



M4 Roper Road Westbound On-ramp Project

Review of Environmental Factors

Transport for NSW | April 2021

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Executive summary

The proposal

Transport for NSW propose to construct a single lane, westbound on-ramp from Erskine Park Road northbound and Roper Road southbound to the M4 Motorway in a G-loop configuration providing access to the M4 Motorway westbound mainline in St Clair and Erskine Park. The proposal is under the Smart Motorways Project and would tie in to the existing M4 Motorway westbound mainline at the western extent of the proposal and would be connected to Erskine Park Road and Roper Road at the southern extent of the proposal.

Key features of the proposal would include:

- Construction of a single lane westbound on-ramp from Erskine Park Road and Roper Road to the M4 Motorway in a G-loop configuration to provide access to the M4 Motorway westbound for traffic travelling from the south on Erskine Park Road and from the north on Roper Road.
- Southbound traffic on Roper Road would access the proposed on-ramp by a free flow left turn slip lane.
- Northbound traffic on Erskine Park Road would access the proposed on-ramp via a dedicated signalised right turn lane at the intersection of Erskine Park Road and the M4 Motorway westbound off-ramp to Erskine Park Road and Roper Road (M4 Westbound off-ramp).
- The existing intersection of Erskine Park Road and the M4 Motorway westbound off-ramp will be reconfigured to accommodate the proposed on-ramp.
- Provision will be made for future installation of Smart Motorway infrastructure including advisory signs and ramp metering devices.
- Construction of the G-loop will require excavation adjacent to the existing bridge abutment beneath the Erskine Park Road bridge over the M4 Motorway.

Construction would commence in mid-2021 and would take around 18 months to complete.

Need for the proposal

The NSW Governments Smart Motorways Project aims to reduce stop-start traffic and improve travel times on the M4 Motorway which is a key transport corridor to and from Western Sydney. With projected and planned future growth in Western Sydney due to the development of the Western Parkland City, Western Sydney International Airport, industrial and commercial precincts associated with the Western Sydney Employment Area (WSEA) and the Western Sydney Aerotropolis, there is a need to plan for increased capacity and access in the region.

The interchange between the M4 Motorway and Roper Road / Erskine Park Road currently includes east facing ramps (an eastbound on-ramp and westbound off-ramp) only. Due to the lack of a west facing ramp, road users whose trips originate from south of the M4 Motorway and are heading west must travel five kilometres through local and residential streets in St Clair to reach the nearest access to the M4 Motorway or proceed further north via Roper Road and join the Great Western Highway. Residents on the northern side of the M4 Motorway (i.e. Colyton, Mount Druitt and Minchinbury) face similar constraints to accessing the M4 Motorway west towards Penrith, if they do not wish to use the Great Western Highway.

It is expected that the Roper Road on-ramp would ease congestion on the existing westbound M4 Motorway on-ramps, existing local roads within Erskine Park and St Clair, and remove non-local road traffic (i.e. motorists who are trying to access a westbound M4 on-ramp) from local roads. Removing this westbound traffic from local roads will improve efficiency of the local road network and improve reliability of travel times.

Proposal objectives

The NSW Government is investing in the M4 Smart Motorway Project which aims to reduce stop-start traffic and improve travel times with upgrades completed or in the process of completion along 35 kilometres of the M4 from Pitt Street, Granville to the Great Western Highway, Lapstone, Blue Mountains. The M4 Smart Motorway Project, under the Easing Sydney's Congestion Program Office (ESCPO), aims to use real time information, communication and smart traffic management systems that work together to smooth the flow of traffic, ease congestion, efficiently manage incidents and improve road safety.

The high level objectives for ESCPO are to:

- Optimise the existing road network, improving travel reliability
- Improve access throughout Sydney
- Implement an integrated approach to infrastructure for urban renewal.

The following location-specific objectives of the proposal include:

- Ease congestion and reduce travel times between St Clair, Erskine Park and Penrith
- Provide an additional route choice to Penrith and the Blue Mountains for local St Clair and Erskine Park road users
- Improve connectivity to the M4 Motorway for local road users
- Improve travel reliability for local road users.

Options considered

Three options were considered for this proposal:

- Option 1: 'Do Nothing'

This option assumes no changes to the proposal area

- Option 2: 'G-loop westbound on-ramp'

This option would involve the construction of a single lane, west-facing on-ramp from Erskine Park Road to the M4 Motorway in a G-loop configuration providing access to the M4 Motorway westbound mainline for traffic travelling northbound on Erskine Park Road and southbound on Roper Road.

- Option 3: 'Left access only westbound on-ramp'

This option would involve the construction of a two lane, directly west-facing on-ramp from Erskine Park Road to the M4 Motorway westbound mainline only for northbound traffic on Erskine Park Road. The left access only westbound on-ramp option would require a larger area of disturbance to the west of Erskine Park Road where threatened ecological communities and threatened fauna species have been identified and where earthworks would be required to mitigate impacts on a stormwater basin.

The preferred option is Option 2 as it best meets proposal objectives and the development criteria by minimising environmental impacts.

Statutory and planning framework

The proposal is for a road and is to be carried out by Transport for NSW and can therefore be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This REF has been prepared to assess the environmental impacts of the proposal during construction and operation. The REF has been prepared in accordance with clause 228 of the Environmental Planning and Assessment Regulation 2000 (the EP&A Regulation). In accordance with Division 5.1 of the EP&A Act, Transport for NSW, as the proponent and determining authority, must examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the proposed activity.

As Roads and Maritime is a public authority and the proposed activity falls within the definition of a road or road infrastructure facility under the State Environmental Planning Policy (Infrastructure) 2007 (the Infrastructure SEPP), the proposal is permissible without consent. Consequently, the environmental impacts of the proposal are being assessed by Roads and Maritime under Division 5.1 of the EP&A Act.

Community and stakeholder consultation

Consultation with key stakeholders commenced in November 2020 and engagement with the community was undertaken between Monday 23 November 2020 to Wednesday 16 December 2020. Refer to Appendix E for the full Community Consultation Report

Transport for NSW received a total of 93 submissions via Have Your Say community consultation. The key matters raised are summarised as follows:

- Support for the project as it would be expected to provide long-term benefits such as shorter travel times, ease congestion and make trips easier for those travelling to Penrith and the Blue Mountains
- Overall project justification was questioned in relation to the proposed on-ramp being unnecessary and that it may cause additional congestion issues, such as along the Erskine Park Road – Roper Road corridor
- Environmental impacts such as noise and tree impacts
- Location of the on-ramp, in particular that an on-ramp to the west of Erskine Park Road with direct left turn access to the M4 Motorway (as represented by Option 3 in the options analysis) would be more practical
- Congestion on the road network as a result of the project.

Consultation will continue with residents and stakeholders throughout the ongoing development and construction of the proposal.

Environmental impacts

The REF identifies the potential environmental benefits and impacts of the proposal and outlines the management measures to mitigate the identified impacts. The main environmental impacts of the proposal are summarised below. Further information is provided in Chapter 6 (Environmental Assessment) of this REF.

Biodiversity

The proposal would involve the removal of up to 2.18 hectares of low to moderate condition native vegetation. A Biodiversity Assessment has been completed and within the proposal area three native Plant Community Types (PCT) were identified. The three PCTs are all Threatened Ecological Communities (TECs):

- PCT 724 - Broad-leaved Ironbark - Grey Box - *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion, which is an Endangered Ecological Community (EEC) under the Biodiversity Conservation Act 2017 but not under the Environmental Protection and Biodiversity Conservation Act 1999
- PCT 725 - Broad-leaved Ironbark - *Melaleuca decora* shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion, which is an EEC under the BC Act and a Critically Endangered Ecological Community (CEEC) under the EPBC Act
- PCT 835 – Forest Red Gum-Rough-barked Apple Grassy Woodland on Alluvial Flats of the Cumberland Plain, Sydney Basin which is an EEC under the BC Act but not under the EPBC Act.

The proposal is not considered to significantly affect the extent or composition of the TECs within the proposal area of the locality and a species impact statement is not required.

Impacts to threatened fauna species within the locality are considered minimal. There will be no removal of areas containing significant connectivity values. Foraging habitat within the area will be retained. As such, no threatened fauna is considered impacted by the proposal.

Five threatened flora species were identified as having a moderate to high likelihood of occurrence, and three of these species were identified during site surveys. Of these species identified, only the Juniper-leaved Grevillea occurs within the construction footprint. The project has avoided and minimised impacts to this species, and the impacts to the species are not considered likely to generate a significant impact.

Noise and vibration

Construction

A construction noise impact assessment has been conducted in accordance with the *Interim Construction Noise Guideline* (ICNG) and *Construction Noise and Vibration Guideline* (CNVG) (DECC 2009).

Reasonable worst case construction scenarios were assessed. Construction of the proposal would occur both during standard construction hours and out of hours to minimise traffic disruptions.

The assessment of noise associated with the construction of the proposal indicated exceedances of the ICNG noise management levels at a number of sensitive receivers. Exceedances of the noise management levels occur during the day and night at the most affected sensitive receivers during construction activities. The magnitude of these impacts is consistent with other redeveloped road works projects and highlights the need for effective noise mitigation and management planning. Effective noise mitigation and management measures would need to be developed by the contractor to minimise the potential noise impacts from the works.

Measures have been recommended to mitigate construction noise impacts upon nearby sensitive receivers. The final number, degree and nature of these measures would ultimately be selected by the contractor and be largely dependent on the construction strategy and work undertaken. Specific noise management and mitigation measures would be detailed in the contractor's Construction Noise and Vibration Management Plan. The recommended management and mitigation measures which would be considered in the plan include:

- Effective community consultation
- Training of construction site workers
- Use of noise barriers
- Noise monitoring
- Appropriate selection and maintenance of equipment
- Scheduling of work for less sensitive time periods
- Situating plant in less noise sensitive locations
- Construction traffic management
- Respite periods.

Operation

An operational road traffic impact noise assessment was completed in accordance with the *Road Noise Policy* (NSW EPA) and the *Noise Criteria Guideline* and *Noise Mitigation Guideline* (Roads and Maritime Services). Noise levels were predicted at sensitive receiver locations throughout the proposal area for both the daytime and night-time scenarios for the 'Year of Opening' of 2021 and the 'Design Year' of 2031.

Exceedances of the applicable noise criteria were identified and were generated by existing high noise levels throughout the proposal area and the close proximity of receivers to the M4 Motorway and Erskine Park Road. A total of 27 receivers are eligible for the consideration of noise mitigation measures.

Appropriate noise mitigation has been recommended to minimise impacts on the community from the proposal. Noise mitigation in the form of quieter road surfaces, noise barriers, and architectural treatments were considered. While low-noise pavements would provide some noise reduction, the reduction would be limited and other design requirements would require the use of other pavements. Noise barriers were not considered for a number of eligible receivers which were located in groups of less than four. A noise barrier was considered for a group of 19 eligible receivers however the barrier was not found to be reasonable when assessed in accordance with the NMG.

Ultimately architectural treatment is recommended at all sensitive receivers found to be eligible for the consideration of noise mitigation. These requirements would be reviewed and confirmed at the detailed design phase when more detailed information would be available.

Hydrology and flooding

The construction of the proposal would have potential to affect local surface water as a result of sediment run off from the works area and proposed site compounds, with the proposal aspects with a higher risk of erosion and sedimentation being; the removal of established vegetation, bulk earthworks to construct the G-loop on-ramp embankment and relocation of an earth bund, stockpiling of materials and trenching for utilities. Safeguards are set out in Section 6 of this REF to minimise the risks to surface water quality.

The proposal area is not located within an area affected by a 100-year average recurrence interval flood event or probable maximum flood as it is outside of the Ropes Creek Flood Planning Area. To the south of the proposal area west of Erskine Park Road are a Council owned stormwater basin and Transport for NSW flood detention basin. The proposal would require the relocation of the earth bund controlling the extent of the flood detention basin and the discharge system. Modelling of the stormwater network upgrades, including the increase in impermeable area, was completed using TUFLOW modelling software which identified that the extent of flooding during a 1% annual exceedance probability event would not result in any changes to flood levels of residential properties.

Landscape character and visual impacts

The proposal area is located within the existing M4 Motorway corridor a major urban road corridor with vegetation buffers between the mainline carriageway and the suburban land uses in the surrounding residential areas. Views of the proposal are predominantly limited to passing road users as direct views of the proposal would only be of site compounds during construction and indirect views of vegetation removed on completion of the construction works. For road users passing by the proposal area during construction, the potential visual impacts would be moderate due to the visibility of site compounds, construction equipment and bulk earthworks. The operational impacts on visual amenity are high-moderate predominantly due to the removal of established areas of vegetation, the increase in pavement due to the proposed on-ramp and the proposed retaining walls adjacent to the M4 Motorway westbound mainline. The vegetation clearance would be mitigated in a small way by the replanting of vegetation within the centre of the G-loop section of the on-ramp where possible and the retention of established vegetation south of the on-ramp alignment to the west of Roper Road would also provide continued views of native forest for road users along Roper Road, Erskine Park Road and the M4 Motorway mainline.

Cumulative impacts

There are a number of other construction projects underway or proposed within the wider area near the proposal, including; Erskine Park Road Upgrades due for completion early 2021, M4 Motorway mainline resurfacing proposed mid-March 2021, Mamre Road Upgrade Project funded to occur in the near to medium term, and the Archbold Road Upgrade and Extension. Where the construction periods of these projects overlap with the proposal, there are potential cumulative impacts relating to construction traffic and noise. The potential cumulative impacts during the construction of the proposal would be limited to the

anticipated 18-month works duration commencing mid-2020. The minor cumulative impacts that may be experienced during the construction period would be justified by the long-term, positive benefits of the proposal, including increased traffic efficiency and safety.

Justification and conclusion

The proposal is subject to assessment under Part 5 of the EP&A Act. This REF has examined and considered all matters affecting or likely to affect the environment by reason of the proposed activity.

The proposal is considered to be consistent with Government strategic planning at Commonwealth, State and regional levels as it would lead to improved efficiency and safety of the road network. While there would be some environmental impacts as a consequence of the proposal, these impacts have been avoided or minimised wherever possible through design and site-specific safeguards (Chapter 6 and Section 7.2).

The assessment of the proposal's impact has concluded:

- The adverse impacts and risks of the proposal would be outweighed by the longer-term benefits of providing additional connections to the M4 Motorway with resulting improvements to traffic flow, reduced congestion and improved safety for all road users. On balance, the proposal is therefore considered justified.
- 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 of Planning under Division 5.2 of the EP&A Act. A Species Impact Statement is not required. The proposal is subject to assessment under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Consent from Council is not required.
- 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* (EPBC Act). A referral to the Australian Department of the Environment is not required.

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1. Introduction

Transport for NSW propose to undertake an upgrade to the M4 Motorway to provide a westbound on-ramp to the M4 Motorway mainline from Erskine Park Road and Roper Road, in St Clair and Erskine Park ('the proposal') to ease congestion, travel time reliability and improved local road connections between St Clair, Erskine Park and Penrith. Currently the closest access to the M4 westbound for local road users from St Clair, Erskine Park and Colyton is at the Mamre Road interchange. The proposed improvement would provide an additional access to the M4 for local road users traveling west towards Penrith.

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

1.1 Proposal identification

Transport for NSW propose to construct a single lane, westbound on-ramp from Erskine Park Road northbound and Roper Road southbound to the M4 Motorway in a G-loop configuration providing access to the M4 Motorway westbound mainline in St Clair and Erskine Park. The proposal is under the Smart Motorways Project and would tie in to the existing M4 Motorway westbound mainline at the western extent of the proposal and would be connected to Erskine Park Road and Roper Road at the southern extent of the proposal.

Key features of the proposal would include:

- Construction of a single lane westbound on-ramp from Erskine Park Road and Roper Road to the M4 Motorway in a G-loop configuration to provide access to the M4 Motorway westbound for traffic travelling from the south on Erskine Park Road and from the north on Roper Road.
- Southbound traffic on Roper Road would access the proposed on-ramp by a free flow left turn slip lane.
- Northbound traffic on Erskine Park Road would access the proposed on-ramp via a dedicated signalised right turn lane at the intersection of Erskine Park Road and the M4 Motorway westbound off-ramp to Erskine Park Road and Roper Road (M4 westbound off-ramp).
- The existing intersection of Erskine Park Road and the M4 westbound off-ramp to Erskine Park Road and Roper Road will be reconfigured to accommodate the proposed on-ramp.
- Provision will be made for future installation of Smart Motorway infrastructure including advisory signs and ramp metering devices.
- Construction of the G-loop will require excavation adjacent to the existing bridge abutment beneath the Erskine Park Road bridge over the M4 Motorway.

These key features are identified in Figure 1-1, the location of the proposal is identified in Figure 1-4 and the proposal is described in more detail in Chapter 3 (Description of the proposal) and on the design drawings provided in Appendix C.



Figure 1-1 Main features of the proposal: Erskine Park Road westbound on-ramp to M4 Motorway, Erskine Park

1.2 Proposal location

The proposal is located within the suburbs of St Clair and Erskine Park which are within the Penrith City Council local government area (LGA), about 38 kilometres west of Sydney's central business district (CBD). St Clair and Erskine Park are located to the south of the M4 Western Motorway approximately 11 kilometres east of Penrith. Both suburbs are primarily residential, however new industrial areas are being developed at the southern side of Erskine Park.

To the north of the M4 within the vicinity of the proposal are the suburbs of Colyton, Mount Druitt and Minchinbury. Erskine Park Road runs from Mamre Road to the south and connects to Roper Road at the overpass of the M4 Motorway. The Roper Road - Erskine Park Road corridor is a key link between the Great Western Motorway, M4 Motorway and the developing growth areas to the south of the M4 Motorway.

Current and future growth areas in Western Sydney are located near the proposal as identified in Figure 1-2 and Figure 1-3 below, including:

- Western Sydney Employment Area (WSEA) – and area protected by State Environmental Planning Policy for employment purposes, including transport, logistics, warehousing and office space (development precincts identified in Figure 1-2)
- Western Sydney International (Nancy Bird Walton) Airport at Badgerys Creek
- Western Sydney International Airport Growth Area (Western Sydney Aerotropolis) – new innovation precinct and home for technology, science and creative industries within the wider Western Parkland City and connected to the Western Sydney International Airport
- South West Priority Growth Area – Development of new communities in precincts such as Oran Park, Turner Road, East Leppington etc. to connect with employment opportunities in Western Sydney International Airport, Western Sydney Aerotropolis, and WSEA.



Figure 1-2 Current and future growth areas located near the proposal area (Source: amended from Western Sydney Infrastructure Plan interactive portal)

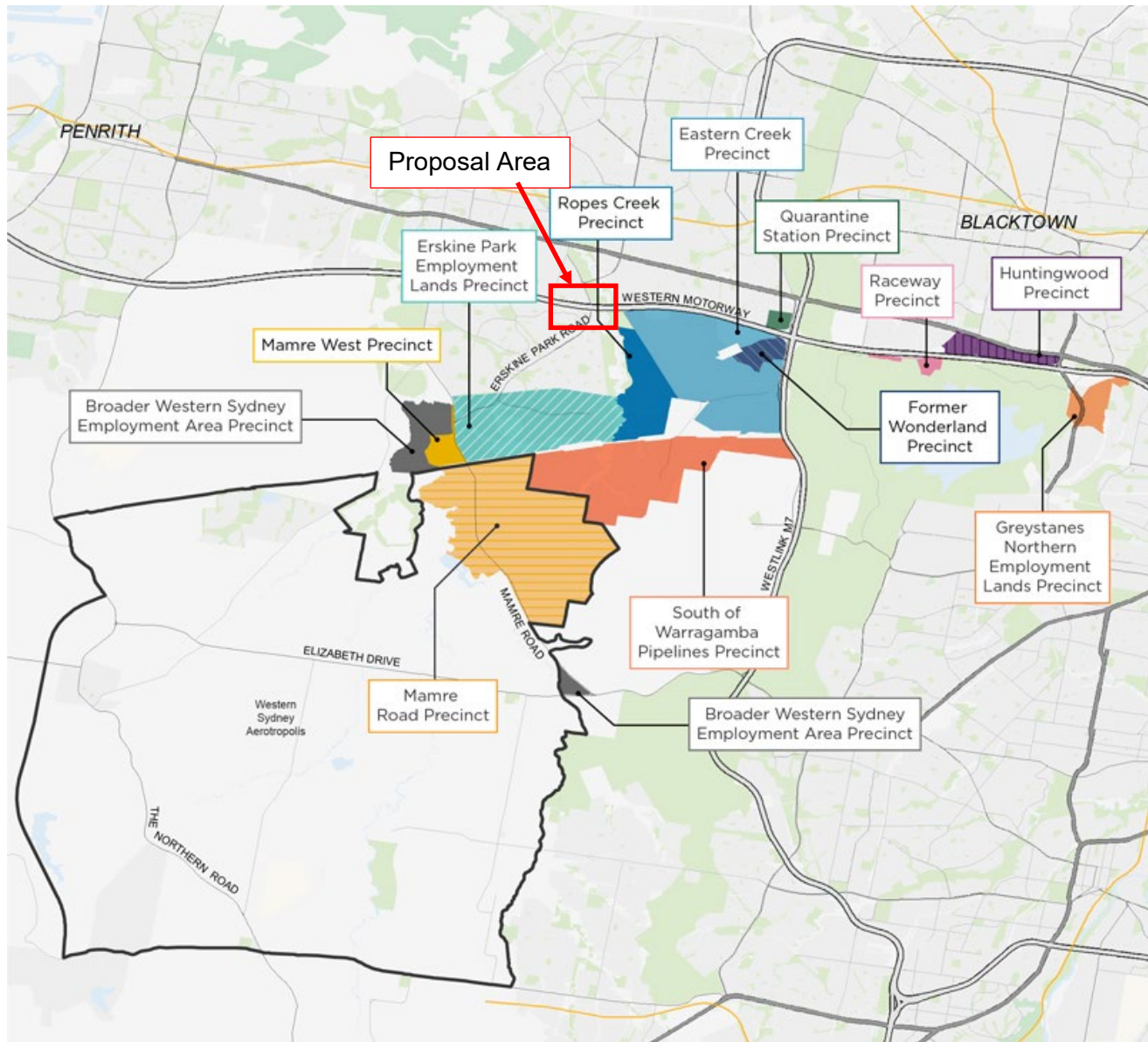


Figure 1-3 Western Sydney Employment Area Precincts and Western Sydney Aerotropolis (Source: NSW Department of Planning, Industry and Environment)

1.3 Definitions

The following definitions have been used in this report:

- The 'works area' refers to the area that would be permanently impacted by the proposal
- The 'proposal area' refers to the area that may be impacted by the proposal in the immediate vicinity (both temporarily and/or permanently) and is shown as the Project Construction Footprint in Figure 1-4 and Appendix D.
- The 'study area' consists of land in the vicinity of, and including, the proposal area. The study area is the wider area surrounding the proposal area, including the land that has the potential to be indirectly impacted by the proposal beyond the immediate works area (for example, as a result of noise).

Chapter 3 describes the proposal in more detail.



Figure 1-4 Location of the proposal area (shown as the construction footprint within red dashed line)

1.4 Purpose of the report

This review of environmental factors (REF) has been prepared by AECOM on behalf of Transport for NSW. For the purposes of these works, Transport for NSW 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 228 of the Environmental Planning and Assessment Regulation 2000, the factors in *Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979* (Is an EIS required? guidelines) (DUAP, 1995/1996), *Roads and Related Facilities EIS Guideline* (DUAP 1996), the *Biodiversity Conservation Act 2016* (BC Act), the *Fisheries Management Act 1994* (FM Act), and the *Australian Government's Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

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

- Section 5.5 of the EP&A Act including that 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 strategic assessment approval granted by the Federal Government under the EPBC Act in September 2015, with respect to the impacts of Transport for NSW's road activities on nationally listed threatened species, ecological communities and migratory species.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning 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 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

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

2.1 Strategic need for the proposal

Easing Sydney's Congestion Program Office (ESCPO) under Transport for NSW is developing projects on the State road Network, in accordance with government initiatives, for managing and improving traffic congestion and road safety within the Sydney region. The NSW Governments Smart Motorways Project aims to reduce stop-start traffic and improve travel times on the M4 Motorway which is a key transport corridor to and from Western Sydney.

With projected and planned future growth in Western Sydney due to the development of the Western Parkland City, Western Sydney International Airport, industrial and commercial precincts associated with the Western Sydney Employment Area (WSEA) and the Western Sydney Aerotropolis, there is a need to plan for increased capacity and access in the region.

By 2056, Greater Sydney will transform to a metropolis of three cities which will include the Eastern Harbour City, the Central River City, and the Western Parkland City which will focus on the Western Sydney Aerotropolis. Over the next 40 years, the Western Parkland City will grow to over 1.5 million people and capitalise on the existing city centres of Liverpool, Penrith and Campbelltown-Macarthur. The Western Parkland City will be established on the strength of the Western Sydney International Airport and the Western Sydney Aerotropolis (a new high-skill jobs hub leveraging off proximity to the airport) and the associated development of new land release areas and connectivity with existing major urban centres.

The interchange between the M4 Motorway and Roper Road / Erskine Park Road currently includes east facing ramps (an eastbound on-ramp and westbound off-ramp) only. Due to the lack of a west facing ramp, road users whose trips originate from south of the M4 Motorway and are heading west must travel five kilometres through local and residential streets in St Clair to reach the nearest access to the M4 Motorway or proceed further north via Roper Road and join the Great Western Highway. Residents on the northern side of the M4 Motorway (i.e. Colyton, Mount Druitt and Minchinbury) face similar constraints to accessing the M4 Motorway west towards Penrith, if they do not wish to use the Great Western Highway.

It is expected that the Roper Road on-ramp would ease congestion on the existing westbound M4 Motorway on-ramps, existing local roads within Erskine Park and St Clair, and remove non-local road traffic (i.e. motorists who are trying to access a westbound M4 on-ramp) from local roads. Removing this westbound traffic from local roads will improve efficiency of the local road network and improve reliability of travel times.

There is currently about 8 kilometres between westbound on-ramps onto the M4 Motorway between Wallgrove Road and Mamre Road. Along the rest of M4 Motorway, westbound on-ramps are provided approximately every 3.5 to 4 kilometres. A westbound on-ramp at Erskine Park Road would continue this frequency along the M4 Motorway. Road users currently have to travel approximately 5 kilometres either east or west to access a westbound on-ramp onto the M4 Motorway at Mamre Road or Wallgrove Road. As Penrith is the major regional hub for services and employment, there are strong drivers for the westbound movement from the suburbs surrounding the proposal to Penrith.

The proposal would complement the Western Sydney Infrastructure Plan which is progressively upgrading a number of major arterial and local roads in Western Sydney to deliver a more efficient, reliable network that meets the future needs of the community and the economy. The provision of the west-facing ramp onto

the M4 Motorway would support the following key infrastructure projects and transport links in Western Sydney (refer Figure 1-2 for location of projects);

- M4 Smart Motorway
- Western Sydney Employment Area (WSEA)
- Western Sydney Aerotropolis
- Western Sydney International Airport
- Erskine Park Road upgrades
- Mamre Road improvements
- Archbold Road upgrade and extension

Further details of these projects are provided in Section 6.13 Cumulative Impacts. The current lack of westbound access onto the M4 Motorway in the area to support the forecast growth in traffic demand due to the WSEA and Western Parkland City, has led to poor local network performance and increased costs to road users. This, in turn has the potential to undermine growth of WSEA and the Western Parkland City as developers are deterred by poor quality of access, particularly for heavy vehicles.

The proposal would address objectives for Sydney's important urban roads and the future growth in Western Sydney outlined in:

- Future Transport Strategy 2056
- Greater Sydney Region Plan: A Metropolis of Three Cities
- Western City District Plan 2018
- Penrith City Council Community Plan 2017
- Greater Sydney Services and Infrastructure Plan
- State Infrastructure Strategy 2018-2038: Building Momentum
- NSW Road Safety Plan 2021
- NSW Freight and Ports Plan 2018-2023

These strategies and relevant objectives are discussed further in the following sections.

2.1.1 Future Transport Strategy 2056

The *Future Transport Strategy 2056* is NSW Government's vision for the next 40 years of transport in NSW (Transport for NSW, 2018a).

The vision is based on the following outcomes:

- Customer focused
- Successful places
- A strong economy
- Safety and performance
- Accessible services
- Sustainability

The purpose of the Strategy is to guide integrated transport and land use planning across regional NSW and Greater Sydney. Transport and customer outcomes to be achieved over the short, medium and long-term to provide better and safer journeys for all transport customers are set out in the Strategy.

The Future Transport Strategy is supported by a suite of issue-specific and place-based plans that focus on the role transport plays in the land use, tourism and economic development of towns and cities. Plans under the Strategy include the *Greater Sydney Services and Infrastructure Plan*, *Regional NSW Services and Infrastructure Plan* and the *Road Safety Plan*.

A key priority and direction under the Future Transport Strategy relates to movement and place; balancing the efficient movement of people and goods with the liveability of places on the transport network. A part of the vision for Greater Sydney is that of a 30-minute city where anyone can reach their nearest Metropolitan and Strategic centre within 30 minutes by public transport seven days a week. Enhanced centre to centre networks and movement corridors are identified as important to achieve that vision.

A future direction under the Strategy is to optimise the network and make better use of existing infrastructure. Congestion in this Strategy is identified as contributing to increased travel times, reduced reliability and a poorer customer experience.

The Future Transport Strategy identifies the wider M4 Motorway as a city-shaping corridor and the upgrades as part of M4 Smart Motorway are identified in the list of Greater Sydney Committed Initiatives (0-10 years) as a major infrastructure upgrade. The proposal supports this Strategy by providing additional access to a key transport corridor, improving route options for travel between centres in Western Sydney through optimising the network and better use of existing infrastructure.

2.1.2 Greater Sydney Region Plan: A Metropolis of Three Cities

The Greater Sydney Region Plan sets a 40-year vision to 2056 and establishes a 20-year plan to manage growth and change for Greater Sydney in the context of social, economic and environmental matters (Greater Sydney Commission, 2018a). It assists infrastructure agencies to plan and deliver for growth and change and to align their infrastructure plans and projects to place-based outcomes.

To meet the needs of a growing and changing population the vision of this Plan seeks to transform Greater Sydney into a metropolis of three cities where most residents live within 30 minutes of their jobs, education and health facilities and services:

- The Western Parkland City
- The Central River City
- The Eastern Harbour City

This Plan is consistent with the *10 Directions for a Greater Sydney* which establishes the aspirations for the region over the next 40 years and is a core component of the vision. This Plan was prepared in conjunction with the *Future Transport Strategy 2056* and *State Infrastructure Strategy 2018-2038: Building Momentum* to align land-use, transport and infrastructure outcomes for Greater Sydney. The infrastructure objectives in this Plan support the 'three cities' model within the Sydney Metropolitan Area and align with forecasted growth in this region.

The vision of this Plan brings together both land use and transport planning considerations for the Greater Sydney Region to improve Sydney's liveability, productivity and sustainability by spreading the benefits of growth. The population of Greater Sydney is projected to grow to eight million over the next 40 years, and with almost half of that population residing west of Parramatta, re-balancing economic and social opportunities will leverage that growth and deliver the benefits more equally and equitably across Greater Sydney.

The transport initiatives in this Plan are sourced from the *Future Transport Strategy 2056*. The initiatives are in four categories: committed, investigation 0-10 years, investigation 10-20 years and visionary 20+ years. The investigation categories require further investigation and ultimately decisions of government on commitments to funding.

Five District Plans have been developed across Greater Sydney for implementing the Greater Sydney Regional Plan covering Western City, Central City, Eastern City, North and South. The District Plans are 20-year plans which create a bridge between regional and local planning initiatives. The Plans inform local environmental plans, community strategic plans and the assessment of planning proposals. The District Plans also help councils to plan and deliver for growth and change, and to align their local planning strategies to place-based outcomes.

The following provisions of the Greater Sydney Region Plan are relevant to the proposal:

- A city supported by infrastructure objectives 1 to 4 which relate to ensuring infrastructure supports the three cities, aligns with forecast growth, adapts to meet future needs and infrastructure use is optimised
- A city for people objective 6 which relates to ensuring services and infrastructure meets communities' changing needs
- A well-connected city objective 14 relating to integrated land use and transport and objective 16 which relates to provision of a freight and logistics network that is competitive and efficient

The proposal would enhance connectivity to Penrith for local residents in and around St Clair and Erskine Park. The westbound on-ramp would enable Roper Road and Erskine Park Road to become a movement corridor to aid in the movement to and from the WSEA. An additional on-ramp to the M4 Motorway would maximise the efficiency and reliability of the network by making use of the existing motorway infrastructure and increase the extent of the 30-minute city within the Western Parkland City. The proposal would also help provide better access, capacity and road infrastructure that would cater to the expected future traffic demand generated by the future development of the surrounding area.

2.1.3 Western City District Plan 2018

The Greater Sydney Commission's five District Plans support the implementation of A Metropolis of Three Cities – the Greater Sydney Region Plan at a District level.

These 20-year plans are a bridge between regional and local planning initiatives. The District Plans inform local environmental plans, community strategic plans and the assessment of planning proposals. The District Plans also help councils to plan and deliver for growth and change, and to align their local planning strategies to place-based outcomes.

The five district boundaries are:

- *Western City*: comprises of Blue Mountains, Hawkesbury, Penrith, Camden, Campbelltown, Fairfield, Liverpool and Wollondilly
- *Central City*: comprises of Blacktown, Cumberland, Parramatta and The Hills
- *Eastern City*: comprises of Bayside, Burwood, Canada Bay, Inner West, Randwick, Strathfield, Woollahra, Waverley and City of Sydney
- *North*: comprises of Hornsby, Hunter's Hill, Ku-ring-gai, Lane Cove, Northern Beaches, Mosman, Willoughby, Ryde and North Sydney
- *South*: comprises of Georges River, Canterbury-Bankstown and Sutherland

The proposal area is located within the Penrith Local government area (LGA) which is within the Western City district boundary. The Western City District Plan is a 20 year plan to manage growth in economic, social and environmental matters to achieve the 40 year vision for Greater Sydney, which informs local strategic planning (Greater Sydney Commission, 2018b). The following planning priorities are relevant to the proposal:

- W1 which relates to planning for a city supported by infrastructure

- W10 which relates to maximising freight and logistics opportunities and planning and managing industrial and urban services land

The proposal is located at the eastern edge of The Western City and is consistent with the vision and planning priorities in the District Plan. Erskine Park is listed in the District Plan as one of the ten largest industrial and urban services precincts, with 116 hectares of undeveloped land in the Erskine Park area for industrial or urban services as part of the WSEA. Optimising existing infrastructure through providing an additional access ramp to the M4 Motorway will assist in optimising the use of the existing M4 infrastructure and providing route options for traffic between Erskine Park and Greater Penrith.

2.1.4 Penrith City Council Community Plan 2017

The Penrith Community Plan is the Penrith City Council 10-year plan to work with their partners to improve the wellbeing of the Penrith community. Two community outcomes of the Community Plan are relevant to the proposal:

- Outcome 2: We plan for our future growth – making sure that services and infrastructure keep up as Penrith grows
- Outcome 3: We can get 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

The proposal would assist in working towards these outcomes and their relevant strategies as the proposal considers the expected increase in population and employment in the surrounding areas. Penrith City Council identified in the Community Plan that the Council would work with Transport for NSW in the design and delivery of road infrastructure.

2.1.5 Greater Sydney Services and Infrastructure Plan

The *Greater Sydney Services and Infrastructure Plan* forms part of the *Future Transport Strategy 2056* and set the customer outcomes for Greater Sydney for the movement of people and freight to meet customer needs and deliver responsive, innovative services (Transport for NSW, 2018b). The Plan defines the network required to achieve the service outcomes under the *Future Transport Strategy 2056*.

The *Greater Sydney Services and Infrastructure Plan* is a 40-year plan for transport in Greater Sydney. It is designed to support the land use vision for Greater Sydney. Building on State-wide transport outcomes identified in the *Future Transport Strategy 2056*, the Plan establishes the specific outcomes transport customers in Greater Sydney can expect and identifies the policy, service and infrastructure initiatives to achieve these.

The focus of this Plan is to enable people and goods to move safely, efficiently and reliably around Greater Sydney, including having access to their nearest centre within 30 minutes of public transport, seven days a week. The transport system will also support the liveability, productivity and sustainability of places on our transport networks. To support this, investment is targeted towards new transport links, better utilising existing capacity, prioritising road space for more efficient vehicles and ensuring the transport network balances the efficient movement of people and goods and sustains the liveability and sustainability of centres it passes through.

Greater Sydney customer outcomes include:

- Convenient and responsive to customer needs
- Sustaining and enhancing the liveability of our places
- Connecting people and places in the growing city
- Safely, efficiently and reliably moving people and goods

- Accessible for all customers
- Makes the best use of available resources and assets

The proposal aims to improve the capacity and journey time of transport services along the existing road network. The proposed additional connection to the M4 Motorway from local roads would maximise broader network efficiency and reliability, improving the connection across the Western Parkland City.

2.1.6 State Infrastructure Strategy 2018-2038: Building Momentum

The *State Infrastructure Strategy 2018-2038* (SIS) developed by Infrastructure NSW provides the NSW Government with advice about infrastructure policy and investment priorities, in line with the requirements of the Infrastructure NSW Act 2011 (NSW Government, 2018a).

The SIS is a 20 year investment plan for the NSW Government which identifies and prioritises the delivery of critical public infrastructure to drive productivity and economic growth. This assessment of the State's existing infrastructure highlighted critical deficiencies in urban road capacity and provides strategic options to meet the challenges of population growth and substantial increases in freight volumes.

One of the sector based infrastructure directions for transport is to ensure that the transport system creates opportunities for people and businesses to access the services and support they need, including addressing existing inefficiencies and pinch points for freight and service networks and overcoming local constraints on the regional road network.

One of the sector-based infrastructure directions for transport is to ensure that the transport system creates opportunities for people and businesses to access the services and support they need, including addressing existing inefficiencies and pinch points for freight and service networks and overcoming local constraints on the regional road network.

The proposal aligns with the SIS as it would provide an additional road connection and supports growth in the surrounding suburbs with greater access to the key M4 Motorway transport corridor, including the WSEA and future Western Sydney Airport. The proposal would also assist in easing congestion at existing westbound M4 on-ramps such as Mamre Road/M4 Motorway interchange.

2.1.7 NSW Road Safety Plan 2021

The *Road Safety Plan 2021* sets out priority areas to address increases in the road toll and to achieve the NSW Government's State Priority Target to reduce fatalities by 30 per cent by 2021 (NSW Government, 2018b).

The Plan delivers on six priority areas, three of which are relevant to the proposal:

- Liveable and safe urban communities – addressing crashes in busy local areas, including pedestrian trauma which accounts for around 17 per cent of all deaths in NSW and 9 per cent of serious injuries
- Using the roads safely – preventing risky road behaviour
- Building a safe future – ensuring that when we plan, develop, design, operate and maintain our roads, safety is at its core

The Plan sets out the direction of the road safety policies and initiatives in NSW in line with the six priority areas identified in this Plan.

The proposal is consistent with the intent and priorities of the Plan as the upgrade to provide a westbound on-ramp would incorporate various road safety measures including barrier systems on each side of the proposed on-ramp, provision of new street lights and for the future installation of smart motorways

infrastructure to efficiently manage congestion, incidents and improve road safety. A reduction in congestion and through traffic on local roads may also lower road safety risks.

2.1.8 NSW Freight and Ports Plan 2018-2023

The *NSW Freight and Ports Plan 2018-2023* is a call to action for government and industry to work together to make the freight system more efficient, more accessible, safer and more sustainable for the benefit of producers, operators, customers and communities across NSW (NSW Government, 2018c). The Plan identifies the M4 Motorway as a Greater Sydney key freight corridor.

The proposal is consistent with this Strategy as it would contribute to improving through movements for freight efficiency, reliability and access along the key freight corridor westbound, in particular an additional access that could be utilised by freight originating or being processed in the Erskine Park Employment Lands Precinct which is part of the WSEA.

2.2 Existing infrastructure

Road infrastructure

Roper Road

Roper Road at the proposal area is two lanes northbound across the bridge over the M4 Motorway until the intersection with the Roper Road eastbound on-ramp to the M4 Motorway where one left turn lane directs traffic onto the on-ramp and two lanes through the intersection which merge to one lane following the intersection. Southbound past the Roper Road eastbound on-ramp to the M4 Motorway intersection there is one lane until the end of the bridge over the M4 Motorway where two lanes join onto Erskine Park Road southbound. Each direction has a posted speed of 60 kilometres per hour and 'No Stopping' restrictions are in place on both sides of the road. The intersection of Roper Road and the M4 eastbound on-ramp is signalised, enabling both left and right turn movements onto the on-ramp. Roper Road links industrial areas, the Great Western Highway and Colyton with the M4 Motorway.

Erskine Park Road

Erskine Park Road is a dual lane carriageway with typically two lanes in each direction and a posted speed limit of 60 kilometres per hour. 'No Stopping' restrictions are in place on both sides of the road and centre concrete median is in place. Erskine Park Road is a vital corridor that services the WSEA and is currently being widened to a four-lane dual carriageway between Bennett Road and Explorers Way to join the existing four lane sections towards the M4 Motorway and Swallow Drive (Erskine Park Road upgrades). Four intersections will also be upgraded along Erskine Park Road.

The intersection of Erskine Park Road with the M4 westbound off-ramp is signalised with four lanes on the M4 westbound off-ramp providing two turning lanes for northbound movements and two lanes for southbound movements onto Erskine Park Road. It is noted that the right turn movement from the M4 westbound off-ramp is highly constrained as the swept path is restricted such that large trucks must use the left-hand right turn lane.

M4 Motorway

The M4 mainline at the proposal area is dual carriageway with three traffic lanes in each direction and a posted speed of 100 kilometres per hour. The interchange between the M4 Motorway and Erskine Park Road / Roper Road currently includes east facing ramps (an M4 eastbound on-ramp and M4 westbound off-ramp) as shown in Figure 2-1. An emergency phone is located at a small shoulder stopping bay approximately 220 metres west of the Erskine Park Road bridge over the M4.



Figure 2-1 M4 Motorway Erskine Park Road off-ramp and Roper Road eastbound on-ramp to the M4 Motorway (base map source: Six Maps NSW)

The nearest alternate ramps onto and off the M4 Motorway are at Mamre Road, located about 3.5 kilometres west of the proposal, or at Wallgrove Road, located about 4.3 kilometres east of the proposal, as identified in Figure 2-2.

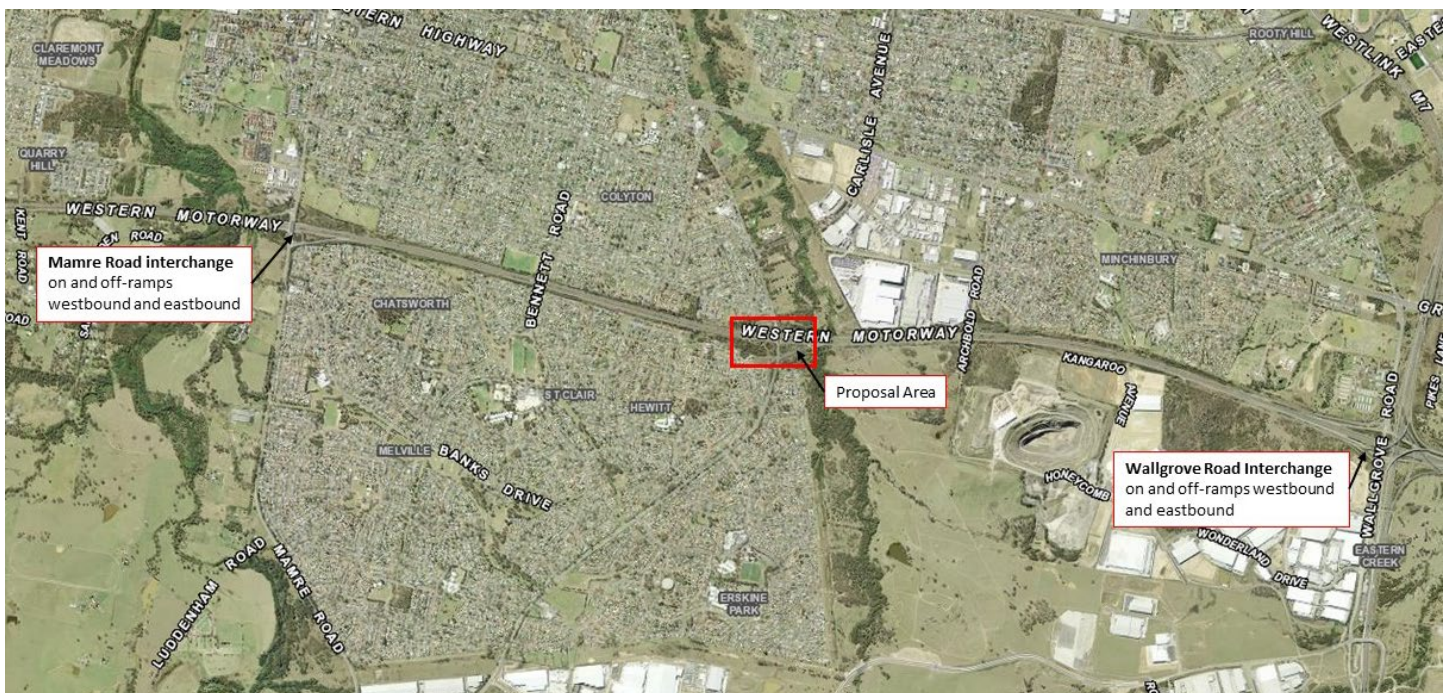


Figure 2-2 Nearby M4 Motorway interchanges (base map source: Six Maps NSW)

Public transport

There are two bus routes within the proposal area which travel the Erskine Road – Roper Road corridor. These routes are shown in Figure 2-3 and are:

- Route 775 – Mount Druitt to Penrith via Erskine Park
- Route 776 – Mount Druitt to Penrith via St Clair

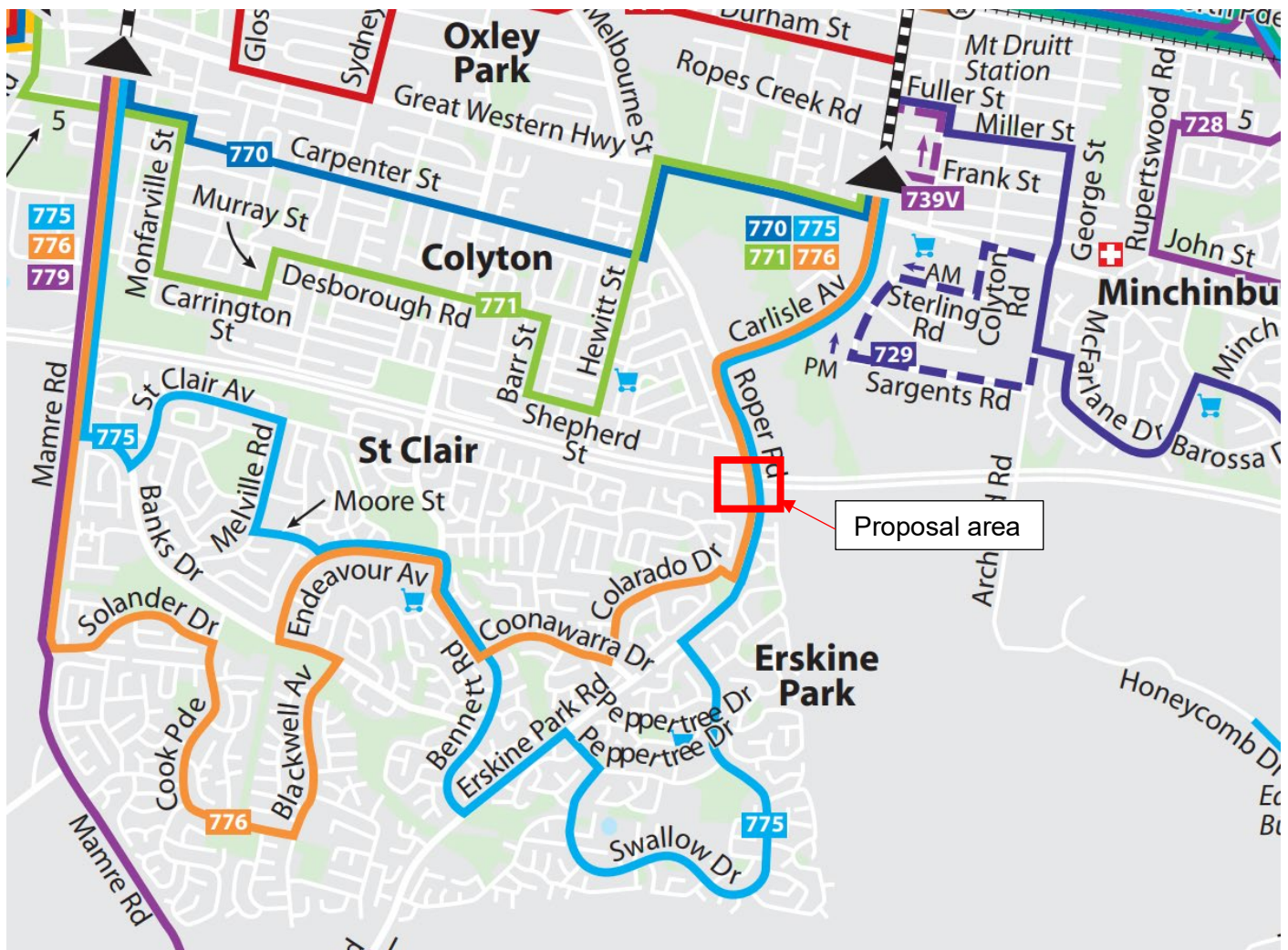


Figure 2-3 Bus routes through the proposal area (Source: Busways Greater Western Sydney Bus Network Map)

There are no bus stops within the proposal area, with the closest stops being TSN #276034 Roper Road after Carlisle Ave – southbound (300 metres north of the proposed Site Compound B along Roper Road) and TSN #276035 Roper Road opposite Carlisle Avenue – northbound (400 metres north of the proposed Site Compound B along Roper Road). No bus stops are located along Erskine Park Road near the proposal area.

The closest train station to the proposal is in Mount Druitt, located 2.6 kilometres north east of the proposal area. The station is serviced by the Sydney Trains T1 North Shore and Western Line.

Pedestrian and cyclist facilities

There are limited dedicated pedestrian facilities located within the proposal area. A footpath is provided on the southbound side of Roper Road from north of the proposal area to the end of the bridge over the M4 Motorway. At the end of the bridge over the M4 no formal footpath is provided and space for pedestrians off the carriageway is limited due to existing safety barriers. No footpath is provided on the northbound side of

Roper Road across the bridge over the M4 Motorway or on either side of Erskine Park Road. A dedicated pedestrian crossing is provided at the intersection of Roper Road and the M4 Roper Road eastbound on-ramp, however no dedicated pedestrian crossing facilities are provided at the intersection of Erskine Park Road and the M4 westbound off-ramp.

There are no dedicated cyclist facilities on Roper Road, Erskine Park Road or the M4.

Drainage

Stormwater runoff from the existing Roper Road interchange with the M4 Motorway is collected via kerb, channel and pits and is conveyed to an outfall at the eastern extent of the project area that discharges to Ropes Creek. To the south of the M4 Motorway westbound mainline and to the west of Erskine Park Road is a stormwater basin discharge system which collects stormwater from St Clair and consists of (also refer Figure 2-4):

- The low-flow drainage system which is located at the basin invert and consists of a gravel bed, subsoil drain, surface outlet filter and discharge control pit. The low-flow drainage system connects via a 150 mm uPVC pipe (with valve) into an existing 525 mm pipe which comes from the council-owned detention basin upstream. This 525 mm pipe then connects into one of the twin 600 mm pipes that cross under the M4 Motorway
- A 'glory-hole' pit which acts as a high flow spill pit for the basin. The 600 mm outlet pipe for this pit connects into one of the twin 600 mm pipes that cross under the M4 Motorway mainline. The sill of the glory hole pit is at 49.85 m Australian height datum (AHD) and is raised above the basin invert. This pit is activated when levels in the basin reach the sill level of the pit. This occurs in a storm event of annual exceedance probability (AEP) between 2% AEP and 1% AEP. The height of the existing earth bund is 50 m AHD.
- An existing pit (EX ERS06) and 375 mm pipe is located at the north-eastern corner of Erskine Park Road and the existing M4 westbound off-ramp. Downstream of this, an existing grated pit (EX M401) and 375 mm pipe is located east of the proposed on-ramp. This pit and pipe drain the M4 Motorway westbound mainline and discharge into Ropes Creek.

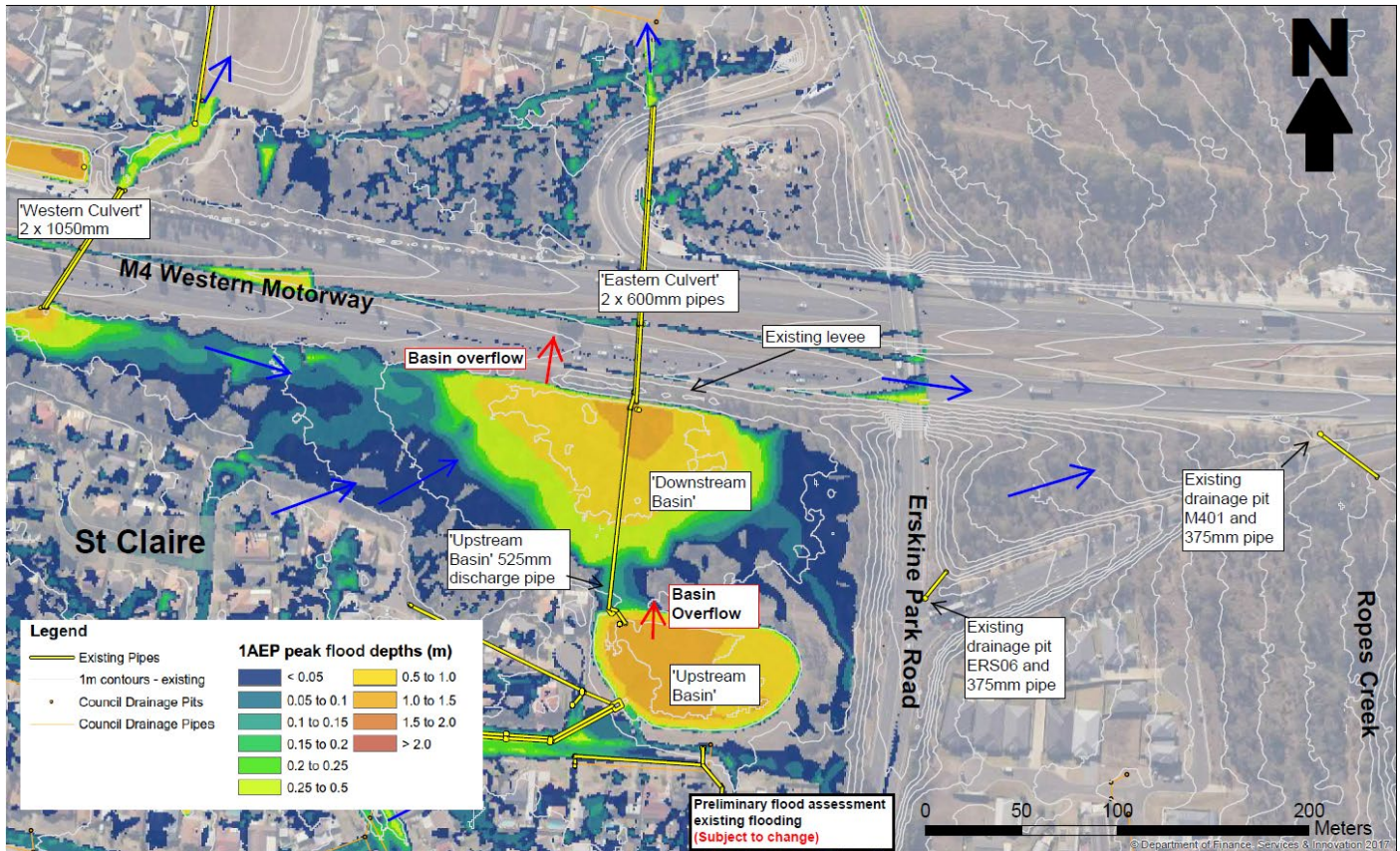


Figure 2-4 Existing stormwater system

2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives

The NSW Government is investing in the M4 Smart Motorway Project which aims to reduce stop-start traffic and improve travel times with upgrades completed or in the process of completion along 35 kilometres of the M4 from Pitt Street, Granville to the Great Western Highway, Lapstone, Blue Mountains. The M4 Smart Motorway Project, under the ESCPO, aims to use real time information, communication and smart traffic management systems that work together to smooth the flow of traffic, ease congestion, efficiently manage incidents and improve road safety.

The high level objectives for ESCPO are to:

- Optimise the existing road network, improving travel reliability
- Improve access throughout Sydney
- Implement an integrated approach to infrastructure for urban renewal.

The following location-specific objectives of the proposal include:

- Ease congestion and reduce travel times between St Clair, Erskine Park and Penrith
- Provide an additional route choice to Penrith and the Blue Mountains for local St Clair and Erskine Park road users
- Improve connectivity to the M4 Motorway for local road users
- Improve travel reliability for local road users.

2.3.2 Development criteria

The development criteria for the proposal is to minimise environmental impacts.

2.4 Alternatives and options considered

2.4.1 Methodology for selection of preferred option

Once the project need was identified, Transport for NSW considered possible options to improve access to the M4 westbound from local roads to improve travel times and provide additional route choices. Initial review of design options was undertaken by Transport for NSW in November and December 2019, which included consideration of the Smart Motorway infrastructure to be incorporated into the design. Results of the preliminary analysis identified the need to re-evaluate the merits of the designs and further consider options which facilitate traffic from both the northern and south sides of the M4 Motorway to access the on-ramp.

Two design options and the do nothing option for the proposal were considered against the proposal objectives and the development criteria. The identified options are listed in Section 2.4.2 and the options assessment is outlined in Section 2.4.3.

2.4.2 Identified options

Two options in addition to the 'do-nothing' option were considered for the proposed works. The options considered are described below.

Option 1 - 'Do nothing'

Involves no works on Erskine Park Road, no provision for westbound access to the M4 Motorway from Erskine Park Road or Roper Road and reflects the existing situation.

Option 2 – 'G-loop westbound on-ramp' (the proposal)

Construct a single lane, west-facing on-ramp from Erskine Park Road to the M4 Motorway in a G-loop configuration providing access to the M4 Motorway westbound mainline for traffic travelling northbound on Erskine Park Road and southbound on Roper Road in St Clair and Erskine Park. This is the proposal as described in Section 1.1 and Section 3.

This option enables local road users from St Clair and Erskine Park suburbs from the south of the M4 Motorway to access the proposed westbound on-ramp and also provides for local road users from suburbs to the north of the M4 Motorway (Colyton, My Druitt and Minchinbury) to access the westbound on-ramp from the north. The works area for Option 2 is predominantly located to the east of Roper Road for the construction of the G-loop on-ramp and the strip of land adjacent to the existing M4 Motorway to the west of Roper Road to provide for traffic to easily merge onto the M4 Motorway.

Option 3 – 'Left-access only westbound on-ramp'

Construct a two lane, directly west-facing on-ramp from Erskine Park Road to the M4 Motorway westbound mainline only for northbound traffic on Erskine Park Road, St Clair. The key features of Option 3 are (also refer Figure 2-5):

- A two lane westbound on-ramp, approximately 1.5 km in length

- Design speed of 60 km/h which increases to 110 km/h at the end of the ramp for safe merging onto the M4 Motorway
- Guardrails along the full length
- Earthworks to mitigate the impacts on the capacity of the stormwater basin and associated infrastructure located to the west of Erskine Park Road and north of Augusta Place
- Smart motorways technology.

This option enables local road users from St Clair and Erskine Park suburbs from the south of the M4 Motorway to access the proposed westbound on-ramp. Access to the on-ramp would not be provided for local road users from the suburbs north of the M4 as right turns from Roper Road southbound to the on-ramp cannot be accommodated.

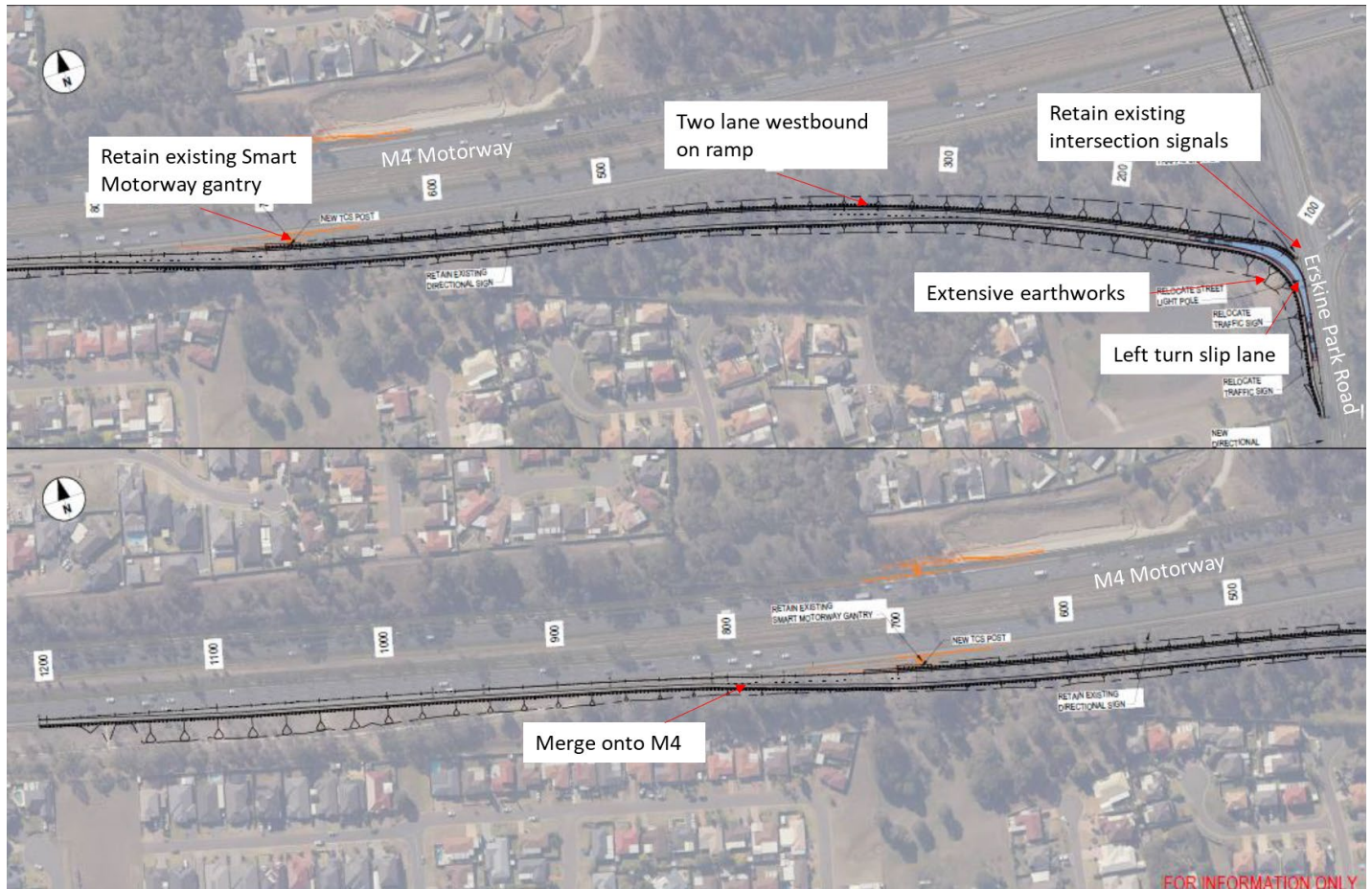























Figure 2-5: Option 3 Layout: Construct a two lane, directly west-facing on-ramp from Erskine Park Road to the M4 westbound mainline only for traffic travelling north on Erskine Park Road, St Clair

2.4.3 Analysis of options

Table 2-1 below sets out the analysis of the options assessed against the project objectives and development criteria.

Table 2-1 Options analysis against the proposal objectives and criteria

Legend:  Does not meet the objective  Partially meets the objective  Meets the objective		Option 1: 'Do nothing'	Option 2: 'G-loop westbound on-ramp' (the proposal)	Option 3: 'Left-access only westbound on-ramp'
Proposal Objectives	Ease congestion and reduce travel times between St Clair, Erskine Park and Penrith	 No change to existing travel times between St Clair, Erskine Park and Penrith	 Vehicles from St Clair and Erskine Park would be able to access the M4 Motorway westbound with a smaller length of route on local road, reducing congestion on local roads and reducing travel times to Penrith by utilising the M4 Motorway.	 Same as Option 2 – with potential advantages in reduced travel time due to a free flow left turn onto the on-ramp compared to a signalised/filtered right turn movement.
	Provide an additional route choice to Penrith and the Blue Mountains for local St Clair and Erskine Park road users	 No additional route choice provided for road users travelling from St Clair and Erskine Park to Penrith and the Blue Mountains	 Provides additional access to the M4 mainline westbound to Penrith and the Blue Mountains as alternative to the use of local roads or using local roads to then access an existing M4 westbound on-ramp	 Same as Option 2 - Provides additional access to the M4 mainline westbound to Penrith and the Blue Mountains as alternative to the use of local roads or using local roads to then access an existing M4 westbound on-ramp
	Improve connectivity to the M4 Motorway for local road users	 No improvement to connections from local roads to the M4	 Local road users from St Clair, Erskine Park and Colyton would have improved access to the M4 westbound both at the proposed on-ramp and due to a reduction in traffic using the Mamre Road interchange. Traffic modelling identified that Option 2 would generate higher 5-hour traffic counts and maximum flows than Option 3 due to the additional access from the north of the M4 Motorway. The estimate of annual traffic use of the on-ramp for Option 2 is 913,069 in 2026 and 924,372 in 2031.	 Connectivity to the M4 westbound is only provided for northbound traffic from Erskine Park Road due to geometry constraints restricting access to the on-ramp from traffic travelling southbound from Roper Road. The estimate of annual traffic use of the on-ramp for Option 3 is 865,343 in 2026 and 906,789 in 2031 which is 47,726 less vehicles in 2026 and 17,583 less vehicles in 2031 compared to Option 2.

