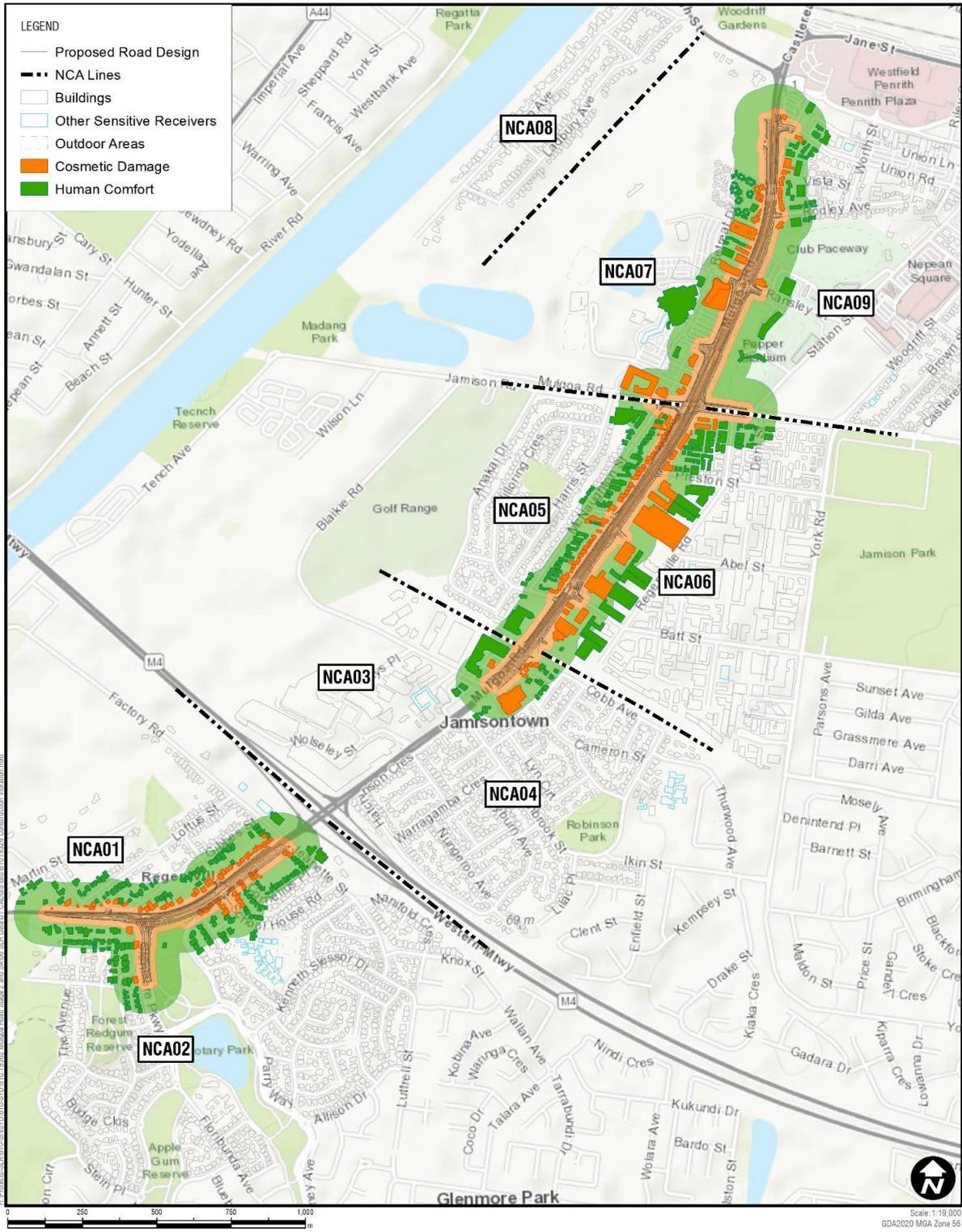


Figure 6-17: Construction vibration assessment

Operation

Operational road traffic noise impacts from the proposal 'without mitigation' have been predicted for all sensitive receivers in the study area. The operational impacts are discussed in the following sections.

Residential receivers

Receivers are generally most affected by the proposal in the daytime period in 2036, due to higher traffic volumes. This scenario is considered to provide worst-case impacts and requirements for mitigation.

The predicted noise levels for the daytime scenario in 2036 are shown in Figure 6.18 and the predicted change in noise levels for the same scenario is shown in Figure 6.19.

The results from the modelled scenarios show that:

- The nearest residential receivers to the proposal are subject to relatively high existing road traffic noise levels, which already exceed the NCG criterion in many cases.
- The proposal is generally not predicted to substantially alter operational road traffic noise levels in the study area, with the majority of receivers predicted to experience noise levels after the proposal is built that are within around 1 dBA of noise levels without the proposal. Noise levels are, however, predicted to increase by more than 2 dBA in some locations.
- Exceedances of the NCG cumulative limit criteria are predicted at most first-row residential receivers on Mulgoa Road.
- Most front-row residential receivers are also predicted to be subject to acute noise levels.

In summary, the proposal is predicted to result in:

- 32 residential receivers experiencing increases in traffic noise of greater than 2 dBA
- 143 residential receivers experiencing noise levels above the cumulative limit criteria
- 133 residential receivers experiencing acute noise levels
- 148 residential receiver buildings are considered eligible for consideration of additional noise mitigation, as per the operational road traffic noise criteria. These exceedances are generally due to relatively high road traffic levels, both with and without the proposal, combined with increases in noise in certain areas.

Certain areas of residential properties next to Mulgoa Road have existing private fencing along the boundary with the road corridor, which would likely provide some degree of shielding to the residential receivers. Operational noise modelling does not typically take into account the effect of boundary fencing and it is likely that the existing boundary fences could provide at least 5 dBA additional attenuation of the noise levels. Therefore, where private boundary fences exist that are in good condition the operational noise assessment results are considered conservative for these receivers.

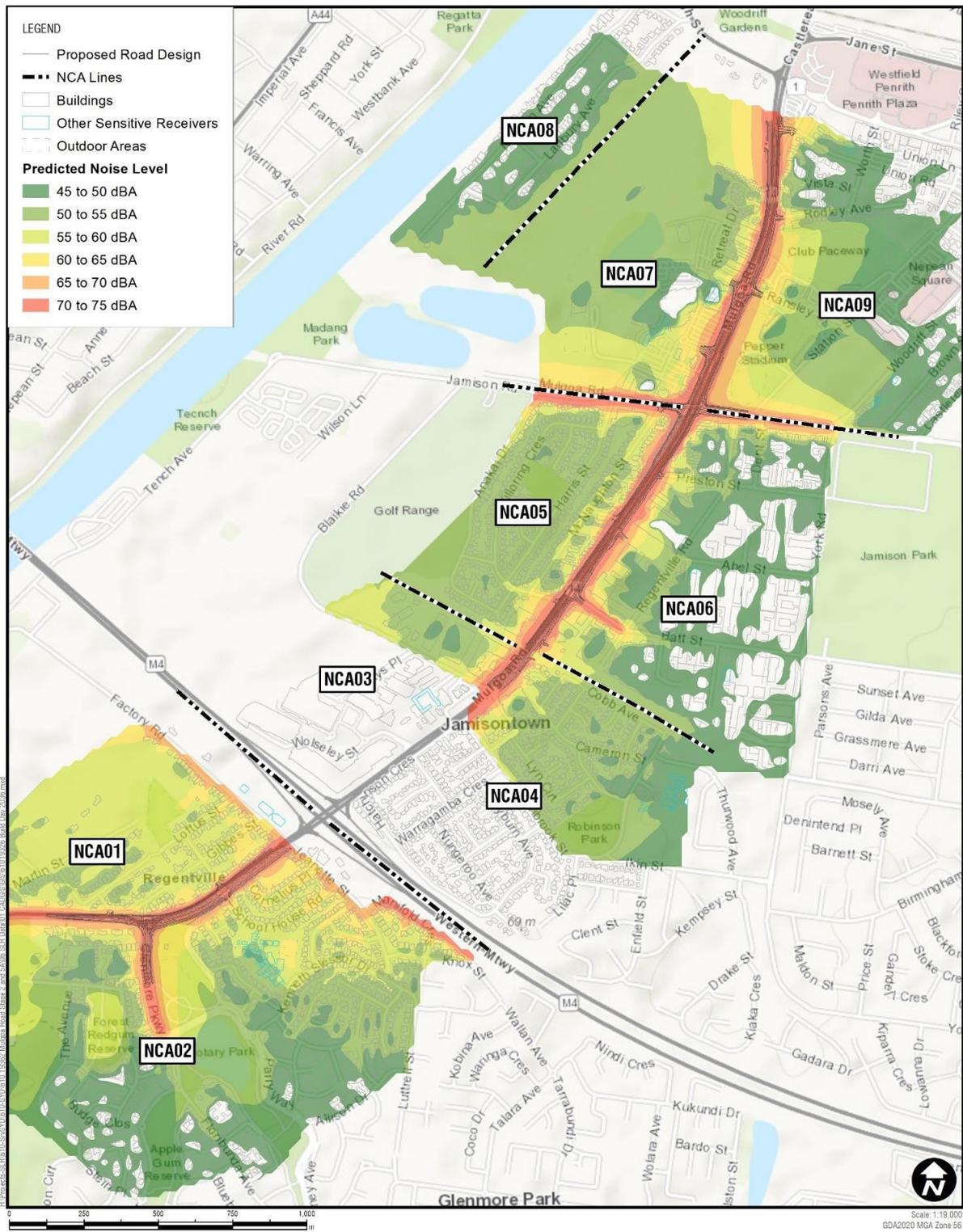


Figure 6-18: Predicted operational noise levels with the proposal (daytime Scenario in 2036)

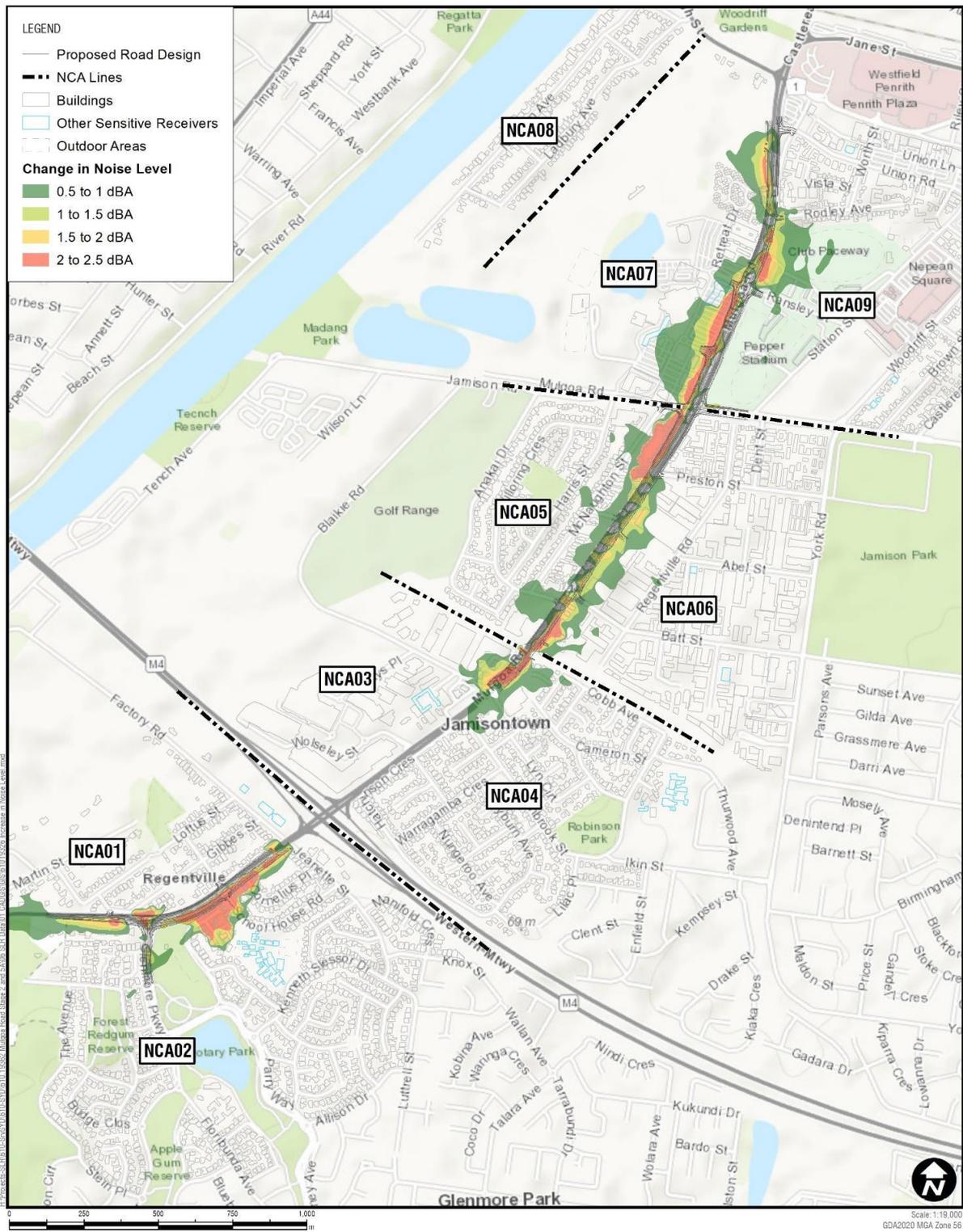


Figure 6-19: Predicted change in operational noise from the proposal (daytime scenario in 2036)

‘Other sensitive’ Receivers

A total of eight ‘other sensitive’ receiver buildings are predicted to have exceedances for the operational road traffic noise data. The location of the triggered ‘other sensitive’ receiver is shown in Figure 6.20. These eight receivers are Regentville Public School, Rotary Park, Kidz Klub OSHC, Western Sydney Conference and Community Centre and Hotel (Approved DA), Little Learners Early Learning Centre, Nepean Tiny Tots, Penrith Early Learning Centre, and Penrith Park.

The criteria for certain ‘other sensitive’ receivers are internal noise levels. As the noise model predicts external noise levels, assumptions have been made about the likely facade performance of these receivers. ‘Other sensitive’ receivers have been conservatively assumed to have openable windows, which corresponds to a 10 dBA outside-to-inside reduction in noise through the building facade.

Receivers eligible for consideration of ‘additional noise mitigation’

The receivers which have been identified as eligible for consideration of ‘additional noise mitigation’ are shown in Figure 6.20 and Table 6-32. A total of 156 sensitive receiver buildings are predicted to have exceedances of the NCG operational road traffic noise criteria and are eligible for consideration of ‘additional noise mitigation’.

Table 6-32: Receivers eligible for consideration for ‘additional noise mitigation’

NCA	Number of triggered residential buildings (floors)	Number of triggered ‘other sensitive’ buildings (floors)	Comments
NCA01	29 (31)	- (-)	Residential receivers to the north of the proposal.
NCA02	32 (47)	2 (2)	Residential receivers to the south of the proposal and Regentville Public School and Rotary Park.
NCA03	- (-)	- (-)	No sensitive receivers in this catchment.
NCA04	5 (5)	- (-)	Residential receivers to the east of the proposal.
NCA05	40 (46)	- (-)	Residential receivers to the west of the proposal.
NCA06	15 (24)	1 (2)	Residential receivers to the east of the proposal and Kidz Klub OSHC.
NCA07	16 (27)	1 (5)	Residential receivers to the west of the proposal and the Western Sydney Conference and Community Centre and Hotel
NCA08	- (-)	- (-)	No sensitive receivers in this catchment.
NCA09	11 (26)	4 (5)	Residential receivers to the east of the proposal and the Little learners Early Learning Centre, Nepean Tiny Tots, Penrith Early Learning Centre and Penrith Park.
Subtotal	148 (206)	8 (14)	TOTAL: 156 (220)

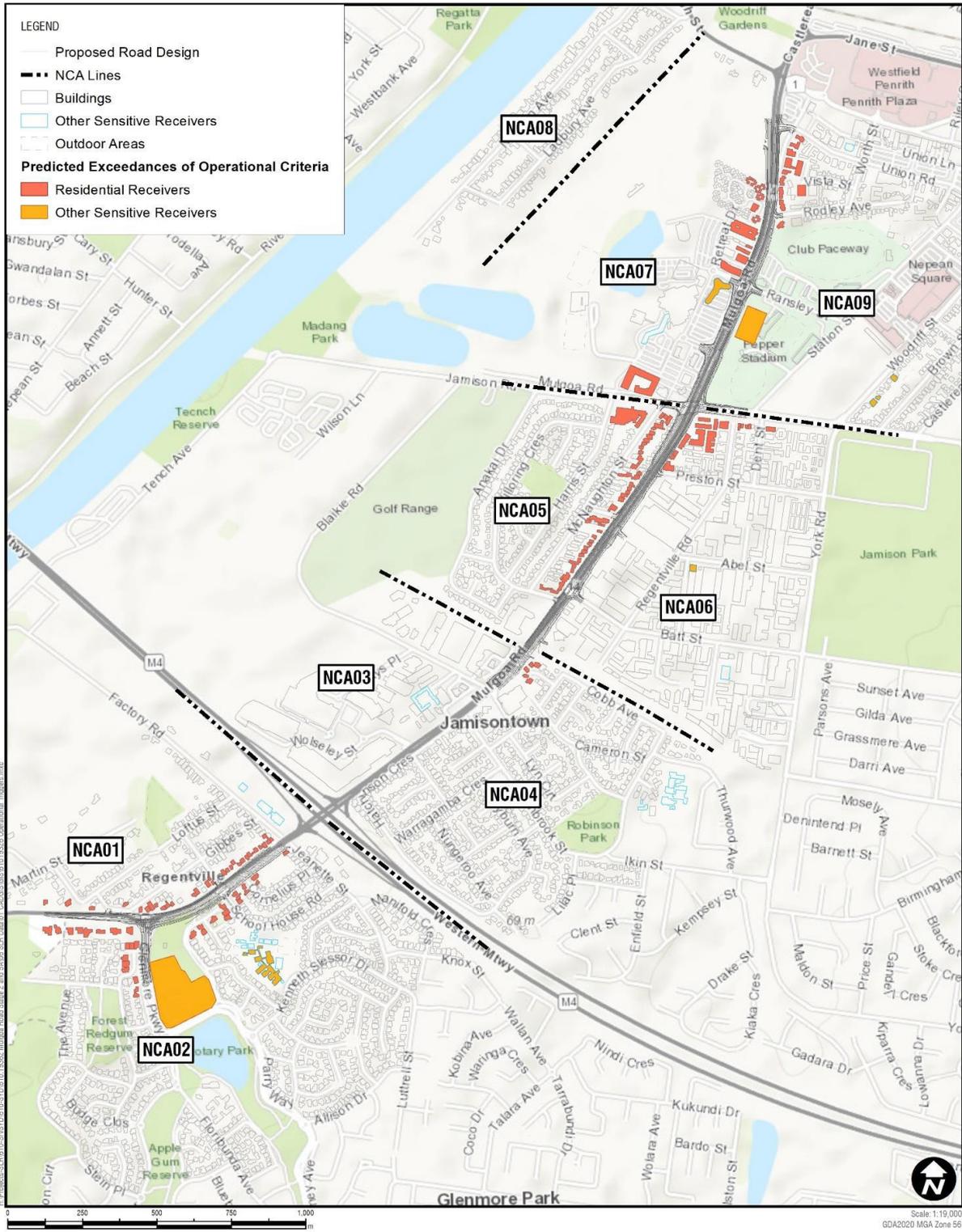


Figure 6-20: Receivers eligible for consideration of additional mitigation

Maximum road traffic noise levels

Existing maximum noise level events are a regular feature at the monitoring locations. Maximum noise events were measured to typically range from around 65 to 90 dBA, with the upper end of the range likely to be from heavy vehicle on Mulgoa Road, and the lower end of the range is likely from nearby light vehicles.

The change in frequency of events is expected to generally be consistent with the change in traffic volumes resulting from the proposal. As the proposal would widen and realign certain roads there is potential for changes to maximum noise level events in the study area due to vehicles being closer to adjacent receivers. A summary of the predicted changes is provided in Table 6-33.

Table 6-33: Predicted change in maximum noise levels

NCA	Worst-case change (dBA)	Discussion
NCA01	+5	Maximum noise levels are predicted to increase by up to 5 dBA at receivers adjacent to the realigned and widened intersection of Mulgoa Road and Glenmore Parkway. Maximum noise levels at receivers to the east of this are predicted to reduce due to Mulgoa Road being realigned to the south to be further away from these receivers.
NCA02	+5 to +10	Maximum noise levels are predicted to increase by up to 5 dBA at receivers already adjacent to Mulgoa Road due to the road being widened. Increases of up to 10 dBA are predicted where buildings are removed to widen Mulgoa Road which exposes previously shielded receivers.
NCA03	-	This catchment has no residential receivers.
NCA04	+3	Maximum noise levels are predicted to increase by up to 3 dBA due to Mulgoa road being widened.
NCA05	+10	Maximum noise levels are predicted to increase by up to 10 dBA where buildings are removed to widen Mulgoa Road which exposes previously shielded receivers. Maximum noise levels at other receivers are predicted to marginally reduce due to Mulgoa Road being moved further away.
NCA06	0	Negligible change predicted for sensitive receivers. Potential minor reduction at some receivers where Mulgoa Road is realigned to be further away.
NCA07	+1	Negligible change in maximum noise levels predicted.
NCA08	0	Negligible change predicted for sensitive receivers. Potential minor reduction at some receivers where Mulgoa Road is realigned to be further away.
NCA09	0	Negligible change predicted for sensitive receivers.

6.3.5 Safeguards and management measures

Construction noise mitigation options

The ICNG acknowledges that due to the nature of construction work it is inevitable that there would be noise and vibration impacts where construction activities are near to sensitive receivers. A Construction Noise and Vibration Management Plan would be prepared prior to work commencing which would detail the approach to providing noise and vibration mitigation during construction. Site specific Construction Noise and Vibration Impact Statements would also be completed for work that is required to be completed outside of Standard Construction Hours that has potential to impact sensitive receivers. Details of the safeguards and management measures to minimise noise and vibration impacts are shown in Table 6-35.

Operational noise mitigation options

Road traffic noise levels from infrastructure projects should be reduced, where feasible and reasonable, to meet the NCG noise criteria using mitigation. For receivers that qualify for consideration of 'additional noise mitigation', the NMG requires that the potential noise mitigation measures provided in Table 6-34.

Table 6-34: Noise mitigation options

Mitigation option	Description	Feasibility
At-source mitigation (low noise pavements)	Low noise pavements are to be considered first when specifying noise mitigation as they reduce source noise levels, which provides noise level benefit to both outside areas and internal spaces. Low noise pavements have no associated visual impact and are also likely to provide noise benefits to receivers at greater distances than noise barriers.	Low noise pavements are generally considered feasible to use where there are four or more closely spaced receivers that exceed the operational road traffic noise criteria. They are generally most effective where vehicle speeds are high, such as on motorways, and less effective where traffic speeds are slower or where traffic is required to slow down or stop. It is noted that the proposal includes several intersections, which would reduce the effectiveness of low noise pavements due to stop/start traffic.
In-corridor mitigation – noise barriers	Noise barriers (in the form of walls or mounds) can provide significant noise reductions and also reduce both external and internal noise levels. Where space allows, raised earth mounds can be used as noise barriers and can be enhanced by placing a low wall on top.	Noise barriers can result in other impacts such as reduced access to property and utilities, visual impacts, overshadowing, changes to drainage, and safety concerns. Noise barriers are typically most efficient when receivers are located at ground floor level.
At-property mitigation – architectural treatment	At-property treatment typically involves using architectural treatments to improve building elements such as doors, windows, vents, etc. Installation of boundary acoustic fences or walls close to the receiver can also be considered, which can have the benefit of reducing noise levels in outdoor spaces.	At-property mitigation is considered the most reasonable noise mitigation strategy where receivers are not grouped together or where there is community preference for this measure. The assessment shows a total of 156 sensitive receiver buildings (220 receiver floors) are predicted to have exceedances of the NCG operational road traffic noise criteria, when assuming no 'additional noise mitigation', such as noise barriers.

Mitigation measures

Table 6-35: Safeguards and management measures for noise and vibration

Impact	Environmental safeguards	Responsibility	Timing	Reference
NV1 - Noise and vibration	<p>A Noise and Vibration Management Plan (NVMP) would be prepared and implemented as part of the CEMP. The NVMP would generally follow the approach in the Interim <i>Construction Noise Guideline</i> (ICNG) (DECC, 2009) and identify:</p> <ul style="list-style-type: none"> • All potential significant noise and vibration generating activities associated with the activity • Feasible and reasonable mitigation measures to be implemented, taking into account <i>Beyond the Pavement: urban design policy, process and principles</i> (Roads and Maritime, 2014). • A monitoring program to assess performance against relevant noise and vibration criteria • Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria. 	Contractor	Pre-construction	Section 4.6 of QA G36 <i>Environment Protection</i>
NV2 - Noise and vibration	<p>The NVMP would include:</p> <ul style="list-style-type: none"> • Identification of nearby sensitive receivers • Description of works, construction equipment and hours work would be completed in • Criteria for the proposal and relevant licence and approval conditions • Requirements for noise and vibration monitoring • Details of how community consultation would be completed • Procedures for handling complaints 	Contractor	Pre-construction	Standard safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> Details on how respite would be applied where ongoing high impacts are seen at certain receivers. 			
NV3 - Noise and vibration	<p>All sensitive receivers (eg schools, local residents) likely to be affected will be notified before commencing any work associated with the activity that may have an adverse noise or vibration impact. The notification would provide details of:</p> <ul style="list-style-type: none"> The project The construction period and construction hours Contact information for project management staff Complaint and incident reporting How to obtain further information. 	Contractor	Construction	Standard safeguard
NV4 - Noise and vibration	<p>Location and activity specific noise and vibration impact assessments should be carried out before (as a minimum) activities:</p> <ul style="list-style-type: none"> With the potential to result in noise levels above 75 dBA at any receiver Required outside Standard Construction Hours likely to result in noise levels in greater than the relevant Noise Management Levels With the potential to exceed relevant criteria for vibration. 	Contacto	Construction	Additional safeguard
NV5 - Noise and vibration	<p>Where noise intensive equipment is to be used near sensitive receivers, the work should be scheduled for standard construction hours, where possible. If it is not possible to restrict the work to standard construction hours then the work should be completed as early as possible in each work shift. Appropriate respite should be provided to affected receivers in accordance with the CNVG.</p>	Contacto	Construction	Additional safeguard
NV6 - Noise and vibration	<p>Hoarding, or other shielding structures, should be used where receivers are impacted near compounds or fixed work areas with long durations. To provide effective noise mitigation, the barriers should break line-of-sight from the nearest receivers to the work and be of solid construction with minimal gaps.</p>	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
NV7 - Monitoring	Monitoring should be carried out at the start of noise and/or vibration intensive activities to confirm that actual levels are consistent with the predictions and that appropriate mitigation measures from the CNVG have been implemented.	Contractor	Construction	Additional safeguard
NV8 -Vibration	Where work is within the minimum working distances and considered likely to exceed the cosmetic damage criteria: <ul style="list-style-type: none"> Different construction methods with lower source vibration levels should be investigated and implemented, where feasible Attended vibration measurements should be undertaken at the start of the work to determine actual vibration levels at the item. Work should be ceased if the monitoring indicates vibration levels are likely to, or do, exceed the relevant criteria. 	Contractor	Detailed design/pre-construction, construction	Additional safeguard
NV9 -Vibration	The potential human comfort impacts and requirement for vibration intensive work should be reviewed prior to construction.	Contractor	Detailed design Pre-construction Construction	Additional safeguard
NV10 - Noise and vibration	Building condition surveys should be completed before and after the work where buildings or structures are within the minimum working distances and considered likely to exceed the cosmetic damage criteria during the use of vibration intensive equipment.	Contractor	Detailed design Pe-construction Construction	Additional safeguard
NV11 – Noise barriers	The design of noise walls would be confirmed during detailed design. This would consider incorporating urban design features such as clear panels, colour, art and graphics to help with navigation and improve aesthetics	Contractor	Detailed design	Additional safeguard

6.4 Hydrology and flooding

This section describes the hydrology and flooding impacts that may occur when constructing and operating the proposal and has been informed by a Hydrology and Hydraulic Assessment report (SMEC 2021), which is provided in Appendix F.

6.4.1 Methodology

The hydrology and flooding assessment included:

- A desktop review of relevant flood studies prepared for the proposal area
- Hydrologic modelling using temporal patterns, initial losses and median pre-burst data from the Australian Rainfall and Runoff (ARR) Data Hub. The key inputs to this modelling was rainfall intensity-frequency-duration (IFD) data, temporal patterns, loss parameters, sub-catchment characteristics and detention basin storages.

The hydraulic flood modelling was undertaken using TUFLOW and 12D software to:

- Assess the capacity of the cross-drainage structures
- Assess flood immunity of the existing and proposed road
- Define off-site flow impacts caused by the road upgrade
- Model the proposal's pavement drainage strategy
- Assess impacts of flood behaviour resulting from the proposal by comparing the flood characteristic of the existing environment to the proposal scenario
- Conduct a climate change sensitivity assessment to understand the implications to the one per cent AEP flood levels and flood velocities of the proposal
- Identify safeguards and management measures to manage the potential impacts on hydrology and flooding.

The layout for the hydrologic and hydraulic models is shown in Figure 6.21.

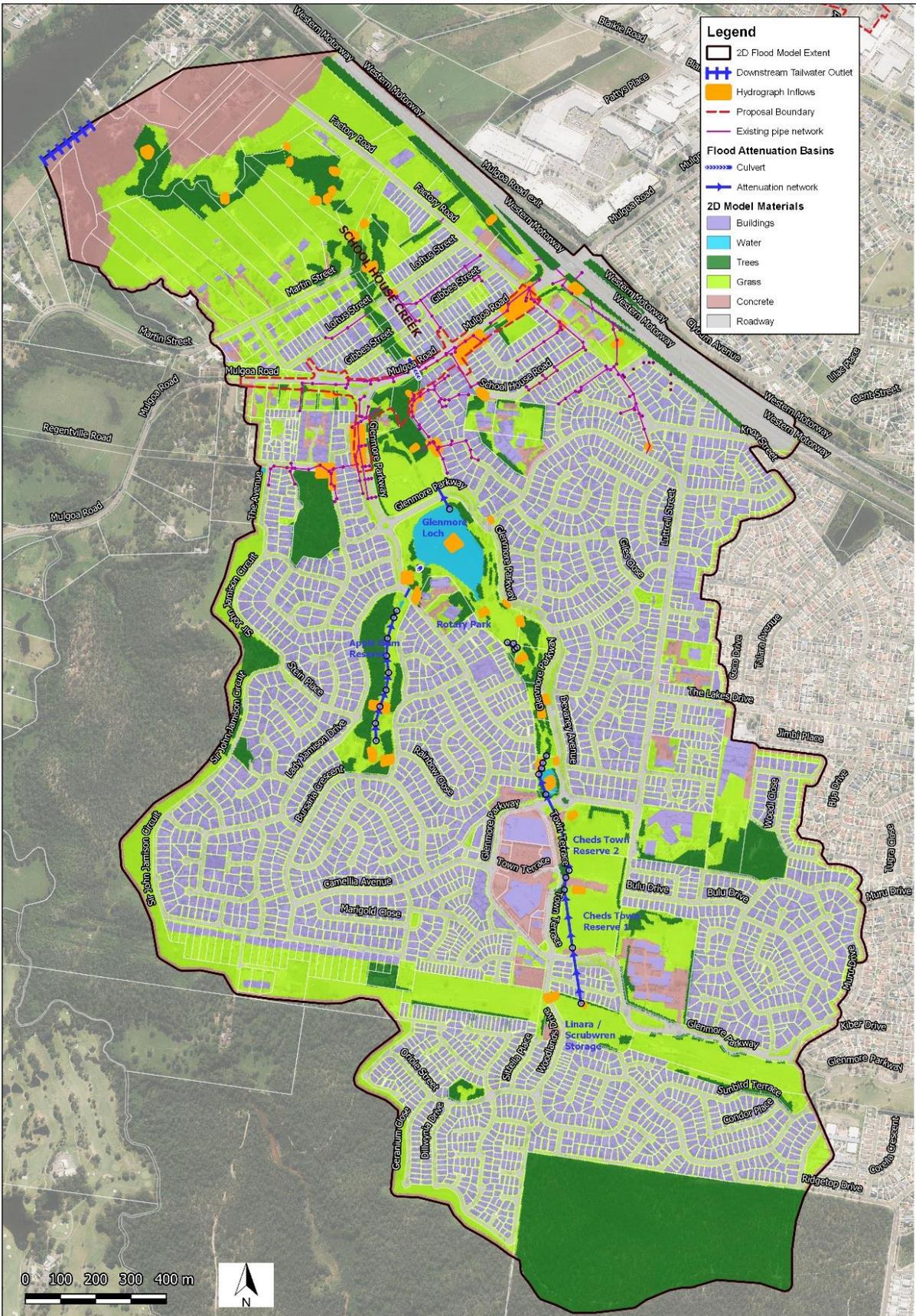


Figure 6-21: Hydraulic model layout

6.4.2 Existing environment

Existing flood modelling shows that Mulgoa Road is prone to flooding in events more frequent than the ten per cent annual exceedance probability (AEP). This means that there is a ten per cent chance of it flooding in a year.

Flooding in the area is due to:

- Local catchment flooding (overland flow across Mulgoa Road and Glenmore Parkway)
- Tributary flooding
- Nepean River regional flooding.

Stage 2

The proposed stage 2 road upgrade is situated in the School House Creek catchment, which is a tributary of the Nepean River. The main arm of School House Creek runs in a northerly direction through the Proposal via an existing culvert. Figure 6.22 shows the overland flow path from sub-catchments in stage 2.

Local catchment flooding is a key reason for flooding in the proposal and adjacent properties. Catchments directly upstream are mainly primarily of residential land. Given the urbanised nature of the catchment, storms that generate peak flood level response for these catchments are typically short, at 10 minutes to 1 hour.

Several overland flows from external residential catchments flow onto Mulgoa Road in events more frequent than the ten per cent AEP flood under existing conditions.

Tributary flooding

The School House Creek catchment upstream of the proposal consists mainly of residential, vegetated land with large flood storage areas. Overland flow from residential areas are directed through flood delaying and storage features weakening what then flows into the School House Creek Tributary. Storms generating peak flood level response for the tributary are typically long, at six hours or longer.

Most of the runoff from Glenmore Park is detained within the Loch. The flows into School House Creek are determined by the overflow structure within the loch and the spillway of Glenmore Parkway. The overtopping level is not activated in events as rare as the one per cent AEP.

The School House Creek culvert through Mulgoa Road reaches capacity during the one per cent AEP flood. The road is therefore not affected by tributary flooding.

Nepean River regional flooding

Nepean River regional flooding incorporates School House Creek as the creek is a tributary of the Nepean River. The *Peach Tree & Lower Surveyors Creek Flood Study* (CSS 2019) describes overland flood events as occurring during the five per cent annual exceedance probability (AEP) river flood levels.

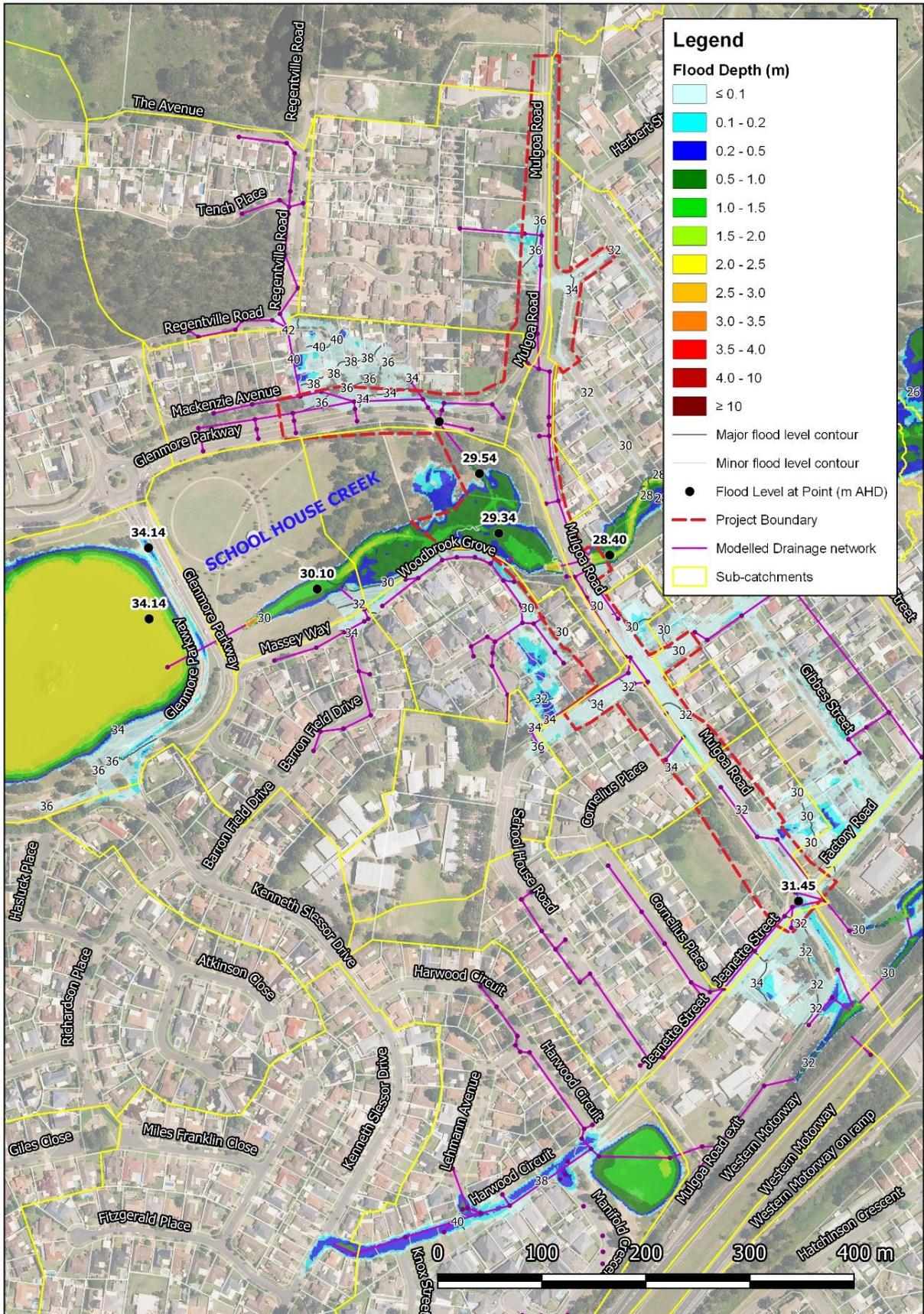


Figure 6-22: Stage 2 - Overland flow path from sub-catchments – 1per cent AEP existing flood depth

Stage 5A and 5B

The proposed Stage 5 road upgrade is situated in the Peach Tree and Lower Surveyors Creek catchment. The catchment consists of residential and commercial land and is split into three main tributaries to Peach Tree Creek upstream of the proposal. The Creek is roughly 500 metres parallel to Mulgoa Road and flows into the Nepean River.