Legend:  Does not meet the objective  Partially meets the objective  Meets the objective		Option 1: 'Do nothing'	Option 2: 'G-loop westbound on-ramp' (the proposal)	Option 3: 'Left-access only westbound on-ramp'
Project Criteria	Improve travel reliability for local road users	 The 'do nothing' option would not change the travel reliability for local road users.	 Travel reliability would be improved for local road users in and from St Clair, Erskine Park and Colyton.	 The additional left-access only on-ramp would improve travel reliability for only those local road users able to access the ramp from the south of the M4 Motorway but not for local road users to the north of the M4 Motorway
	Minimise environmental impacts	 The 'do nothing' option would not result in any physical impacts, with no earthworks, construction noise, vegetation removal or disturbance.	 The works area for this option is predominantly to the east of Roper Road, adjacent to the M4 Motorway mainline and the on-ramp is of a shorter distance, significantly reducing the area of disturbance of TEC and threatened flora and fauna species. An area of 2.17 hectares of TEC would be impacted. On-ramp alignment avoids impacts on the stormwater basin and associated infrastructure.	 Due to the location the on-ramp alignment for Option 3 earthworks would be required to mitigate the impacts on the capacity of the stormwater basin and associated infrastructure located to the west of Erskine Park Road and north of Augusta Place. Also, given the acceleration requirements to merge with M4 Motorway, Option 3 would result in the need for the merge lane to be at the location of a mainline M4 Smart Motorway gantry. As the gantry cannot be moved, the left-access only westbound on-ramp would need to be extended beyond the gantry to enable the merge. These earthworks would require a larger area of disturbance than Option 2. As a result there would be a significant impact to a TEC and multiple endangered flora species.

2.5 Preferred option

Option 2 was selected as the preferred option as it best meets the project objectives and design criteria for the following reasons:

- The do-nothing Option 1 did not result in any construction-related impacts but did not meet any project objectives.
- Options 2 and 3 both provided additional route choice for local St Clair and Erskine Park road users which met most project objectives.
- The proposed G-loop configuration of Option 2 provides M4 Motorway connectivity for road users travelling westbound from suburbs to the north of the M4 Motorway, an additional benefit that could not be accommodated in the design of Option 3. Providing access for local road users to the north of the M4 Motorway increases the total number of vehicles using the on-ramp, particularly as the left-turn onto the on-ramp from the north was the dominant access direction in the majority of the peak periods (O'Brien Traffic, 2020).
- The works area for Option 2 results in less disturbance to TECs, threatened flora and fauna due to the works area predominantly being located to the east of Roper Road where critically endangered ecological communities have not been identified, compared to potentially significant impacts on biodiversity of the Option 3 works area to the west of Roper Road.
- The on-ramp alignment of Option 2 avoids works which would impact the stormwater basin to the south of the proposal area and limits the volume of earthworks required west of Roper Road, whereas Option 3 would encroach on the stormwater basin capacity.

Overall, the preferred option would enable the project objectives to be met whilst minimising the potential environmental impacts of the proposal, particularly in relation to avoiding significant impacts on a TEC by accommodating the on-ramp to the east of Erskine Park Road.

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 for NSW proposes to build a single lane, westbound on-ramp from Erskine Park Road northbound and Roper Road southbound to the M4 Motorway in a G-loop configuration providing access to the M4 Motorway westbound mainline in St Clair and Erskine Park (the proposal). The proposal would tie in to the existing M4 Motorway westbound at the western extent of the proposal and would be connected to Erskine Park Road and Roper Road at the southern extent of the proposal. The proposal is shown in Figure 1-1.

The proposal would include:

- Works to connect the proposed on-ramp to Erskine Park Road and Roper Road at the existing intersection of Erskine Park Road and the M4 westbound off-ramp (i.e. intersection upgrade):
 - reconfiguration of the existing intersection to accommodate the entry point to the proposed on-ramp on the north-east corner of this intersection
 - modification of traffic signals at the intersection to accommodate traffic entering the proposed on-ramp
 - widening to the east of Erskine Park Road southbound to provide a free flow left turn slip lane onto the proposed on-ramp
 - widening to the west of Erskine Park Road northbound to provide a dedicated right turn lane onto the proposed on-ramp
 - reconfiguration of street lighting to accommodate road widening
 - road surfacing and line marking
 - modification of centre medians of Erskine Park Road and Roper Road to allow turning movements to the proposed on-ramp
- Works to construct the proposed on-ramp on the eastern side of Erskine Park Road (i.e. the G-loop):
 - construction of retaining wall (retaining wall A) between the proposed on-ramp and the M4 Motorway mainline east of Roper Road to contain fill and support the ramp formation
 - construction of a Type F barrier along the entry of the proposed on-ramp between the existing M4 westbound off-ramp and proposed on-ramp to contain fill and support ramp formation
 - construction of barrier systems on each side of the proposed on-ramp
 - construction of streetlights to provide required illumination of the proposed on-ramp
 - installation of pits and conduits to support street lighting and future installation of smart motorway technology
 - planting of vegetation on proposed on-ramp batters and in the middle of the G-loop
 - drainage upgrade including additional drainage infrastructure (pits and pipes) and upgrade of existing pipe and headwall discharging stormwater to Ropes Creek
 - road surfacing and line marking

- Works to construct the proposed on-ramp on the western side of Erskine Park Road (i.e. the merge lane onto the M4 Motorway westbound):
 - relocation of the existing flood mitigating earth mound located within the vegetated area along the existing M4 Motorway westbound lane
 - construction of barrier systems on each side of the proposed on-ramp
 - construction of streetlights to provide required illumination of the proposed on-ramp
 - installation of pits and conduits to support street lighting and future installation of smart motorway technology
 - planting of vegetation on the proposed on-ramp batters
 - drainage upgrade including additional drainage infrastructure (pits and pipes)
 - tie-in of the proposed on-ramp to the M4 Motorway westbound mainline pavement
 - road surfacing and line marking
- Works to excavate the existing bridge abutment beneath the Erskine Park Road bridge over the M4 Motorway:
 - importation of material to construct the proposed on-ramp formation
 - construction of retaining wall (retaining wall B) between the proposed on-ramp and the M4 westbound mainline beneath the bridge abutment to contain fill and support the on-ramp formation
 - construction of barrier systems on each side of the proposed on-ramp
 - construction of a protection structure around the southernmost piers of the Erskine Park Road bridge over the M4 Motorway
 - construction of new streetlights to provide required illumination of the proposed on-ramp
 - installation of pits and conduits to support street lighting and future installation of Smart Motorway technology
 - drainage upgrade including additional drainage infrastructure (pits and pipes)
 - tie-in of the proposed ramp to the M4 Motorway westbound mainline pavement
 - road surfacing and line marking.

The key features of the proposal are identified in Figure 3-1 to Figure 3-3, and typical cross sections of the proposed on-ramp are set out in Figure 3-4 to Figure 3-11 in Section 3.2.3 below.

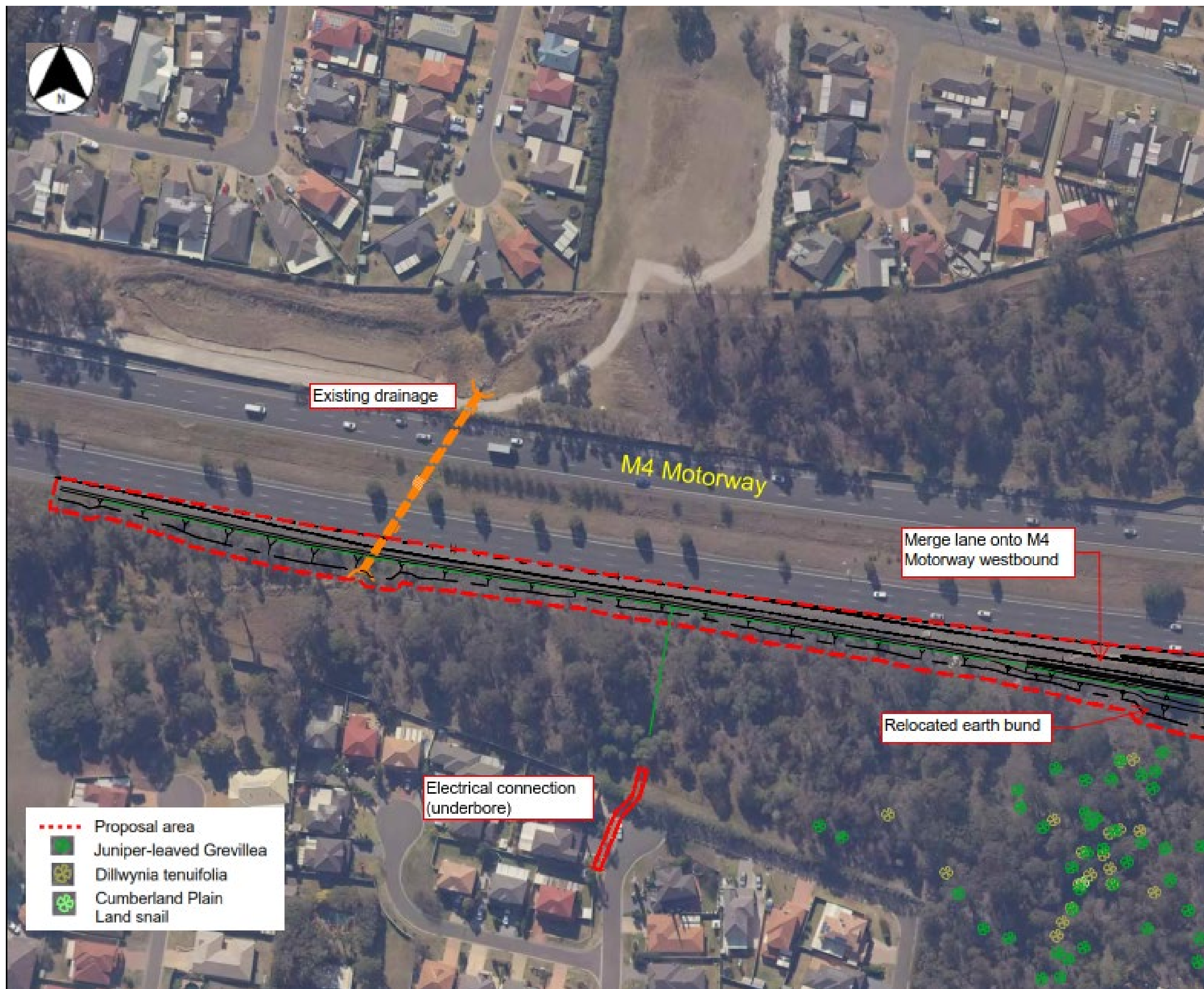


Figure 3-1: Features of the proposal - Merge lane to M4 Motorway section

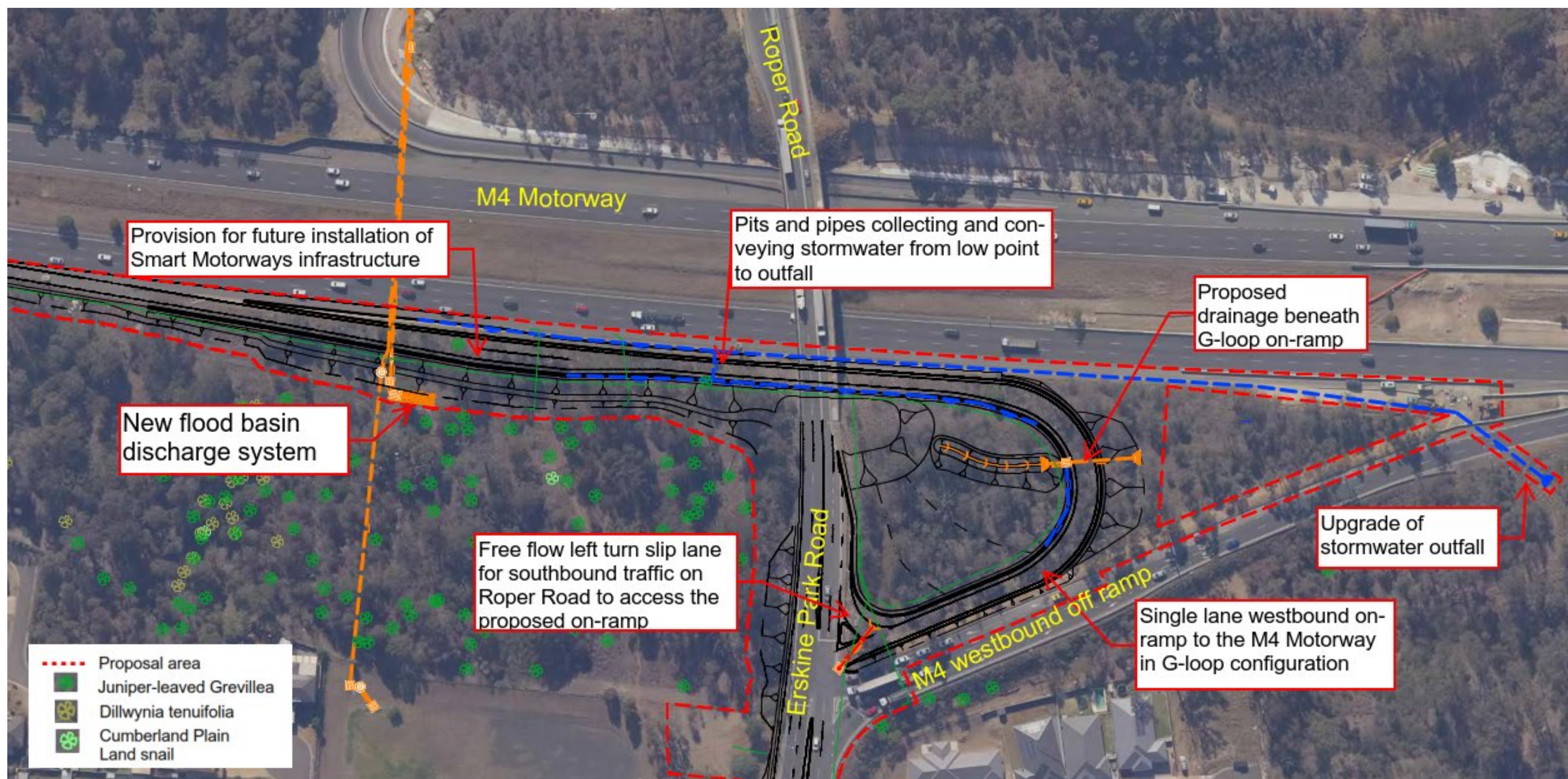


Figure 3-2 Key features of the proposal - G-loop on-ramp section

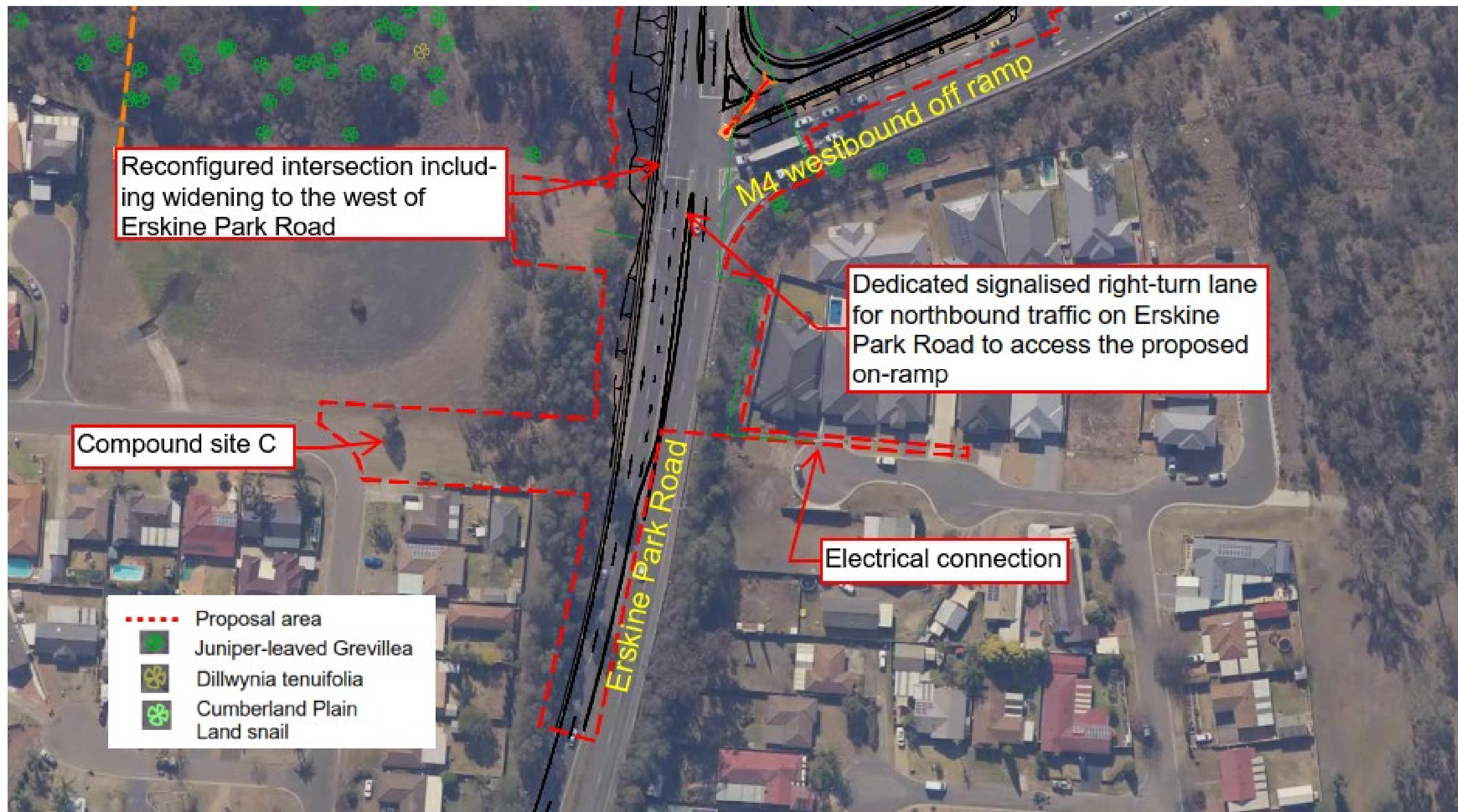


Figure 3-3 Key features of the proposal - Erskine Park Road section

3.2 Design

The proposal was designed to be consistent with Transport for NSW design criteria and other specifications including the requirements of this document. Key reference documentation is the Transport for NSW updates issued for use in conjunction with the *Guide to Road Design* (Austroads, 2009).

3.2.1 Design criteria

The current design of the proposal was prepared in accordance with the following standards:

- Information provided in project meetings and consultation with the Transport for NSW/ESCPO Manager, Network Operations team, Property team and Environment team
- Transport for NSW Quality Assurance (QA) Specification G1: Job Specific Requirements
- Transport for NSW Technical Directions
- Austroads Guides
- Transport for NSW supplementary documents to Austroads
- Australian Standards
- Published Roads and Maritime supplementary documents to Australian Standards
- Standards Australia handbooks
- Transport for NSW Traffic Signal Design Manual
- Penrith City Council Standards

The design criteria used for the development of the proposed design was based on existing speed limits, the current road requirements, Transport for NSW's heavy vehicle route map and the principle of not making the proposed situation any worse than the existing situation. The design values and criteria for the proposal are summarised in Table 3-1.

Table 3-1 Design values adopted for the proposal

Design Element	Design Value	
Design Speed	Erskine Park Road	70 km/h
	M4 Motorway	120 km/h
	Proposed on-ramp	35 km/h
Existing Posted Speed	Erskine Park Road	60 km/h
	M4 Motorway	110 km/h
Design Speed for Turning Paths	15 km/h	
Design Vehicle	Erskine Park Road	25 m B-Double
	M4 Motorway	25 m B-Double
	Proposed on-ramp	25 m B-Double
Check Vehicle	Erskine Park Road	35.4 m b-Triple
	M4 Motorway	35.4 m b-Triple
	Proposed on-ramp	35.4 m b-Triple

Design Element	Design Value	
Traffic lane widths	Erskine Park Road	3.5 m proposed turn lane, two 3.1 m existing traffic lanes
	M4 Motorway	3.5 m (existing lane width)
	Proposed on-ramp	Varying between 4 m and 7 m
Curve radius	35 m (Outside Curve), 28 m (Inside Curve)	
Horizontal alignment	3-5%	
Vertical alignment	Longitudinal grade (outside curve) – 5% Longitudinal grade (inside curve) – 6.5%	

3.2.2 Engineering constraints

A series of engineering constraints were identified during the development of the concept design. The following location-specific constraints have influenced the design of the proposal:

- The proposed G-loop is constrained to the east by the existing M4 Motorway and exit ramp
- The proposed on-ramp is constrained to the south by the Cumberland Plain Woodland containing several threatened species
- The tie-in to the existing M4 Motorway is constrained to the west by an existing integrated speed and lane use sign gantry, about 570 metres west of Erskine Park Road
- Widening on Erskine Park Road for a southbound free flow left turn slip lane to the entry ramp is constrained to the north by the existing bridge over the M4 Motorway
- Widening on Erskine Park Road for a northbound dedicated right-turn lane to the entry ramp is constrained to the west by the Cumberland Plain Woodland and threatened species
- The vertical geometry of the entry ramp is constrained by the clearance requirements to the underside of the existing bridge over the M4 Motorway superstructure
- The width of the entry ramp under the existing Roper Road bridge is constrained by the distance between the existing southern bridge abutment and piers
- The dedicated right-turn lane on Erskine Park Road is constrained by an existing VMS located approximately 80 metres south of Erskine Park Road and the M4 westbound off-ramp
- Existing properties south of the M4 Motorway and east of Erskine Park Road
- The existing batters of embankments within the proposal area may have existing utilities which prevent the batter from being reshaped, particularly to provide for construction access.

3.2.3 Major design features

Major design features are described below. Further details are included in the design drawings provided in Appendix C.

Horizontal and vertical alignment

The geometric design proposes a G-loop configuration on-ramp located to the north east of the existing Erskine Park Road / M4 westbound off-ramp intersection. The horizontal geometry has aimed to minimise the amount of vegetation clearance and bulk excavation required for the on-ramp. The vertical geometry

would tie into the existing road surface of Erskine Park Road and the M4 mainline to the west of the Erskine Park Road bridge over the M4 Motorway.

The free flow left turn slip lane for road users travelling southbound on Erskine Park Road to access the on-ramp would be accommodated through extending the existing embankment to the east, as shown in Figure 3-13. The turning lane would be 3.5 metres wide with two through lanes remaining which would both be 3.1 metres wide. The design vehicle for the on-ramp is a 25 m B-double.

The gradient of the on-ramp would be designed and constructed to provide a fall across the carriageway of between 3 and 7% through cut and fill to create an embankment with batter slopes of 1:2. Typical cross sections of the proposed on-ramp alignment are shown in Figure 3-4 to Figure 3-11.

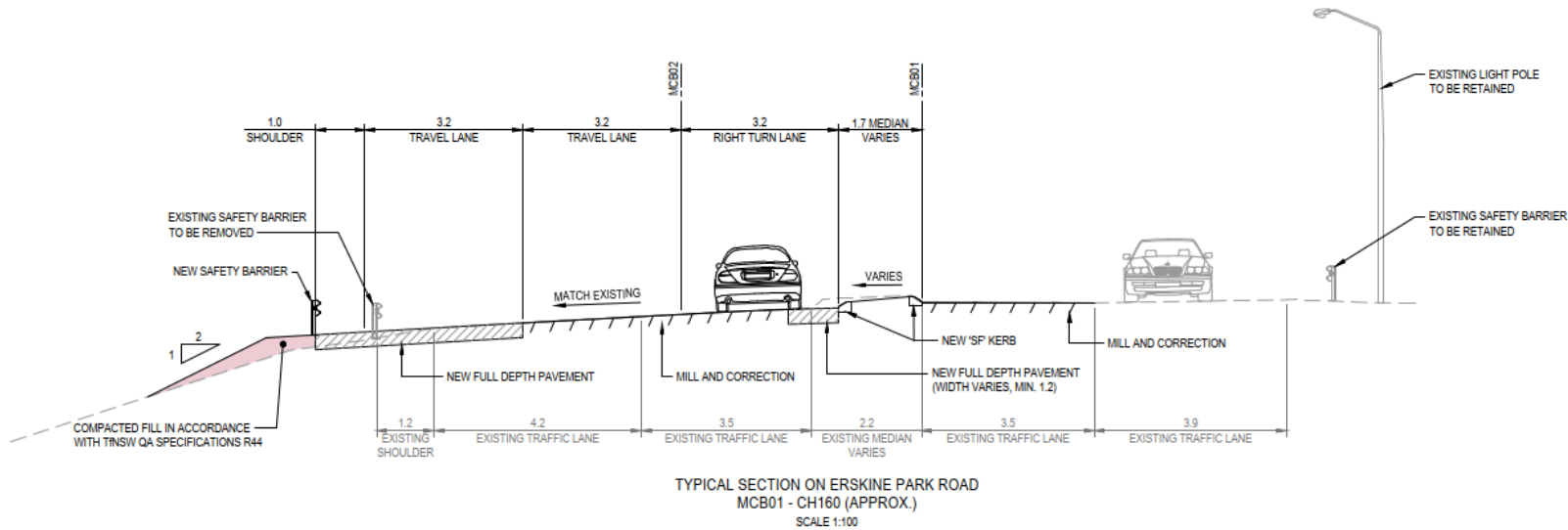


Figure 3-4 Typical cross section (looking north) on Erskine Park Road including the dedicated right turn lane onto the proposed on-ramp

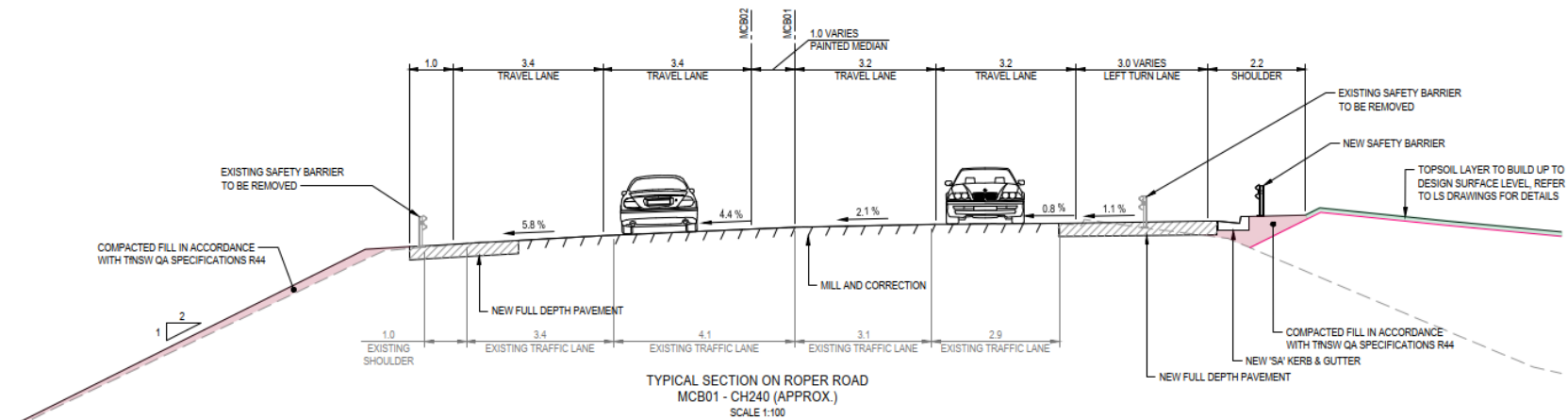


Figure 3-5 Typical cross section (looking north) on Roper Road including the free flow left turn slip lane onto the proposed on-ramp

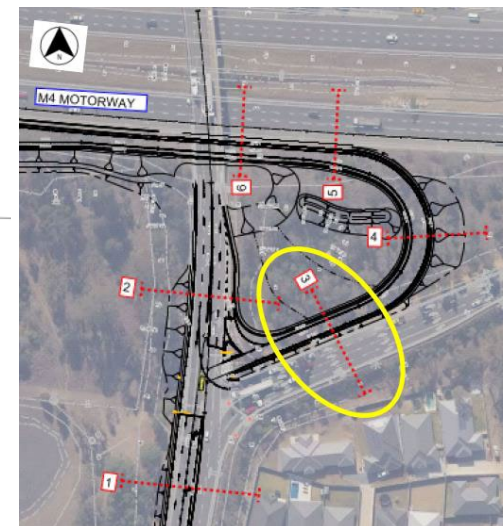
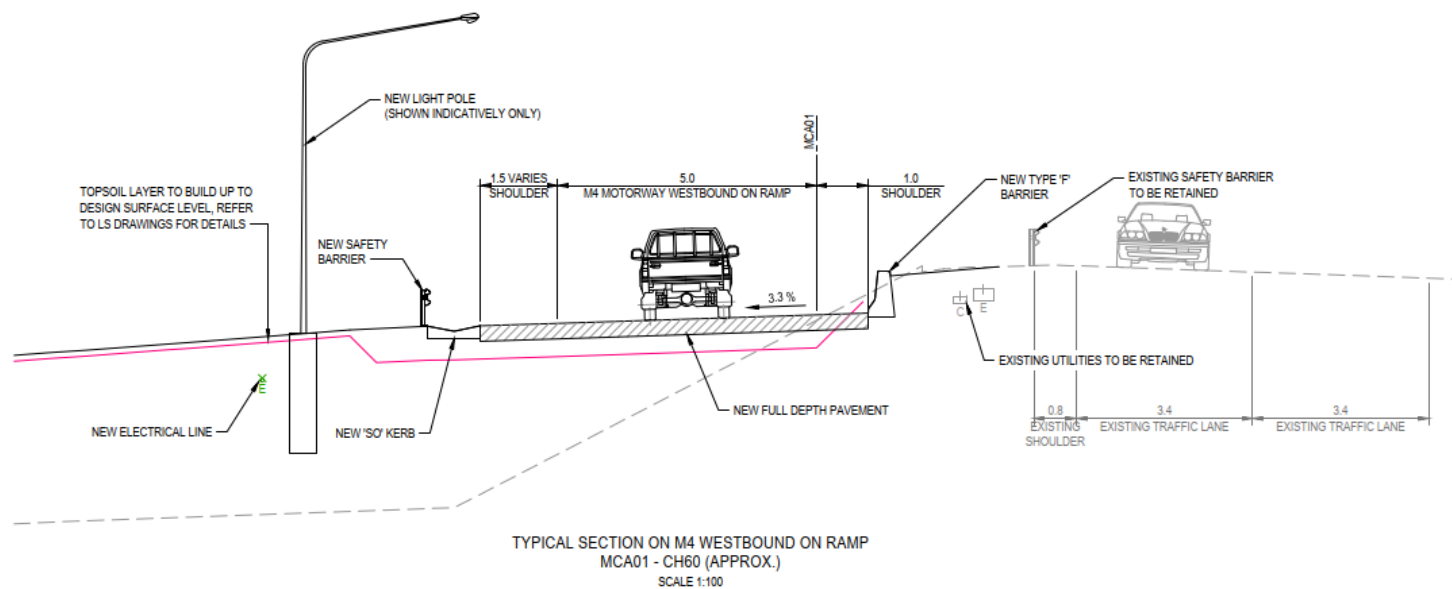


Figure 3-6 Typical cross section (looking north east) of the proposed westbound on-ramp (G-loop). Includes new Type F barrier

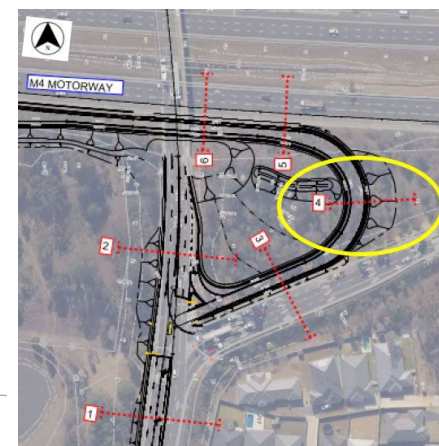
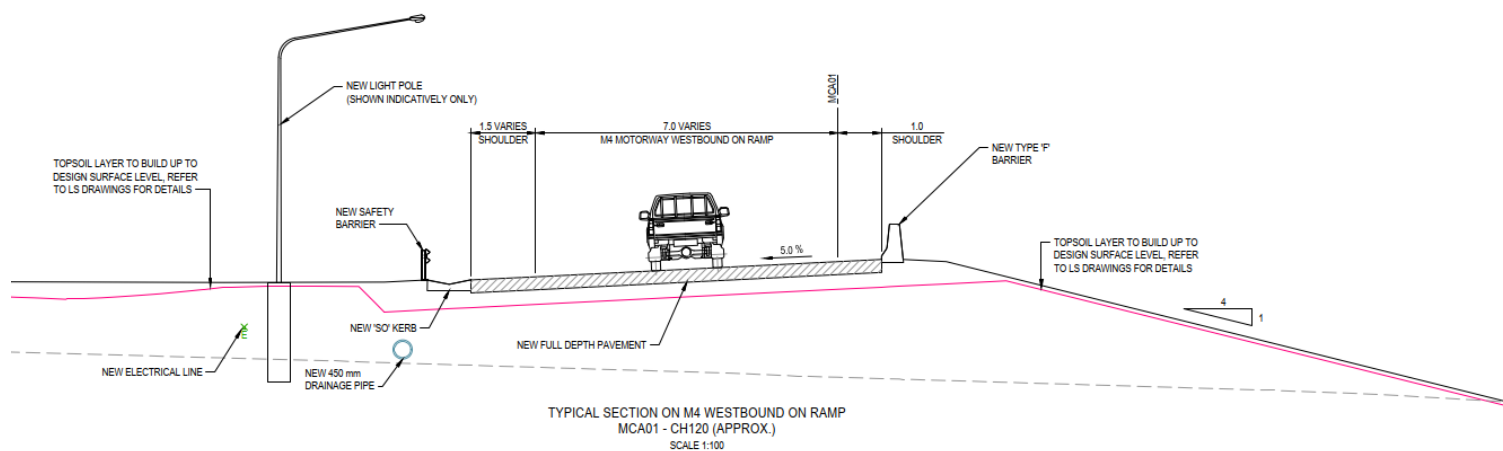


Figure 3-7 Typical cross section (looking north) of the proposed westbound on-ramp (G-loop)

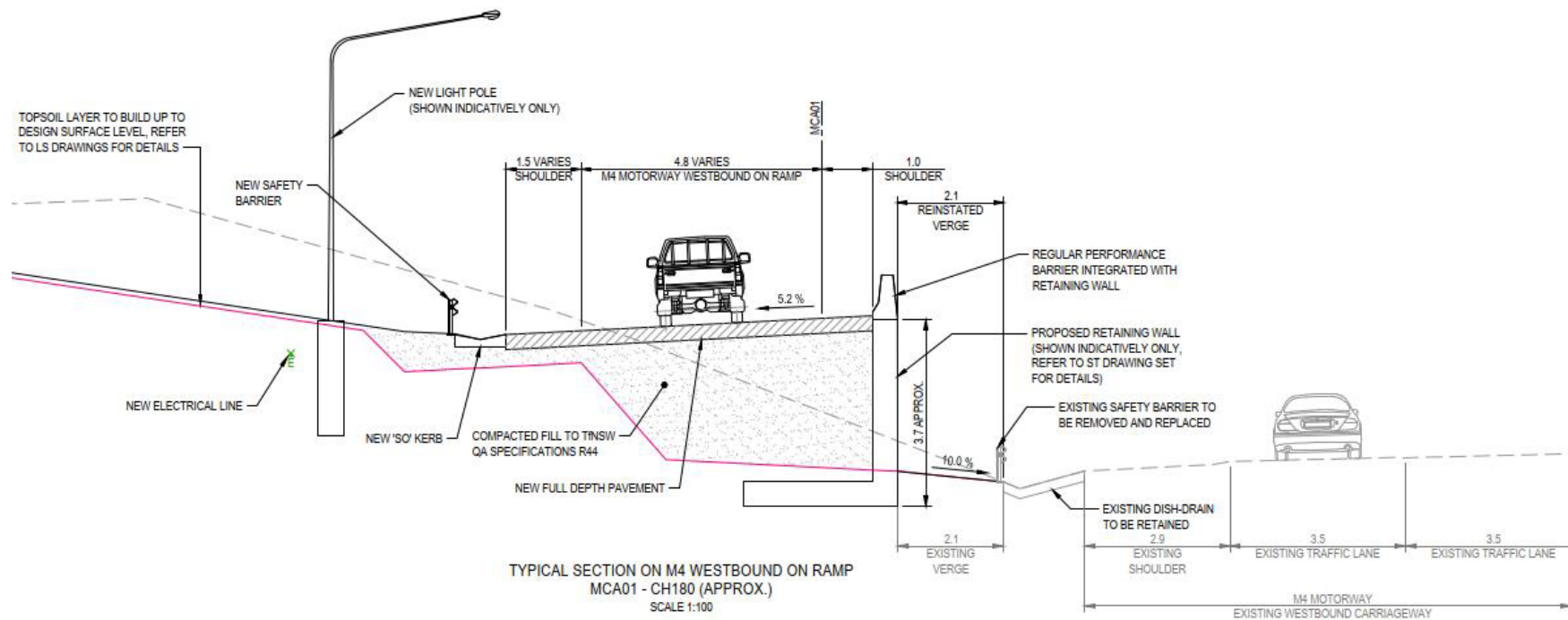


Figure 3-8 Typical cross section (looking west) on the proposed on-ramp including Retaining Wall A (L-shape retaining wall with Type-F barrier)

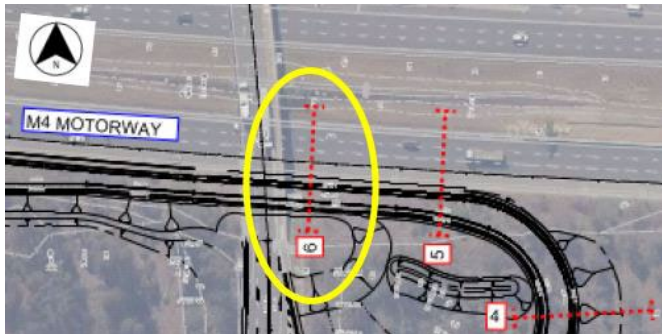
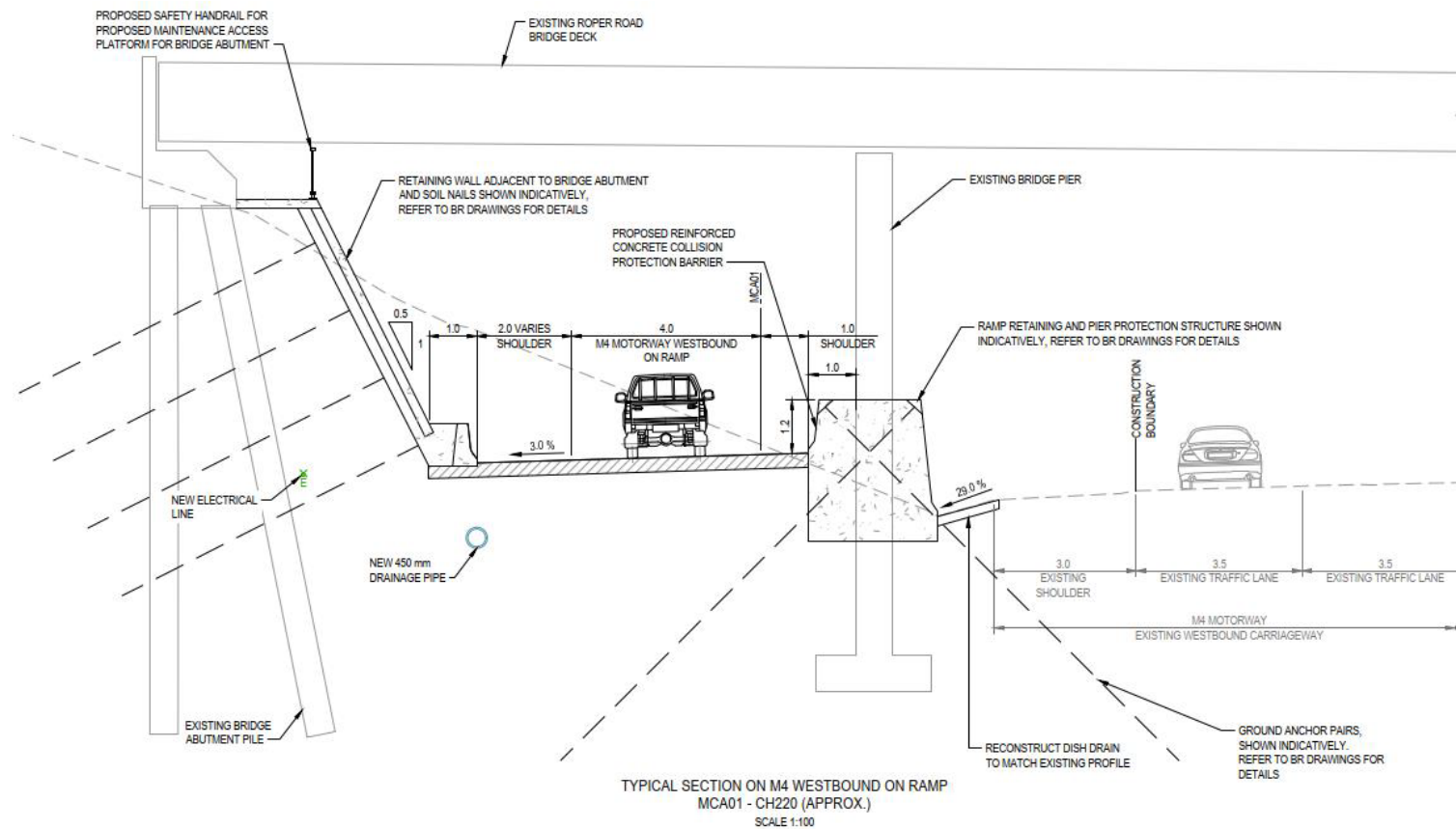


Figure 3-9 Typical cross section (looking west) on the proposed on-ramp under the Erskine Park road bridge. Includes Retaining Walls A (ramp retaining and existing pier protection) and B (adjacent to the bridge abutment).

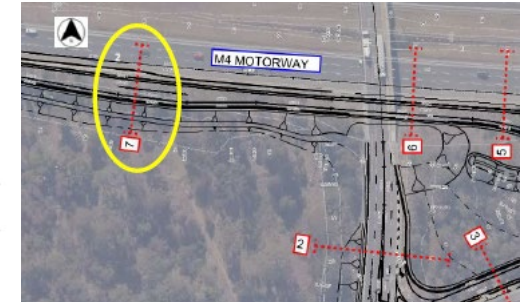
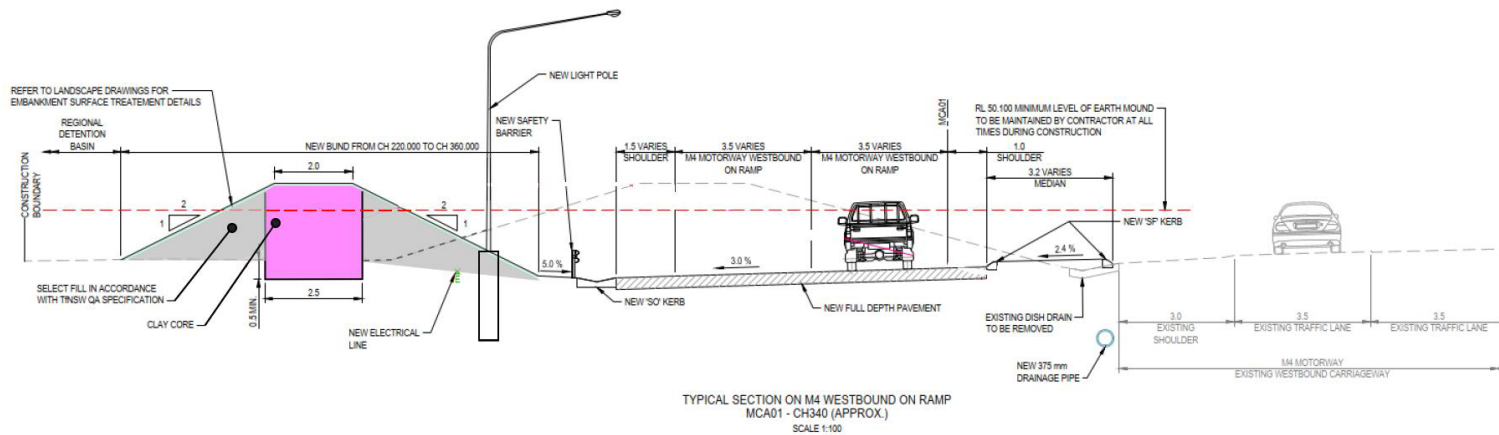


Figure 3-10 Typical cross section (looking west) on the proposed on-ramp (merge lane) including the proposed bund running along the southern extent of the M4 Motorway.

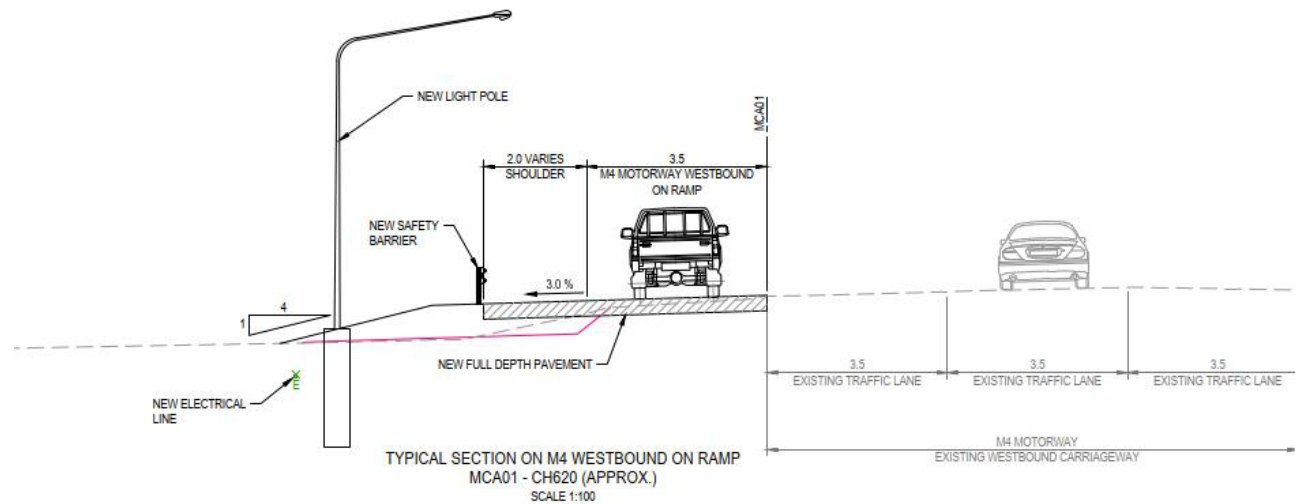


Figure 3-11 Typical cross section (looking west) on the proposed on-ramp (merge lane)

Retaining walls

Two retaining walls would be constructed to support the fill and on-ramp formation, being:

- Retaining Wall A: located along the northern edge of the G-loop on-ramp formation adjacent to the M4 mainline and adjacent to the abutment of the bridge over the M4 Motorway (refer to cross section in Figure 3-8 and Figure 3-9). The retaining wall would be required due to the limited space between the ramp and the mainline where embankment batter slopes could not be provided for. This retaining wall would be about 80 metres long and of a varying height between 0 metres and 3.5 metres as the ramp decreases in height to merge to the M4 mainline. This retaining wall would likely be an L-shaped retaining wall with Type F barrier at the top. At the mid-point of the G-loop, this retaining wall transitions to a Type F barrier which extends to the entry of the proposed on-ramp. The 60 metre long Type F barrier would be located between the M4 westbound off-ramp and the proposed on-ramp, supporting a level difference of up to 0.8 m (refer to cross section in Figure 3-7).
- Retaining Wall B: located beneath the existing bridge over the M4 Motorway. This retaining wall would be about 50 metres long and up to 5.5 metres in height. Refer to next section (Bridge works) and the cross section in Figure 3-9 for further details on Retaining Wall B.

Design of the retaining walls would be completed during detailed design. The approximate location of the retaining walls are identified in Figure 3-12.

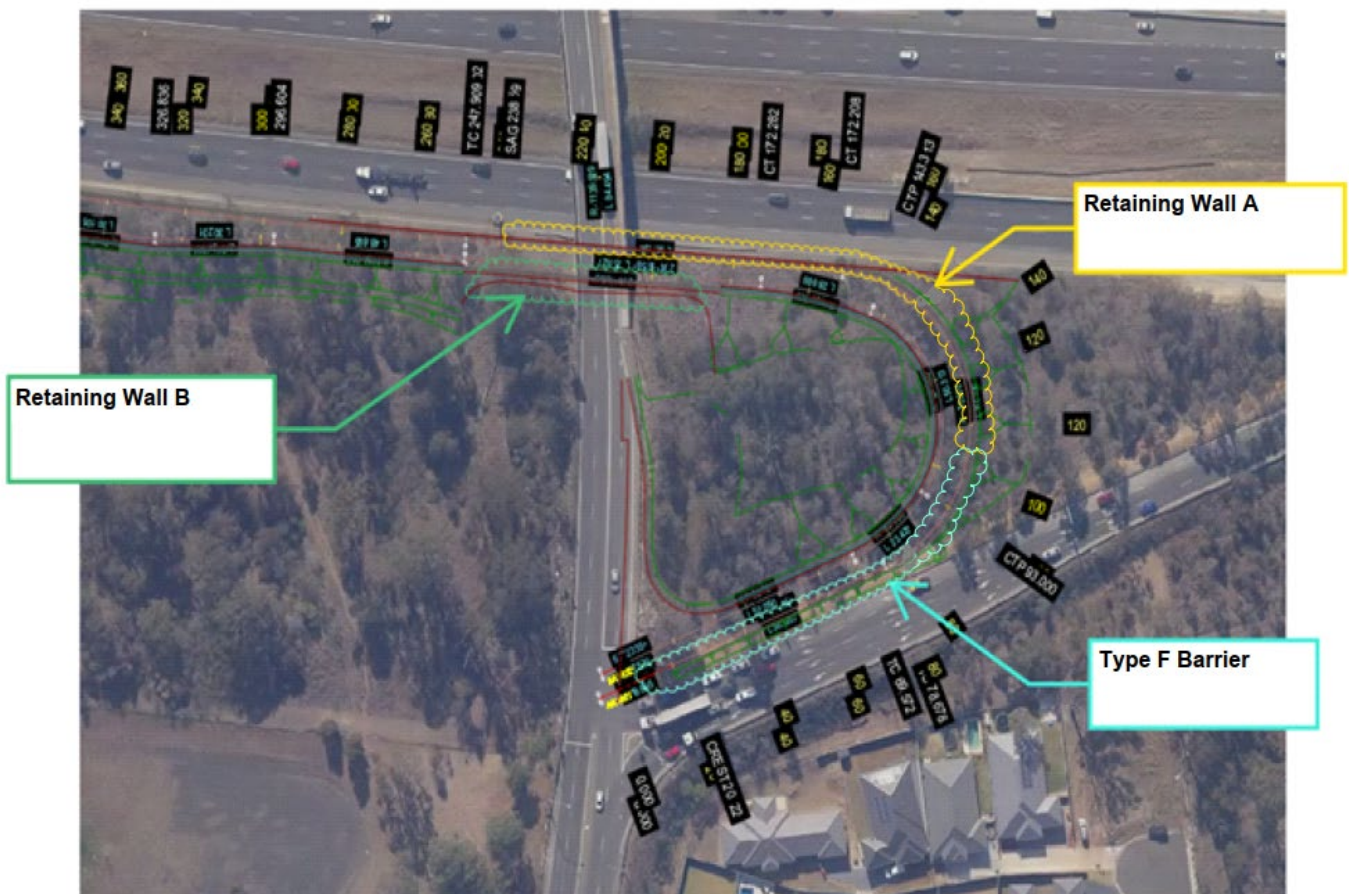


Figure 3-12 Location of proposed retaining walls.

Bridge works

The existing Erskine Park Road bridge over the M4 Motorway will require modification of the Southern spill through abutment to accommodate the alignment of the proposed on-ramp between the Southern abutment and first row of piers.

It is anticipated that due to the removal of a section of the spill through abutment soil strengthening of the existing ground between the abutment piers is required. The design of soil strengthening works will be refined in the detailed design stage and is likely to comprise of soil nails between the abutment piles, concealed with shotcrete or a fascia panel. A type F barrier will also be provided between the proposed on-ramp shoulder and the precast concrete panel.

Due to the proximity of the proposed on-ramp to the existing bridge piers, the retaining wall supporting the on-ramp under the bridge will be designed to provide protection for the piers from vehicle collision. Due to this significant design loading, it is likely that the retaining wall at this section would be a reinforced concrete wall supported on piles. These works will be refined in the detailed design stage.

Refer to Figure 3-9 for the cross section of the proposed on-ramp under the bridge with the proposed bridge works identified.

Road intersection configuration

The existing lane and intersection configuration would remain the same in this location with the exception of the following changes:

- Widening to the east of Erskine Park Road southbound to provide a free flow left turn slip lanes onto the proposed on-ramp
- Widening to the west of Erskine Park Road northbound to provide a dedicated right turn lane to the proposed on-ramp
- Reconfiguration of the north east corner of the intersection to accommodate the entry point to the proposed on-ramp from Erskine Park Road northbound
- Changes to the intersection signalling to provide for right turn movements from Erskine Park Road northbound to the on-ramp
- Future provision for ramp metering on the proposed on-ramp.

No changes are proposed to the northbound through lanes which are 4.0 metres and 3.4 metres wide as identified in Figure 3-4.

The turning movements at the intersection that would be provided for by the proposal are identified in Figure 3-13. It is noted that the turning movements out of the M4 westbound off-ramp are not a new turning movement.

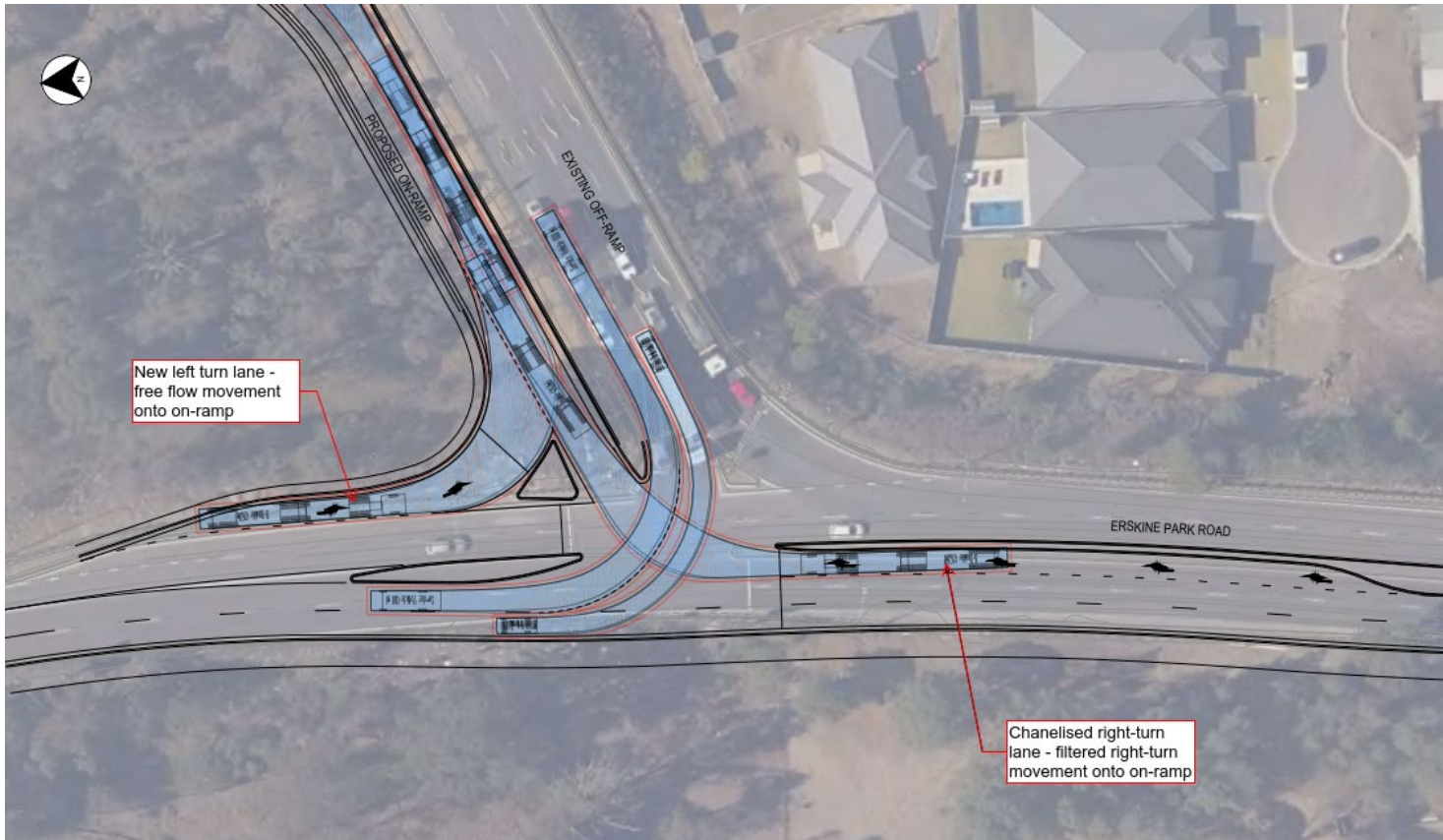


Figure 3-13 Proposal intersection configuration - M4 westbound off-ramp / proposed on-ramp and Erskine Park Road

Stormwater drainage

The proposed on-ramp creates approximately 5150 square metres of additional impervious area in the catchment.

The proposed on-ramp encroaches into an existing Transport for NSW owned flood detention basin on the south side of the M4 Motorway. The existing bund that enforces this basin would be removed and a relocated bund that provides the same capacity for flood containment as the current condition is proposed. The existing basin bund is surveyed at RL 50.0 m AHD. The relocated basin bund would be at 50.1 m AHD.

The proposed on-ramp and relocated bund also encroach on the area where the existing basin discharge system is located. Therefore, a new basin discharge system is proposed. Figure 3-14 identifies the extent of drainage works associated with the proposal and the drainage features are also identified in further detail in Figure 3-1 to Figure 3-3.

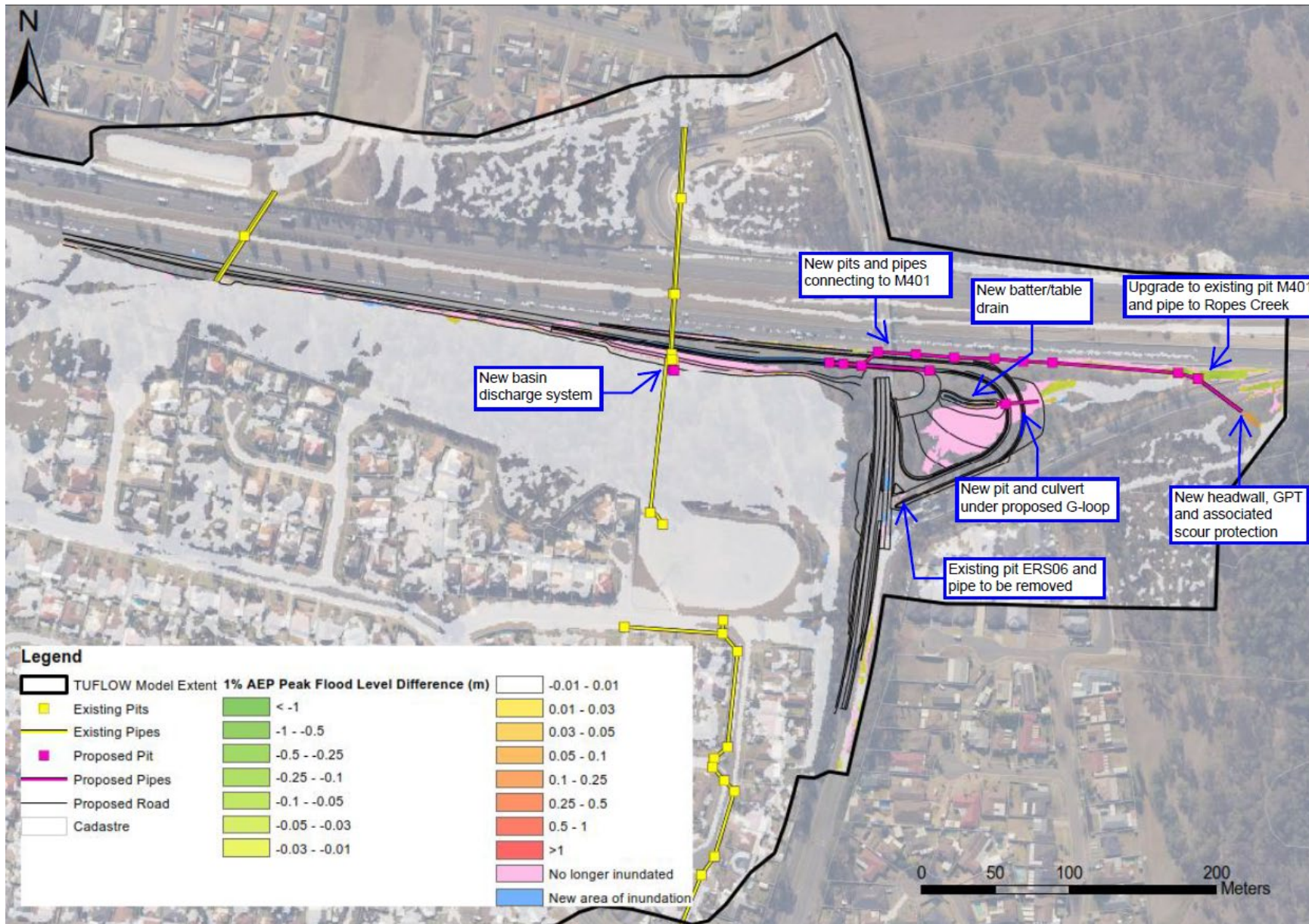


Figure 3-14 Extent of proposed drainage works

The drainage works proposed are identified on Figure 3-2 and include:

- A new basin discharge system as shown in Figure 3-15. This includes:
 - Extension of the 600 mm pipe and new 'glory-hole' pit
 - New low-flow drainage system at the new basin invert which would connect into the new glory-hole pit
 - Modification of the existing pits on the 525 mm pipe. Pits would either be adjusted to suit the new road surface or replaced with pipe to pipe connections.
- A new 600 mm culvert under the G-loop to allow the catchment within the G-loop to drain eastwards as it did in existing conditions. An S02 pit is proposed in the on-ramp kerb directly on top of this 600 mm pipe
- A batter drain to convey outflow from the existing 375 mm pipe at the M4 westbound off-ramp to Erskine Park Road and Roper Road, and Erskine Park Road intersection to the proposed culvert under the G-loop (refer to Figure 3-16 of proposed drain cross section)
- Removal of the existing pipe from pit EX ERS06
- A SO drain and SO pits and pipes along the G-loop kerb and on-ramp kerb
- Pits and pipes at the on-ramp sag point to prevent ponding
- A proposed pipeline from the on-ramp sag point to the existing pit east of the G-loop (EX M401).
- Upgrading the existing 375 mm pipe from pit EX M401. This pipe discharges into Ropes Creek and a new headwall, GPT and associated scour protection would be constructed

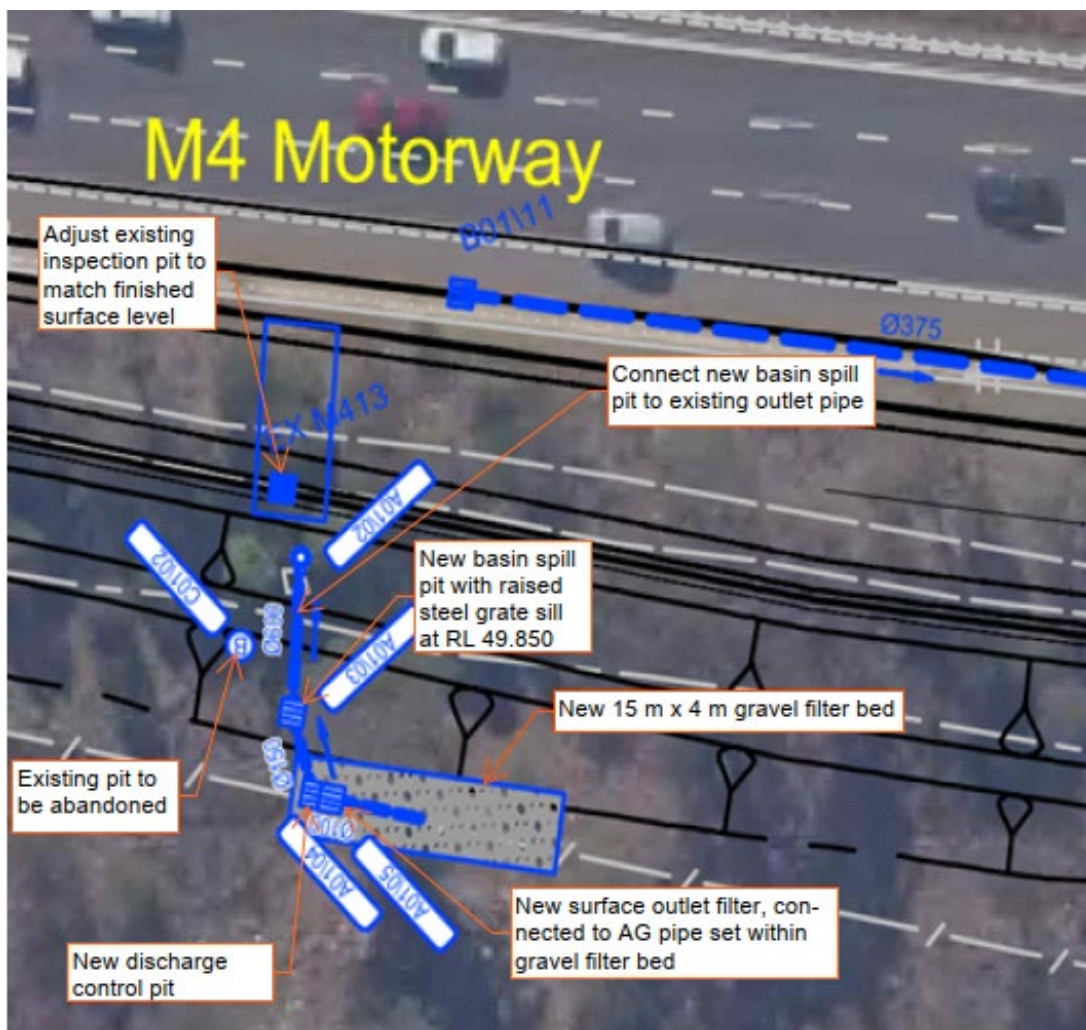


Figure 3-15 Proposed new basin discharge system

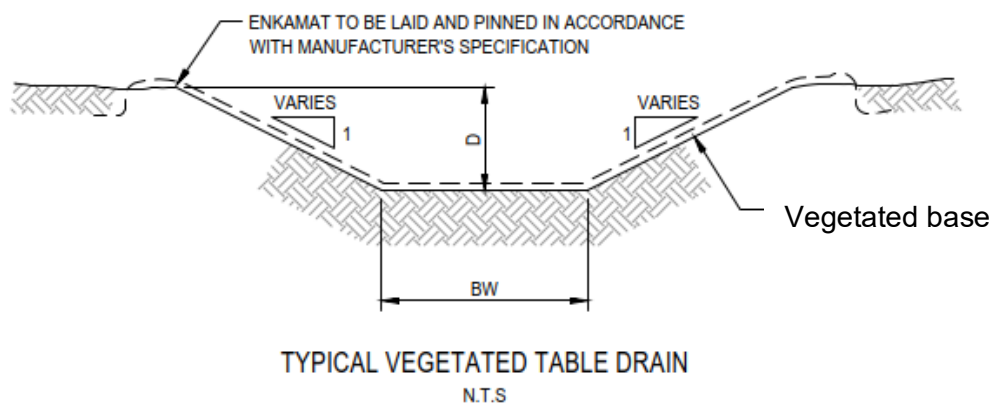


Figure 3-16 Cross-section batter drain proposed within centre of G-loop configuration

Signposting, lighting and pavement marking

Approximately 20 additional street light columns would be required within the proposal area with the location of each street light to be determined during detailed design. All street light columns would be located within the existing M4 Motorway area.

Signposting would include additional directional traffic and speed limit signage.

Pavement markings would be provided to suit the minor amendments to the Erskine Park Road intersection with the M4 westbound off-ramp and the proposed on-ramp.

Urban Design and Landscaping

The urban design of the proposal would be completed during detailed design and would include the following considerations:

- Guide and review the design of all proposed urban design components and interfaces including safety barriers, retaining walls, bridge abutments, noise walls, signage, road furniture and batters to ensure they are legible, logical and coordinated
- Ensure the proposal is integrated with the existing environmental context
- Ensure the proposal provides a positive impact to the surrounding community, and protection of threatened flora and fauna
- Provide treatments (both temporary and permanent) that are durable, fit for purpose, maintainable and appropriate to the environmental conditions which would include selection of materials for urban design elements, applied finishes and landscape treatments.

The landscape works would include:

- Revegetation and planting of disturbed areas and 4H:1V and 2H:1V batters with endemic species, where possible to provide a robust and low maintenance landscape outcome
- Provide appropriate treatment to engineered batters to ensure they are stabilised and minimise erosion
- Where possible establish tree planting within the project boundary close to the road carriageway (behind safety barriers) to remove carbon dioxide, reduce impacts of heat island effect and improve drainage by absorbing stormwater runoff

- Ensure the proposed works are integrated and responds to the surrounding landscape context, both in species and its arrangement to provide resilient ground cover, mid-storey and upper canopy vegetation layers
- Develop an ongoing maintenance program that provides the greatest opportunity for plant establishment and self-management of landscape works that minimises long term maintenance requirements.

3.3 Construction activities

3.3.1 Work methodology

Construction activities would be guided by a Construction Environmental Management Plan (CEMP) that would be developed in accordance with the requirements of the Transport for NSW QA Specification G36 Environmental Protection (Management System). Work would be located within the proposal area identified in this REF and completed to incorporate all safeguards as described in this REF and any other relevant Transport for NSW environmental specifications. A Construction Environmental Management Plan (CEMP) would be developed outlining the methods for managing and minimising environmental impacts. Detailed work methodologies would be determined during detailed design and construction planning stage. The proposed work methodologies are described below.

The proposed construction works and methodology provided is indicative and based on the current concept design and would be further developed during detailed design. Detailed construction staging plans and methodologies would be developed by the construction Contractor(s) after completion of the detailed design. In the event that construction activities result in environmental impacts above those assessed in this REF, further environmental assessment would be required and approved by Transport for NSW prior to works commencing.

Construction works would be expected to involve the following methodology in general:

- Prior to any construction works occurring:
 - Undertake pre-condition survey on any private properties identified as directly impacted by the works
 - Obtain required working approvals from network authorities (including Traffic Management Centre (TMC) and Penrith City Council)
 - Notify adjacent residences of proposed work activities
 - Establish temporary fencing to secure work site (ATF fencing and/or traffic barriers to re-direct pedestrians and traffic using appropriate directional signage)
 - Establish traffic control at worksite including the supply of Variable Message Signs (VMS), installation of traffic management measures such as placing safety barriers and installing temporary traffic control signs in accordance with the traffic control plans
 - Establish environmental controls, including identification and marking of sensitive areas as identified in the REF and the CEMP and installation of a hard barrier around sensitive areas west of Erskine Park Road and west adjacent the M4 access ramp.
 - Identification of underground services, e.g. through potholing
 - Surveying and establishment of any underground services
- Implement the initial environmental controls in accordance with the Erosion and Sediment Control Plan associated with the works. The proposal works would commence with clearing and grubbing of the G-loop configuration east of bridge over the M4 Motorway with erosion and sediment controls in place prior to proceeding. Erosion and Sediment Controls are a developing component of the

project lifecycle with enhancements and/or implementation pending outcomes of Environmental Inspections and new areas commencing.

- Prior to undertaking any vegetation clearance an ecologist report and pre-clearing survey in accordance with *Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) would be completed and exclusion zones set up in accordance with *Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).
- Vegetation removal (clearing and grubbing) would commence following the establishment of Environmental, Traffic and Safety Controls as significant plant and equipment will begin disturbing the natural conditions within the associated work area. Tree removal and vegetation within the allocated footprint will be demolished with the intention to produce re-useable materials such as mulch for potential control measures as the project develops.
- Stripping topsoil would commence once vegetation cleared and the depth would depend on the prior extent of vegetation e.g. heavily vegetated areas may require up to 200 millimetres of topsoil stripping. Material disposal would be minimised by stockpiling reusable materials where ever possible.
- Bulk earthworks would be associated with excavation of road pavements, medians and road verges, utility relocations and upgrades, retaining wall/bund reconstructions and pavement installation as part of the road widening and ramp construction works. The Contractor would introduce large plant and equipment to effectively perform this work in association with a Cut/Fill Methodology. The intention would be to minimise material disposal and material importation through strategic hauling efforts and using as much material in the cut areas to avoid material mismanagement.
- Utility adjustments as required for protection or relocation of services. Within the proposal area are low to medium pressure gas mains, electrical mains, telecommunications, and water services.
- Drainage works would include the construction of drainage systems and the extension of existing drainage, located with the G-loop configuration, the existing discharge point to Ropes Creek, installation of pits and changes to the stormwater basin discharge system. Construction of the drainage works would include trenching, removal of existing pipes, concrete encasement of existing pipes, construction of batter drains and outlet works.
- Pavement works that include select fill, subbase, base course and asphalt wearing surface.
- Bridge works (excavation below the existing abutment) and the construction of retaining structures would occur below the Erskine Park Road bridge over the M4 Motorway to enable continual earthworks to subgrade level.
- Kerb and gutter construction with standard SA kerbs with SA1 and SA2 kerb inlets to tie in with the drainage works.
- Installation and modification of permanent traffic control signals.
- Installation of line marking and signposting.
- Landscaping work.
- Site clean-up and rehabilitation of temporary work areas including site compound rehabilitation.

The works will occur at times dependent on the nature and duration of the works, availability of permits to access roads for works, weather conditions and potential noise impacts on surrounding receivers.

Works are planned to occur in the following two stages:

Stage 1 (Early Works)

- Site Establishment:
 - Submission of all the required Management Plans including the CEMP and ESCP

- Notification of adjacent residences of proposed work activities
- Possession of site and setting out of office facilities
- Induction of personnel onto site
- Establishment of Traffic Management Systems (existing traffic layout maintained during this phase)
- Establishment of environmental controls in accordance with the ESCP for the associated works.
- Survey and Site Investigation:
 - Submission of dilapidation reports, condition surveys etc.
 - Establishment of construction footprint, benchmarks and known utilities model
 - Establishment of exclusion zones around environmentally sensitive areas
 - Investigation works including utility location verification by potholing and waste classification assessment
 - Removal of emergency telephone TEL 373 and relocation of this telephone to the existing maintenance bay 400 metres to the east of its current location.
- Clearing and Grubbing:
 - Submission of ecologist report and pre-clearing assessment to confirm footprint
 - Establishment of necessary access/egress points (probably temporary ramps from Erskine Park) for plant and equipment to enter/exit safely
 - Clearing and grubbing of vegetation within the proposal area
 - Stockpiling of mulch for reuse onsite and potentially dispose of surplus mulch
 - Stripping of the topsoil.
- Commence construction on the eastern side of Erskine Park Road (i.e., G-loop and Type F barrier):
 - Establishment of necessary access/egress points for plant and equipment to enter/exit safely
 - Bulk earthworks down to approximate subgrade level and shape the extent of the G-loop with the Early Works package design
 - Construction of the transverse drainage line within the G-loop that will be below subgrade level
 - Commence construction of the Type F barrier, to continue as part of Stage 2 (Main Works)
 - Stabilisation of the area to mitigate ponding and subgrade disturbance until Stage 2 Main Works is ready to commence.
- Exclusion zone to be maintained for Stage 2 Main Works

Stage 2 (Main Works)

- Site Establishment, similar activities as those outlined for Stage 1
- Survey and Site Investigation, similar activities as those outlined for Stage 1:
 - Also to include establishment of exclusion zones around environmentally sensitive areas using a hard barrier works on western side of Erskine Park Road and west adjacent the M4 access ramp
- Clearing and Grubbing, similar activities as those outlined for Stage 1
- Continuation of construction on the eastern side of Erskine Park Road (i.e., G-loop, Type F barrier and Retaining Wall A):
 - Reinstatement of the work area and removal of any controls that were implemented between Stage 1 and Stage 2
 - Continue earthworks and shaping the carriageway

- Utility adjustment works including low pressure gas main adjustment, electrical supply for streetlighting and possible utility relocation works
- Shaping and protection of the batters to mitigate any damage on the pavement construction process
- Drainage works including construction of longitudinal drainage and subsoils, trench drains, interface drains, drainage risers, etc.
- Construction of pavement layers including kerb and gutter works
- Construction of barrier systems including the Type F barrier and Retaining Wall A (refer below).
- Construction on the western side of Erskine Park Road (i.e. ramp merge side) and under the existing bridge over the M4 Motorway in conjunction with Retaining Wall A and B:
 - Continuation of earthworks from the Clearing and Grubbing phase
 - Utility adjustment works including any ITS works
 - Transverse drainage works below subgrade level
 - Relocation of the flood mitigating earth mound without compromising existing protection measures and levels
 - Shaping and protection of the batters to mitigate any damage on the pavement construction process
 - Drainage works including construction of longitudinal drainage and subsoils, trench drains, interface drains, drainage risers, etc.
 - Construction of pavement layers including kerb and gutter works
 - Construction of barrier systems including Retaining Wall A and B (refer below).
- Type F barrier
 - Shaping and protection of the existing batters to ensure sufficient workspace and protection of motorists on the existing M4 westbound off-ramp
 - Check conformance of the subgrade and ensure bearing capacity of the ground is achieved
 - Formation and installation of steel fabrication for the structure
 - Pour concrete and await sufficient strength before stripping the formwork
 - Continuation of pavement construction along the Retaining Structure.
- Retaining Wall A
 - Check conformance the subgrade and ensure bearing capacity of the ground is achieved
 - Formation of the Retaining Structure
 - Pour concrete and await sufficient strength before stripping the formwork
 - Continuation of pavement construction along the Retaining Structure.
- Retaining Wall B
 - Establish controls to protect the existing batters under the bridge over the M4 Motorway
 - Establishment of temporary levels to perform batter stabilisation works such as soil nails or anchors before constructing Retaining Wall B
 - Retaining Wall construction in the upper levels and progressively lower the temporary construction platforms under ground levels can be tested for bearing capacity
 - Continuation of pavement construction along the Retaining Structure.
- Intersection Upgrade
 - Likely to commence on the Intersection upgrade once the ramp construction levels have reached at least base level and all retaining wall structures are complete.
 - Installation of permanent underground networks for the final Intersection configuration

- Remove and replace existing medians with temporary barriers
- Construction of the proposed islands
- Modification of kerb and gutters and footpaths at the above intersection
- Utility works including any electrical streetlighting, power poles, ITS works, etc.
- Installation of any road furniture
- Mill and re-sheeting and/or other rehabilitation works such as heavy patching at the intersection.
- Drainage pipe under the existing westbound off-ramp and outlet into Ropes Creek upgrade
 - Fast lane closure on the off-ramp in order to safely access the area
 - Clearing/grubbing the width of the outlet corridor
 - Excavation from the headwall towards the fast lane of the off-ramp
 - Lay or pour the headwall in situ and lay the rip rap
 - Lay pipe and progressively backfill to the overlay zone of the pipe
 - Lay pipe beneath the off-ramp. Single-lane closure required with reduced speed to 40 km/hr
 - Reconstruct pavement layers
 - Repeat on other lane
- Completion Phase
 - Traffic Signal Control implementation
 - Final wearing course along the existing intersection and the proposed on-ramp
 - Final line marking
 - Final landscaping
 - Repair of any defects prior to final walk through
 - Removal of temporary roadside barriers and environmental controls
 - Final walkthrough and handover.

Stage 1 works would be undertaken during the day where possible however where works are in proximity of the M4 Motorway mainline which will necessitate closure of M4 lanes, for worker and motorist safety works will need to be undertaken as night works. Stage 2 works would require works at night for some construction activities, such as the installation of line-markings and construction of pavement directly adjacent to the M4 Motorway westbound mainline.

3.3.2 Construction workforce

The construction workforce would vary depending on the phase of construction and associated activities. A typical on-site workforce of around 20 to 40 people is estimated during the construction period, with a maximum of 60 workers per day during peak construction periods.

3.3.3 Construction hours and duration

The anticipated duration for construction of the proposal is expected to take up to 18 months with works commencing in mid-2021.

Aspects of the work would be done during standard construction hours:

- Monday to Friday: 7:00 am to 6:00 pm
- Saturday: 8:00 am to 1:00 pm
- Sunday and public holidays: No work

Where required to minimise disturbance to daily traffic and to ensure the safety of workers, it would be necessary to carry out aspects of the work outside of the standard working hours. Works outside of standard construction hours would be between 6:00 pm to 5:00 am, up to five nights per week from Sunday to Thursday (excluding public holidays) and in accordance with the Road Occupancy License (ROL) issued by TMC. Noisier activities such as jackhammering and concrete cutting would be completed by midnight.

Approval from Transport for NSW would be required for out of hours works and the affected community would be notified of the proposed construction hours at least five working days prior to works commencing in accordance with the *Construction Noise and Vibration Guideline* (Roads and Maritime, 2016) and *EPA Interim Construction Noise Guideline* (ICNG) (DECCW, 2009). They would be provided with works details and contact information if there are any issues.

A noise and vibration assessment has been carried out for the proposal which assesses the potential noise impacts from construction activities. Refer to Section 6.2 and Appendix H for details.

3.3.4 Plant and equipment

Equipment proposed to be used for the proposal includes but is not limited to:

- Light vehicles
- Medium rigid vehicles
- Heavy rigid trucks
- Chainsaw, leaf blowers
- Scissor lift / boom lift truck
- Tree mulcher / wood chipper
- Delivery truck / concrete truck
- Road sweepers
- Water trucks
- Cherry pickers
- Kerbing machine
- Concrete cutting / road saw
- Generator
- Jackhammer
- Tracked excavator (7-20T)
- Skid steer / bobcat
- Milling machine / road profiler
- Asphalt paver
- Road roller
- Generators
- Asphalt delivery trucks
- Underbore equipment - pipe jacking machine and drill
- Small crane (fanners)
- Survey equipment
- Backhoes
- Graders
- Scrapers

- Air compressors
- Vacuum truck.

3.3.5 Earthworks

The majority of earthworks would be associated with the construction of the embankment for the proposed on-ramp carriageway, minor widening of the existing embankment to the east of Erskine Park Road southbound and excavation would also be required below the existing bridge abutment. Minor earthworks would be required for; medians and road pavements, retaining wall construction, utility relocations and upgrades, retaining wall/bund reconstructions and pavement installation as part of the road widening and ramp construction works. The areas of bulk cut and fill associated with the proposal are identified in Figure 3-17 and Figure 3-18. Minor earthworks may be required to the west of Erskine Park Road to widen the northbound carriageway to provide for the separate right turn lane.

Approximately quantities of materials are as follows:

- Topsoil stripping – 1,700 cubic metres
- Cut – 7,000 cubic metres
- Fill – 11,800 cubic metres
- Balance of 4,800 cubic metres

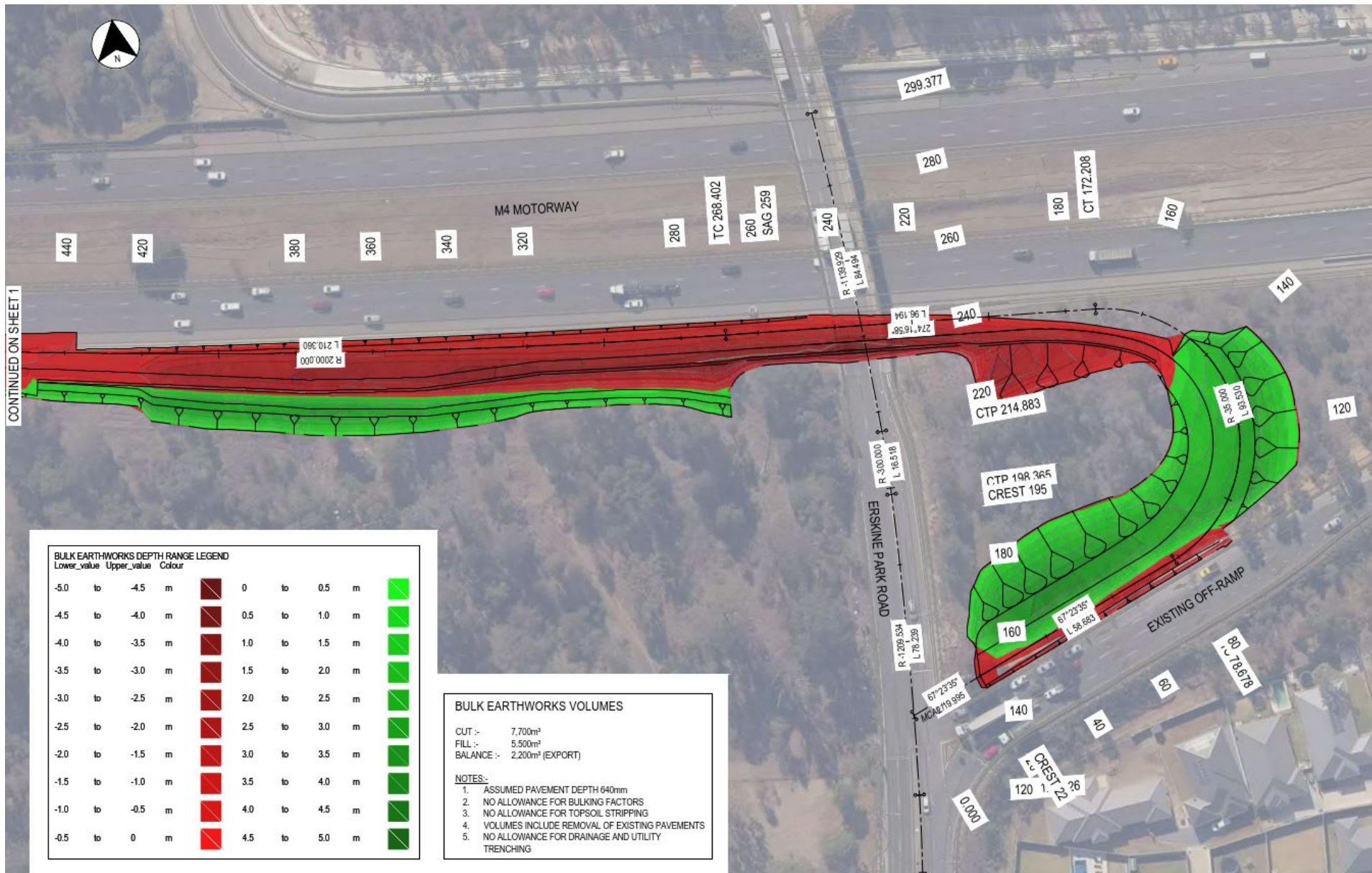


Figure 3-17 Areas of cut and fill (G-loop on-ramp section)



Figure 3-18 Areas of cut and fill (M4 merge lane and shoulder section)

3.3.6 Source and quantity of materials

The following materials required for the construction of the proposal are:

- Topsoil (removal and/or reinstatement)
- Earthworks cut for road pavement for disposal off site
- Imported materials from beyond the proposal area
- PVC pipes to carry power, communication and signalling cables
- Stormwater precast concrete and fibre reinforced drainage pipes
- Kerbs and gutters
- Pavement (sub-base and base)
- Heavy duty asphalt
- Concrete paving (medians and footpaths)

The source and quantity of materials would be determined during the detailed design phase of the proposal and would consider the requirements of the *NSW Sustainable Design Guidelines – Version 3.0* (Transport for NSW, 2013). Materials would be sourced from local suppliers where practicable. Reuse of existing and recycling materials would be undertaken where practicable. Stockpiling of materials would be required on site at the proposed construction site compound.

The road pavement materials would be sourced from appropriate licensed facilities (e.g. quarries). The demand for resources would be separated into the various stages of construction works.

Surplus or unsuitable material that cannot be used on-site would be classified in accordance with the *Waste Classification Guidelines* (EPA, 2014) and disposed of at an approved materials recycling or waste disposal facility.

3.3.7 Water use

Water would be required for activities such as the compaction of earthworks. The use of materials such as ready-mix concrete (required for pavement and kerbs) would reduce the amount of water required during construction. Water would also be required for compaction of pavement layers, such as select layers to adjust the moisture content, and for dust suppression. Required quantities of water are not yet known and would be calculated during detailed design. However it is estimated approximately 15,000 litres of water may be required each week during peak construction. Water for the work would be sourced from available hydrants in the area, authorised off-site sources, including recycled, re-used water or groundwater bores with appropriate licenses.

3.3.8 Traffic management and access

Vehicle and pedestrian movements

Construction of the proposal would generate heavy vehicle movements. These heavy vehicle movements would mainly be associated with:

- Delivery of construction materials
- Spoil removal and disposal
- Delivery and removal of construction equipment and machinery.

Construction vehicles would access the site via M4 westbound lane, M4 westbound off-ramp, Erskine Park Road northbound slow lane and Roper Road southbound slow lane. Light vehicles and foot traffic would also access the site via Augusta Place. The proposed ingress and egress movements are identified in Figure 3-19. Light vehicle movements would be required for the movement of construction personnel, including contractors, site labour force and specialist supervisory personnel. It is expected that construction staff accessing the construction site would use a combination of public transport and personal light vehicles.

Heavy vehicles would be required on-site on a daily basis to deliver materials and equipment to the proposed work area and compound site(s), and to transfer construction materials to nominated stockpile sites within the proposal area. In addition, small vehicles would be required to transport staff in and out of the site per day. Small vehicles used to transport staff to and from the site would generally park at the construction compound or site office, however some may need to be parked close to the work sites for transporting workers and smaller materials between work sites (refer to Section 3.4). Construction traffic consisting of light vehicles and plant within the works area would generally avoid peak traffic conditions, however some heavy vehicle movements to support cut/fill operations may be required during peak hours. As there is limited pedestrian access between the works area and site compounds for workers there would be an increase in traffic between the compounds and works area. Due to the existing levels of congestion in the surrounding road network, the volume of construction traffic to and from the proposal area and between the proposed site compounds would have minor impacts on general traffic.

All road users in the area of the site are likely to be impacted throughout construction of the proposal. Construction would be arranged to generally allow the Erskine Park Road / M4 westbound off-ramp intersection to remain open to traffic with limited lane closures in place during specific construction works e.g. construction of southbound left turn lane onto the proposed on-ramp. Speed reductions on the M4 westbound would be required for worker and motorist safety. It is expected that, subject to TMC approval, the speed on the M4 westbound for approximately 1.5 kilometres immediately adjacent to the works site would be reduced to 80 kilometres per hour for the duration of the project. It is not expected any re-routing will be required during the construction works. There are no driveway accesses affected by the proposed works and there is no pedestrian or cycling facilities within the proposal area. Therefore provision will not be made for the re-routing of pedestrians or cyclists.

There would be no change to bus services that use the Erskine Park Road – Roper Road corridor.

Traffic and transport impacts associated with the construction of the proposal are assessed in Section 6.2 of this REF.

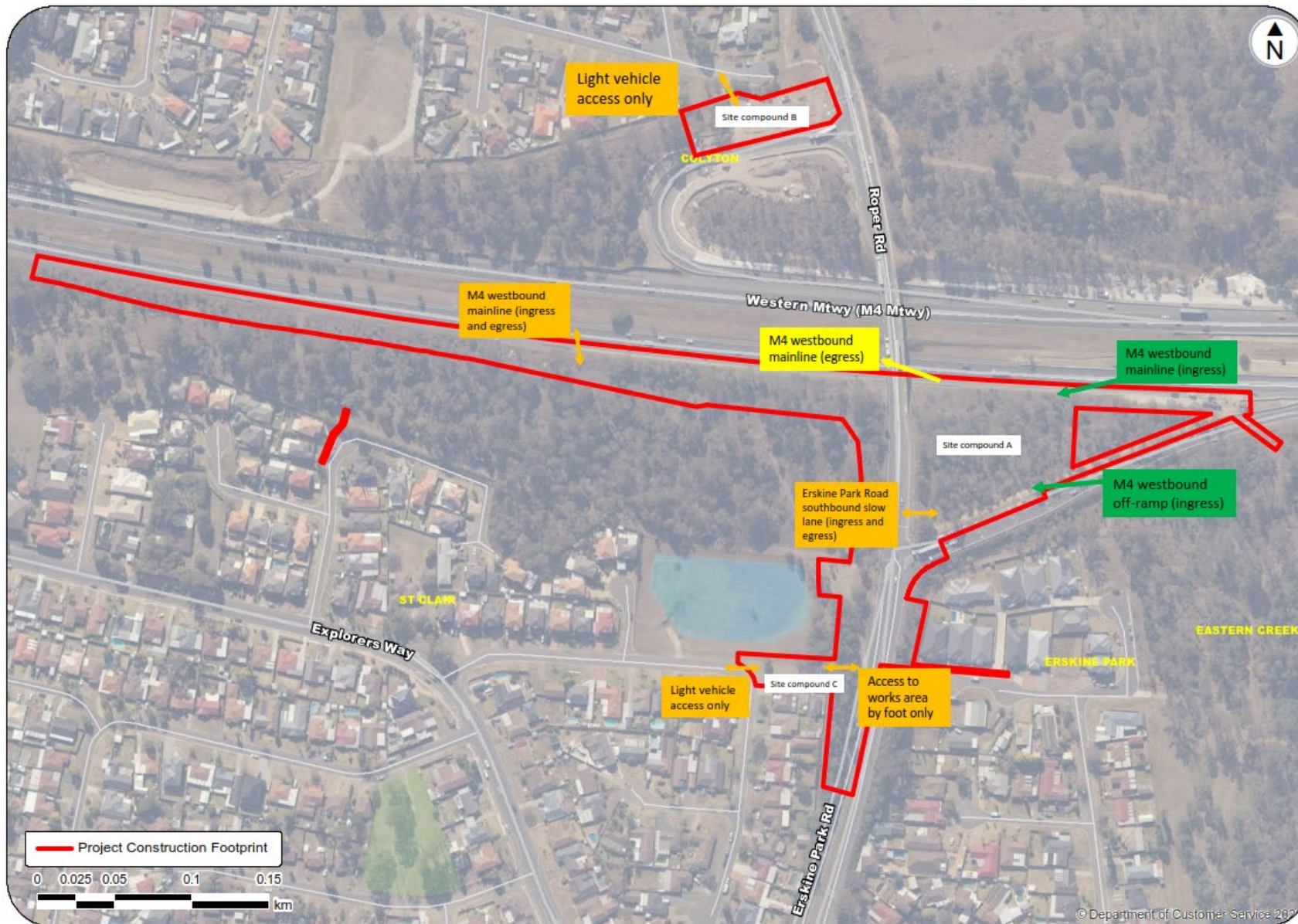


Figure 3-19 Construction traffic ingress and egress from the proposal area to adjacent transport network (labels: green – ingress only, yellow – egress only, orange – ingress and egress)

Traffic management

The proposed construction work would be arranged to minimise the impact to traffic using the local and regional road network. Standard traffic management measures would be employed to minimise short-term traffic impacts expected during construction. These measures would be identified in a detailed traffic management plan (TMP) for the proposal and would be developed as part of the CEMP in accordance with *Transport for NSW Traffic Control at Worksites – Technical Manual* (Transport for NSW, 2020) and *Transport for NSW Specification G10 – Control of Traffic*.

The TMP would provide details of traffic management to be implemented during construction, to ensure that traffic flow along the M4 and Erskine Park Road/Roper Road is maintained throughout construction. Any impacts to the public during construction would be managed through the TMP, including the management of construction parking. The traffic staging would be designed to ensure maintenance of traffic flow throughout the construction period. Shoulder closures, and for short duration lane closures, on Erskine Park Road and the M4 would be required to undertake the majority of works under ROL. It is expected works could occur predominantly during the day, with some activities during night works.

Further details and assessment of traffic and transport impacts are provided in Section 6.2 of this REF.

3.4 Ancillary facilities

A construction site compound would be required close to the proposed works area. At the moment of preparing this REF, three compound sites are proposed as identified in Figure 3-20. Site compounds A and B are owned by Transport for NSW and Site Compound C is owned by Penrith City Council. A description of the uses proposed for each of the site compounds and the access points are described in the following sections.

The biodiversity, noise, visual, traffic and landscape assessments prepared for the REF have considered the potential impacts of the proposed temporary construction site compounds within their assessments and provided suitable mitigation measures to be applied should any of the options be used as a construction site compound. Refer to Section 6 for this assessment and the mitigation measures.



Figure 3-20 Site compound locations

3.4.1 Site Compound A

Site Compound A is located within the proposed G-loop of the west bound on-ramp to the north east of the intersection of Erskine Park Road and the M4 westbound off-ramp as identified in Figure 3-21, with access provided from the M4 mainline westbound, M4 westbound off-ramp and Erskine Park Road southbound slow lane to the south west corner of the proposed G-loop. Site Compound A would be used as a laydown yard, for supply and delivery of materials, equipment parking and as a truck manoeuvring area.

Stockpiling of excavated or raw material may be required at the construction compound. These stockpiles would be managed in accordance with the *Roads and Maritime's Stockpile Site Management Guideline (EMS-TG-10)*.

The vegetation in this area would need to be cleared to accommodate the use of this area as a site compound. Once construction is complete, some vegetation would be reinstated in this area.

No utility relocations would be required for the purposes of Site Compound A.



Figure 3-21 Construction Site Compound A location and proposed access points

3.4.2 Site Compound B

Site Compound B is located to the north of the M4 eastbound on-ramp and to the west of Roper Road with access via Shepherd Street (local road) as identified in Figure 3-22. This site would be used to house the project site office, amenities blocks for construction staff and parking of light vehicles during construction. Temporary storage of material transportable by light vehicle may be required at this site. Site Compound B is located away from areas of ecological value. This site was previously used as a site compound for the M4 eastbound on-ramp at Roper Road project.

No tree removals would be required for the purposes of this site compound; however, some minor trimming may be required to facilitate access for temporary buildings and light vehicles. Standard tree protection measures would be in place within the site for the duration of construction. Once the works are complete, the existing vegetation at the site would be reinstated. The site access points may require some additional stabilisation for light vehicle movements, particularly where there are unsealed surfaces.

No utility relocations would be required for the purposes of Site Compound B.



Figure 3-22 Construction Site Compound B location and proposed access

3.4.3 Site Compound C

Site Compound C is located to the south of the M4 Motorway and Council owned stormwater detention basin and to the east of Erskine Park Road as identified in Figure 3-23. The site would potentially be used to house the project site office, amenities blocks for construction staff and parking of light vehicles during construction. Only light vehicles would be permitted to access Site Compound C via Explorers Way and Augusta Place. Access to the works area from Site Compound C would be from the east of the compound by foot traffic only. Heavy vehicle movements would be limited to access the works area adjacent to Site Compound C from Erskine Park Road to the proposal area.

No tree removals or utility relocations would be required for the purposes of this site compound and no vegetation removal would occur. The site access point may require some additional stabilisation for light vehicle movements, particularly where there are unsealed surfaces.



Figure 3-23 Construction Site Compound C location and proposed access

3.5 Public utility adjustment

Utility investigations were undertaken to determine the services and associated asset owners within the extents of the works are to identify which utilities required relocation / protection as a result of the proposal. This included a desktop study based 'Dial Before You Dig' (DBYD), topographical surveys and potholing.

Initial consultation with utility owners has been carried out, and ongoing consultation would be carried out throughout the detailed design phase and prior to construction. The final location of any relocated utilities is still subject to this consultation and has not been defined to date.

The utilities that would be impacted by the proposal (requiring relocation or protection), are identified below and are based on the current concept design of the proposal. Further assessment and potholing in key locations would be carried out during detailed design to confirm the depths and extent of other utilities in the proposal area to ensure utilities would have sufficient cover and identify any further clashes.

The utilities set out in Table 3-2 would be impacted by the proposal and the proposed changes are identified in Figure 3-24 to Figure 3-26 (refer also to design drawings in Appendix C).

Table 3-2 Utilities impacted by the proposal

Utility	Description and approximate extent
Gas	Relocate: <ul style="list-style-type: none"> M4 Motorway – Westbound lanes southern verge – underneath proposed on-ramp lanes and relocated earth mound – 1 x 110 mm nylon 210 kPa gas main, approximate length 45 m
Telstra	Relocate: <ul style="list-style-type: none"> Erskine Park Road – Southbound lane eastern verge – P50 mm secondary network, approximate length 140 m Abandon: <ul style="list-style-type: none"> M4 Motorway – Westbound lanes southern verge – P35 mm secondary network, approximate length 1240 m

Utility	Description and approximate extent
Endeavour Energy Electrical	Relocate: <ul style="list-style-type: none"> • M4 Motorway – Westbound lanes southern verge – underneath proposed on-ramp lanes and relocated earth mound – 4 x 125 mm underground HV conduits and 1 x 50 mm underground electricity conduit, approximate length 520 m
Street lighting	Install new: <ul style="list-style-type: none"> • M4 Motorway – proposed on-ramp southern verge, section of ramp west of the bridge over the M4 Motorway – from Japura place to proposed on-ramp shoulder – new underground street lighting power supply cables connected to existing LV pillar at 4 Japura Place, approximate length of cables 680 m • M4 Motorway – proposed on-ramp shoulder, section of ramp east of the bridge over the M4 Motorway – new underground street lighting power supply cables connected to existing LV pillar at 5 Miner Glen, approximate length of cables 550 m • Proposed on-ramp to M4 Motorway – edge of proposed on-ramp shoulder – approximately 20 new street light columns and underground cables
ITS Infrastructure	Relocate: <ul style="list-style-type: none"> • M4 Motorway – Proposed on-ramp southern verge – CCTV (CAM86), road side cabinet (RCS86) and pit to be relocated to the eastern corner of M4 Motorway westbound and the bridge over the M4 Motorway with a new electrical and telecommunications line to connect to an existing telecommunications and electrical pit just south of this new location. • Relocate TCS controller (TCS 716) on the north-eastern corner of Erskine Park Road/the existing M4 westbound off-ramp. • Relocate camera (TV01/2048) and pit on Erskine Park Road northbound (western verge) at the existing directional sign approximately 5 m to the south. Install new: <ul style="list-style-type: none"> • New loops and associated conduits and pits at the intersection of M4 westbound off-ramp and Erskine Park Road. • New electrical and telecommunications line (approximately 100 m) on Erskine Park Road northbound (western verge). • New electrical and telecommunications line to cross Erskine Park Road (approximately 35 m) to connect to a new electrical and telecommunications pit located between the new on-ramp and the M4 westbound off-ramp. • New electrical and telecommunications line between the new on-ramp and the M4 westbound off-ramp (approximately 120 m). • Bridge over the M4 Motorway – eastern edge of southbound lane – new telecommunications and electrical line (approximately 85 m). • M4 Motorway – Proposed on-ramp southern verge – new electrical and telecommunications lines for ramp metering, approximate length 75 m • New conduits and pits for the proposed ramp metering on the M4 on-ramp. • Emergency telephone at the proposed maintenance bay to the east of the bridge over the M4 Motorway (approximately 245 m).



Figure 3-24 Utilities impacted by the proposal - Merge lane to M4 Motorway section (subject to detailed design)

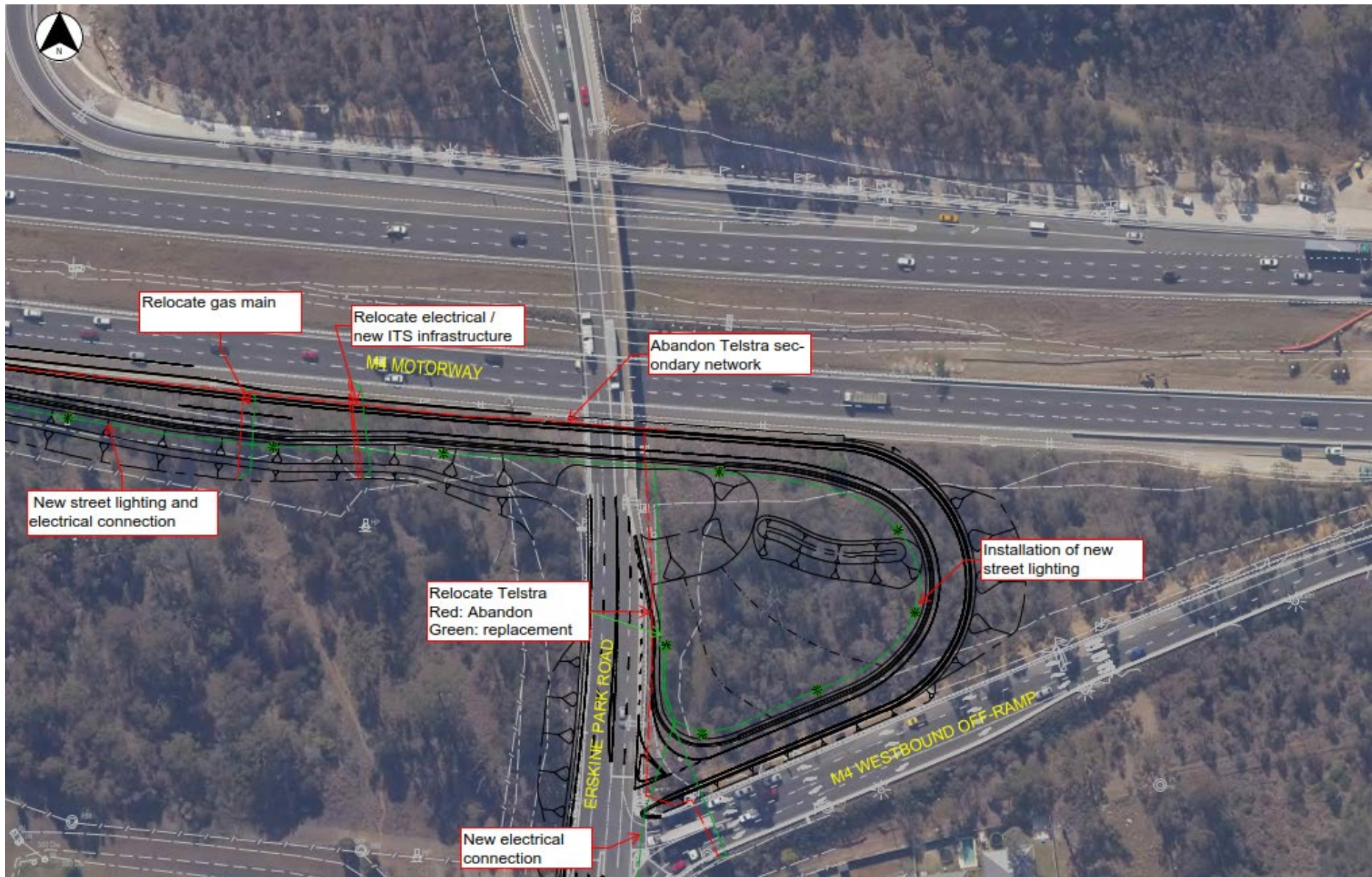


Figure 3-25 Utilities impacted by the proposal - G-loop on-ramp section (subject to detailed design)



Figure 3-26 Utilities impacted by the proposal - Erskine Park Road section (subject to detailed design)

3.6 Property acquisition and adjustments

The proposal would not require property acquisition or adjustments.

4. Statutory and planning framework

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

4.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) establishes the system of environmental planning and assessment in NSW. The proposal is subject to the environmental impact assessment and planning approval requirements of Division 5.1 of the EP&A Act. Division 5.1 of the EP&A Act specifies the environmental impact assessment requirements for activities undertaken by public authorities, such as Transport for NSW, which do not require development consent under Division 5.2 of the EP&A Act.

In accordance with Section 5.5 of the EP&A Act, Transport for NSW, as the proponent and determining authority, must examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposal. Clause 228 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) defines the factors which must be considered when determining if an activity assessed under Division 5.1 of the EP&A Act would have significant impact on the environment.

Chapter 6 of this REF provides an environmental impact assessment of the proposal in accordance with Clause 228 and Appendix A specifically responds to the factors for consideration under Clause 228.

4.1.1 State Environmental Planning Policies

Although the proposal is located within Western Sydney it is not located within the areas covered by either the State Environmental Planning Policy (Western Sydney Employment Area) 2009 or the State Environmental Planning Policy (Sydney Region Growth Centres) 2006.

State Environmental Planning Policy (Infrastructure) 2007

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

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

As the proposal is for a road and road infrastructure facilities and is to be carried out on behalf of Transport for NSW, it can be assessed under Division 5.1 of the EP&A Act. 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 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.

4.1.2 Local Environmental Plans

The entire proposal area is located within the Penrith City Council LGA and the Penrith Local Environmental Plan 2010 (Penrith LEP) applies. Land that would be impacted by the proposal is classified as 'SP2 Infrastructure' in the Penrith LEP, except for a small areas of the proposed Site Compound B, Site Compound C and electrical cable access points at Japura Place and Miner Glen which are classified as 'R2 Low Density Residential', as identified in Figure 4-1.



Figure 4-1 Penrith LEP Land Use Zoning Map - M4 Motorway at Erskine Park Road and Roper Road

The objectives of the SP2 Infrastructure Zone in the Penrith LEP are:

- 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 objectives of the R2 Low Density Residential Zone in the Penrith LEP are:

- To provide for the housing needs of the community within a low density residential environment.
- To enable other land uses that provide facilities or services to meet the day to day needs of residents.
- 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.
- To enhance the essential character and identity of established residential areas.
- To ensure a high level of residential amenity is achieved and maintained.

Developments comprising roads are permitted with consent on land zoned SP2 Infrastructure and R2 Low Density Residential in the Penrith LEP. As outlined in Section 4.1.1, the ISEPP removes the requirement for development consent from councils.

Zoning of land surrounding the proposal area is R2 Low Density Residential, RE1 Public Recreation and E2 Environmental Conservation.

4.2 Other relevant NSW legislation

4.2.1 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) provides a framework to avoid, minimise and offset impacts on biodiversity. Under the BC Act it is an offence to harm animals and plants, damage areas of outstanding biodiversity value, and damage habitat of threatened species or ecological communities. Under Part 2, Division 2 of the BC Act it is a defence if the harm or damage was necessary for the carrying out of a Division 5.1 EP&A Act activity undertaken in compliance with the determination for that activity, or undertaken consistent with a state significant infrastructure approval under Division 5.2 of the EP&A.

The BC Act establishes a test to establish whether a proposed development or activity is, 'likely to significantly affect threatened species'. If an activity under Division 5.1 is likely to significantly affect threatened species then a Species Impact Assessment will be required to be prepared. The proposal is not likely to significantly impact threatened species or ecological communities or their habitats, within the meaning of the BC Act 2016 and a Species Impact Statement or Biodiversity Development Assessment Report is not required.

The REF considers the potential impacts of the proposal on threatened species, populations, ecological communities and critical habitat in accordance with the BC Act. The results of the biodiversity assessment are presented in Section 6.3.

4.2.2 Biosecurity Act 2015

The *Biosecurity Act 2015* specifies the duties of public and private landholders as to the control of priority weeds. Under this Act, priority weeds have been identified for Local Government Areas and assigned duties for control. Part 3 provides that any person who deals with biosecurity matter (ie weeds) and who knows, or ought reasonably to know, the biosecurity risk posed or likely to be posed by the biosecurity matter has a duty to ensure that, so far as is reasonably practicable, the biosecurity risk is prevented, eliminated or minimised.

Section 6.1 of this report discusses priority weeds which may occur within the study area.

4.2.3 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) is the key piece of environment protection legislation administered by the Environment Protection Authority (EPA) and local council (where relevant). The POEO Act provides for the regulation and authorisation of discharges to the environment via environment protection licenses (EPL) for developments and activities, as listed on Schedule 1 of the POEO Act. Under section 148 of the POEO Act, relevant authorities must be notified of any pollution incidents that cause or threaten material harm to the environment.

The proposed works are not a scheduled development work or scheduled activity under the POEO Act and do not require an EPL. Appropriate mitigation and management measures would be established and

maintained to avoid pollution incidents. These are outlined in Chapter 6 (Environmental Assessment) of this REF.

4.2.4 Roads Act 1993

The *Roads Act 1993* sets out procedures for opening and closing public roads, and establishes the authorities responsible for roads, i.e. Transport for NSW, the council of an LGA, Lord Howe Island Board or Crown Lands on behalf of the Minister Administering the *Crown Lands Act 1989*. Section 88 of the Roads Act permits a road authority, despite any other Act or law to the contrary, to remove or lop any tree or other vegetation that is on or overhanging a public road if, in its opinion, it is necessary to do so for the purpose of carrying out road work or removing a traffic hazard.

Tree removal and trimming would be required for the proposal to accommodate the proposed on-ramp and Site Compound A. More details are provided in Sections 3 and 6.1. Section 138 of the Roads Act requires consent from the relevant road authority for the carrying out of work in, on or over a public road. Consent from the relevant roads authority is required for work impacting classified roads. The proposal would involve works on classified State Road maintained by Transport for NSW. Consent under the Roads Act would not be required as the road is maintained by Transport for NSW. However, Road Occupancy Licence/s would need to be obtained for road works and any temporary road closures.

4.2.5 Heritage Act 1977

The *Heritage Act 1977* (NSW) aims to provide for the identification, registration and conservation of items of State heritage significance. Approval must be obtained from the Heritage Council where the proposal affects a place listed on the State Heritage Register, or where excavation may affect an archaeological relic. The *Heritage Act 1977* (NSW) is concerned with all aspects of heritage conservation ranging from basic protection against indiscriminate damage and demolition of buildings and sites, through to restoration and enhancement. A search of the Australian heritage register and NSW State heritage register carried out in November 2020 did not identify local or State heritage listed items within the proposal area, only within the wider surrounding area which are outlined in Section 6.7 of this report.

If any item or material is uncovered during construction of the proposal that has potential heritage value or significance, Transport for NSW would follow an established unexpected finds procedure. Under this procedure, all work at the location of the find would cease until the item or material can be investigated by a suitably qualified person, to establish whether the item or material is of heritage significance, and whether any further actions are warranted for its removal and/or protection.

4.2.6 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides for the establishment and management of National Parks, reserves, historic sites and for the protection of native fauna, flora and Aboriginal heritage.

Sections 86, 87 and 90 of the NPW Act require consent from the NSW Office of Environment and Heritage (OEH) for the destruction or damage of Aboriginal cultural heritage objects. The majority of the works area is located within an area that is entirely within the Aboriginal Heritage Impact Permit (AHIP) obtained for the M4 Smart Motorways Project (C0002113) and works will be managed under the AHIP. Two small areas of works, at Japura Place and Miner Glen, are outside of the M4 Smart Motorways Project AHIP. The Aboriginal Cultural Heritage Officer confirmed the proposed works at Japura Place and Miner Glen are unlikely to have an impact on Aboriginal Heritage and a PACHCI Stage 1 clearance letter has been received for both areas, refer Appendix I. It is considered unlikely that the proposal would disturb any objects of Aboriginal heritage significance. However, if unexpected archaeological items or items of Aboriginal heritage significance are discovered during the construction of the proposal, all works would

cease and appropriate advice sought in accordance with the AHIP. Potential impacts to Biodiversity and Aboriginal heritage are discussed in Section 6.1 and 0 respectively.

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 F and chapter 6 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 also considered as part of Chapter 6 of the REF and Appendix F.

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 the 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. Chapter 6 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 road infrastructure facilities 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 for NSW is the determining authority for the proposal. This REF fulfils Transport for NSW'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.

5. Consultation

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

5.1 Consultation strategy

Consultation activities conducted for the proposal and the outcomes of these are documented in the Have Your Say – Community Consultation Report included in Appendix E. The Community Consultation report outlines the consultation approach carried out, a summary of matters raised by the community, Transport for NSW response to the matters raised, and the next steps to be carried out by Transport for NSW, such as further engagement and engagement outcomes.

The aims of consultation were:

- Creating a greater understanding of the proposal so stakeholders could provide informed feedback
- Gathering feedback that would provide more information about how the proposed ramp would impact or benefit the community and gauging overall sentiment
- Reporting on the outcome to the consultation so that the community and stakeholders know that their comments and concerns are being acknowledged and incorporated, where feasible.

Community consultation was carried out from Monday 23 November to Wednesday 16 December 2020. A summary of the communications tools and methodology used as part of the consultation strategy is provided in Table 5-1.

Table 5-1 Communication tools and methodology

Communications tool	Description
Have Your Say Community Letter Monday 23 November to Wednesday 16 December 2020	<ul style="list-style-type: none">• A community update letter was sent out to local residents asking for feedback to the proposal• 3300 letters were distributed• Coverage included local residents, businesses and key stakeholders in the St Clair and Erskine Park area (refer Figure 5-1)• Community members and stakeholders were invited to call the project hotline, email or mail in a submission.
Website update	<ul style="list-style-type: none">• Details of the proposal and Have Your Say consultation period were available on the project website at – nswroads.work/m4roperwramp
Facebook post	<ul style="list-style-type: none">• A social media post went live from the NSW Roads Facebook page on Tuesday 1 November 2020. Release date was coordinated to be one week after a social media post went live from the local MPs office, announcing the consultation.
Media releases	A media release was published on 12 November 2020 inviting residents of Erskine Park, St Clair and Penrith to have their say on the proposal - https://www.rms.nsw.gov.au/about/news-events/news/members-of-parliament/2020/201123-your-say-on-proposed-new-m4-roper-road-westbound-on-ramp.html

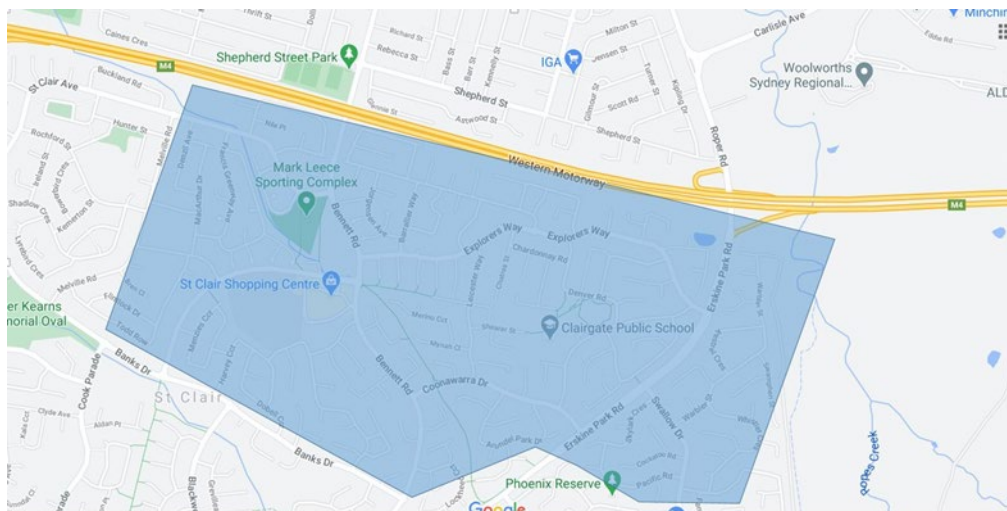


Figure 5-1 Community update letter distribution map during 'Have Your Say'

5.2 Community involvement

A Have Your Say period was opened from Monday 23 November to Wednesday 16 December 2020, where community members and stakeholders were invited to provide feedback on the proposed design using the methods set out in Table 5-1.

Community members and stakeholders were encouraged to provide their comments via phone or email to the project team. Transport for NSW received 93 submissions from local community members and businesses.

Key considerations raised in the submissions received were:

- Support for the project as it would be expected to provide long-term benefits such as shorter travel times, ease congestion and make trips easier for those travelling to Penrith and the Blue Mountains
- Overall project justification was questioned in relation to the proposed on-ramp being unnecessary and that it may cause additional congestion issues, such as along the Erskine Park Road – Roper Road corridor
- Environmental impacts such as noise and tree impacts
- Location of the on-ramp, in particular that an on-ramp to the west of Erskine Park Road with direct left turn access to the M4 Motorway (as represented by Option 3 in the options analysis) would be more practical
- Congestion on the road network as a result of the project.

A summary of the key issues raised by the community in relation to the proposal is provided in Table 5-2.

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

Issue raised	Response / where addressed in REF
Support for the proposal	
<p>The new ramp is welcomed by local residents and will provide long-term benefits and shorter travel times. This is a positive change for local roads and the local area and it is good to see the project starting as it is a long overdue election promise.</p> <p>A westbound ramp onto the M4 Motorway will help ease congestion on Mamre Road, Roper Road and Banks Drive and make trips easier for those travelling to Penrith and the Blue Mountains</p>	<p>Transport for NSW notes the positive feedback for the project.</p>
Opposition to the proposal	
<p>The new ramp is unnecessary and the funds could be used to:</p> <ul style="list-style-type: none"> - Remove tolls - Remove the amount of trucks on the local roads - Create an on-ramp for Archbold Road to allow greater access for trucks and transport vehicles coming out of the Minchinbury area, enabling them to avoid residential streets 	<p>The NSW Government is planning for a future upgrade and extension of Archbold Road between the Great Western Highway, Minchinbury and Old Wallgrove Road, Eastern Creek. Once complete, Archbold Road would be a key north-south route providing access to the Western Sydney Employment Area. The upgrade would include a four lane divided road including a new bridge over the M4 Motorway and east facing ramps. Further information could be found at https://www.rms.nsw.gov.au/projects/archbold-road/index.html.</p> <p>Traffic and transport is further discussed in Section 6.2 of this REF.</p>
<p>This project will increase the movement of trucks in the area and truck induced noise pollution is already a problem along Erskine Park Road. It will increase road congestion and result in a substantial increase in general noise when there is already disruptive road noise throughout the day and into the night from heavy transport vehicles.</p> <p>There are no plans to mitigate the increase in noise along the streets which will see an increase in traffic flow. Namely, the lack of noise barriers down Erskine Park Road which impact the resident's quality of life. There should not be more traffic allowed along this road as it is not equipped to handle it. The ramp will be of limited value to residents and will only increase noise and traffic accidents.</p>	<p>We have engaged a specialist noise consultant to complete a noise assessment to establish the current level of noise within the project area and the predicted level of road traffic noise as a result of the proposal. Any noise mitigation treatments that need to be considered under our Noise Mitigation Guidelines will be confirmed during Detailed Design of the proposal and impacted property owners will be notified. A Construction and Operational Noise Assessment has been undertaken for the proposal. The findings are presented in Section 6.3 of this REF and the full Assessment is in Appendix H. The results of the traffic assessment are discussed in Section 6.2 of the full Assessment is in Appendix G.</p>

Issue raised	Response / where addressed in REF
<p>A northbound, right turn ramp will cause a tremendous amount of traffic to build up along streets that already have a high traffic levels. A westbound ramp will contribute to a permanent crawl of traffic across the whole day. At present, road users already experience traffic banking up down Erskine Park Road beyond Explorers Way and Swallow Drive. If traffic banks up past Swallow Drive, Erskine Park residents will not be able to use it to exit the suburb northbound. From the north there could also be significant impacts for south bound traffic coming from Carlisle Avenue in Mount Druitt.</p> <p>There is already a high flow of traffic travelling south across the bridge over the M4 Motorway. Having two lanes up Roper Road to the roundabout north of the bridge over the M4 Motorway would assist with this.</p>	<p>The intersection and right turn lane have been designed to minimise queueing effects on Erskine Park Road, minimise vegetation clearing, where possible, and minimise potential impacts to specific threatened species and threatened ecological communities that may be present within the construction footprint.</p> <p>Penrith City Council and TfNSW are currently delivering a number of upgrades on Erskine Park Road including:</p> <ul style="list-style-type: none"> • Erskine Park Road and Peppertree Drive Intersection • Erskine Park Road and Bennett Road Upgrade • Erskine Park Road and Coonawarra Drive Intersection • Erskine Park Road and Explorers Way Intersection <p>TfNSW will continue to monitor network performance to assess needs for future infrastructure upgrades.</p> <p>Traffic and transport is further discussed in Section 6.2 of this REF.</p>
Environment	
<p>The project planning should include noise barriers being installed along the M4 Roper Road exit, down Roper Road/Erskine Park Road. The current exit has heavy trucks running all the time using their air brakes. Sound barriers along Roper Road should be made to look nicer with plants to minimise the graffiti along the fences.</p> <p>Which permanent sound abatement measures at M4/M4 ramps are planned? Traffic noise commonly exceeds 60dB at 1 km from Erskine Park Rd/M4 flyover, making it very unpleasant to allow natural circulation of air/cooling at home by leaving doors open.</p>	<p>We have engaged a specialist noise consultant to complete a noise assessment to establish the current level of noise within the project area and the predicted level of road traffic noise as a result of the proposal. Any noise mitigation treatments that need to be considered under our Noise Mitigation Guidelines will be confirmed during Detailed Design of the proposal and impacted property owners will be notified.</p> <p>A Construction and Operational Noise Assessment has been undertaken for the proposal. The findings are presented in Section 6.3 of this REF and the full Assessment is in Appendix H.</p>

Issue raised	Response / where addressed in REF
<p>The trees that are being removed are home to birds and other animals. I would like to know that due consideration is given to limiting their removal and other trees planted nearby to replace them.</p>	<p>A Biodiversity Assessment has been undertaken to assess the ecological impact of the clearing of vegetation for the project and provide recommendations to manage the impact. The findings of the Biodiversity Assessment are presented in Section 6.1 of this REF and the full assessment is in Appendix F.</p> <p>In addition, the project has been designed to minimise vegetation clearing, where possible, and minimise potential impacts to specific threatened species and threatened ecological communities that may be present within the construction footprint. Previous designs of the project generated significant impacts to threatened species, and so the project was redesigned to avoid these impacts.</p> <p>Where clearing of vegetation cannot be avoided, a tree clearing procedure will be implemented to minimise impacts on fauna utilising the habitat to be removed.</p> <p>Where safe to do so, vegetation will be replanted to offset the vegetation removed. For example, replanting will be done in the area in the middle of the proposed on-ramp.</p>
<i>Alternative design and traffic congestion</i>	
<p>There is concern about the increase in traffic around Roper Road and Erskine Park Road particularly if there will be roadworks around opening a new ramp that's not due to be ready until 2022.</p>	<p>Construction of the project will lead to additional traffic movements over the 18-month construction period. Construction traffic movements would occur outside of peak periods where possible and are predicted to have a minor impact on the surrounding road network and public transport services.</p> <p>Construction traffic will be associated with a number of work activities, including delivery and removal of construction material, construction equipment and machinery and movement of construction personnel.</p> <p>The movement of materials will be managed through the scheduling of deliveries and availability of fleet to avoid peak periods. A Traffic Management Plan (TMP) will be prepared as part of the Construction</p>

Issue raised	Response / where addressed in REF
	<p>Environmental Management Plan (CEMP) to address potential impacts and incorporate measures to mitigate impacts on the road network.</p> <p>Traffic and transport is further discussed in Section 6.2 of this REF.</p>
<p>The idea of additional access ramps as proposed is commendable and a long time coming however, this should be done with driver safety in mind, as the top priority, as opposed to providing this improvement at the least cost possible which then defeats the purpose of providing safer roads to the road users in the area.</p>	<p>Safety for all those using or near the ramp is a primary design consideration for this project. This design has addressed all safety and road design standards requirements.</p> <p>Traffic and transport is further discussed in Section 6.2 of this REF.</p>
<p>This design will cause traffic delays and congestion, particularly in peak times, along Erskine Park Road and cars heading south from Roper Road. During peak times southbound traffic banks up into Carlisle Avenue which already makes the roundabout dangerous and holds up both lanes. This situation has the potential for accidents to occur. It is a band aid measure to the exorbitant amount of traffic that already use this road and exit. Consideration also needs to be made for the industrial park at the bottom of Erskine Park Road which will contribute to heavy traffic.</p> <p>Having the new ramp will increase the volume of trucks and commercial vehicles along the passage. There will be a duplication of the traffic blocks that already exist at the Mamre Road bridge which is always horrible.</p>	<p>The proposed on-ramp has been designed based on detailed modelling giving consideration to residential and industrial traffic demands and road capacity. This modelling does not show a significant impact to queueing resulting from the proposed on-ramp.</p> <p>Traffic and transport is further discussed in Section 6.2 of this REF.</p>
<p>Another "cloverleaf" Westbound On-Ramp is not the best option, because it restricts the free flow of traffic, however, given that this section of the M4 Motorway is in desperate need of an additional Westbound On-Ramp; something is far better than nothing at all. "Cloverleaf" on-ramps restrict the free flow of traffic as drivers are required to make a right turn across traffic to access the On-Ramp. This then requires additional placement of Traffic Lights and will always result in queuing for access to the On-Ramp. "Cloverleaf" on-ramps are counter-productive.</p> <p>Entry onto the ramp needs to be as quick as possible with as little stop-starting as possible to cater for added traffic.</p>	<p>A G-loop configuration for the proposed on-ramp was required by a number of design issues specific to this location including:</p> <ul style="list-style-type: none"> • A Threatened Ecological Community to the west of Erskine Park Road; • The location of existing overhead gantries on the M4; • Restricted space on the southern end of the existing bridge necessitating a loop configuration to accommodate access to the proposed on-ramp for traffic travelling in both directions on Erskine Park Road;

Issue raised	Response / where addressed in REF
<p>A slip road on the left side of Roper Road makes more sense and keeps the traffic flowing north with less congestion. Having the on-ramp go directly onto the M4 would mean:</p> <ul style="list-style-type: none"> • No danger of a collision of a tired truck driver having a head on collision with a vehicle exiting the M4 onto Erskine Park Road • No traffic has to cross at lights • Less chaos for traffic travelling South • A cheaper construction option • No excavation of the bridge • Less impact on residential properties <p>There are other examples of loop ramps not working including: Banks Drive exit onto Mamre Road.</p> <p>The existing off-ramp is also very close to the proposed new ramp and there is a potential for northbound motorists to make an error and turn into the wrong road.</p>	<ul style="list-style-type: none"> • Avoid impact to the existing stormwater basin in this location and impact to the drainage infrastructure which manages stormwater in this area. <p>The project has been designed to minimise vegetation clearing where possible and minimise potential impacts to specific, threatened species and threatened ecological communities that may be present within the construction footprint. Previous designs of the project generated significant impacts to threatened species and so the project was redesigned to avoid these impacts. These previous designs considered a direct route onto the M4 Motorway but could not be developed for the above reasons.</p> <p>Access for traffic travelling in both directions is essential to make the project economically viable. Widening of the existing bridge would involve substantial additional costs and is outside the scope of this project.</p>
<p>Consider having the ramp length go to Bennett Road, not the normal 100 m that seems to be standard. Longer ramps are commonplace in QLD and allow for smoother traffic integration. At present, M4 eastbound traffic onto Roper Road is forced to merge almost immediately. This is one of the biggest bottlenecks in the morning.</p>	<p>The length of the ramp has been determined based on national road design standards and giving due consideration to local requirements. The length is designed to safely integrate with the M4 Smart Motorway.</p>

Issue raised	Response / where addressed in REF
<p>To avoid the traffic congestion problem, my suggestion is to proceed with the proposed ramp onto the M4 for southbound traffic only and create a separate westbound on-ramp for northbound traffic along Erskine Park Road, located just south of the existing westbound off-ramp.</p> <p>Currently, congestion is caused by the build-up of traffic from having a single lane over the Roper Road bridge. There should be an additional lane/lanes over the bridge.</p> <p>A left turning lane should go under the overpass, with a lane that can be accessed by northbound traffic onto a slip road and two lanes merging before they meet the M4. A third access point should allow southbound traffic to enter the M4 eastbound without a set of lights to hold up traffic.</p>	<p>The intersection and right turn lane have been designed to minimise queueing effects on Erskine Park Road, minimise vegetation clearing, where possible, and minimise potential impacts to specific threatened species and threatened ecological communities that may be present within the construction footprint.</p> <p>Penrith City Council and TfNSW are currently delivering a number of upgrades on Erskine Park Road including:</p> <ul style="list-style-type: none"> • Erskine Park Road and Peppertree Drive Intersection • Erskine Park Road and Bennett Road Upgrade • Erskine Park Road and Coonawarra Drive Intersection • Erskine Park Road and Explorers Way Intersection <p>TfNSW will continue to monitor network performance to assess needs for future infrastructure upgrades.</p>
<p>There needs to be safe pedestrian access on Roper Road for the current bus stops on either side of the road. If pedestrians need to cross, it is extremely dangerous for them with high volumes of motorists or fast moving vehicles when the traffic is light.</p> <p>People currently walk over the Roper Road bridge and cross in front of the existing off-ramp to walk from Colyton to St Clair. This is not safe, but the only option if you are walking.</p>	<p>Currently there is no pedestrian infrastructure south of Roper Road. Provision of pedestrian infrastructure along Erskine Park Road is beyond the scope of this project.</p> <p>Traffic and transport is further discussed in Section 6.2 of this REF.</p>
<p>There is a gap in this project as there is no safe way for cyclists to cross the Roper Road bridge. There also appears to be a completely useless cycleway structure along the entry to the eastbound ramp from Roper Road, which, if used would deliver cyclists into the middle of eastbound lanes. The NSW Government is supposed to be committed to supporting people to live healthily and delivering integrated transport and enabling the community to be more active. Please do not forget other environmentally friendly forms of active transport.</p>	<p>There is currently no dedicated cycling infrastructure across the Roper Road Bridge and the existing bridge is not wide enough to provide a dedicated cycle way.</p> <p>The cycleway on the eastbound ramp at Roper Road was constructed on the outside of the loop ramp as there was no space beneath the Roper Road bridge for this safe cycle provision.</p>

Issue raised	Response / where addressed in REF
<p>There is a bottleneck being created between Illawarra Drive and Chameleon Drive, both north and southbound due to the works on Erskine Park Road. This two-lane bottleneck will become worse with the work on the new Roper Road on-ramp and this needs to be fixed.</p> <p>The new on-ramp should be designed using the same approach as the M4 westbound on-ramps at Homebush Bay Drive, with dual access points one for northbound from St Clair/Erskine Park and one for southbound traffic from Mount Druitt/Minchinbury. The current design does not accommodate for the increase in traffic that will use Roper Road from the Minchinbury Industrial Estate and eventually from Western Sydney Airport. There will also be increased traffic volumes from the Mount Druitt employment and residential areas.</p> <p>Roper Road already funnels traffic southbound over the bridge over the M4 Motorway. Having a new ramp will increase the traffic congestion down Erskine Park Road also at the following intersections: Swallow Drive, Explorers Way, M4 exit ramp, M4 access ramp. The situation is also exacerbated for trucks coming from the south as Erskine Park Road is uphill.</p>	<p>The intersection and right turn lane have been designed to minimise queueing effects on Erskine Park Road, minimise vegetation clearing, where possible, and minimise potential impacts to specific threatened species and threatened ecological communities that may be present within the construction footprint.</p> <p>Penrith City Council and TfNSW are currently delivering a number of upgrades on Erskine Park Road including:</p> <ul style="list-style-type: none"> • Erskine Park Road and Peppertree Drive Intersection • Erskine Park Road and Bennett Road Upgrade • Erskine Park Road and Coonawarra Drive Intersection • Erskine Park Road and Explorers Way Intersection <p>TfNSW will continue to monitor network performance to assess needs for future infrastructure upgrades. Traffic and transport is further discussed in Section 6.2 of this REF.</p>

5.3 Aboriginal community involvement

The proposal has been considered against the requirements of the *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI) (Roads and Maritime Services, 2011). This procedure is generally consistent with the Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (Department of Environment, Climate Change and Water, 2010). An outline of the procedure is presented in Table 5-3.