Local urban catchments primarily drain towards three key conveyance structures which all run in northerly direction through the Proposal via bridge or culvert:

- BRG-1900, Surveyors Creek (Surveyors Creek Channel)
- DRT-2875, Jamison Channel (Racecourse Channel)
- DRT-3525, Showground Creek (Showground Channel)

Local Catchment flooding and tributary flooding are the two reasons for flooding in the proposal.

Local catchment flooding

Local catchments directly upstream of the proposal consist primarily of commercial and residential land. Overland flow from local catchments enter directly from adjacent properties or through local roads which accumulate upstream local catchment runoff. Storms generating peak flood level response are short, at 10 minutes to 1 hour, due to the urbanised nature of these catchments. Several overland flows from external residential catchments flow onto Mulgoa Road in events more frequent than the ten per cent AEP flood under existing conditions.

Nepean River regional flooding

Surveyors Creek, Jamison Channel and Showground Creek are tributaries of the Peach Tree Creek which ultimately flows into the Nepean River. As with Stage 2, *The Peach Tree & Lower Surveyors Creek Flood Study* (CSS 2019) describes overland flood events as occurring during the five per cent annual exceedance probability (AEP) river flood levels.

Tributary flooding

Catchments upstream of the proposal which do not directly flow onto the Mulgoa Road will flow into one of the three flood conveyance channels. Floodwaters which break out of these conveyance structures are considered as tributary flooding. There are a number of features upstream of the proposal that weaken peak flow and the size of total upstream catchments flowing to the channels, therefore storms generating peak flood level response for the tributary are typically long, at 2-6 hours.

Tributary flooding occurs for different flood events across the three tributaries. Tributary flooding from Surveyors Creek does not affect the proposal up to the one per cent AEP, occurring in the PMF existing flood and is therefore not critical to road design outcomes (shown in Figure 6.23).

Tributary flooding from Jamison Channel affects the proposal in events as rare as the two per cent AEP existing flood event. Flow from the channel alongside Jamison Road exceeds the maximum capacity of the existing twin culvert through the Mulgoa Road / Jamison Road intersection. Channel breakout occurs as water is backed up into the channel and spills across Jamison Road, Mulgoa Road, and the intersection (shown in Figure 6.24).

Tributary flooding from Showground Channel affects the proposal in events as rare as the five per cent AEP existing flood event. Flow from the channel exceeds the maximum capacity of the existing twin culvert through Mulgoa Road. Breakout to the north affects existing properties whilst breakout to the south enters the existing Mulgoa Road and ponds at a sag point through the southbound carriageway (shown in Figure 6.25).

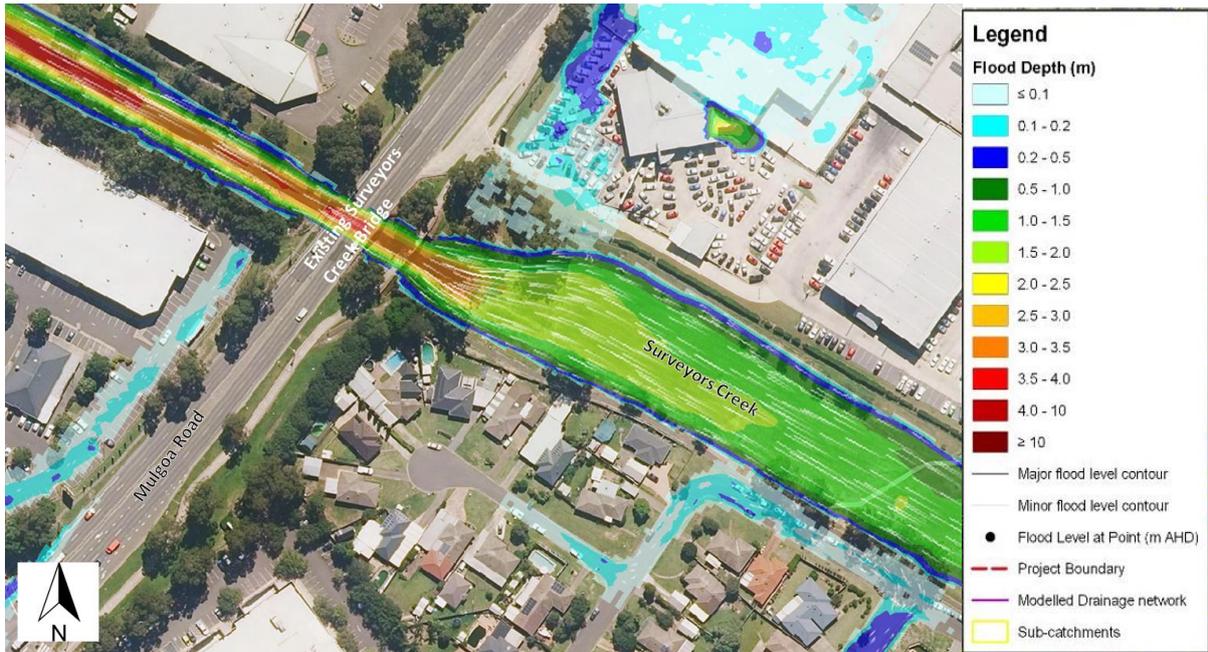


Figure 6-23: 12 per cent AEP existing flood contained within Surveyors Creek

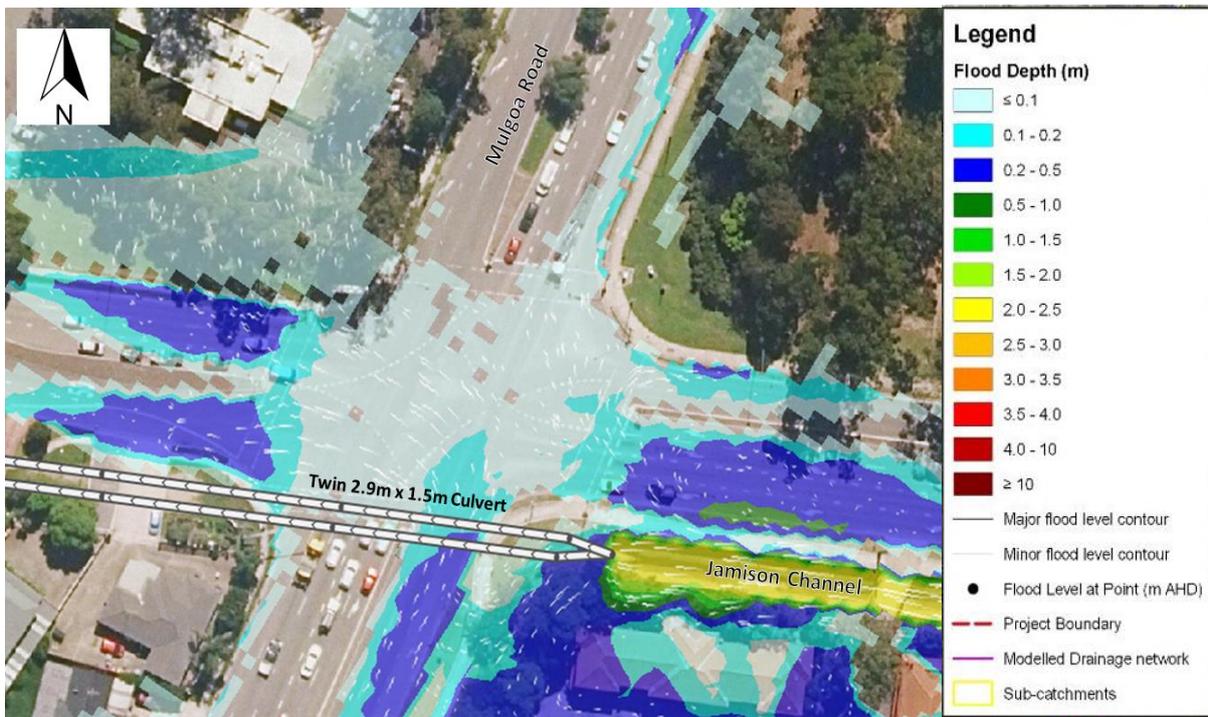


Figure 6-24: 2 per cent AEP existing flood breakout from Jamison Channel

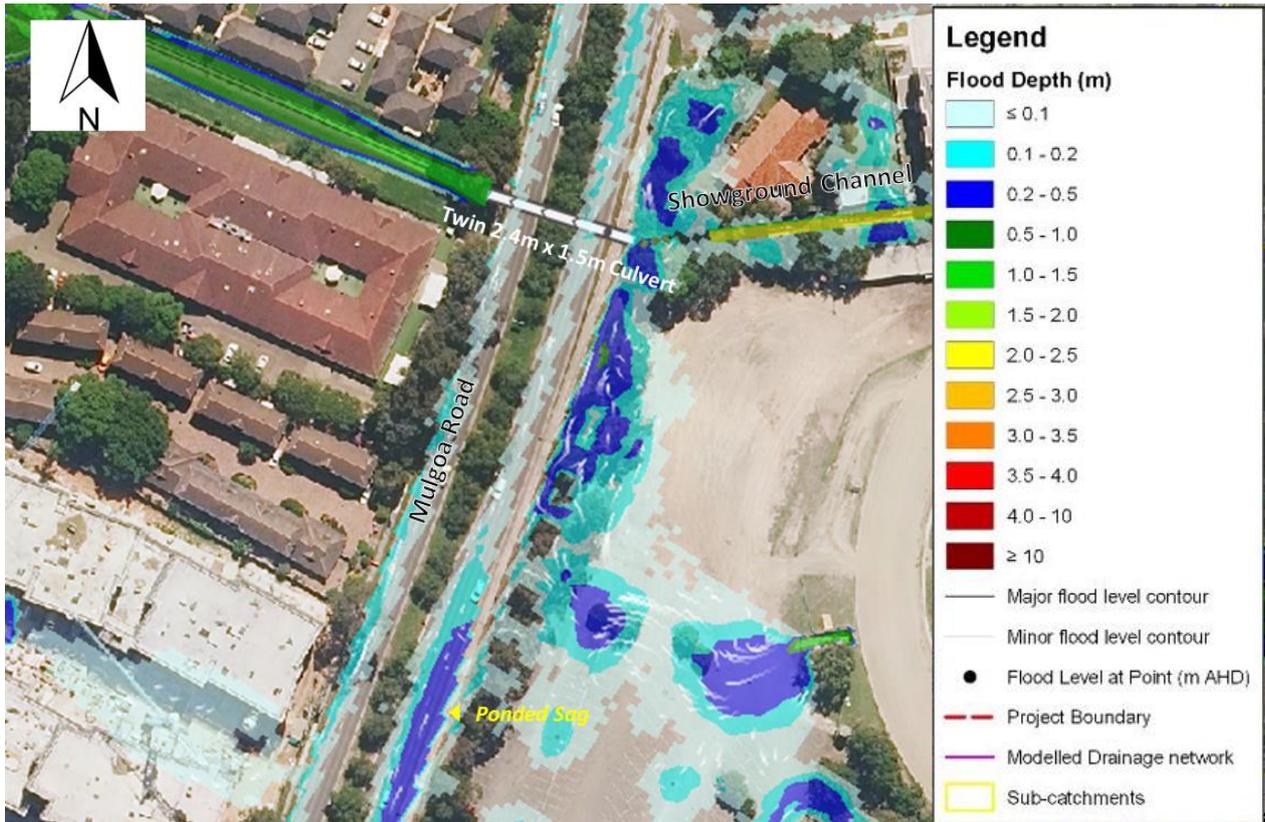


Figure 6-25: 5 per cent AEP existing flood breakout from Showground Channel

6.4.3 Potential impacts

Construction

The potential hydrology and flooding impacts during construction would be:

- Localised flooding impacts from construction works
- Potential flooding of construction and ancillary facility sites during major flood events.

Localised flooding

Impacts would be associated with changes in the local topography and changes to the existing drainage patterns near the site. Such impacts would potentially be a result of earthworks, positioning of ancillary facilities (eg compound builds or stockpiles) or the position of plant and equipment. Impacts would be temporary and localised to small areas.

Flooding of construction areas

Flood events during construction could inundate the proposal area and result in loss and damage to plant and equipment. It could also impact work areas such as substantial erosion of excavated areas.

Construction of the main road alignment has the potential to alter overland water flows due to blockages caused by large machinery and equipment, along with excavations associated with earthworks. Contractors would monitor the weather for predicted heavy rainfall and potential flooding events. When these are predicted, any potential blockages would be moved out of the potential flow path of flood waters.

Further consideration of flooding impacts in relation to the ancillary facilities would be undertaken during detailed design, including identification of any flood mitigation measures required. A construction flood management plan would be developed to make sure that in the event of a flood, measures are in place to minimise any impacts to the construction of the proposal.

Operation

Key features

Some of the existing drainage features, such as the road bridge over Surveyors Creek and culverts, would be modified as part of the proposal to reduce impacts and optimise drainage. This includes tie-ins to existing stormwater and new proposed outlets.

Flood immunity

The road under existing flood conditions is regularly flooded in events more frequent than the five per cent AEP flood in stage 2 and more than ten per cent in stage 5A and 5B. Matched or improved flood immunity would be achieved for the entirety of the Proposal except for one location at Jamison Road Intersection. However, this location remains trafficable for two lanes up to the one per cent AEP.

All lanes would remain open in stage 2, while stage 5A would have at least three lanes and the majority of lanes during stage 5B a sag point north of Ransley Street on the southbound carriageway is considered unsafe for small vehicles for all lanes; and unsafe for all vehicles for three lanes. However, this is consistent with the existing environment.

Private property

Several properties that were affected by flooding under existing conditions are no longer affected by flooding during operation of the proposal. In stage 2 this includes properties along Spencer Street, Gibbes Street, Factory Road and Mulgoa Road. In stage 5A and stage 5B the properties in which have had flood levels reduced include the Panthers Development on the corner of Mulgoa Road and Jamison Road, Mountainview Nursing home, and the new apartment complex on the corner of Retreat Drive and Mulgoa Road.

No adverse impacts would occur to properties as a result of the proposal.

Climate change

Flood sensitivity to climate change has been undertaken to understand the consequence of adverse flooding behaviour to the design. The proposal would not be impacted by sea level rise due to its high elevation above mean sea level. Climate change impacts to flood behaviour are a low risk. Although road immunity outcomes from the proposal provide an improvement on the existing situation, the increased rainfall intensity associated with climate change would affect flooding behaviour near the proposal.

6.4.4 Safeguards and management measures

Table 6-36: Safeguards and management measures for hydrology and flooding

Impact	Environmental safeguards	Responsibility	Timing	Reference
HF1 flooding	<p>A construction flood management plan would be prepared as part of the CEMP to set out processes for monitoring and managing flood risk. The plan would:</p> <ul style="list-style-type: none"> Specify the steps taken in the event of a flood warning Including removal or securing of loose materials, equipment, fuels and chemicals. 	Contractor	Pre-construction Construction	Additional safeguard
HF2-flooding	<p>Further consideration of measures to minimise flooding impacts on the compound sites and construction activities would be undertaken during detailed design. This would include:</p> <ul style="list-style-type: none"> Areas where material storage and stockpiles could be located outside of flood prone land Feasible design measures or construction methods to minimise sedimentation and cross contamination risks where flood prone land cannot be avoided for material storage and stockpiles such as installing erosion and sediment controls around compound site boundaries. 	Contractor	Detailed design	Additional safeguard
HF3 - flooding	<p>A flood evacuation plan for construction personnel, materials and equipment would be prepared to manage a potential flood event during construction and included as part of the CEMP. This plan would be implemented during construction and outline:</p> <ul style="list-style-type: none"> Procedures to monitor rainfall that may influence water levels What flood event would trigger the plan 	Contractor	Pre-construction Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> • Evacuation procedures including a map indicating the area that is flood prone and suitable evacuation locations • Procedures to reduce risk during a flood event including removal of all plant/equipment and stabilising exposed areas. 			
HF4 - flooding	<p>The storage of hazardous material would be confined to areas that are not subject to flooding during a 1 per cent AEP extent or either:</p> <ul style="list-style-type: none"> • Stored in a manner that prevents their mobilisation during times of flood • Be removed from the floodplain when minor rain events are predicted to inundate storage areas and at the onset of a flood. 	Contractor	Construction	Additional safeguard
HF5- flooding	<p>The detailed design should ensure that all lanes will be trafficable and that flood impacts to property will not be worsened during a one per cent annual exceedance probability flood event.</p>	Designer	Detailed design	Additional safeguard

6.5 Surface water and groundwater

This section describes the potential surface water and groundwater impacts associated with the proposal. This section is informed by the surface water and groundwater assessment report (Aurecon, 2021), which is provided in Appendix G.

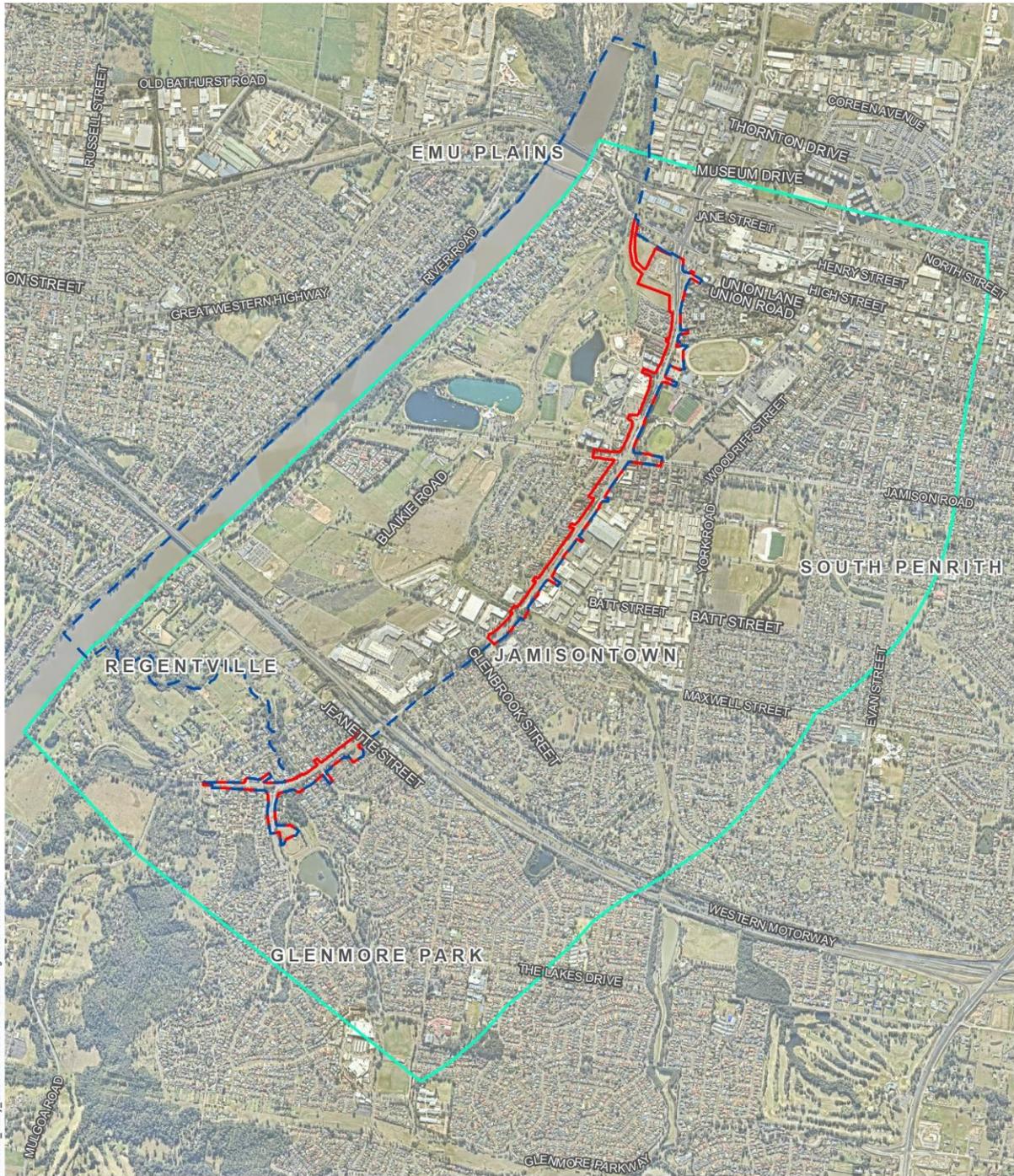
6.5.1 Methodology

The study area used in the surface water assessment includes the creek crossings, lakes and the stretch of the Nepean River from 200 metres upstream of the Mulgoa Creek near Martin Street to 200 metres from Penrith Weir below Peach Tree Creek.

The groundwater assessment study area has been defined as the area between Mulgoa Road and the Nepean River bounded in the south by Mulgoa Creek and in the north by the Great western Highway. There are numerous registered groundwater bores in the study area licenced to be used for irrigation, monitoring and water supply. The study areas are shown in Figure 6.26.

The surface water and groundwater assessment included a desktop review of potential constrains and existing conditions including:

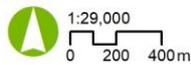
- Climate and weather conditions
- Local hydrology
- Surface water quality
- Flooding
- Soil landscape
- Groundwater bores/information.



P:\GIS\Project-4\project509813_Mulgoa_Road\MR_REF_SWGWIA_Study_areas.mxd JOB No. 16-09-21\Virgil.Robinson\Rev 0

- REF proposal area
- Groundwater study area
- Surface water study area

Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri



Mulgoa Road **Surface Water and Groundwater Impact Assessment**
 Projection: GDA 1994 MGA Zone 56

Figure 6-26: Surface Water and Groundwater assessment study areas

6.5.2 Criteria

The proposal is located within the Hawkesbury-Nepean catchment. The site-specific water quality objectives (WQO) relevant to the proposal is the Hawkesbury-Nepean catchment: Interim Water Quality Objectives (HRC, 1998), Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000) and ANZG Water Quality Guidelines (ANZG, 2018).

The adopted water quality objectives for the proposal are presented in Table 6-37.

Table 6-37: Summary of selected WQO and selected values

Indicator	Unit	Selected WQO	Reference value / criteria
Temperature	°C	16 – 34	Primary and Secondary Contact
Total phosphorus (TP)	mg/L	0.03	Aquatic ecosystem
Total nitrogen (TN)	mg/L	0.5	
Chlorophyll-a	mg/L	0.01 – 0.015	
Turbidity	NTU	6 – 50	Aquatic ecosystem (Hawkesbury Nepean)
Salinity (electrical conductivity)	µS/cm	125 – 2,200	
Dissolved oxygen (DO)	%SAT	85 – 110	
Total suspended solids (TSS)	mg/L		
pH		6.5 – 8.0	

6.5.3 Existing environment

Climate

The Orchard Hills Treatment Works station data, which is about six kilometres from the proposal, was used to obtain rainfall data representative of the proposal area. Typically, November to May are wetter months, and June to October are drier months. This is illustrated in Figure 6-27.

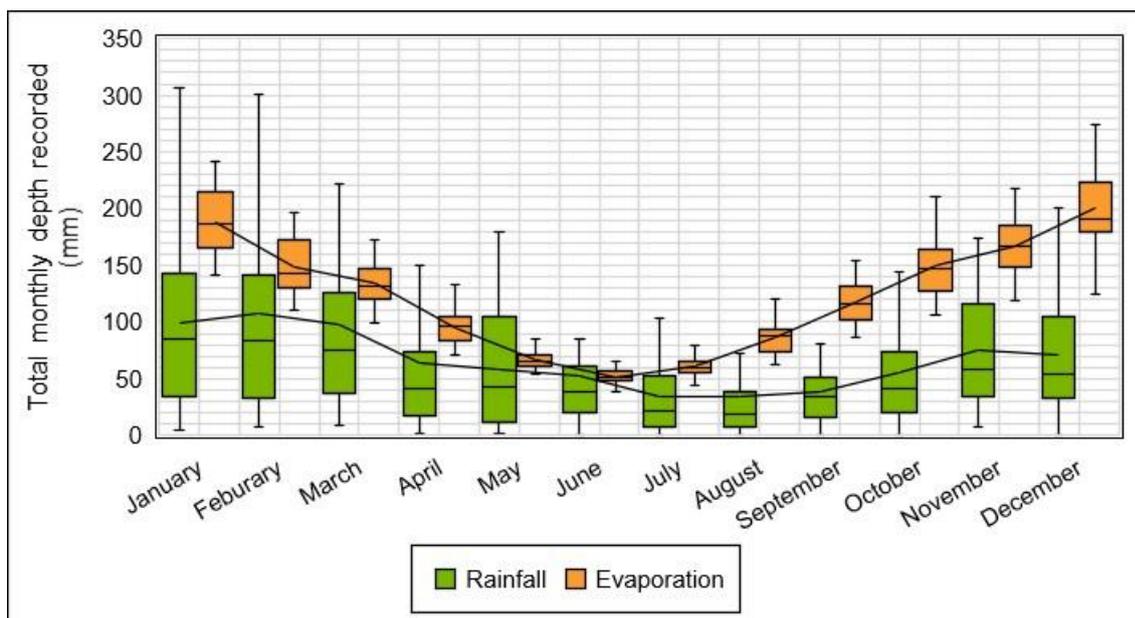


Figure 6-27 Range of total monthly rainfall and evaporation (1971-2019)

Orchard Hills Treatment Works station was also used to determine historical temperature at the proposal area. It indicates that there are warm to hot summers, with an average maximum of 29 degrees Celsius, and cooler winters with an average minimum of below 20 degrees Celsius and a minimum of about six degrees Celsius, as illustrated in comparison of Figure 6-27 and Figure 6-28 reveal that there is correlation between the evaporation rate and temperature.

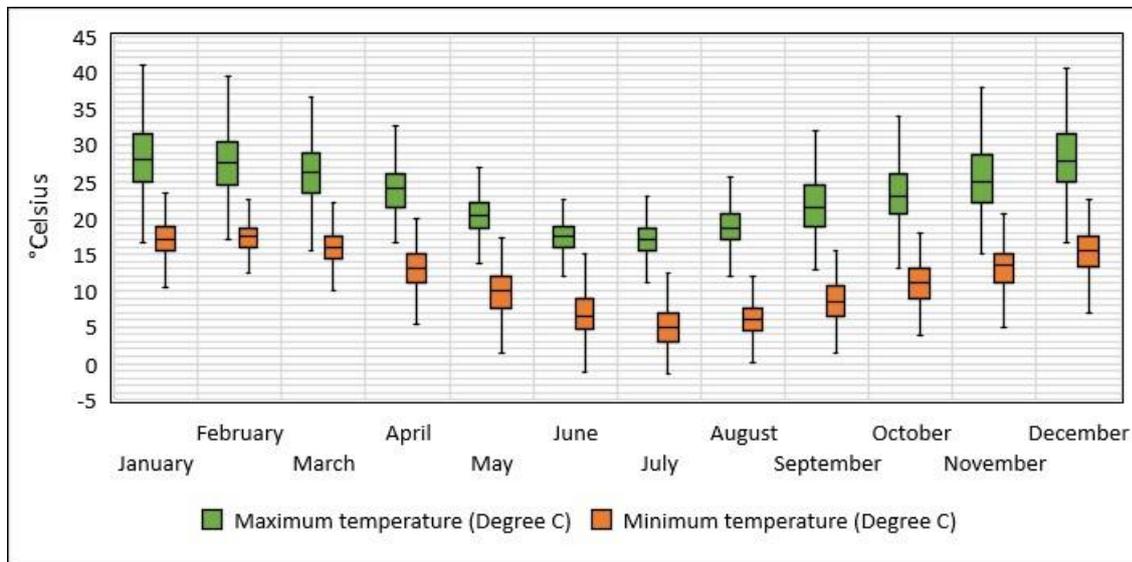


Figure 6-28: Monthly maximum and minimum temperature ranges (1971-1989)

Climate change

Long term climate patterns may be affected by climate change. Analysis of expected local climatic changes in the proposal area indicate a future increase in the intensity of extreme rainfall events. As a result, the runoff volume from the proposal area to receiving surface watercourses would increase. These changes are described in Table 6-38.

Table 6-38: Long term climate patterns (OEH 2015)

State planning region	Percent change in near future (2020-2039)			Percent change in far future (2060-2079)		
	Rainfall	Runoff	Recharge	Rainfall	Runoff	Recharge
Metropolitan Sydney	0.4	4.0	-5.0	8.1	17.6	12.5
Hawkesbury Nepean Catchment	-0.1	0.9	-9.3	6.1	13.4	5.6

Soils

The proposal crosses the Richmond, Luddenham and Blacktown soil landscapes. These soil landscape have characteristics that may influence the interaction between surface water and groundwater impacts. These limitations include:

- Erodibility
- Erosion hazard
- Localised season waterlogging
- Flood hazard.

The proposal is not located within an acid sulfate soils (ASS) risk area. Soils are described in detail in Section 6.8.2.

Hydrological soil groups

The proposal is located in an area mapped as containing group D soils (refer to Figure 6.29) from the hydrological soil group classification (Department of Planning, Industry and Environment, 2021). This may affect surface water runoff and groundwater recharge, as this group have moderate to high runoff potential when saturated, with water movement through soil being restricted or very restricted.

Catchment and surface water

The proposal is located within the Hawkesbury-Nepean catchment. The Nepean River is the longest river in the catchment and has several westerly flowing tributaries, including the Avon, Cordeaux and Cataract rivers. Other major tributaries include the Wollondilly River, Nattai River, Bargo River and Coxs River.

The tributaries of Peach Tree Creek drain into Peachtree Creek around 600 metres, 350 metres and one kilometre downstream of the proposal boundary respectively. Peachtree Creek flows north easterly, parallel to the proposal before flowing northerly to its confluence with the Nepean River around 1.25 kilometres north west of the proposal boundary.

The upper catchment of Surveyors Creek is undeveloped rural land, with the lower catchment containing residential and business land use. The Racecourse Creek Channel catchment is predominantly urbanised with residential land and the Showground Creek Channel catchment contains a mix of mostly residential, mixed use and commercial land use. Surveyors Creek, Racecourse Creek Channel and Showground Creek Channel are all hard (concrete) lined within proximity to the proposal. However, Surveyors Creek is grass lined immediately upstream of the proposal area and further downstream before its confluence with Peach Tree Creek.

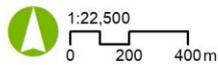
School House Creek flows north westerly across the proposal corridor before flowing westerly to Mulgoa Creek about 1.7 kilometres downstream and 0.9 kilometres from the proposal. Mulgoa Creek then flows into the Nepean River 30 metres further downstream. The School House Creek channel is unlined and vegetated upstream and downstream of the proposal. School House Creek was observed to be flowing during a field investigation.



P:\GIS\Project-4\project509813_Mulgoa_Road\MR_REF_SW\GWA_Hydrological_soil_groups.mxd\JOB No. 02-09-21\Virgil.Robinson\Rev.0

- REF proposal area
- Hydrological soil groups
- A
- B
- C
- D

Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri



Mulgoa Road **Surface Water and Groundwater Impact Assessment**

Projection: GDA 1994 MGA Zone 56

FIGURE 4-3: Hydrological soil groups

Figure 6-29: Hydrological soil groups

Both School House Creek and Surveyors Creek are designated as key fish habitat along with Peach Tree Creek downstream. No threatened species are considered to have a moderate or higher likelihood of occurring within the creek lines of the study area (refer to Section 6.1).

Surface water quality

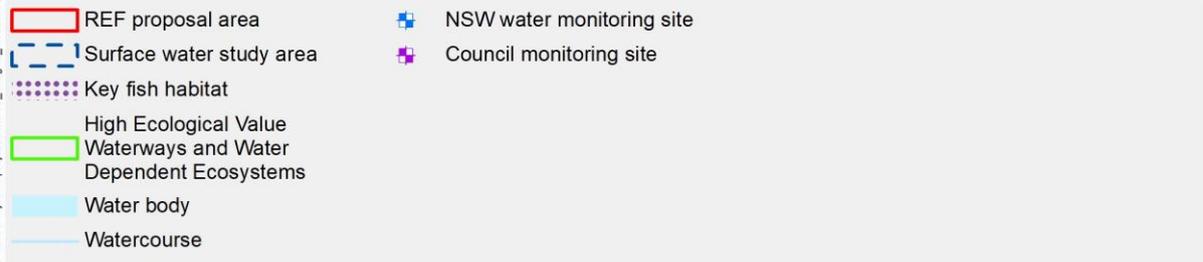
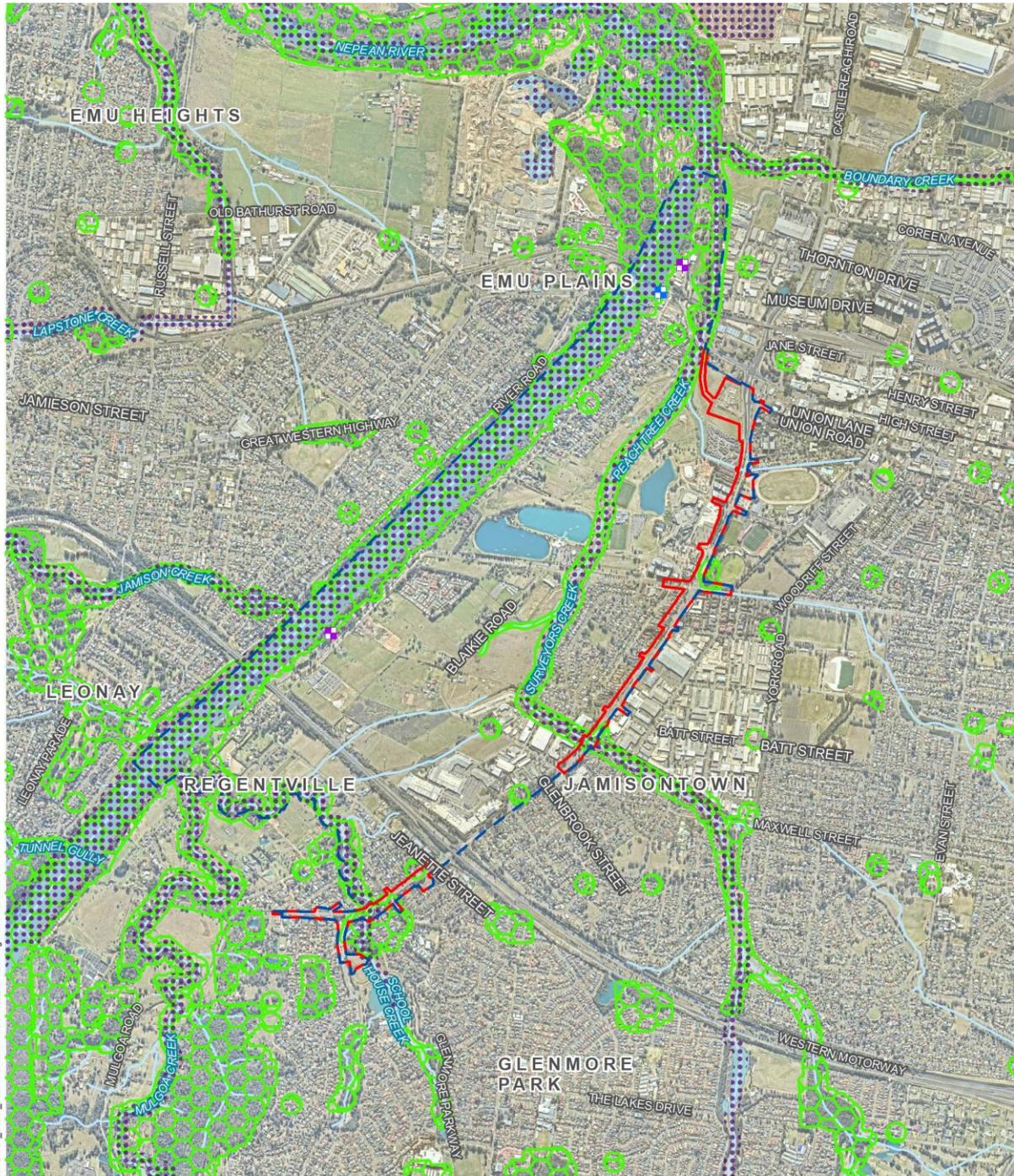
Liverpool City Council surface water monitoring data was taken from two locations, the Rowing Club and Tench Reserve. This data has been compared with the selected WQOs as summarised in Table 6-37. Bold cells indicated that the water quality objectives are exceeded.