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

The full process summarised above was completed for the extent of the M4 Smart Motorway Project, within which the majority of the proposal area is located. The outcome of the M4 Smart Motorway Project PACHCI is the project wide AHIP (C0002113) and the proposal would be managed in accordance with that AHIP.

For the two small parts of the proposal area outside the M4 Smart Motorway Project on Japura Place and Miner Glen, a basic search of the Aboriginal Heritage Information System (AHIMS) was conducted on 22 December 2020 and 22 February 2021 specific to the Japura Place and Miner works area. No known Aboriginal heritage sites or items were identified within a 50 metres radius of the Japura Place works area. To confirm the results, consultation was undertaken with a Transport for NSW Aboriginal Cultural Heritage Officer in accordance with the PACHCI procedure. The Aboriginal Cultural Heritage Officer confirmed the proposed works at Japura Place and Miner Glen are unlikely to have an impact on Aboriginal Heritage and a PACHCI Stage 1 clearance letter has been received for both areas, refer Section 6.7 of this REF and Appendix I.

5.4 ISEPP consultation

Appendix B contains an ISEPP consultation checklist that documents how ISEPP consultation requirements have been considered in relation to any potentially impacted local councils and State agencies. As the proposal area is all within Transport for NSW owned land or only inconsequential excavation of local road (Japura Place) there are no requirements to consult with Penrith City Council as per the requirements of ISEPP.

5.5 Government agency and stakeholder involvement

In addition to the local community, the Penrith City Council will be contacted in relation to the use of land for Site Compound C. No further government agency or stakeholder consultation has occurred in relation to the proposal.

5.6 Ongoing or future consultation

Transport for NSW expect to begin construction of the proposal in mid-2021 with the proposal operational late 2022. Nearby residents would be notified prior to the commencement of any construction. This notification would reference working hours and expected impacts. Contact details of the works supervisor would be made available to residences via a letterbox drop to allow any construction phase issues to be raised and addressed.

Ongoing consultation would continue to be carried out with the following stakeholders during detailed design and construction. The community would be informed of any major design changes. Further communications would be provided to the community and stakeholders as the project progresses.

6. Environmental assessment

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

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

Site-specific safeguards and management measures are provided to mitigate the identified potential impacts.

6.1 Biodiversity

6.1.1 Methodology

An independent biodiversity consultant (NGH Environmental) was engaged to assess the potential ecological impacts of the proposal, including the identification and validation of vegetation communities, identification of all flora species and observations of fauna habitat within the nominated study area which included the immediate proposal area and surrounds. The study area covered land within the proposal that would be affected by the proposal as described in Chapter 3 as well as land within the surrounding locality as featured within the wider desktop review searches. A copy of the biodiversity assessment is provided in Appendix F.

The biodiversity assessment comprised of the following process:

- Definition of the study area
- A desktop assessment of the study area, including review of spatial datasets
- Field investigation to determine flora and fauna within the study area
- Impact assessment of the proposal on biodiversity
- Completion of tests of significance under the Biodiversity Conservation Act 2017

Desktop research

The following biodiversity searches were completed to inform the habitat assessment and field surveys:

- Office of Environment and Heritage (OEH) Bionet Atlas with a search radius of 10 km to identify any threatened fauna species
- Environmental Protection and Biodiversity Conservation (EPBC) Act Protected Matters Search Tool (PMST) was utilised to determine the presence of records or suitable habitat for Matters of National Environmental Significance (MNES) within the study area

Using information from the above searches a habitat assessment table was prepared to assess the likelihood of threatened flora, fauna and ecological communities occurring within the study area. The local occurrence of threatened ecological communities was determined using existing vegetation mapping (OEH_VIS_ID 4207) within a 10 km radius of the study area.

Field surveys

Site assessments of the study area were undertaken on 6 November 2019, 26 June 2020 and 24 August 2020. A range of survey methods were used as summarised in Table 6-1 and set out in full in Appendix F.

Table 6-1 Biodiversity assessment field survey methods

Survey type	Objectives	Method / Information recorded
Random meander search – opportunistic surveys	<ul style="list-style-type: none">• Used for site inspection to allow inspection of all available habitat types	<ul style="list-style-type: none">• Native flora species and vegetation communities present;• Targeted threatened species identified during background searches;• Opportunistic fauna sightings where suitable habitat was present;• Weed species present and their abundance.

Survey type	Objectives	Method / Information recorded
Fauna Habitat Survey	<ul style="list-style-type: none"> Completed to assess habitat availability 	<ul style="list-style-type: none"> Habitat value (leaf litter, fallen timber, ground cover extent and type); Condition of vegetation; Floristic diversity of vegetation; Presence of hollow-bearing trees; Presence of species-specific foraging or breeding habitat.
Vegetation Surveys	<ul style="list-style-type: none"> Identify whether threatened species are present, or have the potential to occur, within the proposal sites; Determine vegetation communities present within the study area, their condition and extent; Identify potential Threatened Ecological Communities (TECs) and determine their extent and condition; Assess the distribution and abundance of declared weeds at the proposal sites. 	<ul style="list-style-type: none"> Vegetation plots conducted using Biodiversity Assessment Methodology (BAM) with three 400m² plots and five 1 m x 1 m sub plots to assess groundcover composition Data recorded was stratum and layer in which each species occurs, growth form, species name, % foliage cover and abundance rating
Targeted flora and fauna surveys	<ul style="list-style-type: none"> Identification of any threatened flora and fauna species 	<ul style="list-style-type: none"> Targeted search within areas of suitable habitat for species of state or national significance Sightings of common fauna and their traces (e.g. scats, tracks and scratches) where observed and recorded

6.1.2 Existing environment

Locality and land use

Penrith City Council LGA is located within the Cumberland sub-region of the Sydney Basin Bioregion and the study area is within the Cumberland Plain Mitchell Landscape. The Cumberland Plain Mitchell Landscape is an over cleared landscape as 89% of native vegetation has been cleared.

The study area is located in an urban environment dominated by the state road network, however there are areas adjacent to the existing road footprint which have undisturbed vegetation, including on the west and east of Roper Road to the south of the M4 Motorway.

Database search results

The Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) Protected Matters Search Tool identified the protected matters with potential to occur within 10 kilometres of the study area set out in Table 6-2. The full habitat assessment resulting from the desktop searches is included in the biodiversity assessment in Appendix F.

Table 6-2 Matters identified in EPBC Act Protected Matters Search Tool

Matter of National Environmental significance	Potential presence with 10 kilometres of the study area
World Heritage Properties	0
National Heritage Place	0
Wetlands of International Importance	0
Great Barrier Reef Marine Park	0
Commonwealth Marine Area	0
Listed Threatened Endangered Ecological Communities (EECs)	<ul style="list-style-type: none"> • Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion. • Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of New South Wales and South East Queensland ecological community. • Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion. • Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. • Western Sydney Dry Rainforest and Moist Woodland on Shale
Listed Threatened Species	41
Listed Migratory Species	15

Plant community types and threatened ecological communities

Three plant community types (PCT) were identified within the proposal area and a small area of urban/exotic vegetation, as summarised in Table 6-3 and identified on Figure 6-1. There is also an area of 0.3 ha identified within the proposal area that was identified as Urban / Exotic Vegetation.

All three identified PCTs are Threatened Ecological Communities (TEC) classified as Endangered Ecological Communities (EECs) under the Biodiversity Conservation Act 2016 (BC Act). Under the EPBC Act only PCT 725 is classified as a Critically Endangered Ecological Community (CEEC) as:

- PCT 725 within the study area forms part of the Cooks River/Castlereagh Ironbark Forest TEC and meets the conditions of a CEEC under the EPBC Act as the PCT is more than 2 ha and has more than 50% native perennial species in the understorey

- PCT 724 within the study area forms part of the Shale Gravel Transition Forest in the Sydney Basin Bioregion TEC but is not classified as CEEC under the EPBC Act as it has less than 50% native perennial understorey vegetation cover.
- PCT 835 within the study area forms River-flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions TEC but is not classified as CEEC under the EPBC Act as it is less than 0.5 ha.

The Castlereagh Shale-Gravel Transitional Forest (EEC) was identified as a groundwater dependent ecosystem which reflects the presence of multiple creeks, ponds and swamps in the wider area surrounding the site, in particular Ropes Creek 100 metres to the east of the study area.

There are no areas of outstanding biodiversity within the study area.

Table 6-3 Summary of identified Plant Community Types within the study area and threatened ecological community characteristics

Plant community type	Area (ha) in study area	Threatened ecological community	Status		Condition	Local occurrence (ha)	Conservation status	Vegetation formation / class	Description of PCT identified within proposal area
			BC Act	EPBC Act					
PCT 724 - Broad-leaved Ironbark - Grey Box - <i>Melaleuca decora</i> grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	0.97	Yes – TEC Castlereagh Shale Gravel Transition Forest	EEC	No	Poor	628	Critically Endangered (NSW), Endangered (Federally)	Dry Sclerophyll Forests (Shrub/grass sub-formation) / Cumberland Dry Sclerophyll Forests	<ul style="list-style-type: none"> Identified in the area between Erskine Park Road, the M4 westbound off-ramp and the M4 mainline westbound Consists of diagnostic canopy species such as Red Ironbark (<i>Eucalyptus fibrosa</i>) and <i>Melaleuca decora</i> Understory is dominated by exotic grasses and forbs due to previous disturbance
PCT 725 - Broad-leaved Ironbark - <i>Melaleuca decora</i> shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	7.41	Yes – TEC Cooks River / Castlereagh Ironbark Forest	EEC	CEEC	Moderate	254	Endangered (NSW), Critically Endangered (Federally)	Dry Sclerophyll Forests (Shrub/grass sub-formation) / Cumberland Dry Sclerophyll Forests	<ul style="list-style-type: none"> Identified mainly west of Roper Road and comprises most of the native vegetation within the study area Community has relatively high structural integrity and floristic diversity
PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	0.41	Yes – TEC Cumberland River-flat Eucalypt Forest on Coastal Floodplains	EEC	No	Poor	1655	Endangered (NSW) Critically Endangered (Federally)	Forested wetlands Coastal floodplain wetlands	<ul style="list-style-type: none"> Identified in small strip south of the main patch of vegetation (to the west of Erskine Park Road) and a patch at the eastern extent of the proposal area Poor condition due to imported soils, altered hydrology, edge effects and weed infestation Mid and ground layer species are largely exotic

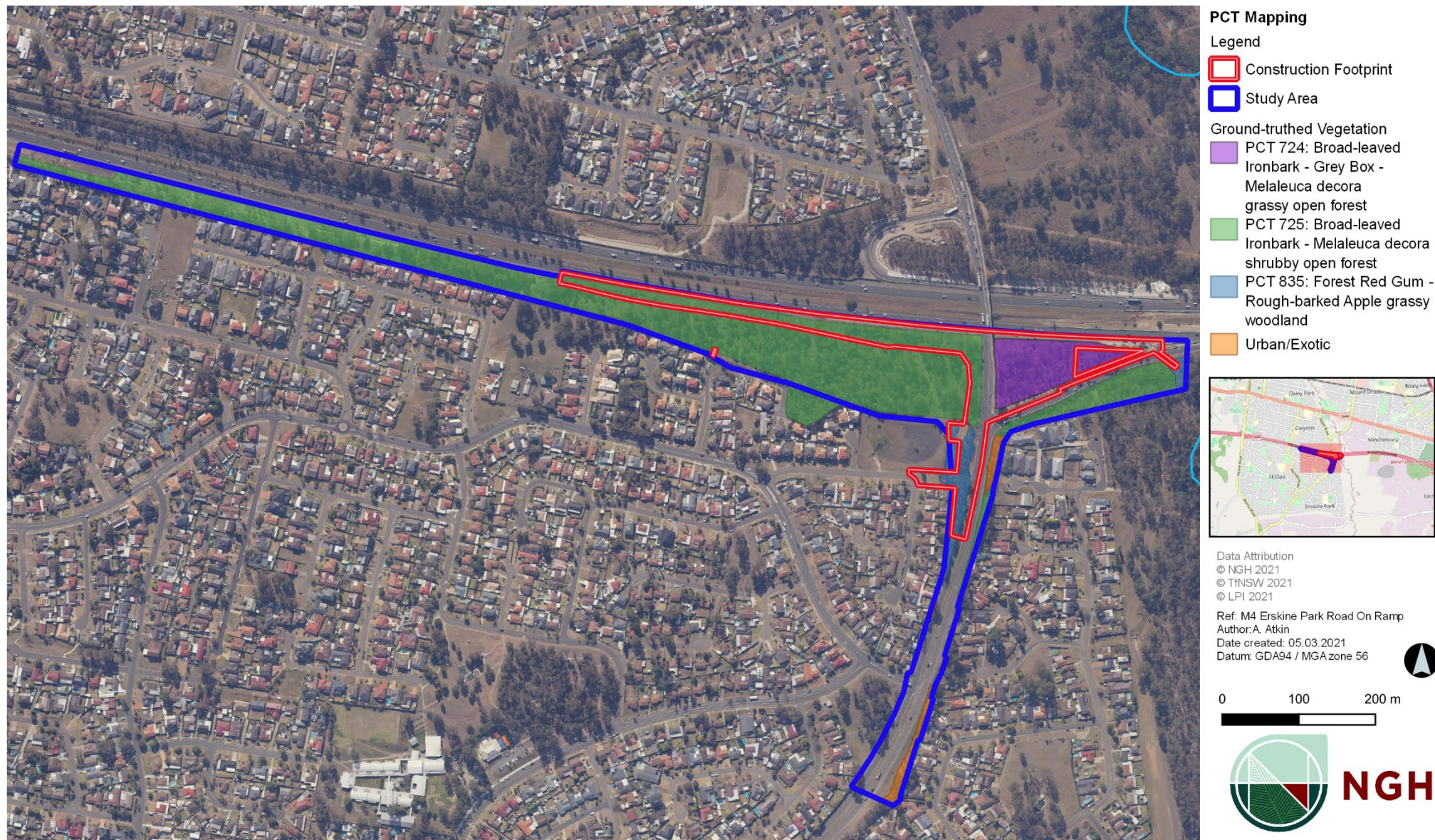


Figure 6-1 Plant community types and threatened ecological communities within the study area (Source: NGH Environmental, 2021)

Fauna habitat

Threatened fauna habitat exists within the study area in the form of foraging habitat from flowering Eucalypts, native and exotic trees, and shrubs. This flora likely constitutes occasional foraging habitat for nomadic and migratory threatened fauna. It is considered unlikely that the threatened fauna utilising the vegetation as foraging habitat would be solely reliant on these patches and are thus considered unlikely to be significantly impacted. Eight hollow bearing trees were identified within the study area and three of these are located within the works area as identified in Figure 6-2. Tree hollows identified may provide areas for nests or roosts for the following fauna species which may be present within the study area; Powerful Owl, Masked Owl, Yellow-bellied Sheath-tail-bat, Eastern Coastal Free-tailed Bat, Eastern False Pipistrelle, Southern Myotis, Greater Broad-nosed Bat, Little Bent-winged Bat,

Threatened species

The habitat assessment completed indicated that within the study area potential habitat for threatened fauna exists in the form of foraging habitat with remnant vegetation. Table 6-4 summarises the threatened flora and fauna species that may occur within the study area and the species that were recorded during targeted surveys. Four threatened flora species and 1 fauna species were recorded during the surveys and a further 1 flora species and 7 fauna species are considered to have a moderate potential occurrence.

The full set of flora and fauna species recorded within the study during site investigations is included in the biodiversity assessment that is provided in Appendix F.

Table 6-4 Habitat assessment and targeted survey results

Scientific name	Common Name	Status		Potential occurrence
		BC Act	EPBC Act	
Flora species				
<i>Acacia pubescens</i>	Downy Wattle	V	V	Recorded (identified in previous surveys, not recorded during 2020 targeted surveys)
<i>Dillwynia tenuifolia</i>	-	V		Recorded
<i>Micromyrtus minutiflora</i>	-	E	V	Moderate
<i>Grevillea juniperina subsp. juniperina</i>	Juniper-leaved Grevillea	V		Recorded
<i>Pultenaea parviflora</i>	-	E	V	Recorded
Fauna species				
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	E		Recorded
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	V		Moderate
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V		Moderate

Scientific name	Common Name	Status		Potential occurrence
		BC Act	EPBC Act	
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V		Moderate
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V		Moderate
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V		Moderate
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V		Moderate
<i>Myotis macropus</i>	Southern Myotis	V		Moderate

V = vulnerable species, E = endangered species, grey = species recorded within proposal area

Weed and pest species

Within the Greater Sydney region, there are 108 listed priority weeds and the following priority weeds were observed in and adjacent to the study area:

- African olive (*Olea europaea subsp. Cuspidata*)
- Bridal creeper (*Asparagus asparagoides*)
- African Boxthorn (*Lycium ferocissimum*)
- Ground Asparagus (*Asparagus aethiopicus*)

6.1.3 Potential impacts

The ecological assessment in Appendix F provides an assessment of the impacts of the proposal on the ecological values of the proposal area and an assessment of the proposal against the relevant State and Commonwealth legislation. A summary of the impacts identified is provided in the following sections.

Construction

Removal of native vegetation

The proposal would require the clearance of vegetation for the formation of the proposed on-ramp (G-Loop and merge lane), relocation of the earth bund, and construction of utility upgrades. The area of vegetation impacted as a result of vegetation clearance would be a total of approximately 2.17 hectares, across the three identified PCTs, as summarised in Table 6-5 and identified in Figure 6-2. Given the larger areas of local occurrence the highest percentage of reduction of ecological communities within the local area of 10 kilometres is a 0.43% reduction in PCT 725 broad-leaved ironbark.

Table 6-5 Impacts on vegetation

PCT	Status		Area impacted by proposal ¹	Local occurrence (ha) ²	Reduction in local occurrence due to proposal
	BC Act	EPBC Act			
PCT 724 - Broad-leaved Ironbark - Grey Box	EEC	No	0.80 ha	628 ha	0.13%
PCT 725 - Broad-leaved Ironbark	EEC	CEEC	1.09 ha	254 ha	0.43%
PCT 835 - Forest Red Gum	EEC	No	0.28 ha	1655 ha	0.01%

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

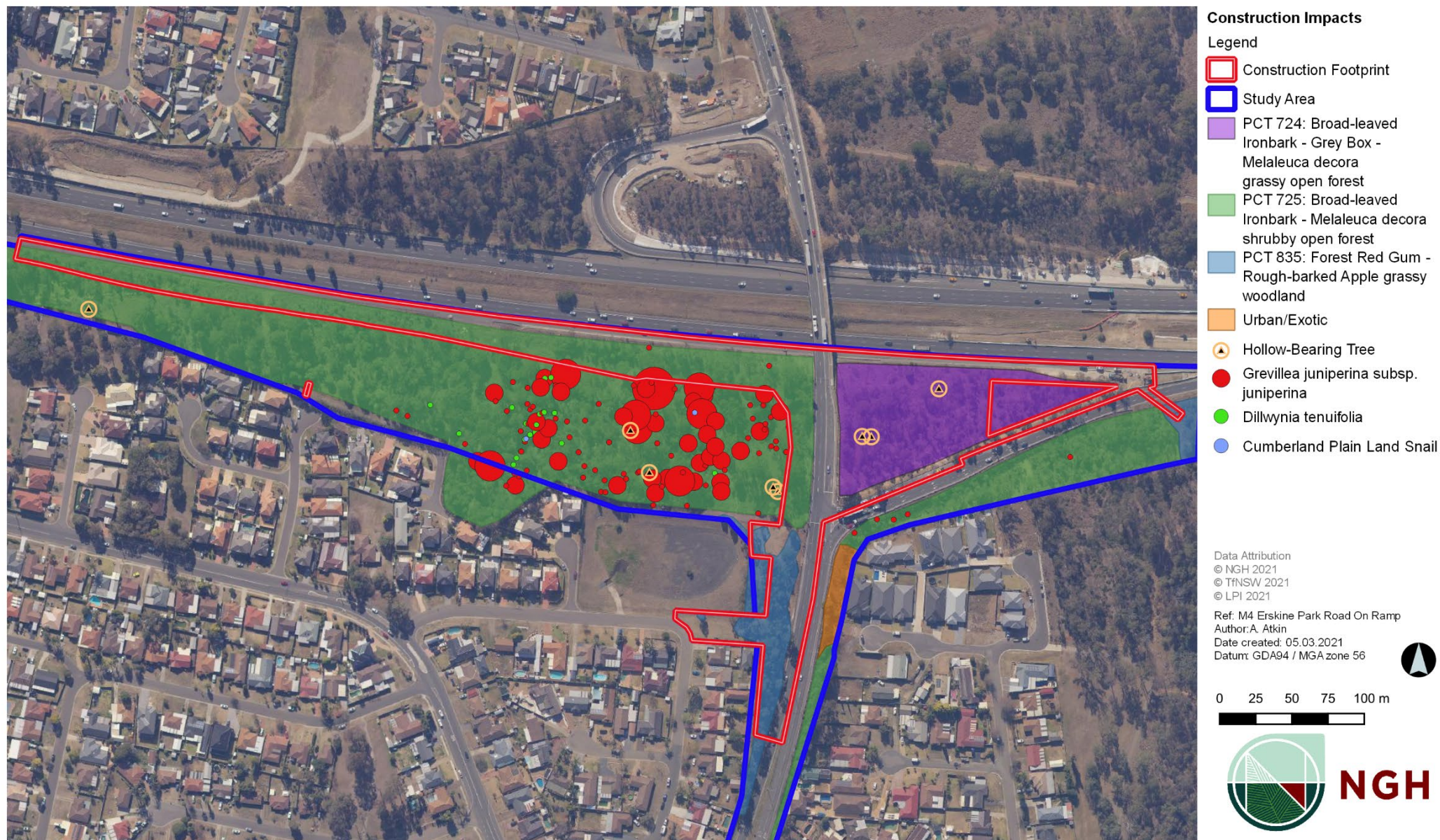


Figure 6-2 Area of vegetation removal of each PCT within the proposal area (Source: NGH Environmental, 2021)

The condition of the vegetation where a canopy is present is generally of low to moderate condition. All the identified PCT's are all at risk of extinction. The proposal would marginally exacerbate this risk, however the impacts to these communities are considered unlikely to have an adverse effect on the extent of the community such that its local occurrence is likely to be placed at risk of extinction. The proposal will impact approximately 0.80 ha of the PCT 724 (Shale Gravel Transition Forest), 1.09 ha of PCT 725 (Cooks River/Castlereagh Ironbark Forest) and 0.28 ha of PCT 835 (River-Flat Eucalypt Forest), however it is likely that these communities will continue to exist within areas adjacent to the proposal area, and within larger patches of higher ecological integrity protected in the broader locality.

The proposal is considered unlikely to substantially and adversely modify the composition of these TECs to an extent that its local occurrence is placed at risk of extinction as these communities already occur in a degraded state. Given the extent of local occurrence of native vegetation that has been identified within the study area, the area of native vegetation clearance as a result of the proposal, the reduction within the locally occurring vegetation as a result of the proposal would be minor.

Removal of threatened fauna habitat

Threatened fauna habitat exists within the study area in the form of foraging habitat from flowering Eucalypts, native and exotic trees, and shrubs, likely used as occasional foraging habitat for nomadic and migratory threatened fauna. It is considered unlikely that the threatened fauna utilising the vegetation as foraging habitat would be solely reliant on these patches and are thus considered unlikely to be significantly impacted. Three hollow bearing trees would be removed as a result of the proposal.

Of the threatened fauna species that potentially occur within the proposal area, it is considered that no individuals would be directly impacted by the works to construct the proposal as a tree clearing procedure would be implemented to minimise impacts on fauna utilising the habitat to be removed.

Removal of threatened flora habitat

Of the threatened flora species identified as having moderate potential to occur within the study area, only three of the species were identified during site investigations and only the Juniper-leaved Grevillea species was identified within the works area. None of the identified threatened flora species have ecosystem or species credit species. A summary of the flora species identified and impacted by the proposal is provided in Table 6-6 and the three individuals impacted are identified in Figure 6-3. All three of the impacted individuals are Juniper-leaved Grevillea and are located to the west of Roper Road immediately south of the M4 mainline.

Table 6-6 Impacts on threatened flora

Species	Status		Habitat or individuals in the study area	Individuals impacted	
	BC Act	EPBC Act			
Juniper-leaved Grevillea (<i>Grevillea juniperina</i> subsp. <i>juniperina</i>)	V		598 individuals	3 individuals	
Downy Wattle (<i>Acacia pubescens</i>)	V	V	3	0	
<i>Dillwynia tenuifolia</i>	V		49	0	
<i>Micromyrtus minutiflora</i>	E	V	0	0	
<i>Pultenaea parviflora</i>	E	V	0	0	

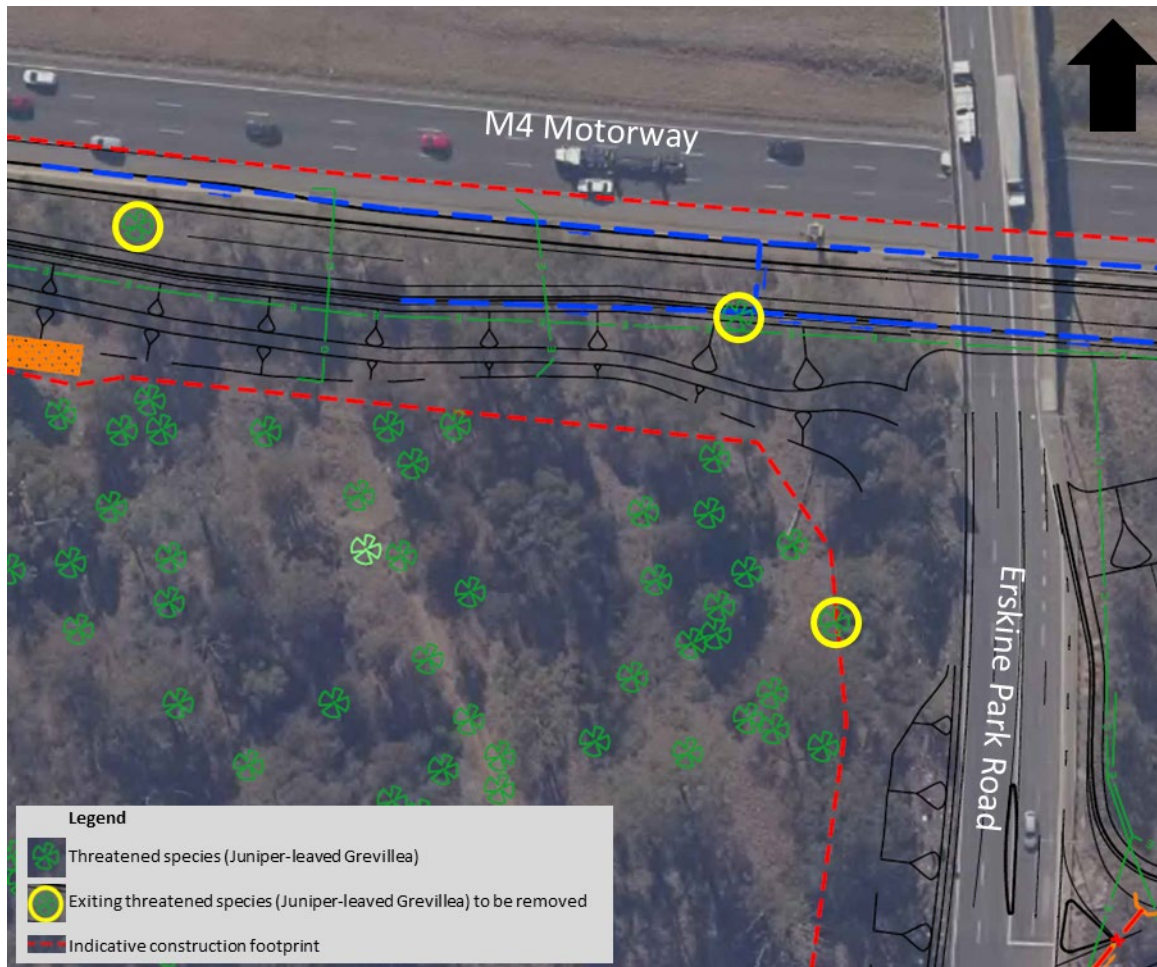


Figure 6-3 Juniper-leaved Grevillea impacted by the proposal

The proposal has the potential to add to a growing cumulative impact towards impacting population viability of the Juniper-leaved Grevillea due to the removal of known individuals. The proposal as currently proposed would impact on approximately 0.3% of the known population of the species within the proposal area, in addition to potential indirect impacts to individuals adjacent to the site through alteration of hydrology, changes in light and shade due to canopy tree removal, increased rubbish from the adjacent motorway and increased dust from construction and operation of the proposal. The removal of 0.3% of the population within the proposal area is not considered likely to lead to a long-term decrease in the species. Tests of significance were completed for the threatened flora species identified as having moderate potential to occur within the study area and all tests indicated no significant impacts are likely.

Injury and mortality

Injury and mortality are considered unlikely because of the proposal as the proposal predominantly involves the removal of groundcover vegetation and will not impact fauna habitat connectivity. Preclearing surveys and clearing supervision would occur to ensure that fauna is not injured during any tree clearing.

Noise, light and vibration

Noise and vibration from construction machinery would occur during the works and during night works lighting will be used. Night works would generate light spill within adjacent vegetation and vibratory rolling will occur. The impacts from these works would be temporary in nature and are not considered likely to significantly impact adjacent vegetation or fauna habitat.

Significance of impacts

Tests of significance under the BC Act and the EPBC Act have been prepared for the TECs, flora, birds, mammal, bats and invertebrate. A summary of the tests of significance is included in Table 6-7 and the details are included in Appendix F. The potential for significance has been considered for all TECs and species that have been recorded or are considered likely to occur within the proposal area. In relation to all the significance assessment questions the likely significant impact was “no or positive impact” or “not applicable”.

Table 6-7 Tests of significance under the BC Act and EPBC Act (Source: NGH, 2021)

Threatened species, or communities	Likely significant impact?
BC Act significance assessments	
Shale Gravel Transition Forest in the Sydney Basin Bioregion	No
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	No
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	No
Juniper-leaved Grevillea	No
<i>Micromyrtus minutiflora</i>	No
Downy Wattle	No
<i>Pultenaea parviflora</i>	No
<i>Dillwynia tenuifolia</i>	No
Varied Sittella	No
Dusky Woodswallow	No
Grey-headed Flying-fox	No
Eastern Coastal Free-tailed Bat	No
Eastern False Pipistrelle	No
Southern Myotis	No
Greater Broad-nosed Bat	No
Cumberland Plain Land Snail	No
EPBC Act significance assessments	
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	No
<i>Micromyrtus minutiflora</i>	No
Downy Wattle	No
<i>Pultenaea parviflora</i>	No

Threatened species, or communities	Likely significant impact?
Grey-headed Flying-fox	No

bold = TEC, species recorded within the site during surveys

As described in the ecological assessment provided in Appendix F, the proposal is not likely to significantly impact threatened species or ecological communities or their habitats, within the meaning of the BC Act or *Fisheries Management Act 1994* and therefore a Species Impact Statement or Biodiversity Development Assessment Report is not required. Full details of the assessment of significance under the EP&A Act are presented in Appendix F.

The proposal is not likely to significantly impact threatened species, ecological communities or migratory species, within the meaning of the EPBC Act.

Operation

Wildlife connectivity corridors

As the proposal area contains limited fauna habitat value, connectivity is not considered to be reduced because of the proposal. The proposal area occurs within a fragmented urban landscape and would not involve the removal of large patches of vegetation; therefore it is not considered likely that the proposal will increase the degree of this fragmentation such that it would significantly reduce the connectivity of habitat for threatened or common flora and fauna.

Edge effects on adjacent native vegetation and habitat

The native vegetation within and adjacent to the study area exists in a degraded state with areas of high weed incursion and fragmentation of vegetation. As such, it is unlikely that the proposal would exacerbate fragmentation and weed invasion within those areas.

Invasion and spread of weeds, pests, pathogens and disease

The proposal would involve the removal of vegetation and excavation which has the potential to introduce new weeds, pests, pathogens and disease into the study area and spread wider. The Biosecurity Act 2015 dictates that all plants are regulated with a general biosecurity duty to prevent, eliminate, or minimise any biosecurity risk they may pose. The four priority weeds identified within or adjacent to the study area have the following required duties and actions:

- African olive (*Olea europaea subsp. Cuspidata*) – Whole region: The plant or parts of the plant are not traded, carried, grown, or released into the environment. Exclusion zone: The plant is eradicated from the land and the land kept free of the plant. Core infestation area: Land managers prevent spread from their land where feasible.
- Bridal creeper (*Asparagus asparagoides*) – Prohibition on dealings. Must not be imported into the State or sold *this requirement also applies to the Western Cape form of bridal creeper
- African Boxthorn (*Lycium ferocissimum*) – Prohibition on dealings. Must not be imported into the State or sold
- Ground Asparagus (*Asparagus aethiopicus*) – Prohibition on dealings. Must not be imported into the State or sold

There is also potential for the transmission of *Phytophthora cinnamomi* (soil-borne pathogen that spreads in plant roots) due to the transportation of machinery between sites.

The CEMP for the proposal would include protocols for the management of weed spread, invasive species and soil-borne pathogens which will be implemented during the construction. Where the protocols are

implemented the proposal is unlikely to cause the invasion or spread of weed species, pest species and pathogens due to the proposal area being limited to corridors of vegetation in developed areas.

Waterways

The nearest waterway to the proposal is Ropes Creek which is located about 100m east of the proposal area (addressed further in Section 6.5). Impacts to waterways and aquatic habitat would be minimal as the proposed would not result in physical modifications to any waterways nearby. There is potential for minor changes to hydrology, turbidity and sedimentation from an increase in impervious area and stormwater runoff. Mitigation measures designed to limit these minor changes to aquatic habitat and waterways are included in 6.1.4 and 6.5.4.

Light spill

The proposal would include the installation of approximately 20 additional street light columns, all located within the existing M4 Motorway area. Light spill from the additional street lights may occur into TECs, however due to the location of the works within the wider motorway infrastructure the potential impacts would be minor.

6.1.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity	<p>A Flora and Fauna Management Plan will be prepared in accordance with Transport for NSW's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects</i> (RMS, 2011) and implemented as part of the CEMP. It will include, but not be limited to:</p> <ul style="list-style-type: none"> plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas requirements set out in the <i>Landscape Guideline</i> (RMS, 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) 	Contractor	Detailed design / pre-construction	Section 4.8 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> • Protocols to manage weeds and pathogens. 			
Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	Contractor	Detailed design / pre-construction	
Biodiversity – Removal of vegetation	<p>An Environmental Work Method Statement (EWMS) is required for clearing and grubbing works.</p> <p>The EWMS would be submitted to the Transport for NSW Environment branch staff for review and endorsement prior to commencement of works.</p> <p>The EWMS must include, but not be limited to:</p> <ul style="list-style-type: none"> • description of the works/activities including machinery and set up of exclusion zones • outline of the sequence of work/activities, including interfaces with other construction activities (for example the interface between cut and fill areas, stabilisation of exposed areas, excavation for an installation or upgrade of culverts) • identification of potential environmental risks/impacts due to the works/activities which is to include risks associated with wet weather events • evaluation of methods to eliminate/reduce the environmental risk • mitigation measures to reduce environmental risk • any safeguards resulting from consultation with public authorities and other stakeholders, where appropriate • a map / diagram indicating the locations of sensitive locations (such as threatened species), the likely potential environmental 	Contractor	Pre-construction/ Construction (pending work schedule)	Section 3.2.4 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<p>impacts and work areas as well as controls</p> <ul style="list-style-type: none"> • identification of works areas and exclusions areas • details of a process for progressive review, for example monitoring processes and mitigations to eliminate/reduce environmental risks/impacts 			
Biodiversity – Removal of native vegetation	Pre-clearing surveys will be undertaken in accordance with <i>Guide 1: Pre-clearing process</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Prior to construction	
Biodiversity – Removal of native vegetation	Vegetation removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bush rock</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	During Construction	
Biodiversity – Removal of native vegetation	Native vegetation will be re-established in accordance with <i>Guide 3: Re-establishment of native vegetation</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Post construction	
Biodiversity – Removal of native vegetation	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	During construction	
Biodiversity – Removal of threatened species habitat and habitat features	Habitat removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bush rock</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	During construction	
Biodiversity – Removal of threatened species habitat	The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	During construction	

Impact	Environmental safeguards	Responsibility	Timing	Reference
and habitat features	<i>projects</i> (RTA 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.			
Biodiversity - Edge effects on adjacent native vegetation and habitat	Exclusion zones will 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). Exclusion zones around sensitive areas will be set up using a hard barrier such as jersey kerbs.	Contractor	During construction	Section 4.13 of QA G36 <i>Environment Protection</i>
Biodiversity - Injury and mortality of fauna	Fauna will be managed in accordance with <i>Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	During construction	
Biodiversity - Invasion and spread of weeds	Weed species will be managed in accordance with <i>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	During construction	
Biodiversity - Invasion and spread of pests	Pest species will be managed within the proposal site.	Contractor	During construction	
Biodiversity - Invasion and spread of pathogens and disease	Pathogens will be managed in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	During construction	

Other safeguards and management measures that would address biodiversity impacts are identified in sections 6.3, 6.4 and 6.5.

6.1.5 Biodiversity offsets

The Biodiversity Assessment identifies that 1.09 ha of TEC Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion would be impacted by the proposal. Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion is listed as endangered under the BC Act and critically endangered under the EPBC Act. Within the proposal area this TEC is assessed as being in moderate condition. In accordance with the Transport for NSW guidelines (draft 2019) where there is any clearing of a critically endangered ecological community in moderate to good condition an offset is to be provided. This would be incorporated into the existing Biodiversity Offset Strategy for the broader project.

6.2 Traffic and transport

6.2.1 Methodology

The traffic and transport assessment was informed by site observations, desktop investigations and associated traffic modelling assessments and design reports undertaken for the proposal area between 2018 and 2020. The Traffic Assessment Report is included in Appendix G and a summary is provided in this section of the REF.

It is noted that the Traffic Assessment references modelling results which consider scenarios both with the Mamre Road Upgrade Project completed and without the upgrades proceeding. Mamre Road is located approximately 4 km south of the proposal area along Erskine Park Road, as identified in Figure 6-4. Given the proximity of and interaction between Mamre Road and the Erskine Park Road – Roper Road corridor and the M4 Motorway, the traffic assessment considered it necessary to evaluate the potential impact of the proposal within the context of the Mamre Road Upgrades.

A description of the proposed upgrades to Mamre Road is provided in Section 6.13.3 – Cumulative impacts, however in summary the proposed upgrade works generally include widening of Mamre Road, providing separated turning lanes and intersection improvements. The assessment notes that the Mamre Road Upgrade Project has been funded and is likely to occur in the medium term. However, as the Mamre Road Upgrade project is not yet approved, this REF only considers the potential impacts of the proposed M4 Roper Road on-ramp project on traffic and transport without the implementation of the Mamre Road Upgrade Project.

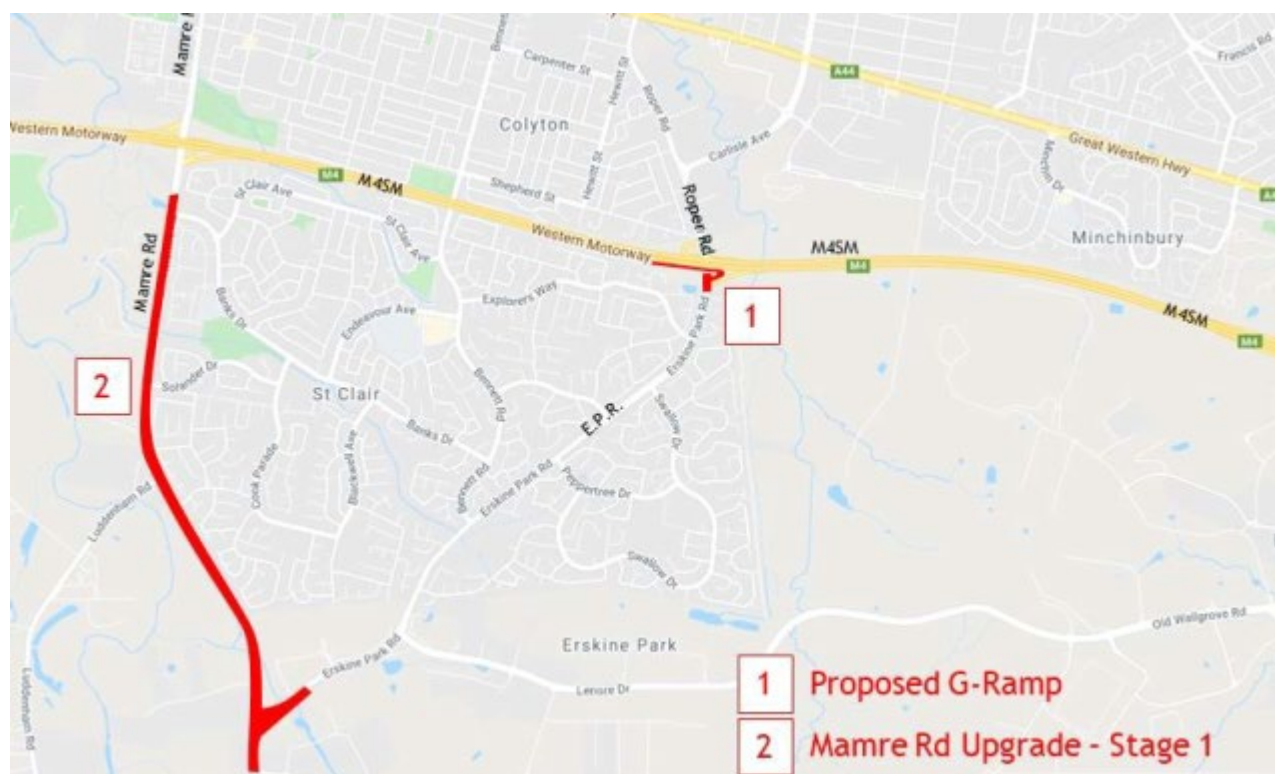


Figure 6-4 Location of Mamre Road Upgrade Project in relation to the proposal (Source: O'Brien Traffic, 2020)

Local road trip comparison

To determine the changes to local road usage as a result of changing road user behaviour to utilise the proposed on-ramp, five representative trip routes were established and typical trips assessed. Typical journeys likely to utilise the proposed on-ramp were mapped using Google Traffic data, generating

estimates of journey kilometres and travel time per trip across differing times of the day. The number of vehicles estimated as likely to utilise the ramp was extracted from the volume plots derived from the Sydney GMA Strategic Traffic Forecasting Model (STFM) for individual links in the local network. The vehicle flows for Erskine Park Road and Roper Road and surrounding network were provided for weekday morning (AM) and afternoon (PM) 2-hour peak periods in the forecast years 2021, 2026 and 2031. The proportion of ramp switching trips using each of the representative routes was based on a review of the STFM. The representative trips considered were:

- Trips currently using the Mamre Road on-ramp that divert to the proposed on-ramp
 - Intersection of Bennett Road & Coonawarra Drive, St Clair to the M4 westbound at South Creek, Orchard Hills (refer Figure 6-10) – 21% of trips were assumed to take this route
 - Intersection of Peppertree Drive & Capella Street, Erskine Park to M4 westbound at South Creek, Orchard Hills (refer Figure 6-11) – 32% of trips were assumed to take this route
- Trips currently heading north across the bridge over the M4 Motorway that divert to the proposed on-ramp
 - Erskine Park Road bridge over the M4 Motorway (south side) to Intersection of Queen Street & Chapel Street, St Marys (refer Figure 6-12) – 47% of trips were assumed to take this route
- Trips that would divert to utilise the proposed on-ramp from the north
 - Great Western Highway / Carlisle Road, Colyton to Erskine Park Road bridge over M4 Motorway (south side) to M4 westbound at South Creek, Orchard Hills (refer Figure 6-13) – 60% of trips were assumed to take this route
 - Carlisle Avenue at Ropes Creek, Minchinbury to O'Connell Street & Sunflower Drive, Claremont Meadows (roundabout) (refer Figure 6-14) – 40% of trips were assumed to take this route

For each trip the route distances, speed and travel time was derived for the base case and the proposal case where the proposed on-ramp alternative route was used. The data for the combined typical flows was then multiplied by estimated traffic volume on the ramp and relevant expansion factors to estimate annual Vehicle Kilometres Travelled (VKT) and Vehicle Hours Travelled (VHT) overall for the representative local road trips.

M4 Motorway Modelling

To consider the potential options for the proposed on-ramp, including the proposed layout and the recommended signal phasing, and the potential impacts on traffic and transport, modelling was completed using the M4 Smart Motorway Operational Traffic Model (M4SM OTM). M4SM OTM is a hybrid microscopic / mesoscopic model of the M4 Motorway corridor and surrounding road network. The microscopic portions of the model allow for detailed vehicle movement and behaviour characteristics to be modelled and observed on the M4 Motorway and the interchanges whilst the mesoscopic portions allowed network capacity to be accurately reflected in the modelling. The model uses Aimsun software and is capable of modelling ramp metering.

For all the scenarios the M4SM OTM was used with the following assumptions

- A 5-hour AM peak (5:00am to 10:00am)
- A 5-hour PM peak (2:00pm to 7:00pm)
- 2021 and 2031 Model Years that include approved land use and trip generation assumptions and a range of wider region road network improvements
- SCATS ramp metering applied in the 'SRMS' scenarios.

A range of data model outputs were used to assess potential impacts of the proposal, including:

- movement speeds at key locations to highlight congestion and ramp meter activation issues

- traffic flow profiles and traffic counts
- maximum vehicle queue results
- section density data outputs
- screenshots of vehicle queuing in the model
- summary statistics for network performance which compare overall network performance speeds such as average speeds and completed/underway/waiting journeys.

Modelling outputs are reported in the Traffic Assessment and are summarised in Section 6.2.3 of this REF to assess potential impacts in relation to:

- Impacts on the Erskine Park Road – Roper Road corridor and M4 Motorway interchange, including
 - Future usage of the proposed on-ramp
 - Impacts on Erskine Park Road – Roper Road
 - Impacts on the M4 westbound off-ramp
 - Impacts on the Roper Road eastbound on-ramp to M4 Motorway intersection
- Impacts on the surrounding road network, including:
 - Impacts on nearby M4 on and off-ramps
 - Impacts on the westbound M4 Motorway mainline
 - Overall network impacts

Scenario C2 of the modelling undertaken represents the proposal and has been used in this report to provide a summary of the modelling results. Scenario C2 assumes the proposal would include a dedicated right turn lane for traffic from Erskine Park Road northbound, turning right onto the proposed on ramp and filtered control signalling.

Road safety

Crash statistics in the project area were obtained from Transport for NSW Centre for Road Safety, Crash and casualty statistics – LGA view (Penrith) which has finalised data available for the 5-year period 2015 to 2019.

6.2.2 Existing environment

The existing road network infrastructure is described in Section 2.2, the traffic volumes, congestion issues, local trip distances and road safety in the study area is summarised in the following sections. It is noted that there is no road side parking within the proposal area, as all areas of the M4 Motorway, Erskine Park Road and Roper Road within the proposal area are 'No Stopping'. Unrestricted parking is provided on local roads Shepherd Street and Augusta Place adjacent to Site Compounds B and C respectively.

Existing traffic volumes

Erskine Park Road records approximately 3000 vehicles in the AM peak, and 3500 vehicles in the PM peak (2018). Roper Road experiences slightly more traffic than Erskine Park Road with approximately 3700 vehicles in the AM peak, and 4200 vehicles in the PM peak.

The M4 Motorway experiences a significant volume of traffic in the peak periods, with approximately 14500 vehicles in the AM peak, and 16000 vehicles in the PM peak. The M4 westbound off-ramp carries approximately 1800 vehicles in the AM peak and 2600 vehicles in the PM peak. The Roper Road on ramp onto the M4 Motorway carries approximately 2000 vehicles in the AM peak, and 1500 vehicles in the PM peak.

Existing average traffic volumes for 2018 peak periods for roads within the proposal area are summarised in Table 6-8.

Table 6-8 Existing average traffic volumes (2 hr peak) - 2018

Road	Direction	AM Peak (7AM – 9AM)	PM Peak (4PM – 6PM)	ADT
M4 Motorway	EB	8,122	6,213	54,419
	WB	6,168	9,676	41,324
	<i>Total</i>	<i>14,290</i>	<i>15,889</i>	<i>95,744</i>
Erskine Park Road	NB	1,687	1,690	11,301
	SB	1,437	1,832	9,626
	<i>Total</i>	<i>3,123</i>	<i>3,522</i>	<i>20,927</i>
Roper Road	NB	2,497	2,538	16,710
	SB	1,278	1,746	8,565
	<i>Total</i>	<i>3,776</i>	<i>4,284</i>	<i>25,276</i>
M4 westbound off-ramp	WB	1,850	2,601	12,397
Roper Road – M4 eastbound on-ramp	EB	1,972	1,455	13,215

Transport for NSW have developed a Sydney GMA Strategic Traffic Forecasting Model (STFM) as part of the M4 Smart Motorway project. The STFM is a wide-area strategic traffic forecasting model area including Sydney and Newcastle that is used to provide consistent land use and transport network forecasts for projects in the region. Average daily traffic numbers for the surrounding road network, for 2021, 2026 and 2031 without the proposal are provided in Table 6-9.

Table 6-9 Future average daily traffic volumes (without the proposed on-ramp)

Road	Direction	2021	2026	2031
M4 Motorway	EB	57,830	60,719	61,366
	WB	43,462	46,367	47,534
	Total	101,292	107,085	108,900
Erskine Park Road	NB	11,926	12,640	13,504
	SB	9,093	11,786	12,863
	Total	21,019	24,426	26,367
Roper Road	NB	13,937	13,413	13,243
	SB	8,061	8,529	8,958
	Total	21,998	21,942	22,200

Road	Direction	2021	2026	2031
M4 Motorway – westbound off-ramp	WB	12,982	11,098	10,708
Roper Road – M4 eastbound on ramp	EB	13,154	10,094	10,320

Existing road network and congestion issues

The existing road environment within the proposal area is described in Section 2.2. There are no clearways or on-street parking available within the proposal area. As described in Section 2.2 there are no dedicated cycle facilities and limited dedicated pedestrian facilities provided.

There are several network capacity constraints relating to the existing road network at and surrounding the proposal area which cause existing congestion issues. These include:

- Capacity of the northbound through movements across the bridge over the M4 is impacted by queue back from the eastbound Roper Road on-ramp to the M4 during the AM peak and also very high right turn movements from the M4 westbound off-ramp during the PM peak. The ramp meter queue-back from the eastbound Roper Road on-ramp has been identified to extend back to block the left-hand northbound lane of the bridge over the M4 Motorway.
- Southbound through movement of the Roper Road corridor and M4 Motorway interchange can be constrained due to queue back of the right turn lane onto the eastbound Roper Road on-ramp from the north which can overspill the separate lane storage and block the single southbound through lane.
- M4 westbound off-ramp queue back issues along the M4 mainline, however due to the 'trap lane' exit (the 4th mainline lane becomes the M4 westbound off-ramp) the queue back is contained away from the continuing M4 westbound mainline lanes.

Existing local road trips

Road users originating from the south of the M4 Motorway and heading west, currently travel approximately five kilometres (and up to 15 minutes in peak hour) through local streets in St Clair to reach their nearest access to the M4 Motorway (Figure 6-5). These local roads include Explorers Way, St Clair Avenue, Banks Drive, Bennett Road, and Endeavour Avenue. All these roads are 50 km/h and primarily residential. To reach the Mamre Road on-ramp from Erskine Park Road requires road users to travel through at least four intersections along local roads within St Clair.

Alternatively, road users with trips originating from south of the M4 Motorway and heading west, may choose to cross over to the northern side of the M4 Motorway via up Roper Road or Bennett Road and join with the Great Western Highway. This represents a distance of approximately 6 kilometres (and up to 15 minutes in peak hour) (Figure 6-6). Road users wishing to use the Wallgrove Road on-ramp onto the M4 Motorway must travel approximately eight kilometres (and up to 15 minutes in peak hour) via Lenore Drive and Old Wallgrove Road (Figure 6-7).

Road users originating from the north of the M4 Motorway and heading west, currently travel approximately 6 to 7 kilometres (and up to 15 minutes in peak hour) through local streets in Colyton / Minchinbury / St Marys to reach their nearest access to the M4 Motorway at the Mamre Road interchange (Figure 6-8). These local roads include Hewitat Street, Carpenter Street, Monfarville Street and Mitchell Street. All of these roads are 50 km/h and primarily residential. To reach the Mamre Road on-ramp from Minchinbury/Colyton can require road users to pass through up to 16 intersections.

These routes could be avoided if the proposed on-ramp to the M4 Motorway was provided, reducing travel time and removing unnecessary traffic from local roads, resulting in a safer environment for local pedestrians and cyclists.



Figure 6-5 Existing local road access to the M4 Motorway westbound from Erskine Park Road via Mamre Road



Figure 6-6 Existing local road access to the Great Western Highway westbound via Roper Road and Bennett Road



Figure 6-7 Existing local road access onto the M4 Motorway westbound from Erskine Park Road via Lenore Drive and Wallgrove Road

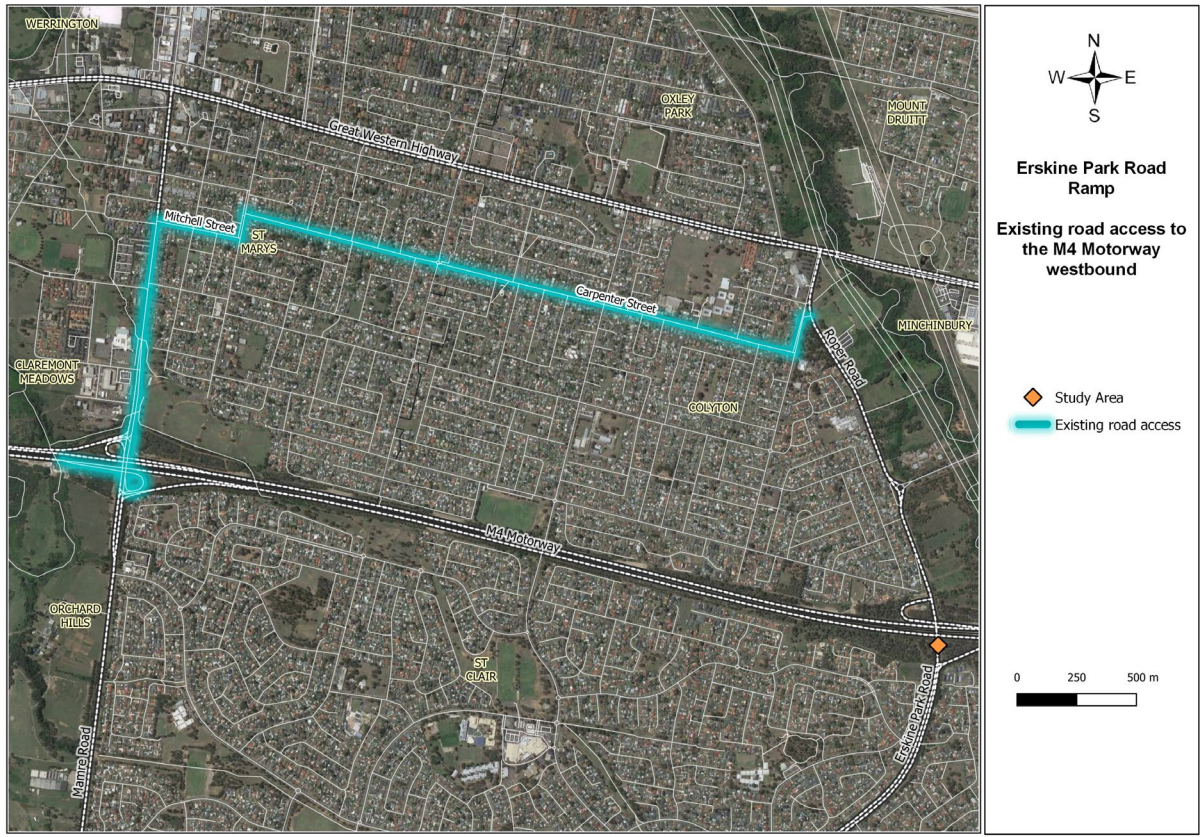


Figure 6-8 Existing local road access to the M4 Motorway from Colyton and Minchinbury

Existing road crash history

The Penrith LGA Crashes Map with data from 2015 to 2019 was reviewed and the data is summarised in Table 6-10 and shown on Figure 6-9. The main types of crashes recorded in the proposal area are rear end dual freeway and T Junction crashes, followed by crashes involving vehicles leaving the road to the left or right. Of the crashes recorded between 2015 and 2019 in the proposal area, 15 were non-casualty, 9 resulted in moderate injury, 8 in minor injury and 4 in serious injuries.

Table 6-10 Road crash data in the proposal area (Transport for NSW, 2020)

Location	Type of crash	Number of crashes
T Junction (21 crashes)- intersections of Erskine Park Road – Roper Road interchange with M4 Motorway or local roads	Right turn sideswipe	1
	Right near	5
	Rear end	6
	U turn	2
	Cross traffic	1
	Right through	1
	Other same direction	2
	From footpath	1
	Off road (left or right)	2
2-way undivided (3 crashes) – Erskine Park Road bridge over the M4 Motorway	Rear end	1
	Of road (left or right)	1
	Lane change	1
Dual freeway (18 crashes) – M4 Motorway	Off road (left or right)	6
	Rear end	7
	Lane change	2
	Lane sideswipe	1
	Other same direction	2
Divided road – Erskine Park Road	Off road (left or right)	1
	Rear end	1
Other	Off left/left bend	1

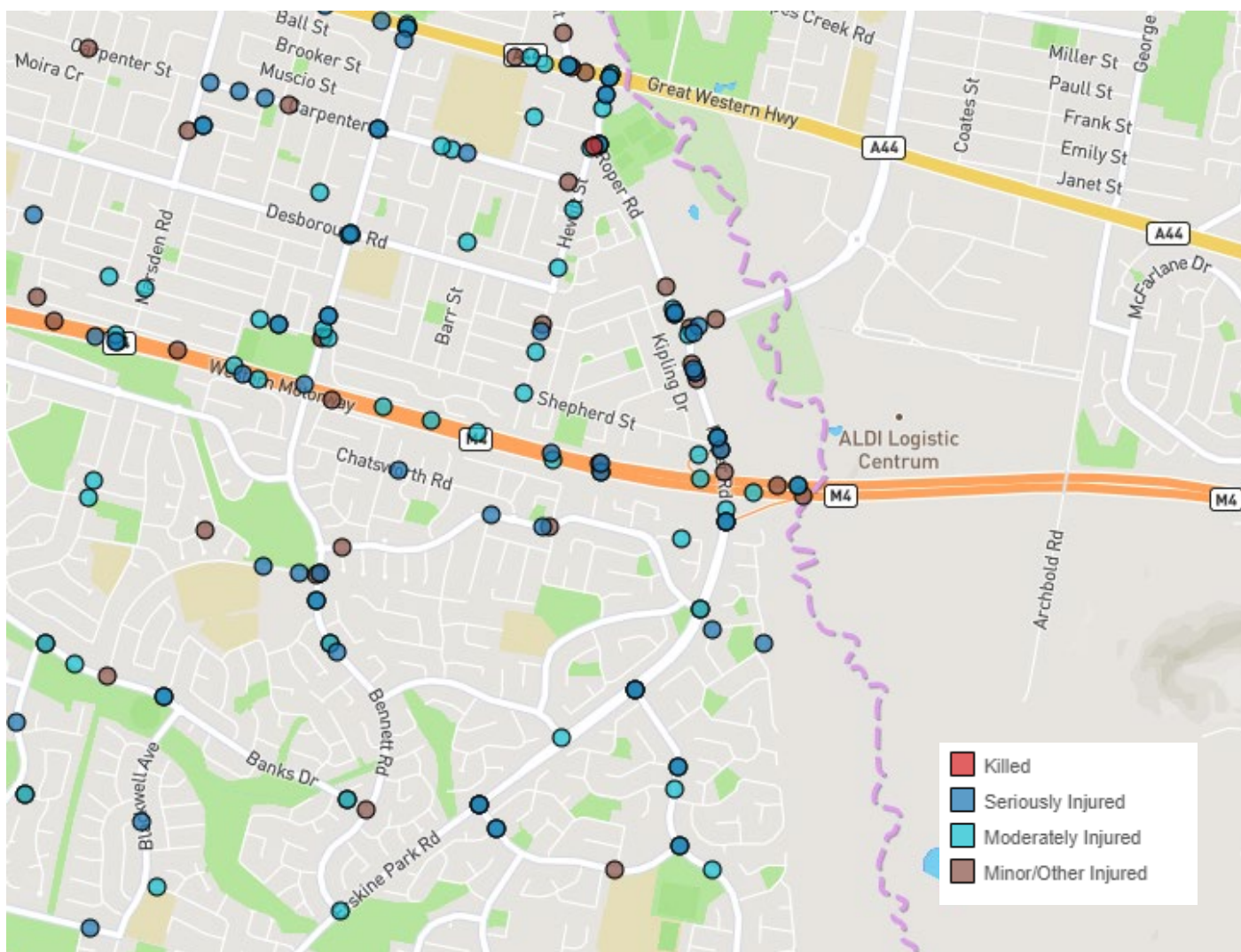


Figure 6-9 Road crash and causality statistics near the proposal area - Penrith LGA (Source: Transport for NSW, 2021)

6.2.3 Potential impacts

Construction

Traffic generation

Construction of the proposal would lead to additional traffic movements over the 18-month construction period. Construction traffic would be associated with a number of work activities, including:

- Delivery of construction materials
- Material removal
- Delivery and removal of construction equipment and machinery
- Movement of construction personnel, including Contractors, site labour force and specialist supervisory personnel.