Table 6-39]: Summary of Liverpool city council monitoring data at the rowing club

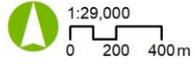
Analyte	Unit	WQO	20 th percentile	Median	80 th percentile
Temperature	°C	16 – 34	22	23.08	25.46
pH	N/A	6.5 – 8	7.384	7.81	8.75
Conductivity	uS/cm	125 – 2200	0.181	0.27	0.328
Dissolved Oxygen (%)	%	85 – 110	98.22	120.3	129.68

Table 6-40: Summary of Liverpool city council monitoring data at Tench Reserve

Analyte	Unit	WQO	20 th percentile	Median	80 th percentile
Temperature	°C	16 – 34	21.88	23.25	26.00
pH	N/A	6.5 – 8	7.37	7.56	8.38
Conductivity	uS/cm	125 – 2200	0.212	0.250	0.314
Dissolved Oxygen (%)	%	85 – 110	103.9	111.9	119.3



Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri



Mulgoa Road **Surface Water and Groundwater Impact Assessment**
 Projection: GDA 1994 MGA Zone 56 **FIGURE 4-8: Local Catchment and Surface Water Features**

Figure 6-30: Local catchment and surface water features

Groundwater

Groundwater in the local area is characterised by two main aquifers defined by the local geology. It is anticipated that the proposal area may interact with the alluvial aquifer, which may have indirect effects upon the porous rock aquifer. Groundwater flow direction is expected to be north-easterly within the Hawkesbury Sandstone. There are some faults in the area that could indicate enhanced connectivity between the shallow and deeper groundwater systems.

The proposal is located within the Hawkesbury Alluvium Groundwater Source as per the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011 available on SEED (NSW Government, 2021). The groundwater source has specific rules relating to the granting and managing of access licences, water allocation accounts, water supply works approvals, limiting water availability and water trading rules.

Geotechnical and contamination studies undertaken in early 2021 associated with this proposal installed one groundwater monitoring well at the Mulgoa Road crossing of Surveyor Creek indicated a groundwater level of 8.9 metres below ground level (BGL) at this location (Aurecon, 2021). A search of registered boreholes show that the groundwater levels range between 4.5 and 25 metres BGL indicating that groundwater interception is likely for excavations.

There are 31 bores with current licences that are used for purposes including groundwater monitoring, stock and domestic uses. These bores are owned privately, where the majority are in clusters used for monitoring at service stations.

Groundwater dependent ecosystems

The aquatic groundwater dependent ecosystems (GDE) is limited to the Nepean River which is classified as high potential aquatic GDE. The terrestrial GDEs within the study areas are classified as high potential GDEs, these include the Cumberland Shale Plains Woodland and the Cumberland River Flat Forest in areas south of the proposal.

6.5.4 Potential impacts

Construction

Surface water

Impacts to surface water include erosion, scouring of natural waterways and sedimentation and contamination. The most direct impact to surface water would be during construction activities that cross the School House creek, Surveyors Creek, Racecourse Creek Channel and Showground Creek Channel. This has a potentially high impact to surface water quality.

Potential impacts associated with establishment of temporary waterway crossings would be minimised by designing the structure to include appropriate pipe outlets, scour protection and flood immunity.

Compound one and three are subject to possible flooding impacts (refer to Section 6.4), which is a risk to water quality if construction materials including fuel, chemicals and ablution from toilet facilities are mobilised by overland flows into adjacent waterways if proper procedures are not in place in regards to storage of materials including stockpiles.

Measures to manage construction activities across waterways and within waterfront land would be included in the Soil and Water Management Plan.

Other impacts may result from stormwater sources, with drainage lines potentially being interfered with through construction activities such as excavation and earthworks and leaks and spills from construction which have a low-moderate impact.

Groundwater

Groundwater potential impacts that are relevant to the construction phase include aquifer interference and groundwater contamination. There is the potential for interference with groundwater during construction activities, however given the depth of groundwater and construction methodology it is unlikely to be intercepted for the majority of road construction activities.

There is potential for small volumes of groundwater to enter trenches during excavations required for utility and service trenches, construction of drainage infrastructure and piling for construction of noise barriers and bridge structures. This may result in dewatering/localised aquifer drawdown and flow disturbance. However, the impacts would be temporary and localised with impacts considered low.

Impacts to terrestrial and aquatic groundwater dependent ecosystems as a result in changes in groundwater level would be minor.

Potential groundwater contamination may result when construction activities intercept with the water table, including the piling activities for the construction of the bridge footings. The potential impacts of groundwater contamination are considered moderate.

Operation

Surface water

Increased impervious surfaces as a result of the road upgrade, including roadway and pavements, would result in increased stormwater runoff volume, frequency and rate and associated increases in pollutant loading to receiving waterways. With no treatments the proposal would result in a minor increase (less than five per cent) in total suspended solids (TSS), total phosphorus (TP), total nitrogen (TN) and gross pollutant loads from the local drainage catchments assessed.

Scour and erosion at new drainage outlets, downstream of culverts and within grass drains and channel realignment works may occur as a result of the proposal if disturbed areas are not well stabilised or if constructed scour protection works are not effective. Scour and erosion could potentially occur within School House Creek at new drainage outlets, downstream of the new culvert, or within the grass drains and channel realignment works if they are not well stabilised or if scour protection is not implemented effectively.

Due to the hard-lined channel at Surveyors Creek, Racecourse Creek Channel and Showground Channel, scour and erosion is unlikely to occur during operation at new drainage outlets, culverts or within proximity to the new bridge structure.

Accidental spills from motorists or maintenance personnel during operation may result in oils or other chemicals being transported into drainage lines and the receiving waterways.

Groundwater

Groundwater is unlikely to be affected by the operation of the proposal. Minor operational phase impacts occur from hydrocarbon leakages from road users, which are likely to be short term and localised due to the soil type within the proposal.

6.5.5 Safeguards and management measures

Table 6-41 describes the proposed safeguards and management measures that would be implemented to manage the potential surface water and groundwater impacts from the proposal

Table 6-41: Safeguards and management measures for surface water and groundwater

Impact	Environmental safeguards	Responsibility	Timing	Reference
SW1- soil erosion and water pollution	A Soil and Water Management Plan (SWMP) would be prepared and implemented as part of the CEMP. The SWMP would identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks would be addressed during construction.	Contractor	Pre-construction	Section 2.1 of QA G38 Soil and Water Management
SW2 - soil erosion and water pollution	A site-specific Erosion and Sediment Control Plan/s would be prepared and implemented as part of the Soil and Water Management Plan. The Plan would include arrangements for managing wet weather events, including monitoring of potential high-risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.	Contractor	Pre-construction	Section 2.1 of QA G38 Soil and Water Management
SW3 - soil erosion and water pollution	The design and construction of waterway crossings, works within the waterways including new drains and outlets or any works on waterfront land as defined by the <i>Water Management Act 2000</i> would be undertaken with consideration to the Guidelines for instream works on waterfront land (DPE, 2012a) and Guidelines for watercourse crossings on waterfront land. (DPE, 2012b) and in accordance with relevant, Transport specifications and guidelines. Measures to manage the potential impacts would be included in the Soil and Water Management Plan (SWMP).	Contractor	Detailed design Pre-construction	Additional Safeguard
SW4 - soil erosion and water pollution	The construction and use of ancillary facilities and compounds during the construction phase of the proposal, mitigation measures in terms of storage, handling,	Contractor	Pre-construction Construction	Additional Safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	disposal and reuse of materials and associated procedures would be documented within the CEMP. Measures to manage the potential water quality impacts associated with runoff would be included in the SWMP.			
SW5 - soil erosion and water pollution	Stockpiles sites would be established and managed in accordance with Environmental Procedure Management of Wastes on Roads and Maritime Services Land (RMS, 2014) and Stockpile Site Management Guideline (RMS, 2015) and storage and use procedures would be outlined in the CEMP. Further consideration of how to manage stockpiles, material laydown and chemical storage with respect to floodwaters would be undertaken during detailed design.	Contractor	Pre-construction Construction	Additional Safeguard
SW6 - construction accidental spills	Measures to minimise the potential impacts associated with accidental leaks and spills during construction would be incorporated into a site-specific emergency spill plan incorporated within the CEMP.	Contractor	Pre-construction Construction	Additional Safeguard
SW7 - construction accidental spills	Measures to manage potential groundwater impacts during construction as a result of spills and storage of chemicals and stockpiles would be included within the CEMP and SWMP.	Contractor	Construction	Additional Safeguard
SW8 - soil erosion and water pollution	All stormwater outlet locations and culverts would be designed to include appropriate dissipation and/or scour protection measures as required to control scour and erosion within the receiving waterway with consideration to the existing channel form and lining.	Contractor	Detailed design Pre-construction	Additional Safeguard
SW9 - soil erosion and water pollution	The design of structures within and around the waterways including drainage outlets, bridge works, culverts, channel realignment works and stabilisation would be undertaken in accordance with relevant Transport guidelines and specifications and with consideration to Department of	Designer	Detailed design	Additional Safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	Primary Industries, Office of Water guidelines for controlled activities.			
SW10 - water pollution	Additional operational stormwater quality treatment opportunities should be investigated during detailed design in consultation with Penrith City Council.	Designer	Detailed design	Additional Safeguard
SW11 – soil erosion and water pollution	Structures within and around the waterways including drainage outlets, bridge works and culverts, should be designed to consider biodiversity principles and minimise erosion and sedimentation issues and prevent substantial changes in flow rates that may impact both the immediate area and downstream features. See <i>Why do fish need to cross the road?</i> (Fairfull and Witheridge, 2003) for potential design considerations.	Designer	Detailed design	Additional safeguard
SW12 – School House Creek	A management plan would be prepared for in-stream works in School House Creek and implemented as part of the SWMP.	Contractor	Pre-construction Construction	Additional safeguard

6.6 Aboriginal cultural heritage

The potential Aboriginal heritage impacts of the proposal have been assessed in an Aboriginal cultural heritage assessment report (CHAR) (AMBS 2021) provided in Appendix H. The existing heritage sensitivities, potential impacts of the proposal and safeguards to mitigate them, are summarised in this chapter.

6.6.1 Methodology

This report is consistent with the principles of the Burra Charter: *The Australia ICOMOS Charter for Places of Cultural Significance, 2013*. The assessment of Aboriginal heritage significance has been undertaken in accordance with the requirements of the Heritage NSW, Department of Premier and Cabinet (Heritage NSW) guidelines as specified in the Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW 2010), and the requirements of Stage 2 of the Roads and Maritime Services Procedure for Aboriginal cultural heritage consultation and investigation (PACHCI).

Stage 2 of the Transport PACHCI must be carried out where there is potential for Aboriginal heritage objects to be impacted by proposed work, and requires initial engagement with key Aboriginal community stakeholders, an archaeological survey of the project area, and preparation of an archaeological survey report.

The following tasks were undertaken:

- Consultation with the local Aboriginal community as per Stage 2 of the Transport PACHCI
- Search and review of the Heritage NSW Aboriginal Heritage Information Management System (AHIMS) database, to determine the location and nature of any Aboriginal heritage sites recorded within, or in the vicinity of, the study area
- Review of relevant previous archaeological reports specific to the area, to determine the extent of past Aboriginal archaeological research in the region
- Field survey with local Aboriginal community representatives, to allow identification and assessment of Aboriginal heritage values present in the study area
- Preparation of a report describing the results of the background research, the extent and significance of heritage items recorded in the study area, and management recommendations and mitigation measures for any Aboriginal heritage resources, including constraints and opportunities.

6.6.2 Existing environment

Land use and disturbance

The study area has been significantly disturbed by the construction of Mulgoa Road, which would have required significant levelling, cutting of landforms and impacts to lands next to the road and within the road easement. Significant vegetation clearing has occurred and any trees that remain near to the study areas would be considered regrowth. This disturbance is likely to have impacted on the integrity of Aboriginal archaeological deposits. If modified trees (scarred or carved) were present in the study area by Aboriginal people in the past these have now been removed. Historic aerial imagery reveals that by the 1940s, the study areas, laydown areas and their surroundings had been extensively cleared of vegetation and land had been modified to allow construction of roads, artificial dams, and buildings.

Regional cultural context

What is now known as Penrith is believed to have been traditionally occupied by the Mulgoa clan of the Darug language group, with the Gundungurra located to the south.

A European expedition in 1789 travelled to Penrith noticing signs of Aboriginal life along the Nepean River in the form of canoes, gunyas (huts) and animal traps (Stacker 2014:11). Charles Darwin's visit to what is now known as the Blue Mountains in 1836 observed a number of Aboriginal people and noted them as "good humoured and pleasant, and they appeared far from being such utterly degraded beings as they have usually been represented" (Darwin cited in Stacker 2014:11). Aboriginal groups in and near hinterland areas, away from the main British settlements, were able to uphold their traditional hunting and plant gathering practices longer than those living in the coastal regions were able to (Attenbrow 2010:84).

Regional archaeological context

Aboriginal occupation of the greater Sydney region has evidence that dates more than 50,000 years (Nanson et al. 1987). The evidence includes artefacts found in gravels of the Cranebrook Terrace on the Nepean River. Late Pleistocene occupation sites have been identified on the fringes of the Sydney basin and from rock shelter sites in adjoining areas.

The spread of urban development across the Cumberland Plain, particularly over the last few decades, has meant that archaeological investigations have intensified with the need for environmental impact assessments. A number of predictive models relating to Aboriginal occupation patterns and site locations have been formulated through archaeological investigations in the Cumberland Plain (Haglund 1980; Kohen 1986; Smith 1989).

The most common site types found on the Cumberland Plain are open artefact scatters and open camp sites, followed by scarred trees and isolated finds. Shelter sites and grinding grooves are also found. Key trends are summarised below:

- Site frequency and density are directly related to the location of sites within the landscape
- Complex sites are usually located close to permanent water sources
- Sites with large numbers of artefacts can occur on ridge tops and hill crests
- Sites situated in alluvial soils retain the potential for stratified deposits
- Potential Archaeological Deposits (PADs) are most likely to be located along valley floors and low slopes in well-drained areas
- Artefact scatters are most commonly linked to the close proximity of permanent water sources in areas such as creek and river banks and alluvial flats. The majority of these sites are located within 100m of permanent fresh water
- Artefact assemblages generally comprise a small proportion of formal tool types with the majority of assemblages dominated by unretouched flakes and debitage
- High concentrations of artefacts are more likely to be located within resource rich areas
- Silcrete is the dominant raw material used for tool manufacture, followed by chert (also known as tuff). Silcrete sources are located in the north western Cumberland Plain
- Stands of remnant old growth vegetation retain the potential for scarred trees to be present; however, large scale land clearance of the plain in general means that such stands of vegetation are rare

- Evidence of post-contact camp sites may be located in close proximity to early European houses and farms, or official buildings.

Artefacts

Three artefact scatters were identified along both sides of Jamisons Creek:

- A large density of artefacts located on an upper terrace
- A small density of artefacts located on a lower terrace
- A density of artefacts located on a lower terrace between the creek and a swamp.

In 1984, Kohen undertook a surface collection and excavations to determine the remaining archaeological potential of the three artefact scatters. A total of 758 artefacts were collected from the surface, with material types including chert, silcrete, quartz, basalt and quartzite, and artefact types including core, blade, hammerstone, scraper, Bondi point and edge-ground axe. Low densities of artefacts were yielded from the excavations with 40 artefacts per cubic metre.

Registered Aboriginal sites

An extensive search of the AHIMS database was undertaken on the 28 September 2020 which identified 107 previously recorded Aboriginal sites. The most frequent site types previously recorded in the local area are open camp sites.

AHIMS site #45-5-0418 is located within at the western end of stage 2, and is the only site located within the proposal area. This site was recorded as an open camp site and is described as a surface scatter of artefacts in a shallow dish-like depression of 7 metres by 5 metres. The artefacts consisted of silcrete, quartz, silcrete and mudstone and varied in size but were under five centimetres in length. Although this site is still valid, the National Parks Wildlife Service provided a letter that advised the site has received a Consent to Destroy associated with the Penrith City Council construction of a sewer pump station.

Table 6-42 Table 6-42 summarises the AHIMS sites that are registered within the vicinity of the proposal area.

Table 6-42: Identified Aboriginal archaeological sites within the Aboriginal heritage study area

AHIMS number	Site feature/s	Proximity to proposal area
45-5-0418	Open camp site. A consent to destroy was issued prior to 1988.	Within the western extent of the stage 2 proposal area
45-5-0299	Surface artefacts. A consent to destroy was issued in 1988.	80 metres south east of compound site one
45-5-0301	Surface artefacts. A consent to destroy was issued in 1988.	370 metres south of compound site one
45-5-0302	Surface artefacts. A consent to destroy was issued in 1988.	230 metres south east of compound site one
45-5-0303	Surface artefacts. A consent to destroy was issued in 1988.	245 metres south east of compound site one
45-5-0304	Surface artefacts. A consent to destroy was issued 1988.	285 metres south east of compound site one
45-5-5019	PAD site	25 metres east of stage 5B
45-5-0790	Surface artefacts	595 metres east of stage 5B

AHIMS number	Site feature/s	Proximity to proposal area
45-5-0541	Surface artefacts	200 metres south west of compound site three
45-5-0540	Surface artefacts	575 metres east of stage 5B
45-5-0539	Surface artefacts	500 metres west of stage 5B
45-5-0538	Surface artefacts	800 metres north of stage 2

Archaeological survey

An Aboriginal archaeological survey assessment of the study area was undertaken on February 2021. No Aboriginal heritage sites, objects or places were identified in any of the study areas during the archaeological survey. Ground disturbance was observed across all study areas, with most areas levelled or modified for construction of the roads or buildings meaning limited visibility.

The survey results indicated that most of the stage 2 proposal area has been disturbed by levelling and the construction of roads. The proposed location of laydown area 1 has also been impacted by levelling.

Most of stage 5A and 5B comprises modified flat landforms, which have been disturbed by levelling and construction of roads, footpaths, residential areas, commercial properties, car parking areas and other infrastructure.

6.6.3 Potential impacts

Construction

No Aboriginal heritage objects or areas of potential archaeological deposit were identified during the archaeological survey. While AHIMS site #45-5-0418 was originally recorded within southern extent of the stage 2 proposal area, the site has been destroyed to allow construction of sewer pump station sometime before 1988. Due to extensive modification in the area it is unlikely that the Aboriginal objects remain present at the site, or that they have survived within the stage 2 proposal area near its location. No other AHIMS sites fall within the proposal area.

Based on the results of previous Aboriginal heritage investigations in the region, the predictive model for Aboriginal heritage sites, and high levels of previous ground disturbance, it is considered that the proposal areas are unlikely to retain Aboriginal heritage items or areas of subsurface archaeological deposit. The Deerubbin Local Aboriginal Land Council have indicated that the proposal area does not have any specific cultural significance. The proposal area is therefore not considered to have significance for Aboriginal heritage.

Operation

No Aboriginal heritage items or places are likely to be impacted during operation of the proposal.

6.6.4 Safeguards and management measures

Table 6-56 describes the proposed safeguards that would be introduced to manage the potential impacts on Aboriginal heritage.

Table 6-43: Aboriginal heritage safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
AH1 - Aboriginal heritage	<p>An Aboriginal Heritage Management Plan (AHMP) would be prepared in accordance with the <i>Procedure for Aboriginal cultural heritage consultation and investigation</i> (Roads and Maritime, 2012) and <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) and implemented as part of the CEMP. It would provide specific guidance on measures and controls to be implemented for managing impacts on Aboriginal heritage. The AHMP would be prepared in consultation with all relevant Aboriginal groups.</p>	Contractor	Detailed design Pre-construction	Section 4.9 of QA G36 <i>Environment Protection</i>
AH2 - Aboriginal heritage	<p><i>The Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) would be followed if an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Transport for NSW 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 would only re-commence once the requirements of that Procedure have been satisfied.</p>	Contractor	Detailed design Pre-construction	Section 4.9 of QA G36 <i>Environment Protection</i> . Section 87 or Section 90 of the NPW Act

6.7 Non-Aboriginal heritage

The potential non-Aboriginal impacts during construction and operation of the proposal have been assessed as part of the *Non-Aboriginal Heritage and Archaeological Impact Assessment – Mulgoa Road Upgrade Stage 2, 5a and 5b* (Aurecon, 2021) provided in Appendix I. The existing heritage sensitivities, potential impacts of the proposal and safeguards to mitigate them, are summarised in this chapter.

6.7.1 Methodology

The methodology for the Non-Aboriginal heritage and archaeological impact assessment involved:

- Review of applicable statutory heritage lists within the heritage proposal area, including:
 - The State Heritage Register (SHR)
 - Local heritage items (as included on Schedule 5 of the relevant LEP)
 - Other statutory lists such as State Agency Section 170 registers
 - The Commonwealth Heritage List (CHL) and the National Heritage List (NHL)
 - Non-Statutory heritage lists and registers, such as the National Trust Register (NSW)
- Review of the past heritage studies and Statements of Heritage Impact relevant to the proposal area
- Historic research, including sourcing historic maps, plans and images from the relevant collections
- Review of the concept design
- Inspection of the proposal area on 28 October 2020.

The approach and terminology outlined in the Australia ICOMOS Charter for Places of Cultural Significance, Australia ICOMOS, 2013 (*the Burra Charter*) was followed. In addition, the following heritage guideline and policy documents were considered:

- Heritage Council of NSW Statements of Heritage Impact (updated 2002)
- Heritage Council of NSW Assessing Heritage Significance: NSW Heritage Manual (updated 2002)
- Heritage Branch of the NSW Department of Planning Assessing Heritage Significance for Historical Archaeological Sites and 'Relics' (2009).

A heritage impact ranking system was used to categorise the impacts in accordance with their severity or neutrality ranging from major positive to Major adverse.

6.7.2 Existing environment

Historical context

A summary of the history of the proposal area and the phases that have influenced the development of the proposal area includes:

- Phase 1 – Early exploration, land grants and settlement (1803-1850)

- Phase 2 – Pastoralism and grazing – mid-nineteenth century to Federation (1850-1900) including when the Workmen’s Cottages were built in 1885, and Jamisontown United Church in 1889
- Phase 3 – Farming, closer settlement – (1900-1945)
- Phase 4 – Post war development and urban expansion (1945 onward).

Heritage items and sites

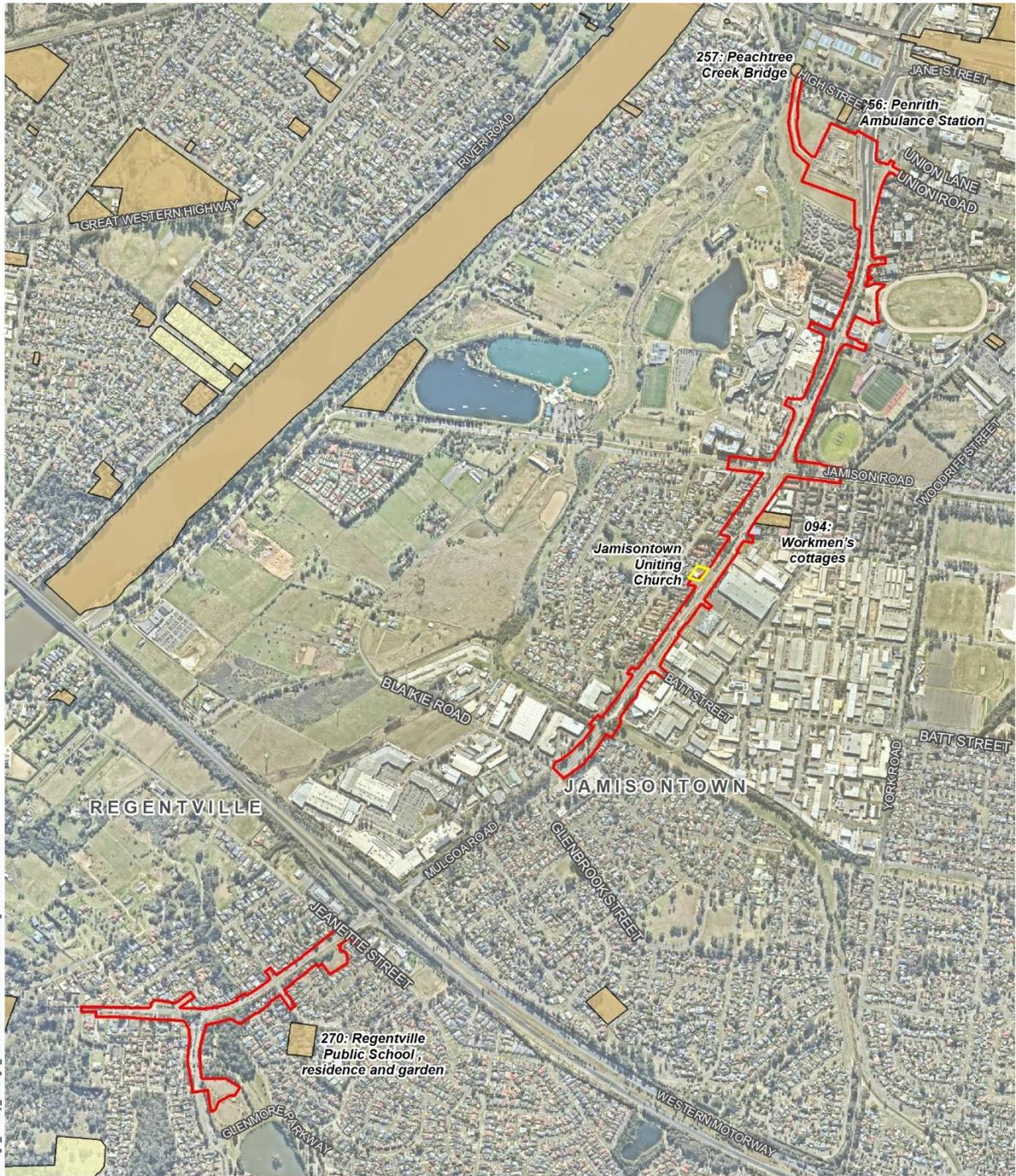
Figure 6.31 and Table 6-44 show the four listed heritage items as well as Jamisontown Uniting Church, which has been identified as having potential historic heritage significance at a local level.

Table 6-44: Listed non-Aboriginal heritage items

Item	Description	Listing	Significance level
Regentville Public School and Residence	Regentville Public School was established in 1868 as one of the first public schools in the Penrith area. It was first built in 1881 and an additional classroom block was added in 1910. The 1881 building on School House Road is an excellent example of standard school building design and remains one of the few early public buildings developed in the area.	Penrith LEP #270	Local
Workmen’s Cottages	The row of single storey terraced cottages shows a new phase in the development of the area in the late 19th Century demonstrating early brickmaking. These brick cottages have been altered in recent years.	Penrith LEP #93	Local
Peach Tree Creek Bridge	This is a good example of an early reinforced concrete bridge that has been successively modified to reflect the changing demands of the road system. The structure demonstrates the design and construction features of concrete slab road bridges of the 1920s (or earlier) and 1940s.	Penrith LEP #257	Local
Penrith Ambulance Station	Designed by T.W. Hodgson and Sons and built in 1936, Penrith Ambulance Station is the first example of a building associated with a non-transport government service to serve the greater Nepean region. The building is a two-storey brick structure in the Inter-war Romanesque style of architecture. NSW Health is currently redeveloping the site.	Penrith LEP #256	Local

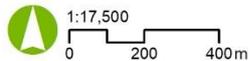
Places with potential heritage significance

The Jamisontown Uniting Church has been identified as having potential historic heritage significance at a local level, however the item is not listed on any heritage registers. This item was assessed against the NSW Heritage Assessment Criteria, as outlined in Heritage Council of NSW *Assessing Heritage Significance: NSW Heritage Manual*, however the item is not listed on any heritage registers. Table 6-45 summarises the significance assessment.



- REF proposal area
- Heritage items
- Conservation areas
- Local heritage items
- Archaeological items
- Potential heritage item

Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri



Projection: GDA 1994 MGA Zone 56

Figure 6-31: Nearby heritage items

Table 6-45: Significance assessment – Jamisontown Uniting Church

NSW Heritage Criteria	Brief assessment description
A – Historical significance	Jamisontown Uniting Church has historical significance at a Local level for its long-standing service to the community as a place of worship and education for over 130 years. The 1889 church building also has significance for its general intactness as a simple brick, Victorian style, Protestant church.
B – Associative significance	The Church has associative significance for its links to the Methodist and Presbyterian communities of the Jamisontown area.
C – Aesthetic significance	The aesthetic significance of the Church is limited to the simple, brick, gabled 1889 church building which is intact and demonstrates a simple Victorian style church, however these elements are not necessarily exceptional.
D – Social significance	The Church has social significance at a Local level for its continued ties to the Methodist and Presbyterian communities of the Jamisontown area since its establishment in the late 19th Century.
E – Research potential	There are minor levels of research potential at this Church, which could yield information relating to the Christian communities of the Penrith area in the late 19th Century including information about the education of local children and the religious practices in the area.
F – Rarity	This Church is not a rare example of a late 19th Century brick church in the NSW context however as it remains an active place of worship and is largely intact, these qualities could be considered endangered within the Penrith area.
G – Representativeness	Jamisontown Uniting Church is a representative example of an intact, simple, brick Victorian church and has attributes which are typical of a late 19th Century Protestant church, however these elements are not necessarily outstanding.

The remainder of the proposal area is unlikely to contain archaeological deposits of value. Medium to low density residential development, large scale retail development, construction and expansion of existing road networks, services and utilities installation, and urban expansion generally have resulted in a moderate to high level of disturbance across the entire proposal area.

6.7.3 Potential impacts

Construction

There would be limited potential for indirect vibration, noise and dust impacts to impact the Workmen’s Cottages (Penrith LEP #94). The potential historical archaeological impacts from construction across the proposal area are summarised in Table 6-46.

Table 6-46: Archaeological impacts of construction

Archaeological item	Potential impact	Discussion
Workmen’s cottages	Low	Previous disturbance in the vicinity of the cottages has resulted in a low potential for any subsurface historical archaeological remains associated with the historical use to be found.

Archaeological item	Potential impact	Discussion
		Construction activities would not result in direct contact with any of the buildings or structures associated with the Workmen's cottages.
Remainder of proposal area	Low	Due to previous disturbance the remainder of the proposal area is unlikely to contain archaeological deposits of value and the potential for archaeological impacts is low.

Operation

The proposal would not result in any major or moderate adverse visual or setting impacts to any of the listed or potential heritage items within the proposal area. Table 6-47 summarises the potential operational impacts to non-Aboriginal heritage items.

Table 6-47: Operation impacts to heritage items

Heritage or potential heritage item	Impact ranking
Workmen's Cottages	There would be no direct, moderate or major adverse impacts expected to the Workmen's Cottages as a result of the proposal. A pedestrian footpath and kerbing about 10 metres wide would be provided from the front fence of the Cottages to the new traffic lanes. This separation would act as a physical buffer zone to the Cottages.
Jamisontown Uniting Church	There would be no direct physical impacts to the Church structure as a result of the proposal. The proposal boundary currently interfaces with the lot that the Church resides on. There would be clearance of about 19 metres between the Church and the new road pavement. The current pedestrian footpath and kerb is 18 metres from the Church whereas the new footpath would be 6 metres from the Church.
Peach Tree Creek Bridge	The Peach Tree Creek Bridge would not be impacted by the proposal because it is located over 300 metres north-west outside of the proposal area.
Penrith Ambulance Station	Penrith Ambulance Station would not be impacted by the proposal because it is located about 125 metres north-west of the proposal area.
Regentville Public School and Residence	Regentville Public School and Residence would not be impacted by the proposal because it is located over 150 meters south-east of the proposal area.

6.7.4 Safeguards and management measures

Table 6-48 describes the proposed safeguards and management measure that would be implemented by the proposal to mitigate any impacts to non-Aboriginal heritage items.

Table 6-48: Non-Aboriginal heritage safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
NH1 - non-Aboriginal heritage	A Non-Aboriginal Heritage Management Plan (NAHMP) would be prepared and implemented as part of the CEMP. It would provide specific guidance on measures and	Contractor	Detailed design Pre-construction	Section 4.10 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	controls to be implemented to avoid and mitigate impacts to Non-Aboriginal heritage.			
NH2 - non-Aboriginal heritage	<i>The Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) would be followed if any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered. Work would only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Detailed design Pre-construction	Section 4.10 of QA G36 <i>Environment Protection</i>
NH3 - non-Aboriginal Heritage	Site inductions and heritage awareness training should be undertaken. This would detail historical relics, structures and deposits that may be encountered during construction.	Contractor	Construction	Additional Safeguard
NH4 - non-Aboriginal Heritage – Workmen’s Cottages	Vibration monitoring should be undertaken on the Workmen’s Cottages throughout construction. Pre and post construction condition surveys should be undertaken on heritage items in the proposal area. Records should be retained for all monitoring and condition survey findings.	Contractor	Pre-construction Construction Post-construction	Additional safeguard
NH5 – non-Aboriginal Heritage – Workmen’s Cottages	If architectural noise mitigation treatments are specified in the detailed design for the Workmen’s Cottages, they should be designed to minimise impacts on heritage significance. Architectural noise mitigation treatments to heritage structures should be designed in consultation with a suitably qualified heritage advisor, Penrith City Council and the landowner.	Contractor	Detailed design	Additional safeguard

6.8 Contamination, landform, and soils

The potential impacts of the proposal in relation to contaminated soils are assessed in the *Detailed Site Investigation Report* (Aurecon, 2021). A summary of this assessment is presented in this section, with the full report provided in Appendix J.

6.8.1 Methodology

A Detailed Site Investigation (DSI) was carried out for the proposal. To inform this report a desktop review of the following was completed that included:

- Past and current activities in the proposal area and other potential on-site/offsite sources of contamination
- Lot and deposited plans (DP) and land use zoning information
- Historical aerial photographs (from the 1940s until present)
- NSW EPA databases on the contaminated land record and NSW EPA's Protection of the Environment Operations Act 1997(POEO Act) licences for the site and Penrith City Council LGA
- Geology, soil, topography and registered groundwater bore maps
- Acid sulfate soil (ASS) and salinity risk maps
- Department of Defence unexploded ordnance (UXO) risk mapping
- The NSW EPA priority per- and polyfluoroalkyl substances (PFAS) investigation risk sites within 10 km of the project extents/sites
- Review of previous reports completed by Hills Environmental (2015) and Coffey (2016) prepared for the Mulgoa Road Upgrade.

A site walkover was conducted on 3 August 2020 and soil investigation field activities were completed 4 January 2021 to 3 February 2021. Groundwater investigation field activities were completed from 27 January 2021 to 3 February 2021. During these contamination investigations seven boreholes, 24 pavement cores, 16 test pits and one hand auger location were undertaken.

The following activities were also completed:

- Installation of one groundwater monitoring well
- Collection of groundwater samples
- Collection of three soil samples from each borehole location at varying depths by hand, hand auger or stainless-steel hand trowels. There was a total of 103 primary soil samples collected and analysed.

6.8.2 Existing environment

Topography

The proposal area is relatively flat with elevations ranging between 28 metres Australian Height Datum (AHD) to 38 metres AHD. In the southern part of the proposal area the topography is slightly undulating and slightly more elevated than other areas, before becoming relatively flat from Surveyors Creek northwards.

Geology and Soils

Geological and hydrogeological information was sourced from the NSW Seamless Geology Database and the eSPADE 2.0 Web application (DPE). The proposal area is mainly underlain by black to light grey shale and laminate of Ashfield Shale from the Wianamatta

Group. The proposal area has deposits of sand, gravel, silt, clay, quartz-lithic sand and polymictic gravel.

Soil landscape of the areas include Richmond soils, Luddenham soils and Blacktown soils. The key characteristics and their locations in the proposal are described in Table 6-49.

Table 6-49: Key soil properties

Soil landscape	Key characteristics	Location
Richmond	Mainly flat alluvial plains. Limitations include localised flood hazards, localised water logging as well as localised water erosion hazard on terrace edges.	Stage 2, 5A and 5B
Luddenham	Undulating to rolling low hills, with narrow ridges, hillcrests and valleys.	Stage 2
Blacktown	Gently undulating rises with broad (rounded ridges and crests). Limitations include localised seasonal waterlogging, localised water erosion hazard, moderately reactive highly plastic subsoil with localised surface movement.	Stage 2

Hydrology and drainage

School House Creek and Surveyors Creek pass through the proposal area, with the Nepean River running parallel about 1.3 kilometres to the west. The direction of groundwater flow is likely to be controlled by proximity to local surface water bodies and areas of higher permeability alluvium. Regional groundwater flow is expected to be consistent with the topography, flowing northwest toward Nepean River. Review of access data available through the WaterNSW Groundwater Map (2021) revealed several groundwater wells within the proposal area, mostly for monitoring at current and former petrol stations and EPA notified sites.

Acid sulfate soils

A review of information available through both the NSW OEH (eSPADE 2.0) and the Australia Soil Resource Information System (ASRIS) indicates that the proposal area is not located within an acid sulfate soils risk area.

Site history

A review of aerial photographs showed that most of proposal area was predominantly rural use land with some agricultural areas until the 1980s. From the 1980s onward, there was substantial increase in commercial buildings in the stage 5A and 5B area, and substantial increase in residential blocks in all proposal stage areas. Some filling of former alignments of School House Creek and Surveyors Creek were observed. The Panthers Penrith commercial complex underwent substantial earthworks and development between 1980s to 2000s, with a large lagoon established adjacent. The industrial area east of Regentville Road was established between 1980s to the present.

Observations from the site inspection on 3 August 2020 include:

- Some mounding observed
- Numerous groundwater monitoring wells observed at 229 Mulgoa Road, Jamisontown (EPA notified site)
- Automotive part fragments on the Jamisontown 7-Eleven driveway and some potential hydrocarbon or oil marks observed on the concrete suggesting a recent accident

- Several car dealerships and service stations
- No other unusual odours or staining on surfaces along proposal area.

A search conducted of the Department of Defence records on 11 February 2021 revealed there are no records of unexploded ordnance (UXO) risk within three kilometres of the proposal area.

Previous investigations

Two previous investigations have been carried out for the proposal area.

Hills Environmental made the following recommendations for Transport for the entire Mulgoa Road Upgrade project area in 2015:

- Appropriate soil, contaminated land, salinity, erosion and sediment control measures should be specified in any future project environmental management documentation as relevant
- A stage 1 preliminary site investigation (PSI) should be prepared as part of any future detailed environmental impact assessment
- Consideration to be given to salinity related impacts during environmental assessment.

Coffey later conducted a Stage 1 Contamination Assessment (PSI) for the entire Mulgoa Road project including the stage 2, 5A and 5B proposal area (Coffey, 2016). A risk assessment was conducted that found one location considered at high risk of contamination potentially impacting the proposal area, 92 Mulgoa Road, Jamisontown. This location sits directly adjacent to the proposed area. The risk assessment of potential contamination sources found a total of 14 locations within the proposal area to be areas of potential environmental concern (APECs) requiring further investigation.

Contamination

Three contaminated site records were found through a search of the NSW EPA public register on 20 February 2021. Details are summarised in Table 6-50.

Table 6-50: NSW EPA notified sites within proposal area

Site name	Site address	Contamination Activity Type	Management Class
BP Service Station Jamisontown	124-128 Mulgoa Road, Jamisontown	Service Station	Regulation under CLM Act not required
Former Caltex Jamisontown	229-231 Mulgoa Road, Jamisontown	Service Station	Regulation under CLM Act not required
7-Eleven Service Station	92 Mulgoa Road, Jamisontown	Service Station	Contamination currently regulated under CLM Act

A search of environmental protection licences (EPLs) on 11 February 2021 found several sites within 500 metres of the proposal area under the *Protection of the Environmental Operations Act 1997* (POEO Act 1997). Six licenses were noted with scheduled activities including road construction, hazardous waste activities, concrete batching and railway system activities. Two were noted as non-compliances but after review were believed not pose a contamination risk to the proposal area.

A search of the per-and polyfluoroalkyl substances (PFAS) investigation program (NSW EPA) on 11 February 2021 revealed no records of PFAS sites within a five kilometre radius of the proposal area.

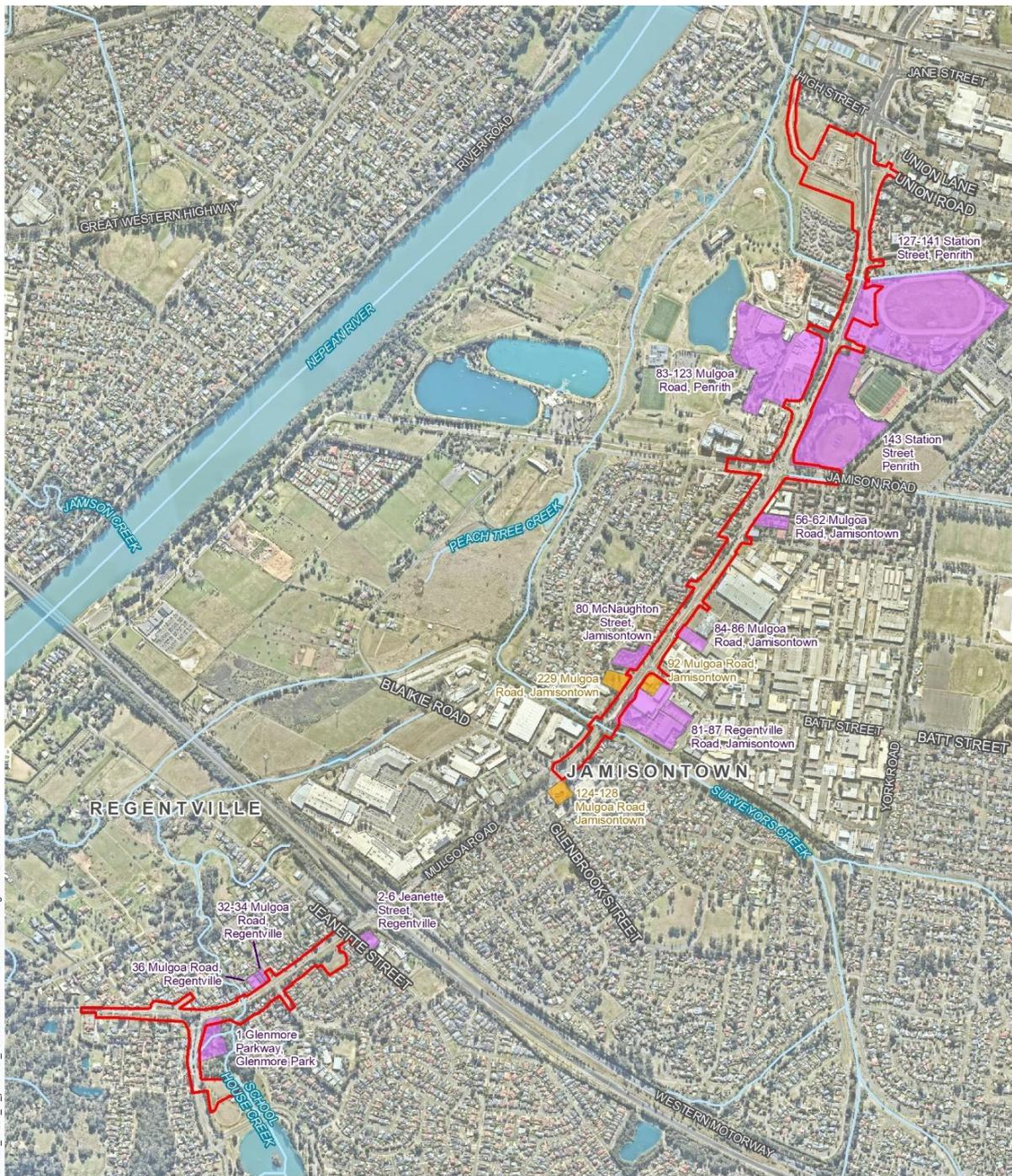
No asbestos containing material was detected during the site investigation from samples analysed, or visually observed within excavated materials.

Areas of potential environmental concern

Eleven locations were identified by Coffey (2016) that pose a potential contamination risk for the proposal. The APEC requiring assessment by this investigation are detailed below in Table 6-51 and Figure 6.32.

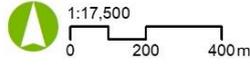
Table 6-51: Areas and contaminants of potential concern (Coffey 2016)

Address	Potential Contamination Source/Landuse	Risk	Contaminant of Potential Concern (COPC)
1 Glenmore Parkway, Glenmore Park	Park – Fill mound adjacent footpath	Medium	TRH, BTEX, PAH, heavy metals, OCP, OPP, asbestos
32-34 Mulgoa Road, Regentville	Vacant Block	Low	TRH, BTEX, PAH, heavy metals, OCP, OPP, asbestos
36 Mulgoa Road, Regentville	7-Eleven Service Station	Medium	TRH, BTEX, PAH, lead
2-6 Jeanette Street, Regentville	Fill mound adjacent footpath/Regentville Fire Station	Medium	TRH, BTEX, PAH, heavy metals, OCP, OPP, asbestos, PFAS
81-87 Regentville Road, Jamisontown	Penrith Mazda Dealership	Low	TRH, BTEX, PAH, VHCs, lead
124-128 Mulgoa Road, Jamisontown	BP Service Station	Medium	TRH, BTEX, PAH, lead
92 Mulgoa Road, Jamisontown	7-Eleven Service Station	High	TRH, BTEX, PAH, lead
80 McNaughton Street, Jamisontown	Fill mound adjacent footpath	Medium	TRH, BTEX, PAH, heavy metals, OCP, OPP, asbestos
84-86 Mulgoa Road, Jamisontown	Mazda Used Car Dealership	Low	TRH, BTEX, PAH, VHCs, lead
56-62 Mulgoa Road, Jamisontown	Residential Cottages	Low	Heavy metals, asbestos
83-123 Mulgoa Road, Penrith	Fill mound adjacent footpath	Medium	TRH, BTEX, PAH, heavy metals, OCP, OPP, asbestos
229 Mulgoa Road, Jamisontown	Unoccupied lot (former petrol station)	Medium	TRH, BTEX, PAH, lead
124-128 Mulgoa Road, Jamisontown	BP Service Station	Medium	TRH, BTEX, PAH, lead
143 Station Street Penrith	Park – Fill mound adjacent footpath	Low	TRH, BTEX, PAH, heavy metals, OCP, OPP, asbestos
127-141 Station Street, Penrith	Penrith Paceway – Fill mound adjacent footpath	Low	TRH, BTEX, PAH, heavy metals, OCP, OPP, asbestos



- REF proposal area
- Water body
- Watercourse
- Area of potential concern
- EPA notified site

Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri



Projection: GDA 1994 MGA Zone 56

Mulgoa Road **Review of Environmental Factors**

Areas of potential concern

Figure 6-32: Areas of potential contamination concern

Soil investigation results

75 primary samples and nine field duplicates were analysed from the soil investigation against the relevant adopted human health or ecological health guidelines.

The majority of the proposal area is covered in fill layers of varying thickness. The following was identified through the soil investigation:

- Concentrations of phenols did not exceed the laboratory limit of reporting (LOR) and did not exceed any adopted human health or ecological health investigation levels. It is unlikely that coal tar asphalt was used within the sections of Mulgoa Road investigated
- Concentrations of zinc from a supuplicate sample taken along Mulgoa Road in stage 5A about 100 metres north of Surveyors Creek, exceeded the National Environment Protection Measures (NEPM) ecological investigation levels for commercial/industrial land use likely due to the heterogeneity of fill materials. The zinc source is likely from zinc coatings.
- Benz(o)apyrene and total PAH from fill material from a sample taken along Mulgoa Road in stage 2, about 100 metres west of School House Road, exceeded the NEPM ecological screening levels criteria for commercial/industrial land use and the NEPM health investigation level for open space/recreational land use. A deeper sample at this location showed slightly reduced concentrations. These soil impacts are likely due to run off from the nearby 7-Eleven (Regentville) and are believed to be localised.
- Concentrations of benzo(a)pyrene and benzo(a)pyrene TEQ (LOR) for a sample pair exceeded NEPM health investigation level for open space/recreational land use and NEPM ecological screening levels for commercial/industrial land use at a sample taken along Mulgoa Road in stage 5B, about 50 metres south of Rodley Avenue. The exceedances are likely due to the presence of road base materials in fill material rather than a significant contamination source.

Concentrations of all other soil COPCs either did not exceed the laboratory LOR or did not exceed any adopted human health or ecological health criteria. No asbestos or asbestos containing material was visually observed on the ground surface or within intrusive holes during the site works.

Groundwater results

Measured groundwater physiochemical parameters showed groundwater was anaerobic, from a freshwater source, slightly oxidating, and of a neutral pH. Concentrations of all COPCs analysed within the groundwater samples either did not exceed the laboratory LOR or did not exceed any adopted human health or ecological health criteria.

6.8.3 Potential impacts

Construction

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

- Soil erosion and loss of topsoil: This could result from removal of vegetation (clearing and grubbing) and disturbance of the ground surface during site preparation, earthwork, excavation and other construction activities. Earthmoving activities have the potential to expose loose soils and mobilise these materials.
- Mobilisation of contaminated material: Earthworks within potentially contaminated areas could potentially expose contaminants in soil that may be mobilised as part of dewatering activities or via runoff to local waterways if poorly managed. These soil contaminated risks can be managed during future construction works with standard practices and strategies.
- Spills of contaminating materials: There would be potential for construction activities to result in contamination of soil and/or water due to leaks and spills of potentially contaminating materials. Spill containment would be used at ancillary sites to contain spills and spill response procedures would be followed. These impacts would generally be temporary. Safeguards and management measures which would be implemented to reduce these impacts are provided in Section 6.8.4.

Waste classification

Soil analytical results were screened against threshold values from the NSW EPA Waste Classification guidelines (2014) in order to establish an indicative waste classification for likely spoil.

Several exceedances were noted for benzo(a)pyrene and total PAH. Results indicated that the majority of spoil from fill layers and underlying natural material would meet the indicative classification of General Solid Waste (non-putrescible). However, one sample was classified as Hazardous Waste due to exceedance of leachate criteria. Therefore, soil waste provided would be considered Hazardous Waste unless additional testing is completed.

No asbestos was detected during the site investigations from samples analysed. All indicative waste classifications are based on limited information only and analysis would need to be undertaken before disposal.

Areas of potential environmental concern

Three historical uses of the area were identified as areas of potential environmental concern. The overall risk of these sites in regard to human health and the environment has been modelled. This considers the pathways of contamination including direct contact, incidental ingestion, inhalation and stormwater/wastewater inflows to excavations. These risks and potential receptors are summarised in Table 6-52.

Operation

There would be minimal or no operational risks to geology and soils as a result of the proposal.

Table 6-52: Potential construction impacts

Potential source	COPCs	Receptor	Pathway	Comments
Historical use of coal tar asphalts for roads	Phenolic compound	Human (onsite workers, site users) Surface water receptors Groundwater receptors	Dermal contact, Ingestion, Inhalation Surface water runoff Infiltration to groundwater	Asphalting of road surface with the potential to contain coal tar asphalts, asphalt mixes and pre-coated aggregate which contain phenolic compounds and other COPCs. The linkage to human health and ecological receptors is considered to be incomplete . There is a low risk rating.
Fill mounds and incidental filling of unknown quality and origin	BTEX, TRH, PAH, OCPs, OPPs, asbestos	Human (onsite workers, local residents) Surface water receptors Groundwater receptors	Dermal contact, Ingestion, Inhalation Surface water runoff Infiltration to groundwater	Fill mounds were observed near street frontages and as observed from historical aerials on several lots which could contain localised COPCs. Future site workers may be exposed to contamination impacts from soil. Contaminated samples located within 100 metres to identified key fish habitats as well as sensitive vegetation communities. While there does not appear to be groundwater interaction with these impacts, measures must be put in place during construction to reduce the risk of surface water runoff impacting ecological receptors. The linkage to human health and ecological receptors within the proposal area is considered to be potentially complete. There is a low risk rating
Former and current fuel stations and vehicle workshops	TRH, PAH, BTEX, VHCs, heavy metals	Human (onsite workers) Surface water receptors Groundwater receptors	Dermal contact, ingestion, inhalation Surface water runoff Infiltration to groundwater	The soil impacts are localised and related to fuels or chemicals from the service station or a drain nearby. Future on-site workers are likely to be exposed to these soil impacts through the identified pathways. A sample is located within 100 metres of identified key fish habitats as well as sensitive vegetation communities, measures must be put in place during construction to reduce the risk of surface water runoff impacting ecological receptors. Several potential source sites are EPA notified sites and a more detailed assessment closer to these sources after property acquisition is recommended. The linkage to human health and ecological receptors is considered to be potentially complete. There is a moderate risk rating.

6.8.4 Safeguards and management measures

Table 6-53 describes the proposed safeguards that would be introduced to manage the potential impacts on contamination, landform, geology and soils.

Table 6-53: Safeguards and management measures for contamination, landform, geology and soils

Impact	Environmental safeguards	Responsibility	Timing	Reference
CL1 - contaminated land	<p>A Contaminated Land Management Plan will be prepared in accordance with the <i>Guideline for the Management of Contamination</i> (Roads and Maritime, 2013) and implemented as part of the CEMP. The plan will include, but not be limited to:</p> <ul style="list-style-type: none"> • Capture and management 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) • Management of 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. • Due to the cancellation of several locations and limited intrusive investigation, an unexpected finds procedure (UFP) must be included so that contamination hazard, including asbestos containing material, that was previously identified is managed appropriately during construction • Work health and safety (WHS) and environmental protection measures are recommended such as wetting surfaces, using wet drilling or other approved dust suppression methods, and use of appropriate PPE and should be specified in the contractor's CEMP. 	Contractor	Pre-construction Construction	Section 4.2 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
CL2 - contaminated land	If contaminated areas are encountered during construction, appropriate control measures would be implemented to manage the immediate risks of contamination. All other work that may impact on the contaminated area would stop until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Transport for NSW Environment Manager and/or EPA.	Contractor	Construction	Section 4.2 of QA G36 <i>Environment Protection</i>
CL3 - accidental spill	A site specific emergency spill plan would be developed, and include spill management measures in accordance with the Transport for NSW <i>Code of Practice for Water Management</i> (RTA, 1999) 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 Transport for NSW and EPA officers).	Contractor	Pre-construction Construction	Section 4.3 of QA G36 <i>Environment Protection</i>
CL4 - contaminated Land	Additional investigations should be carried out around known APECs, particularly EPA notified sites after land acquisition to delineate the nature and extent of impacts to establish any constraints, reduce project delays and minimise waste disposal or management costs during future works.	Contractor	Pre-construction Construction	Additional Safeguard
CL5 - asbestos	A licensed asbestos assessor (LAA) should visually assess areas of historical fill and historical surface disturbance to identify any management actions required during construction.	Contractor	Pre-construction Construction	Additional Safeguard
CL6 - waste	Excavated soil with the potential to be hazardous waste, i.e. the fill layers at PC08, should be carefully segregated from other excavated spoil for offsite disposal.	Contractor	Construction	Additional Safeguard
CL7 - waste	During construction additional samples should be collected from stockpiles to confirm the waste classification in accordance with the <i>Waste Classification Guidelines</i> . Materials may be classified as excavated natural material (ENM) if characterisation of the 48 material is undertaken as per the NSW EPA <i>ENM Resource Recovery Order and Exemption</i> . Materials may also be suitable for reuse as Excavated Public Road Material under the <i>NSW EPA Excavated Public Road Material Order and Exemption 2014</i> .	Contractor	Construction	Additional Safeguard NSW EPA <i>Waste Classification Guidelines</i> (2014), NSW EPA <i>ENM Resource Recovery Order and Exemption</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
CL8 - waste	Where waste soils cannot be reused on site under appropriate beneficial reuse conditions, soil should be disposed of offsite to a licensed waste facility in accordance with the NSW EPA <i>Waste Classification Guidelines</i> and the Transport licensed waste facility requirements and waste policy.	Contractor	Construction	Additional Safeguard
CL9 - waste	Any spoil excavated and reused as backfilling for the proposal should be classified as suitable for intended use based on soil contaminant concentrations via testing.	Contractor	Construction	Additional Safeguard
CL10 - waste	Records, waste classifications, waste disposal records, beneficial reuse of spoil, asbestos monitoring and asbestos clearance certificates should be held by the contractor and provided to Transport on completion.	Contractor	Pre-construction Construction	Additional Safeguard

6.9 Air quality

This section describes the potential air quality impacts associated with the proposal. This section summarises the Air Quality Impact Assessment (AQIA) prepared by SLR (2021) provided in Appendix K.

6.9.1 Methodology

The AQIA presents an assessment of potential air quality impacts at nearby sensitive receptor locations as a result of the traffic emissions from Mulgoa Road with and without the proposal. A quantitative assessment of operation impacts associated with identified sources of air emissions from the proposal was performed.

The methodology applied in assessing the potential for air-quality related impacts included:

- Identification of key risks on nearby sensitive receptors of the proposal, as well as suitable criteria for the evaluation of these risks
- Characterisation of key features of the surrounding environment, including prevailing climate and meteorological conditions and background air quality. Air quality monitoring data was collected from Air Quality Monitoring Stations (AQMS).
- A screening level quantitative assessment of the potential for impacts to occur during operations using the Tool for Roadside Air Quality (TRAQ) prediction mode. The assessment tool was used to assess the potential air quality impacts from the vehicular emissions on surrounding sensitive receptors from the proposal. Predictions of CO, NO₂ and PM₁₀ concentrations at various distances from the road kerb were provided. The four modelling scenarios performed were
 - Projected 2031 traffic flows with the proposal
 - Projected 2031 traffic flows without the proposal
 - Projected 2041 traffic flows with the proposal
 - Projected 2041 traffic flows without the proposal

Based on the outcomes of the above, mitigation measures have been recommended to effectively manage identified risks to air quality for nearby receptors.

State air quality guidelines adopted by the NSW EPA are published in the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA. (2017)). The Approved Methods (Section 4.2 in Appendix K) set out impact assessment criteria for the air pollutants.

6.9.2 Existing environment

The assessment analysed the potential changes in pollutant concentrations up to 200 metres from the kerbside, which is the nominated study area of this assessment. This study area is shown in reference to the proposal area in Figure 6.33.

The proposal area is reasonably flat, with a slight increase in elevation towards the south and southwest with an elevation of 0 metres to 280 metres AHD. The area immediately surrounding Mulgoa Road is relatively open without any high-rise buildings (which could facilitate the dispersion of emissions to air and prevent accumulation of air pollutants). Figure 2 in Appendix K shows a three-dimensional representation topography of the region.

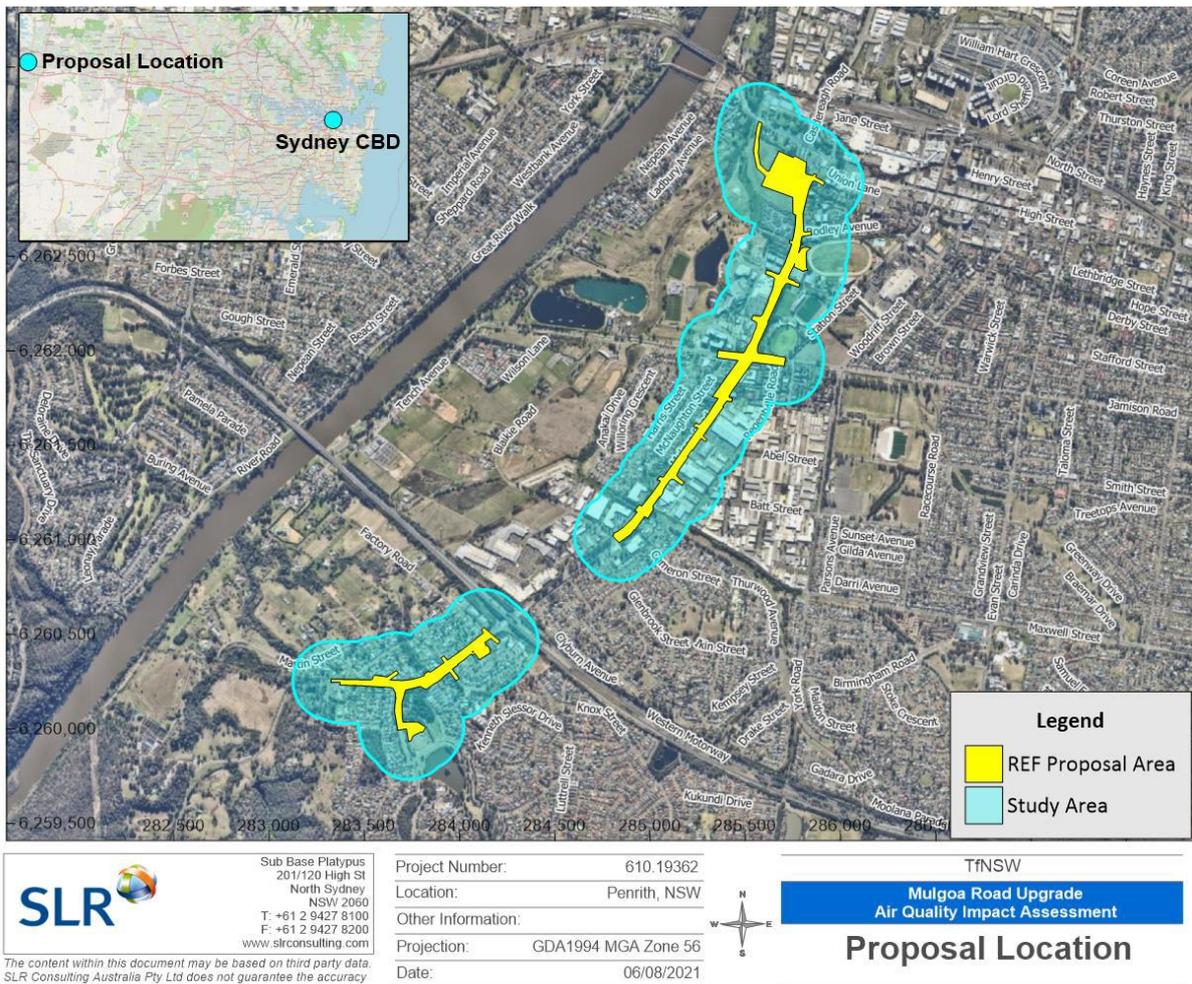


Figure 6-33: Air quality proposal location

Local wind speed and direction influence the dispersion of air pollutants. The closest weather station to the proposal is the Penrith Lakes Automatic Weather Station (maintained by BoM), 3.5 kilometres northwest of the northern proposal boundary. Annual and seasonal wind roses for the years 2016 to 2020 inclusive show that the predominant wind directions in the area are consistently from the south-west and south. The annual average frequency of calm wind conditions was recorded to be about 14 percent for the 2016 to 2020 period. The historical seasonal wind rises indicate that there is little variation in seasonal wind patterns and there has been some variation in the percentage of calm conditions. Winds from the northeast and southwest directions, which would blow air emissions from the proposal towards the nearest sensitive receptors (located to the southwest and northeast), occur about 5 -6 percent of the time.

Sensitive receptors

Most of the land on either side of the proposal area is zoned as residential (R2, R3 or R4), or commercial/business (B3, B5), with some recreational areas towards the north (RE2, SP3) in the *Penrith LEP*.

The closest residential receptors are identified to be located about 10 metres from the kerbside. At the time of writing the AQIA, data regarding the affected residences ie change in separation distances from the kerbside was not available, so it is assumed that with the proposal, the closest residential receptors would remain at 10 metres from the kerbside. A list of the identified sensitive receptors other than residential receivers is shown in Table 2 of Appendix K.

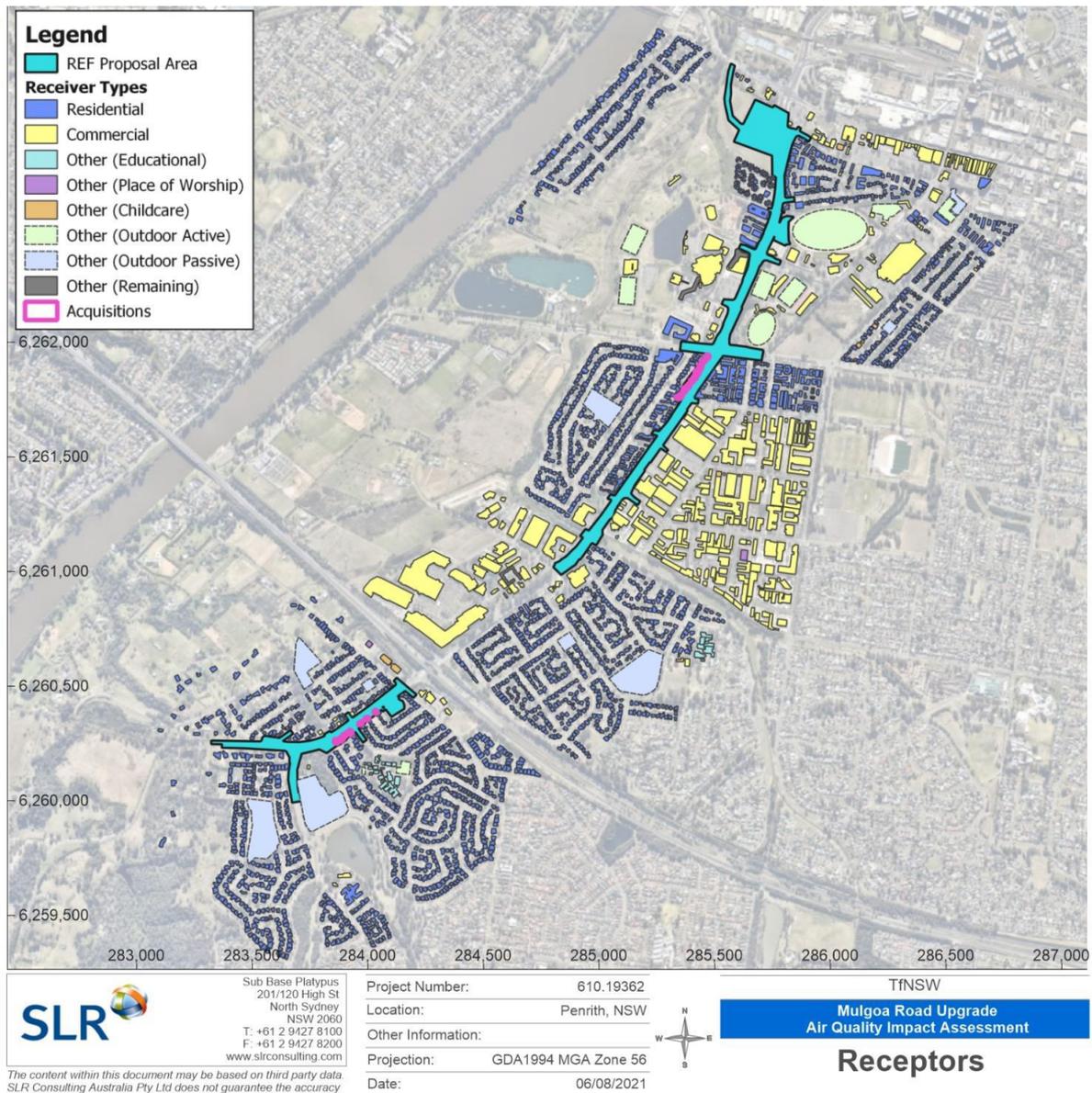


Figure 6-34: Identified air quality sensitive receptors

Background air quality

Based on information from the 43 Station Air Quality Monitoring Network (AQMN), between 2000 and 2019, the air quality was 'very good', 'good' or 'fair' for 94 per cent of days in the Sydney northwest region, within which the proposal is located (DPE). In Sydney more broadly, air quality is generally classified as good.

The nearest AQMS to the proposal are located at St Marys and Penrith (although the Penrith AQMS was only commissioned in July 2020). The St Marys AQMS is located 8.4 km southwest of the proposal and monitors the concentration levels of Oxides of nitrogen (NO, NO₂ and NO_x) and fine particles (PM_{2.5} and PM₁₀). The Prospect AQMS was used for data of ambient concentrations for CO and SO₂.

From the nearby AQMS, the 24-hour average PM₁₀ and PM_{2.5} concentrations are generally below the relevant 24-hour average guidelines. However isolated exceedances (normally on less than ten days per year) have been recorded in most years largely due to bushfire emergencies, dust storms and hazard reduction burns. The exception to this was the November 2019 to January 2020 period where extensive bushfires within NSW resulted in an extended period of very elevated particulate guidelines across Sydney that were significantly above the 24-hour PM₁₀ and PM_{2.5} guidelines.

Ambient concentrations of the gaseous pollutants NO₂, CO and SO₂ were all well below the relevant criteria for all years investigated. A summary of ambient PM₁₀, PM_{2.5} and NO₂ data at St Marys AQMS is in Table 5 of Appendix K and a summary of ambient CO and SO₂ Data at Prospect AQMS is in Table 6 of Appendix K.

Industrial sites surrounding the proposal with the potential to be significant emitters of air pollutants of interest in this assessment were identified through a review of facilities required to report to the National Pollutant Inventory (NPI). A search of the NPI database identified several sources of combustion-related air emissions and emissions of Volatile Organic Compounds (VOCs) within the Penrith LGA. These emissions are listed in Table 7 and shown in Figure 9 of Appendix K.

The only potentially significant emission sources identified, considering the regional monitoring data presented in the AQIA, are the PM_{2.5} emissions from the Enviroguard Landfill (Erskine Park) and NO₂ and SO₂ emissions from the Owen Illinois (OI) glass manufacturing facility in Penrith. Neither of these operations are considered likely to have a significant impact on local air quality that would not be captured by the regional monitoring data.

Two service stations located on Mulgoa Road (within the proposal boundary) may have the potential to impact air quality. The operation of these service stations has the potential to result in elevated concentrations of VOCs in the area immediately surrounding each facility. However, the concentrations of VOCs are expected to have returned to background levels within about 30 – 50 metres of the service stations.

6.9.3 Potential impacts

Construction

During construction, the following activities would potentially generate air emissions and dust or odour which would impact air quality:

- Clearing of vegetation
- Construction demolition
- Stripping, stockpiling and managing of topsoil
- Earthworks, excavation and road pavement work
- Road preparation and pavement work
- Transport and handling of soil
- Use of construction vehicles, machinery, and plant
- Spray painting of the road for line marking.

These air quality impacts have potential to impact surrounding residential receivers and construction workers. However, impacts would be localised and largely be dependent on daily weather conditions including wind direction and strength.

Operation

The primary source of air pollutant emissions associated with the operational phase of the proposal will be vehicles travelling along Mulgoa Road. The primary pollutants from combustion engines are:

- Particulate matter less than 2.5 µm in aerodynamic diameter (PM_{2.5})
- Particulate matter less than 10 µm in aerodynamic diameter (PM₁₀)
- Oxides of nitrogen (NO_x)
- Carbon monoxide (CO)
- Sulfur dioxide (SO₂)
- VOCs

Other substances that are also emitted from vehicle exhausts in trace amounts include products of incomplete combustion, such as metallic additives which contribute to the particulate content of the exhaust. In addition, ozone is formed as a secondary pollutant and is used as a key indicator of smog in urban environments.

The rate and composition of air pollutant emissions from road vehicles is a function of a number of factors, including the type, size and age of vehicles within the fleet, the type of fuel combusted, number and speed of vehicles and the road gradient.

Detail on the potential health impacts of the pollutants identified is provided in section 4.1 of Appendix K.

Table 6-54 presents the projected peak hourly traffic numbers associated with the proposal. The largest increase in vehicle numbers projected to occur as a result of the proposal occur between the M4 southbound on/off ramp and Batt Street, while the section between Batt Street and Jamison Road is predicted to have the highest peak hour traffic with the proposal.

Table 6-54: Change in projected peak hourly traffic volumes due to the proposal

Road sections		Percentage change with the proposal compared to without ¹	
From	To	Northbound total	Southbound total
2031 Projections			
Project western end	Glenmore Parkway	3%	3%
Glenmore Parkway	M4 (northbound) on/off ramp	3%	3%
M4 (northbound) on/off ramp	M4 (southbound) on/off ramp	6%	9%
M4 (southbound) on/off ramp	Batt Street	10%	18%
Batt Street	Jamison Road	11%	19%
Jamison Road	High Street	10%	10%
2041 Projections			
Project western end	Glenmore Parkway	2%	5%
Glenmore Parkway	M4 (northbound) on/off ramp	2%	3%
M4 (northbound) on/off ramp	M4 (southbound) on/off ramp	4%	10%
M4 (southbound) on/off ramp	Batt Street	15%	26%

Road sections		Percentage change with the proposal compared to without ¹	
Batt Street	Jamison Road	13%	21%
Jamison Road	High Street	9%	16%

Note 1: ('With build' – 'Without build')/'With build'

Both 'with the proposal' and 'without the proposal' models predict the proposal would not result in unacceptable air quality impacts. Pollutant concentrations decrease with increasing distance from the road, and pollutant concentrations at locations further than 10 metres from the kerbside are lower. However, the results indicated that the predicted cumulative PM₁₀, NO₂ and CO concentrations are below the relevant air quality criteria within 10 metres of the kerbside. Elevated annual average PM_{2.5} concentrations are predicted by TRAQ to be above the current annual average guideline and the reduce Ambient Air NEPM guideline. These cumulative impacts are driven mainly by the background concentration of PM_{2.5} within the local airshed, which in some years already exceed the annual average guideline. These impacts would be consistent with many urban areas across Sydney and the proposal would only be a minor contributor to total cumulative concentrations.

The predicted downwind air pollutant concentrations increase slightly for the 'with proposal' scenarios compared to the 'without proposal' scenarios, which is a result of the projected increase in traffic numbers for these scenarios. However, the increases in the predicted cumulative annual average concentrations at 10 metres from the kerbside as a result of the upgrade are minimal and less than the change in the concentrations predicted for 2031 compared to 2041 even if the proposal was not to proceed (see Table 13 in Appendix K).

The upgrade may improve traffic flows and minimise congestion levels that may otherwise be expected to occur without the proposal, which would assist in minimising air pollutant emissions and downwind impacts, particularly at the nearest receptors.

6.9.4 Safeguards and mitigation measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
AQ1 - Air quality	An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to: <ul style="list-style-type: none"> • Potential sources of air pollution • Air quality management objectives consistent with any relevant published EPA and/or OEHD/DPE guidelines • Minimise the number of stockpiles onsite, avoid stockpiling in exposed areas and ensure long term stockpiles are covered or stabilised • Emission and dust mitigation and suppression measures to be implemented 	Contractor	Detailed design / pre-construction / construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> • Vehicles and mobile plant to use designated haulage and access routes and restrict traffic speeds on site • All vehicles transporting soils, rock or other materials are covered when entering or exiting the site • Maintain all vehicles and plant in accordance with manufacturer specifications • Methods to manage work during strong winds or other adverse weather conditions. Daily monitoring of weather forecasts to be undertaken to determine when adverse weather conditions are predicted • A progressive rehabilitation strategy for exposed surfaces • Daily visual observations of dust to identify construction activities, vehicles, plant or equipment that are generating excessive air emissions. Additional mitigation strategies to be implemented where necessary. 			

6.10 Socio-economic

This section describes the potential socio-economic impacts associated with the proposal. This section is informed by the socio-economic impact assessment (SEIA) (Aurecon, 2021) which is provided in Appendix L.

6.10.1 Methodology

The SEIA was carried out in accordance with the 'moderate' level of assessment in the *Environmental Impact Assessment Practice Note – Socio-economic Assessment (EIA-N05)* (Transport, 2020). The moderate level reflects the scale and magnitude of potential socio-economic impacts. The assessment includes:

- Review of statutory planning and legislative requirements, including a review of existing State and local government strategies relevant to the social and economic environment of the study area
- Description of the existing socio-economic environment of the study area to establish the baseline, including:
 - Analysis of key population and demographic indicators, including data from the 2016 Australian Bureau of Statistics (ABS) Census of Population and Housing
 - Analysis of existing data and information on local business and industry, employment and income, and dwelling characteristics
 - Review of existing social infrastructure and community features near to the proposal, including recreation uses, educational facilities, places of worship, public transport and walking and cycling facilities.
- Identification and assessment of the potential socio-economic impacts of the proposal's construction and operation on property and land use, local amenity and community values, social infrastructure, business operations and access
- Measures to manage or mitigate potential impacts on the socio-economic environment and maximise potential benefits of the proposal.