The construction workforce would vary depending on the phase of construction and associated activities. A typical on-site workforce of around 20 to 40 people is estimated during the construction period, with a maximum of 60 workers per day during peak construction periods. It is expected that construction staff accessing the construction site would use a combination of public transport and personal light vehicles.

Construction traffic movements would generally occur outside of peak periods and are predicted to have a minor impact on the surrounding road network and public transport services. Construction vehicles would access the site via arterial roads (M4, Erskine Park Road and Roper Road) and Augusta Place to the west of Erskine Park Road and construction vehicles accessing Site Compound B which has access of Shepherd Street (local road) would be restricted to light vehicles.

The movement of materials would be managed through the scheduling of deliveries and availability of fleet to avoid peak periods. A Traffic Management Plan (TMP) would be prepared as part of the Construction Environmental Management Plan (CEMP) to address potential impacts and incorporate measures to mitigate impacts on the road network.

Temporary lane closures and speed controls

Some impacts on traffic flow may occur during the construction phase of the works. During construction, it is anticipated that roads are to remain open, however some lane closures may occur to ensure the safety of construction personnel. Temporary lane closures would be required at times during both stages of construction, particularly where works are required directly adjacent to existing traffic lanes, such as Roper Road southbound where the left turn slip way is proposed and the M4 Motorway westbound mainline which the on-ramp would merge onto.

Speed controls would temporarily impact travel times along roads in the proposal area, however these are only anticipated to be minor and temporary. The construction of the proposal is expected to result in improved traffic efficiency during operation and as such, the potential minor impacts to travel times during the construction period are considered justified.

Parking and property access

No parking or property access arrangements would be impacted by the proposal works to construct the on-ramp.

It is expected access to all residential properties can be maintained during the minor works at both Miner Glen and Japura Place during utility works. Short term temporary disruption to on-street parking may occur at Japura Place and Miner Glen during the use of the cul de sacs to install electrical cables for streetlights. This would only be for the duration of the works to install cables. Residents whose parking would be impacted would be notified as least five working days in advance before the start of disruptions to traffic.

There is potential for construction staff to impact the availability of existing unrestricted parking near Site Compound B on Shepherd Street and Site Compound C on Augusta Place, however this impact is expected to be minor as the number of vehicles expected to access the area during construction would be low and the proposed Site compounds B and C would provide for some off-street parking.

Pedestrian and cycling facilities

Limited dedicated pedestrian access is currently provided in the vicinity of the proposal area as described in Section 2.2. Pedestrians using the area south of the bridge over the M4 Motorway have no safe walking area as no dedicated footpath facilities are provided and the space between the carriageway and safety barriers is limited. As there is currently no pedestrian access traffic management would not be provided during construction works.

The construction of the proposal would not result in any impacts to cycling facilities as no dedicated cycle routes have been identified within the proposal area.

Public transport facilities

Bus service routes and timetables would generally remain unaffected during construction as all lanes will typically remain open. Where lane closures are in place temporarily, traffic congestion may slow buses passing through the area. No changes to bus stops would be required during construction as all nearby stops are outside the proposal area.

Given this, the impacts are predicted to have a minor impact on the reliability of local bus services running between Mount Druitt and Penrith via St Clair and Erskine Park which pass through the proposal area.

Operation

Impacts on local road trips

The provision of the proposed on-ramp would provide an additional option for local road users travelling west towards Penrith to use the M4 Motorway instead of local roads to access other on-ramps in the area. The five representative trips identified in Table 6-11 show that the trip length in time is less for routes using the proposed on-ramp by between approximately 1.6 and 5.8 minutes. The kilometres travelled is generally longer for routes using the proposed on-ramp as shown in the trip routes in Figure 6-10 to Figure 6-14.

Table 6-11 Local road trip comparison of existing trips to trips using the proposed on-ramp

Trip #	From / To	Existing route (base case)	Route using on-ramp (proposal case)
Trips currently using the Mamre Road on-ramp that divert to the proposed on-ramp			
1B / 1P Refer Figure 6-10	Intersection of Bennett Road & Coonawarra Drive, St Clair to M4 westbound at South Creek, Orchard Hills	<ul style="list-style-type: none"> Local roads in St Clair Mamre Road on-ramp WB M4 Motorway Trip length: approximately 6-10 minutes	<ul style="list-style-type: none"> Erskine Park Road Proposed westbound on-ramp to M4 M4 Motorway Trip length: approximately 6 minutes
2B / 2P Refer Figure 6-11	Intersection of Peppertree Drive & Capella Street, Erskine Park to M4 westbound at South Creek, Orchard Hills	<ul style="list-style-type: none"> Local Roads in St Clair Mamre Rd on-ramp WB M4 Motorway Trip length: approximately 7-12 minutes	<ul style="list-style-type: none"> Erskine Park Road Proposed westbound on-ramp to M4 M4 Motorway Trip length: approximately 7 minutes
Trip currently heading north across the bridge over the M4 Motorway that divert to the proposed on-ramp			
3B / 3P Refer Figure 6-12	Roper Road M4 over bridge (south side) to Intersection of Queen Street & Chapel Street, St Marys	<ul style="list-style-type: none"> Roper Road Melbourne Street Glossop Street Trip length: approximately 9-14 minutes	<ul style="list-style-type: none"> Proposed westbound on-ramp to M4 Motorway Mamre Road Trip length: approximately 6-12 minutes
Trips that would divert to utilise the proposed on-ramp from the north			
4B / 4P Refer Figure 6-13	Great Western Highway / Carlisle Road, Colyton to Roper Rd M4 over bridge (south side) to M4 westbound at South Creek, Orchard Hills	<ul style="list-style-type: none"> Great Western Highway Mamre Road Mamre Rd on-Ramp WB Trip length: approximately 7-16 minutes	<ul style="list-style-type: none"> Carlisle Road Roper Road Proposed westbound on-ramp to M4 M4 Motorway Trip length: approximately 6-9 minutes

Trip #	From / To	Existing route (base case)	Route using on-ramp (proposal case)
5B / 5P Refer Figure 6-14	Carlisle Avenue at Ropes Creek, Minchinbury to O'Connell Street & Sunflower Drive, Claremont Meadows (roundabout)	<ul style="list-style-type: none"> Roper Road Great Western Highway Gipps Street <p>Trip length: approximately 10-22 minutes</p>	<ul style="list-style-type: none"> Roper Road Proposed westbound on-ramp to M4M4 Motorway Kent Road <p>Trip length: approximately 6-11 minutes</p>

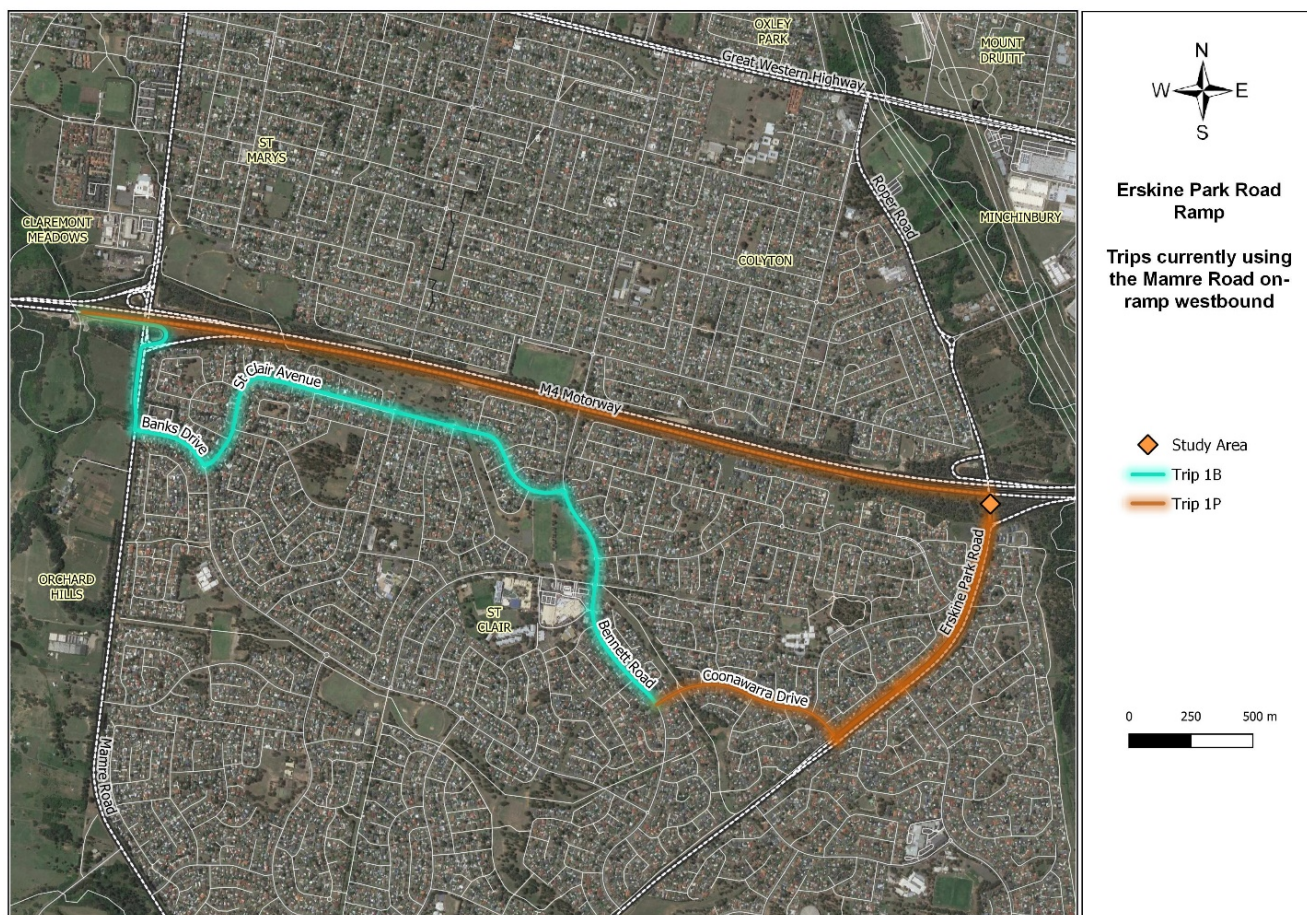


Figure 6-10 Trip 1B (existing) / 1P (with proposal) - St Clair to M4 Motorway westbound

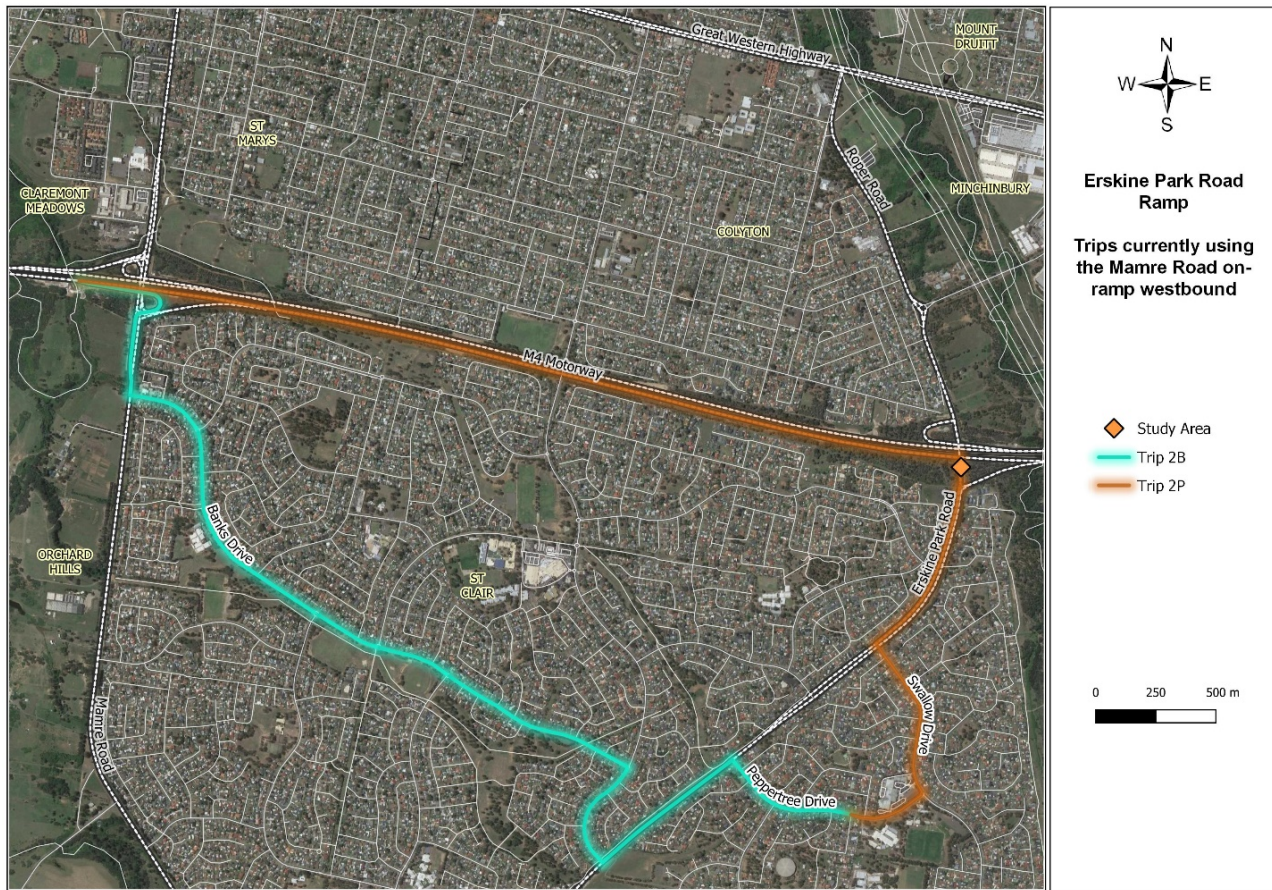


Figure 6-11 Trip 2B (existing) / 2P (with proposal) - Erskine Park to M4 Motorway westbound

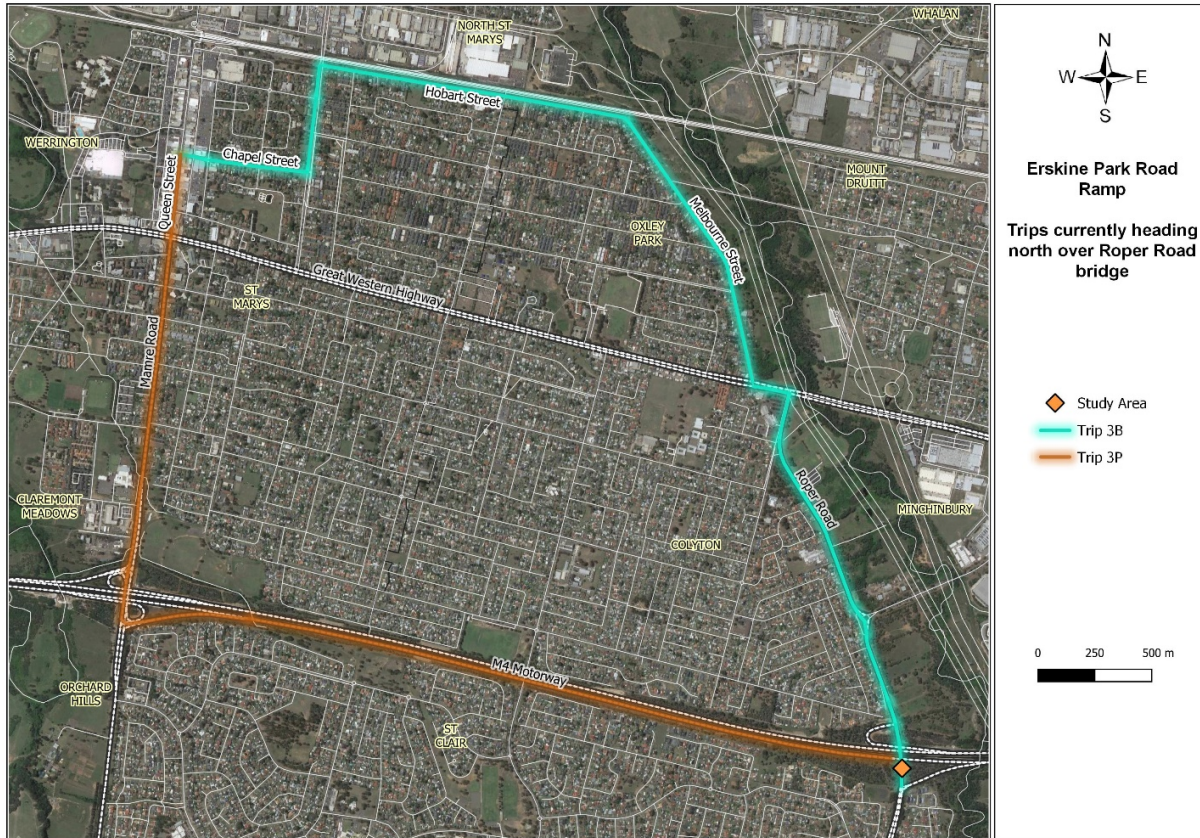


Figure 6-12 Trip 3B (existing) / 3P (with proposal) - Erskine Park to St Marys

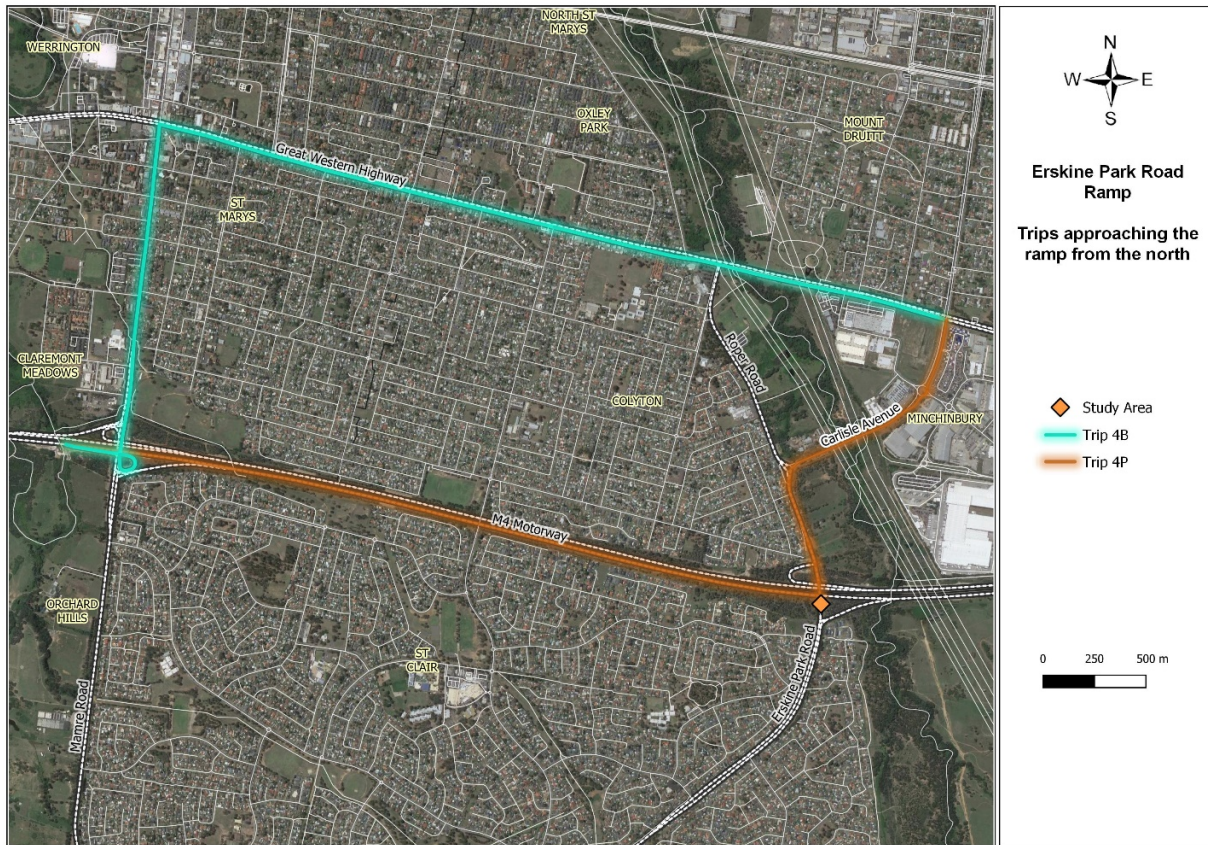


Figure 6-13 Trip 4B (existing) / 4P (with proposal) - Colyton to M4 Motorway westbound

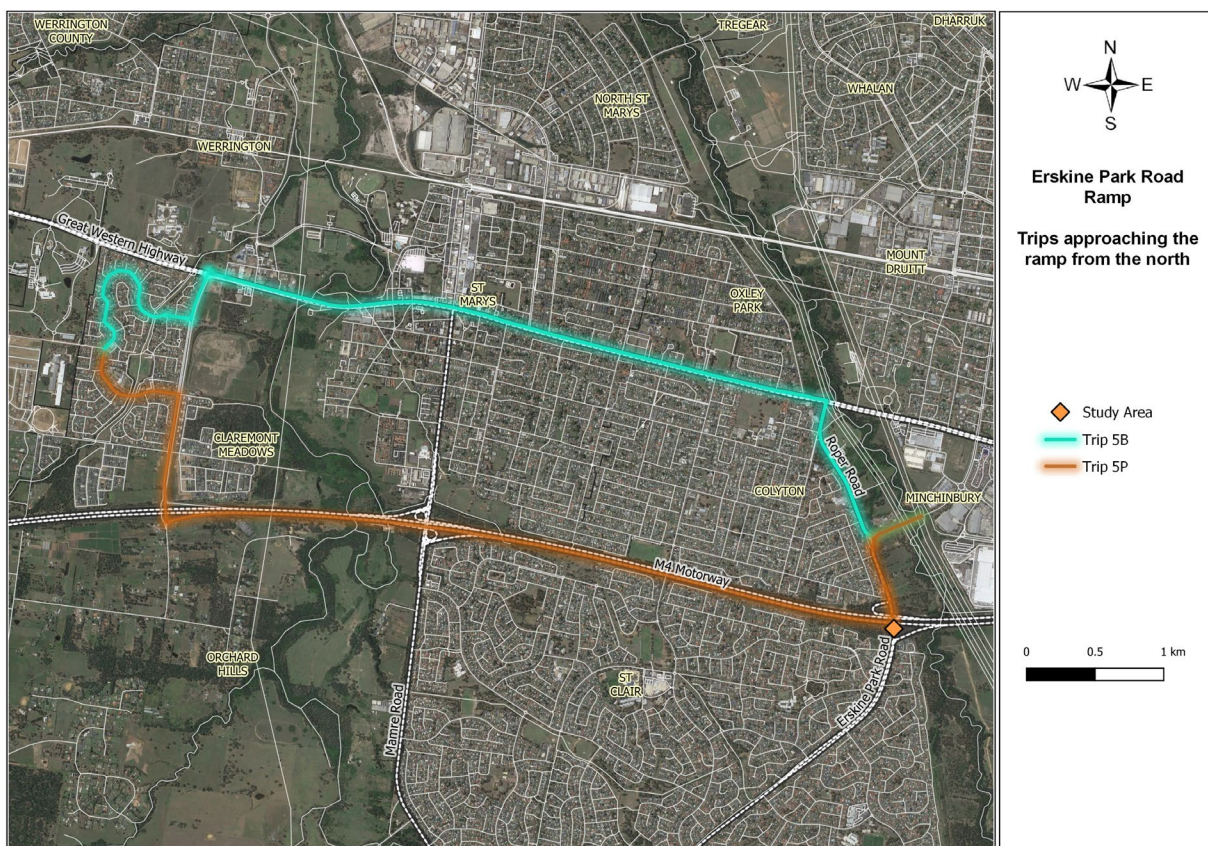


Figure 6-14 Trip 5B (existing) / 5P (with proposal) - Minchinbury to Claremont Meadows

The estimated change in local road trip metrics are provided in Table 6-12 which shows that in 2031 the total vehicle kilometres are 1.5% higher under the proposal compared to the base case but total vehicle hours are 18.5% lower with average speeds increased by 7.8 kilometres per hour. This means that although road users would travel more kilometres, utilising the M4 Motorway rather than local roads would result in a faster trip time due to the increase in average speed provided for through using the motorway. Overall, this is a benefit of the proposal as road users making trips from St Clair, Erskine Park, Minchinbury and Colyton to Penrith or further west would take less travel time and be safer due to road users passing through less intersections.

Table 6-12 Annual traffic estimates for representative local road trips

Scenario	Vehicle hours travelled - km	Vehicle kilometres travelled - hours	Average Speed (km/h)	Total on-ramp traffic (Annual)
2026 – No improvement	11,054,892	350,137	31.6	0
2026 – Proposal	11,209,925	285,350	39.3	913,069
Change	155,033	-64,788	7.7	913,069
2031– No improvement	11,353,505	359,383	31.6	0
2031 – Proposal	11,526,222	292,584	39.4	924,372
Change	172,717	-66,529	7.8	924,372

(Impacts: green – beneficial impact, red – negative impact, black - neutral)

Impacts on the Erskine Park Road – Roper Road Corridor and M4 Motorway interchange

Future use of the proposed on-ramp

The modelled use of the proposed on-ramp is identified in Table 6-13. This identifies that the proposed on-ramp would attract more traffic in the PM peaks.

Table 6-13 Modelled traffic usage of the G-loop on-ramp (Source: O'Brien Traffic, 2020)

Scenario	Total 5-hour count	Maximum hourly flow rates	Maximum hourly count
2021 AM	584	200	180
2031 AM	617	240	182
2021 PM	1,684	452	416
2031 PM	1,554	472	369

In relation to the direction traffic accesses the proposed on-ramp from, the modelling results identified:

- the left turn from the Roper Road southbound lane onto the ramp was the dominant access direction in all peak periods except for the 2031 AM peak
- the right turn from the Erskine Park Road northbound lane onto the ramp was busier in the PM peaks than the AM peaks.

Impacts on Erskine Park Road – Roper Road interchange

The traffic assessment notes that there is existing significant congestion along Erskine Park Road – Roper Road through the proposal area, particular as a result of queue back from the Roper Road eastbound on-ramp to the M4 Motorway.

Table 6-14 Predicted traffic flows along the Erskine Park Road - Roper Road corridor for 2021 and 2031 (Source: Noise and Vibration Assessment)

Scenario	Daytime (7 am to 10 pm)		Night- time (10 pm to 7 am)	
	2021	2031	2021	2031
Erskine Park Road northbound – south of M4 westbound off-ramp				
No improvement	16,432	15,472	3,982	3,974
Proposal	16,727	18,389	4,071	4,512
Change	295	2,917	89	538
Roper Road northbound – bridge over M4 Motorway				
No improvement	26,394	26,892	5,644	6,069
Proposal	26,032	26,436	5,643	6,017
Change	-362	-456	-1	-52
Erskine Park Road southbound – south of M4 westbound off-ramp				
Existing	14,182	14,154	2,403	2,817
Proposal	13,908	13,179	2,422	2,737
Change	-274	-975	19	-80
Roper Road southbound – bridge over M4 Motorway				
Existing	7,325	8,690	1,218	1,799
Proposal	8,695	9,073	1,407	1,960
Change	1,370	383	189	163

(Impacts: green – decrease in traffic flow, red – increase in traffic flow)

The traffic flows summarised above indicate an increase in road users travelling to the Erskine Park Road – Roper Road M4 Motorway interchange to access the proposed on-ramp. A reduction in traffic flows to the north and south of the proposal on-ramp indicates fewer road users travelling through the interchange as means of crossing the M4 Motorway.

Use of a 100 metre long dedicated right turn lane with storage capacity of about 13 vehicles, for vehicles travelling northbound on Erskine Park Road and turning right onto the proposed on-ramp is shown in Figure 6-15 (AM Peak) and Figure 6-16 (PM Peak). In relation to containment of vehicles within the 100 metre right turn lane onto the proposed on ramp, the modelling results identified:

- during the 2021 and 2031 AM Peak, the right turn lane is likely to experience full queue containment
- during the 2021 and 2031 PM Peak, the right turn lane is likely to experience some queue storage overspill into the adjacent northbound through lanes on Erskine Park Road. Increase queue storage overspill would be experienced in the 2031 PM Peak compared to the 2021 PM Peak.

The proposed dedicated right turn lane would be about 65 metres long and have capacity for about nine vehicles and so the right turn lane would be likely to experience additional queue storage overspill in the 2031 AM and PM peak than that shown in the figures. However the traffic report notes that the existing capacity of the northbound bridge over the M4 is constrained by right turn movements from the westbound Erskine Park Road off-ramp, which can be very high particularly in the PM peak. The traffic report identifies that northbound queuing on the bridge could be improved by inhibiting northbound through traffic flows from the proposed on-ramp access suggesting that queue back in peak periods would have benefits for the existing capacity issues for vehicles travelling north over the bridge. Measures to mitigate traffic impacts as a result of queue storage overspill would be further investigated during operation of the proposal.

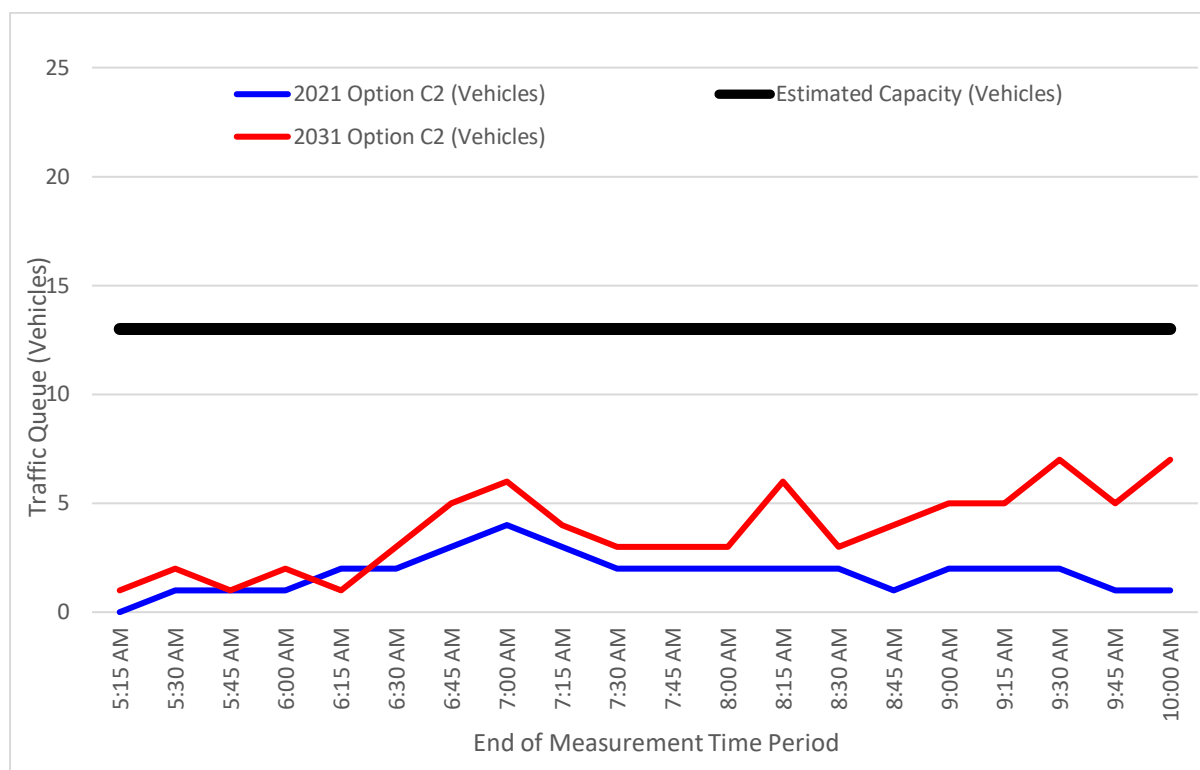


Figure 6-15 Maximum right turn queues onto proposed on ramp, 2021 and 2031 AM Peak

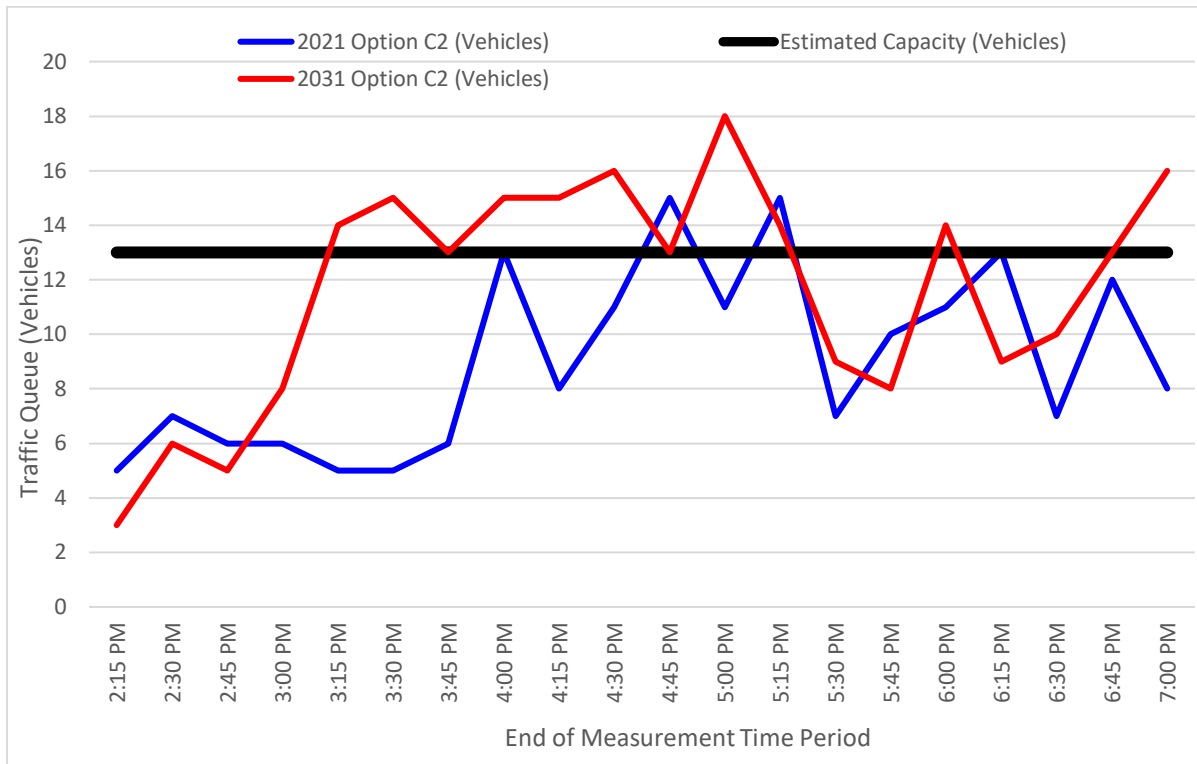


Figure 6-16 Maximum right turn queues onto proposed on ramp, 2021 and 2031 PM Peak

Impacts on the M4 westbound off-ramp to Erskine Park Road and Roper Road

Modelling identified that the addition of the proposed on-ramp at Erskine Park Road and Roper Road resulted in substantial increases in the use of the M4 off-ramp to Erskine Park Road and Roper Road Table 6-15 provides a summary of the 5-hour count for vehicles using the M4 westbound off-ramp for the proposal compared to the no improvement scenario.

Table 6-15 Change in traffic count of vehicles using the existing M4 Motorway westbound Erskine Park Road – Roper Road off-ramp (Source: O'Brien Traffic, 2020)

Scenario	5 Hour count – Combined flows (left turn and right turn from off-ramp)			
	2021 AM	2031 AM	2021 PM	2031 PM
No improvement	3,900	4,299	8,133	6,922
Proposal	4,144	4,442	8,255	7,202
Change	244	143	122	280

The above highlights the increase in traffic using the M4 westbound off-ramp which is considered to be due to road users exiting the M4 Motorway mainline earlier to avoid congestion between the proposed on-ramp and the Mamre Road M4 Motorway interchange. The Traffic Assessment notes that as a result of the proposed on-ramp the volume of vehicles making the following movements at the intersection changed as below:

- left turn exits to the south generally increased
- right turn exits to the north:
 - decreased in the 2021 AM and PM peaks and 2031 AM peak, releasing capacity at the interchange
 - increased in the 2031 PM peak, placing additional pressure on the interchange.

Average vehicle speeds at the exit nose of the off-ramp was modelled to evaluate queue-back from the off-ramp onto the M4 mainline for each of the scenarios in the 2021 and 2031 AM and PM Peaks. These are shown in Figure 6-17 to Figure 6-20.

Overall, management of queue-back risks on the off-ramp was generally improved by the addition of the proposed on ramp, as shown by the improvement in average speed data at the exit ramp nose. The Traffic Assessment notes that this is because it reduced the efficiency of the No improvement layout at feeding traffic onto the congested northbound bridge lanes.

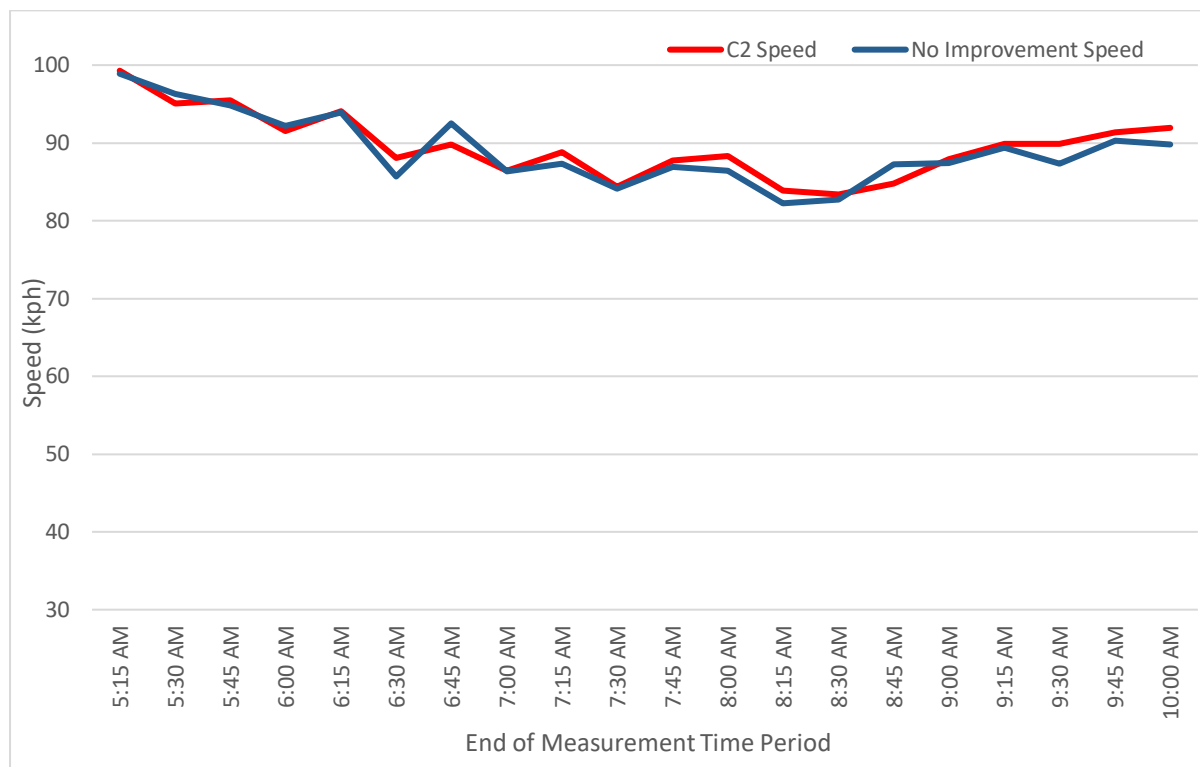


Figure 6-17 Speeds at the exit nose of the M4 westbound off-ramp to Erskine Park Road and Roper Road – 2021 AM Peak

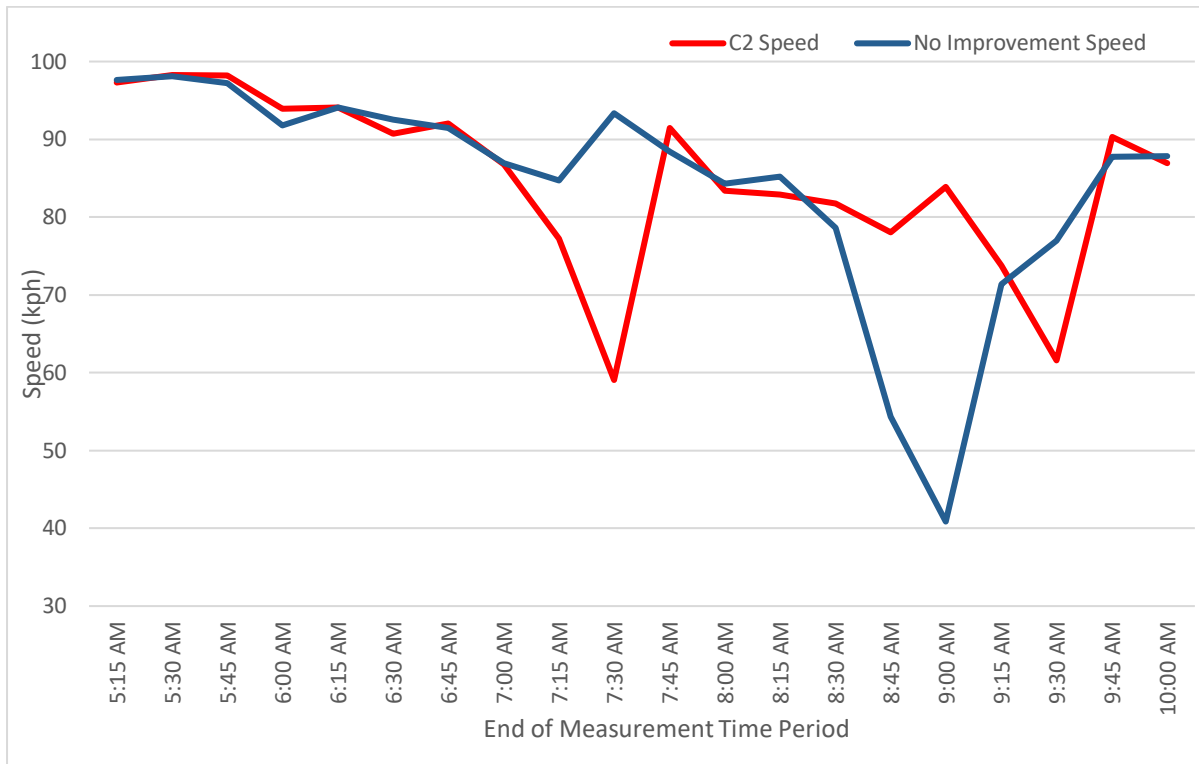


Figure 6-18 Speeds at the exit nose of the M4 westbound off-ramp to Erskine Park Road and Roper Road – 2031 AM Peak

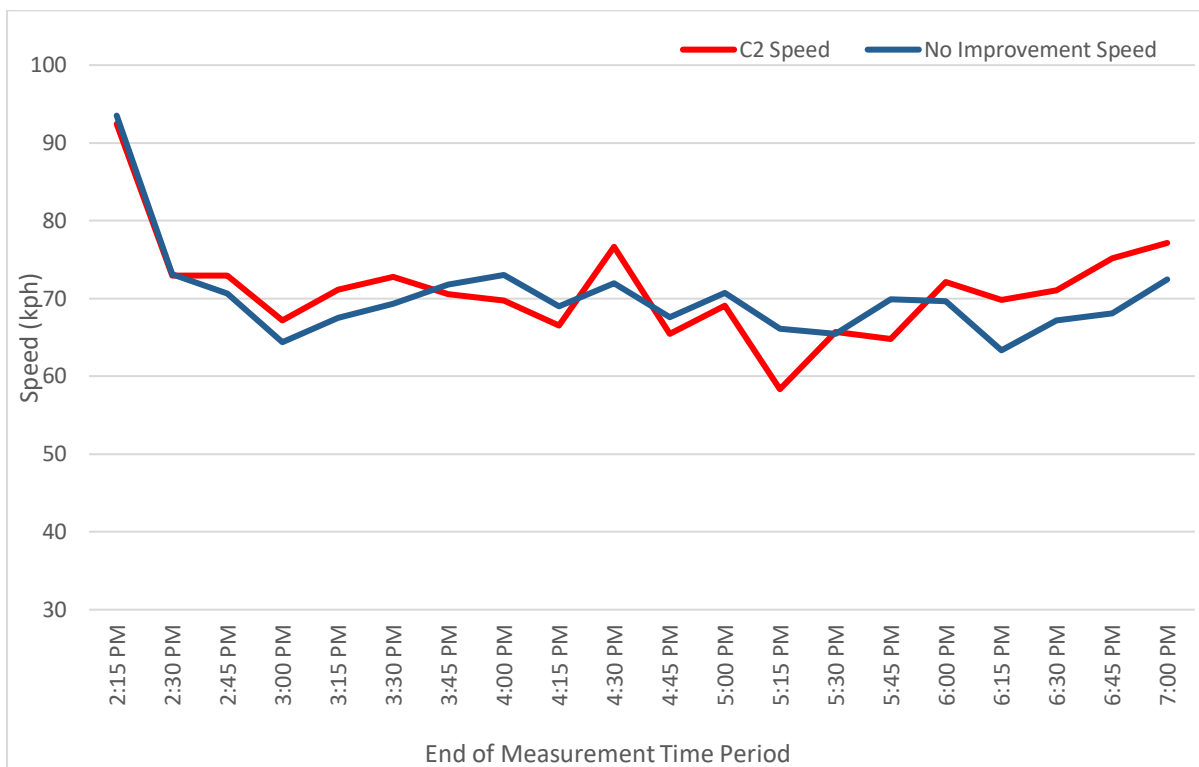


Figure 6-19 Speeds at the exit nose of the M4 westbound off-ramp to Erskine Park Road and Roper Road – 2021 PM Peak

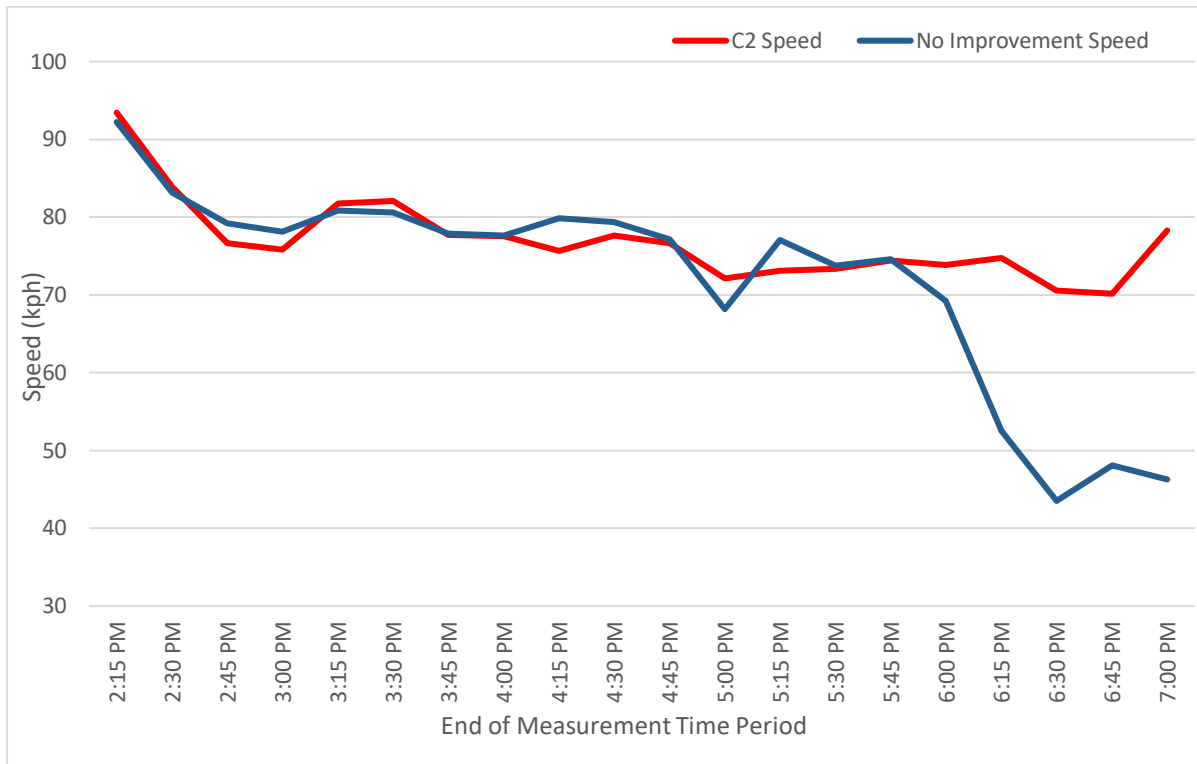


Figure 6-20 Speeds at the exit nose of the M4 westbound off-ramp to Erskine Park Road and Roper Road – 2031 PM Peak

Impacts on the Roper Road eastbound on-ramp to M4 Motorway intersection

The Traffic Assessment notes that the eastbound Roper Road on-ramp access capacity issues were so significant and sustained that they became the dominant source of congestion approaching the Erskine Park Road interchange from the north and the south – and a key cause of queue-back on M4 westbound off-ramp. The changes in the volume of traffic movements at the M4 eastbound Roper Road on-ramp intersection as a result of the proposal are identified in Table 6-16 and the changes in DOS at the intersection are summarised in Table 6-17.

Table 6-16 Change in 5-hour traffic counts for key turns at the Eastbound Roper Road on-ramp intersection compared to existing traffic flows (Source: O'Brien Traffic, 2020)

Scenario / Movement	2021 AM	2031 AM	2021 PM	2031 PM
North to west (right turn onto on-ramp)	-73	214	272	39
South to north through movement	-80	-437	-298	-196
North to south through movement	269	457	385	225
South to west (left turn onto on-ramp)	-33	-58	84	21

(Impacts: green – decrease in traffic movement, red – increase in traffic movement)

Table 6-17 Impacts on the degree of saturation of the north to west right turn versus south to north through movement at the eastbound Roper Road on-ramp to the M4 Motorway due to the proposal (Source: O'Brien Traffic, 2020)

Scenario		2021 AM	2031 AM	2021 PM	2031 PM
No improvement	Maximum hourly	0.84	1.00	1.00	1.00
	Average hourly	0.74	0.93	0.96	0.98
Proposal	Maximum hourly	0.82	1.00	1.00	1.00
	Average hourly	0.73	0.92	0.97	0.97
Change	Maximum hourly	-0.02	-	-	-
	Average hourly	-0.01	-0.01	0.01	-0.01

(Impacts: green – improvement in DOS, red – decrease in DOS, - no change)

It is noted that the No Improvement scenarios were often operating at or near capacity for much of the peak periods (approximate DOS of 1.0). The existing scenario has chronic queueing in the northbound lanes on the over bridge across the M4 Motorway which affects the function of the eastbound Roper Road on-ramp intersection. The proposal would cause negligible additional saturation impacts on the eastbound on-ramp to the M4 Motorway intersection, particularly in the 2021 AM peak modelling scenario.

Impacts on the surrounding road network

Impacts on nearby M4 on and off-ramps

Based on the modelling completed the primary source of ramp traffic transferring to the proposed on-ramp is from traffic which would currently use the Mamre Road on-ramp. The change in westbound on-ramp usage at Mamre Road is identified in Table 6-18. This identifies that traffic counts at the Mamre Road westbound on-ramp decrease in all scenarios if the proposal is implemented. Changes in traffic volumes at other nearby westbound on-ramps to the M4 resulted in limited changes to traffic counts using those on-ramps as identified in Table 6-19. A minor increase in the traffic count of road users exiting the M4 Motorway at the Werrington westbound on ramp was shown in the modelling as also identified in Table 6-19 which would indicate an increase in traffic using the M4 Motorway towards Penrith.

Table 6-18 5 hour traffic count - Mamre Road westbound on-ramp and off-ramp to the M4 (Source: O'Brien Traffic, 2020)

Scenario	2021 AM		2031 AM		2021 PM		2031 PM	
	On-ramp	Off-ramp	On-ramp	Off-ramp	On-ramp	Off-ramp	On-ramp	Off-ramp
No improvement	2,246	2,076	2,931	1,879	5,435	5,077	5,326	5,175
Proposal	1,930	2,161	2,514	1,879	4,286	4,773	4,799	5,242
Change	-316	85	-417	-157	-1,149	-304	-257	67

(Impacts: green – increase in traffic volume, red – decrease in traffic volume)

Table 6-19 5 hour traffic count – nearby M4 Motorway on and off-ramps (Source: O'Brien Traffic, 2020)

Scenario	2021 AM	2031 AM	2021 PM	2031 PM
Wallgrove Road westbound on-ramp to the M4 Motorway				
No improvement	1,420	1,054	4,506	4,604
Proposal	1,458	899	4,294	4,522
Change	38	-155	-212	-82
Westbound M7 on-ramp to the M4 Motorway				
No improvement	4,791	4,391	7,620	6,651
Proposal	4,850	4,479	7,592	6,762
Change	59	88	-28	111
Werrington westbound off-ramp from the M4 Motorway				
No improvement	1,621	2,269	3,037	3,120
Proposal	1,670	2,315	3,302	3,554
Change	49	46	265	434

(Impacts: green – increase in traffic volume, red – decrease in traffic volume)

Impacts on the westbound M4 mainline

Modelling of the westbound M4 mainline west of the proposed on-ramp identified that during all AM peak scenarios the traffic flows were well below the 5,400 vehicle per hour unmetered capacity. However, the PM peak westbound M4 mainline flows were near the unmetered capacity for a 3-lane motorway section (5400 vehicles per hour) prior to the addition of the G-loop. After the addition of the G-loop, significant traffic diversions to exit the M4 mainline early at the M4 westbound off-ramp occurred as detailed in the previous sections. The traffic assessment considered the modelled traffic flows on the M4 westbound mainline midway between the proposed on-ramp and the off-ramp to Mamre Road, measured at Bennett Road Bridge. The PM peak scenarios are identified in Figure 6-21 and Figure 6-22 below (proposal identified as scenario C2).

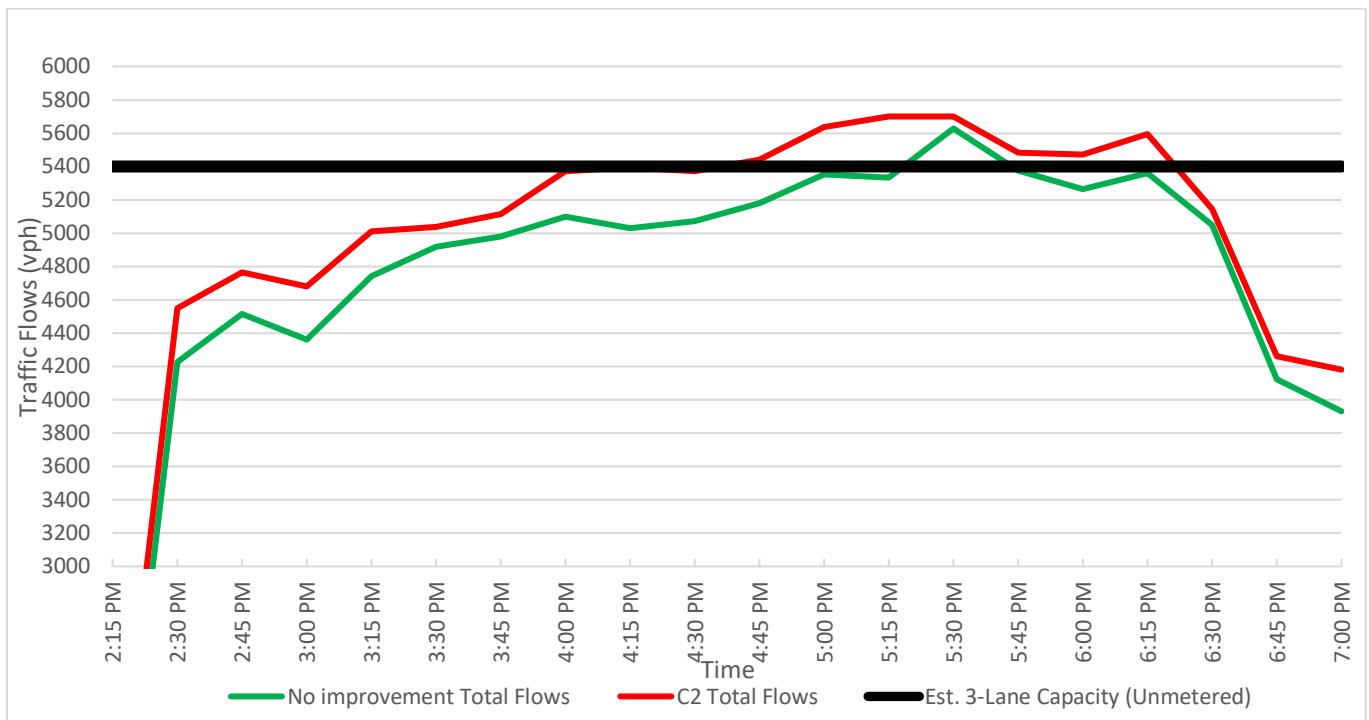


Figure 6-21 2021 PM Peak westbound M4 mainline total flows at Bennett Road (between proposed on-ramp and Mamre Road off-ramp - No Mamre Road improvements (Source: O'Brien Traffic, 2020)

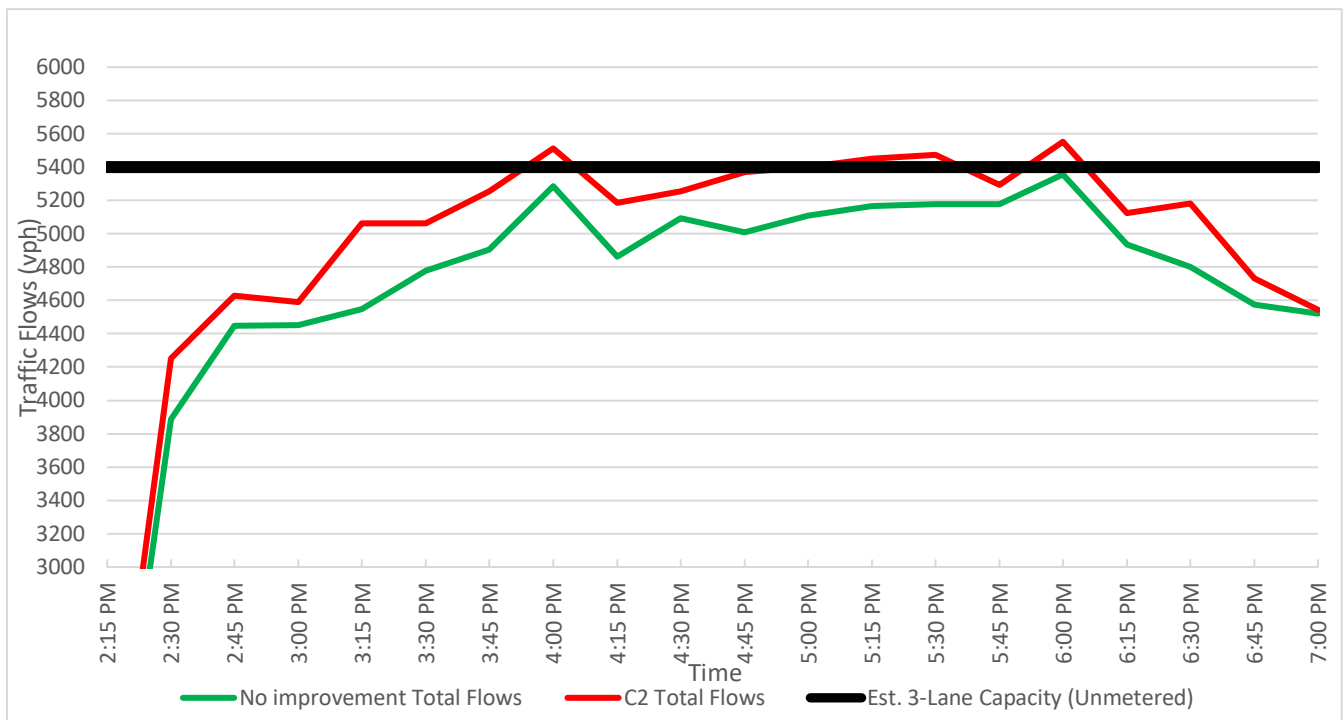


Figure 6-22 2031 PM Peak westbound M4 mainline total flows at Bennett Road (between proposed on-ramp and Mamre Road off-ramp - No Mamre Road improvements (Source: O'Brien Traffic, 2020)

The above graphical results indicate the PM peak traffic flows increased compared to the existing M4 mainline traffic flows as a result of the proposed on-ramp and were above the unmetered capacity for extended periods. These indicate that a ramp meter is likely to be highly desirable to manage PM peak

conditions effectively. Capacity for future installation of Smart Motorway infrastructure including advisory signs and ramp metering devices have been incorporated into the design.

Network impacts

Overall results of the modelling on the wider network, which includes the full M4SM OTM model area from Emu Plains in the west and Rosehill in the east, are provided in Table 6-20, with the following typical key network performance statistics set out:

- Total Vehicle Hours Travelled (VHT) – the total quantity of travel time across the model network for completed journeys
- Total Vehicle Kilometres Travelled (VKT) – the total number of kilometres travelled by all vehicles in the model network for completed journeys
- Average speed – total kilometres travelled divided by the total vehicle hours travelled for completed journeys
- Journeys completed – the number of vehicle trips that have entered and exited the model network by the end of the simulation (typically reflects differences in the effective capacity of the modelled networks)
- Journeys underway – the number of vehicle trips that have entered but not exited the model network by the end of the simulation (typically represents differences in the congestion present in the network near the end of the model runs)
- Journeys waiting – the number of vehicle trips that are yet to enter the model network by the end of the simulation (typically represents differences in vehicles blocked by local congestion near the trip generating ‘centroids’ from entering the network and similarly reflects the severity of congestion in the network).

Table 6-20 provides the outputs from the M4SM OTM model at a broader level to highlight impacts across the wider network i.e. the full M4 Motorway corridor and surrounding local roads.