A business survey will be undertaken as part of the proposal with the aim to understand how surrounding businesses interact with Mulgoa Road, including access, operational requirements and future operational needs. The results of this survey would be included in the proposal's submissions report to be completed after the public exhibition of the REF. Businesses would be chosen based on their proximity and use of Mulgoa Road, with questions focusing on:

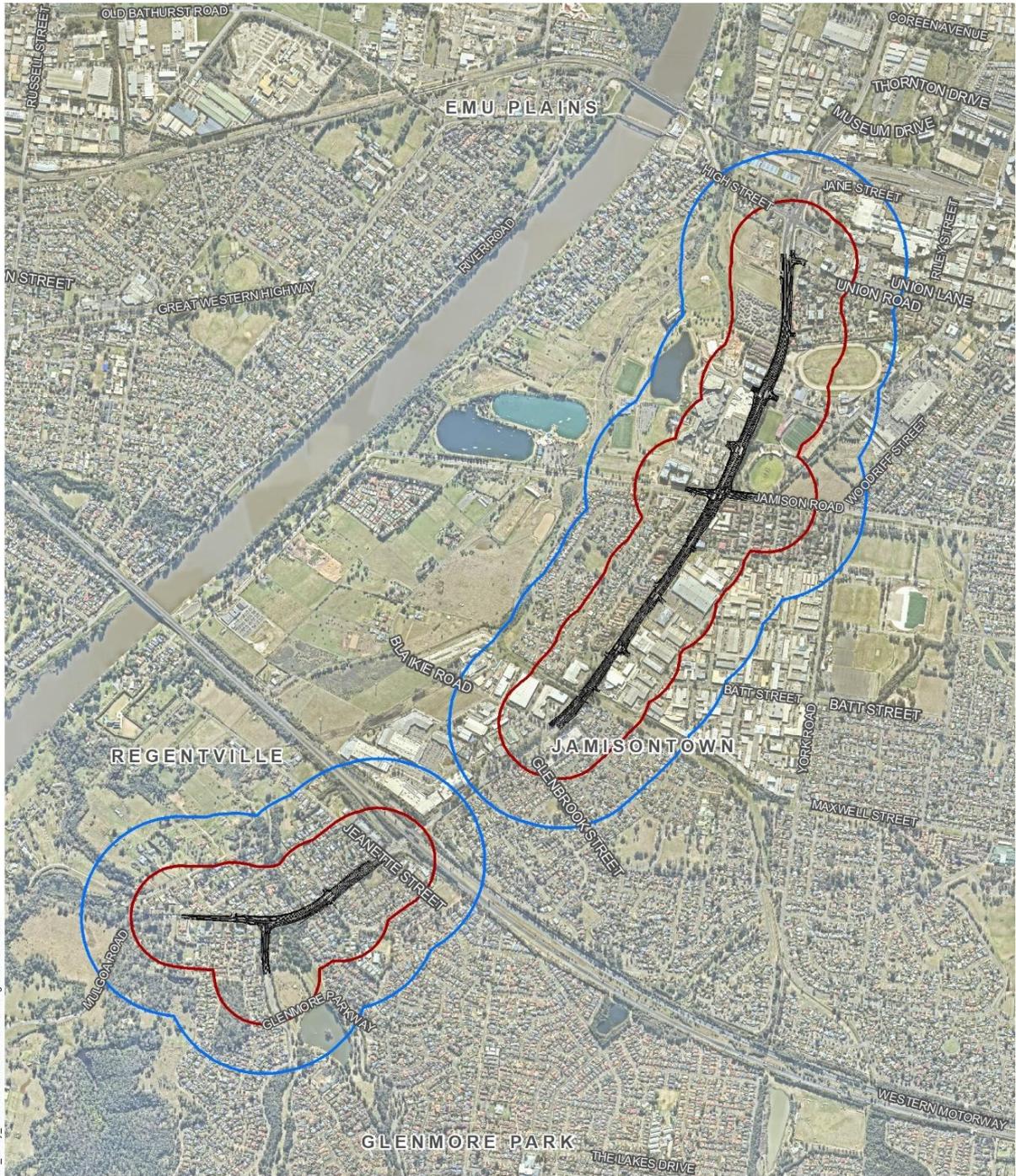
- Basic business information
- Access
- Amenity
- The proposal: Questions and awareness of the proposal
- Future operations of existing businesses
- Open-ended questions: Any other comments.

Assessment area

The following areas have been selected as the assessment areas and have been developed to assess the direct and indirect impacts of the proposal as well as provide context about the existing environment. These areas are detailed in Table 6-55 and Figure 6.35.

Table 6-55: Direct and indirect impacts on proposal

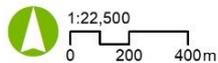
Area	Definition
Direct impact area	<p>The direct study area is 200 metres from the design. It has been developed using a 200-metre buffer area measured from the design. The area used generally follows the proposal area.</p> <p>Direct impacts are assessed in this area, including amenity impacts (noise and visual impacts), property and access impacts and impacts to the surrounding community. The direct study area encompasses residents along the Mulgoa Road corridor, including properties that are set back from the road but may still experience direct impacts of the proposal.</p>
Study area	<p>The socio-economic study area is 400 metres from the design. Indirect impacts of the proposal are considered in the socio-economic study area.</p> <p>This area is used to assess indirect impacts of the proposal (primarily impacts to access and connectivity, as well as some amenity impacts that may occur from people using the proposal but not as frequently as those within the direct study area). The study area is based on a 400-metre buffer from the design which is walking distance around the proposal. The socio-economic study area has been selected as a representation of the area surrounding the proposal.</p>
Broader study area	<p>To provide context about the liveability of the area surrounding the proposal, the socio-economic database coverage area has been developed based on the following ABS areas:</p> <ul style="list-style-type: none"> • Proposal area: <ul style="list-style-type: none"> ○ Mulgoa - Luddenham - Orchard Hills ○ Jamisontown – South Penrith ○ Glenmore Park – Regentville ○ Penrith • In comparison with: <ul style="list-style-type: none"> ○ Penrith LGA ○ Greater Sydney <p>The investigation of these areas outside of the direct and indirect impact areas is important to understand the range of services, facilities and lifestyle of the community.</p>



P:\GIS\Project-4\project\09813_Mulgoa_Road\MR_REF_SIA_Study_areas.mxd\JOB No. 08-08-21\Virgil.Robinson\Rev 0

-  Concept design
-  Direct study area
-  Socio-economic study area

Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri



Projection: GDA 1994 MGA Zone 56

Mulgoa Road Review of Environmental Factors

Direct study area and socio-economic study area

Figure 6-35: Direct study area and socio-economic study area

6.10.2 Existing environment

Population and demography

In 2016, the population of the broader study area was 61,328 people. In summary the broader study area:

- Has a slightly younger population with about 21 per cent of people ages 14 years or younger, than Greater Sydney with about 19 per cent.
- Has a smaller proportion of overseas born residents and languages other than English spoken at home compared to Greater Sydney.
- Has a higher proportion of people who require help or assistance with self-care, body movements of communications than Greater Sydney.
- The population of Penrith LGA is expected to increase by 167,649 people by 2041 (ABS ASGS, 2019). This is an increase of about 83 per cent between 2016 and 2041 and is substantially higher than the percentage of growth expected in Greater Sydney.
- Separate dwellings were the highest proportion of dwellings in Penrith LGA.
- A higher proportion of people live in family households compared to Greater Sydney. It also had a higher proportion of residents with the same address as five years ago than Greater Sydney, indicating there may be a strong connection to place.
- The number of households in Penrith LGA are expected to almost double by 2041, with a total increase of about 94 per cent. This is substantially higher than Greater Sydney, with an expected increase of about 58 per cent.
- In 2016, the broader study area had a score between 926 to 1077 based on the Socio-economic Indices of Areas (SEIFA). Penrith SA2, Jamisontown – South Penrith SA2 and the Penrith LGA has a lower than average economic and social conditions when compared to NSW. Mulgoa – Luddenham – Orchard Hills SA2 and Glenmore Park – Regentville SA2 had higher than average economic and social conditions when compared to NSW.

Economy, industry and businesses

The key economic trends of the study area include:

- Unemployment was highest in Greater Sydney, at six per cent, compared to about five per cent in the broader study area
- Employment in construction was the top industry, while retail trade and health care and social assistance also employed a high proportion of people in the broader study area.

There is a mix of businesses located within the direct study area including:

- Light industrial and home services businesses such as, Panther Glass, Highgrove Bathrooms, Bay Gallery Outdoor Furniture Sydney, AMart Furniture Penrith, Home Heat and BBQ Penrith, Domayne Penrith Furniture Store
- Food and restaurant businesses such as, Hog's Breath Penrith, Osso Penrith, Mcdonalds Penrith, Krispy Kreme Penrith, KFC Penrith, Outback Steakhouse, Guzman and Gomez Mexican Restaurant, Rashays, Hungry Jack's Penrith, Red Rooster, Grey Gums Bistro, S.A.L.T Café
- Accommodation services such as, Mercure Penrith, Grey Gums Hotel, Quality Inn Penrith

- Recreational services and businesses such as, Aqua Golf, iFly Down Under, Panthers Penrith Rugby Leagues Club, Penrith Showgrounds, BlueBet Stadium, Drummond Golf Penrith, BCF Penrith.

Land use

The proposal is located within a highly developed urban environment. The proposal area is within the following land zones under the *Penrith Local Environmental Plan 2010* (refer to Figure 4.1):

- SP2 – Infrastructure
- SP3 – Tourist
- R1 – General Residential
- R2 – Low Density Residential
- R5 – Large Lot Residential
- E1 – National Parks and Nature Reserves
- E2 – Environmental Conservation
- RE1 – Public Recreation
- RE2 – Private Recreation
- RU4 – Primary Production Small Lots
- IN1 – General Industrial
- IN2 – Light Industrial
- B3 – Commercial Core
- B4 – Business Development
- B5 – Enterprise Corridor
- W2 – Recreational Waterways.

Mulgoa Road is zoned as SP2 – Infrastructure, as it is an important connection between the Great Western Highway and the M4 Motorway. It is located within a wide corridor which has footpaths and grassed and vegetated areas along its extent.

Along the western side of Mulgoa Road, land use is a mix of large recreational reserves, tourist businesses, large cleared agricultural/rural properties and low-density residential properties. The Nepean River is a W2 Recreational Waterway, while the areas surrounding are as RE1 Public Recreation, E2 Environmental Conservation and SP3 Tourist. This area provides a range of open space and recreational activities including Huntington Reserve, Tench Reserve, Cables Wake Park and Aqua Park.

The eastern side of Mulgoa Road is highly developed with a range of commercial, industrial, recreational and residential activities. Social infrastructure through this area includes the Panthers Stadium, Howell Oval, Fire and Rescue NSW Regentville Fire Station and Regentville Public School.

Major projects and development

The following five major projects are closely linked to this proposal:

- Western Sydney Airport: The Australian Government is currently constructing the Western Sydney International (Nancy-Bird Walton) Airport. The airport site is in Badgerys Creek, in the Liverpool LGA south of the proposal. Scheduled to open in 2026, the new airport would be developed in stages. Traffic on Mulgoa Road is not expected to substantially increase as the proposed M12 Motorway is expected to take most operational traffic.

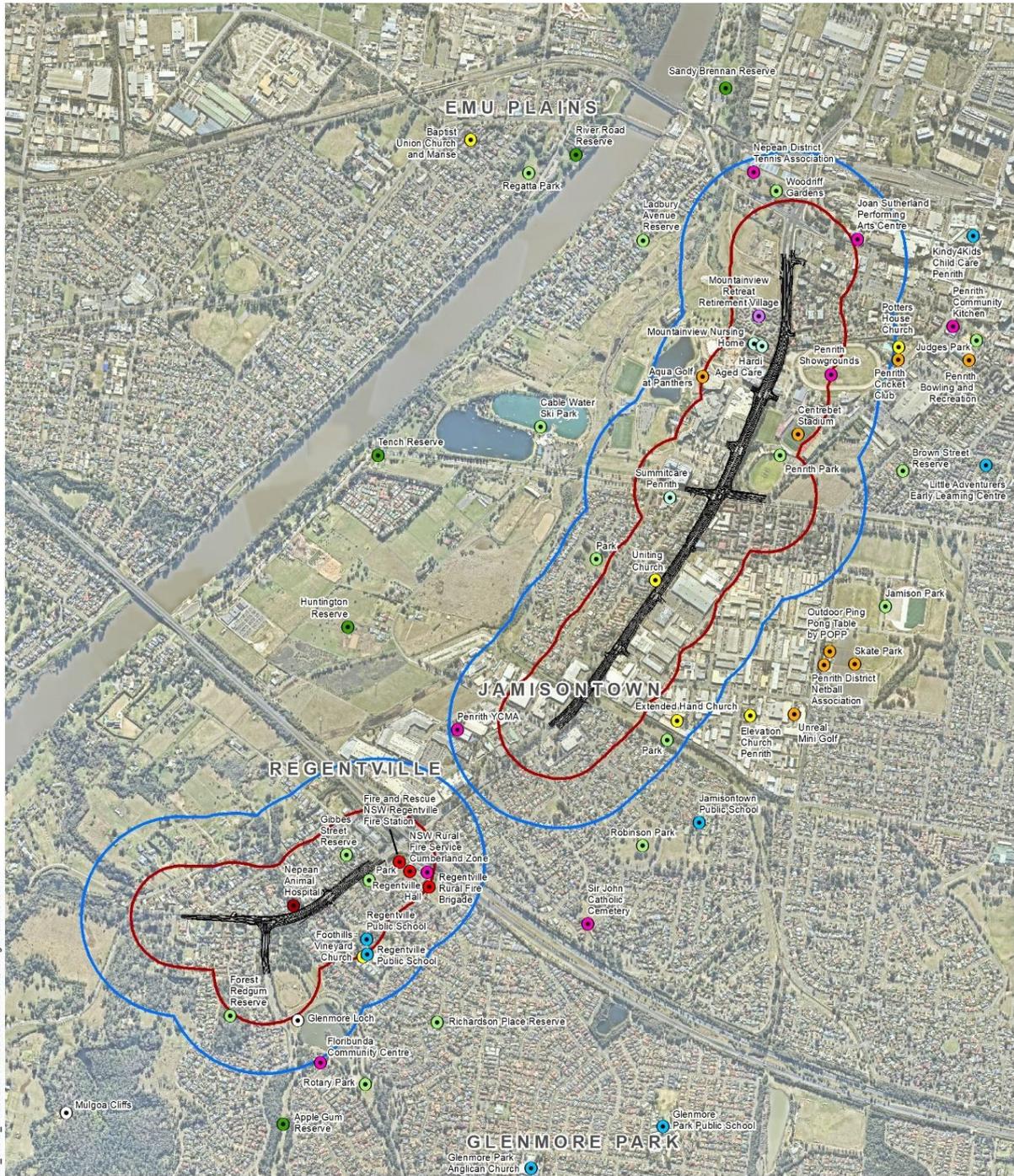
- Western Sydney Employment Area: The Western Sydney Employment Area (WSEA) was developed to provide businesses with land for industrial and employment purposes, close to major road transport corridors. The WSEA would be located to the east of the proposal and is expected to provide industrial land for future employment opportunities, accommodate a number of construction jobs and ongoing employment opportunities once fully developed.
- M12 Motorway project: to construct the M12 Motorway between the M7 Motorway at Cecil Hills and The Northern Road at Luddenham. The new motorway would provide direct access to the Western Sydney Airport and Sydney's motorway network (Transport, 2019). Construction for the project is expected to commence in early 2022 and be completed before the opening of the new airport. The M12 Motorway would not connect to Mulgoa Road but would pass over Mulgoa Road. Mulgoa Road would connect to Elizabeth Drive to access the Airport.
- Mamre Road Upgrade: located to the east of the proposal and would upgrade about 3.8 kilometres of road to a four-lane divided road.
- Great Western Highway Upgrade Programme: located directly north of the proposal. It is an infrastructure programme of national significance which will unlock the potential of regional NSW.

Social infrastructure

The socio-economic study area has a broad range of facilities for the community including:

- Parks and reserves including Robinson Park used by Jamisontown Public School, Penrith Park, Clyburn Reserve, Gibbes Street Reserve, Glenmore Loch and Woodriff Gardens
- Education facility including Regentville Public School
- Childcare centre facilities including King4Kids Child Care Penrith, Little Adventurers Early Learning Centre, Kids Academy Regentville, Kids Academy Penrith
- Community facilities including Penrith YMCA, Penrith City Library, Joan Sutherland Performing Arts Centre, Foruinda Community Centre
- Places of worship including Jamisontown Uniting Church, Extended Hand Church, Foothills Vineyard Church and Potters House Church
- Nursing homes and aged care centres including SummitCare Penrith and Hardi Aged Care (Mountainview)
- Recreational facilities including Penrith Showgrounds, Bluebet Stadium, Aqua Golf at Panthers, Nepean Aquatic Centre, Penrith Indoor Sports and Recreation
- Emergency facilities including Nepean Animal Hospital, Fire and Rescue NSW – Regentville Fire Station.

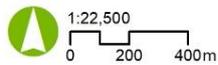
An overview map of social infrastructure is shown in [Figure 6.36](#).



P:\GIS\Project-4\project\509813_Mulgoa_Road\MR_REF_SIA_Social_Infrastructure.mxd\UE No.11-08-21\Virgil.Robinson\Rev.0

- | | |
|------------------------------|--------------------------|
| Concept design | Park |
| REF proposal area | Place of worship |
| Direct study area | Retirement village |
| Socio-economic study area | Emergency infrastructure |
| Social infrastructure | Natural landmark |
| Community facility | Reserve |
| Nursing home | Sports facility |
| Education | |

Source: Aurecon, TfNSW, Spatial Services, Nearmap, Esri



Projection: GDA 1994 MGA Zone 56

Mulgoa Road Review of Environmental Factors

Social Infrastructure

Figure 6-36: Social Infrastructure

Areas of community interest and community values

Penrith City Council has developed the Community Strategic Plan (CSP) 2017 to provide a planning framework for Penrith. It identified the following seven outcomes:

- Work close to home: Helping our community find a local job that suits them
- Plan for our future growth: Making sure that services and infrastructure keep up as Penrith grows
- Getting around our city: Making sure we can get from place to place safely and easily, whether we drive, walk, cycle or ride the train or bus
- Safe, vibrant places: Making sure our public spaces are safe, pleasant places to be
- Our environment: Protecting our air and water quality, and our natural areas
- Health and community spirit: Supporting the physical and mental health of our community.
- Our Council: Putting our values into action: We are accountable. We show respect. We encourage innovation

The CSP states that the creation of vibrant places is a priority for the surrounding community, including protection of local heritage.

The following two primary areas of community value are located within the direct study area:

- Nepean River – located to the west of the proposal. It is used for recreational boating, fishing and activities by the community. A number of recreational facilities and businesses are located along the extent of the river.
- Jamisontown Uniting Church – is a key landmark in Jamisontown’s local heritage. The church has served the local community for over 130 years.

6.10.3 Potential impacts

Construction

Property acquisition and adjustments

The construction of the proposal would require acquisition of 58 properties. This includes partial and permanent acquisitions. There are also 18 temporary acquisitions proposed. Permanent acquisition and temporary lease arrangements would be required for the widened road, intersection adjustments, ancillary facilities and associated permanent project features, such as the reinstated shared pathway. The impacted properties are listed in Section 3.6 and shown in Figure 3.22 to Figure 3.24.

Most acquisitions required for the proposal would be partial acquisitions or adjustments to properties (including new fencing and driveway access). Acquisition would consist of a strip acquisition of properties to the east of Mulgoa Road, while to the west of Mulgoa Road, property adjustments are mostly required. These areas may change during the design refinement phase of the proposal. As the majority of the residences are set back from the road, impacts to the properties would not require the demolition of any residences, structures or buildings. These partial acquisitions are a mix of private, local government and crown owned land, most of which currently comprise the vegetated areas and grassed areas that surround the road corridor. Crown land to be acquired for the proposal is located either side of Mulgoa Road.

Consultation with landowners and businesses would be ongoing to establish necessary agreements and arrangements for leasing and access prior to construction.

Land use changes

Land use changes required during construction would be located at compound sites one and three, as they are currently zoned as RE1 – Public recreation zoned area. Site one would occupy a small part of green space between Glenmore Parkway and Schoolhouse Road. Site three would be located on cleared land to the north and asphalt car parking areas to the south. These areas would only be used temporarily and would be restored to their previous use when construction is completed.

The sensitivity of land occupiers, owners and the broader study area to changes in land use is low. This is due to the existing land use within the proposed ancillary sites. The magnitude of the changes would be low resulting in the significance of the impact being low.

Access and connectivity

There would be temporary changes to existing traffic movements on the local road network, with alternative configurations required to maintain the flow of traffic. Changes would include the use of contraflow and traffic switching. These alternate arrangements can result in confusion and anxiety in road users, as well as result in delays and disruptions due to reduced lanes and slower movements.

Alternate traffic routes would be required at the intersections of Schoolhouse Road and Glenmore Parkway during certain construction stages. This would impact the efficiency of travel for people wanting access via these intersections. It may also result in an increase of traffic using nearby local roads, reducing efficiency of the local road network, and may cause frustration and confusion for residents. As construction would be staged, impacts would be relatively short in duration and limited to certain sections of Mulgoa Road at one time. The use of detours and alternate traffic arrangements would be temporary and limited to out of peak traffic periods where possible, such as during the night.

Property access

Property access would be maintained during construction (unless otherwise agreed with the property owner/occupier) however, nearby properties may experience delays in accessing properties. Parking arrangements, storage of materials and large vehicle movements may also result in changes to business operations to accommodate these movements.

Most of the properties on the western side of Mulgoa Road park private vehicles within their driveways and turn within their properties to exit back onto Mulgoa Road. Construction of the widened road would require some partial property acquisition, which would reduce some of the space at the front of some of these properties. Vehicle movements within properties for vehicles exiting onto Mulgoa Road and a reduction in space may result in less turning space within properties. This may also be impacted due to alternate traffic arrangements on Mulgoa Road during construction such as the temporary closure of some lanes and presence of construction plant and machinery. Changes to access would be carried out in consultation with the relevant property owner/occupier.

Freight and commercial movements

Construction may impact business operations through temporary alternate traffic arrangements and construction traffic on Mulgoa Road. This includes businesses either side of Mulgoa Road between Blaikie Road and Jamison Road.

Some businesses may be operational over 24-hour periods, or outside of peak periods, therefore road closures during these periods may impact business movements and customer access. This includes the BP Mulgoa Road, 7 Eleven Penrith, Adonis Athletics 24/7, Shell Penrith, 7-Eleven Regentville and McDonalds Penrith which are open 24-hours a day.

Mulgoa Road is used a key freight route, providing connection to the Great Western Highway, M4 Motorway and Western Sydney Airport. These routes have been identified as two of Greater Sydney's key freight corridors within the Freight and Ports Plan. If detours are proposed, heavy vehicle movements within the direct study area may be difficult to negotiate on the local road network in suburbs such as Jamisontown, South Penrith and Penrith. If alternative traffic arrangements are proposed, heavy vehicle movements within the direct study area and socio-economic study may impact freight carriers, particularly in terms of travel times. For some activities during construction, as lane closures or detours may be required. Alternate routes for heavy vehicles may also impact some businesses, including businesses south of the proposal in Regentville and Mulgoa.

Public transport

Temporary delays may be experienced during construction in the direct study area however impacts are expected to be minimal. Access to bus stops along Mulgoa Road would be maintained during construction. They may be slightly adjusted, however it is expected to be minimal. Adjustments and movements around traffic barriers and construction zones may make accessing these areas more difficult for the elderly or less mobile public transport users.

Active transport

There would be temporary impacts to users of the shared user path along the eastern end of Mulgoa Road, and the pedestrian footpath on the western side of Mulgoa Road. These would be altered for construction activities, including widening and ancillary works such as noise walls. Access for pedestrians and cyclists would be mostly maintained with detours and alternative routes provided where necessary.

During construction of the new Surveyors Creek bridge, the existing cycleway bridge would need to close. Cyclists and pedestrians would be redirected to an alternative path on Regentville Road and re-join the existing shared user path at Batt Street.

These accessibility and connectivity impacts would be mitigated through the implementation of a Traffic Management Plan (TMP). Community consultation would also continue to be undertaken to understand existing travel patterns of cyclists and inform the public of any impacts and alternatives routes.

The sensitivity of road users (both local and those travelling through the direct study area) to changes in access and connectivity is high. The magnitude of the temporary changes during construction would be moderate, resulting in the significance of the impact being high-moderate.

Social infrastructure

Impacts to social infrastructure within the direct study area are the following:

- Jamisontown Uniting Church – due to partial acquisition there would be changes to visual amenity and setting impact as it would reduce the distance between the church and Mulgoa Road by 12 metres. There would also be potential for indirect vibration, noise and dust impacts during construction. Indirect impacts during operation would include increased difficulty and reduced access affecting the number of people attending services.
- Glenmore Loch and surrounding reserve – there would be part of it temporarily leased for construction ancillary facility site one. This may result in impacts to access, noise, visual and air quality impacts.
- Howell Oval – there would be part of it temporarily leased for construction ancillary facility site three. This may result in impacts to access, noise, visual and air quality impacts. There may be indirect impacts on the usage of the oval, including use by Penrith Cricket Club.

Impacts to social infrastructure within the socio-economic study area are the following:

- Recreational use of the Nepean River – there would be amenity impacts including visual and noise impacts that could affect the attractiveness and enjoyment of using the river.
- Regentville Public School – there may be some indirect vibration, noise and dust impacts during construction. However, given the distance to the construction footprint this would be low.

The overall sensitivity of social infrastructure to potential impacts of construction, including, visual and noise impacts which may impact the operation of facilities is low. Based on the assessment of impacts to the community enjoyment and attractiveness of facilities during construction, the magnitude of impacts is moderate. Therefore, the overall level of significance would be low.

Businesses and commercial operations

Businesses within and surrounding the direct study area would experience temporary impacts to amenity, including visual, noise and air quality impacts. These impacts may result in a reduction in customers to businesses such as accommodation facilities, restaurants and cafes, especially those located on Mulgoa Road between Blaikie Road and Jamison Road.

Construction plant and equipment may restrict views to businesses and associated business signage. In addition, patrons of the identified businesses may be reluctant to access these businesses due to nearby construction activities and changed access arrangements.

Impacts would be temporary as the construction of the proposal would be staged to mitigate impacts on the local road network. Consultation with businesses to maintain access and visibility from Mulgoa Road would be undertaken. Changed access arrangements would be confirmed during detailed design and outlined in a Traffic Management Plan that would be included as part of the Construction Environmental Management Plan for the proposal.

The sensitivity of businesses and to commercial operations is moderate. The magnitude of the temporary changes during construction would be moderate, resulting in the significance of the impact being moderate.

People working from home

Due to COVID-19 there is a substantial amount of people working from home with ongoing precautions implemented by the NSW Government. This is likely to result in an increase in people working from home in the future. As a result, the residential areas surrounding the proposal, may experience similar amenity effects to businesses. Noisy works may impact people's ability to concentrate and interrupt telecommunications such as business calls and meetings. This is likely to cause frustration and concern, particularly if people have been working from home for a substantial period.

Employment opportunities

Construction is the highest area of employment in the broader study area. Construction may provide additional employment opportunities in the area and may also result in construction worker expenditure at local shops and businesses during the two-year construction period.

Amenity and community values

A reduction in amenity is likely through impacts to air quality, noise, visual and traffic. Noise impacts are expected for residents closest to the proposal either side of Mulgoa Road. The increased noise has the potential to cause sleep disturbance in these residences. This would generally be limited to the front-row residential receivers to the west of Mulgoa Road above Willoring Crescent.

Removal of vegetation on the western and eastern sides of the proposal, and the presence of construction areas would impact visual amenity and may contribute to concerns about air quality, with dust generation from vegetation removal work, as well as heavy vehicle movements.

The community of Penrith LGA value movement and 'getting around their city'. Construction of the proposal may temporarily impact the accessibility and connectivity for road users on Mulgoa Road. This may result from construction traffic and alternative traffic arrangements, which could be frustrating for local road users and people travelling through the direct study area.

The sensitivity of the community to changes in amenity and values is low. The magnitude of the impacts during construction is low, resulting in the level of significance being low.

Cumulative impacts

The proposal has the potential to result in cumulative impacts during the construction period between 2024 to 2026. These impacts include:

- Traffic – additional pressure on road networks could lead to congestion and frustration for motorists
- Amenity – traffic noise, visual and perceived air quality impacts may occur. The community and stakeholders may experience congestion and construction fatigue.

The sensitivity of the community to cumulative impacts is moderate due to the potential cumulative impacts associated with concurrent projects occurring near the proposal. The magnitude of the impacts during construction is moderate, resulting in the level of significance being moderate.

Operation

Property acquisition and adjustments

The proposal would require the full permanent acquisition for 23 residential properties and public space in the road corridor.

Partial acquisition of land on residential properties would not require the acquisition of residences, and residents would not be required to move. Therefore, permanent impacts of property acquisition are expected to be low. Consultation with impacted property owners/occupiers would be undertaken to mitigate impacts of property acquisition.

Based on the number of affected property owners and occupiers and the changing nature of the surrounding areas, sensitivity of these stakeholders is moderate. The magnitude of changes during operation would be low due to the majority of acquisition being partial rather than full acquisitions, resulting in the significance of the impact being moderate-low.

Land use and development

The proposal would result in some changes in land use in the road corridor. These changes would be to areas that are vacant or vegetated that would form part of the road footprint. This includes areas previously zoned under the Penrith LEP as:

- RE1 – Public recreation
- R2 – low density residential.

Consultation with Penrith City Council about the council owned land and assets (including the areas classified as community land) would continue. The design for the proposal would also be refined during detailed design to minimise impacts on community land, where possible.

The sensitivity of land occupiers, owners and the community to permanent changes in land use is low due to the changing nature of the surrounding area. The magnitude of these changes is moderate due to the expansion of road corridor and existing land uses being absorbed into the road, resulting in the level of significance being moderate-low.

Access and connectivity

The proposal would improve safety, movement and travel times along Mulgoa Road between the Great Western Highway and the M4 Motorway. It would provide increased road capacity for the project traffic volumes along the network. While some permanent adjustments to access would occur, access would be maintained to properties during operation of the proposal.

Pedestrian and cyclist facilities would be improved with the new section of shared user path between Blaikie Road and Preston Street providing an off-road route for cyclists and pedestrian connection. This would improve safety and connection.

Public transport travelling through the proposal area may experience better movement and travel times due to the increased capacity on the road network. Provision for future bus priority lanes on Mulgoa Road would help improve transport choice and support public transport usage within the socio-economic study area. The design has also included footpaths with sufficient width to accommodate bus stops along Mulgoa Road. The existing bus stops would also be reinstated along Mulgoa Road to account for the new layout of the road.

The sensitivity of residents and businesses to changes in access in connectivity is low. The magnitude of these changes is low given Mulgoa Road would continue to function, resulting in the level of significance being low.

Social Infrastructure

The proposal is expected to have an indirect positive impact as reduced congestion and the active transport options would result in better access to social infrastructure facilities. The proposal would benefit the Fire and Rescue NSW Regentville Fire Station by helping the efficient operation of the emergency fire service to the surrounding community.

The sensitivity of people using social infrastructure during operation of the proposal is negligible. The magnitude of the operation if the proposal on social infrastructure is low, given the lack of direct impacts, resulting in a low impact of significance.

Commercial operations and businesses

The increased road capacity and improved travel times would benefit commercial operations and businesses. It would also benefit freight carriers and vehicles travelling to industrial precincts in the broader study area.

The proposal may also have an indirect positive impact on tourism during the operational phase of the proposal. The improved movements, travel time and opportunities for active and public transport connectivity would improve access through the broader study area and future Western Sydney Airport.

The sensitivity of businesses during operation of the proposal is low due to the existing nature of the commercial area and through route. The magnitude of the operation if the proposal on businesses is negligible, resulting in a negligible impact of significance.

Amenity and community values

The proposal would benefit the community by providing improvement of movement and travel times. The increased capacity of Mulgoa Road would also contribute to a safer road network with improved traffic flow. The green cover included at the shared user path would also have a positive impact on the visual amenity of the area.

The proposal would have an adverse impact on the physical amenity as a result of vegetation removal, reconfiguration of fencing and signage structure and widening of the road corridor bringing the road closer to residential properties.

The sensitivity of the community to changes in amenity and values is moderate, given the potential impacts on community priorities. The magnitude of the impacts during construction is moderate, as the road corridor would expand and affect some area of vegetation and landscape values, resulting in the level of significance being moderate.

Cumulative impacts

Cumulative impacts could occur during operation if other projects commence in the vicinity of the proposal. This includes other future stages of the Western Sydney Airport development and the potential future development to the east of the proposal.

The design development of the proposal has captured the expected traffic generation from surrounding developments together with population growth and associated traffic demands. The proposal would support future economic and residential growth in Western Sydney by increasing the capacity of Mulgoa Road and improving road safety and movement.

The sensitivity of the community to cumulative impacts is low. The magnitude of the impacts during operation is negligible, resulting in the level of significance being low.

6.10.4 Safeguards and management measures

Table 6-56 describes the proposed safeguards and management measures that would be implemented to manage the potential socio-economic impacts from the proposal.

Table 6-56: Socio-economic safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
SE1 - socio-economic	<p>A Communication Plan (CP) would be prepared and implemented as part of the CEMP to help provide 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 will be prepared in accordance with the <i>Community Involvement and Communications Resource Manual</i> (RTA, 2008).</p>	Contactor	Detailed design Pre-construction	Standard safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
SE2 - community consultation	Transport would continue to consult with the community until the completion of the proposal. Discussions including, proposed acquisition requirements, property/driveway adjustments and leasing, the nature and timing of construction works would be required to identify relevant noise, visual, air quality and access mitigation measures for residents, stakeholders and people using the proposal.	Transport	Pre-construction Construction	Additional safeguard
SE3 -property	Transport would continue to consult with affected property owners and land occupiers until the completion of the proposal. Discussions including the nature and timing of construction works would be required to identify relevant mitigation measures for noise, traffic, access and visual impacts.	Transport	Pre-construction Construction	Additional safeguard
SE4 – property acquisition	Land acquisition would occur in accordance with the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> . Transport would continue to consult with Penrith City Council regarding council owned land and assets. The design for the proposal will also be refined during detailed design to minimise impacts on community land, where possible.	Transport	Pre-construction	Additional safeguard
SE5 - changes in access	Temporary and permanent changes in access will be discussed with impacted land occupiers before commencement of construction and during construction activities should arrangements	Transport	Pre-construction Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	change. This includes access onto Mulgoa Road from properties on the western side of the proposal.			
SE6 - business consultation	Transport would consult with businesses about construction activities and any changes in access required for the proposal,	Transport	Pre-construction Construction	Additional safeguard
SE7 - social infrastructure	Transport would consult with facilities near the proposal including Jamisontown Uniting Church, Howell Oval, Workmen's Cottages and Regentville Public School.	Transport	Pre-construction Construction	Additional safeguard
SE8 - relocation of bus stops during construction	Public transport users would be notified in advance of any changes to bus stop locations through signage at the existing bus stop. Temporary bus stops would have similar features to existing bus stops, including shelter and rest areas for less mobile and elderly people. Adequate way finding signage would be installed. Consultation with the relevant bus authorities would be undertaken (including school buses) to mitigate potential impacts to bus routes and times.	Transport	Pre-construction Construction	Additional safeguard
SE9 -traffic management for all road users, including pedestrians and cyclists	Alternative routes for active transport users would be clearly identified by signage and the use of traffic controllers where required.	Transport	Pre-construction Construction	Additional safeguard

6.11 Landscape character and visual impacts

This section describes the landscape character and visual impacts from the proposal. This section summarises the *Urban design report including landscape character and visual impact assessment* prepared for the proposal by Scape Design that is included in Appendix M.

6.11.1 Methodology

Visual impact assesses the unmitigated impact of the project on each representative viewpoint. Impacts are based on a qualitative assessment of the sensitivity of the view and magnitude of the proposal potentially visible in that view (summarised in Table 6-57).

Table 6-57: Sensitivity and magnitude matrix

		Magnitude			
		High	Moderate	Low	Negligible
Sensitivity	High	High	High-moderate	Moderate	Negligible
	Moderate	High-moderate	Moderate	Moderate-Low	Negligible
	Low	Moderate	Moderate-low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

The landscape character impact considers a combination of the area's built, natural and cultural character. Sensitivity is the measure of the 'completeness' and the perceived 'value' of the existing view. The 'magnitude of visual change' describes the contrast or type of change resulting from the project or project, the extent of change and also the proximity of the viewer.

Desktop studies and a site investigation were conducted to understand the natural environment as well as human intervention and the shaping of the environment. This was used to identify landscape character zones. The visual assessment was based on assessing the impact on specific viewpoints by considering how sensitive the viewer would be to the magnitude of change in the landscape.

6.11.2 Existing environment

Regional context

The proposal is located within a developed urban environment. Mulgoa Road is an important north-south commuter, freight and bus route within Western Sydney, and provides access across Sydney with the intersection to the M4 Motorway.

Stage 2 transitions from a scenic rural landscape with large lot residential properties and nature reserves in the south through to low density residential areas. It includes areas that are vegetated as well as open and green space. The M4 Motorway corridor is located to the north. Stage 5A and 5B include commercial and residential areas, sporting complexes and outdoor facilities, as well as high density residential areas in the north.

Landscape character zones

The landscape has been divided into eight character zones (LCZ 1-8) to represent the different land uses in the proposal area. The eight LCZs are summarised in Table 6-58 and are mapped in Figure 6.37.