Table 6-20 Network performance summary results - No Improvement vs the proposal (Source: O'Brien Traffic, 2020)

Scenario	VHT	VKT	Average Speed	Journeys completed	Journeys underway	Journeys waiting
2021 AM - No improvement	65,295	2,991,658	42.99	425,930	10,687	2,646
2021 AM - Proposal	65,598	2,992,242	42.91	425,832	10,779	2,652
Change	303	584	-0.08	-98	92	6
2031 AM – No improvement	88,960	3,217,757	38.35	476,004	17,889	16,102
2031 AM – Proposal	87,598	3,221,561	38.62	476,329	18,347	15,319
Change	-1,362	3,804	0.27	325	458	-783
2021 PM – No improvement	78,463	3,307,935	40.82	497,534	12,949	6,555
2021 PM – Proposal	76,690	3,323,610	41.17	498,845	11,945	6,248
Change	-1,722	15,675	0.35	1,311	-1,004	-307
2031 PM – No improvement	99,128	3,578,568	37.32	557,014	19,255	22,442

Scenario	VHT	VKT	Average Speed	Journeys completed	Journeys underway	Journeys waiting
2031 PM – Proposal	99,214	3,590,187	37.46	557,866	18,777	22,068
Change	86	11,619	0.14	852	-478	-374

(Impacts: green – beneficial impact, red – negative impact)

Table 6-20 identifies the following network performance changes resulting from the modelling undertaken:

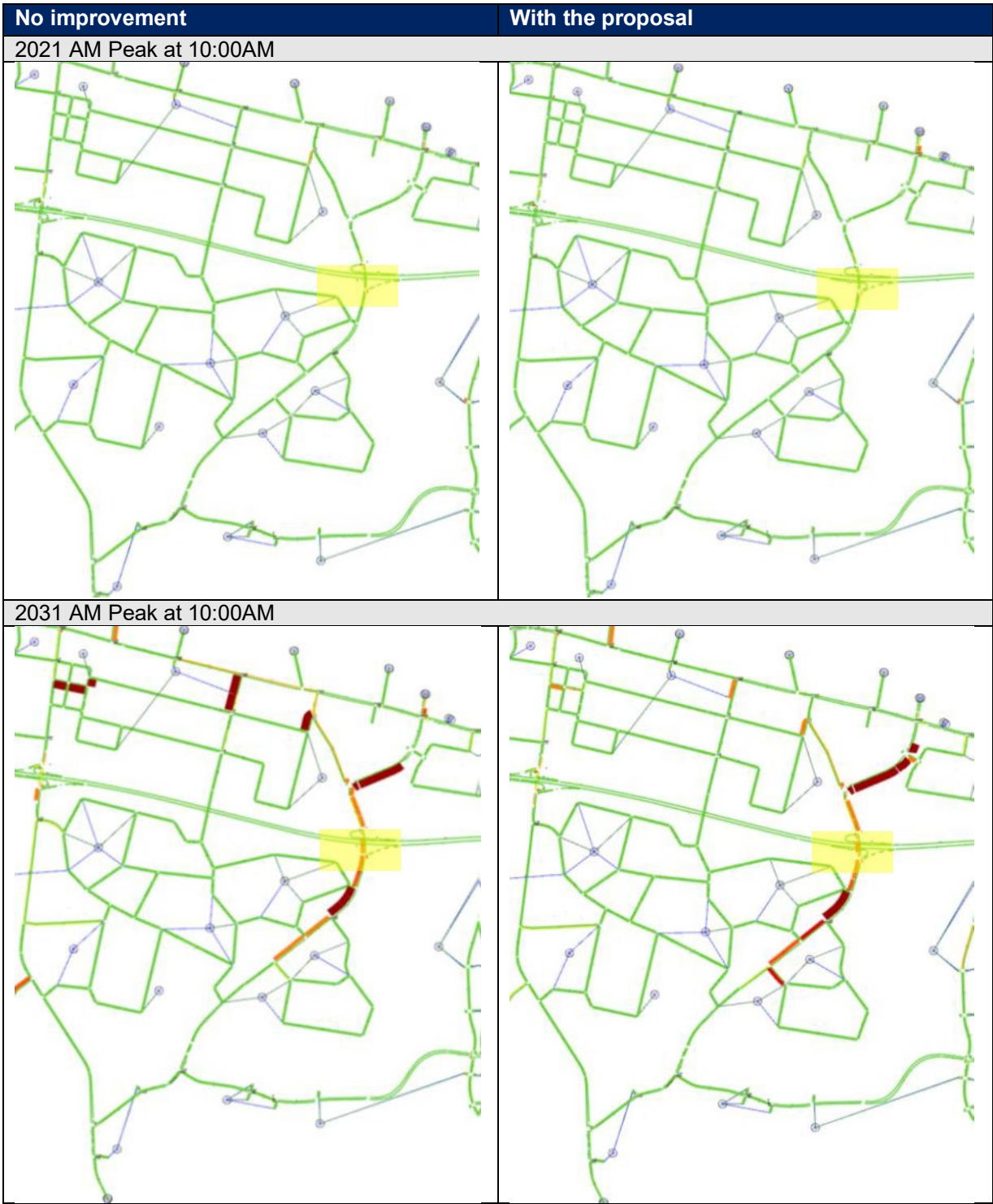
- Across all scenarios the total vehicle hours travelled increased, most notably in the PM peak scenarios which reflects more road users diverting to the M4 Motorway rather than the shorter distance but longer travel time of the nearby local roads
- Network performance improvements offered by the proposed on-ramp are generally reasonably small, with improvements in completed journeys, less journeys waiting, and vehicle hours travelled.
- In relation to average speeds, except for the 2021 AM, the average speed increased likely due to the use of the M4 Motorway with a higher speed limit than local roads
- Journeys completed increased across all scenarios, except for the 2021 AM peak where a minor decrease was identified
- Except for 2021 AM peak, all scenarios resulted in fewer journeys waiting at the end of the model run

It is noted that congestion and capacity issues associated with the M4 eastbound Roper Road on-ramp access issues were so significant and sustained that it is the dominant source of congestion approaching the Erskine Park Road – Roper Road interchange from the north and the south.

The residual (modelled end of peak period) queue length and congestion extent is compared for the No improvement scenario and the proposal in the network section traffic density plots in Table 6-21.

Overall, the provision of the proposed on-ramp appears to reduce the severity and frequency of queue backs compared to the No improvement conditions. The traffic benefits of the proposed on-ramp are realised in the PM peak when the proposed on-ramp attracts the most traffic.

Table 6-21 Comparison of residual (end of modelled peak period) congestion in 2021 and 2031 for the No improvement scenario and the proposal. Green represents little to no congestion, with congestion increasing through yellow, orange and red colours and the thickness of the colouration lines.





6.2.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Traffic and transport	<p>A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Transport for NSW <i>Traffic Control at Work Sites Manual</i> (RTA, 2010) and <i>QA Specification G10 Control of Traffic</i> (Transport for NSW, 2008). The TMP will include:</p> <ul style="list-style-type: none"> • confirmation of haulage routes • measures to maintain access to local roads and properties • site specific traffic control measures (including signage) to manage and regulate traffic movement • measures to maintain pedestrian and cyclist access • requirements and methods to consult and inform the local community of impacts on the local road network • access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads. • a response plan for any construction traffic incident • consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic • monitoring, review and amendment mechanisms. 	Contractor	Detailed design / Pre-construction	Section 4.8 of QA G36 <i>Environment Protection</i>
Traffic and transport	The movement of construction materials (haulage and deliveries) will be scheduled to minimise the number of haulage and delivery vehicles required during peak periods and weekends.	Contractor	Construction	

Impact	Environmental safeguards	Responsibility	Timing	Reference
Traffic and transport	Vehicle access to Site Compound B is to be limited to light vehicles.	Contractor	Construction	
Traffic and transport	Where possible, current traffic movements and property accesses will be maintained during the works. Any disturbance will be minimised to prevent unnecessary traffic delays.	Contractor	Construction	
Traffic and transport	Road users and local communities will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.	Contractor	Construction	

6.3 Noise and vibration

6.3.1 Methodology

An assessment of potential noise and vibration impacts associated with the proposal (AECOM, 2021) has been undertaken with input from an independent noise specialist. The assessment identified nearby sensitive receivers, characterised background noise conditions, developed appropriate construction and operational noise and vibration assessment criteria in accordance with relevant policy and guidelines, quantitatively assessed potential noise and vibration-related impacts and recommended suitable management measures to minimise impacts during construction and operation. The results of this assessment are summarised below, with the complete assessment provided in the noise and vibration report in Appendix G.

Background noise monitoring

Ambient noise monitoring and concurrent traffic counts were undertaken at three representative locations within the study area in December 2020, as outline in Table 6-22 and shown in Figure 6-23. Attended noise measurements were also undertaken to determine the nature of the local noise environment and to confirm road traffic was the controlling noise source. Traffic counts were taken concurrently to verify the operational noise model. The results of the noise monitoring were processed in accordance with the procedures contained in the EPA's Road Noise Policy (RNP) and the EPA's Noise Policy for Industry (NPfI). Weather data recorded during the noise monitoring survey periods was obtained from the Bureau of Meteorology weather station at Horsley Park, about 8 kilometres from the study area.

Table 6-22 Noise monitoring details

Noise logger	Address	Assessment purpose	Measurement period
NL1	Road reserve adjacent to Hartwell Circuit, St Clair	Construction noise, Operational road noise, Maximum road noise	9 – 17 December 2020
NL2	Road reserve adjacent to Erskine Park Road, St Clair	Construction noise, Operational road noise	9 – 17 December 2020
NL3	Road reserve adjacent to Miner Glen, Erskine Park	Construction noise	9 – 17 December 2020

Construction noise

A construction noise and vibration impact assessment has been conducted in accordance with the *Interim Construction Noise Guideline* (ICNG) and *Construction Noise and Vibration Guideline* (CNVG) (DECC 2009). Reasonable worst-case construction scenarios have been assessed. Construction of the proposal would occur both during standard construction hours and out of hours to minimise traffic disruptions.

Noise levels due to the construction activities were predicted at nearby noise sensitive receivers using SoundPLAN noise modelling software v8.2. The modelling used the ISO 9613 algorithm and includes ground topography, buildings, structures and representative construction noise sources. Noise levels were predicted at a height of 1.5 metres above ground level.

Differences between predicted and measured noise levels can be expected due to variations in instantaneous operating conditions, plant in operation during the measurement and also the location of the

plant equipment. The acoustic shielding calculated in the model due to fixed building structures would also vary as the construction equipment moves around the site.

Construction vibration

The minimum working distances as presented in the CNVG were applied to the proposed vibration intensive construction activities. A buffer zone was created and marked out to indicate receivers which may be impacted by vibration during construction.

Operational noise

An operational road traffic noise assessment has been completed in accordance with the RNP and Roads and Maritime's Noise Criteria Guideline (NCG) and Noise Mitigation Guideline (NMG). To assess the potential impact of the proposal on noise sensitive receivers, the following steps were completed:

- Existing road traffic noise levels were modelled with existing (2020) road traffic volumes. This model was then validated with noise measurements and road traffic surveys.
- Future road traffic noise levels were modelled for the 'Project only' (project only roads) scenarios for the year of opening (2021) and design year (2031).
- Future road traffic noise levels were modelled for the 'No Build' (without proposal), and 'Build' (with proposal) scenarios for the year of opening (2021) and design year (2031).

Road traffic noise levels were calculated using SoundPLAN v8.2 software, which implements the Calculation of Road Traffic Noise (CoRTN) algorithm. The UK Department of Transport devised the CoRTN algorithm and with suitable corrections, this method has been shown to give accurate predictions of road traffic noise under Australian conditions. The modelling parameters which were included in the model are detailed in Appendix G.

For a proposal corridor of 600 metres either side of the roadway, the CoRTN algorithm has a well-documented accuracy of ± 2 dB(A). If the differences between measured and predicted road traffic noise levels fall within this margin, then the model is considered to have a suitable level of accuracy for that location. The median difference between the measured road traffic noise level and the predicted noise level for the proposal was 1.3 dB for the daytime and 2.4 dB at night. As the difference between the measured road traffic noise level and the predicted noise level was slightly in excess of the CoRTN accepted accuracy of ± 2 dB for the night-time, validation factors of -1.3 and -2.4 dB were applied for daytime and night-time respectively.

Study area

The operational road traffic noise assessment area extends to where noise levels are dominated by other roads that are not being assessed as part of the proposal, as detailed in the NCG. The RNP defines the study area width as '600 metres from the centre line of the outermost traffic lane on each side of the subject road'.

6.3.2 Existing environment

Surrounding land use and receivers

Sensitive receivers in this area are predominantly one storey residential properties with some two storey residential properties interspersed. Other non-residential noise sensitive receivers include:

- Clairgate Public School
- Little Smarties Childcare Centre
- Sunny Patch Preparation School and Long Day Care Centre

The location of these receivers is shown in Figure 6-23.

Existing background noise

Table 6-23 provides the logarithmically averaged background noise levels (L_{A90}) at each noise monitoring location. Table 6-24 provides the logarithmically averaged road traffic noise levels ($L_{Aeq,9hr}$ and $L_{Aeq,15hr}$) measured at each noise monitoring location which have been used for the assessment of road traffic noise.

Table 6-23 Existing background (L_{A90}) noise levels

Noise logger	L_{Aeq} background noise level, dB(A)		
	Day ¹	Evening ²	Night ³
NL1	61	56	44
NL2	58	54	52
NL3	55	52	45

1 Day is defined as 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays.

2 Evening is defined as 6pm to 10pm Monday to Sunday and Public Holidays.

3 Night is defined as 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.

Table 6-24 Ambient road traffic noise levels

Noise	Address	Ambient road traffic noise level, dB(A) ¹	
		Day (7am to 10pm) $L_{Aeq, 15hr}$	Night (10pm to 7am) $L_{Aeq,9hr}$
NL1	Road reserve adjacent to Hartwell Circuit, St Clair	65	60
NL2	Road reserve adjacent to Erskine Park Road, St Clair	65	61

1 Measured level during 14-17 December 2020

The location of noise loggers is shown in Figure 6-23.



Attachment B - Study Area

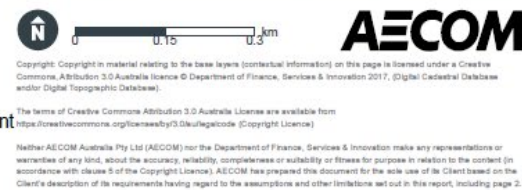
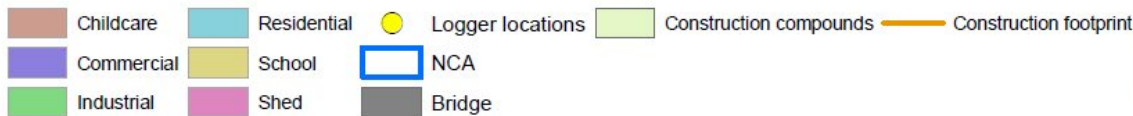


Figure 6-23 Surrounding receivers, noise catchment areas and noise monitoring locations

6.3.3 Criteria

Construction noise criteria

The potential risk of adverse impact of construction noise on a receiver is determined by the extent of its emergence above the existing background noise level, the duration of the event and the characteristics of the noise. The ICNG is a NSW Government document that outlines methods to deal with the impacts of construction noise on residences and other sensitive land uses.

Predicted noise levels at nearby noise sensitive receivers (e.g. residences, schools, hospitals, places of worship, passive and active recreation areas) are compared to the levels provided in the ICNG. Where an exceedance of the management levels is predicted the ICNG advises that receivers can be considered 'noise affected' and the proponent should apply all feasible and reasonable work practices to minimise the noise impact. The proponent should also inform all potentially affected residents of the nature of the works to be carried out, the expected noise level and duration, as well as contact details should they wish to make a complaint.

Where construction noise levels at the receiver reach 75 dB(A), residential receivers are considered to be 'highly noise affected' and the ICNG advises that the proponent, in consultation with the community, consider restrictions to the hours of construction to provide respite periods. Additionally, the ICNG notes that strong justification is required for work that is proposed outside of standard working hours.

Construction noise management levels

Noise management levels (NMLs) for the proposal for residential receivers are derived using the information in Table 6-25.

Table 6-25 Construction noise management levels (NMLs) – guidance from ICNG for residential receivers

Time of day	Construction NML $L_{Aeq(15min)}$ ICNG guidance
Recommended standard hours: <ul style="list-style-type: none">Monday to Friday 7am to 6pmSaturday 8am to 1pmno work on Sundays or public holidays.	Noise affected: RBL + 10 dB(A)
	Highly noise affected: 75 dB(A)
Outside recommended standard hours	Noise affected: RBL + 5 dB(A)

To assist in determining noise criteria for the receivers surrounding the proposal, the study area was split into three Noise Catchment Areas (NCAs). The noise environment within each NCA is considered to be comparable and has been used to develop assessment criteria for similar noise environments. Table 6-26 provides the applicable NMLs for this proposal for each NCA, based on the measured RBLs from ambient noise monitoring and have been derived from the guidance outlined in Table 6-25 above. Criteria for each NCA was derived from noise monitoring data from its associated representative logger.

Table 6-26 Construction NMLs - residential receivers

Representative logger	NCA	Period	RBL, dB(A)	NML ^{1,2} , L _{Aeq} (15min)
NL1	NCA1	Day	61	71
		Evening	56	61
		Night	44	49
NL2	NCA2	Day	58	58
		Evening	54	59
		Night	52	57
NL3	NCA3	Day	55	65
		Evening	52	57
		Night	45	50

1 Day NML = RBL + 10 dB(A)

2 Evening/Night NML = RBL + 5 dB(A)

Noise management levels recommended by the ICNG for non-residential sensitive land uses, such as schools, hospitals or places of worship and commercial and industrial premises are provided in Table 6-27.

Table 6-27 Construction NMLs - non-residential receivers

Time of day	Construction NML L _{Aeq} (15 min)
Classrooms at schools and other educational institutions	Internal noise level: 45 dB(A)
Hospital wards and operating theatres	Internal noise level: 45 dB(A)
Places of worship	Internal noise level: 45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level: 65 dB(A)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level: 60 dB(A)
Community centres	Depends on the intended use of the centre. Refer to the recommended "maximum" internal levels in AS2107 for specific uses.
Industrial premises	External noise level: 75 dB(A)
Offices, retail outlets	External noise level: 70 dB(A)

Sleep disturbance

The ICNG requires a sleep disturbance assessment to be undertaken where construction works are planned to extend over more than two consecutive nights. The ICNG makes reference to the EPA's NSW Environment Criteria for Road Traffic Noise (ECRTN), now superseded by the RNP, for the assessment of sleep disturbance. The RNP references the recommendations in the ECRTN as providing the most appropriate assessment guidance. The guidance provided in the RNP for assessing the potential for sleep disturbance recommends that to minimise the risk of sleep disturbance during the night-time period (10pm to 7am), the $L_{A1(1 \text{ min})}$ noise level outside a bedroom window should not exceed the $L_{A90(15 \text{ min})}$ background noise level by more than 15 dB(A).

The RNP contains a review of research into sleep disturbance which represents NSW EPA advice on the subject of sleep disturbance due to noise events. It concludes that having considered the results of research to date that, 'Maximum internal noise levels below 50-55 dB(A) are unlikely to cause awakening reactions. Therefore, given that an open window provides around 10 dB(A) in noise attenuation from outside to inside, external noise levels of 60-65 dB(A) are unlikely to result in awakening reactions.

Table 6-28 presents the sleep disturbance screening and sleep disturbance awakening reaction criteria.

Table 6-28 Construction noise sleep disturbance criteria (external)

Representative logger	NCA	Night time RBL, dB(A)	Sleep disturbance screening $L_{A1(1 \text{ min})}$ criteria, dB(A)	Sleep disturbance awakening reaction $L_{A1(1 \text{ min})}$ criteria, dB(A)
NL1	NCA1	44	59	65
NL2	NCA2	52	67	65
NL3	NCA3	45	60	65

Construction road traffic noise

Guidance from the RNP for the assessment of noise arising from construction traffic on public roads was used to assess noise impacts from construction traffic. An initial screening test has been undertaken by evaluating whether existing road traffic noise levels would increase by more than 2 dB(A). Where the predicted noise increase is 2 dB(A) or less, then no further assessment is required. However, where the predicted noise level increase is greater than 2 dB(A), and the predicted road traffic noise level exceeds the road category specific criterion, then noise mitigation should be considered for those receivers affected. The RNP does not require assessment of noise impact to commercial or industrial receivers.

Construction vibration criteria

The relevant standards/guidelines for the assessment of construction vibration are summarised in Table 6-29.

Table 6-29 Standards/guidelines used for assessing construction vibration

Item	Standard/guideline
Structural damage	Heritage structures – German Standard DIN 4150 – Part 3 – Structural Vibration in Buildings – Effects on Structures (DIN 4150) Non-heritage structures – Evaluation and Measurement for Vibration in Buildings Part 2, (British Standard (BS) 7385:Part 2-1993) (BS 7385)
Human comfort (tactile vibration)	Assessing Vibration: A Technical Guideline (AVATG)
Human comfort (ground-borne noise)	Interim Construction Noise Guideline (ICNG)

The recommended minimum working distances for cosmetic/structural damage and human comfort from the standards and guidelines are presented in Table 6-30. Human comfort criteria are more stringent than structural damage criteria as humans are able to detect vibration at lower levels than at levels that would pose a risk of damage to a building or its contents. Therefore, the human comfort criteria are aimed at avoiding human annoyance.

Table 6-30 Recommended minimum working distances for vibration intensive plant (Adapted from CNVG)

Plant	Rating/description	Minimum working distances (metres)	Plant
		Cosmetic damage (BS 7385) Light-framed structures	Human response (EPA's Vibration guideline)
Vibratory roller	<50 kN (Typically 1-2 T)	5	15-20
	<100 kN (Typically 2-4 T)	6	20
	<200 kN (Typically 4-6 T)	12	40
	<300 kN (Typically 7-13 T)	15	100
	>300 kN (Typically 13-18 T)	20	100
	>300 kN (> 18 T)	25	100
Small hydraulic rock hammer	(300 kg – 5-12 T excavator)	2	7
Medium hydraulic rock hammer	(900 kg – 12-18 T excavator)	7	23
Jack hammer	Handheld	1 nominal	2

Operational noise criteria

Operational road traffic noise

Noise criteria are assigned to sensitive receivers using the NCG which provides guidance on how to apply the RNP. The RNP requires the consideration of three scenarios, the 'No Build' option (without the proposal), the 'Build' option (with the proposal) and the "Project Only" (only roads altered as part of the project). The No Build option represents the scenario if the proposal was not to proceed. The build option represents the scenario if the proposal was to proceed. The Project Only represents the impact of the road project. Each of these scenarios must be considered at two points in time, the year of opening and the design year which is typically ten years after opening. For this proposal, the year 2021 has been assessed as the year of opening, and 2031 has been assessed as the design year.

The operational road traffic noise assessment area extends to where noise levels are dominated by other roads that are not being assessed as part of the proposal, as detailed in the NCG. The RNP defines the study area width as '600 metres from the centre line of the outermost traffic lane on each side of the subject road'. Residential receivers may be assigned new, redeveloped, transition zone or relative increase criteria depending on how the proposal would influence their noise levels. For each façade of the residential receiver the most stringent applicable criteria are used in the assessment.

Criteria are based on the road development type which is affecting the residential receiver. Provided in Table 6-31 is the road traffic noise criteria for existing residential land use developments affected by noise from the redevelopment of an existing freeway/arterial road. These criteria apply to all residential receivers within the study area. The external noise criteria are applied at one metre from the façade that is most exposed to traffic noise and at a height of 1.5 metres from the floor level. The criteria include an allowance for noise reflected from the façade.

The criteria for other sensitive (non-residential) receivers are also presented in Table 6-31. For other sensitive receivers such as schools, places of worship and childcare facilities, the NCG criteria are based on internal noise levels.

Table 6-31 Road traffic noise assessment criteria

Residential land use		
Road category	Day time assessment criteria dB(A)	Night time assessment criteria dB(A)
	(7am to 10pm)	(10pm to 7am)
Freeway/arterial/sub-arterial	L _{Aeq} (15 hr) 60 (external)	L _{Aeq} (9 hr) 55 (external)
Non-residential land use ¹		
School classrooms	L _{Aeq} (1 hr) 40 (internal)	-
Hospital wards	L _{Aeq} (1 hr) 35 (internal)	L _{Aeq} (1 hr) 35 (internal)
Places of worship	L _{Aeq} (1 hr) 40 (internal)	L _{Aeq} (1 hr) 40 (internal)
Open space (active use)	L _{Aeq} (15 hr) 60	-
Open space (passive use)	L _{Aeq} (15 hr) 55	-
Child care facilities	Sleeping rooms L _{Aeq} (1 hr) 35 Indoor play areas L _{Aeq} (1 hr) 40 (internal) Outdoor play areas L _{Aeq} (1 hr) 55 (external)	-
Aged care facilities	L _{Aeq} (15 hr) 60 (external)	L _{Aeq} (9 hr) 55 (external)

¹ There are additional considerations for each land use. Refer to Appendix D of the Noise and Vibration Assessment.

Guidance for the evaluation of feasible and reasonable noise mitigation measures

Where the NCG criteria are exceeded, the Roads and Maritime's Noise Mitigation Guideline (NMG) provides further discussion of situations where provision of additional controls, such as noise barriers, architectural treatments and quieter pavements, would be considered 'feasible and reasonable'. It should be acknowledged that these considerations apply only if it can be demonstrated that all 'feasible and reasonable' traffic management and other road design opportunities for reduction of traffic noise at the source have been exhausted.

The NMG provides guidance on managing and controlling road traffic generated noise and describes the principles to be applied when reviewing noise mitigation options. The NMG recognises that the criteria recommended by the NCG are not always practicable and that it is not always feasible and/or reasonable to expect that they should be achieved.

The NMG provides two triggers where a receiver may qualify for consideration of noise mitigation (beyond the adoption of road design and traffic management measures). These are:

- The predicted build noise level exceeds the NCG controlling criterion and the noise level increase due to the proposal (i.e. the noise predictions for the build minus the no build) is greater than 2.0 dB(A), or
- The predicted build noise level is 5 dB(A) or more above the criteria (meets or exceeds the cumulative limit) and most of the noise is caused by the proposal (i.e. the contribution from the proposal adds 2.0 dB(A) or more to the total noise level), regardless of the incremental impact of the proposal.

In addition if the noise level contribution from the road proposal is acute (daytime $L_{Aeq(15\text{ hr})}$ 65 dB(A) or higher, or night time $L_{Aeq(9\text{ hr})}$ 60 dB(A) or higher) then it qualifies for consideration of noise mitigation even if noise levels are dominated by another road.

The eligibility of receivers for consideration of additional noise mitigation, such as at-property treatments, is determined before the benefit of noise mitigation such as quieter pavement and noise barriers is included. If the NCG criterion cannot be satisfied with quieter pavement and noise barriers, then the receiver is eligible for consideration of at-property treatment.

Maximum noise levels

Guidance for assessing maximum noise levels are provided in Practice Note iii of the Environmental Noise Management Manual (ENMM). The maximum noise assessment should be used as a tool to help prioritise and rank mitigation strategies but should not be used as a decisive criterion in itself and should not be used to aid in designing the degree of mitigation required.

The assessment considers the following:

- Calculation of maximum noise levels
- The extent to which the maximum noise levels for individual vehicle pass-bys exceed the L_{Aeq} noise level for each hour of the night (i.e. L_{Amax} noise levels greater than 65 dB(A) where $L_{Amax} - L_{Aeq(1hr)} \geq 15\text{ dB(A)}$)
- The number of times the maximum noise levels for individual vehicle pass-bys exceed the L_{Aeq} noise level for each hour of the night.

6.3.4 Potential impacts

Construction

Eight representative construction noise scenarios were identified for the proposal. Construction noise modelling was based on construction equipment and associated sound power levels (SWL) that would typically be used in these construction scenarios. The construction equipment and associated SWL typically used in these construction scenarios are also identified in Table 6-32. The construction scenarios include provision for the three compound sites.

Table 6-32 Construction scenario and associated equipment

Scenario	Plant/Equipment	SWL, dB(A)	Overall SWL, dB(A)
Enabling works Mobilisation and site establishment	Truck (medium rigid) ¹	103	115
	Road truck	108	
	Scissor lift	98	
	Franna crane	98	
Enabling works Corridor clearing - General land clearing	Bulldozer D9	116	121
	Excavator (tracked) 35t	110	
	Chainsaw 4-5hp	114	
	Tub grinder/ mulcher 40-50hp	116	
	Dump truck ¹	110	

Scenario	Plant/Equipment	SWL, dB(A)	Overall SWL, dB(A)
Enabling works Bulk Earthworks	Bulldozer D9	116	123
	Scraper 651	110	
	Excavator (tracked) 35t	110	
	As above + hydraulic hammer	122	
	Grader	113	
	Dump truck ²	110	
	Compactor	106	
	Roller (large pad foot)	109	
	Water cart	107	
Main works Retaining walls	Piling rig - bored	112	119
	Power generator	103	
	Mobile crane	113	
	Concrete vibrator	113	
	Concrete pump	109	
	Welding equipment	105	
	Excavator (tracked) 35t	112	
	Air track drill	124	
Main works Paving/ asphaltting	Pavement laying machine	114	118
	Dump truck ¹	110	
	Asphalt truck & sprayer	103	
	Concrete truck	109	
	Smooth drum roller	107	
	Concrete saw	118	
Main works Re-surfacing works	Daymakers	98	118
	Pavement profiler	117	
	Dump truck ¹	110	
	Front end loader	112	
	Pavement laying machine	114	
	Asphalt truck & sprayer	106	
	Smooth drum roller	107	
	Backhoe	110	115

Scenario	Plant/Equipment	SWL, dB(A)	Overall SWL, dB(A)
Main works Drainage infrastructure	Franna crane 20t	98	
	Excavator (tracked) 35t	110	
	Concrete truck	109	
	Truck compressor	75	
	Vibratory roller	109	
	Road truck	108	
Main works Local roads works	Bulldozer D9	116	120
	Excavator (tracked) 35t	110	
	Chainsaw 4-5hp	114	
	Tub grinder/ mulcher 40-50hp	116	
	Front end loader	112	
	Scraper 651	110	
	Backhoe	111	
	Compactor	106	
	Dump truck ¹	110	
	Road truck ¹	108	
	Water cart	107	

1 Four per hour

2 Eight per hour

Predicted construction noise impacts

A summary of the predicted construction noise impacts for residential receivers associated with each stage of construction is presented below for standard hours works and out of hours works. The number of receivers where the construction noise levels are predicted to exceed the NML (and to what extent) and the number of highly affected receivers for each construction scenario are discussed along with maximum distances at which a particular mitigation measure may be applicable.

Typically, the number of sensitive receivers where noise levels exceed the noise management levels would be reduced appreciably depending on instantaneous operating conditions. Some receivers are predicted to be exposed to noise levels which exceed the noise management levels and a number of receivers are identified as being likely to be highly noise affected. This is due to the nearby locations of the work to the receivers and the high noise-generating equipment intended to be used on site.

The predicted L_{Aeq} noise levels are shown for the worst-case construction scenarios in Attachment D of the noise and vibration report (in Appendix H of this REF) and maps detailing the areas where additional construction noise mitigation measures are required are presented in Attachment E of the noise and vibration report for each construction scenario.

Enabling works – Mobilisation and site establishment

Sensitive receivers near to the Mobilisation and site establishment works would experience elevated noise levels during these works. Noise levels would be moderately intrusive at around 18 receivers or up to 200 metres from the works in the daytime and mitigation measures (N, V) would be required at these receivers within this distance from the Mobilisation and site establishment works. It is noted that the works are progressive and therefore the number of receivers affected at any one point in time would be lower than stated above.

Enabling works – Corridor clearing - General land clearing

Sensitive receivers near to the corridor clearing works would experience elevated noise levels during these works. Noise levels would be moderately intrusive at around 4 receivers or up to 100 metres from the works in the daytime and mitigation measures (N, V) would be required at these receivers within this distance from the corridor clearing works. Night-time mitigation measures would be required for approximately 675 receivers or up to 600 metres from the works with perceptions ranging from 'clearly audible' to only 9 receivers predicted to be affected by noise levels considered 'highly intrusive'. Additionally, approximately 520 receivers or up to 800 metres from the works would require notification of night-time works, at these receivers construction noise may be 'noticeable'. It is noted that the works are progressive and therefore the number of receivers affected at any one point in time would be much lower than stated above.

Enabling works – Bulk Earthworks

Sensitive receivers near to the bulk earthworks would experience elevated noise levels during these works. Noise levels would be moderately intrusive at around 5 receivers or up to 100 metres from the works in the daytime and mitigation measures (N, V) would be required at these receivers within this distance from the bulk earthworks. Night-time mitigation measures would be required for approximately 898 receivers or up to 700 metres from the works with perceptions ranging from 'clearly audible' to only 15 receivers predicted to be affected by noise levels considered 'highly intrusive'. Additionally, approximately 440 receivers or up to 800 metres from the works would require notification of night-time works, at these receivers construction noise may be 'noticeable'. It is noted that the works are progressive and therefore the number of receivers affected at any one point in time would be much lower than stated above.

An example of the noise associated with the bulk earthworks is shown below in Figure 6-24. It can be seen that the 20 highly affected residential receivers are located directly adjacent to the bulk earthworks. Figure 6-24 also demonstrates that residences located further from the bulk earthworks are shielded by the first rows of residences and are therefore exposed to lower levels of construction noise. In the daytime where noise levels are >10dB(A) over the NML noise levels are considered to be 'moderately intrusive'. In the night-time noise levels are considered to be 'clearly audible' where they are more >5 dB(A) over the NML, they are considered to be 'moderately intrusive' where they are >15 dB(A) over then NML and are considered to be 'highly intrusive' where they are >25 over the NML.

An example of the mitigation measures required with the bulk earthworks is shown below in Figure 6-25. It can be seen that receivers directly adjacent to the bulk earthworks which are within the red area may require alternative accommodation among other mitigation measures (AA, V, IB, N, PC, SN, R2, DR). Receivers within the orange area require similar mitigation measures as the receivers in the red area, with the exception of alternative accommodation. Receivers in the light green area would require verification and the consideration of respite periods as well as duration respite (V, N, R2, DR), with receivers in the dark green area only requiring notification of the bulk earthworks.

Main works – Retaining walls

Daytime mitigation measures would not be required for retaining wall works. Night-time mitigation measures would be required for approximately 190 receivers or up to 550 metres from the works with perceptions ranging from 'clearly audible' to 'moderately intrusive'. Additionally, approximately 440 receivers or up to 800 metres from the works would require notification of night-time works, at these receivers construction noise may be 'noticeable'.

Main works – Paving/asphalting

Sensitive receivers near to the paving/asphalting works would experience elevated noise levels during these works. Noise levels would be moderately intrusive at around 8 receivers or up to 200 metres from the works in the daytime and mitigation measures (N, V) would be required at these receivers within this distance from the paving/asphalting works. Night-time mitigation measures would be required for approximately 480 receivers or up to 500 metres from the works with perceptions ranging from 'clearly audible' to only 3 receivers predicted to be affected by noise levels considered 'highly intrusive'. Additionally, approximately 380 receivers or up to 700 metres from the works would require notification of night-time works, at these receivers construction noise may be 'noticeable'. It is noted that the works are progressive and therefore the number of receivers affected at any one point in time would be much lower than stated above.

Main works – Re-surfacing works

Sensitive receivers near to the re-surfacing works would experience elevated noise levels during these works. Noise levels would be moderately intrusive at around 2 receivers or up to 100 metres from the works in the daytime and mitigation measures (N, V) would be required at these receivers within this distance from the re-surfacing works. Night-time mitigation measures would be required for approximately 140 receivers or up to 500 metres from the works with perceptions ranging from 'clearly audible' to 'moderately intrusive'. Additionally, approximately 360 receivers or up to 700 metres from the works would require notification of night-time works, at these receivers construction noise may be 'noticeable'. It is noted that the works are progressive and therefore the number of receivers affected at any one point in time would be much lower than stated above.

Main works – Drainage infrastructure

Daytime mitigation measures would not be required for drainage infrastructure works. Night-time mitigation measures would be required for approximately 15 receivers or up to 300 metres from the works who would perceive the noise as 'clearly audible'. Additionally, approximately 50 receivers or up to 550 metres from the works would require notification of night-time works, at these receivers construction noise may be 'noticeable'.

Main works – Local roads works

Sensitive receivers near to the local roads works would experience elevated noise levels during these works. Noise levels would be moderately intrusive at around 10 receivers or up to 250 metres from the works in the daytime and mitigation measures (N, V) would be required at these receivers within this distance from the local roads works. Night-time mitigation measures would be required for approximately 330 receivers or up to 650 metres from the works with perceptions ranging from 'clearly audible' to a single receiver predicted to be affected by noise levels considered 'highly intrusive'. Additionally, approximately 460 receivers or up to 1,000 metres from the works would require notification of night-time works, at these receivers construction noise may be 'noticeable'. It is noted that the works are progressive and therefore the number of receivers affected at any one point in time would be much lower than stated above.

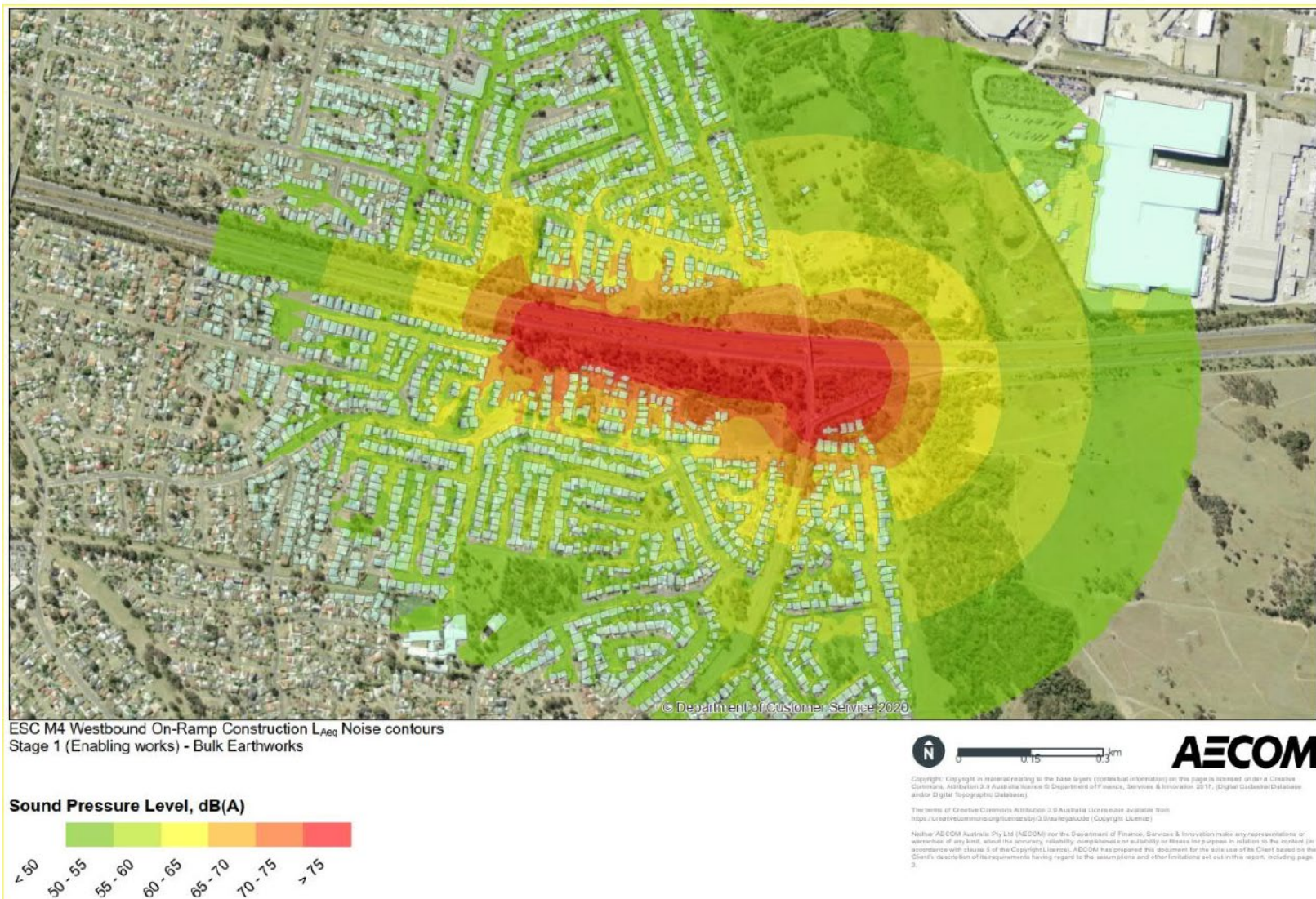
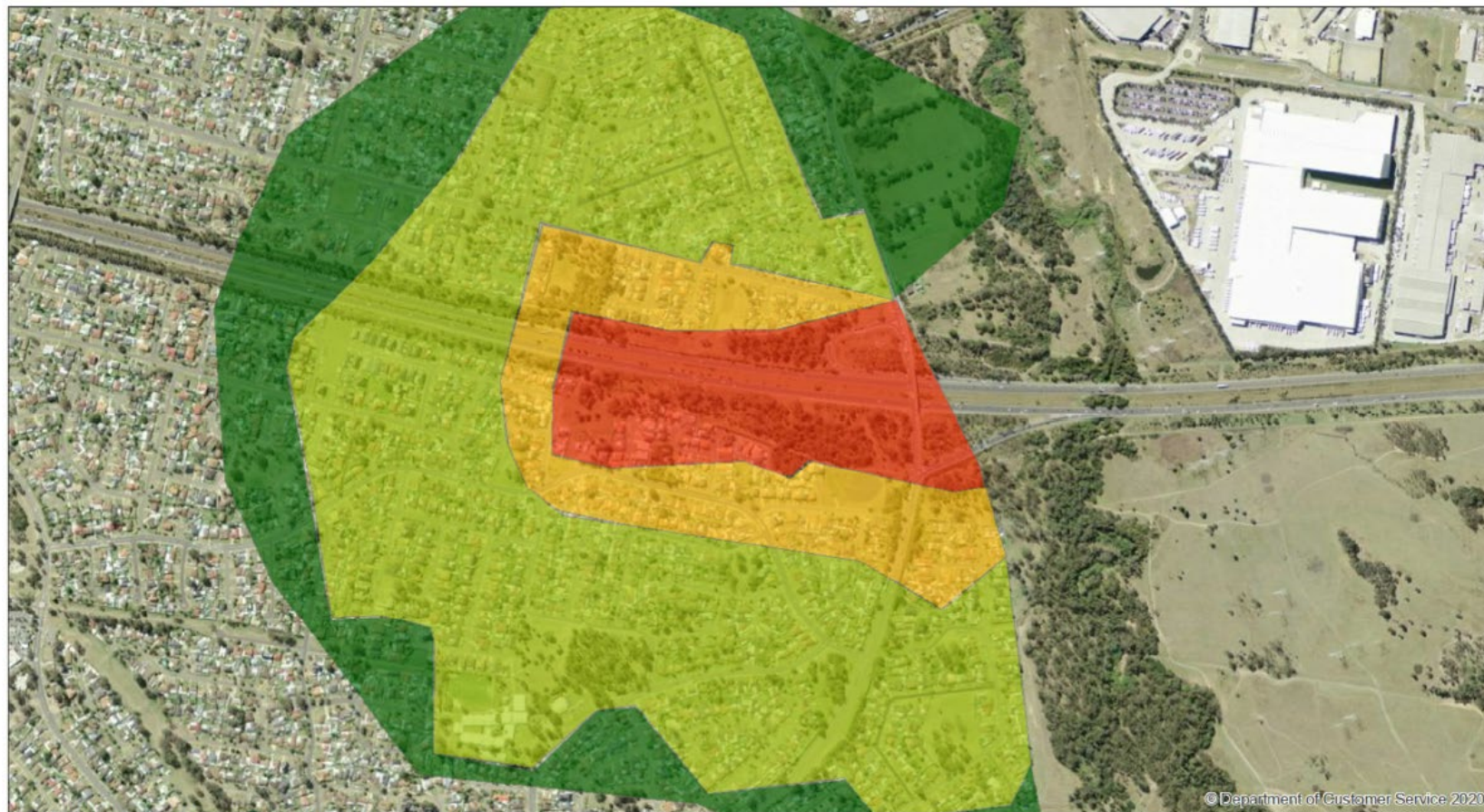


Figure 6-24 Bulk earthworks construction contours



ESC M4 Westbound On-Ramp Construction Mitigation - Night-time
 Stage 1 (Enabling works) - Bulk Earthworks
Mitigation

- N
- V, N, R2, DR
- V, IB, N, PC, SN, R2, DR
- AA, V, IB, N, PC, SN, R2, DR



AECOM

Report prepared by AECOM for the Department of Customer Service as part of the M4 Westbound On-Ramp Construction Mitigation - Night-time Stage 1 (Enabling works) - Bulk Earthworks project. The report is for informational purposes only and does not constitute a recommendation or endorsement of any product or service. AECOM is not responsible for any errors or omissions in this report. For more information, please contact the project manager.

Source:

Figure 6-25 Bulk earthworks night-time mitigation measures

Predicted construction noise impacts for non-residential receivers are presented in Table 6-33. The predicted L_{Aeq} noise levels are shown for the worst-case construction scenarios and maps detailing the areas where additional construction noise mitigation measures are required for each construction scenario are presented in the noise and vibration report in Appendix H of this REF.

Noise levels at up to 3 non-residential sensitive receivers are likely to exceed the noise management levels during various construction scenarios. The receivers include a school and two childcare centres. The exceedances of the NMLs are up to 4 dB(A) with Sunny Patch Preparation School & Long Daycare being the worst affected non-residential sensitive receiver.

Table 6-33 Predicted construction noise impacts for non-residential receivers

Construction activity	Affected receivers	NML	Construction noise level, L_{Aeq}
Enabling works – Mobilisation and site establishment	-	55 dB(A)	
Enabling works – Corridor clearing - General land clearing	Sunny Patch Preparation School & Long Daycare	55 dB(A)	57 dB(A)
Enabling works – Bulk Earthworks	Clairgate Public School Little Smarties Childcare Centre Sunny Patch Preparation School & Long Daycare	55 dB(A)	56 dB(A) 56 dB(A) 59 dB(A)
Main works – Retaining walls	-	55 dB(A)	
Main works – Paving/asphalting	Sunny Patch Preparation School & Long Daycare	55 dB(A)	56 dB(A)
Main works – Resurfacing works	-	55 dB(A)	
Main works – Drainage infrastructure	-	55 dB(A)	
Main works – Local roads works	Sunny Patch Preparation School & Long Daycare	55 dB(A)	58 dB(A)

Sleep disturbance

Sleep disturbance is assessed using an $L_{A1(1 \text{ min})}$ parameter, which is considered to be the maximum noise level excluding extraneous noise events. The noise modelling results are provided below and are discussed along with maximum distances at which awakening reactions may be expected from receivers. The distances are indicative and maps indicating where sleep awakening reactions are likely (Attachment F of the noise and vibration report in Appendix H of this REF) should be referred to, to determine whether sleep awakening reactions may be expected to occur.

A large number of exceedances of the sleep disturbance screening criteria and awakening reaction screening criterion have been predicted due to the night-time construction works associated with the proposal. The exceedances are attributed to the close proximity of the construction site to residences, and

the length of the proposal. It is difficult to predict the number of times the sleep awakening reaction criterion would be exceeded, however the impacts are considered to be consistent with other similar projects and indicate the need for effective noise mitigation and management planning.

The works would generally be progressive so that not all receivers would be affected at any one time, or for the whole duration of the works. An effective communication plan and noise management measures would need to be developed during detailed design to minimise the impacts upon affected sensitive receivers.

Enabling works – Corridor clearing - General land clearing

Sensitive receivers near to the corridor clearing works would experience elevated noise levels during these works such that sleep awakening reactions may be expected at around 210 receivers or up to 250 metres from the works. It is noted that as the works are progressive, the actual number of receivers affected on any one night would be much more limited.

Enabling works – Bulk Earthworks

Sensitive receivers near to the bulk earthworks would experience elevated noise levels during these works such that sleep awakening reactions may be expected at around 622 receivers or at distances up to 650 metres from the works (refer Figure 6-26). It is noted that as the works are progressive, the actual number of receivers affected on any one night would be much more limited.

Main works – Retaining walls

Sensitive receivers near to the retaining wall works would experience elevated noise levels during these works such that sleep awakening reactions may be expected at around 266 receivers or at distances up to 650 metres from the works.

Main works – Paving/asphalting

Sensitive receivers near to the paving/asphalting works would experience elevated noise levels during these works such that sleep awakening reactions may be expected at around 704 receivers or at distances up to 550 metres from the works. It is noted that as the works are progressive, the actual number of receivers affected on any one night would be much more limited.

Main works – Re-surfacing works

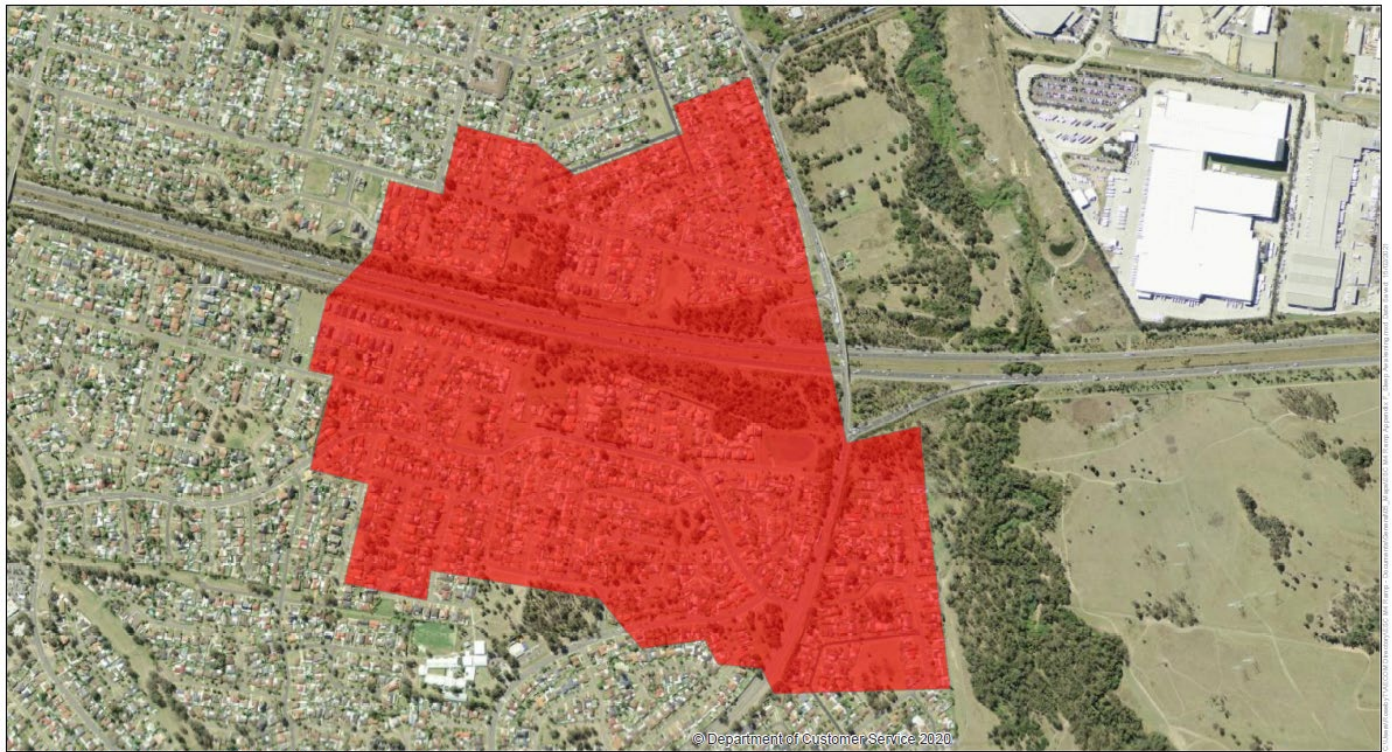
Sensitive receivers near to the re-surfacing works would experience elevated noise levels during these works such that sleep awakening reactions may be expected at around 75 receivers or at distances up to 300 metres from the works. It is noted that as the works are progressive, the actual number of receivers affected on any one night would be much more limited.

Main works – Drainage infrastructure

Sleep awakening reactions are not expected to occur during these works.

Main works – Local roads works

Sensitive receivers near to the local roads works would experience elevated noise levels during these works such that sleep awakening reactions may be expected at up to 228 receivers or at distances up to 550 metres from the works. It is noted that as the works are progressive, the actual number of receivers affected on any one night would be much more limited.



ESC M4 Westbound On-Ramp Construction Noise Sleep Disturbance



Stage 1 (Enabling works) – Bulk Earthworks

■ Exceeds Awakening Reaction

Figure 6-26 Area subject to sleep awakening reaction during bulk earthworks

Construction road traffic noise

Construction road traffic noise would be generated by vehicles associated with the construction of the proposal, including heavy vehicles transporting spoil and light vehicle movements generated by construction workers.

Estimated daily construction traffic movements includes 30 light vehicle movements and 80 heavy vehicle movements (consisting of 50 truck and dogs and 30 bogie trucks).

The existing daytime 15 hour and night-time 9 hour traffic flows along the existing M4 westbound off ramp are presented in Table 6-34 from traffic counts that were conducted concurrently with noise monitoring for the proposal. The results indicate that the predicted noise increases on the road from construction traffic associated with the project are significantly lower than the 2 dB(A) screening criteria presented in the RNP. As a result, no further consideration of construction traffic noise is required at this stage. Existing traffic flows on Roper Road and Erskine Park Road are similar to the M4 westbound off ramp and therefore the construction impact would not change on these roads.

A review of the construction traffic noise would be included as part of the CNVMP developed prior to construction to confirm the conclusions of this assessment.

Table 6-34 Existing traffic flows and additional traffic flows due to construction traffic

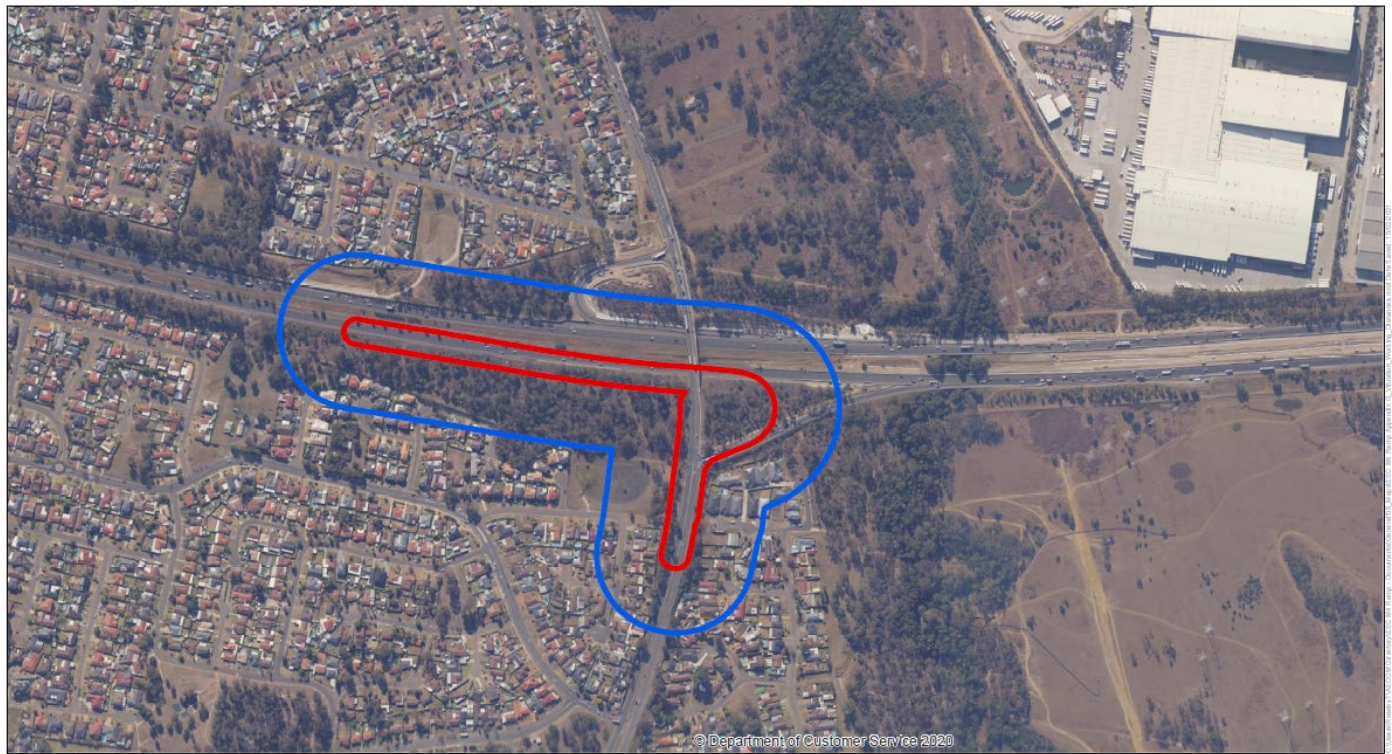
Road	Existing traffic flow		Additional traffic flow		Relative noise increase, dB(A)
	Light	Heavy	Light	Heavy	
Daytime (15 hr)	11,385	1,534	30	80	0.2
Night-time (9 hr)	2,700	362	30	80	0.9

Construction vibration

Based on the proposed construction equipment, the vibration criteria may be exceeded at times if the minimum working distances (refer Table 6-30) are not adhered to, depending on the equipment to be selected. Vibration intensive plant (Paving/asphalting) are not expected to be used within the minimum working distances of any building. Figure 6-27 presents the minimum working distances where the vibration criteria may be exceeded if mitigation measures are not implemented, based on the use of a 7-13 T Vibratory roller.

The primary form of mitigation of vibration would be ensuring vibration intensive works do not occur within these minimum working distances. If vibration intensive works are planned within the minimum working distances identified, alternative equipment would be identified, or vibration monitoring would be implemented. Further mitigation of vibration would not be required where the human response minimum working distances are adhered to.

In some circumstances, construction activity within the minimum working distance cannot be avoided due to the work required and the prevalent geological site conditions. These conditions may not be fully understood until work has commenced, resulting in a potential change in operating equipment. If work is required to occur within minimum working distances then monitoring should be undertaken to confirm site specific minimum working distances.



ESC M4 Westbound On-Ramp- Appendix G

Minimum Working Distance - 7-13 T Vibratory roller

 	101.75
 	16.75

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Figure 6-27 Vibration minimum working distances – 7-13 tonne vibratory roller

Operation

Operational road traffic noise

Noise levels have been predicted for each assessment scenario across the extent of the proposal. Operational road traffic noise contours are presented in Attachment H and a summary of all sensitive receivers where road traffic noise levels exceed the applicable noise criteria is presented in Attachment J of the noise and vibration report (Appendix H of this REF).

Considering the impacts in both Year 2021 and Year 2031 during the daytime and night-time periods, the greatest impacts were identified during Year 2031 and are summarised as follows:

- Road traffic noise levels are predicted to exceed the L_{Aeq} controlling noise criterion at a total of 351 sensitive receivers
- Of these noise sensitive receivers:
 - Noise levels are not predicted to increase by more than 2 dB(A) at any sensitive receiver
 - Noise levels are predicted to exceed the cumulative limit at 26 sensitive receivers. (ie $\geq L_{Aeq(15\text{ hr})}$ or $L_{Aeq(9\text{ hr})}$ noise criterion + 5 dB(A) and contribution from the proposal adds 2.0 dB(A) to the total road noise level)
 - Seven noise sensitive receivers have been identified as being acute (i.e. the 'Project only' road noise levels are equal to or greater than $L_{Aeq(15\text{ hr})}$ 65 dB(A) or $L_{Aeq(9\text{ hr})}$ 60 dB(A), noise levels at six of these receivers are also predicted to exceed the cumulative limit.

- 27 sensitive receivers are considered to be eligible for the consideration of feasible and reasonable noise mitigation measures.

The receivers eligible for consideration of additional mitigation measures are presented in Table 6-35. The receivers considered to be eligible for the consideration of feasible and reasonable noise mitigation measures are presented in Figure 6-28.

Table 6-35 Receivers eligible for consideration of additional mitigation measures

Address	Buildin g ID	Criteria	L _{Aeq} (period), dB(A)								Reason for eligibility ¹
			Day – 2021				Day – 2031				
			No build	Design	Change	Project only	No build	Design	Change	Project only	
4 Swales Place, Colyton	1050	60	65	65	0	61	65	65	0	61	Exceeds cumulative noise limit
5 Japura Place, St Clair	1195	60	71	72	0.2	68	71	72	0.2	68	Exceeds cumulative noise limit
13 Seine Court, St Clair	1241	60	71	71	0.2	68	71	71	0.1	67	Exceeds cumulative noise limit
14 Seine Court, St Clair	1242	60	67	67	0.1	63	67	67	0.1	63	Exceeds cumulative noise limit
10 Seine Court, St Clair	1291	60	72	72	0.2	67	72	72	0.2	67	Exceeds Acute noise limit
12 Seine Court, St Clair	1335	60	72	73	0.2	69	72	73	0.1	68	Exceeds cumulative noise limit
11 Seine Court, St Clair	1348	60	72	72	0.2	68	72	72	0.2	68	Exceeds cumulative noise limit
7 Swales Place, Colyton	1702	60	65	65	0.1	61	65	65	0.1	61	Exceeds cumulative noise limit
4 Japura Place, St Clair	1773	60	67	67	0.2	65	67	67	0.2	65	Exceeds cumulative noise limit
6 Japura Place, St Clair	1781	60	69	69	0.2	67	69	69	0.3	67	Exceeds cumulative noise limit
17 Seine Court, St Clair	1784	60	65	65	0	63	65	65	0.1	62	Exceeds cumulative noise limit
1 Hartwell Court, St Clair	1785	60	69	69	0.2	67	69	69	0.2	66	Exceeds cumulative noise limit
3 Hartwell Court, St Clair	1789	60	69	69	0.2	66	69	69	0.3	66	Exceeds cumulative noise limit
2 Hartwell Court, St Clair	1793	60	69	69	0.2	66	69	69	0.3	66	Exceeds cumulative noise limit
4 Hartwell Court, St Clair	1808	60	66	66	0.2	63	65	66	0.3	63	Exceeds cumulative noise limit
4 Loire Place, St Clair	1810	60	68	69	0.3	65	68	69	0.2	65	Exceeds cumulative noise limit
5 Loire Place, St Clair	1812	60	68	69	0.2	65	68	69	0.3	65	Exceeds cumulative noise limit

Address	Buildin g ID	Criteria	L _{Aeq(period)} , dB(A)								Reason for eligibility ¹
			Day – 2021				Day – 2031				
			No build	Design	Change	Project only	No build	Design	Change	Project only	
2 Loire Place, St Clair	1818	60	65	65	0	62	65	65	0.1	62	Exceeds cumulative noise limit
3 Loire Place, St Clair	1827	60	67	67	0.1	64	67	67	0	64	Exceeds cumulative noise limit
7 Hartwell Court, St Clair	1942	60	66	66	0.1	63	66	66	0.1	63	Exceeds cumulative noise limit
6 Hartwell Court, St Clair	1947	60	65	65	0.1	62	65	65	0.2	62	Exceeds cumulative noise limit
4 Miner Glen, Erskine Park	2430	60	67	66	-0.1	65	66	67	0.3	65	Exceeds cumulative noise limit
7 Shrike Glen, Erskine Park	2439	60	65	65	-0.1	61	65	65	0.6	61	Exceeds cumulative noise limit
8 Shrike Glen, Erskine Park	2505	60	64	64	0	61	64	64	0.7	61	Exceeds cumulative noise limit
25 Augusta Place, St Clair	2544	60	64	64	0	60	64	65	1	60	Exceeds cumulative noise limit
27 Augusta Place, St Clair	2583	60	65	65	0.2	63	65	65	0.5	63	Exceeds cumulative noise limit
27 Augusta Place, St Clair	2584	60	67	67	0.1	65	66	68	1.1	66	Exceeds cumulative noise limit

¹ Whilst receivers can be eligible for consideration of additional noise mitigation due to more than one trigger, only one trigger is listed in the table in the following order: exceeds cumulative noise limit, acute, increases >2 dB



ESC M4 Westbound On-Ramp - Operational Noise Mitigation

Receiver eligible for consideration of noise mitigation

- ☐ No
- ☒ Yes



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Source:

Figure 6-28 Receivers eligible for consideration of noise mitigation

Noise barrier assessment

As noted above there are 27 noise sensitive receivers considered to be eligible for the consideration of feasible and reasonable noise mitigation measures. The NMG advises that noise barriers should be considered where there are four or more closely spaced receivers. Noise barriers are not considered reasonable for these groups of isolated receivers.

A noise barrier assessment has been undertaken for the proposal in accordance with the NMG. The assessment considers incremental increases in barrier height (0 metres to eight metres in 0.5 metres increments). For a noise barrier to be considered reasonable, it should be capable of providing an insertion loss of 5 dB(A) at receivers for heights up to 5 metres and 10 dB(A) at receivers for heights up to 8 metres.

A road barrier was considered for the assessment as shown in Figure 6-29. A comparison of noise reductions for a range of barrier heights has been carried out for the 19 receivers located to the south of the M4 Motorway and west of Erskine Park Road in St Clair.



Figure 6-29 Noise barrier assessment area

The assessment concluded that the design barrier does not meet the minimum insertion loss of 10 dB(A) and that 22 at property treatments would still be required. As a result, an 8 metre high noise barrier in this area is not considered reasonable. A smaller barrier of 5 metre height could be considered given that an insertion loss of 5 dB(A) is achieved, however it was observed that a noise barrier of 5 metres does not reduce the number of treatments which are required. Therefore, it was concluded that a noise barrier in this area is not considered reasonable.

Therefore at-property treatments are recommended for all properties listed in Table 6-35. Further investigations into additional mitigation measures including at-property treatments for eligible receivers would be undertaken during detailed design. In addition, post-construction noise assessment would be undertaken to confirm which receivers are eligible for additional mitigation.

Maximum noise level assessment

A maximum noise level assessment during the night-time was completed for the operation of the proposal. Maximum noise levels were recorded over one week and were typically around 70 to 79 dB(A). The number of events was highest during 11:00pm until 1:00am, as the ambient noise levels drops during that period. While the area is controlled by road traffic noise, it cannot be confirmed that noise associated with each maximum noise level is attributable to road traffic.

These maximum noise levels indicate that the area is already exposed to some maximum noise level events that have the potential for awakening reactions. However, given the low number of maximum noise levels 15 dB above the $L_{Aeq(1hr)}$, it is likely that the existing traffic can be described as free flowing.

In future scenarios overall traffic noise levels are predicted to increase slightly, resulting in higher L_{Aeq} noise levels. The overall levels associated with maximum noise events is driven by the type of truck, speed to a lesser degree and distance to the receiver. Given the distance to receivers would slightly decrease due to the addition of the on ramp, L_{Amax} noise levels are expected to increase by up to 0.5 dB(A) at the receivers closest to the road.

Although slight, there is the potential for additional maximum noise level events in the future due to increased traffic flows. In addition due to traffic on the new ramp merging with the existing M4 Motorway heavy vehicles on the existing M4 Motorway may slow down, causing further maximum noise level events. However, there is no criterion associated with these impacts. Transport does not provide any requirements to provide noise mitigation options on the basis of the maximum noise level assessment. Rather, maximum noise level assessments can be used to prioritise the application of noise mitigation measures. Noise mitigation measures recommended to control L_{Aeq} noise levels from road traffic noise would also control maximum noise events. In addition, Transport have long term strategies which are being employed to ensure noise levels from trucks are reduced across the entire network.