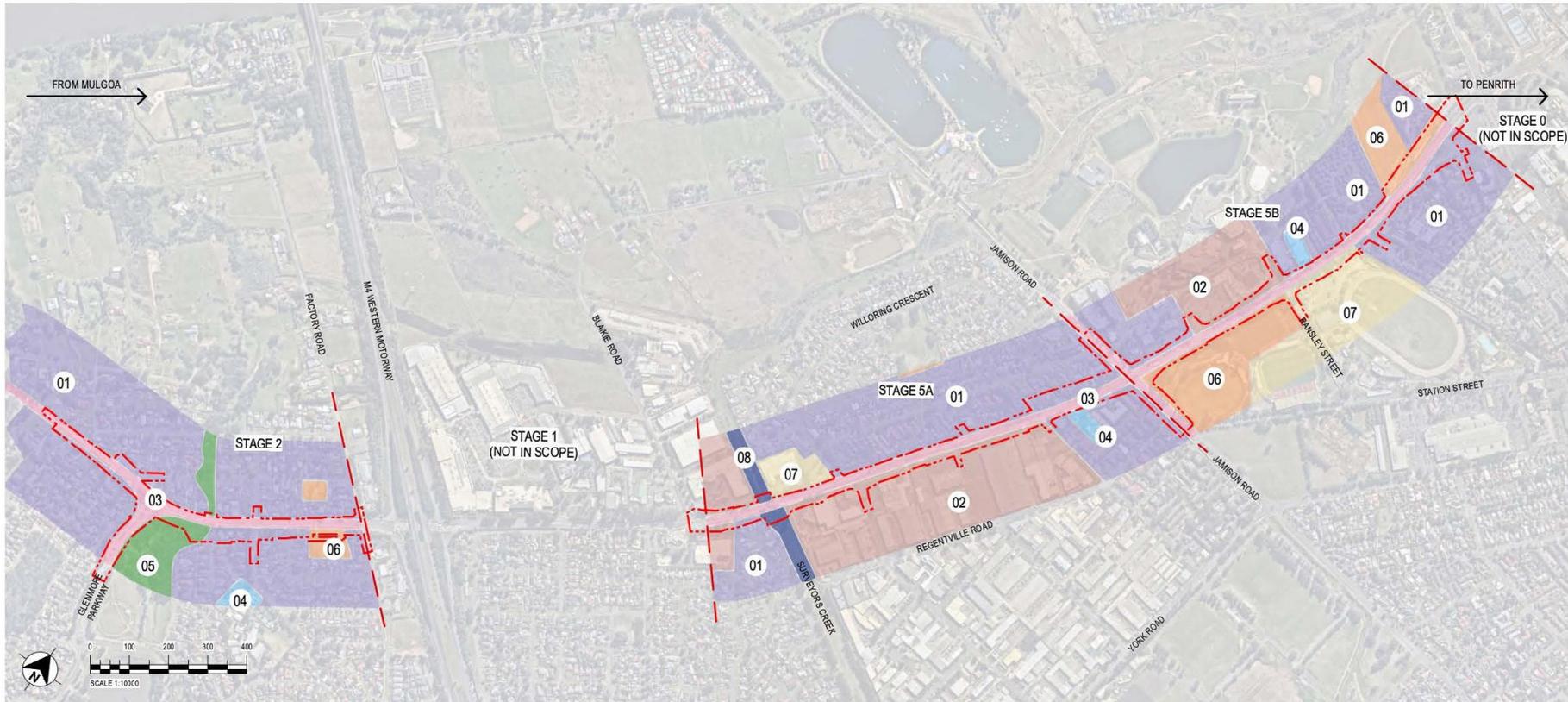


Figure 6-37: Landscape character zones

Table 6-58: Landscape character zones

Zone	Zone characteristics
<p>LCZ 1: Residential</p> 	<p>In stage 2 this zone comprises of rural landscape and begins in the suburb of Mulgoa. It transitions to low density residential suburbs in Glenmore Park and Regentville, most of which are single storey dwellings.</p> <p>In stage 5A and 5B, the zone comprises of the residential suburb of Jamisontown with low and medium density properties as well as higher density aged care facilities in the suburb of Penrith.</p>
<p>LCZ 2: Light commercial</p> 	<p>In stage 5A this zone is defined by a mix of light-industrial, commercial warehouses and retailers. Signage structures are visually prominent on the façade of warehouses with car parking and landscaped garden areas. Mature native trees are scattered in front of buildings.</p> <p>In stage 5B this zone is comprised of the Penrith Panthers Football Club building and associated facilities. There are a range of different built facilities including car parking and mature native trees along the Mulgoa Road frontage.</p> <p>This zone is minimal in stage 2.</p>
<p>LCZ 3: Existing road corridor</p> 	<p>This zone comprises of the existing Mulgoa Road. The corridor feels more enclosed in stage 2 as a result of built form and public and private roadside vegetation. In stage 5A and 5B, two lanes in each direction are separated by a central medium turf and mature and exotic trees, with the road corridor feeling more expansive. There are occasional long-range views towards the Blue Mountains.</p>
<p>LCZ 4: Heritage</p> 	<p>This zone comprises of a single storey terrace comprised of four private residential dwellings (Workmen’s Cottages). The terrace is constructed of brick (rendered in the southern most units) with a hipped roof and front verandah with a bull nose profiled roof supported by timber posts. It is set close to Mulgoa Road and is a prominent heritage feature on this major arterial road.</p>

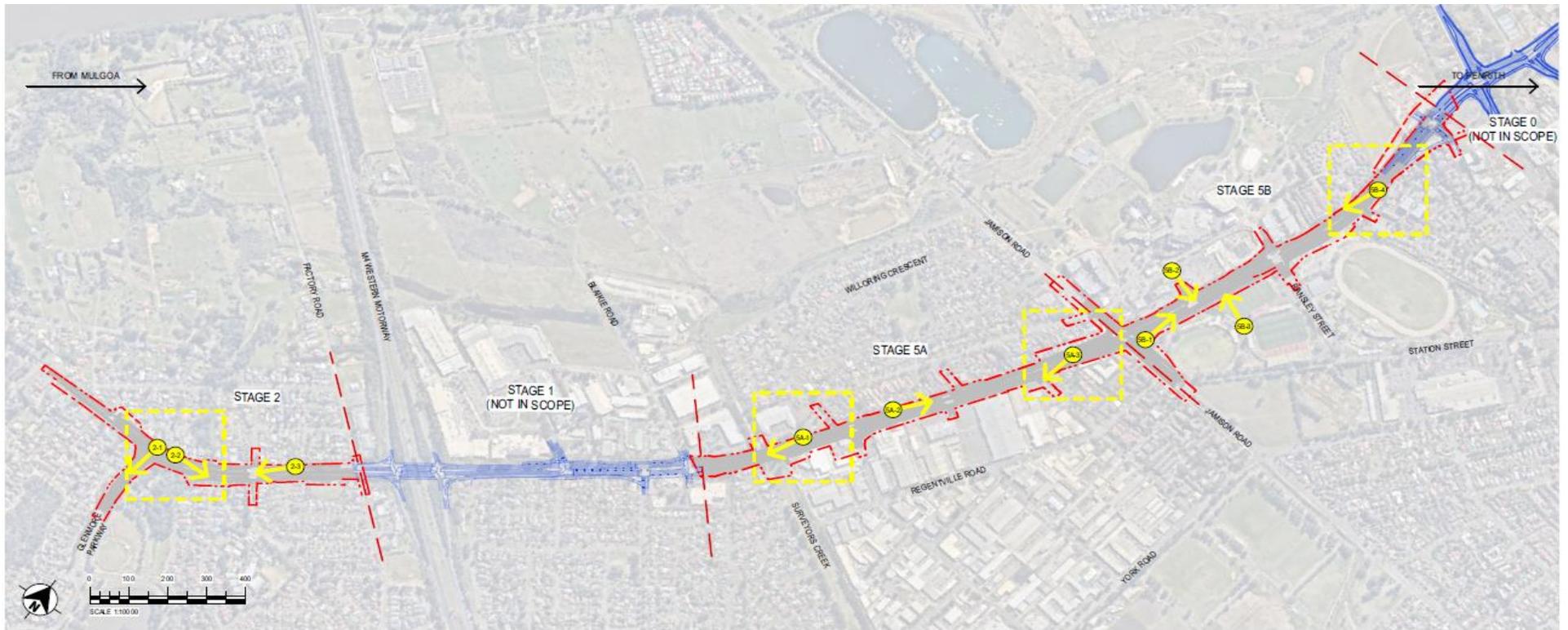
Zone	Zone characteristics
<p>LCZ 5: Riparian bushland</p> 	<p>This zone is in stage 2 and comprises of heavily vegetated riparian corridor that intersects Mulgoa Road north-east of the Glenmore Parkway. Mature native plants create a vegetative gateway with the watercourse sunken and not visible from the road carriageway.</p>
<p>LCZ 6: Public open space</p> 	<p>This zone comprises open space of turf that provides passive recreation opportunities. The zone is set back from the road corridor and mature trees planting along the road frontage provide visual separation, shade and amenity to the space. The zone is dominated by a large cricket oval.</p>
<p>LCZ 7: Private open space</p> 	<p>This zone is open space with turf and a gravel surface harness paceway racing track. An earth mound with mature trees forms an edge along the Mulgoa Road corridor frontage offering some physical separation from the road and a sense of enclosure away from the road.</p>
<p>LCZ 8: Drainage channel</p> 	<p>This zone has a grass engineered drainage channel, enclosed by various boundary fences. Clusters of scattered native trees, east of the road corridor, offer some visual amenity. West of the road corridor the channel is an open concrete lined drainage channel with established riparian vegetation scattered along its length.</p>

Viewpoints and receivers

The location of the viewpoints were selected to assess potential visual impacts including:

- Residents and workers alongside Mulgoa Road
- Users of the green and recreational spaces locally
- Popular destinations and tourist attractions
- Existing road users.

The assessment has identified areas where the proposal would be visible. The visual viewpoints are illustrated in Figure 6.38:. Table 6-59 provides detail on the location and description of these viewpoints and associated receivers.



LEGEND

VIEWPOINT LOCATIONS

-  3D LOCATION
-  VIEWPOINT 2-1 - GLENMORE PARKWAY INTERSECTION
-  VIEWPOINT 2-2 - SCHOOLHOUSE CREEK RIPARIAN ZONE AND PROPOSED BRIDGE
-  VIEWPOINT 2-3 - SCHOOLHOUSE ROAD INTERSECTION AND NOISE WALL
-  VIEWPOINT 5A-1 - SURVEYORS CREEK BRIDGE AND DRAINAGE CHANNEL
-  VIEWPOINT 5A-2 - PRIVATE RESIDENTIAL AND COMMERCIAL SENSITIVE RECEIVERS
-  VIEWPOINT 5A-3 - WORKMENS COTTAGES LOCAL HERITAGE SENSITIVE RECEIVER
-  VIEWPOINT 5B-1 - JAMISON ROAD INTERSECTION TO NEW ROAD AND MEDIAN TREES
-  VIEWPOINT 5B-2 - PENRITH PANTHERS LEAGUES CLUB SENSITIVE RECEIVER
-  VIEWPOINT 5B-3 - PENRITH PANTHERS STADIUM PRECINCT TO NEW ROAD
-  VIEWPOINT 5B-4 - MOUNTAINVIEW RETREAT RETIREMENT VILLAGE SENSITIVE RECEIVER

Figure 6-38: Visual viewpoints

Table 6-59: Summary of representative viewpoints for the proposal

Viewpoint ID	Location and description	Affected receivers
VP 2-1	This viewpoint is located within a northbound lane of Mulgoa Road looking south-west towards the residential area of Glenmore Park. The main elements within this view are the existing native and exotic vegetation within the road verges and traffic islands.	Motorists, pedestrians and cyclists
VP 2-2	This viewpoint is located on an existing pedestrian footpath along Mulgoa Road. It looks north-east along the road corridor and the eastern fringe of the view is dominated with established Alluvial Woodland vegetation associated with School House Creek. There are residential front gardens with vegetation on both sides of the corridor. Driveways and fences of the residential dwellings in Regentville are also very prominent as well as road safety barriers retaining walls and power poles.	Motorists, residents, pedestrians and cyclists
VP 2-3	This viewpoint is located within the northbound lane of Mulgoa Road. It looks south-west with the eastern fringe dominated by vegetation and high brick and timber fencing of residential properties. The signalised intersection, and associated infrastructure, of Mulgoa Road and School House Road is prominent.	Motorists, residents, pedestrians and cyclists
VP 5A-1	This viewpoint is located within the northbound lane of Mulgoa Road and looks south-west. There is existing riparian vegetation associated with Surveyors Creek and stands of large, established trees within road corridor. There are large commercial driveways and tall signage structures. Warehouses are set back from Mulgoa Road surrounded by car parking.	Motorists, pedestrians and cyclists
VP 5A-2	This viewpoint is located within the northbound lane of Mulgoa Road and looks north-east. There are wide medians of turf, exotic trees and concrete pedestrian refuge islands. Warehouses are set back on Mulgoa Road surrounded by car parking, manicured garden beds, tall signage structures and concrete driveways.	Motorists, residents, pedestrians and cyclists
VP 5A-3	This viewpoint is located within the northbound lane of Mulgoa Road and looks south-east. existing road corridor is prominent. Heritage and residential structures are visible with native trees.	Residents, motorists, pedestrians and cyclists
VP 5B-1	This viewpoint looks west across Mulgoa Road and is located on the edge of Howell Oval within a vegetated buffer of existing Eucalypts screening the open space reaction site from Mulgoa Road. A fast food chain is visible set back from Mulgoa Road and a six-storey residential block is partially visible through tree canopies as well as glimpses of the Blue Mountains.	Motorists, open space users, pedestrians and cyclists.

Viewpoint ID	Location and description	Affected receivers
VP 5B-2	This viewpoint is located within the Penrith Panthers Rugby Leagues Club site. It looks east towards Mulgoa Road with trees and a car park visible before the road corridor. Larger vehicles moving along Mulgoa Road are visible although the road corridor cannot be seen.	Motorists, guests and staff within the Panthers site
VP 5B-3	This viewpoint is close to the Howell Oval car parking area and the southern end of the Panthers Stadium. It looks west towards Mulgoa Road and is dominated by a turf training field. Trees are located along the southbound fringe of the Mulgoa Road corridor. Vehicles can be seen along Mulgoa Road beyond the trees.	Spectators, players and staff within the Howell Oval and the Panthers site,
VP 5B-4	This viewpoint is located within the southbound lane of Mulgoa Road and looks south-west across the road corridor over a vegetated median towards a Mountain View Retreat Retirement Village. Exotic vegetation is prominent contributing to the boulevard character of the road.	Motorists, pedestrians and cyclists

6.11.3 Potential impacts

Construction

General construction activities would result in temporary landscape character and visual impacts. These are likely to occur due to:

- Vegetation clearance, earthworks and ground disturbance
- Movement and operation of various machinery and light and heavy vehicles
- Erection and use of temporary facilities such as fencing and lighting
- Construction of noise walls and retaining walls
- Lighting used during out-of-hours construction activities.

Visual impacts would be likely for residents that overlook Mulgoa Road or construction compounds.

Commercial properties overlook Mulgoa Road however most of these are set back from Mulgoa Road, such as Penrith Panthers Rugby Leagues Club, warehouses and fast food restaurants. Staff and visitors to commercial and social infrastructure facilities are less likely to be impacted by construction phase visual impacts.

Motorists, pedestrians and cyclists using Mulgoa Road and connecting local roads would be exposed to visual impacts during construction.

Some construction compounds would be used outside of standard construction hours to support specific activities which would need to be carried out during the night. The operation of the construction compound at night has the potential to result visual impacts from light spill on neighbouring residents.

The magnitude of the impacts from construction would vary based on stage of the project and location. Construction would be staged, therefore impacts to receivers may not exist for the entire construction period.

Operation

Landscape character impacts

During operation, the proposal would have impacts across all of the eight LCZs. Table 6-60 provides an assessment of potential impacts likely within each landscape character zone.

Table 6-60: Landscape character impacts during operation of the proposal

Zone	Description of change	Sensitivity	Magnitude	Impact rating
LCZ-1 Residential Estate	The proposal would include widening the road carriageway, new signalised intersection (Glenmore Parkway), land acquisitions, shared user path on the southbound side, pedestrian path on northbound side, and new road furniture	Moderate: This zone has different buildings and vegetation and therefore can accommodate some change without impacting its visual character. Given how close this zone is to the existing road corridor and the proposed widening of the corridor, it is considered to have a moderate sensitivity to change.	High: The proposal would directly impact this zone as a result of full and partial acquisition of several properties. It would ultimately increase the bulk and scale of road and how close it is to the zone.	High-Moderate: The proposal may alter the border areas of the zone as a result of property acquisition and the introduction of new retaining walls and noise walls. The greatest impacts are likely to be to those residents directly opposite the proposal with most of the suburb remaining unaffected.
LCZ-2 Light Commercial	Stage 5A and 5B of the proposal would include widening road carriageway, shared user path on the southbound side, pedestrian path on the northbound side and new road furniture	Low: This zone has various buildings and scattered vegetation. Given how close the zone is to the existing road corridor it is considered to have a low sensitivity to change.	Moderate: Whilst there would be some property adjustments to cater to the widening of the corridor, the visual setting and appearance of the commercial precinct would not be greatly impacted.	Moderate-Low Overall, a Moderate-Low impact would be expected on this character zone, limited to the fringe boundaries.
LCZ-3 Existing road corridor	The proposal would include widening road carriageways, new signalised intersection from Jamison Road to Union Road, bridge structures over waterways and new road furniture	Low: This zone consists of a highly modified existing arterial road corridor. The upgrade would be consistent with the existing use and character and this reduces the zone's sensitivity to the proposal.	Moderate The character is currently defined by road infrastructure however the road widening would increase the bulk and scale of the road.	Moderate-Low: A higher level of sensitivity would be associated with changes to road reserve areas as the proposal would need a full redevelopment of the corridor with more concentrated road infrastructure elements.

Zone	Description of change	Sensitivity	Magnitude	Impact rating
LCZ-4 Heritage	Stage 5A and 5B of the proposal would include widening road carriageway, shared user path on the southbound side, pedestrian path on the northbound side and new road furniture	High: This zone has recognised scenic values with the heritage listed Workmen's Cottages on Mulgoa Road, indicating that the sensitivity to changes in the landscape character would be high.	Moderate: Although physical changes within the zone would be minimal, the relationship between the corridor and the cottages would result in a moderate magnitude of change.	Moderate: The greatest impacts are likely to be experienced by the residents living at the property close to the widened road corridor.
LCZ-5 Riparian bushland	Stage 2 of the proposal would include a bridge structure over School House Creek	Moderate: The character of this zone is reasonably consistent especially along road corridor boundary areas. Most areas are dominated by attractive remnant riparian vegetation with smaller less dominant weed species closer to the existing road corridor.	High: Potential clearing would impact the visibility of the vegetative gateway, amenity for users and would be significant in terms of overall character.	High-Moderate: The proposal would require the clearance of vegetation along the existing road corridor. Reduction in batter widths, reducing the construction footprint and revegetation would assist in limiting the impacts on this zone further.
LCZ-6 Public Open space	The proposal would include widening road carriageway, shared user path on the southbound side, pedestrian path on the northbound side and removal of existing vegetation along the road interface	High: The character of this zone is reasonably consistent particularly along road corridor boundary areas where mature vegetation adds to the character of the zone. It is reasonably vulnerable to change.	Moderate: Due to the location of prominent vegetation primarily along boundaries, this would open up the landscape and notably change the landscape character.	High-Moderate: This impact may reduce over time as revegetation matures, returning the site to a similar visual appearance as it is currently.

Zone	Description of change	Sensitivity	Magnitude	Impact rating
LCZ-7 Private open space	Stages 5A and 5B of the proposal would include widening road carriageway and removal of existing vegetation along the road interface	Moderate: The character of this zone is largely defined by the buildings surrounding open active sporting areas. The development associated with the proposal would be similar to the existing road corridor and this reduces the zone's sensitivity.	Low: Whilst there would be some property adjustments to cater to the widening of the corridor, the visual appearance of the zone would not be substantially impacted.	Moderate-Low: This impact may reduce over time as revegetation becomes established and matures, returning the site to a similar visual appearance as it is currently.
LCZ-8 Drainage channel	Stage 5A of the proposal would include new and adjusted bridge structures over Surveyors Creek	Low: The character of this zone is reasonably consistent and includes some attractive features, particularly the vegetation which makes an important contribution to the character of the area.	Low: There would be little impact on landscape features within this zone owing largely to the fact that the proposal is an upgrade of an existing road. Some trees would be removed but the loss would not greatly affect overall character	Low: This impact may reduce over time as revegetation matures, returning the site to a similar visual appearance as it is currently.

Visual impacts

The ten viewpoints have been used to assess the visual impact of the proposal. These are summarised in Table 6-61.

Table 6-61: Visual viewpoint impacts during operation

Zone and Description of Change	Sensitivity	Magnitude	Impact Rating
VP 2-1	<p>Moderate:</p> <p>Major elements in the view are roadside vegetation together with the existing road corridor.</p>	<p>Moderate:</p> <p>The footprint of the intersection would increase, meaning more of the view would be road infrastructure. The proposal includes an increase in the dominance of road infrastructure.</p>	<p>Moderate:</p> <p>The new road corridor would be straightened and widened. Existing foreground vegetation within the verges and medians would be removed opening up views. Additional road furniture would increase how much infrastructure is in view.</p>
VP 2-2	<p>High:</p> <p>While much of this view is of the existing road corridor, existing remnant vegetation and tree cover are important elements that frame the view and would have low capacity to absorb the proposed changes.</p>	<p>Moderate:</p> <p>The width of the road would more than double from about 12 metres to about 30 metres with changes to existing remnant vegetation. The proposal includes an increase in the dominance of road infrastructure.</p>	<p>Moderate-High:</p> <p>The new road corridor would be wider and existing vegetation within the southbound verge would be removed. Majority of the existing vegetation would remain, however. Additional road furniture, medians and a widened shared user path would increase the how much infrastructure is in view.</p>
VP 2-3	<p>Moderate:</p> <p>The irregular tree cover within the southbound verge is a noticeable element. Existing road surfaces have a high capacity to absorb the proposed changes, while existing verges and private front gardens would not easily absorb them.</p>	<p>Moderate:</p> <p>The width of the road would increase from about 16 metres to about 28 metres with substantial tree removal. The proposal results in a larger portion of the view being comprised of road infrastructure.</p>	<p>Moderate:</p> <p>The new road corridor would be wider and four existing dwellings as well as existing vegetation behind the southbound verge, would be removed changing the road user experience. Additional road furniture would increase the prominence of the infrastructure within the view.</p>

Zone and Description of Change	Sensitivity	Magnitude	Impact Rating
VP 5A-1	<p>Moderate:</p> <p>The tree cover is a very noticeable element in view. However, a large part of the view is of the road corridor itself.</p>	<p>Moderate:</p> <p>The width of the road would increase from about 13 metres to about 32 metres with changes to existing vegetation. The proposal includes an increase in road infrastructure such as planted medians and a widened shared user path.</p>	<p>Moderate:</p> <p>The new road corridor would be wider and some existing dwellings and vegetation would be removed, changing the road user experience. Additional road furniture would increase the prominence of the infrastructure in view.</p>
VP 5A-2	<p>Low:</p> <p>Existing road corridor has a high capacity to absorb the proposed changes, while existing verges and private front gardens would not easily absorb them.</p>	<p>Low:</p> <p>While the width of the road carriageway would expand into the existing southbound road reserve, it would not result in a large increase of the view being comprised of road infrastructure.</p>	<p>Low:</p> <p>The widened road carriageway is unlikely to be a more dominant feature. While there would be a minor loss of existing vegetation within the northbound verge of Mulgoa Road and a loss of trees within the median, the change in view would not be major.</p>
VP 5A-3	<p>High:</p> <p>The presence of residents and outdoor recreation users within the verge environment that value their landscape setting and local amenity suggests receptors are generally of high sensitivity</p>	<p>Moderate:</p> <p>The footprint of the proposed upgrade would increase but would shift west, resulting in a larger verge environment along the heritage frontage.</p>	<p>High-Moderate:</p> <p>The widened road corridor is unlikely to be a more dominant feature. While there would be a minor loss of existing vegetation within the southbound verge and within the median, the change in view would not be major. The increase of road infrastructure with new built features would be visible to slower moving pedestrians, cyclists and some residents.</p>

Zone and Description of Change	Sensitivity	Magnitude	Impact Rating
VP 5B-1	<p>High: The presence of outdoor recreation users from the open space environment that value their landscape setting and local amenity suggests receptors are generally of high sensitivity</p>	<p>Moderate: The proposal results in a slightly larger portion of the view being comprised of road infrastructure and a loss of areas of vegetation.</p>	<p>High-Moderate: Existing vegetation gives way to open spaces to the east. The existing semi-restricted views to the west would be slightly increased by removal of vegetation along western margins. The proposal would slightly increase how much infrastructure is within view from vegetation clearing.</p>
VP 5B-2	<p>Low: Major elements in the view are the existing internal access road with street trees together with roadside vegetation along Mulgoa Road.</p>	<p>Moderate: As result of roadside vegetation removal on Mulgoa Road the slightly increased road carriageway footprint would become more noticeable within the view but at almost 85 metres.</p>	<p>Moderate-Low: From this location the widened road carriageway is unlikely to be a more dominant feature within the view. However, there would be an increase in the prominence of some road infrastructure elements and vehicles moving across the view due to removal of exiting vegetation. More road features added within this view may be noticeable to guests.</p>
VP 5B-3	<p>High: The park like setting and outlook makes this view highly sensitive to the proposed changes.</p>	<p>Low: While the width of the road carriageway would expand it would not result in a substantial increase of the view being made up of road infrastructure.</p>	<p>Moderate: The widened road carriageway would not be a more dominant feature within the view and although there may be a small loss of vegetation within the southbound verge of Mulgoa Road this would not constitute a major change in the view. The slight increase in road infrastructure measures and vehicles moving across these alterations are not considered to have negative impacts.</p>

Zone and Description of Change	Sensitivity	Magnitude	Impact Rating
VP 5B-4	<p>High: The presence of residents and some outdoor recreation users who value their landscape setting and local amenity suggests receptors are generally of high sensitivity.</p>	<p>High: Changes especially within the western verge with the introduction of noise walls means an increase in the dominance of infrastructure.</p>	<p>High: The widened road carriageway would not be a more dominant feature within the view. However, the loss of vegetation within the median and adding noise walls would increase the prominence of infrastructure within the view which would be a major change. The increase of road infrastructure with new vertical built features (west of this viewpoint) would be visible to slower moving pedestrians and cyclists and for residents as well.</p>

6.11.4 Safeguards and management measures

Table 6-62 describes the proposed safeguards and management measures that would be implemented to manage the potential landscape character and visual impacts from the proposal.

Table 6-62: Landscape character and visual safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
V1 - landscape character and visual impact	<p>An Urban Design Plan would be prepared to support the final detailed project design and implemented as part of the CEMP.</p> <p>The Urban Design Plan would present an integrated urban design for the project, providing practical detail on the application of design principles and objectives identified in the environmental assessment. The Plan would include design treatments for:</p> <ul style="list-style-type: none"> • Location and identification of existing vegetation and proposed landscaped areas, including species to be used • Built elements including retaining walls, bridges and noise walls • Pedestrian and cyclist elements including footpath location, paving types and pedestrian crossings • Fixtures such as seating, lighting, fencing and signs • Details of the staging of landscape work taking account of related environmental controls such as erosion and sedimentation controls and drainage • Procedures for monitoring and maintaining landscaped or rehabilitated areas. <p>The Urban Design Plan would be prepared in accordance with relevant guidelines, including:</p> <p>Beyond the Pavement urban design policy, process and principles (Roads and Maritime, 2014)</p> <ul style="list-style-type: none"> • Landscape Guideline (RTA, 2008) • <i>Bridge Aesthetics</i> (Roads and Maritime 2012) 	Contractor	Detailed design Pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> Noise Wall Design Guidelines (RTA, 2006) Shotcrete Design Guideline (RTA, 2005). 			
V2 - planting	<p>The landscaping plan for the proposal would be confirmed during detailed design and would consider:</p> <ul style="list-style-type: none"> Provide screen planting to childcare centre Planting trees at regular intervals to provide 'boulevard' treatment Selecting appropriate plant species and arrangements to maintain long vistas to the Blue Mountains escarpment Plant diverse and varied plant species combinations along the length of the road corridor to reinforce different landscape character areas Maintaining roadside vegetation where possible Selecting and arranging appropriate plants along the workers cottages curtilage Selecting plant species to screen and soften hard elements within the corridor Minimising the footprint of the road corridor by planting appropriate native vegetation in laydown areas Reinstating appropriate vegetation in riparian corridors associated with creeks and channels Carefully select plant species to ensure landscape treatments adhere to the guidelines for designated Bush Fire Prone Land Ensuring planting conforms to sight lines and clear zone requirements so that pedestrian portals are safe and well utilised Ensuring robust and long life planting and materiality selections for whole of life design to minimise the requirements for ongoing maintenance and whole of life costs Improving localised microclimates and conditions by providing urban cooling through tree shade and urban heat island considerate materials. 	Transport	Detailed Design	Additional Safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
V3 - connectivity, noise walls and pedestrian portals	<p>The detailed design of the noise walls and pedestrian portals would consider:</p> <ul style="list-style-type: none"> • Reflecting the distinctive landscape character zones along the road corridor through colour, art and texture, lighting and signage • Way-finding opportunities at pedestrian portals • Ensuring existing signage and art is protected and preserved in existing locations and reinstating in a suitable location if works require that they are moved • Designing noise walls surfaces to reflect the distinctive landscape character zones along the road corridor and to reflect the road corridors historical features • Consolidating signage structures to minimise visual clutter and obstructions • Ensuring shared user path design contributes to existing network and linear identity • Creating human centric spaces by minimising shading and scale of noise walls when next to residential lots. 	Transport	Detailed Design	Additional Safeguard

6.12 Other impacts

6.12.1 Existing environment and potential impacts

Table 6-63: Other existing and potential environmental impacts

Environmental factor	Existing environment	Potential impacts
Waste and resources	<p>Existing waste volumes within the proposal area is minor and limited to roadside litter, illegal dumping and other waste material associated with roadside maintenance. Directly adjacent to the proposal area waste would be in greater volumes from industry.</p> <p>The resource management hierarchy principles in order of priority as outlined in the Waste Avoidance and Resource Recovery Act 2001 would be applied to the proposal, these are:</p> <ul style="list-style-type: none"> • avoidance of unnecessary resource consumption • resource recovery (including reuse, reprocessing, recycling and energy recovery) • disposal. <p>By adopting the above principles, Transport encourages the most efficient use of resources and reduces cost and environmental harm in accordance with the principles of ecologically sustainable development.</p>	<p>The resources to be used during construction are common materials and their use would not result in any resource supply shortages in the region.</p> <p>Waste generated during construction would likely include:</p> <ul style="list-style-type: none"> • Residual road and building materials including concrete, asphalt and aggregate • Packing materials including pallets, crates, plastics • Domestic garbage including food waste and general site waste and litter • Wastewater from facilities, vehicle wash down and dust suppression • Residual chemical including oils, lubricants, waste fuels and batteries • Green waste including timber, vegetation and weeds • Hazardous waste including oils, lubricants, waste fuels and batteries • Potentially contaminated waste. <p>Inappropriately managed waste has the potential to result in impacts to air quality, human health, water quality and visual impacts.</p> <p>During operation, waste sources would not change from the existing environment, including:</p> <ul style="list-style-type: none"> • roadside litter • waste material associated with road maintenance illegal dumping. <p>Waste would be reused and recycled on site where possible, however additional or contaminated material would be classified and disposed of</p>

Environmental factor	Existing environment	Potential impacts
		at a licensed waste facility in accordance with <i>EPA Waste Classification Guidelines</i> (EPA, 2014).
Greenhouse gases and climate change	<p>Climate change is caused by increases in greenhouse gas concentrations in the atmosphere, including those that have been emitted due to human activities. Climate change is associated with several effects including the increased severity and frequency of extreme weather events.</p> <p>The transport sector is the fastest growing component of NSW-generated greenhouse gases. Transport emissions are currently the second largest component of the greenhouse gas emissions in NSW, comprising 20 per cent of total emissions. Road transport accounts for 85 per cent of these transport emissions (AdaptNSW, 2019). Vehicle idling and localised congestion generally increases the quantity of greenhouse gases emitted compared to when vehicles travel under free-flow conditions.</p>	<p>During construction, the proposal would result in minor greenhouse gas emissions through use of materials (including the embodied emissions in the production of materials) as well as use of construction equipment and vehicles and longer vehicle trips during use of the detour route. However, given the small scale of the proposal and the duration of the proposed detour route, these emissions would have a negligible contribution to NSW's emissions. Opportunities to minimise emissions related to construction of the proposal would be further investigated during detailed design, including optimising the construction schedule to reduce the duration of full road closures, sourcing materials from local suppliers and using recycled and low embodied energy materials, where practical.</p> <p>The potential impacts of climate change in relation to flooding has been assessed. Climate change impacts to flood behaviour are a low risk. Although road immunity outcomes from the proposal provide an improvement on the existing situation, the increased rainfall intensity associated with climate change would affect flooding behaviour near the proposal. Analysis of expected local climatic changes in the proposal area indicate a future increase in the intensity of extreme rainfall events. As a result, the runoff volume from the proposal area to receiving surface watercourses would increase. While increased rainfall results in additional overland flows, road immunity outcomes still remain better than existing. During operation, the proposal would improve network reliability and reduce congestion along Mulgoa Road, which may reduce the amount of greenhouse gas emissions from vehicles. However, the overall magnitude of any reductions in greenhouse gas emissions from vehicles travelling along the proposal are expected to be negligible given the small scale of the proposal in the context of the wider road network.</p>

6.12.2 Safeguards and management measures

Table 6-64: Other impacts safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
W1 - waste	<p>A Waste Management Plan (WMP) would be prepared and implemented as part of the CEMP. The WMP would include but not be limited to:</p> <ul style="list-style-type: none"> Measures to avoid and minimise waste associated with the project Classification of wastes and management options (re-use, recycle, stockpile, disposal) 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. <p>The WMP would be prepared taking into account the <i>Environmental Procedure - Management of Wastes on Roads and Maritime Services Land</i> (Roads and Maritime, 2014) and relevant Transport for NSW Waste Fact Sheets.</p>	Contactor	Detailed design Pre-construction	Section 4.2 of QA G36 <i>Environment Protection</i>
U1 - utilities	<p>Before commencing work the location of existing utilities and any utility relocation designs will be confirmed in consultation with the affected utility owners.</p> <p>If the scope or location of proposed utility relocation work falls outside of the assessed proposal scope and footprint, further assessment will be undertaken.</p>	Contactor	Detailed design Pre-construction	Additional safeguard
HR1 - hazards and risk management	<p>A Hazard and Risk Management Plan (HRMP) would be prepared and implemented as part of the CEMP. The HRMP would include, but not be limited to:</p> <ul style="list-style-type: none"> Details of hazards and risks associated with the activity Measures to be implemented during construction to minimise these risks Record keeping arrangements, including information on the materials present on the site, material safety data sheets, and personnel trained and authorised to use such materials A monitoring program to assess performance in managing the identified risks 	Contactor	Detailed design Pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> Contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations. <p>The HRMP would be prepared in accordance with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, and EPA or DPE publications.</p>			
RU1 – resource use	<p>The following resource management hierarchy principles would be followed:</p> <ul style="list-style-type: none"> Avoid unnecessary resource consumption as a priority Avoidance would be followed by resource recovery (including reuse of materials, reprocessing, and recycling and energy recovery) disposal would be undertaken as a last resort (in accordance with the <i>Waste Avoidance and Resource Recovery Act, 2001</i>). 	Contractor	Detailed design/ pre-construction/ construction	Additional safeguard
EC1- Energy consumption	Energy efficient LEDs would be considered for new streetlights installed as part of the proposal.	Transport	Detailed design	Additional safeguard

6.13 Cumulative impacts

6.13.1 Study area

The study area for this assessment of cumulative impacts was defined by considering other projects within the Penrith City Council LGA that would have the potential to contribute to cumulative impacts with the proposal, when considering their location, scale and timing. This assessment includes regional projects of similar scale and excludes local residential developments of minor road works for local council roads. It focuses on projects that would be built at a similar time to the proposal, which is expected to start construction in 2024, subject to approvals, funding and weather.

A search of the following databases was completed to identify any projects which may result in a cumulative impact with the proposal:

- Department of Planning, Industry and Environment – Major Project Register
- Penrith City Council Development Application Register.

6.13.2 Broader program of work

The proposal is part of a broader program to upgrade 6.5 kilometres of the Mulgoa Road / Castlereagh Road corridor between Glenmore Parkway, Glenmore Park and Andrews Road, Penrith. This has been separated into eight stages shown in Figure 6.39 and includes:

- Mulgoa Road – Glenmore Parkway to Jeanette Street (stage 2)
- Mulgoa Road – Jeanette Street to Blaikie Road (stage 1)
- Mulgoa Road – Blaikie Road to Jamison Road (stage 5A)
- Mulgoa Road – Jamison Road to Union Road (stage 5B)
- Mulgoa Road – Union Road to Museum Drive (stage 0)
- Castlereagh Road – Museum Drive to Coreen Avenue (stage 3)
- Castlereagh Road – Coreen Avenue to Lugard Street (stage 6)
- Castlereagh Road – Lugard Street to Andrews Road (stage 4).

The proposal complements the other stages that are being delivered by Transport for NSW under this project. Mulgoa Road – Jeanette Street to Blaikie Road (stage 1) has undergone community consultation and received planning approval. While construction began in December 2018 for Union Road to Museum Drive (stage 0), with significant progress on the upgrade completed to replace the existing railway bridge and widen the road underneath.