6.3.5 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Noise and vibration	<p>A Construction Noise and Vibration Management Plan (CNVMP) will be prepared as part of the CEMP. The CNVMP will include but not be limited to:</p> <ul style="list-style-type: none">• a map indicating the locations of sensitive receivers including residential properties• a quantitative noise assessment in accordance with the EPA Interim Construction Noise Guidelines (DECCW, 2009)• management measures to minimise the potential noise impacts from the quantitative noise assessment and for	Contractor	Detailed design / pre-construction	Section 4.6 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<p>potential works outside of standard construction hours (including implementation of EPA Interim Construction Noise Guidelines (DECCW, 2009)</p> <ul style="list-style-type: none"> • a risk assessment to determine potential risk of activities likely to affect receivers (for activities undertaken during and outside of standard construction hours) • mitigation measures to avoid noise and vibration impacts during construction activities including those associated with truck movements • a process for assessing the performance of the implemented mitigation measures • a process for documenting and resolving noise and vibration issues and complaints • a construction staging program incorporating a program of noise and vibration monitoring for sensitive receivers • a process for updating the CNVMP when activities affecting construction noise and vibration change • Toolbox talks will identify where noise and vibration management is required. 			
Noise and vibration	<p>All sensitive receivers (eg schools, local residents) likely to be affected will be notified at least five working days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of:</p> <ul style="list-style-type: none"> • the project 	Contractor	Detailed design / pre-construction	

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> the construction period and construction hours contact information for project management staff complaint and incident reporting how to obtain further information. 			
Complaints	During work hours, a community liaison phone number will be provided to enable complaints to be received and responded to.	Contractor	Construction	Standard safeguard N8
Work practices	<p>The environmental induction program for construction personnel will include specific noise and vibration issues awareness training including, but not limited to, the following:</p> <ul style="list-style-type: none"> avoiding use of radios during work outside normal hours. avoiding shouting and slamming doors. where practical, operating machines at low speed or power and switching off when not being used rather than left idling for prolonged periods. minimising reversing. avoiding dropping materials from height and avoiding metal to metal contact on material. 	Contractor	Construction	Standard safeguard N10
Construction scheduling	Noisy work will be scheduled during standard construction hours as much as possible. Noisy activities that cannot be undertaken during standard construction hours will be scheduled as early as possible during the evening and/or night-time periods. Particularly noisy activities such as use of road and	Contractor	Detailed design / pre-construction / construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<p>concrete saws and jack hammers will be completed before midnight.</p> <p>Consultation will be undertaken with other contractors to manage cumulative impacts on sensitive receivers within commonly affected areas. Feasible and reasonable mitigation measures will be detailed in the CNVMP.</p>			
Respite	Respite measures will be implemented for noisy work and vibration intensive activities consistent with the CNVG.	Contractor	Construction	Additional safeguard
Construction mitigation	During the detailed design stage of the proposal, further investigations of all feasible and reasonable mitigation options will be undertaken for affected receivers in accordance with the <i>Road Noise Policy (DECCW 2011)</i> and the <i>Environmental Noise Management Manual Practice Note 4 (RTA 2001)</i> .	Contractor	Detailed design	Standard safeguard N1
Construction traffic noise	<p>Management of construction traffic noise will include:</p> <ul style="list-style-type: none"> • following designated vehicle routes, parking locations, acceptable delivery hours and other relevant practices. Vehicle routes will be reviewed to consider noise impacts • site access and egress points will be located away from sensitive receivers, where feasible and reasonable • deliveries and spoil removal will be planned to avoid queuing of trucks and be conducted during the daytime where feasible and reasonable • construction sites will be arranged to limit the need 	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	for reversing associated with regular/repeatable movements (eg trucks transporting spoil).			
Plant and equipment	Plant and equipment will: <ul style="list-style-type: none"> • be appropriately selected for each task to minimise the noise contributions • be regularly inspected and maintained to ensure it is in good working order be located on site with as much distance as possible between the plant and noise sensitive receivers or be orientated away from residential receivers where feasible and reasonable. 	Contractor	Pre-construction / construction	Additional safeguard
Construction compound noise	Consider orienting the construction compound layout so that primary noise sources including noisy plant items (generators, pumps, fixed plant) are located away from nearby noise sensitive receivers), with solid structures (sheds and containers) placed between sensitive receivers and noise sources (and as close to the noise sources as is practical);	Contractor	Pre-construction / construction	Standard safeguard N3
Construction vibration	A vibration assessment will be prepared and included in the CNVMP. The vibration assessment will include (as a minimum): <ul style="list-style-type: none"> • identification of potentially affected properties/receivers • a risk assessment to determine the potential for discrete work activities to affect receivers • a map indicating the locations considered likely to be impacted and those requiring building condition surveys • outline a vibration monitoring program 	Contractor	Pre-construction	Standard safeguard N13

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> a process for assessing the performance of the implemented mitigation measures and a process for resolving issues and conflicts. 			

6.4 Soils and topography

6.4.1 Methodology

The assessment of soils and topography is primarily based on the desktop analysis of publicly available information and site inspections:

- The description of soil type is based on the information available on NSW governmental portal eSPADE freely available online (NSW Office of Environment and Heritage, 2020)
- Contaminated land information was obtained from the NSW EPA Contaminated land record searched by LGA.
- Acid sulfate soil identification was obtained from eSPADE freely available online
- Salinity information was obtained from The Central Resource for Sharing and Enabling Environmental Data in NSW (SEED) freely available online

6.4.2 Existing environment

Topography

The topography throughout the Penrith City Council LGA is predominantly flat or gently sloping and the overall topography of the M4 Motorway in the vicinity of the proposal area is the same with an elevation of approximately 50 metres AHD. Topography within the proposal area is shown in Figure 6-30. The proposal area generally has a slight slope from west to east down towards Ropes Creek to the east of the M4 westbound on-ramp to Erskine Park Road and Roper Road. Sloping embankments at the site are in place as a result of previous construction of the bridge over the M4 motorway, on and off-ramps.

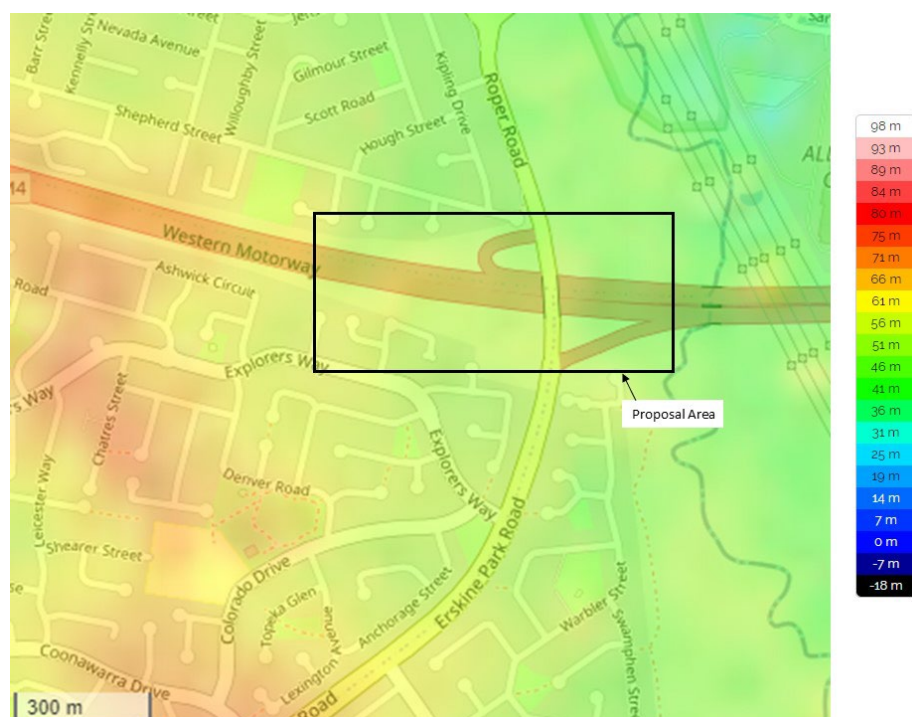


Figure 6-30 Topography surrounding the proposal area (Source: <https://en-au.topographic-map.com/maps/janv/Sydney/>)

Soils

The proposal is underlain by two soil landscape categories (NSW Office of Environment and Heritage, 2020):

- Blacktown Soil Landscape (majority of the proposal area) – described as gently undulating rises on Wianamatta Group shales which occurs extensively on the Cumberland Lowlands. Soils are shallow to moderately deep hard setting mottled texture contrast soils, red and brown podzolic soils. These soils are likely to have localised water erosion hazard (high erodibility) and localised surface movement potential.
- South Creek Soil Landscape (small part of eastern side of the proposal area) – described as flood plains, valley flats and drainage depressions of the channels on the Cumberland Plain. Soils are often very deep layered sediments over bedrock or relict soils. These soils are likely to have localised water erosion hazard (moderate erodibility) and localised surface movement potential.

Contaminated land

The search of the NSW EPA Contaminated Land record on 11 November 2020 identified 8 records for Penrith City Council and 2 records for Blacktown City Council (the border of which is approximately 200 metres east of the proposal area). Of the records the closest contaminated site to the proposal area is Colyton Coles Service Station, 86-88 Great Western Highway which is located approximately 1.9 kilometres north west of the proposal area. That site is recorded as having soil and groundwater contamination including; total recoverable hydrocarbons, benzene, toluene, ethylbenzene and xylenes. All other recorded sites are more than five kilometres from the proposal area.

The proposal area is not located in an area with identified acid sulfate soils risk.

Salinity

A review of the SEED data for salinity potential of Western Sydney identified that the proposal area is predominantly within an area of moderate salinity potential, with areas to the east of the site towards Ropes Creek identified as an area of high salinity potential (NSW Government, 2020c).

6.4.3 Potential impacts

Construction

Topography

The proposal would result in changes to the ground levels at the proposal area due to the construction of the embankments to support the proposed on-ramp, particularly within the G-loop configuration and below the Erskine Park Road bridge over the M4 Motorway. Stockpiling during construction would also cause temporary changes to topography. The changes in topography due to the cut and fill for the proposed on-ramp embankment and relocation of the earth bund are identified in Figure 3-17 and Figure 3-18. Within the context of the existing motorway corridor the changes in topography during the construction would be minor.

Soil disturbance

The proposal would be constructed within the existing road corridor, predominantly adjacent to existing carriageways. Construction would involve earthworks and vegetation clearance to both the west and east of Roper Road and Erskine Park. Earthworks would be required for the construction of the embankment for the proposed on-ramp carriageway, minor widening of the existing embankment to the east of Erskine Park Road southbound, below the existing bridge abutment and to relocate the earth bund. Minor earthworks

would be required for; medians and road pavements, retaining wall construction, utility relocations and upgrades, retaining wall/bund reconstructions and pavement installation as part of the road widening and ramp construction works.

If not adequately managed, excavation, stockpiling and transportation of spoil would potentially have the following impacts:

- Erosion of exposed soil and stockpiled materials, or dispersal of stockpiled materials
- An increase in sediment loads entering the receiving stormwater system and/or the receiving tributaries within the wider catchments

Soil disturbance can also uncover saline soils which can degrade the environment and decrease plant growth and water quality if not managed appropriately.

Where the works are managed to stabilise disturbed soils as soon as possible and erosion and sediment control measures are implemented the risks of soil erosion due to the vegetation and disturbance required can be adequately mitigated. Further discussion of erosion and sediment control risks associated with the proposal are set out in Section 6.5.3.

It is unlikely contamination would be encountered during the construction of the proposal. If contamination was encountered, an unexpected finds procedure would be employed to appropriately contain, handle and dispose of contaminated material. Safeguards proposed in Section 6.4.4 would manage the risks associated with soil disturbance and unexpected discovery of contaminated soils.

Operation

All disturbed areas would be reinstated or stabilised as part of the proposal which would remove operational risks of disturbed soils. The potential impacts of changes to topography on flooding and overland flow paths caused by the finished design levels of the on-ramp and surrounding road network are addressed in Section 6.5.

6.4.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Contaminated land	If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Transport for NSW Environment Manager and/or EPA.	Contractor	Detailed design / Pre-construction	Section 4.2 of QA G36 <i>Environment Protection</i>
Soils	Site stabilisation of disturbed areas shall be carried out progressively as stages are completed.	Contractor	Construction	Section 3.1 of QA G38 <i>Soil and Water Management</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
Soils	Controls shall be implemented at exit points to minimise the tracking of soil and particulates onto pavement surfaces.	Contractor	Construction	Section 3.1 of QA G38 <i>Soil and Water Management</i>
Contaminated land	Any fuel, oils or other liquids stored on site shall be stored in an appropriately sized impervious bunded at least 120 per cent larger than the greatest container and in an area at least 50 metres away from waterbodies.	Contractor	Construction	Section 4.3 of QA G36 <i>Environment Protection</i>
Contaminated land	If asbestos is encountered during construction procedures for management and disposal of asbestos in accordance with NSW EPA guidelines, Australian Standards and relevant industry codes of practice will be followed.	Contractor	Construction	Section 4.2 of QA G36 <i>Environment Protection</i>

Other safeguards and management measures that would address hydrology and flooding impacts are identified in section 6.5.4.

6.5 Hydrology and flooding

6.5.1 Methodology

The assessment of hydrology and flooding is based on the desktop analysis of the following publicly available information:

- Hydrological information was obtained from the South Creek Floodplain Risk Management Study (Advisian, 2020).
- Water NSW – Real-time data website - All Groundwater Map

6.5.2 Existing environment

Surface water and hydrology

The proposal area is located about 200 metres west of Ropes Creek which is a major tributary of South Creek, refer Figure 6-31. South Creek is a tributary of Hawkesbury River which generally flows from south to north and is a catchment of 412 square kilometres in Western Sydney (Advisian, 2020).

The stormwater system within the proposal area currently consists of pits and pipes which collect run-off from low points of the road system and discharge either to an outlet at the eastern extent of the proposal area to Ropes Creek or to a connection below the M4 Motorway westbound mainline that discharges to the north of the M4 Motorway eastbound Roper Road on-ramp. To the south of the M4 Motorway westbound mainline is a Transport for NSW stormwater basin constructed with an earth bund parallel to the M4 Motorway mainline. Below the Transport for NSW stormwater basin and above Augusta Place to the west

of Erskine Park Road is a Council owned stormwater basin which connects to the discharge system of the Transport for NSW basin. Both stormwater basins discharge to pipes conveying stormwater to the north below the M4 Motorway mainline. The basins discharge during AEP storm events between 2% AEP and 1% AEP (refer to Figure 2-4).

Additional stormwater basins are being constructed in the median of the M4 Motorway mainline to the east of the Roper Road eastbound on-ramp to minimise potential flooding impacts of the additional impervious area constructed as part of the M4 Smart Motorway project (separate to the proposal).

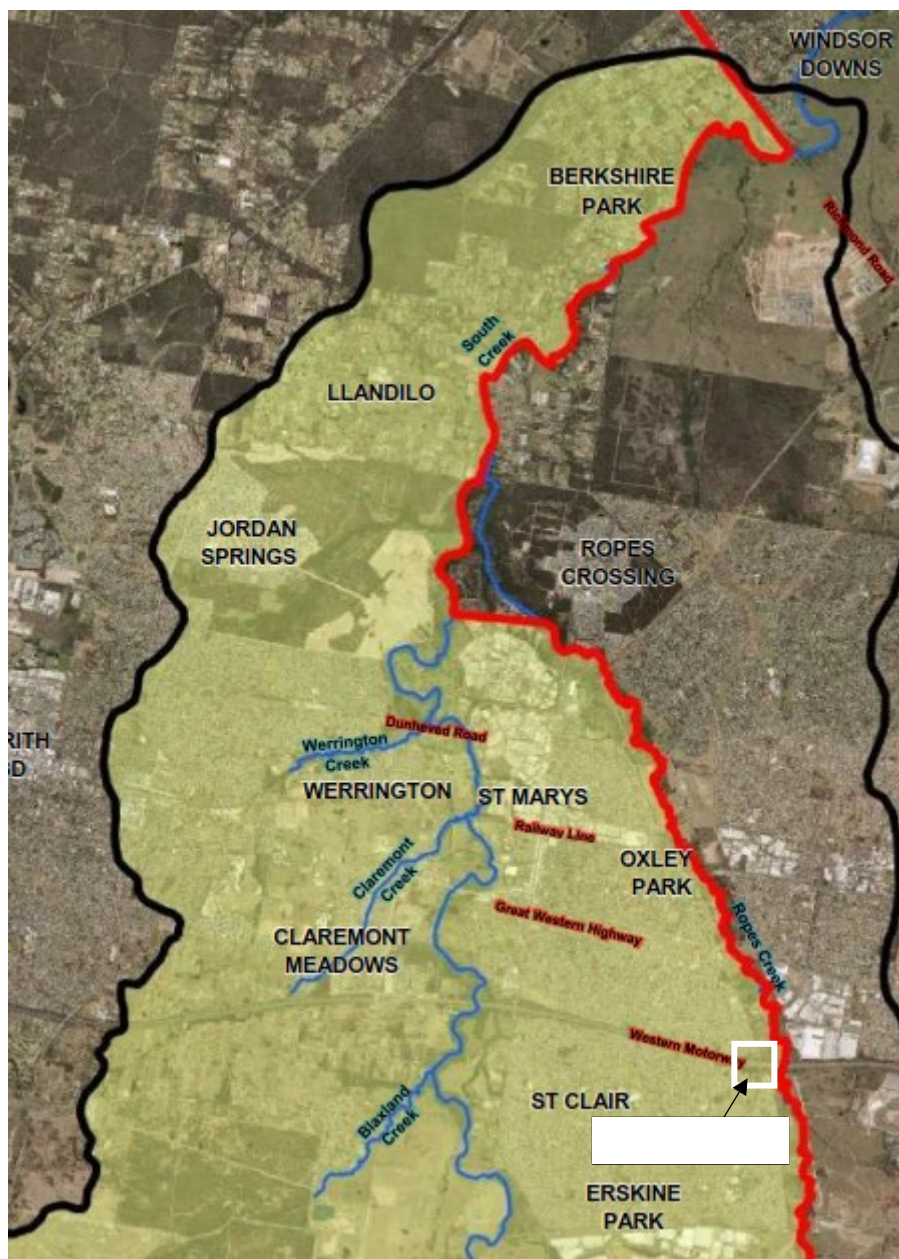


Figure 6-31 South Creek catchment downstream of proposal area. Source: Penrith City Council, 2020)

Ropes Creek near the proposal area is within the Flood Planning Area defined in the Penrith LEP and the South Creek Floodplain Risk Management Study completed for Penrith City Council in 2020 identified the Probable Maximum Flood (PMF) as identified in Figure 6-32. The PMF is limited to an area east of the proposal area.

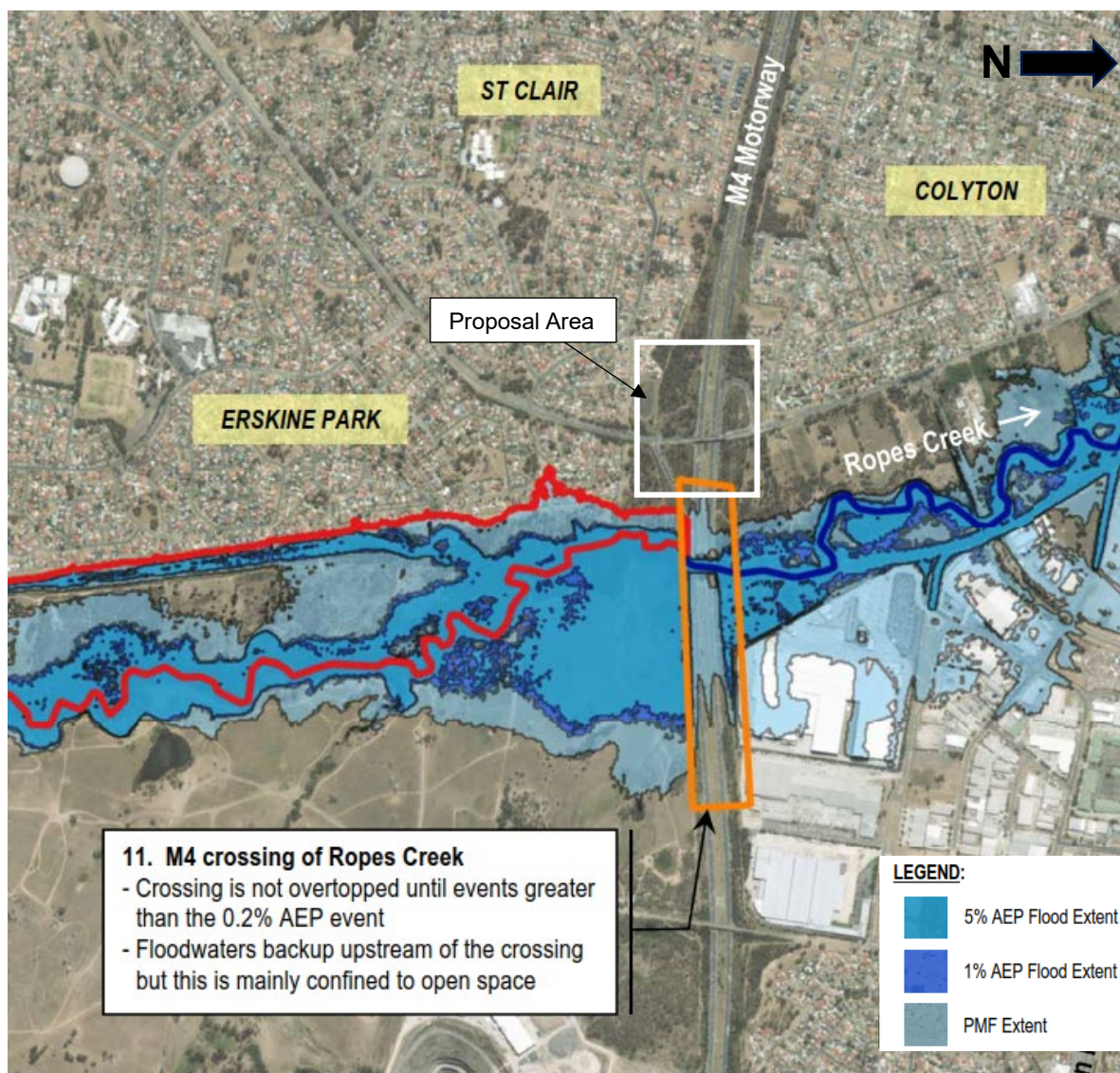


Figure 6-32 Flood extent of Ropes Creek at M4 Motorway crossing near the proposal area (Source: Advisian, 2020)

Groundwater

Bore logs completed at the site did not record any groundwater. Based on the site geological features, it is anticipated that groundwater would generally be present around R 40 m AHD which is approximately the level of Ropes Creek in the vicinity of the site.

The closest groundwater bores to the site identified on the Water NSW All Groundwater Map are summarised in Table 6-36. GW114803- GW114805 are all located within 300 metres of Ropes Creek flood plain and therefore more likely to represent the potential depth to groundwater within the proposal area.

Table 6-36 Depth to Groundwater of groundwater bores surrounding the proposal area

Groundwater site	Distance from proposal area	Groundwater depth below surface level (Metres)	Year of last measurement
GW110312	1.5 km south east	39.8	2009
GW110314	1.5 km south east	40.3	2009

Groundwater site	Distance from proposal area	Groundwater depth below surface level (Metres)	Year of last measurement
GW114805	1.3 km north	3.7 to 5	2015
GW114803	1.4 km north	3.7 to 5	2010
GW114804	1.3 km north	3.7 to 5	2010

6.5.3 Potential impacts

Construction

Surface water

Soil disturbance for construction of the proposal would primarily be related to vegetation removal, excavation for the road widening and installation of utilities and drainage. Soil disturbance has the potential to result in erosion and sedimentation. Without management measures in place, erosion and sedimentation could potentially impact on downstream water quality, via entering the stormwater network or onsite runoff.

Construction activities have the potential to affect local surface water as a result of:

- Sediment run off from the site and proposed site compounds into the stormwater network during rainfall events due to increased soil exposure
- Pollutants from site (including paint for line marking, fuel, chemicals or wastewater from accidental spills, and sediment from excavations and stockpiles) reaching nearby stormwater drains and flowing into waterways.

The identified areas of risk for erosion and sedimentation resulting from earthworks are as follows:

- **Removal of established vegetation**
 - increased risk of soil erosion due to the loss of stabilising vegetation from existing slopes and embankments within the proposal area
 - potential for the alteration of local overland flow routes due to changes in land surface following clearance of vegetation and topsoil removal
- **Bulk earthworks to construct the G-loop on-ramp embankment and relocation of the earth bund**
 - wide area of soil disturbance to the east of Erskine Park Road contained within proposed G-loop configuration, with limited opportunity to divert clean water around the disturbed area
 - area to the west of Erskine Park Road adjacent to the M4 Mainline westbound where earthworks would be required to relocate the bund and prepare the ground for the on-ramp merge lane
 - all earthworks areas slope to the north towards existing drainage along the southern side of the M4 mainline westbound (concrete kerb and channel conveying water to pipe at the east of the proposal area which discharges to Ropes Creek)
 - minor earthworks along the embankment west of Erskine Park Road to provide for a separate right turn lane would result in disturbed land sloping down towards the Council owned stormwater detention basin
- **Stockpiling of materials**
 - erosion from stockpiles of excavated spoil, fill and other erodible material

- dust discharges from stockpiles during dry wind conditions
- **Trenching for utilities**
 - exposed soils form open trenches at higher risk of mobilising sediment during rainfall events
 - potential for disturbance of existing drainage features during the works such as pipes, culverts and outlets
 - new overland drain construction would require stabilisation to avoid discharges of sediment prior to completion of works
 - outlet works at the east of the proposal would be in closer proximity to Ropes Creek and provision would be required for clean water diversion around the works

The closest waterway to the proposal area is Ropes Creek, located approximately 100 meters east. Parts of the existing stormwater network discharge to Ropes Creek, therefore existing pits are to be protected during construction to minimise potential for the loss of sediment laden stormwater discharging to the waterway. Appropriate safeguards would be implemented to minimise and mitigate potential impacts caused by the proposed work to the surrounding environment as outlined in Section 6.5.4. These safeguards include the development of Site Specific Erosion and Sediment Control Plan(s) to minimise sediment moving off-site and sediment laden water entering any waterways, drainage lines or drainage pits. With the implementation of the proposed safeguards and management measures, the risks to surface water quality would be minimal.

Groundwater

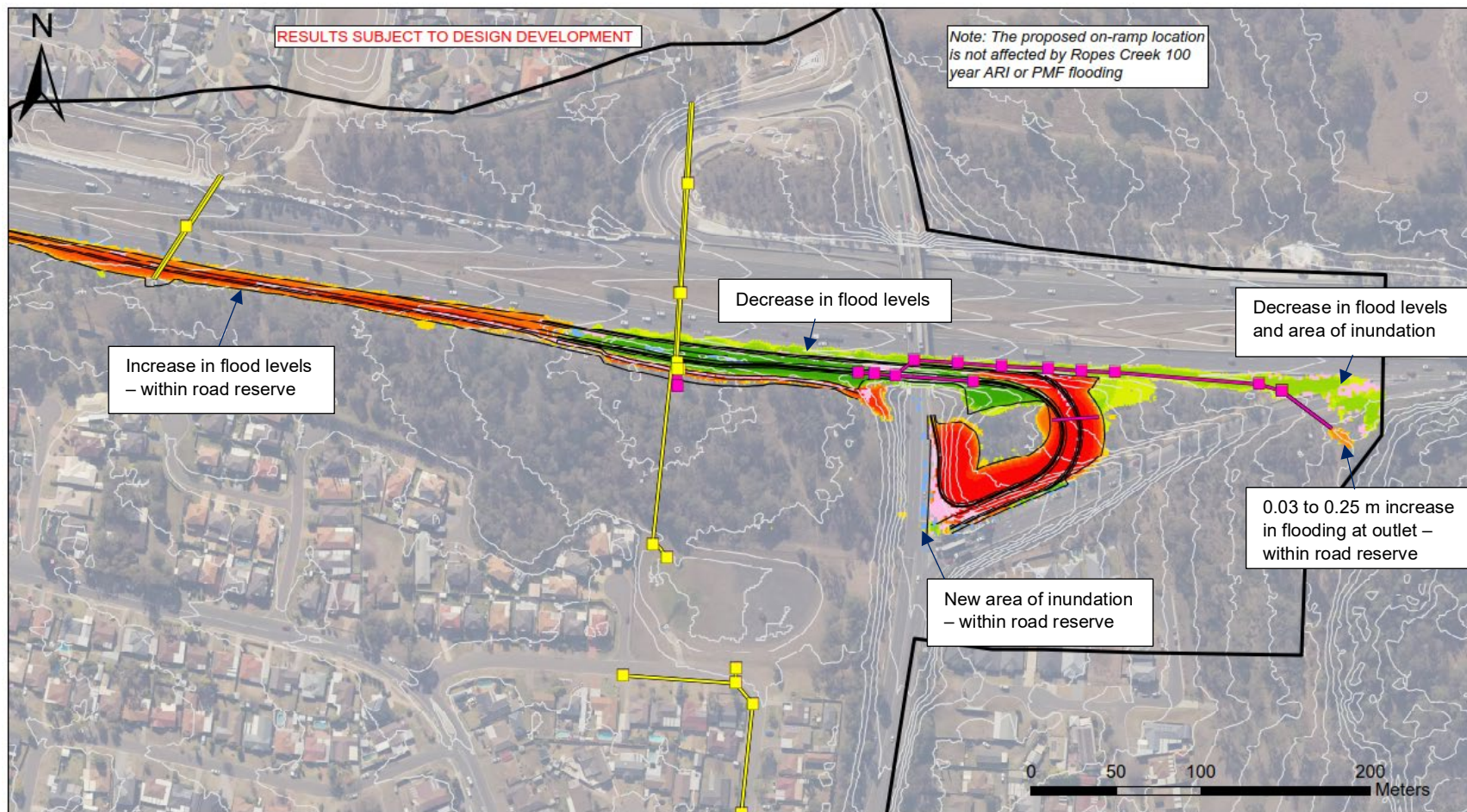
The depth to groundwater from published data near the site and lack of groundwater identified in bore logs as the site identifies that groundwater may be around 40 m AHD, at the level of Ropes Creek located to the east of the proposal area. As the maximum depth of cut is proposed to be 5 metres, it is unlikely groundwater would be encountered during construction.

Operation

All disturbed areas would be reinstated as part of the proposal which would remove operational risks to soils, topography and water quality as a result of soil disturbance during the construction of the proposal.

The proposed on-ramp creates approximately 5150 square metres of additional impervious area in the catchment, therefore there is potential for increased stormwater flows potentially leading to larger flows entering the stormwater network. Additional stormwater pipes, pits and batter drains and upgrades to the culvert and stormwater outlet discharging to Ropes Creek are proposed to manage stormwater run-off from the increase in impervious area.

Modelling of the upgrades to the stormwater network including the large impermeable area was completed using TUFLOW modelling software and the extent of flooding during a 1% AEP rainfall event is shown in Figure 6-33 below. This identifies that as a result of the proposal (including drainage works) the extent of flooding has increased (new area of inundation) in two locations: an area of the proposed on-ramp merge lane to the west of Erskine Park Road and areas to the south of the Erskine Park Road bridge over the M4 Motorway. All new areas of flooding inundation are within road reserve. No changes to flood levels of residential properties would be caused by the proposal. A reduction in the area of inundation would also be expected in three locations within the proposal area: a small area west of Erskine Park Road, to the north east of the Erskine Park Road intersection with the M4 westbound off-ramp and to the eastern extent of the proposal area where the M4 westbound off-ramp departs from the M4 Motorway mainline.



Legend

TUFLOW Model Extent	1% AEP Relative Flood Level Impacts (m)		
Existing Pits	< -1	-0.03 - -0.01	0.5 - 1
Existing Pipes	-1 - -0.5	-0.01 - 0.01	>1
Proposed Pits	-0.5 - -0.25	0.01 - 0.03	No longer inundated
Proposed Pipes	-0.25 - -0.1	0.03 - 0.05	New area of inundation
Proposed Road	-0.1 - -0.05	0.05 - 0.1	
1m contours - existing	-0.05 - -0.03	0.1 - 0.25	
		0.25 - 0.5	

Figure 6-33 Modelled flooding impacts within the proposal area (areas of red and orange identify increased flood levels during a 1% AEP rainfall event)

6.5.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Soil and water	<p>A site specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the CEMP.</p> <p>The Plan will include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.</p>	Contractor	Detailed design / Pre-construction	Section 2.2 of QA G38 <i>Soil and Water Management</i>
Soil and water	<p>Erosion and sediment measures will be implemented and maintained to:</p> <ul style="list-style-type: none"> Minimise sediment moving off-site and sediment laden water entering any waterways, drainage lines or drainage pits Minimise the amount of material transported from site to surrounding pavement surfaces Divert clean water around the site. 	Contractor	Construction	
Soil and water	Controls are to be implemented at exit points to minimise tracking soil and particulates onto pavement surfaces.	Contractor	Construction	
Soil and water	Any material transported onto pavements would be swept and removed at the end of each working shift and prior to rainfall			
Soil and water	Erosion and sedimentation controls are to be checked and maintained on a regular basis and after a rain event of ten millimetres or greater (including clearing of sediment from behind barriers) and records kept and provided on request.	Contractor	Construction	
Soil and water	Vehicle wash down and/or cement truck washout is to occur in a designated bunded area and least 50 metres away from water bodies and surface water drains.	Contractor	Construction	

Impact	Environmental safeguards	Responsibility	Timing	Reference
Soil and water	Site stabilisation of disturbed areas would be carried out progressively as stages are completed.	Contractor	Construction	
Soil and Water	All stockpiles would be designed, established, operated and decommissioned in accordance with Roads and Maritime Services' Stockpile Management Guidelines (EMS-TG-10).	Contractor	Construction	
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>
Accidental spill	Emergency wet and dry spill kits would be kept on site at all times and all staff would be made aware of the location of the spill kit and trained in its use.	Contractor		

Other safeguards and management measures that would address hydrology and flooding impacts are identified in section 6.4.4.

6.6 Aboriginal cultural heritage

6.6.1 Methodology

The Aboriginal heritage assessment was carried out in accordance with the Procedure for Aboriginal cultural heritage consultation and investigation – PACHCI (Roads and Maritime, 2011). As the proposal area is entirely within the Aboriginal Heritage Impact Permit (AHIP) obtained for the M4 Smart Motorways Project (C0002113), this process was limited to confirming consistency of the project area with the boundaries of the AHIP. The full AHIP documentation is included in Appendix I. Confirmation that the proposal area is within the AHIP boundary is included in Appendix I and also confirmed is that:

- No further archaeological assessment is required
- PACHCI Stage 2 is not required as the entire project area is within the existing AHIP.

Two small areas of proposed works are outside the M4 Smart Motorways AHIP boundary, at the Japura Place cul de sac and the Minor Glen cul de sac. These areas were checked for archaeological sites by completing a basic Aboriginal Heritage Information System (AHIMS) search on 22 December 2020 and 22 February 2021. To confirm the results, consultation was undertaken with a Transport for NSW Aboriginal Cultural Heritage Officer in accordance with the PACHCI procedure.

6.6.2 Existing environment

The proposal area is located to the west of Sydney within the Penrith City Council LGA and Deerubbin Local Aboriginal Land Council (LALC). The Deerubbin LALC covers a large proportion of the Sydney Basin from the Blue Mountains in the west to Parramatta in the east, and the Colo River in the north to the border of the City of Blue Mountains LGA in the south.

In preparation for the M4 Smart Motorway Project an Aboriginal archaeological survey was prepared in accordance with the Office of Environment and Heritage (OEH) *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*. The survey identified a number of archaeological sites within the M4 corridor, including two near the proposal area, as identified in Figure 6-34 and described in Table 6-37.

Table 6-37 Archaeological sites identified within M4 corridor near the proposal area

Location	AHIMS ID	Significance	Description ¹	Distance from proposed works
Location 6 Roper Road	45-5-1068	Low	Three silcrete artefacts recorded at the site – usewear, blade and possible heat-treated flake fragment	100 metres
Location 7 Hewitt Street	45-5-1069	Low	Four artefacts recorded at the site – flake fragment of igneous material, one silcrete, two indurated mudstone artefacts	110 metres

¹ from M4 Smart Motorway Review of Environmental Factors – Appendix E (Roads and Maritime, 2013)



Figure 6-34 M4 Motorway AHIP boundary at the proposal area (blue hatching)

The basic AHIMS search in the area of the Japura Place works did not identify any Aboriginal heritage sites and the search in the area of Miner Glen identified one Aboriginal heritage site. The Aboriginal Cultural Heritage Officer confirmed the proposed works at Japura Place and Miner Glen are unlikely to have an impact on Aboriginal Heritage and a PACHCI Stage 1 clearance letter has been received, refer Appendix I.

6.6.3 Potential impacts

Construction

Construction works would include excavation and other ground disturbing activities for the construction on the proposed on-ramp, widening of Roper Road and the M4 westbound carriageway to enabling turning onto the on-ramp and merging, construction of retaining walls and trenching for the relocation and installation of services.

No direct or indirect impacts to items of Aboriginal cultural heritage are expected as a result of the proposal, due to:

- No Aboriginal sites have been identified within the proposal area
- The proposal area has undergone extensive landscape modification and a high level of disturbance from urban development within and adjacent to the M4 Motorway corridor.

Much of the proposal area has previously been disturbed due to the construction of embankments or carriageways of the existing road network. Areas within the G-loop construction may extend beyond previously modified areas. In the event unexpected heritage items are identified the safeguards in Section 6.6.4 would be implemented, including the Unexpected Finds Procedure.

In accordance with the procedure and based on the assessed risk to Aboriginal heritage arising from the proposal, there is no requirement to undertake further archaeological assessment and the potential for impacting Aboriginal heritage items during construction of the proposal is low.

Operation

No impacts to Aboriginal heritage are anticipated during operation of the proposal.

6.6.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Aboriginal heritage	<ul style="list-style-type: none"> <i>The Standard Management Procedure - Unexpected Heritage Items</i> (Transport for NSW, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where 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 will 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>

6.7 Non-Aboriginal heritage

6.7.1 Methodology

Non-Aboriginal heritage items in the vicinity of the proposal were identified by conducting searches of the following databases on 20 November 2020:

- Penrith LEP
- Blacktown LEP
- NSW State Heritage Register
- Roads Maritime s170 Heritage Register
- Australian Heritage database

The results of the searches are provided in Appendix J.

6.7.2 Existing environment

The heritage database searches did not identify any heritage items or conservation areas within the proposal area. Heritage items identified within the wider area surrounding the proposal area are summarised in Table 6-38 and the closest items are identified in Figure 6-35. The works area is generally within already disturbed land within or directly adjacent to existing road carriage way, except for the works to the eastern side of Erskine Park Road where the G-loop configuration is proposed which may not have been previously disturbed.

Table 6-38 State and local heritage items in the vicinity of the proposal

Site Name and Reference	Address	Listing	Significance	Location relative to the proposal area
Item 228 – Mamre (SHR 00264)	181 – 275 Mamre Road	Penrith LEP 2010 / State Heritage Register	State	3.2 km W
Item 229 – Memorial cairn	181 – 275 Mamre Road	Penrith LEP 2010	Local	3.2 km W
Item 862 – Milestone	Great Western Highway, fronting Lot 1, DP 538063	Penrith LEP 2010	Local	2.3 km NW
Item 304 - Milestone	Great Western Highway (between Marsden Road and Day Street)	Penrith LEP 2010	Local	2.3 km NW
Item 303 - St Marys General Cemetery	175–191 Great Western Highway	Penrith LEP 2010	Local	2.3 km NW
Item I50 – Place – Mount Druitt Waterholes	Simpson Hill Road and Great Western Highway	Blacktown LEP 2015	Local	1.6 km N

Site Name and Reference	Address	Listing	Significance	Location relative to the proposal area
Item I48 - House— Schoolmaster's Residence (former)	59 Nelson Street (also known as Great Western Highway, 1 Mark Archer & Alan Streets)	Blacktown LEP 2015	Local	1.7 Km N
Item I40 - School building— Colyton Public School	Great Western Highway	Blacktown LEP	Local	1.6 km N
Item I41 – House – Neoblie (SHR	1170 Great Western Highway	Blacktown LEP 2015 / State Heritage Register	State	1.3 km NE

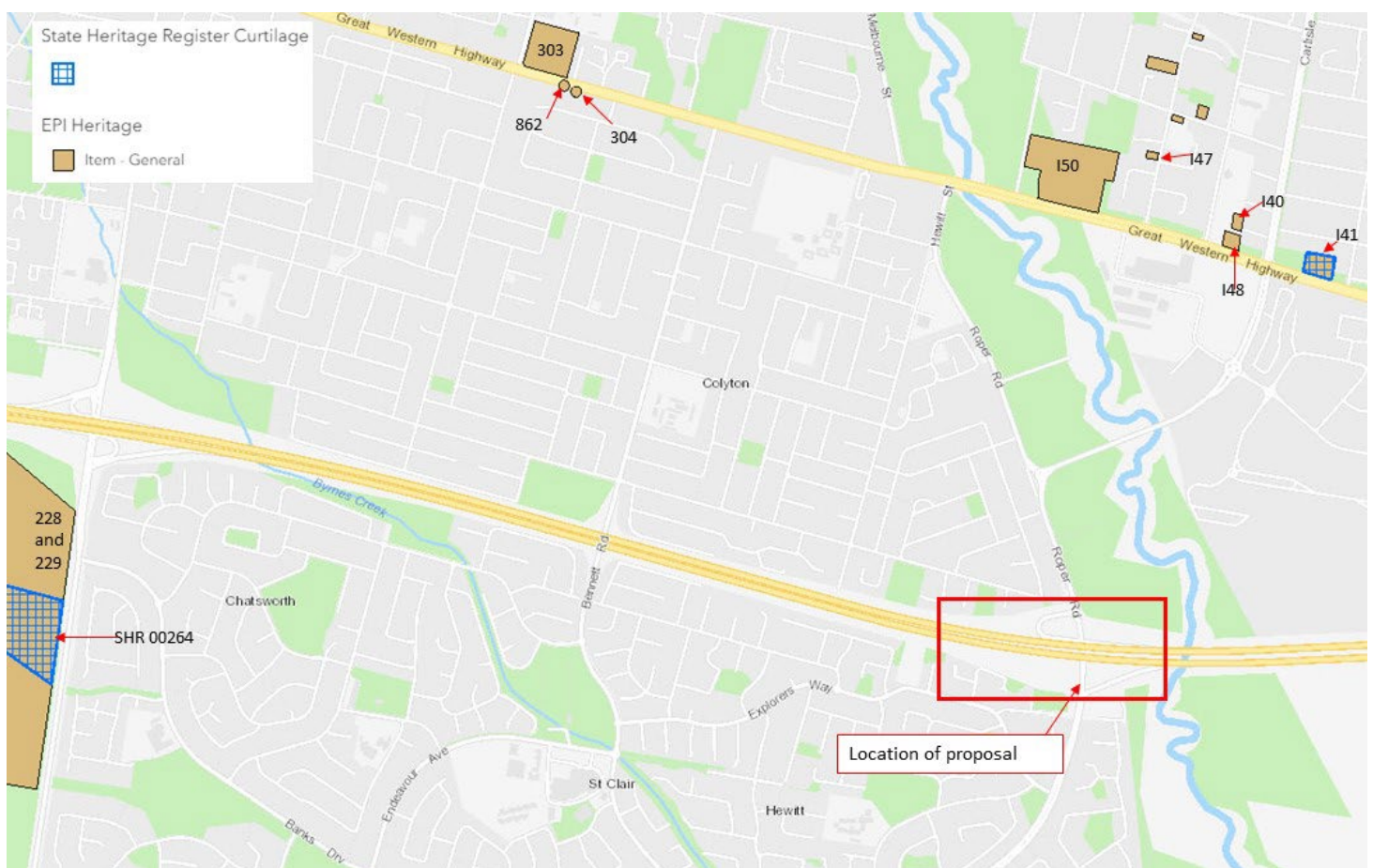


Figure 6-35 Non-Aboriginal heritage items in the wider area of the proposal

6.7.3 Potential impacts

Construction

The proposal would not directly impact any known heritage items or conservation areas. Much of the proposal area is previously disturbed land directly adjacent to existing road infrastructure or the constructed

earth bund for the stormwater basin. Due to previous ground disturbance in these locations it is considered unlikely previously unidentified heritage items would be encountered.

Within the part of the proposal area to the east of Erskine Park Road where the G-loop configuration is proposed to be constructed there are previously undisturbed areas. As the proposal in this area would result in the clearance of vegetation, stripping of topsoil and bulk earthworks there is potential for works to uncover unregistered heritage items. Where heritage items are identified during construction the safeguard listed in Section 6.7.4 would be implemented to minimise impacts on Non-Aboriginal heritage.

Operation

Operation of the proposal will consist of continued use of the road corridor, including the proposed on-ramp. No disturbance of the surrounding land would occur, and no impact to non-Aboriginal heritage is anticipated during operation of the proposal.

6.7.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Non-Aboriginal heritage	<ul style="list-style-type: none"> <i>The Standard Management Procedure - Unexpected Heritage Items</i> (Transport for NSW, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered. Work will only re-commence once the requirements of that Procedure have been satisfied. 	Contractor	Detailed design / pre-construction	Section 4.10 of QA G36 <i>Environment Protection</i>

6.8 Landscape character and visual impacts

6.8.1 Methodology

The assessment was carried out in accordance with the *Guideline for Landscape Character and Visual Impact Assessment – Environmental Impact Assessment Practice Note EIA-No4* (Transport for NSW, 2020).

The method to measure landscape character and visual impact is based on the combination of the sensitivity of the existing area or view to change and the magnitude (scale, character, distance) of the proposal on that area or view.

Sensitivity refers to the qualities of an area, the number and type of receivers and how sensitive the existing character of the setting is to the proposed change. For example, a pristine natural environment will be more sensitive to change than a built-up industrial area.

Magnitude refers to the physical scale of the project, how distant it is and the contrast it presents to the existing condition. For example, a large interchange would have a very different impact on landscape character than a localised road widening in the same area.

The combination of sensitivity and magnitude will provide the visual impact for viewpoints (refer to Table 6-39 for grading values). Both the landscape character and visual environment assessment were based on a desktop assessment.

Table 6-39 Impact assessment grading matrix

		Magnitude			
Sensitivity		High	Moderate	Low	Negligible
	High	High	High-Moderate	Moderate	Negligible
	Moderate	High-Moderate	Moderate	Moderate-low	Negligible
	Low	Moderate	Moderate-low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

6.8.2 Existing environment

Landscape character

The proposal area is located within the existing M4 Motorway corridor a major urban road corridor with vegetation buffers between the mainline carriageway and the suburban land uses in the surrounding residential areas. Hard pavement, road furniture and landscaped areas adjacent to the carriageway and within the median are the predominant landscape features. Vegetation along the M4 corridor provides an important contribution to the scale and character of the proposal area.

Compound site B is located alongside the M4 Motorway corridor and close to low density residential development and access is from a local road.

Visual environment

The key existing viewpoints in the area would be from road users (predominantly vehicles) and residential properties which overlook Site Compound B. Four key viewpoints were used to assess the potential visual impact of the proposal and are defined in Table 6-40 and Figure 6-36.

Table 6-40 Key views of the proposal area

Viewpoint	Description
VP1 – Shepherd Place	Views from single storey residences constructed to face south which look out onto reserve and open space proposed to be used as Site Compound B. Roper Road eastbound on-ramp to M4 is located past open space and raised up such that views of traffic are limited. Refer Figure 6-37.
VP2 – M4 mainline	Road users have direct views of the vegetation buffer along both sides of the M4 mainline and would have direct views of the proposal. Refer Figure 6-38.
VP3 – Erskine Park Road	Road users have direct views along Erskine Park Road towards the bridge over the M4 Motorway and of the existing vegetation between the M4 westbound mainline and the M4 westbound off-ramp. View is dominated by road infrastructure and would have direct views of the proposal. Refer Figure 6-39.
VP4 – Japura Place	Views from residences and road users of Japura Place towards the M4 mainline – separated by noise wall and dense vegetation. Direct views of the proposal would be limited to construction works to install electrical connections. Refer Figure 6-40.
VP5 – Minor Glen	Views from residences of Minor Glen which back onto the M4 westbound off-ramp and road users travelling on the M4 westbound off-ramp. Residents backyards are located at the base of the M4 westbound off-ramp embankment limiting views into Site Compound A but with direct views of taller vegetation within the G-loop and of traffic using the M4 westbound off-ramp. Road users at this view point would have direct views to Site Compound A and of the proposed on-ramp. Refer Figure 6-41.
VP6 – Augusta Place	Views from residences and road users of Augusta Place towards the western embankment of Erskine Park Road northbound and the proposed Site Compound C. Direct views would be of the proposed temporary site compound during construction and the works to widen Erskine Park Road to provide for the proposed right turn lane onto the proposed on-ramp from the south. Refer Figure 6-42.



Figure 6-36 Key viewpoint locations (base map source: Six Maps NSW)



Figure 6-37 VP1 - looking south across Shepherd Street from residential properties to Site Compound B (Source: Site visit photo)



Figure 6-38 VP2 - looking west on M4 mainline towards Erskine Park Road bridge over the M4 Motorway (Source: Google maps)



Figure 6-39 VP3 - looking north on Erskine Park Road towards the bridge over the M4 Motorway (Source: Google maps)



Figure 6-40 VP4 – looking north from Japura Place towards M4 Motorway noise wall (Source: Google Maps)



Figure 6-41 VP5 - looking north from residences on Miner Glen (Source: Site visit photo)



Figure 6-42 VP6 - looking north east from the corner of Augusta Place (Source: Google Maps)

6.8.3 Urban design objectives

The following design objectives have been established to guide the project, and in particular the urban and landscape design outcomes which will be developed through the detailed design of the proposal:

Integration – achieve a built outcome that is consistent and fully integrated within its context and achieves a ‘best fit’ within the existing landscape

Safe – provide a safe and legible road connection for all users

Legibility – achieve a simple, unified design outcome that is consistent with the M4 Motorway corridor

Landscape – maximise long term landscape and environmental opportunities that are maintainable and appropriate to context

Location – provide a good travel experience and sense of location for all users.

6.8.4 Potential impacts

Landscape character

The main impact of the proposal on the landscape character of the proposal area would be as a result of the removal of vegetation where the on-ramp is proposed to be located and where the bund is proposed to be relocated. Vegetation clearance would occur across an area of 1.65 ha, predominantly directly adjacent to the M4 mainline and the G-loop section of the on-ramp east of Roper Road. Further to the south of the proposal area, closer to Augusta Place, existing established vegetation will remain as it would not be impacted by the proposal. This would ensure the backdrop of the landscape retains the buffering features between the M4 Motorway and nearby residents. The proposal would include the addition of Retaining Wall A adjacent to the M4 Motorway mainline which would vary in height from 0 to 3.5 metres as the proposed

on-ramp decreases in height and Retaining Wall B immediately under the bridge over the M4 Motorway which would have a height of up to 5.5 metres. These retaining walls would only be visible from the M4 Motorway mainline and are considered to be an expected feature of a major transport corridor. A Type F barrier would be located along the entry of the proposed on-ramp between the M4 westbound off-ramp and proposed on-ramp and would support a level difference of up to 0.8 metres. This Type F barrier would be between the two ramps, with the level difference below road level and therefore not visible. Refer to Figure 3-12 for the proposed location of the retaining walls.

Overall, the proposal is considered to be in keeping with the scale and bulk of existing road infrastructure at the proposal area. Therefore the impacts on the landscape character of the proposal area would be minor.

Visual sensitivity

During construction, there would be impacts on visual amenity from general construction activities and vegetation clearing. The presence of hoardings and temporary signage may result in a cluttered streetscape and there may be a visible increase in traffic congestion due to construction zone speed limits and the presence of construction vehicles. These impacts would occur throughout the construction period only and would be mainly temporary, with the exception of the removal or trimming of vegetation. Construction worksites would be restored following the completion of construction.

During the establishment and operation of the site compounds, there would be temporary and short-term impacts in the area surrounding the compounds. Security fencing, site buildings and stockpiles will be visible from Shepherd Place, Roper Road, Erskine Park Road, M4 mainline and the M4 westbound off-ramp, however these impacts would be temporary and only for the duration of the construction period. The area of Site Compound B and C would be restored to their prior condition following the completion of construction.

Due to the location of the construction works within the existing road corridor, which is predominantly screened from residential receivers, there are not expected to be impacts resulting from the use of lighting, other than at site compounds B and C, where a safeguard would require lighting to be directed away from residential receivers.

The key visual changes following completion of the construction of the proposal would be:

- Removal of established vegetation within the proposal area – particularly adjacent to the M4 Motorway mainline as a result of the relocation of the earth bund and replacement with vegetation on the bund with grasses due to the steepness of the batter slope and east of Erskine Park Road due to the construction of the proposed G-loop
- Introduction of retaining wall structures to the south of M4 Motorway mainline to support the proposed on-ramp formation
- Increase in pavement area due to the proposed on-ramp and merge lane
- Additional road signage such as directional signs with the proposal area

Operational impacts on visual sensitivity have been identified as High – Moderate due to the extent of vegetation proposed to be removed to enable construction of the on-ramp. The vegetation clearance would be mitigated in a small way by the replanting of vegetation within the centre of the G-loop section of the on-ramp where possible and the retention of established vegetation south of the on-ramp alignment to the west of Roper Road would also provide continued views of native forest for road users along Roper Road, Erskine Park Road and the M4 Motorway mainline.

There are a limited number of visual receptors within the broader view shed and the visual impacts during both the construction and operational phase surrounding the proposal area are assessed as a range between negligible to high-moderate as summarised in Table 6-41.

Table 6-41 Potential visual impacts arising from the proposal

Sensitivity	Phase	Elements of the proposal visible	Magnitude	Potential visual impact
VP1 – Shepherd Place				
Moderate <ul style="list-style-type: none"> Limited number of residents with direct views Residents at this viewpoint have direct views of reserve space which currently provides a buffer of the motorway infrastructure beyond Residents would regularly see views to the proposal for moderate periods of time from their homes and property grounds and from a closer proximity. 	Construction	<ul style="list-style-type: none"> Site Compound B, including temporary fencing, site offices, stockpiles and equipment Light vehicles entering and leaving the site from Shepherd Place 	Moderate <ul style="list-style-type: none"> Disruption of views to the open space area proposed to be used as Site Compound B would be temporary Temporary fencing around the perimeter of the compound site would provide partial screening of the site 	Moderate
	Operation	<ul style="list-style-type: none"> Rehabilitated site compound – no change in views following completion of construction 	Negligible <ul style="list-style-type: none"> On completion of construction the Site Compound B area would be restored to open space Residents would not have any views of the completed on-ramp 	Negligible
VP2 – M4 mainline				
Low <ul style="list-style-type: none"> A large number of road users would obtain views of the proposal but these individual views to the proposal area would be seen as a series of high speed individual 'snapshot' views within their greater journey Views from the M4 Motorway generally include substantial infrastructure such as on and off-ramps, over bridges and large signs 	Construction	<ul style="list-style-type: none"> Direct views of Site Compound A and construction works, including barriers and fencing Construction vehicles entering and leaving the site Views of vegetation removal, bulk earthworks and construction of embankment and retaining walls Presence of additional construction related signage 	Moderate <ul style="list-style-type: none"> Barriers around the construction site would limit views of construction and would be similar to construction sites along other areas of the M4 Motorway Views of vegetation beyond the earth bund would be retained During construction works area would be rehabilitated once completed 	Moderate -Low
	Operation	<ul style="list-style-type: none"> Existing established vegetation along the south of the M4 mainline on both 	High	Moderate

Sensitivity	Phase	Elements of the proposal visible	Magnitude	Potential visual impact
		<p>the west and east of Roper Road would be removed with the paved on-ramp and grassed bund visible. Vegetation behind the relocated bund would remain visible</p> <ul style="list-style-type: none"> Proposed retaining walls (A and B) would be visible adjacent to the M4 mainline and beneath the bridge over the M4 Motorway Wider pavement area viewed to the north 	<ul style="list-style-type: none"> Changes in views as a result of the proposal would be directly visible from this viewpoint and would show a reduction in native vegetation and extended road infrastructure Views of vegetation beyond the earth bund would be retained Some replanting within the G-loop would be visible but generally the view east of Roper Road would be the on-ramp and retaining walls. 	
VP3 – Erskine Park Road				
Moderate <ul style="list-style-type: none"> Road users would obtain views of the proposal as ‘snapshot’ views at a slower pace compared to from VP2 and whilst stopped at traffic lights Both sides of Erskine Park Road have established areas of vegetation providing a more natural outlook from the road 	Construction	<ul style="list-style-type: none"> Direct views of Site Compound A and C and construction works Direct views of vegetation clearance and bulk earthworks to both the west and east of Erskine Park Road 	Moderate <ul style="list-style-type: none"> Barriers around the construction site would provide screening of some views of construction During construction works area would be rehabilitated once completed 	Moderate
	Operation	<ul style="list-style-type: none"> Existing established vegetation on both the west and east of Roper Road would be removed with the paved on-ramp and grassed bund visible. Planting of the relocated bund would be of grasses as the batter slope is too steep for trees Vegetation between the stormwater basin and the relocated bund would remain visible and some vegetation that will be replanted within the G-loop will be visible. 	High <ul style="list-style-type: none"> Changes in views as a result of the proposal would be directly visible from this viewpoint The change in extent of established vegetation to on-ramp pavement and grassed embankment/earth bund would be visible whilst at the intersection and when crossing the bridge over the M4 Motorway. 	High - Moderate

Sensitivity	Phase	Elements of the proposal visible	Magnitude	Potential visual impact
VP4 – Japura Place				
Moderate <ul style="list-style-type: none"> Residents at this viewpoint would have direct views of the utility connection works within the cul de sac No direct views of the M4 motorway from their homes but of a quiet roadway with limited traffic and noise wall in front of established vegetation 	Construction	<ul style="list-style-type: none"> Construction works include the use of the cul de sac to under bore electrical cables for lighting with direct views from residences 	Low <ul style="list-style-type: none"> The duration of these works would be limited Changes would be temporary Views of main proposal works avoided due to existing noise wall 	Moderate-Low
	Operation	<ul style="list-style-type: none"> At completion of the proposal construction there will be no change in views 	Negligible <ul style="list-style-type: none"> No change in views 	Negligible
VP5 – Miner Glen				
Moderate <ul style="list-style-type: none"> Residents would have predominantly indirect views of the proposal area during construction as views are separated by the M4 westbound off-ramp Direct views of taller vegetation which contributes to parkland views from residents' backyards 	Construction	<ul style="list-style-type: none"> Views from VP5 during the construction would be limited to construction traffic and indirect views of Site Compound A as the views are blocked by the M4 westbound off-ramp embankment 	Low <ul style="list-style-type: none"> Lighting of the proposal area during night works would be visible but viewed in the context of the existing street lighting of the M4 westbound off-ramp Vegetation clearance and earthworks may be visible beyond the M4 westbound off-ramp embankment. 	Moderate-Low
	Operation	<ul style="list-style-type: none"> Changes to views would be partially screened by the existing embankment and separation of the M4 westbound off-ramp, however views of taller established vegetation removed to enable construction of the G-loop section of the on-ramp would be lost. 	Moderate <ul style="list-style-type: none"> Replanting of areas within the G-loop would assist in mitigating the decrease in views of vegetation. 	Moderate

Sensitivity	Phase	Elements of the proposal visible	Magnitude	Potential visual impact
VP6 – Augusta Place				
Moderate <ul style="list-style-type: none"> Limited number of residents with direct views Residents at this viewpoint have direct views of reserve space which currently provides a buffer of the motorway infrastructure beyond Residents would regularly see views to the proposal for moderate periods of time from their homes and property grounds and from a closer proximity. 	Construction	<ul style="list-style-type: none"> Site Compound C, including temporary fencing and site offices Light vehicles entering and leaving the site from Augusta Place Screened views of earthworks and vegetation clearance to the west of Erskine Park Road due to widening to provide for a separate right turn lane. 	Low <ul style="list-style-type: none"> Disruption of views to the open space area proposed to be used as Site Compound B would be temporary Temporary fencing around the perimeter of the compound site would provide partial screening of the site. Views of main proposal works limited due to separation distance and extent of vegetation providing screening of views 	Moderate -Low
	Operation	<ul style="list-style-type: none"> Views of the western embankment of Erskine Park Road would be changed due to the vegetation clearance to provide for a separate right turn lane. Established vegetation outside the construction footprint would be retained. 	Moderate <ul style="list-style-type: none"> Views from Augusta Place would continue to be of open space and the remaining established vegetation would provide screening of areas of vegetation clearance within the proposal area. The width of the established vegetation buffer between residences and Erskine Park Road would be reduced. There would be no views directly to the proposed on-ramp or earth bund relocation. 	Moderate

6.8.5 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Landscape character and visual impact	Light spill into adjacent visually sensitive properties during construction is to be minimised by the use of cut-off lighting at Site Compound B, directing construction lighting into the construction areas and ensuring the site is not over-lit. This includes the sensitive placement and specification of lighting to minimise any potential increase in light pollution, particularly during night works	Contractor	Construction	
Landscape character and visual impact	Work site areas and the construction compound are to be kept clear and tidy, and screened with shade cloth (or similar material, where necessary) to minimise visual impacts from key viewing locations.	Contractor	Construction	
Landscape character and visual impact	Temporary hoardings, barriers, traffic management and signage are to be removed when no longer required.	Contractor	Construction	
Landscape character and visual impact	<p>A landscape plan would be prepared for the proposal in general accordance with:</p> <ul style="list-style-type: none"> • Transport for NSW's Beyond the Pavement Urban design approach and procedures for road and maritime infrastructure planning, design and construction (Transport for NSW, 2020) • Roads and Maritime's <i>Landscape design guidelines</i> (RMS, 2018) • Relevant council landscape and tree guidelines • The plan shall outline the proposed landscaping rehabilitation to be carried out following construction • The landscape plan shall take into consideration the species of trees removed (replacing like-for-like where practical) 	Transport for NSW / Contractor	Detailed design / pre-construction	

Impact	Environmental safeguards	Responsibility	Timing	Reference
Landscape character and visual impact	Landscape planting within the G-loop configuration of the on-ramp is to be established on completion of the construction.	Contractor	Post - construction	

Other safeguards and management measures that would address landscape character and visual impacts are identified in section 6.1 biodiversity.

6.9 Socio-economic, property and land use

6.9.1 Methodology

The description of the existing socio-economic environment principally draws on data from the *Australian Bureau of Statistics (ABS) 2016 Census of Population and Housing*. This is supplemented with data and information from:

- NSW Department of Planning and Environment, relating to population projections
- Profile ID, relating to population trends and characteristics within each suburb
- Penrith City Council website, relating to social infrastructure and community values

6.9.2 Existing environment

Demographics

The proposal is located within the Penrith City Council LGA and the suburbs of St Clair and Erskine Park, with the suburb boundaries identified in Figure 6-43. According to the Australian Bureau of Statistics (ABS), the estimated resident population of Penrith City as at June 2019 was 212,977 people (Profile ID, 2020). The 2019 NSW Population Projections estimate a population of 369,250 by 2041 through a both natural change (births and deaths) and migration (NSW Department of Planning and Environment, 2019).

As recorded in the 2016 census the median age was 34 years old, females accounted for 50.6% and males 49.4% of people. The majority of the population is between 18 and 69 years old. A summary of demographic data for the suburbs of St Clair and Erskine Park is provided in Table 6-42.

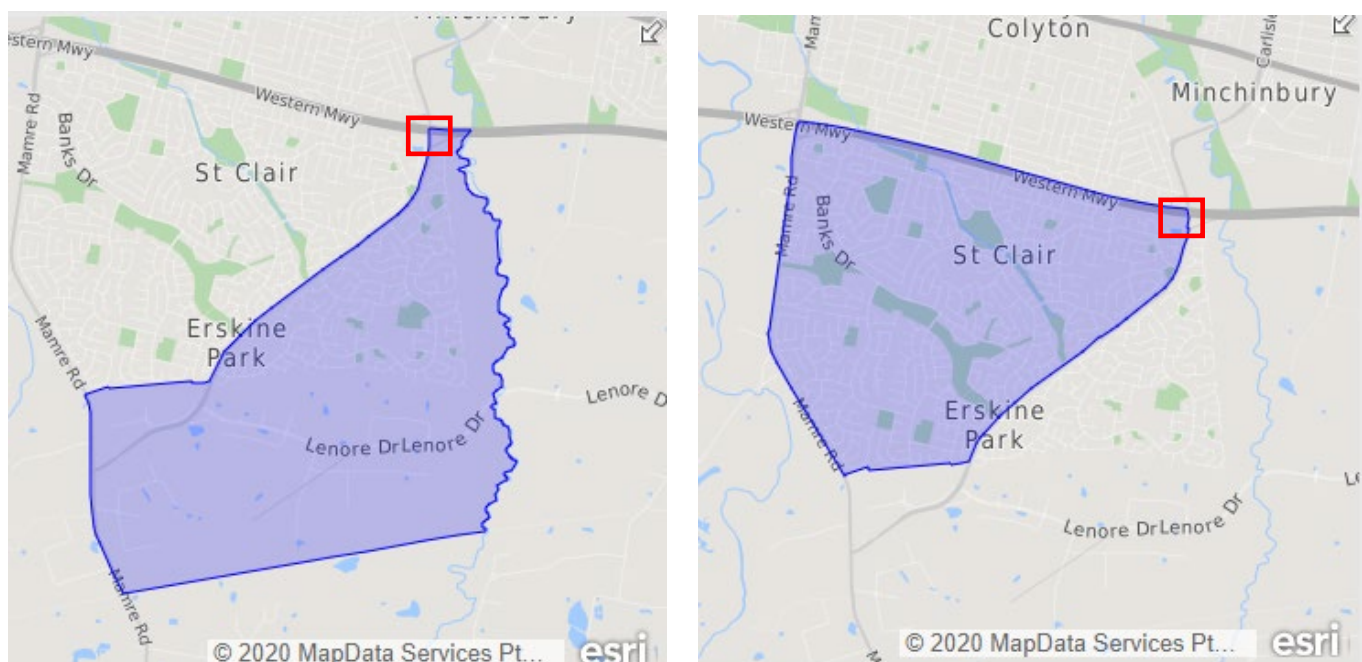


Figure 6-43 Suburb boundaries of Erskine Park and St Clair (Source: Australian Bureau of Statistics, 2020)

Table 6-42 Census data for St Clair and Erskine Park (Source: 2016 Census QuickStats, ASB)

	St Clair	Erskine Park
Population	19,897	6,436
Gender	Male 49.7% Female 50.3%	Male 49.7% Female 50.3%
Median age	34	34
Travel to work	By public transport – 10.1% By car as driver or passenger – 79.8%	By public transport – 8.6% By car as driver or passenger – 81.5%
Dwelling structure	Separate house – 99.2% Semi-detached – 0.7%	Separate house – 98.6% Semi-detached – 1.4%

The most common occupations in St Clair and Erskine Park included Clerical and Administrative Workers, Technicians and Trades Workers, Professionals, Managers, and Machinery Operators and Drivers, and Sales Workers (ASB, 2020). In Penrith City, 56.4 of the city's working residents travel outside of the area to work and of worker travelling to Penrith for work the majority are from Blacktown, Blue Mountains or Hawkesbury (ASB, 2020 – profile ID).