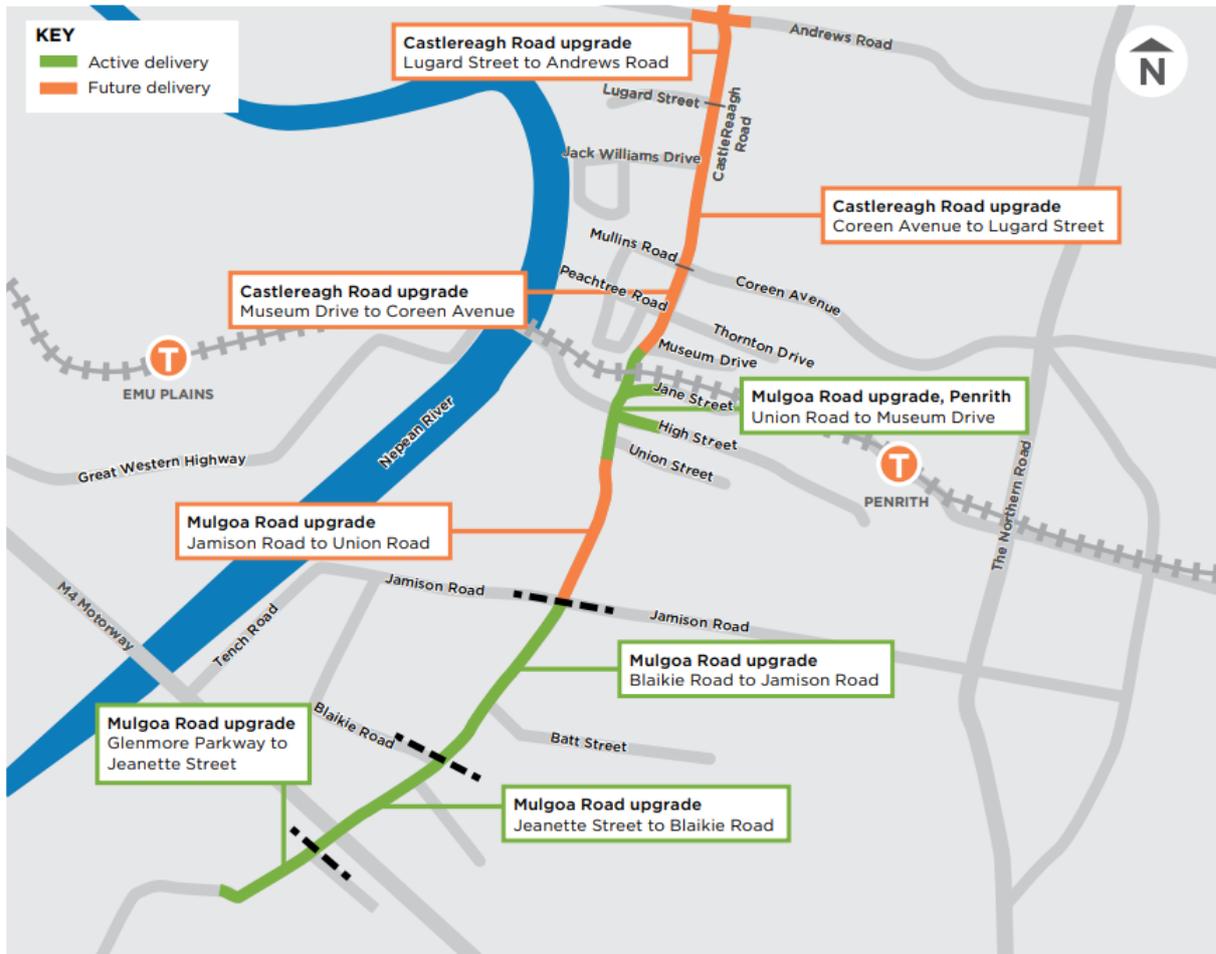


Figure 6-39: Mulgoa Road / Castlereagh Road corridor map

6.13.3 Other projects and developments

Table 6-65: Past, present and future projects

Project	Construction impacts	Operational impacts
Penway Place apartments (Mulgoa Road at intersection with Union Road)	Construction impacts may include: <ul style="list-style-type: none"> • Traffic impacts with additional construction vehicles on the road network • Noise impacts due to construction 	The proposal would generate additional vehicles on Mulgoa Road and the surrounding network with the new residents of the complex using the area.
M12 Motorway. New dual-carriageway motorway connecting Western Sydney Airport with The Northern Road. Expected 2022-2025	Construction impacts may include: <ul style="list-style-type: none"> • Clearing of vegetation including threatened ecological communities • 1,560 additional construction vehicles per day • Noise, vibration, dust, traffic and light spill impacts on local amenity of communities close to construction works • Release of pollutants into downstream waterways and sensitive receiving environments and erosion and sedimentation of downstream water courses. 	Operational impacts of the project may include: <ul style="list-style-type: none"> • Improved intersection performances along Elizabeth Drive corridor between The Northern Road and Mamre Road (south east of the proposal area) • Removal of most of the operational traffic associated with the new Western Sydney Airport from the local road network • Removal / reduction of some “rat running” from local roads by providing better level of service and reduce delay on higher order of roads and encouraging more utilisation of higher order roads • Introduction of substantial infrastructure into the existing Cumberland Plain landscape • Changes in localised flow from one sub water catchment to the next.
Mamre Road Upgrade. Upgrade of key transport corridor to the east of Mulgoa Road.	Construction impacts may include: <ul style="list-style-type: none"> • Increased traffic across the Western Sydney road network • Increased noise levels experienced by sensitive receivers • Removal of vegetation and habitat 	Operational impacts may include: <ul style="list-style-type: none"> • Benefits to traffic flow, reliability, road safety, connectivity in Western Sydney • Increased edge effects and reduction in vegetation patch size leading to local and regional loss of vegetation communities and loss of biodiversity across the area

Project	Construction impacts	Operational impacts
	<ul style="list-style-type: none"> • Changed visual amenity with the presence of compound sites, stockpiles and construction plant, and equipment • Potential for dust and sediment-laden runoff to be generated from large areas of exposed soils which may enter surrounding waterways • Potential for construction fatigue to be experienced by both receivers who live or work near the proposal area, or those who regularly commute through the proposal. 	<ul style="list-style-type: none"> • Potential impacts to soil erosion and sedimentation (which can be minimised with landscaping and vegetation management and installation of water quality treatment measures)
<p>Sydney Metro Western Sydney Airport. Construction of new metro railway around 23 kilometres between St Marys and Sydney Aerotropolis Core. Construction expected 2021-2026.</p>	<p>Construction impacts may include:</p> <ul style="list-style-type: none"> • Additional construction vehicles on roads around construction site • Noise and vibration • Clearing of threatened ecological communities • Impacts on Aboriginal and non-Aboriginal Heritage • Temporary blockage of flood flow paths and increased flow rates due to vegetation clearing • Groundwater drawdown at locations with drained excavations 	<p>Operational impacts may include:</p> <ul style="list-style-type: none"> • Increased traffic using the proposed Luddenham station • Increased peak flood levels in isolated locations
<p>Western Sydney Airport. Construction of Western Sydney airport to provide additional aviation capacity in Sydney. Due for completion in 2026.</p>	<p>Construction impacts of the project may include:</p> <ul style="list-style-type: none"> • Land clearing, impacting flora and fauna, and major bulk earthworks • Generation of an estimated 202,500 tonnes of vegetation and construction materials waste • Growth in employment opportunities in the region • Temporary visual impacts for sensitive receivers in Luddenham and Bringelly • Disturbance of Aboriginal and non-Aboriginal heritage site 	<p>Operational impacts may include:</p> <ul style="list-style-type: none"> • Growth in investment, infrastructure and employment opportunities in Western Sydney • Long-term noise from aircraft noise and ground based noise • Increase in air quality impacts • An additional 103,000 additional vehicle trips daily • Long-term transformation of the environment from one that is mainly rural to one that is urban • Changes in social amenity and lifestyle • Visual impacts from overflights in areas close to the airport

Project	Construction impacts	Operational impacts
		<ul style="list-style-type: none"> • Change to catchment areas from earthworks activities • Occasional over-size vehicles to carry plant for the airport's operations.
<p>M4 Smart Motorways. Introduction of intelligent technology to the M4 Motorway between Pitt Street, Parramatta and Mulgoa Road, Penrith. Completion expected in 2021.</p>	<p>Construction impacts may include:</p> <ul style="list-style-type: none"> • Congestion on the M4 during AM and PM peak periods when the average speed would be up to 50 per cent less than the posted speed limits • Clearing of planted and remnant vegetation, including threatened ecological communities • Increased noise levels • Increased risk of dust. 	<p>Operational impacts may include:</p> <ul style="list-style-type: none"> • Enhanced travel time reliability • Enhanced traffic throughput, efficiency, productivity and safety • Reduced vehicle emissions due to less stop-start traffic flow • Enhanced traveller journey decision making • High impact on some identified landscape character zones.

6.13.4 Potential impacts

Table 6-66: Cumulative impacts

Environmental factor	Construction	Operation
Traffic	All nearby construction projects would generate additional construction traffic, including increased heavy vehicle activity on the surrounding road network. This is likely to affect main roads in the area including Mulgoa Road, Glenmore Parkway and Mamre Road.	The proposal would create cumulative benefits to the traffic flow, reliability and road safety along Mulgoa Road and other key roads in Western Sydney.
Noise	Construction of the proposal at the same time as other nearby projects would potentially lead to a short-term cumulative increase in construction noise levels experienced by sensitive receivers or result in construction fatigue.	Any cumulative noise impacts during operation would be negligible.
Air quality	There may be a decrease in air quality, from machinery and dust produced during construction.	Any cumulative air quality impacts during operation would be negligible given the urban environment, including current land use being an existing road corridor, and existing air quality.

6.13.5 Safeguards and management measures

Table 6-67: Cumulative impacts safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
CU1 - cumulative construction impacts	<p>Other developers would be consulted in accordance with the Community Stakeholder and Engagement Plan to:</p> <ul style="list-style-type: none"> Obtain information about project timeframes and impacts Manage the interfaces of the proposal's staging and program in combination with other projects occurring in the area Identify and implement appropriate safeguards and management measures to minimise cumulative impacts. 	Transport for NSW and Contractor	Pre-construction Construction	Additional safeguard

7 Environmental management

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

7.1 Environmental management plans (or system)

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

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

The CEMP will be prepared before construction of the proposal and must be reviewed and certified by the Transport for NSW Environment Officer, before commencing any on-site work. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in accordance with the specifications set out in the QA Specification G36 – *Environmental Protection (Management System)*, QA Specification G38 – *Soil and Water Management (Soil and Water Plan)*, QA Specification G40 – *Clearing and Grubbing*, QA Specification G10 – *Traffic Management*.

7.2 Summary of safeguards and management measures

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

Table 7-1: Summary of safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
GEN1	General - minimise environmental impacts during construction	<p>A CEMP will be prepared and submitted for review and endorsement of the Transport for NSW Environment Manager before commencing the activity.</p> <p>As a minimum, the CEMP will address the following:</p> <ul style="list-style-type: none"> • Any requirements associated with statutory approvals • Details of how the project will implement the identified safeguards outlined in the REF • Issue-specific environmental management plans • Roles and responsibilities • Communication requirements • Induction and training requirements • Procedures for monitoring and evaluating environmental performance, and for corrective action • Reporting requirements and record-keeping • Procedures for emergency and incident management • Procedures for audit and review. <p>The endorsed CEMP will be implemented during the undertaking of the activity.</p>	Contractor Transport	Pre-construction Detailed design	Standard safeguard
GEN2	General - notification	All businesses, residential properties and other key stakeholders (eg schools, local councils) affected by the activity will be notified at least five days before commencing the activity.	Contractor Transport	Pre-construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
GEN3	General – environmental awareness	<p>All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular 'toolbox' style briefings.</p> <p>Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include:</p> <ul style="list-style-type: none"> Areas of heritage sensitivity Threatened species habitat Adjoining residential areas requiring particular noise management measures. 	Contractor Transport	Pre-construction Detailed design	Standard safeguard
B1	Biodiversity	<p>A Flora and Fauna Management Plan would be prepared in accordance with Transport for NSW 's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</i> (RTA, 2011) and implemented as part of the CEMP. It would include, but not be limited to:</p> <ul style="list-style-type: none"> • Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas • Requirements set out in the <i>Landscape Guideline</i> (RTA, 2008) • Pre-clearing survey requirements • Procedures for unexpected threatened species finds and fauna handling • Procedures addressing relevant matters specified in the <i>Policy and guidelines for fish habitat conservation and management</i> (DPI Fisheries, 2013) • Protocols to manage weeds and pathogens. 	Contractor	Pre-construction Construction	Standard safeguard
B2	Biodiversity	<p>Measures to further avoid and/or minimise the construction footprint and native vegetation and/or habitat removal would be investigated during detailed design and implemented, where practicable and feasible.</p>	Contactoer	Detailed design Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
B3	Removal of vegetation	Pre-clearing surveys would be undertaken in accordance with <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)	Contractor	Pre-construction	Additional safeguard
B4	Removal of vegetation	Vegetation removal would be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)	Contractor	Construction	Additional safeguard
B5	Removal of vegetation	Native vegetation would be re-established in accordance with <i>Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011). Preference to revegetate disturbed areas to former TEC using all structural layers and species native to the community. Accredited bush regenerators would implement native revegetation in accordance with PCT mapping within the Biodiversity Assessment Report (Aurecon 2021).	Transport Contractor	Construction Post-construction	Additional safeguard
B6	Unexpected species finds	The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	Contractor	Construction	Additional safeguard
B7	Biodiversity impacts to School House and Surveyors Creek	A restoration plan would be developed to mitigate clearing and fragmentation, improve the condition of the riparian vegetation along School House and Surveyors Creek within and adjacent to the proposal area. The restoration plan would focus upon removing high threat exotics and revegetation using province-sourced plants belonging to PCT 835 Cumberland River-Flat Forest. The restoration plan would form an Appendix to the Operational Flora and Fauna Management Plan or Operation Environmental Management Plan (OEMP).	Transport Contractor	Operation	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
B8	Impact to TECs	Clearing limits and exclusion zones within TECs would be installed before commencing work. These areas are to be physically delineated e.g. flagging tape, etc and signposted to inform personnel of environmental significance.	Contractor	Pre-construction Construction	Additional safeguard
B9	Habitat removal	Habitat removal would be minimised through detailed design. Exclusion zones would be implemented around hollow bearing trees that have been identified for retention. Installation of nesting boxes for hollows removed in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Transport Contractor	Detailed design	Additional safeguard
B10	Habitat removal	Habitat would be replaced or re-instated in accordance with <i>Guide 5: Re-use of woody debris and bushrock</i> and <i>Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011). Consideration should be given to the reuse of salvaged hollows and timber removed trees to be incorporated into the design of nest boxes where possible. The incorporation of microbat habitat into culverts and bridges should be considered during detailed design.	Transport Contractor	Construction	Additional safeguard
B11	Aquatic habitat impacts	Aquatic habitat would be protected in accordance with <i>Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) and <i>Section 3.3.2 Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013</i> (DPI (Fisheries NSW) 2013).	Contractor	Detailed design Pre-construction Construction	Additional safeguard
B12	Aquatic habitat impacts	Structures within and around the waterways including drainage outlets, bridge works and culverts, should be designed to consider biodiversity principles and minimise erosion and sedimentation issues and prevent substantial changes in flow rates that may impact both the immediate area and downstream features. See	Designer	Detailed design	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		Why do fish need to cross the road? (Fairfull and Witheridge, 2003) for potential design considerations.			
B13	Groundwater dependent ecosystems	Interruptions to water flows associated with groundwater dependent ecosystems would be minimised through detailed design.	Transport Contractor	Detailed design	Additional safeguard
B14	Changes to hydrology	Changes to existing surface water flows would be minimised through detailed design.	Transport Contractor	Detailed design	Additional safeguard
B15	Fragmentation of identified habitat corridors	Fauna connectivity measures will be considered in detailed design in accordance with the Wildlife Connectivity Guidelines for Road Projects (RTA 2011). Any connectivity measures implemented would be designed in consultation with an experienced ecologist.	Transport Contractor	Detailed design Construction Post-construction	Additional safeguard
B16	Edge effects on adjacent native vegetation and habitat	Exclusion zones would be set up at the limit of clearing in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Transport	Post construction	Additional safeguard
B17	Light	Shading and artificial light impacts will be minimised through detailed design.	Contractor	Detailed design	Additional safeguard
B18	Tree removal	Trees to be retained should be appropriately protected in accordance with the tree protection measures outlined in the Arborist Impact Assessment, including but not limited to signage and fencing for tree protection zones.	Transport Contractor	Pre-construction	Additional safeguard
TT1	Traffic and transport	A Traffic Management Plan (TMP) would be prepared and implemented as part of the CEMP. The TMP would be prepared in accordance with the <i>Roads and Maritime Traffic Control at Work Sites Manual</i> (RTA, 2010) and <i>QA Specification G10 Control of Traffic</i> (Roads and Maritime, 2008). The TMP would include: <ul style="list-style-type: none"> • Confirmation of haulage routes • Measures to maintain access to local roads and properties • Site specific traffic control measures (including signage) to manage and regulate traffic movement 	Contractor	Construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> Measures to maintain pedestrian and cyclist access Requirements and methods to consult and inform the local community of impacts on the local road network Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads. A response plan for any construction traffic incident Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic Monitoring, review and amendment mechanisms. 			
TT2	Compound site management	Ancillary facility sites would be securely fenced with fencing maintained to ensure continual site security.	Contractor	Pre-construction Construction	Additional safeguard
TT3	Compound site management	Boundary screening would need to be erected around ancillary facility sites that are adjacent to sensitive receivers for the duration of construction, unless otherwise agreed with Council and affect residents, businesses and landowners.	Contractor	Pre-construction Construction	Additional safeguard
TT4	Compound site management	Signage on fencing or hoardings surrounding construction ancillary facilities must identify the project and have a project telephone number, postal address and email address. Signage must be available before the commencement of work and for the duration of construction.	Transport Contractor	Construction	Additional safeguard
TT5	Compound site management	Upon construction completion, temporary compound sites, work areas and established stockpiles, would be safely disassembled with the site cleared of all rubbish and site restored to its previous condition.	Transport Contractor	Construction	Additional safeguard
TT6	Bus routes	Relevant bus route operators would be notified of the proposed works and timing of works.	Contractor	Pre-construction	Additional safeguard
TT7	Bus routes	Temporary bus furniture and bus signage would need to be installed to accommodate for temporary route changes, where relevant.	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
TT8	Cyclist and pedestrian safety	<p>The TMP would investigate the opportunity to maintain cyclist and pedestrian routes in areas that would not be impacted by construction activities.</p> <p>Where routes cannot be maintained, route diversions are to be communicated to local cyclist groups, the local community local community and to specialist groups (ie local cycling groups/forums).</p> <p>Where route diversions cannot be accommodated, traffic control would be implemented to facilitate traffic flow.</p>	Contractor	Construction	Additional safeguard
TT9	Local roads used for haulage	Council must be consulted for any additional local roads that are proposed to be used for haulage of spoil and fill. Use of these roads cannot be undertaken until Council has been consulted.	Transport Contractor	Pre-construction Construction	Additional safeguard
TT10	Heavy vehicles haulage impacting roads	<p>Before any local road is used by a heavy vehicle for the purposes of construction of the project, a Road Dilapidation Report must be prepared.</p> <p>A copy of the Road Dilapidation Report must be provided to Council before the road is used by heavy vehicles associated or required by the project.</p>	Transport Contractor	Pre-construction	Additional safeguard
NV1	Noise and vibration	<p>A Noise and Vibration Management Plan (NVMP) would be prepared and implemented as part of the CEMP. The NVMP would generally follow the approach in the Interim <i>Construction Noise Guideline</i> (ICNG) (DECC, 2009) and identify:</p> <ul style="list-style-type: none"> • All potential significant noise and vibration generating activities associated with the activity • Feasible and reasonable mitigation measures to be implemented, taking into account <i>Beyond the Pavement: urban design policy, process and principles</i> (Roads and Maritime, 2014). • A monitoring program to assess performance against relevant noise and vibration criteria 	Contractor	Pre-construction	Section 4.6 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> • Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria. 			
NV2	Noise and vibration	<p>The NVMP would include:</p> <ul style="list-style-type: none"> • Identification of nearby sensitive receivers • Description of works, construction equipment and hours work would be completed in • Criteria for the proposal and relevant licence and approval conditions • Requirements for noise and vibration monitoring • Details of how community consultation would be completed • Procedures for handling complaints • Details on how respite would be applied where ongoing high impacts are seen at certain receivers. 	Contactors	Pre-construction	Standard safeguard
NV3	Noise and vibration	<p>All sensitive receivers (eg schools, local residents) likely to be affected will be notified before commencing any work associated with the activity that may have an adverse noise or vibration impact. The notification would provide details of:</p> <ul style="list-style-type: none"> • The project • The construction period and construction hours • Contact information for project management staff • Complaint and incident reporting • How to obtain further information. 	Contractor	Construction	Standard safeguard
NV4	Noise and vibration	<p>Location and activity specific noise and vibration impact assessments should be carried out before (as a minimum) activities:</p> <ul style="list-style-type: none"> • With the potential to result in noise levels above 75 dBA at any receiver 	Contactors	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> Required outside Standard Construction Hours likely to result in noise levels in greater than the relevant Noise Management Levels With the potential to exceed relevant criteria for vibration. 			
NV5	Noise and vibration	Where noise intensive equipment is to be used near sensitive receivers, the work should be scheduled for standard construction hours, where possible. If it is not possible to restrict the work to standard construction hours then the work should be completed as early as possible in each work shift. Appropriate respite should be provided to affected receivers in accordance with the CNVG.	Contractor	Construction	Additional safeguard
NV6	Noise and vibration	Hoarding, or other shielding structures, should be used where receivers are impacted near compounds or fixed work areas with long durations. To provide effective noise mitigation, the barriers should break line-of-sight from the nearest receivers to the work and be of solid construction with minimal gaps.	Contractor	Construction	Additional safeguard
NV7	Monitoring	Monitoring should be carried out at the start of noise and/or vibration intensive activities to confirm that actual levels are consistent with the predictions and that appropriate mitigation measures from the CNVG have been implemented.	Contractor	Construction	Additional safeguard
NV8	Vibration	Where work is within the minimum working distances and considered likely to exceed the cosmetic damage criteria: <ul style="list-style-type: none"> Different construction methods with lower source vibration levels should be investigated and implemented, where feasible Attended vibration measurements should be undertaken at the start of the work to determine actual vibration levels at the item. Work should be ceased if the monitoring indicates vibration levels are likely to, or do, exceed the relevant criteria. 	Contractor	Detailed design/pre-construction, construction	Additional safeguard
NV9	Vibration	The potential human comfort impacts and requirement for vibration intensive work should be reviewed prior to construction.	Contractor	Detailed design Pre-construction Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NV10	Noise and vibration	Building condition surveys should be completed before and after the work where buildings or structures are within the minimum working distances and considered likely to exceed the cosmetic damage criteria during the use of vibration intensive equipment.	Contractor	Detailed design Pre-construction Construction	Additional safeguard
NV11	Noise barriers	The design of noise walls would be confirmed during detailed design. This would consider incorporating urban design features such as clear panels, colour, art and graphics to help with navigation and improve aesthetics	Contractor	Detailed design	Additional safeguard
HF1	Flooding	A construction flood management plan would be prepared as part of the CEMP to set out processes for monitoring and managing flood risk. The plan would: <ul style="list-style-type: none"> Specify the steps taken in the event of a flood warning Including removal or securing of loose materials, equipment, fuels and chemicals. 	Contractor	Pre-construction Construction	Additional safeguard
HF2	Flooding	Further consideration of measures to minimise flooding impacts on the compound sites and construction activities would be undertaken during detailed design. This would include: <ul style="list-style-type: none"> Areas where material storage and stockpiles could be located outside of flood prone land Feasible design measures or construction methods to minimise sedimentation and cross contamination risks where flood prone land cannot be avoided for material storage and stockpiles such as installing erosion and sediment controls around compound site boundaries. 	Contractor	Detailed design	Additional safeguard
HF3	Flooding	A flood evacuation plan for construction personnel, materials and equipment would be prepared to manage a potential flood event during construction and included as part of the CEMP. This plan would be implemented during construction and outline: <ul style="list-style-type: none"> Procedures to monitor rainfall that may influence water levels What flood event would trigger the plan 	Contractor	Pre-construction Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> Evacuation procedures including a map indicating the area that is flood prone and suitable evacuation locations Procedures to reduce risk during a flood event including removal of all plant/equipment and stabilising exposed areas. 			
HF4	Flooding	<p>The storage of hazardous material would be confined to areas that are not subject to flooding during a 1 per cent AEP extent or either:</p> <ul style="list-style-type: none"> Stored in a manner that prevents their mobilisation during times of flood Be removed from the floodplain when minor rain events are predicted to inundate storage areas and at the onset of a flood. 	Contractor	Construction	Additional safeguard
HF5	Flooding	The detailed design should ensure that all lanes will be trafficable and that flood impacts to property will not be worsened during a one per cent annual exceedance probability flood event.	Designer	Detailed design	Additional safeguard
SW1	Soil erosion and water pollution	A Soil and Water Management Plan (SWMP) would be prepared and implemented as part of the CEMP. The SWMP would identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks would be addressed during construction.	Contractor	Pre-construction	Section 2.1 of QA G38 Soil and Water Management
SW2	Soil erosion and water pollution	<p>A site-specific Erosion and Sediment Control Plan/s would be prepared and implemented as part of the Soil and Water Management Plan.</p> <p>The Plan would 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.</p>	Contractor	Pre-construction	Section 2.1 of QA G38 Soil and Water Management
SW3	Soil erosion and water pollution	The design and construction of waterway crossings, works within the waterways including new drains and outlets or any works on waterfront land as defined by the <i>Water Management Act 2000</i> would be undertaken with consideration to the Guidelines for instream works on waterfront land (DPE, 2012a) and Guidelines for watercourse crossings on waterfront land. (DPE, 2012b) and in accordance with relevant, Transport specifications and guidelines.	Contractor	Detailed design Pre-construction	Additional Safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		Measures to manage the potential impacts would be included in the Soil and Water Management Plan (SWMP).			
SW4	Soil erosion and water pollution	The construction and use of ancillary facilities and compounds during the construction phase of the proposal, mitigation measures in terms of storage, handling, disposal and reuse of materials and associated procedures would be documented within the CEMP. Measures to manage the potential water quality impacts associated with runoff would be included in the SWMP.	Contractor	Pre-construction Construction	Additional Safeguard
SW5	Soil erosion and water pollution	Stockpiles sites would be established and managed in accordance with Environmental Procedure Management of Wastes on Roads and Maritime Services Land (RMS, 2014) and Stockpile Site Management Guideline (RMS, 2015) and storage and use procedures would be outlined in the CEMP. Further consideration of how to manage stockpiles, material laydown and chemical storage with respect to floodwaters would be undertaken during detailed design.	Contractor	Pre-construction Construction	Additional Safeguard
SW6	Construction accidental spills	Measures to minimise the potential impacts associated with accidental leaks and spills during construction would be incorporated into a site-specific emergency spill plan incorporated within the CEMP.	Contractor	Pre-construction Construction	Additional Safeguard
SW7	Construction accidental spills	Measures to manage potential groundwater impacts during construction as a result of spills and storage of chemicals and stockpiles would be included within the CEMP and SWMP.	Contractor	Construction	Additional Safeguard
SW8	Soil erosion and water pollution	All stormwater outlet locations and culverts would be designed to include appropriate dissipation and/or scour protection measures as required to control scour and erosion within the receiving waterway with consideration to the existing channel form and lining.	Contractor	Detailed design Pre-construction	Additional Safeguard
SW9	Soil erosion and water pollution	The design of structures within and around the waterways including drainage outlets, bridge works, culverts, channel realignment works and stabilisation would be undertaken in accordance with relevant Transport guidelines and specifications and with consideration to Department of Primary Industries, Office of Water guidelines for controlled activities.	Designer	Detailed design	Additional Safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SW10	Water pollution	Additional operational stormwater quality treatment opportunities should be investigated during detailed design in consultation with Penrith City Council.	Designer	Detailed design	Additional Safeguard
SW11	Soil erosion and water pollution	Structures within and around the waterways including drainage outlets, bridge works and culverts, should be designed to consider biodiversity principles and minimise erosion and sedimentation issues and prevent substantial changes in flow rates that may impact both the immediate area and downstream features. See <i>Why do fish need to cross the road?</i> (Fairfull and Witheridge, 2003) for potential design considerations.	Designer	Detailed design	Additional safeguard
SW12	School House Creek	A management plan would be prepared for in-stream works in School House Creek and implemented as part of the SWMP.	Contractor	Pre-construction Construction	Additional safeguard
AH1	Aboriginal heritage	An Aboriginal Heritage Management Plan (AHMP) would be prepared in accordance with the <i>Procedure for Aboriginal cultural heritage consultation and investigation</i> (Roads and Maritime, 2012) and <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) and implemented as part of the CEMP. It would provide specific guidance on measures and controls to be implemented for managing impacts on Aboriginal heritage. The AHMP would be prepared in consultation with all relevant Aboriginal groups.	Contractor	Detailed design Pre-construction	Section 4.9 of QA G36 <i>Environment Protection</i>
AH2	Aboriginal heritage	<i>The Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) would be followed if an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Transport for NSW 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 would only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Detailed design Pre-construction	Section 4.9 of QA G36 <i>Environment Protection</i> Section 87 or Section 90 of the NPW Act
NH1	Non-Aboriginal heritage	A Non-Aboriginal Heritage Management Plan (NAHMP) would be prepared and implemented as part of the CEMP. It would provide	Contractor	Detailed design Pre-construction	Section 4.10 of QA G36

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		specific guidance on measures and controls to be implemented to avoid and mitigate impacts to Non-Aboriginal heritage.			<i>Environment Protection</i>
NH2	Non-Aboriginal heritage	<i>The Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) would be followed if any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered. Work would only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Detailed design Pre-construction	Section 4.10 of QA G36 <i>Environment Protection</i>
NH3	Non-Aboriginal Heritage	Site inductions and heritage awareness training should be undertaken. This would detail historical relics, structures and deposits that may be encountered during construction.	Contractor	Construction	Additional Safeguard
NH4	Non-Aboriginal Heritage – Workmen’s Cottages	Vibration monitoring should be undertaken on the Workmen’s Cottages throughout construction. Pre and post construction condition surveys should be undertaken on heritage items in the proposal area. Records should be retained for all monitoring and condition survey findings.	Contractor	Pre-construction Construction	Additional safeguard
NH5	Non-Aboriginal Heritage – Workmen’s Cottages	If architectural noise mitigation treatments are specified in the detailed design for the Workmen’s Cottages, they should be designed to minimise impacts on heritage significance. Architectural noise mitigation treatments to heritage structures should be designed in consultation with a suitably qualified heritage advisor, Penrith City Council and the landowner.	Contractor	Detailed design	Additional safeguard
CL1	Contaminated land	A Contaminated Land Management Plan will be prepared in accordance with the <i>Guideline for the Management of Contamination</i> (Roads and Maritime, 2013) and implemented as part of the CEMP. The plan will include, but not be limited to: <ul style="list-style-type: none"> • Capture and management 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) 	Contractor	Detailed design Pre-construction	Section 4.2 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> Management of 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. Due to the cancellation of several locations and limited intrusive investigation, an unexpected finds procedure (UFP) must be included so that contamination hazard, including asbestos containing material, that was previously identified is managed appropriately during construction Work health and safety (WHS) and environmental protection measures are recommended such as wetting surfaces, using wet drilling or other approved dust suppression methods, and use of appropriate PPE and should be specified in the contractor's CEMP. 			
CL2	Contaminated land	If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other work that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Transport for NSW Environment Manager and/or EPA.	Contractor	Detailed design Pre-construction	Section 4.2 of QA G36 <i>Environment Protection</i>
CL3	Accidental spill	A site specific emergency spill plan will be developed, and include spill management measures in accordance with the Transport for NSW <i>Code of Practice for Water Management</i> (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Transport for NSW and EPA officers).	Contractor	Detailed design Pre-construction	Section 4.3 of QA G36 <i>Environment Protection</i>
CL4	Contaminated Land	Additional investigations should be carried out around known APECs, particularly EPA notified sites after land acquisition to delineate the nature and extent of impacts to establish any	Contractor	Pre-construction Construction	Additional Safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		constraints, reduce project delays and minimise waste disposal or management costs during future works.			
CL5	Asbestos	A licensed asbestos assessor (LAA) should visually assess areas of historical fill and historical surface disturbance to identify any management actions required during construction.	Contractor	Pre-construction Construction	Additional Safeguard
CL6	Waste	Excavated soil with the potential to be hazardous waste, i.e. the fill layers at PC08, should be carefully segregated from other excavated spoil for offsite disposal.	Contractor	Construction	Additional Safeguard
CL7	Waste	During construction additional samples should be collected from stockpiles to confirm the waste classification in accordance with the <i>Waste Classification Guidelines</i> . Materials may be classified as excavated natural material (ENM) if characterisation of the 48 material is undertaken as per the NSW EPA <i>ENM Resource Recovery Order and Exemption</i> . Materials may also be suitable for reuse as Excavated Public Road Material under the <i>NSW EPA Excavated Public Road Material Order and Exemption 2014</i> .	Contractor	Construction	Additional Safeguard NSW EPA <i>Waste Classification Guidelines (2014)</i> , NSW EPA <i>ENM Resource Recovery Order and Exemption</i>
CL8	Waste	Where waste soils cannot be reused on site under appropriate beneficial reuse conditions, soil should be disposed of offsite to a licensed waste facility in accordance with the NSW EPA <i>Waste Classification Guidelines</i> and the Transport licensed waste facility requirements and waste policy.	Contractor	Construction	Additional Safeguard
CL9	Waste	Any spoil excavated and reused as backfilling for the proposal should be classified as suitable for intended use based on soil contaminant concentrations via testing.	Contractor	Construction	Additional Safeguard
CL10	Waste	Records, waste classifications, waste disposal records, beneficial reuse of spoil, asbestos monitoring and asbestos clearance	Contractor	Pre-construction Construction	Additional Safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		certificates should be held by the contractor and provided to Transport on completion.			
AQ1	Air quality	<p>An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to:</p> <ul style="list-style-type: none"> • Potential sources of air pollution • Air quality management objectives consistent with any relevant published EPA and/or OEH/DPE guidelines • Minimise the number of stockpiles onsite, avoid stockpiling in exposed areas and ensure long term stockpiles are covered or stabilised • Emission and dust mitigation and suppression measures to be implemented • Vehicles and mobile plant to use designated haulage and access routes and restrict traffic speeds on site • All vehicles transporting soils, rock or other materials are covered when entering or exiting the site • Maintain all vehicles and plant in accordance with manufacturer specifications • Methods to manage work during strong winds or other adverse weather conditions. Daily monitoring of weather forecasts to be undertaken to determine when adverse weather conditions are predicted • A progressive rehabilitation strategy for exposed surfaces • Daily visual observations of dust to identify construction activities, vehicles, plant or equipment that are generating excessive air emissions. Additional mitigation strategies to be implemented where necessary. 	Contractor	Detailed design / pre-construction / construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SE1	Socio-economic	<p>A Communication Plan (CP) would be prepared and implemented as part of the CEMP to help provide 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 will be prepared in accordance with the <i>Community Involvement and Communications Resource Manual</i> (RTA, 2008).</p>	Contractor	Detailed design Pre-construction	Standard safeguard
SE2	Community consultation	Transport would continue to consult with the community until the completion of the proposal. Discussions including, proposed acquisition requirements, property/driveway adjustments and leasing, the nature and timing of construction works would be required to identify relevant noise, visual, air quality and access mitigation measures for residents, stakeholders and people using the proposal.	Transport	Pre-construction Construction	Additional safeguard
SE3	Property	Transport would continue to consult with affected property owners and land occupiers until the completion of the proposal. Discussions including the nature and timing of construction works would be required to identify relevant mitigation measures for noise, traffic, access and visual impacts.	Transport	Pre-construction Construction	Additional safeguard
SE4	Property acquisition	<p>Land acquisition would occur in accordance with the <i>Land Acquisition (Just Terms Compensation) Act 1991</i>.</p> <p>Transport would continue to consult with Penrith City Council regarding council owned land and assets. The design for the proposal will also be refined during detailed design to minimise impacts on community land, where possible.</p>	Transport	Pre-construction	Additional safeguard
SE5	Changes in access	Temporary and permanent changes in access will be discussed with impacted land occupiers before commencement of construction and during construction activities should arrangements change. This includes access onto Mulgoa Road from properties on the western side of the proposal.	Transport	Pre-construction Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SE6	Business consultation	Transport would consult with businesses about construction activities and any changes in access required for the proposal,	Transport	Pre-construction Construction	Additional safeguard
SE7	Social infrastructure	Transport would consult with facilities near the proposal including Jamisontown Uniting Church, Howell Oval, Workmen's Cottages and Regentville Public School.	Transport	Pre-construction Construction	Additional safeguard
SE8	Relocation of bus stops during construction	Public transport users would be notified in advance of any changes to bus stop locations through signage at the existing bus stop. Temporary bus stops would have similar features to existing bus stops, including shelter and rest areas for less mobile and elderly people. Adequate way finding signage would be installed. Consultation with the relevant bus authorities would be undertaken (including school buses) to mitigate potential impacts to bus routes and times.	Transport	Pre-construction Construction	Additional safeguard
SE9	Traffic management for all road users, including pedestrians and cyclists	Alternative routes for active transport users would be clearly identified by signage and the use of traffic controllers where required.	Transport	Pre-construction Construction	Additional safeguard
V1	Landscape character and visual impact	An Urban Design Plan would be prepared to support the final detailed project design and implemented as part of the CEMP. The Urban Design Plan would present an integrated urban design for the project, providing practical detail on the application of design principles and objectives identified in the environmental assessment. The Plan would include design treatments for: <ul style="list-style-type: none"> • Location and identification of existing vegetation and proposed landscaped areas, including species to be used • Built elements including retaining walls, bridges and noise walls • Pedestrian and cyclist elements including footpath location, paving types and pedestrian crossings • Fixtures such as seating, lighting, fencing and signs 	Contactator	Detailed design Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> • Details of the staging of landscape work taking account of related environmental controls such as erosion and sedimentation controls and drainage • Procedures for monitoring and maintaining landscaped or rehabilitated areas. <p>The Urban Design Plan would be prepared in accordance with relevant guidelines, including: Beyond the Pavement urban design policy, process and principles (Roads and Maritime, 2014)</p> <ul style="list-style-type: none"> • Landscape Guideline (RTA, 2008) • <i>Bridge Aesthetics</i> (Roads and Maritime 2012) • Noise Wall Design Guidelines (RTA, 2006) Shotcrete Design Guideline (RTA, 2005). 			
V2	Planting	<p>The landscaping plan for the proposal would be confirmed during detailed design and would consider:</p> <ul style="list-style-type: none"> • Provide screen planting to childcare centre • Planting trees at regular intervals to provide 'boulevard' treatment • Selecting appropriate plant species and arrangements to maintain long vistas to the Blue Mountains escarpment • Plant diverse and varied plant species combinations along the length of the road corridor to reinforce different landscape character areas • Maintaining roadside vegetation where possible • Selecting and arranging appropriate plants along the workers cottages curtilage • Selecting plant species to screen and soften hard elements within the corridor • Minimising the footprint of the road corridor by planting appropriate native vegetation in laydown areas 	Transport	Detailed Design	Additional Safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> • Reinstating appropriate vegetation in riparian corridors associated with creeks and channels • Carefully select plant species to ensure landscape treatments adhere to the guidelines for designated Bush Fire Prone Land • Ensuring planting conforms to sight lines and clear zone requirements so that pedestrian portals are safe and well utilised • Ensuring robust and long life planting and materiality selections for whole of life design to minimise the requirements for ongoing maintenance and whole of life costs • Improving localised microclimates and conditions by providing urban cooling through tree shade and urban heat island considerate materials. 			
V3	Connectivity, noise walls and pedestrian portals	<p>The detailed design of the noise walls and pedestrian portals would consider:</p> <ul style="list-style-type: none"> • Reflecting the distinctive landscape character zones along the road corridor through colour, art and texture, lighting and signage • Way-finding opportunities at pedestrian portals • Ensuring existing signage and art is protected and preserved in existing locations and reinstating in a suitable location if works require that they are moved • Designing noise walls surfaces to reflect the distinctive landscape character zones along the road corridor and to reflect the road corridors historical features • Consolidating signage structures to minimise visual clutter and obstructions • Ensuring shared user path design contributes to existing network and linear identity • Creating human centric spaces by minimising shading and scale of noise walls when next to residential lots. 	Transport	Detailed Design	Additional Safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
W1	Waste	<p>A Waste Management Plan (WMP) would be prepared and implemented as part of the CEMP. The WMP would include but not be limited to:</p> <ul style="list-style-type: none"> Measures to avoid and minimise waste associated with the project Classification of wastes and management options (re-use, recycle, stockpile, disposal) 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. The WMP would be prepared taking into account the <i>Environmental Procedure - Management of Wastes on Roads and Maritime Services Land</i> (Roads and Maritime, 2014) and relevant Transport for NSW Waste Fact Sheets. 	Contactor	Detailed design Pre-construction	Section 4.2 of QA G36 <i>Environment Protection</i>
U1	Utilities	<p>Before commencing work the location of existing utilities and any utility relocation designs will be confirmed in consultation with the affected utility owners.</p> <p>If the scope or location of proposed utility relocation work falls outside of the assessed proposal scope and footprint, further assessment will be undertaken.</p>	Contactor	Detailed design Pre-construction	Additional safeguard
HR1	Hazards and risk management	<p>A Hazard and Risk Management Plan (HRMP) would be prepared and implemented as part of the CEMP. The HRMP would include, but not be limited to:</p> <ul style="list-style-type: none"> Details of hazards and risks associated with the activity Measures to be implemented during construction to minimise these risks 	Contactor	Detailed design Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> Record keeping arrangements, including information on the materials present on the site, material safety data sheets, and personnel trained and authorised to use such materials A monitoring program to assess performance in managing the identified risks Contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations. <p>The HRMP would be prepared in accordance with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, and EPA or DPE publications.</p>			
RU1	Resource use	<p>The following resource management hierarchy principles would be followed:</p> <ul style="list-style-type: none"> Avoid unnecessary resource consumption as a priority <p>Avoidance would be followed by resource recovery (including reuse of materials, reprocessing, and recycling and energy recovery) disposal would be undertaken as a last resort (in accordance with the <i>Waste Avoidance and Resource Recovery Act, 2001</i>).</p>	Contractor	Detailed design/ pre-construction/ construction	Additional safeguard
EC1	Energy consumption	Energy efficient LEDs would be considered for new streetlights installed as part of the proposal.	Transport	Detailed design	Additional safeguard
CU1	Cumulative construction impacts	<p>Other developers would be consulted in accordance with the Community Stakeholder and Engagement Plan to:</p> <ul style="list-style-type: none"> Obtain information about project timeframes and impacts Manage the interfaces of the proposal's staging and program in combination with other projects occurring in the area Identify and implement appropriate safeguards and management measures to minimise cumulative impacts. 	Transport for NSW and Contractor	Pre-construction Construction	Additional safeguard

7.3 Licensing and approvals

Table 7-2: Summary of licensing and approvals required

Instrument	Requirement	Timing
<i>Protection of the Environment Operations Act 1997 (s43)</i>	Environment protection licence (EPL) for scheduled activities [road construction] from the EPA, subject to construction staging and excavated material quantity.	Prior to start of the activity.
<i>Water Management Act 2000 (s91C)</i>	Drainage work approval from DPI (Water).	Prior to start of the activity.
<i>Water Management Act 2000 (s91D)</i>	Flood work approval from DPI (Water). [Note exemption under s41E of the Water Management (General) Regulation 2011.]	Prior to start of the activity.
<i>Water Act 1912 (s10/s18F)</i>	Licence and/or permit for construction or use of a 'work' (eg water conservation, irrigation, water supply, drainage or changing the course of a river) for certain purposes from DPI (Water).	Prior to start of the activity
<i>Crown Land Management Act 2016 (Division 3.4, 5.5 and 5.6)</i>	Lease or licence to occupy areas of Crown land.	Prior to start of the activity.
<i>Roads Act 1933 (s138)</i>	A Road Occupancy Licence would be required from the relevant roads authority by the contractor for prior to work on public roads	Prior to start of the activity.

8 Conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Part 8 of the Environmental Planning and Assessment Regulation 2021.

8.1 Justification

8.1.1 Social factors

The proposal would result in positive long-term social impacts during operation through provided improved network reliability and road safety along Mulgoa Road by widening the road from Glenmore Parkway, Glenmore Park to Union Road, Penrith. This road upgrade would reduce congestion, improve traffic times, and improve safety by minimising stop start traffic along the network.

However, construction of the proposal would result in traffic disruptions as temporary lane closures, and construction speed limits are enforced. Consultation would be undertaken with the local community, businesses and industry that may experience disruptions.

Construction noise and vibration from the proposal may also temporarily impact amenity of local residents, however, these impacts would be further reduced through review of the construction methodology and consideration of alternative equipment during detailed design. These potential noise impacts would be minimised and managed in accordance with Transport for NSW's CNVG.

Overall, the social benefits of the proposal associated with the increased road safety and network reliability are considered to outweigh the potential adverse social impacts identified.

8.1.2 Biophysical factors

The proposal may result in some minor adverse biophysical impacts, which are largely limited to impacts during the construction phase of the proposal and are not expected to significantly impact the biophysical environment.

The proposal would involve removal of 0.79 hectares of native vegetation consistent with an CEEC and EEC under the BC Act and EPBC Act.

Overall, the proposal is not likely to have a significant impact on threatened species, population, ecological communities of their habitats.

8.1.3 Economic factors

The proposal would improve network reliability and road safety along Mulgoa Road and the surrounding network. This would have indirect positive impacts on the local economy in the area, as it would reduce the likelihood of traffic delays from road incidents and would contribute to improved productivity and reduced costs associated with traffic delays for road users. This is expected to benefit commuters travelling to work as well as freight operators, as Mulgoa Road is a main access route from Penrith to the M4 Motorway and connects the Penrith community with other parts of Greater Sydney. These benefits for an improved road network in the long-term are considered to outweigh the short-term inconvenience on road users during construction.

8.1.4 Public interest

The proposal is justified to be in the public interest on the basis that it improves the network reliability and safety of Mulgoa Road without any significant negative long-term impacts on society, the biophysical environment or the local economy. The proposal is also aligned with several strategic policies and government strategies, such as *Future Transport Strategy 2056* (Transport, 2018a) and *Road Safety Plan 2021 – Towards Zero* (NSW Government, 2018a).

8.2 Objects of the EP&A Act

Table 8-1 describes how the proposal is consistent with or furthers the objects of the EP&A Act.

Table 8-1: Consideration of objects of the EP&A Act for the proposal

Object	Comment
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	The proposal would contribute to improved traffic flow and road safety along Mulgoa Road, which would promote the social and economic welfare of the community.
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	The principles of ecologically sustainable development are considered with respect to the proposal in Section 8.2.1 below.
1.3(c) To promote the orderly and economic use and development of land.	The proposal would improve an important section of road infrastructure within NSW and is aligned with several State and local policies and strategies that identify the need for upgrades (refer to Section 2.1). The proposal is also within an existing road corridor and consistent with the land zoning provisions of the Penrith City Council LEP.
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the project.

Object	Comment
1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	The need to minimise impacts on the environment, including threatened and native species has been considered during development of the proposal. Where potential impacts have been identified on native animals and plants, ecological communities and their habitats, safeguards and management measures have been proposed to avoid or minimise the impacts (refer to Section 6.1).
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The need to minimise impacts on built and cultural heritage has been considered during development of the proposal. Where potential impacts have been identified on heritage, safeguards and management measures have been proposed to avoid or minimise the impact (refer to Sections 6.6 and 6.7).
1.3(g) To promote good design and amenity of the built environment.	Urban design objectives have been developed for the proposal to promote good design and amenity of the built environment (refer to Section 6.11).
1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	Not relevant to the project.
1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	Not relevant to the project.
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	<p>The projects consultation strategy is outlined in Section 5.1. Extensive community consultation has been carried out in the lead up to preparing this REF.</p> <p>The community will be invited to provide a submission on the proposal during the public of this REF, which provides an opportunity to participate in the environmental planning and assessment process. Transport for NSW would review and respond to the community submissions before determining whether to proceed with the proposal.</p>

8.2.1 Ecologically sustainable development

Ecologically sustainable development (ESD) is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD have been an integral consideration throughout the development of the project.

ESD requires the effective integration of economic and environmental considerations in decision-making processes. The four main principles supporting the achievement of ESD are discussed below.

The precautionary principle

The precautionary principle deals with reconciling scientific uncertainty about environmental impacts with certainty in decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

This principle was considered during route options development (refer to Chapter 2). The precautionary principle has guided the assessment of environmental impacts for this EIS and the development of mitigation measures.

The proposal has sought to take a precautionary approach to minimise environmental impacts, including through assessing impacts based on the 'worst case' or conservative scenarios. This has also been applied in the development of safeguards and management measures using best available technical information, environmental safeguards and guidelines.

Intergenerational equity

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Inter-generational equity introduces a temporal element with a focus on minimising the distribution of costs to future generations.

The proposal has integrated both short and long-term economic, social and environmental considerations so that any likely impacts are not left to be addressed by future generations. For example, although the proposal was required to be implemented in the short-term to address key safety and network reliability concerns, the traffic assessment details how the upgrade allows for population growth while not putting the upgraded road at capacity.

Issues that have potential long-term implications were minimised or avoided, for example consumption of non-renewable resources, waste disposal, greenhouse emissions, removal of vegetation and impacts on water quality, through route/concept selection and application of management measures

Conservation of biological diversity and ecological integrity

The preferred option was selected to avoid and minimise biodiversity impacts as far as practical.

The proposal would require of up to 0.79 hectares of native vegetation. Removal of this could lead to loss of threatened fauna habitat. There is also likely to be a risk of fauna injury and mortality from construction equipment. The proposal would not have a significant impact on threatened biodiversity.

A biodiversity offset package has been developed. Environmental safeguards and management measures to avoid and minimise impacts to biodiversity are to be implemented.

Improved valuation, pricing and incentive mechanisms

The principle of internalising environmental costs into decision making requires consideration of all environmental resources which may be affected by the carrying out of a project, including air, water, land and living things.

Environmental issues were considered as key matters in the options selection process and in the economic and financial feasibility assessments for the proposal. The value of the proposal to the community in terms of improved safety was also recognised.

Environmental safeguards and management measures for the avoidance, reuse, recycling and management of waste during construction and operation are to be implemented.

8.3 Conclusion

The proposed Mulgoa Road Upgrade, stage 2, 5A and 5B is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

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

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

8.3.1 Significance of impact under NSW legislation

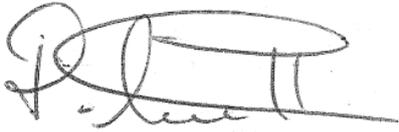
The proposal would be unlikely to cause a significant impact on the environment. Therefore, it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Public Spaces under Division 5.2 of the EP&A Act. A Biodiversity Development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

8.3.2 Significance of impact under Australian legislation

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



Peter Fawcett
Principal, Environment and Planning
Aurecon
Date: 4 March 2022

I have examined this review of environmental factors and accept it on behalf of Transport for NSW.



Matthew Allen
Senior Project Development Manager
Western Parkland City
Sydney Infrastructure Development
Transport for NSW
Date: 4 March 2022

10 References

- ABS ASGS (2019) Population, Household and Implied Dwelling Projections by Greater Sydney Region and Regional NSW
- AdaptNSW. (2019). NSW Emissions. Retrieved from <https://climatechange.environment.nsw.gov.au/about-climate-change-in-nsw/nsw-emissions>
- Arup. (2018). Mulgoa Road Stage 1 -Detailed Design & REF - Surface water and Groundwater Working Paper.
- Attenbrow V (2010) Sydney's Aboriginal Past, 2nd edition. University of New South Wales Press Ltd, Sydney.
- Aurecon (2021). Biodiversity assessment report.
- Aurecon (2021). Contamination detailed site investigation report.
- Aurecon (2021) Non-Aboriginal heritage and archaeological impact assessment.
- Aurecon (2021). Specialist study: surface water and groundwater assessment.
- Bannerman, S. M. and Hazelton, P. A. (1990) Soil Landscapes of the Penrith 1:100 000 Sheet. Soil Conservation Service of NSW, Sydney.
- Bureau of Transport Statistics (2011). 2011 Journey to work data. Available [2011 Journey to Work data \(nsw.gov.au\)](http://www.bts.gov.au/2011-Journey-to-work-data)
- Casey and Lowe (2005) Archaeological Investigation: Red Cow Inn and Penrith Plaza Station, Jane and Riley Streets, Penrith.Consultancy report prepared for Bovis Lend Lease.
- Catchment Simulation Solutions, (2020). Peach Tree and Lower Surveyors Creek Flood Study - Report. [online] Penrith: Penrith City Council. Available at: [Peach Tree and Lower Surveyors Creek Flood Study - Report - Datasets - NSW Flood Data Portal](http://www.penrith.nsw.gov.au/peach-tree-and-lower-surveyors-creek-flood-study-report-datasets-nsw-flood-data-portal)
- Coffey, (2016), *Stage 1 Contamination Assessment, Castlereagh Road / Mulgoa Road Widening Penrith, NSW*, prepared for NSW Roads and Maritime Services, 17 May 2016
- Comber Consultants (2018) Toga Penrith: Aboriginal Archaeological Assessment. Consultancy report prepared for Toga.
- Commonwealth Government (1999). Environment Protection and Biodiversity Conservation Act 1999
- Commonwealth of Australia. (2016). *Smart Cities Plan*. <https://www.infrastructure.gov.au/cities/smartcities/plan/index.aspx>
- Davies, P (2007) Penrith Heritage Study, Volume 2 Thematic History. Prepared for Penrith City Council.
- DECC (2009). Interim construction noise guidelines. Available [Interim Construction Noise Guideline \(nsw.gov.au\)](http://www.decc.nsw.gov.au/interim-construction-noise-guideline)
- Department of Environment, Climate Change and Water NSW (DECCW) (2010a) Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW.DECCW, Sydney.
- Department of Primary Industries (2013). Policy and guidelines for fish habitat conservation and management. Available from: http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0009/468927/Policy-and-guidelines-for-fish-habitat.pdf.

- Department of Planning, Industry and Environment (2020b). Surveying threatened plants and their habitats. Available from: <https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/surveying-threatened-plants-and-habitats-nsw-survey-guide-biodiversity-assessment-method-200146.pdf>
- DPE. (2021). eSpade. Retrieved from Environment NSW: <https://www.environment.nsw.gov.au/eSpade2Webapp>
- DPE (n.d.a) Overview of the Western Sydney Employment Area. Accessed from: <https://www.planning.nsw.gov.au/Plans-for-your-area/Priority-Growth-Areas-and-Precincts/Western-Sydney-Employment-Area/Overview-of-the-Western-Sydney-Employment-Area>
- EPA (2014). Classifying waste Guidelines. Available [Waste classification guidelines Part 1: Classifying waste \(nsw.gov.au\)](https://www.epa.gov.au/waste-classification-guidelines-part-1-classifying-waste)
- Greater Sydney Commission (2018a). Greater Sydney Services and Infrastructure Plan. Retrieved from <https://future.transport.nsw.gov.au/plans/greater-sydney-services-and-infrastructure-plan>
- Greater Sydney Commission (2018b). Western City District Plan. Retrieved from <https://www.greater.sydney/western-city-district-plan/introduction>
- Haglund L (1980) Report on Archaeological Survey in the City of Blacktown. Consultancy report prepared for NPWS.
- Hills Environmental, (2015), *Mulgoa Road Upgrade – Penrith, Jamisontown, Glenmore Park, Regentville Preliminary Environmental Investigation*, prepared for NSW Roads and Maritime Services, 9 June 2015
- Insite Heritage (2000) An Archaeological Assessment of the proposed Penrith Lakeside Village, Cranebrook NSW. Consultancy report prepared for Bowdens Group.
- Kohen J L (1986) Prehistoric Settlement in the Western Cumberland Plain: Resources, Environment and Technology. Unpublished PHD paper for Macquarie University, Sydney.
- Mattheck, C. and Breloer, H. 1994. *'Field Guide for Visual Tree Assessment'* Arboricultural Journal, Vol 18 pp 1-23.
- Nanson, G. R, Young, E. and Stockton (1987) "Chronology and Paleoenvironment of the Cranebrook Terrace [near Sydney] Containing Artefacts more than 40,000 Years Old". *Archaeology in Oceania*22(2):72-78.
- NSW Department of Urban Affairs and Planning (1996). Roads and Related Facilities EIS Guideline
- NSW Department of Urban Affairs and Planning (1999), 'Is an EIS Required?' Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979
- NSW EPA. (2017). *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*. Prepared by NSW Environment Protection Authority, which is part of the NSW Office of Environment and Heritage (OEH). Retrieved from <http://www.environment.nsw.gov.au/resources/air/ammodelling05361.pdf>
- NSW EPA (2020), Guidelines for Consultants Reporting on Contaminated Land
- NSW Government (1994). *Fisheries Management Act 1994*
- NSW Government (2016a). *Biodiversity Conservation Act 2016*
- NSW Government. (2017). *Air Quality in NSW*. Retrieved from <https://www.epa.nsw.gov.au/~/-/media/EPA/Corporate%20Site/resources/air/Air-Quality-in-NSW.ashx>
- NSW Government (1979). *Environmental Planning and Assessment Act 1979*. Retrieved from <https://legislation.nsw.gov.au/view/html/inforce/current/act-1979-203>

- NSW Government (2018a). *Greater Sydney Regional Plan – A Metropolis of Three Cities*. Retrieved from <https://www.greater.sydney/metropolis-of-three-cities/vision-of-metropolis-of-three-cities>
- NSW Government (2018b). *Road Safety Plan 2021*. Retrieved from <https://towardszero.nsw.gov.au/roadsafetyplan>
- NSW Government (2018c). *State Infrastructure Strategy 2018-2038: Building Momentum*. Retrieved from <https://www.nsw.gov.au/nsw-infrastructure-strategy-2018-2038>
- NSW Government (2021a). *NSW Premier's Priorities*. Retrieved from <https://www.nsw.gov.au/premiers-priorities>
- NSW Government. (2021b). The Central Resource for Sharing and Enabling Environmental Data in NSW. Retrieved from https://geo.seed.nsw.gov.au/Public_Viewer/index.html?viewer=Public_Viewer&locale=en-AU
- Office of Environment and Heritage (2011), *Sustainable Mountain Biking Strategy*, Sydney
- Penrith City Council (2013). *Penrith City Strategy*. Retrieved from <https://www.penrithcity.nsw.gov.au/resources-documents/documents/strategic-planning>
- RMS (2013), *QA Specification R44 – Earthworks*
- RMS (2013), *Guideline for the management of contamination*. Available [RMS Guideline for the Management of Contamination \(nsw.gov.au\)](#)
- RMS. (2014). *ENVIRONMENTAL PROCEDURE - MANAGEMENT OF WASTES ON ROADS*.
- RMS. (2015). *Stockpile Site Management Guideline*.
- RMS (2016). *Construction Noise and Vibration Guidelines*
- Roads and Traffic Authority of New South Wales (2011). *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects*. Available from: https://www.rms.nsw.gov.au/business-industry/partners-suppliers/documents/guides-manuals/biodiversity_guidelines.pdf
- RTA, (1999), *Code of Practice for Water Management: Road Development and Management*. RTA, April 1999.
- Smith L (1989) *Aboriginal Sites Planning Study in the Sydney Basin Stage 1: The Cumberland Plain. Archaeological Site Survey and Analyses of Sites on the Northern Cumberland Plain*. Consultancy report prepared for NSW NPWS.
- Stacker L (2014) *Penrith: the makings of a city*. Halstead Press; Braddon, Australian Capital Territory: Gorman House, Ultimo, New South Wales.
- Transport (2018). *Freight and Ports Plan 2018-2023*. Retrieved from <https://future.transport.nsw.gov.au/plans/nsw-freight-and-ports-plan-2018-2023>
- Transport (2020a) *EIA-N05 Environmental Impact Assessment Practice Note – Socio-economic Assessment*
- Transport (2020b). *Future Transport Strategy 2056*. Retrieved from <https://future.transport.nsw.gov.au/future-transport-strategy>

Terms and acronyms used in this REF

Term/ Acronym	Description
AEP	Annual exceedance probability
AHIMS	Aboriginal Heritage Information Management System
AHMP	Aboriginal Heritage Management Plan
AIA	Arboricultural Impact Assessment
Alignment	The vertical and horizontal location of the road
AQMS	Air Quality Monitoring Station(s)
AQMN	Air Quality Monitoring Network
AQIA	Air Quality Impact Assessment
ARR	Australian Rainfall and Runoff
ASRIS	Australia Soil Resource Information System
ASS	Acid sulfate soils
BAM	Biodiversity Assessment Method
BAR	Biodiversity assessment report
BC Act	<i>Biodiversity Conservation Act 2016</i> (NSW).
Capacity	Maximum number of vehicles which has a reasonable expectation of passing over a given section of a lane or a road in one direction during a given time period under prevailing road and traffic conditions.
CEMP	Construction environmental management plan
CHAR	Cultural heritage assessment report
CNVG	<i>Construction Noise and Vibration Guideline</i>
DP	Deposit plans
DPE	Department of Planning and Environment
DSI	Detailed site investigation
DUAP	Department of Urban Affairs and Planning
EIA	Environmental impact assessment
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW). Provides the legislative framework for land use planning and development assessment in NSW
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
EPA	Environmental Protection Authority
EPL	Environmental protection licence
ERSED	Erosion and sediment
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased

Term/ Acronym	Description
FM Act	<i>Fisheries Management Act 1994 (NSW)</i>
FPP	<i>Freight and Ports Plan 2018-2023</i>
GDE	Groundwater Dependent Ecosystems
GSRP	<i>Greater Sydney Region Plan: A Metropolis of Three Cities</i>
Heritage Act	<i>Heritage Act 1977 (NSW)</i>
HTE	High Threat Exotic
HV	Heavy vehicles
ICNG	Interim Construction Noise Guideline
IFD	Intensity-frequency-duration
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
LGA	Local government area
LoS	Level of Service. A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers.
MNES	Matters of national environmental significance under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
NML	Noise Management Level
NPW Act	<i>National Parks and Wildlife Act 1974 (NSW)</i>
PACHCI	<i>Procedure for Cultural Heritage Consultation and Investigation</i>
PADs	Potential Archaeological Deposits
PFAS	Per- and polyfluoroalkyl substances
PMST	Protection Matters Search Tool
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
PTA	Preliminary Tree Assessment
QA Specifications	Specifications developed by Transport for NSW for use with road work and bridge work contracts let by Transport for NSW.
REF	Review of Environmental Factors
Roads Act	<i>Roads Act 1993</i>
Roads and Maritime	NSW Roads and Maritime Services, now known as Transport for NSW
ROL	Road occupancy licence
SCATs	Sydney Coordinated Adaptive Traffic System
SEED	NSW Government's Sharing and Enabling Environmental Data
SEIA	Socio-economic impact assessment
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
SES	State Emergency Services

Term/ Acronym	Description
SIS	<i>State Infrastructure Strategy 2018-2038: Building Momentum</i>
SREP 20	<i>Sydney Regional Environmental Plan No 20 – Hawkesbury-Nepean River</i>
SWMP	Soil and water management plan
TCS	Traffic control signals
TEC	Threatened ecological community
TMC	Transport Management Centre
TMP	Traffic Management Plan
Transport	Transport for New South Wales
TRAQ	Tool for Roadside Air Quality
UFP	Unexpected finds procedure
UXO	Unexploded ordnance
WARR Act	<i>Waste Avoidance and Resource Recovery Act 2001</i>
WM Act	<i>Water Management Act 2000</i> provides for the sustainable management and protection of water sources in NSW.

Appendix A

Consideration of clause 171(2) factors and matters of national environmental significance and Commonwealth land

Clause 171 Checklist

In addition to the requirements of the *Is an EIS required?* guideline (DUAP 1995/1996) and the *Roads and Related Facilities EIS Guideline* (DUAP 1996) as detailed in the REF, the following factors, listed in clause 171 of the Environmental Planning and Assessment Regulation 2021, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

Factor	Impact
<p>a) Any environmental impact on a community?</p> <ul style="list-style-type: none"> During construction, the proposal would result in potential impacts to noise and vibration, traffic, access and localised air quality. 	<p>Short term moderate negative</p>
<p>b) Any transformation of a locality?</p> <ul style="list-style-type: none"> Construction equipment and activities would have short term visual impacts. Operation of the proposal would reduce congestion on Mulgoa Road resulting in improvements to amenity and safety. The proposal would also transform the rural landscape by the introduction of a new built element and removal of vegetation. 	<p>Short term, moderate negative</p> <p>Long term, moderate positive and negative</p>
<p>c) Any environmental impact on the ecosystems of the locality?</p> <ul style="list-style-type: none"> The proposal would require the removal of up to 0.79 hectares of native vegetation. Safeguards to minimise impacts are listed in Section 7. 	<p>Long term, minor negative</p>
<p>d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?</p> <ul style="list-style-type: none"> During construction, the proposal would have noise and visual impacts to closest sensitive receivers including residential properties, commercial and recreational facilities The proposal would have impact to the environmental and scientific quality of the area through minor habitat and vegetation loss. Safeguards to minimise impacts are listed in Section 7. 	<p>Short term, minor negative</p> <p>Long term, minor negative</p>
<p>e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations?</p> <ul style="list-style-type: none"> The proposal would have potential minor impacts on non-Aboriginal Heritage. The Workmen's Cottages are a listed non-Aboriginal Heritage item and there would be some limited potential for indirect vibration, noise and dust impacts to impact the Workmen's' Cottages. Other non-Aboriginal Heritage have either been previously destroyed or are too far from the proposal area to be affected by construction or operation. The proposal is expected to have no impact on Aboriginal Heritage. No Aboriginal objects were identified in surveys, no Aboriginal cultural issues or sensitivities associated with the study area were identified, and the study sites are believed to be unlikely to retain Aboriginal Heritage items 	<p>Short term, minor negative</p>

Factor	Impact
f) Any impact on the habitat of protected fauna (within the meaning of the <i>National Parks and Wildlife Act 1974</i>)? <ul style="list-style-type: none"> The proposal is not located on land reserved under the <i>National Parks and Wildlife Act 1974</i> 	Nil
g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? <ul style="list-style-type: none"> Removal of vegetation could lead to loss of fauna or flora habitat The proposal may result in a potential for fauna injury or mortality throughout the construction phase due to vehicle and equipment movements within the proposal area. An assessment of the proposal's impact found that there is unlikely to be a significant impact on nationally listed threatened species, endangered ecological communities and migratory species. 	Long term, minor negative Long term, minor negative
h) Any long-term effects on the environment? <ul style="list-style-type: none"> The proposal would result in loss of vegetation due to the works, however this would not result in a significant impact to the environment. 	Long-term, minor negative
i) Any degradation of the quality of the environment? <ul style="list-style-type: none"> If uncontrolled, the proposal has the potential to temporarily degrade the quality of the environment during construction through erosion, sedimentation, dust, vegetation removal and noise and vibration impacts. Safeguards and mitigation measures have been proposed to manage and minimise these potential impacts. Provided the mitigation measures in Chapter 7 are implemented, the proposal is not expected to result in any significant degradation of the quality of the environment. 	Long-term, minor negative
j) Any risk to the safety of the environment? <ul style="list-style-type: none"> The construction work has the potential to temporarily decrease safety on the local road network due to construction activities The operation of the proposal would result in increased safety for users of Mulgoa Road, included vehicles, pedestrians and cyclists, through the provision of improved road 	Short-term minor negative Long-term moderate positive
k) Any reduction in the range of beneficial uses of the environment? <ul style="list-style-type: none"> The proposal would result in changed land use to road infrastructure. Safeguards to minimise impacts are listed in Chapter 7. 	Long term, minor negative
l) Any pollution of the environment? <ul style="list-style-type: none"> During construction noise and surface water and groundwater impacts may occur. Safeguards to minimise impacts are listed in Chapter 7. 	Short-term minor negative
m) Any environmental problems associated with the disposal of waste? <ul style="list-style-type: none"> The proposal would result in the generation of waste. One area was noted to potentially have hazardous waste in excavating soil. Providing the mitigation measures outlined in Section 7 are implemented, the proposal is not likely to 	Nil

Factor	Impact
cause environmental problems associated with this waste disposal.	
<p>n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply?</p> <ul style="list-style-type: none"> • Various standard construction materials, including fill material, are readily available within NSW would be needed to build the proposal. The proposal is not likely to result in increased demands on resources which are or are likely to become in short supply. 	Nil
<p>o) Any cumulative environmental effect with other existing or likely future activities?</p> <ul style="list-style-type: none"> • There is potential for cumulative traffic, noise and biodiversity impacts, where another project is being constructed nearby at the same time as the proposal. Cumulative impacts are outlined in Chapter 6.13. Chapter 7 summarises the safeguards to avoid or minimise these impacts, where possible. • During operation, the proposal would result in cumulative positive traffic impacts with other nearby future road upgrades proposed to improve the safety, movement and travel times within the surrounding road network. • During operation, cumulative noise and air quality impacts would be negligible 	<p>Short term minor negative</p> <p>Long term moderate positive</p>
<p>p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?</p> <ul style="list-style-type: none"> • The proposal would not impact on coastal processes or hazards, including those under projected climate change conditions. 	Nil
<p>q) Any applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1?</p> <ul style="list-style-type: none"> • There are several strategic plans related to the proposal. These include: <i>Premier's Priorities, Future Transport Strategy 206, Greater Sydney Services and Infrastructure Plan, Freight and Ports Plan 2018-2023, Road Safety Plan 2021, State Infrastructure Strategy, Greater Sydney Region Plan – A Metropolis of Three Cities, Western City District Plan, Smart Cities Plan, and Penrith City Strategy</i>. The proposal is expected to have a positive impact as the aims of the proposal aligns with many aims of these strategic plans. 	Long term moderate positive
<p>r) Any other relevant environmental factors?</p> <ul style="list-style-type: none"> • During construction, the proposal would result in minor greenhouse gas emissions through use of materials as well as use of construction equipment. 	Short term minor negative

Matters of National Environmental Significance and Commonwealth land

Under the environmental assessment provisions of the EPBC Act, the following matters of national environmental significance and impacts on the Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of Agriculture, Water and Environment.

A referral is not required for proposed actions that may affect nationally listed threatened species, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Factor	Impact
a) Any impact on a World Heritage property?	Nil
b) Any impact on a National Heritage place?	Nil
c) Any impact on a wetland of international importance?	Nil
d) Any impact on a listed threatened species or communities? The proposal would require removal of up to 0.79 hectares of native vegetation identified as CEEC and EEC. There would not be a significant impact on these communities. Safeguards to minimise impacts are listed in Section 7.	Minor
e) Any impacts on listed migratory species? 16 species of migratory animals were identified to potentially occur in the study area. Of those 16, the only species likely to have a moderate or higher likelihood of being impacted by the proposal is the Black-faced Monarch (<i>Monarcha melanopsis</i>). However, the study area is highly modified and urbanised and therefore it is unlikely that the proposal would significantly impact upon important habitat for the Black-face Monarch. However, the assessment of the proposal's impact on and migratory species found that there is unlikely to be a significant impact on relevant matters of national environmental significance.	Minor
f) Any impact on a Commonwealth marine area?	Nil
g) Does the proposal involve a nuclear action (including uranium mining)?	Nil
h) Additionally, any impact (direct or indirect) on the environment of Commonwealth land?	Nil

Appendix B

Statutory consultation checklists

Infrastructure SEPP

Certain development types

Development type	Description	Yes/No	If 'yes' consult with	ISEPP clause
Car Park	Does the project include a car park intended for the use by commuters using regular bus services?	No	Penrith City Council	ISEPP cl. 95A
Bus Depots	Does the project propose a bus depot?	No	Penrith City Council	ISEPP cl. 95A
Permanent road maintenance depot and associated infrastructure	Does the project propose a permanent road maintenance depot or associated infrastructure such as garages, sheds, tool houses, storage yards, training facilities and workers' amenities?	No	Penrith City Council	ISEPP cl. 95A

Development within the Coastal Zone

Issue	Description	Yes/No/NA	If 'yes' consult with	ISEPP clause
Development with impacts on certain land within the coastal zone	Is the proposal within a coastal vulnerability area and is inconsistent with a certified coastal management program applying to that land?	No	Penrith City Council	ISEPP cl. 15A

Note: See interactive map here: <https://www.planning.nsw.gov.au/policy-and-legislation/coastal-management>. Note the coastal vulnerability area has not yet been mapped.

Note: a certified coastal zone management plan is taken to be a certified coastal management program

Council related infrastructure or services

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
Stormwater	Is the work likely to have a <i>substantial</i> impact on the stormwater management services which are provided by council?	No	Penrith City Council	ISEPP cl.13(1)(a)

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
Traffic	Is the work likely to generate traffic to an extent that will <i>strain</i> the capacity of the existing road system in a local government area?	No	Penrith City Council	ISEPP cl.13(1)(b)
Sewerage system	Will the work involve connection to a council owned sewerage system? If so, will this connection have a <i>substantial</i> impact on the capacity of any part of the system?	No	Penrith City Council	ISEPP cl.13(1)(c)
Water usage	Would the work involve connection to a council owned water supply system? If so, would this require the use of a <i>substantial</i> volume of water?	No	Penrith City Council	ISEPP cl.13(1)(d)
Temporary structures	Would the work involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, would this cause more than a <i>minor</i> or <i>inconsequential</i> disruption to pedestrian or vehicular flow?	Yes	Penrith City Council	ISEPP cl.13(1)(e)
Road & footpath excavation	Would the work involve more than <i>minor</i> or <i>inconsequential</i> excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	Yes	Penrith City Council	ISEPP cl.13(1)(f)

Local heritage items

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
Local heritage	Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the work? If yes, does a heritage assessment indicate that the potential impacts to the heritage significance of the item/area are more than <i>minor</i> or <i>inconsequential</i> ?	No	Penrith City Council	ISEPP cl.14

Flood liable land

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
Flood liable land	Is the work located on flood liable land? If so, would the work change flood patterns to more than a <i>minor</i> extent?	Yes	Penrith City Council	ISEPP cl.15
Flood liable land	Is the work located on flood liable land? (to any extent). If so, does the work comprise more than minor alterations or additions to, or the demolition of, a building, emergency work or routine maintenance	Yes	State Emergency Services Email: erm@ses.nsw.gov.au	ISEPP cl.15AA

Note: Flood liable land means land that is susceptible to flooding by the probable maximum flood event, identified in accordance with the principles set out in the manual entitled *Floodplain Development Manual: the management of flood liable land* published by the New South Wales Government.

Public authorities other than councils

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
National parks and reserves	Is the work adjacent to a national park or nature reserve, or other area reserved under the <i>National Parks and Wildlife Act 1974</i> , or on land acquired under that Act?	No	Environment, Energy and Science, DPE	ISEPP cl.16(2)(a)

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
National parks and reserves	Is the work on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?	No	Environment, Energy and Science, DPE	ISEPP cl. 16(2)(b)
Aquatic reserves	Is the work adjacent to an aquatic reserve or a marine park declared under the <i>Marine Estate Management Act 2014</i> ?	No	Department of Planning, Industry and Environment	ISEPP cl.16(2)(c)
Sydney Harbour foreshore	Is the work in the Sydney Harbour Foreshore Area as defined by the <i>Place Management NSW Act 1998</i> ?	No	Property NSW	ISEPP cl.16(2)(d)
Bush fire prone land	Is the work for the purpose of residential development, an educational establishment, a health services facility, a correctional centre or group home in bush fire prone land?	No	Rural Fire Service	ISEPP cl.16(2)(f)
Artificial light	Would the work increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map? (Note: the dark sky region is within 200 kilometres of the Siding Spring Observatory)	No	Director of the Siding Spring Observatory	ISEPP cl.16(2)(g)
Defence communications buffer land	Is the work on buffer land around the defence communications facility near Morundah? (Note: refer to Defence Communications Facility Buffer Map referred to in clause 5.15 of Lockhardt LEP 2012, Narrandera LEP 2013 and Urana LEP 2011.	No	Secretary of the Commonwealth Department of Defence	ISEPP cl. 16(2)(h)

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
Mine subsidence land	Is the work on land in a mine subsidence district within the meaning of the <i>Mine Subsidence Compensation Act 1961</i> ?	No	Mine Subsidence Board	ISEPP cl. 16(2)(i)

Appendix C

Biodiversity Assessment Report

Appendix D

Traffic and Transport Impact Assessment

Appendix E

Noise and Vibration Impact Assessment

Appendix F

Hydrology and Flooding Assessment

Appendix G

Surface water and Groundwater Assessment

Appendix H

Aboriginal Heritage Assessment

Appendix I

Non-Aboriginal Heritage Assessment

Appendix J

Detailed Site Investigation

Appendix K

Air Quality Impact Assessment

Appendix L

Socio-economic Impact Assessment

Appendix M

Landscape Character and Visual Impact Assessment