Residential, commercial, and business properties

There are a limited number of residential properties that have direct views of the proposal area and which have access from their property to roads within the proposal area. Residential properties with access to local roads within the proposal area are located on Augusta Place, Japura Place and Shepherd Street.

There are no commercial or business properties within the study area that would be impacted by the proposal. Within the wider area are commercial and business properties located within the small commercial centres of St Clair and Erskine Park and further south the businesses established as part of the WSEA.

6.9.3 Potential impacts

The potential socio-economic impacts of the proposal are assessed below with reference to the following related environmental factors assessed in the REF:

- Section 6.1 Biodiversity
- Section 6.2 Traffic and transport
- Section 6.3 Noise and vibration
- Section 6.5 Hydrology and flooding
- Section 6.8 Landscape character and visual impacts
- Section 6.13 Cumulative impacts

The potential impacts identified below would be mitigated through the implementation of safeguards and management measures outlined in these sections above as well as in this section.

Construction

During construction there is potential for temporary impacts on local residents, workers and road users. These impacts include:

- Temporary impacts to traffic movements (refer Section 6.2)
- Increase in construction noise, vibration, dust and visual impacts (refer Sections 6.3 and 6.8)
- Impacts on visual amenity due to the removal of vegetation (refer Sections 6.1 and 6.8)

Residential properties and businesses

Residential properties near the proposal area would be exposed to increased noise and traffic during construction due to reduced speed limits, lane closures and construction activities.

Sensitive receivers such as residents would be impacted by construction noise during the day and night. The magnitude of these impacts is consistent with other redeveloped road works projects and highlights the need for effective noise mitigation and management planning. Effective noise mitigation and management measures would need to be developed by the contractor to minimise the potential noise impacts from the works (refer Section 6.3).

Businesses within the nearby suburbs may be impacted by increased traffic congestion during construction, however the Traffic Management measures would be in place to mitigate potential effects as far as practical. No businesses were identified directly adjacent to the proposal area; therefore businesses are not expected to be affected by construction noise.

Access and connectivity

Vehicular access to nearby properties would not be impacted during construction of the proposal and traffic management would be in place to mitigate potential effects of construction vehicles accessing the site and site compounds. As there is currently no safe pedestrian or cycle access provided though the proposal area no provision for pedestrians or cyclists will be provided during construction.

Operation

There would be positive long term impacts during operation of the proposal including improved access to the M4 Motorway, reduced congestion and improved safety for motorists. The proposal would improve the overall efficiency of the road network with corresponding benefits for local and regional business and residents of the surrounding local areas.

The proposed on-ramp would result in exceedances of the applicable noise criteria, generated by existing high noise levels throughout the proposal area and the close proximity of receivers to the M4 Motorway and Erskine Park Road. Architectural treatment would be investigated during detailed design to minimise noise impacts to sensitive receivers found eligible for consideration of noise mitigation (refer Section 6.3).

The removal of established vegetation for the construction of the proposed on-ramp and the relocation of the earth bund to the west of Erskine Park Road would result in long-term visual impacts due to the change in views, predominantly views from road users passing through the area. Over time mitigation of visual impacts would occur as replanting within the G-loop becomes established.

6.9.4 Safeguards and management measures

The proposed safeguards and management measures for socio-economic impacts are listed below. Other safeguards and management measures that would address socio-economic impacts are identified in:

- Section 6.1.4 Biodiversity
- Section 6.2.4 Traffic and transport

- Section 6.3.5 Noise and vibration
- Section 6.7.4 Non-Aboriginal heritage
- Section 6.8.4 Landscape character and visual impacts

Impact	Environmental safeguards	Responsibility	Timing	Reference
Socio-economic	<p>A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum):</p> <ul style="list-style-type: none"> • mechanisms to provide details and timing of proposed activities to affected residents, 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	Section 3.7 of QA G36 <i>Environment Protection</i>
Socio-economic	<p>A complaints handling procedure and register would be included in the CEMP and maintained for the duration of the project. The procedure must include:</p> <ul style="list-style-type: none"> • how complaints are to be recorded • how a qualified community representative or delegate would be available to respond and appropriate action community complaints • how RMS would be informed of complaints • how complaints are to be reported • how complaints would be followed up and managed • how the complaints would be established and maintained 	Contractor	Construction	Section 3.7 of QA G36 <i>Environment Protection</i>
Socio-economic	Residents would be informed prior to any interruptions to utility services that may be experienced as a result of utilities relocation.	Contractor	Construction	

Impact	Environmental safeguards	Responsibility	Timing	Reference
Socio-economic	Road users, pedestrians and cyclists would be informed of changed conditions, including likely disruptions to access during construction.	Contractor	Construction	

6.10 Waste and resource use

Transport for NSW construction works often require significant amounts of waste to be managed which can cause adverse environmental impacts. Transport for NSW is committed to the responsible reuse of waste where possible in accordance with the resource management hierarchy principles embodied in the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act).

6.10.1 Policy setting

The waste regulatory framework is administered under the principal legislation of the *Protection of the Environment Operations Act 1997* (POEO Act) and the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act). The purpose of these Acts are to prevent degradation of the environment, eliminate harmful wastes, reduce the amount of waste generated and establish priorities for waste reuse, recovery and recycling. The WARR Act establishes a waste hierarchy, which comprises the following principles:

- Avoidance of waste – minimising the amount of waste generated during construction by avoiding unnecessary resource consumption (i.e. avoiding the use of inefficient plant and construction equipment and avoiding materials with excess embodied energy, waste and excessive packaging)
- Resource recovery – reusing, reprocessing and recycling waste products generated during construction to minimise the amount of waste requiring disposal
- Disposal – where resources cannot be recovered, they would be appropriately disposed of to minimise the potential adverse environmental impacts likely to be associated with their disposal.

By adopting the WARR Act principles, Transport for NSW encourages the most efficient use of resources and reduces cost and environmental harm in accordance with the principles of ecologically sustainable development.

6.10.2 Potential impacts

Construction

Waste generating activities

The proposal has potential to generate waste from the following activities:

- Vegetation removal
- Excavation for proposed road infrastructure
- Relocation and/or installation of utilities and services
- Relocation of road signage and barriers

Waste streams

The quantities of waste generated during construction are not like to be substantial. Waste material anticipated to accumulate during construction is classified as 'general solid waste (non-putrescible)' with asbestos containing materials classified as 'special waste'.

Waste streams likely to be generated during the construction stage include:

- Construction and demolition waste from removal of existing road surface, road furniture, fences, retaining walls and utility relocation (soil, bitumen, concrete, asphalt, metal, asbestos containing material, building wastes, brick, timber)
- Excess construction material

- Excess spoil from excavations unsuitable for reuse
- Roadside materials (such as signage and fencing)
- Green waste from vegetation removal
- Paper and packaging wastes from materials brought to site
- Sewage from ablutions
- Redundant erosion and sediment controls
- Wastewater from wash down or bunded areas
- General and domestic waste from compound site
- Potential asbestos and other hazardous waste from existing utilities

In relation to the proposal, there would be little opportunities for reuse of materials given the nature of the activities proposed, however materials that can be recycled would be disposed of at licensed recycling facilities. Spoil generated from earthworks could potentially be re-used in some locations if it meets the appropriate soil quality and classification standards for re-use.

Materials and spoil found unsuitable to be reused would be classified in accordance with the Waste Classification Guidelines (EPA, 2014) and disposed of at an approved recycling or waste disposal facility depending on whether they can be reused or not.

Hazardous waste

There is potential for asbestos containing material (ACM) to be encountered during the excavation works, particularly within the road corridor from existing utilities.

Exposure to asbestos containing material presents a health and safety risk to construction personnel and nearby residential receivers if not identified or managed appropriately. To address this risk, an Asbestos Management Plan (AMP) would be prepared prior to construction outlining appropriate handling, removal and disposal procedures should asbestos containing materials be encountered during construction.

Resource use

The materials required during the proposed construction works are not currently restricted resources although, materials such as metals and fuels are considered non-renewable and should be used conservatively. As discussed in Section 3.3.6, road pavement materials would be sourced from appropriately licensed facilities and from local suppliers where practical. Where possible, the reuse of existing materials and the recycling of materials would be conducted.

Operation

The operation of the proposal would not result in increased waste generation.

6.10.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Waste and 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, 	Contractor	Detailed Design, Pre-Construction and Construction	

Impact	Environmental safeguards	Responsibility	Timing	Reference
	reprocessing, and recycling and energy recovery) <ul style="list-style-type: none"> disposal would be undertaken as a last resort (in accordance with the <i>Waste Avoidance and Resource Recovery Act, 2001</i>). 			
Waste and resource use	<p>A Resource and Waste Management Plan (RWMP) would be prepared, which would include the following (as a minimum):</p> <ul style="list-style-type: none"> the type, classification and volume of all materials to be generated and used on site including identification of recyclable and non-recyclable waste in accordance with EPA Waste Classification Guidelines quantity and classification of excavated material generated as a result of the proposal (Refer RMS Waste Management Fact sheets 1-6, 2012) interface strategies for cut and fill on site to ensure re-use where possible strategies to 'avoid', 'reduce', 'reuse' and 'recycle' materials classification and disposal strategies for each type of material destinations for each resource/waste type either for on-site reuse or recycling, offsite reuse or recycling, or disposal at a licensed waste facility details of how material would be stored and treated on-site identification of available recycling facilities on and off site identification of suitable methods and routes to transport waste procedures and disposal arrangements for unsuitable excavated material or contaminated material 	Contractor	Pre-Construction and Construction	Section 4.11 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> site clean-up for each construction stage 			
Waste and resource use	Procurement would endeavour to use materials and products with a recycled content where that material or product is cost and performance effective.	Contractor	Detailed Design & Pre-Construction	
Waste and resource use	A dedicated concrete washout facility that is impervious would be provided during construction so that runoff from the washing of concrete machinery, equipment and concrete trucks can be collected and disposed of at an appropriate waste facility.	Contractor	Construction	
Waste and resource use	All wastes would be managed in accordance with the Protection of the Environment Operations Act 1997.	Contractor	Pre-Construction and Construction	
Waste and resource use	Types of waste collected, amounts, date/time and details of disposal are to be recorded in a waste register.	Contractor	Construction	
Waste and resource use	Works sites would be maintained, kept free of rubbish and cleaned up at the end of each working day.	Contractor	Construction	
Waste and resource use	Suitable waste disposal locations would be identified and used to dispose of litter and other wastes on-site. Suitable containers would be provided for waste collection.	Contractor	Pre-construction & Construction	

6.11 Air quality

6.11.1 Methodology

No air quality monitoring or modelling has been undertaken for the proposal. The air quality assessment was carried out using qualitative analysis and existing desktop information available on the National Pollutant Inventory and NSW Department of Planning, Industry and Environment Website.

6.11.2 Existing environment

The existing air quality within and surrounding the proposal area is typical of an urban environment that is in close proximity to major transport corridors and would be heavily influenced by emissions from motor vehicles using the road network. Other sources of air emissions would include residential land uses. No significant emitters or air pollutants are located within the vicinity of the proposal area.

The nearest air quality station is located at St Marys, off Mamre Road ('Sydney North-west – commissioned 1992) (OEH, 2020) about 3.5 kilometres south west from the western extent of the proposal area. The following air pollutants and meteorological variables are currently measured at St Marys:

- Ozone (O₃)
- Oxides of nitrogen (NO, NO₂ and NO_x)
- Visibility using nephelometry
- Fine particles as PM₁₀
- Fine particles as PM_{2.5}
- Wind speed, wind direction and sigma theta
- Ambient temperature
- Relative humidity

A 24-hour snapshot summary was obtained on 20 November 2020 to understand the type and concentrations of air pollutants in the surrounding area. The results are shown Figure 6-44 which identifies recent air quality in the area is 'good'.

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20 November 2020
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		GOOD	FAIR	POOR	VERY POOR	EXTREMELY POOR					
Pollutants		Ozone O3	Ozone O3	Nitrogen dioxide NO2	Visibility NEPH	Carbon monoxide CO	Sulfur dioxide SO2	Particles PM10	Particles PM2.5	Site AQC	Regional AQC
Averaging Periods		1-hour average	rolling 4-hour average	1-hour average	1-hour average	rolling 8-hour average	1-hour average	1-hour average	1-hour average	highest level at the site	highest level for the region
Units		pphm	pphm	pphm	10 ⁻⁴ m ⁻¹	ppm	pphm	µg/m ³	µg/m ³		
Sydney East	Cook And Phillip	0.6	0.4	1.3	0.25	0.2	0.2	27.2	11.5	GOOD	GOOD
	Chullora	1.2	0.6	1.5	0.30	0.1	0.6	44.5	11.5	GOOD	
	Earlwood	1.3	0.8	1.5	0.28			36.9	8.2	GOOD	
	Macquarie Park	1.9	0.9	0.8	0.27	0.3	0.4	40.0	7.7	GOOD	
	Randwick	1.7	1.3	0.3	0.34		0.2	39.4	10.0	GOOD	
Sydney North-west	Rozelle	1.4	0.9	1.2	0.31	0.1	0.3	37.0	9.1	GOOD	GOOD
	Parramatta North	1.8	1.0	1.0	0.26	0.2	0.4	44.1	1.4	GOOD	
	Penrith	2.1	1.0	0.3	0.32	0.1	0.2	30.4	0.3	GOOD	
	Prospect	1.5	0.9	1.0	0.31	0		44.4	10.3	GOOD	
	Richmond	2.2	1.0	0.2	0.32		0.1	36.9	0	GOOD	
Sydney South-west	Rouse Hill	2.3	1.1	0.4	0.30	0.2	0.2	40.4	14.0	GOOD	GOOD
	St Marys	1.6	0.8	1.1	0.37			42.6	6.1	GOOD	
	Bargo	3.1	1.7	0.3	0.28		0.1	26.0	9.9	GOOD	
	Bringelly	1.9	1.1	0.8	0.43		0.2	49.4	3.5	GOOD	
	Camden	2.1	1.0	0.5	0.30	0.1		31.9	18.9	GOOD	
	Campbelltown West	1.8	0.8	0.8	0.32	0.2	0.1	38.5	17.8	GOOD	
	Liverpool	1.5	0.7	1.6	0.34	0.1	0.4	46.3	9.2	GOOD	
	Oakdale	2.9	2.3	0.1	0.25			28.6	8.0	GOOD	

Figure 6-44 24-hour Air Quality Pollutant Index for 20 November 2020 - nearest air quality station at St Marys identified in red (Source: OEH, 2020)

The National Pollutant Inventory was searched on 20 November 2020, identifying 5 sources of pollutants within four kilometres, refer Figure 6-45 and Table 6-43. The types of emissions identified from these sources are predominantly; carbon monoxide, particular matter (both PM₁₀ and PM_{2.5}), metals and compounds, sulfur dioxide and hydrocarbons.

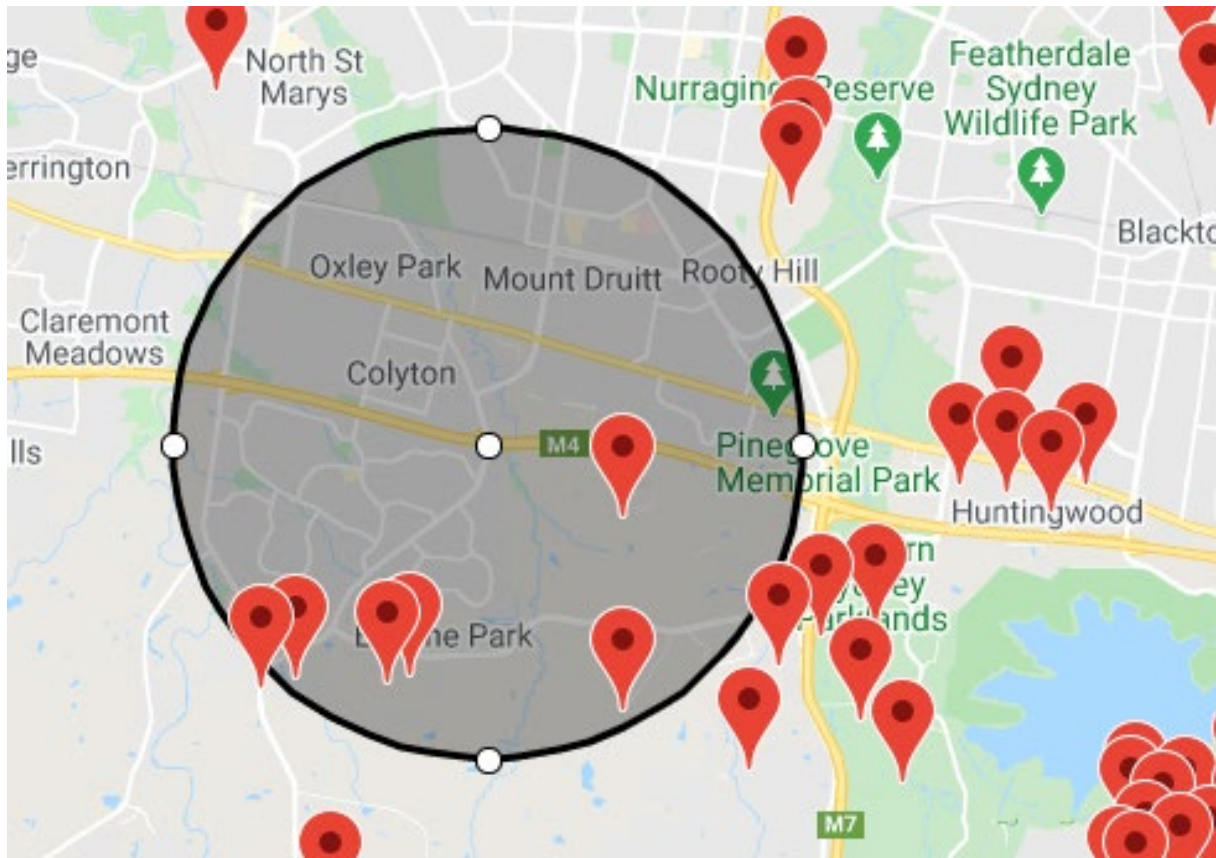


Figure 6-45 National Pollutant Industry sources within 4 kilometres of the proposal area (Source: NPI, 2020)

Table 6-43 National Pollutant Inventory source facilities and distance from the proposal area (Source: NPI, 2020)

Facility name / location	Distance from proposal area	Industry details
Western Sydney Service Centre 25-55 Templar Road	3.2 km S	Coating and painting of steel products
Wallgrove Asphalt Plant Honeycomb Drive, Eastern Creek	1.9 km SE	Hot mix asphalt manufacturing / other petroleum and coal product manufacturing
PGH Bricks and Pavers Horsley Park Old Wallgrove Road, Horsely Park	3.7 km SE	Manufacture of clay bricks and pavers
Goodman Fielder Consumer Foods Pty Ltd 16 Templar Road, Erskine Park	3.2 km S	Manufacturing of liquid groceries
Enviroguard Erskine Park Landfill 50 Quarry Road, Erskine Park	3.5 km SW	Waste application to land (landfilling)

Potential sensitive receivers in regard to emissions to air in the vicinity of the proposal area would be road users and residents. The closest residential land uses to the works area are 25-30 metres south of the M4 westbound off-ramp.

6.11.3 Potential impacts

Construction

There is potential for temporary localised air quality impacts during construction due to ground disturbances, plant machinery and equipment. The likely impacts would be from dust creation and exhaust emissions.

Air quality impacts during construction would largely result from dust generated during earthworks and other engineering activities associated with road construction including:

- Clearing of vegetation within the road reserve to construct the on-ramp and provide compound site hardstand areas
- Excavation of the road reserve and fill of existing embankment for construction of the on-ramp and widening of Erskine Road southbound to provide a left turn lane onto the proposed on-ramp
- Relocation and installation of utilities including gas, Telstra, and electrical cabling
- Transport, Stockpiling and handling of soils and materials to and from the proposed works areas and compound site
- Road pavement works including sub-grade preparation.

It is anticipated that potential air quality impacts during construction would mostly be associated with dust generation from the construction of the on-ramp and widening of Erskine Park Road and the M4 Motorway mainline to provide turning and merging lanes. Dust emissions have the potential to settle on nearby properties and negatively affect air quality in the surrounding area for a short duration of time during the construction period. Areas of exposed land would also be susceptible to dust generation from wind erosion and mechanical disturbance depending on the size of exposed areas. Potential air quality impacts would be limited to the construction period and would be minimised by employing the safeguards outlined in Section 6.11.4. Therefore, potential air quality impacts arising from dust emissions as a result of the proposal are considered to be minor.

The operation of construction plant and vehicles is anticipated to result in a temporary increase of exhaust emissions such as carbon dioxide, methane and nitrous oxide. However, the impact of these emissions would be limited to the construction period and considered to be negligible in comparison to the exhaust fumes currently emitted by traffic on the M4 Motorway, Erskine Park Road and Roper Road. Safeguards listed in 6.11.4 would be implemented to ensure construction plant and vehicles are operated in an efficient manner during the construction period.

There is potential for odorous emissions during the sealing and line marking of the additional road surface. Given the limited duration of sealing and line marking works and that it would be confined to the construction period, the impacts of potentially odorous emissions are considered to be minor.

Operation

The proposed ramp would result in additional traffic volumes in and through the proposal area which could impact the localised air quality due to an increase in vehicle emissions. As this traffic would currently be using local roads or different access to points to the M4 Motorway, it is expected there would be a corresponding reduction in vehicle emissions from local roads. The change in route options used from local road trips to using the M4 Motorway would provide more efficient travel between the suburbs of St Clair / Erskine Park and Penrith, with potential reductions in air quality across the wider study area. Given this, any changes in air quality due to the changes in traffic movements as a result of the proposed on-ramp would likely be negligible.

6.11.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Air quality	<p>An Air Quality Management plan (AQMP) would be prepared as part of the CEMP. The plan would include but not be limited to:</p> <ul style="list-style-type: none"> • a map identifying locations of sensitive receivers • identification of potential risks/impacts due to the work/activities as dust generation activities • management measures to minimise risk including a progressive stabilisation plan • a process for monitoring dust on site and weather conditions • a process for altering management measures as required 	Contractor	Pre-construction, construction	Section 4.4 of QA G36 <i>Environment Protection</i>
Air quality	<p>The management measures within the AQMP would include but not limited to the following:</p> <ul style="list-style-type: none"> • vehicles transporting waste or other materials that have a potential to produce odours or dust are to be covered during transportation • dust would be suppressed on stockpiles and unsealed or exposed areas using methods such as water trucks, temporary stabilisation methods, soil binders or other appropriate practices • disturbed areas would be minimised in extent and rehabilitated progressively • speed limits would be imposed on unsealed surfaces • stockpiles would be located as far away from residences and other sensitive receivers • works (including the spraying of paint and other materials) 	Contractor	Pre-construction, construction	

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<p>would not be carried out during strong winds or in weather conditions where high levels of dust or air borne particulates are likely</p> <ul style="list-style-type: none"> • plant, vehicles and equipment would be maintained in good condition and in accordance with manufacturer's specifications • plant and machinery would be turned off when not in use. • no burning of any timbers or other combustible materials would occur on site • visual monitoring of air quality would be undertaken to verify the effectiveness of controls and enable early intervention • work activities would be reprogrammed if the management measures are not adequately restricting dust generation 			
Air quality	Plant and machinery must be maintained in accordance with manufacturer's specification. Smokey emissions must be kept within the standards and regulations under the <i>Protection of the Environment Operations Act 1997</i> that no vehicle shall have continuous smoky emissions for more than 10 seconds. Vehicles must not be left running when idle.	Contractor	Construction	
Air quality	Measures for dust suppression, including watering or covering exposed areas and stockpiles, shall be implemented and be in accordance with the Roads and Maritime Services Stockpile Site Management Guideline (EMS-TG-10).	Contractor	Construction	

6.12 Climate change

6.12.1 Existing environment

Climate change adaptation is required to meet the earth's changing environment, weather patterns and event intensity. The effects of climate change in the Sydney region are considered to be weather extremes, storm intensity, coastal hazards, flooding and increased risk and intensity of bushfires.

Hazards

The proposal is not within the coastal zone and therefore is not at risk of being affected by coastal hazards. As described in Section 6.5, the proposal area is not within flood prone land, with the nearest area of flood prone land located about 200 metres east of the site towards Ropes Creek.

The proposal area is located within Bushfire Prone Land – Vegetation Category 1 and Vegetation Buffer as identified in Figure 6-46. Vegetation Category 1 land is considered to be the highest risk for bush fire due to the highest combustibility and likelihood of forming fully developed fires including heavy ember production (NSW Rural Fire Service, 2015).

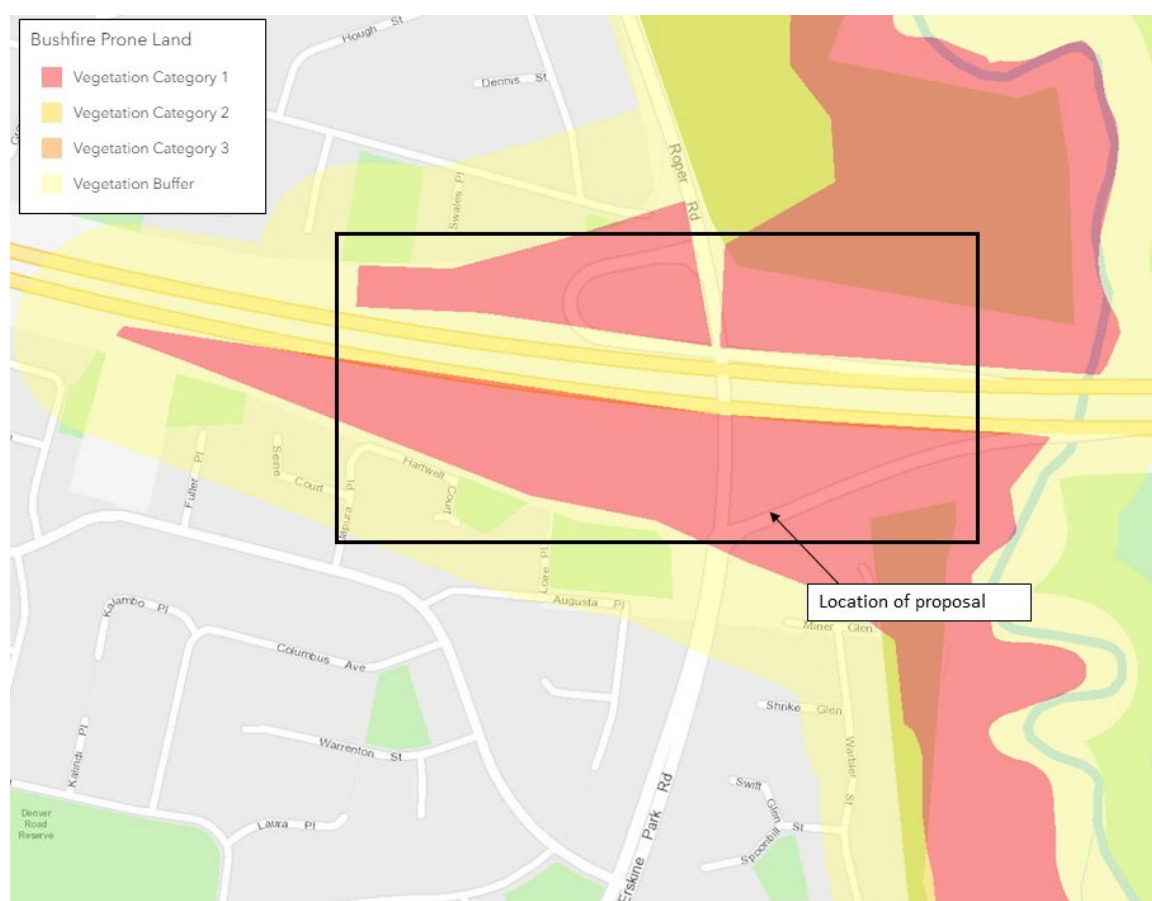


Figure 6-46 Location of bush fire prone land hazard categories within the proposal area (Source: NSW ePlanning Spatial Viewer)

Climatic conditions

A search of the Bureau of Meteorology (BoM) Climate Statistics for the suburbs of St Clair and Erskine Park indicated that the Orchard Hills Treatment Works weather station was the closest to the proposal area with full datasets (approximately 9 kilometres away). Temperature and rainfall data for this station are provided below in Table 6-44 as an indicative representation of weather conditions experienced at the proposal area.

Table 6-44 Meteorological data for the proposal area from the Orchard Hills Treatment Works weather station (BoM, 2020)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean maximum temperature (°C)	28.3	27.8	26.5	23.8	20.4	17.3	17.2	18.9	21.8	23.9	25.8	28.7
Mean Minimum temperature (°C)	16.9	17.4	16.0	13.0	9.6	7.0	5.3	5.9	8.7	11.1	13.2	15.5
Mean rainfall (mm)	99.3	112.9	93.2	63.7	55.3	56	36.3	40.1	36.8	54.8	78.2	72.3

Greenhouse gases

Existing sources of greenhouse gases within the vicinity of the proposal area would largely be attributed to vehicle exhaust emissions from traffic on the M4 Motorway, Erskine Park Road, Roper Road and nearby local roads. Other minor sources of greenhouse gases would arise from nearby developments through the use of hydrocarbon fuelled construction plant.

6.12.2 Potential impacts

Construction

Climatic conditions

The construction period of the proposal would not impact upon climate.

Greenhouse gases

Greenhouse gas emissions are anticipated to increase slightly during the construction of the proposal. The emissions would be predominantly carbon monoxide from plant exhaust as well as minor exhaust increases from traffic delays caused by the proposal.

The greenhouse gas emissions due to the construction of the proposal are minor and temporary. The impacts of greenhouse gas emissions would be managed through measures and safeguards proposed in Section 6.12.3.

Hazards

As the proposal is located within bushfire prone land and nearby flood prone land, additional considerations are required during construction to mitigate the risks associated with these hazards. The potential impacts on hydrology and flooding are addressed in Section 6.5. Safeguards to be implemented during construction to mitigate bush fire risks are set out in 6.12.3.

Operation

Climatic conditions

The proposal is not considered to be of a scale that would influence meteorological conditions at either a local or regional extent during the operation of the proposal.

Greenhouse gases

Greenhouse gas emissions are expected to slightly reduce when compared to the existing environment due to improved traffic flow and reduction in delays to general traffic on local roads. Improved traffic flow would also reduce emissions produced by stop and start traffic, from both road users and buses. Given the small scale of the works when compared to the wider NSW road network and future population growth, this improvement in greenhouse gas emissions is expected to be negligible.

Hazards

The operation of the proposal is unlikely to contribute to increased likelihood of fires as a greater area of Bushfire Prone Land will now be paved, less vegetation would remain and the area is not anticipated to be impacted by increased frequency and intensity of bushfires. The potential impacts on hydrology and flooding are addressed in Section 6.5 and the design of the drainage system capacity would account for the climate change induced increase in intensity and frequency of rainfall events. With this capacity, impacts from an extreme rainfall event would be minimal.

6.12.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Climate change	Detailed design would take into consideration the potential effect of climate change on the proposal, including drainage requirements.	Transport for NSW	Detailed Design	
Bush fire risk	All items of plant used during proclaimed high fire danger periods that could discharge sparks must be fitted with spark arresters.	Contactor	Construction	
Bush fire risk	Any activities likely to generate fires (such as cutting, welding or grinding) will not be undertaken in the open on days when a total fire ban is proclaimed.	Contactor	Construction	
Bush fire risk	No burning of any timbers or other combustible materials would occur on site.	Contactor	Construction	

6.13 Cumulative impacts

Cumulative impacts occur when two or more projects are carried out concurrently and in close proximity to one another. The impacts may be caused by both construction and operational activities and can result in a greater impact to the surrounding area than would be expected if each project was carried out in isolation.

6.13.1 Study area and methodology

A desktop review was carried out to identify any other projects or developments that may have the potential to contribute to cumulative impacts with the proposal. The potential for cumulative impacts was largely focussed on construction impacts as the operational impacts from approved developments are generally already assessed as part of the environmental approval process for those developments.

Traffic modelling for the proposal has already factored in the potential operational cumulative impacts from other approved developments in the modelling software as described in Section 6.2.

A search of the following databases was conducted in November 2020:

- Department of Planning and Environment's Major Projects Register
- Transport for NSW current projects viewer
- Penrith City Council Development Application Tracker

6.13.2 Broader program of work

The proposal is part of the broader M4 Smart Motorway programme. The programme is near completion with road sensors, traffic cameras, ramp signals, and overhead gantries installed along the corridor to better manage traffic, improve incident response times, and move more people. Refer to Table 6-45 for additional information.

6.13.3 Other projects and developments

A search of the Transport for NSW current project viewer identified a number of road projects in the area that could impact the proposal, these projects are set out in Table 6-45 below. The searches of the Department of Planning and Environment's Major Projects Register and Penrith City Council Development Application Tracker did not identify any major projects that would impact the proposal.

6.13.4 Potential impacts

Cumulative impacts are likely to occur as the proposal would potentially be carried out at the same time as other Transport for NSW and development applications. Refer to Table 6-45 for an assessment of potential impacts of the proposal being carried out at the same time as other nearby projects.

The potential cumulative impacts during the construction of the proposal would be limited to the anticipated 18-month works duration commencing mid-2020. The minor cumulative impacts that may be experienced during the construction period would be justified by the long-term, positive benefits of the proposal, including increased traffic efficiency and safety. Furthermore, potential cumulative impacts would be minimised by implementing the safeguards as outlined in Section 6.13.5 and Chapter 7 (Environmental management).

Table 6-45: Past, present and future projects

Project	Construction impacts	Operational impacts
Erskine Park Road Upgrade Widening of Erskine Park Road to a four-lane dual carriageway between Bennett Road and Explorers Way, including the upgrade of the intersections with Bennett Road, Peppertree Drive, Coonawarra Drive and Explorers Way Construction is underway and expected to be completed early 2021, weather permitting	The construction area ties in close to the proposal area and depending on timing of the Erskine Park Road Upgrade completion timeframe, construction periods may overlap with the proposal.	Improved traffic flow along Erskine Park Road which feeds into the proposal area and access to the proposed on-ramp.
M4 Motorway mainline re-surfacing Proposed to occur mid-March 2021	Construction periods may overlap or cause lane closures/speed restrictions to be in place along the M4 Motorway mainline adjacent to the works to be in place over a longer period compared to only one of the projects being completed.	Improved road surface
Mamre Road Upgrade Project Duplication of Mamre Road from Erskine Park Road (in the south) to just north of Banks Drive (in the north) Stage 1 funded and likely to occur in the near to medium term	The main cumulative impact that may arise as a result of construction would be traffic impacts which have been considered in Section 6.2. Given the distance to the Mamre Road works from the proposal area (approximately 4 kilometres), other minor cumulative impacts are not expected.	Improved traffic flow between nearby suburbs and the M4.
M4 Smart Motorways Project completion	Other minor cumulative impacts may include: <ul style="list-style-type: none"> Increased noise, vibration and dust impacting surrounding receivers Traffic impacts due to lowering of speed limits around construction sites Visual impacts due to the construction work site/s and removal of roadside vegetation 	Improved traffic flow along the M4.
Western Sydney Employment Area – Mamre Road Development Area	The proposed WSEA – Mamre Road area is over 4 km south east of the proposal area. Cumulative construction impacts are considered to be limited to construction traffic movements on the wider road network due.	Increase in traffic flow due to increase in population and workers accessing the new employment areas.

Project	Construction impacts	Operational impacts
Archbold Road Upgrade and Extension Upgrade and extension of a five km section of Archbold Road from the Great Western Highway at Minchinbury to Old Wallgrove Road at Eastern Creek REF completed 2017	<p>This project is located 1.3 km east of the proposal area. Where the construction period overlaps with the proposal, minor cumulative impacts would include:</p> <ul style="list-style-type: none"> Increased noise, vibration and dust impacting surrounding receivers Traffic impacts due to lowering of speed limits around construction sites Visual impacts due to the construction work site/s and removal of roadside vegetation 	Improved traffic flow between M4 Motorway and the WSEA.

6.13.5 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Cumulative impacts	<p>The CEMP would be revised to consider potential cumulative impacts from surrounding development activities as they become known. This would include a process to review and update mitigation measures as new works begin or if complaints are received.</p>	Contractor	Pre-Construction & Construction	
Cumulative impacts	<p>The community Engagement and Stakeholder Strategy will be prepared to:</p> <ul style="list-style-type: none"> Gain an understanding of construction timeframes and impacts Coordinate impact mitigation and management if necessary. <p>The Community Engagement and Stakeholder Strategy shall provide for regular consultation with Penrith City Council and other government agencies to obtain information on any new development activities that arise within the surrounding area that may impact the proposal.</p>	Transport for NSW/ Contractor	Pre-Construction & Construction	

7. Environmental management

This chapter describes how the proposal will be managed to reduce potential environmental impacts throughout detailed design, construction and operation. A framework for managing the potential impacts is provided. A summary of site-specific environmental safeguards is provided and the licence and/or approval requirements required prior to construction are also listed.

7.1 Environmental management plans (or system)

A number of safeguards and management measures have been identified in the REF in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A 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 prior to construction of the proposal and must be reviewed and certified by the Transport for NSW Environment Officer, Greater Sydney, prior to the commencement of any on-site works. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in accordance with the specifications set out in the QA Specification G36 – *Environmental Protection (Management System)*, QA Specification G38 – *Soil and Water Management (Soil and Water Plan)*, QA Specification G40 – *Clearing and Grubbing*, QA Specification G10 – *Traffic Management*].

7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF will be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards and management measures will minimise any potential adverse impacts arising from the proposed works on the surrounding environment. The safeguards and management measures are summarised in Table 7-1.

Table 7-1: 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 prior to commencement of the activity.</p> <p>As a minimum, the CEMP will address the following:</p> <ul style="list-style-type: none"> any requirements associated with statutory approvals details of how the project will implement the identified safeguards outlined in the REF issue-specific environmental management plans roles and responsibilities communication requirements induction and training requirements procedures for monitoring and evaluating environmental performance, and for corrective action reporting requirements and record-keeping procedures for emergency and incident management procedures for audit and review. <p>The endorsed CEMP will be implemented during the undertaking of the activity.</p>	Contractor / Transport for NSW project manager	Pre-construction / detailed design	Section 3 of QA G36 <i>Environment Protection</i>
GEN2	General - notification	All businesses, residential properties and other key stakeholders (eg schools, local councils) affected by the activity will be notified at least five days prior to commencement of the activity.	Contractor / Transport for NSW project manager	Pre-construction	

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"> • threatened species habitat • adjoining residential areas requiring particular noise management measures 	Contractor / Transport for NSW project manager	Pre-construction / detailed design	
B1	Biodiversity	<p>A Flora and Fauna Management Plan will be prepared in accordance with Transport for NSW's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects</i> (RMS, 2011) and implemented as part of the CEMP. It will include, but not be limited to:</p> <ul style="list-style-type: none"> • plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas • requirements set out in the <i>Landscape Guideline</i> (RMS, 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	Detailed design / pre-construction	Section 4.8 of QA G36 <i>Environment Protection</i>
B2	Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	Contractor	Detailed design / pre-construction	
B3	Biodiversity – Removal of vegetation	An Environmental Work Method Statement (EWMS) is required for clearing and grubbing works.	Contractor	Pre-construction/ Construction	Section 3.2.4 of QA G36

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<p>The EWMS would be submitted to the Transport for NSW Environment branch staff for review and endorsement prior to commencement of works.</p> <p>The EWMS must include, but not be limited to:</p> <ul style="list-style-type: none"> • description of the works/activities including machinery and set up of exclusion zones • outline of the sequence of work/activities, including interfaces with other construction activities (for example the interface between cut and fill areas, stabilisation of exposed areas, excavation for an installation or upgrade of culverts) • identification of potential environmental risks/impacts due to the works/activities which is to include risks associated with wet weather events • evaluation of methods to eliminate/reduce the environmental risk • mitigation measures to reduce environmental risk • any safeguards resulting from consultation with public authorities and other stakeholders, where appropriate • a map / diagram indicating the locations of sensitive locations (such as threatened species), the likely potential environmental impacts and work areas as well as controls • identification of works areas and exclusions areas • details of a process for progressive review, for example monitoring processes and mitigations to eliminate/reduce environmental risks/impacts 		(pending work schedule)	<i>Environment Protection</i>
B4	Biodiversity – Removal of native vegetation	Pre-clearing surveys will be undertaken in accordance with <i>Guide 1: Pre-clearing process</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Prior to construction	
B5	Biodiversity – Removal of native vegetation	Vegetation removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bush rock</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	During Construction	
B6	Biodiversity – Removal of native vegetation	Native vegetation will be re-established in accordance with <i>Guide 3: Re-establishment of native vegetation</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Post construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
B7	Biodiversity – Removal of native vegetation	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	During construction	
B8	Biodiversity – Removal of threatened species habitat and habitat features	Habitat removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bush rock</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	During construction	
B9	Biodiversity – Removal of threatened species habitat and habitat features	The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.	Contractor	During construction	
B10	Biodiversity - Edge effects on adjacent native vegetation and habitat	Exclusion zones will be set up at the limit of clearing in accordance with <i>Guide 2: Exclusion zones</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011). Exclusion zones around sensitive areas will be set up using a hard barrier such as jersey kerbs.	Contractor	During construction	
B11	Biodiversity - Injury and mortality of fauna	Fauna will be managed in accordance with <i>Guide 9: Fauna handling</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	During construction	
B12	Biodiversity - Invasion and spread of weeds	Weed species will be managed in accordance with <i>Guide 6: Weed management</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	During construction	
B13	Biodiversity - Invasion and spread of pests	Pest species will be managed within the proposal site.	Contractor	During construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
B14	Biodiversity - Invasion and spread of pathogens and disease	Pathogens will be managed in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	During construction	
T1	Traffic and transport	<p>A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the <i>Transport for NSW Traffic Control at Work Sites Manual</i> (RTA, 2010) and <i>QA Specification G10 Control of Traffic</i> (Transport for NSW, 2008). The TMP will include:</p> <ul style="list-style-type: none"> • confirmation of haulage routes • measures to maintain access to local roads and properties • site specific traffic control measures (including signage) to manage and regulate traffic movement • measures to maintain pedestrian and cyclist access • requirements and methods to consult and inform the local community of impacts on the local road network • access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads. • a response plan for any construction traffic incident • consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic • monitoring, review and amendment mechanisms. 	Contractor	Detailed design / Pre-construction	Section 4.8 of QA G36 <i>Environment Protection</i>
T2	Traffic and transport	The movement of construction materials (haulage and deliveries) will be scheduled to minimise the number of haulage and delivery vehicles required during peak periods and weekends.	Contractor	Construction	
T3	Traffic and transport	Vehicle access to Site Compound B is to be limited to light vehicles.	Contractor	Construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
T4	Traffic and transport	Where possible, current traffic movements and property accesses will be maintained during the works. Any disturbance will be minimised to prevent unnecessary traffic delays.	Contractor	Construction	
T5	Traffic and transport	Road users and local communities will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.	Contractor	Construction	
N1	Noise and vibration	<p>A Construction Noise and Vibration Management Plan (CNVMP) will be prepared as part of the CEMP. The CNVMP will include but not be limited to:</p> <ul style="list-style-type: none"> • a map indicating the locations of sensitive receivers including residential properties • a quantitative noise assessment in accordance with the EPA Interim Construction Noise Guidelines (DECCW, 2009) • management measures to minimise the potential noise impacts from the quantitative noise assessment and for potential works outside of standard construction hours (including implementation of EPA Interim Construction Noise Guidelines (DECCW, 2009) • a risk assessment to determine potential risk of activities likely to affect receivers (for activities undertaken during and outside of standard construction hours) • mitigation measures to avoid noise and vibration impacts during construction activities including those associated with truck movements • a process for assessing the performance of the implemented mitigation measures • a process for documenting and resolving noise and vibration issues and complaints • a construction staging program incorporating a program of noise and vibration monitoring for sensitive receivers • a process for updating the CNVMP when activities affecting construction noise and vibration change • Toolbox talks will identify where noise and vibration management is required. 	Contractor	Detailed design / pre-construction	Section 4.6 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
N2	Noise and vibration	<p>All sensitive receivers (eg schools, local residents) likely to be affected will be notified at least five working days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of:</p> <ul style="list-style-type: none"> • the project • the construction period and construction hours • contact information for project management staff • complaint and incident reporting • how to obtain further information. 	Contractor	Detailed design / pre-construction	
N3	Complaints	During work hours, a community liaison phone number will be provided to enable complaints to be received and responded to.	Contractor	Construction	Standard safeguard N8
N4	Work practices	<p>The environmental induction program for construction personnel will include specific noise and vibration issues awareness training including, but not limited to, the following:</p> <ul style="list-style-type: none"> • avoiding use of radios during work outside normal hours. • avoiding shouting and slamming doors. • where practical, operating machines at low speed or power and switching off when not being used rather than left idling for prolonged periods. • minimising reversing. • avoiding dropping materials from height and avoiding metal to metal contact on material. 	Contractor	Construction	Standard safeguard N10
N5	Construction scheduling	Noisy work will be scheduled during standard construction hours as much as possible. Noisy activities that cannot be undertaken during standard construction hours will be scheduled as early as possible during the evening and/or night-time periods. Particularly noisy activities such as use of road and concrete saws and jack hammers will be completed before midnight.	Contractor	Detailed design / pre-construction / construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		Consultation will be undertaken with other contractors to manage cumulative impacts on sensitive receivers within commonly affected areas. Feasible and reasonable mitigation measures will be detailed in the CNVMP.			
N6	Respite	Respite measures will be implemented for noisy work and vibration intensive activities consistent with the CNVG.	Contractor	Construction	Additional safeguard
N7	Construction mitigation	During the detailed design stage of the proposal, further investigations of all feasible and reasonable mitigation options will be undertaken for affected receivers in accordance with the <i>Road Noise Policy (DECCW 2011)</i> and the <i>Environmental Noise Management Manual Practice Note 4 (RTA 2001)</i> .	Contractor	Detailed design	Standard safeguard N1
N8	Construction traffic noise	<p>Management of construction traffic noise will include:</p> <ul style="list-style-type: none"> • following designated vehicle routes, parking locations, acceptable delivery hours and other relevant practices. Vehicle routes will be reviewed to consider noise impacts • site access and egress points will be located away from sensitive receivers, where feasible and reasonable • deliveries and spoil removal will be planned to avoid queuing of trucks and be conducted during the daytime where feasible and reasonable • construction sites will be arranged to limit the need for reversing associated with regular/repeatable movements (eg trucks transporting spoil). 	Contractor	Construction	Additional safeguard
N9	Plant and equipment	<p>Plant and equipment will:</p> <ul style="list-style-type: none"> • be appropriately selected for each task to minimise the noise contributions • be regularly inspected and maintained to ensure it is in good working order be located on site with as much distance as possible between the plant and noise sensitive receivers or be orientated away from residential receivers where feasible and reasonable. 	Contractor	Pre-construction / construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
N10	Construction compound noise	Consider orienting the construction compound layout so that primary noise sources including noisy plant items (generators, pumps, fixed plant) are located away from nearby noise sensitive receivers), with solid structures (sheds and containers) placed between sensitive receivers and noise sources (and as close to the noise sources as is practical);	Contractor	Pre-construction / construction	Standard safeguard N3
N11	Construction vibration	<p>A vibration assessment will be prepared and included in the CNVMP. The vibration assessment will include (as a minimum):</p> <ul style="list-style-type: none"> • identification of potentially affected properties/receivers • a risk assessment to determine the potential for discrete work activities to affect receivers • a map indicating the locations considered likely to be impacted and those requiring building condition surveys • outline a vibration monitoring program • a process for assessing the performance of the implemented mitigation measures and a process for resolving issues and conflicts. 	Contractor	Pre-construction	Standard safeguard N13
S1	Soil and water	<p>A site specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the CEMP.</p> <p>The Plan will include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.</p>	Contractor	Detailed design / Pre-construction	Section 2.2 of QA G38 <i>Soil and Water Management</i>
S2	Soil and water	<p>Erosion and sediment measures will be implemented and maintained to:</p> <ul style="list-style-type: none"> • Minimise sediment moving off-site and sediment laden water entering any waterways, drainage lines or drainage pits • Minimise the amount of material transported from site to surrounding pavement surfaces • Divert clean water around the site. 	Contractor	Construction	
S3	Soil and water	Controls are to be implemented at exit points to minimise tracking soil and particulates onto pavement surfaces.	Contractor	Construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
S4	Soil and water	Any material transported onto pavements would be swept and removed at the end of each working shift and prior to rainfall			
S5	Soil and water	Erosion and sedimentation controls are to be checked and maintained on a regular basis and after a rain event of ten millimetres or greater (including clearing of sediment from behind barriers) and records kept and provided on request.	Contractor	Construction	
S6	Soil and water	Vehicle wash down and/or cement truck washout is to occur in a designated bunded area and least 50 metres away from water bodies and surface water drains.	Contractor	Construction	
S7	Soil and water	Site stabilisation of disturbed areas would be carried out progressively as stages are completed.	Contractor	Construction	
S8	Soil and Water	All stockpiles would be designed, established, operated and decommissioned in accordance with Roads and Maritime Services' Stockpile Management Guidelines (EMS-TG-10).	Contractor	Construction	
S9	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>
S10	Accidental spill	Emergency wet and dry spill kits would be kept on site at all times and all staff would be made aware of the location of the spill kit and trained in its use.	Contractor		
A1	Aboriginal heritage	<ul style="list-style-type: none"> <i>The Standard Management Procedure - Unexpected Heritage Items</i> (Transport for NSW, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where 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. 	Contractor	Detailed design / pre-construction	Section 4.9 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> Work will only re-commence once the requirements of that Procedure have been satisfied. 			
H1	Non-Aboriginal heritage	<ul style="list-style-type: none"> <i>The Standard Management Procedure - Unexpected Heritage Items</i> (Transport for NSW, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered. <p>Work will only re-commence once the requirements of that Procedure have been satisfied.</p>	Contractor	Detailed design / pre-construction	Section 4.10 of QA G36 <i>Environment Protection</i>
V1	Landscape character and visual impact	Light spill into adjacent visually sensitive properties during construction is to be minimised by the use of cut-off lighting at Site Compound B, directing construction lighting into the construction areas and ensuring the site is not over-lit. This includes the sensitive placement and specification of lighting to minimise any potential increase in light pollution, particularly during night works	Contractor	Construction	
V2	Landscape character and visual impact	Work site areas and the construction compound are to be kept clear and tidy, and screened with shade cloth (or similar material, where necessary) to minimise visual impacts from key viewing locations.	Contractor	Construction	
V3	Landscape character and visual impact	Temporary hoardings, barriers, traffic management and signage are to be removed when no longer required.	Contractor	Construction	
V4	Landscape character and visual impact	<p>A landscape plan would be prepared for the proposal in general accordance with:</p> <ul style="list-style-type: none"> Transport for NSW's Beyond the Pavement Urban design approach and procedures for road and maritime infrastructure planning, design and construction (Transport for NSW, 2020) Roads and Maritime's <i>Landscape design guidelines</i> (RMS, 2018) Relevant council landscape and tree guidelines The plan shall outline the proposed landscaping rehabilitation to be carried out following construction 	Transport for NSW / Contractor	Detailed design / pre-construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> The landscape plan shall take into consideration the species of trees removed (replacing like-for-like where practical) 			
V5	Landscape character and visual impact	Landscape planting within the G-loop configuration of the on-ramp is to be established on completion of the construction.	Contractor	Post - construction	
SOC1	Socio-economic	<p>A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum):</p> <ul style="list-style-type: none"> mechanisms to provide details and timing of proposed activities to affected residents, 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	
SOC2	Socio-economic	<p>A complaints handling procedure and register would be included in the CEMP and maintained for the duration of the project. The procedure must include:</p> <ul style="list-style-type: none"> how complaints are to be recorded how a qualified community representative or delegate would be available to respond and appropriate action community complaints how RMS would be informed of complaints how complaints are to be reported how complaints would be followed up and managed how the complaints would be established and maintained 	Contractor	Construction	
SOC3	Socio-economic	Residents would be informed prior to any interruptions to utility services that may be experienced as a result of utilities relocation.	Contractor	Construction	
SOC4	Socio-economic	Road users, pedestrians and cyclists would be informed of changed conditions, including likely disruptions to access during construction.	Contractor	Construction	
W1	Waste and 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 	Contractor	Detailed Design, Pre-Construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> 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>). 		and Construction	
W2	Waste and resource use	<p>A Resource and Waste Management Plan (RWMP) would be prepared, which would include the following (as a minimum):</p> <ul style="list-style-type: none"> the type, classification and volume of all materials to be generated and used on site including identification of recyclable and non-recyclable waste in accordance with EPA Waste Classification Guidelines quantity and classification of excavated material generated as a result of the proposal (Refer RMS Waste Management Fact sheets 1-6, 2012) interface strategies for cut and fill on site to ensure re-use where possible strategies to 'avoid', 'reduce', 'reuse' and 'recycle' materials classification and disposal strategies for each type of material destinations for each resource/waste type either for on-site reuse or recycling, offsite reuse or recycling, or disposal at a licensed waste facility details of how material would be stored and treated on-site identification of available recycling facilities on and off site identification of suitable methods and routes to transport waste procedures and disposal arrangements for unsuitable excavated material or contaminated material site clean-up for each construction stage 	Contractor	Pre-Construction and Construction	
W3	Waste and resource use	Procurement would endeavour to use materials and products with a recycled content where that material or product is cost and performance effective.	Contractor	Detailed Design & Pre-Construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
W4	Waste and resource use	A dedicated concrete washout facility that is impervious would be provided during construction so that runoff from the washing of concrete machinery, equipment and concrete trucks can be collected and disposed of at an appropriate waste facility.	Contractor	Construction	
W5	Waste and resource use	All wastes would be managed in accordance with the Protection of the Environment Operations Act 1997.	Contractor	Pre-Construction and Construction	
W6	Waste and resource use	Types of waste collected, amounts, date/time and details of disposal are to be recorded in a waste register.	Contractor	Construction	
W7	Waste and resource use	Works sites would be maintained, kept free of rubbish and cleaned up at the end of each working day.	Contractor	Construction	
W8	Waste and resource use	Suitable waste disposal locations would be identified and used to dispose of litter and other wastes on-site. Suitable containers would be provided for waste collection.	Contractor	Pre-construction & Construction	
AQ1	Air quality	<p>An Air Quality Management plan (AQMP) would be prepared as part of the CEMP. The plan would include but not be limited to:</p> <ul style="list-style-type: none"> • a map identifying locations of sensitive receivers • identification of potential risks/impacts due to the work/activities as dust generation activities • management measures to minimise risk including a progressive stabilisation plan • a process for monitoring dust on site and weather conditions • a process for altering management measures as required 	Contractor	Pre-construction, construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
AQ2	Air quality	<p>The management measures within the AQMP would include but not limited to the following:</p> <ul style="list-style-type: none"> • vehicles transporting waste or other materials that have a potential to produce odours or dust are to be covered during transportation • dust would be suppressed on stockpiles and unsealed or exposed areas using methods such as water trucks, temporary stabilisation methods, soil binders or other appropriate practices • disturbed areas would be minimised in extent and rehabilitated progressively • speed limits would be imposed on unsealed surfaces • stockpiles would be located as far away from residences and other sensitive receivers • works (including the spraying of paint and other materials) would not be carried out during strong winds or in weather conditions where high levels of dust or air borne particulates are likely • plant, vehicles and equipment would be maintained in good condition and in accordance with manufacturer's specifications • plant and machinery would be turned off when not in use. • no burning of any timbers or other combustible materials would occur on site • visual monitoring of air quality would be undertaken to verify the effectiveness of controls and enable early intervention • work activities would be reprogrammed if the management measures are not adequately restricting dust generation 	Contractor	Pre-construction, construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
AQ3	Air quality	Plant and machinery must be maintained in accordance with manufacturer's specification. Smokey emissions must be kept within the standards and regulations under the <i>Protection of the Environment Operations Act 1997</i> that no vehicle shall have continuous smoky emissions for more than 10 seconds. Vehicles must not be left running when idle.	Contractor	Construction	
AQ4	Air quality	Measures for dust suppression, including watering or covering exposed areas and stockpiles, shall be implemented and be in accordance with the Roads and Maritime Services Stockpile Site Management Guideline (EMS-TG-10).	Contractor	Construction	
CC1	Climate change	Detailed design would take into consideration the potential effect of climate change on the proposal, including drainage requirements.	Transport for NSW	Detailed Design	
CC2	Bush fire risk	All items of plant used during proclaimed high fire danger periods that could discharge sparks must be fitted with spark arresters.	Contractor	Construction	
CC3	Bush fire risk	Any activities likely to generate fires (such as cutting, welding or grinding) will not be undertaken in the open on days when a total fire ban is proclaimed.	Contractor	Construction	
CC4	Bush fire risk	No burning of any timbers or other combustible materials would occur on site.	Contractor	Construction	
C1	Cumulative impacts	The CEMP would be revised to consider potential cumulative impacts from surrounding development activities as they become known. This would include a process to review and update mitigation measures as new works begin or if complaints are received.	Contractor	Pre-Construction & Construction	
C2	Cumulative impacts	The community Engagement and Stakeholder Strategy will be prepared to: <ul style="list-style-type: none"> • Gain an understanding of construction timeframes and impacts • Coordinate impact mitigation and management if necessary. The Community Engagement and Stakeholder Strategy shall provide for regular consultation with Penrith City Council and other government agencies to obtain information on any new development activities that arise within the surrounding area that may impact the proposal.	Transport for NSW/ Contractor	Pre-Construction & Construction	

7.3 Licensing and approvals

Table 7-2 below contains a list of the possible license/approval requirements applicable to the proposal activities. Requirements outside the list below should also be considered and included where relevant.

Table 7-2: Summary of licensing and approvals required

Instrument	Requirement	Timing
Road Occupancy License	For lane closures	Prior to start of construction.
Division 5.1 of the EP&A Act	<p>This demonstrates the consideration of all relevant matters of national environmental significance, including the requirements of the EPBC Act strategic assessment approval with respect to nationally listed threatened species, endangered ecological communities and migratory species.</p> <p>This has been addressed in this REF as outlined in Chapter 6 (Environmental Assessment).</p>	The completion and approval of this REF for the proposal.

8. Conclusion

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

8.1 Justification

The REF has assessed the potential biophysical and social impacts of the preferred option. The proposed construction of a westbound on-ramp from Roper Road to the M4 Motorway in St Clair would result in a number of environmental impacts including:

- Biodiversity due to vegetation clearance and removal
- Traffic impacts for the duration of construction
- Traffic impacts during operation
- Construction and operational noise level exceedances
- Visual impacts due to removal of trees and shrubs

This REF has concluded that the adverse impacts of the proposal would be outweighed by the long-term beneficial impacts of providing improved connectivity to the M4 Motorway for local road users, ease congestion, reduce travel times and provide additional route options for road users between St Clair, Erskine Park, Colyton and Minchinbury, and Penrith. The proposal is consistent with strategic plans for Western City and would contribute to the continued development of the Western Sydney Employment Area.

The proposal is considered justified as it would meet the proposal objectives and does this in a manner that would minimise impacts on the natural and built environments and the community providing the safeguards are implemented. If the proposal did not proceed, the current road network would be less prepared to support the growth and land use changes within the Penrith City Council LGA and the wider Sydney Metropolitan area.

The following sections consider the justification of the proposal in relation to the social, biophysical and economic factors and the public interest.

8.1.1 Social factors

Social and economic factors have been assessed in Section 0 of this REF. Works would predominately be carried out within the SP2 Infrastructure classified land associated with the M4 Motorway where road infrastructure is provided for. Socioeconomic impacts are considered to be minimal for the proposal as the surrounding area is mostly residential, and businesses and commercial facilities are not expected to be adversely affected. Some residential receivers would experience increased road traffic noise due to the proposed on-ramp and increased traffic along Erskine Park Road.

The proposal would have a long term, positive effect for the local community and businesses in the wider vicinity as it would improve traffic efficiency and road safety and ease traffic congestion. This would be achieved through the provision of the additional on-ramp to the M4 Motorway.

8.1.2 Biophysical factors

Potential environmental impacts as a result of the proposal are described throughout Section 6 of this REF. The proposal is likely to have a minor biophysical impact due to the removal of vegetation which is part of threatened ecological communities and the removal of two threatened Juniper-leaved Grevillea. There would also be temporary impacts to amenity, including local air quality, noise and vibration and visual impacts. These impacts would not be significant and are manageable through the application of the safeguards and management measures set out in Section 6 and summarised in Section 7.

8.1.3 Public interest

During construction, the public is likely to experience:

- Amenity impacts such as noise (refer Section 6.3) and visual impacts (refer Section 6.8)
- Minor traffic delays (refer Section 6.2)
- Minor air quality impacts (refer Section 6.11).

These impacts would be temporary and limited to the construction period only. Once in operation the proposal is expected to provide public benefit and would be in the public interest as it would contribute to improving the connectivity of local road users to the M4 Motorway westbound, improving the route options and travel reliability between suburbs and main centres throughout the Sydney metropolitan area.

8.2 Objects of the EP&A Act

Table 8-1 provides consideration of the proposal in accordance with Part 1 Section 1.3 of the EP&A Act.

Table 8-1 Objects of the EP&A Act

Object	Comment
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	The proposal is for the provision of the proposed on-ramp to the M4 Motorway westbound mainline from Erskine Park Road and Roper Road. The proposal would try to limit its use of natural and artificial resources and would source locally where possible. Social and economic impacts are assessed in Section 6.9. The assessment includes management measures to avoid and/or minimise impacts.
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	Ecologically sustainable development is considered in Sections 8.2.1 below.
1.3(c) To promote the orderly and economic use and development of land.	The proposal is contained within the existing road corridor and would support the development of land and employment areas in Greater Western Sydney.
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the project.
1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	<p>The proposal would result in the removal of up to 2.17 ha of low to moderate condition native vegetation. The proposal is considered unlikely to have an adverse effect on the three TECs (Shale Gravel Transition Forest EEC, River-Flat Eucalypt Forest EEC and Cooks River/Castlereagh Ironbark Forest EEC/CEEC) present within the proposal area such that the local occurrence of these communities is likely to be placed at further risk of extinction. Overall the proposal is unlikely to result in a significant impact to the TECs.</p> <p>Of the five threatened flora species identified as having a moderate to high likelihood of occurrence within the proposal area only 2 threatened Juniper-leaved Grevillea occurs within the construction footprint and would be impacted by the proposal. The proposal is not considered to significantly impact the Juniper-leaved Grevillea species.</p>
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The proposal would not impact on Aboriginal cultural heritage items or Non-Aboriginal heritage items. Any Aboriginal cultural heritage items or Non-Aboriginal heritage identified or encountered during construction would be managed in accordance with standard safeguards.

Object	Comment
1.3(g) To promote good design and amenity of the built environment.	Landscaping and urban design plans are to be developed during detailed design of the proposal to maintain the amenity of the built environment within the proposal area.
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.	Community consultation would continue at detailed design, prior to the commencement of construction, and during the construction period.

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 REF and the development of mitigation measures.

The proposal does not pose a threat of serious or irreversible damage to the environment. The potential impacts described in the REF have been predicted with a reasonable level of scientific certainty. Mitigation and management measures have been proposed based on previous experience with similar projects. Therefore, application of the precautionary principle is not appropriate for this proposal.

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 short and long term impacts of the proposed on-ramp have been considered and addressed through the development of the concept design and REF and on-balance would benefit both current and future generations.

Conservation of biological diversity and ecological integrity

The proposal would have a limited impact on the flora and fauna and would not compromise the biological diversity or ecological integrity of the proposed area. As set out in Section 6.1 Biodiversity the proposal

would require the removal of native vegetation and up to three threatened species, however the impact is not considered significant under either the BC Act or the EPBC Act.

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.

The proposal reflects the natural, social and economic values of the locality. This REF has examined the environmental consequences of the proposal and identified mitigation measures and safeguards to address potential adverse impacts. The value of environmental safeguards implementation was not able to be determined at the time this REF was prepared.

8.3 Conclusion

The proposed M4 Motorway Roper Road westbound on-ramp at St Clair and Erskine Park is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

This has included consideration (where relevant) of conservation agreements and plans of management under the NPW Act, biodiversity stewardship sites under the BC Act, wilderness areas, areas of outstanding value, impacts on threatened species and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the Federal EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some impacts on biodiversity, noise, and visual amenity. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also improve connectivity of local roads to the M4 Motorway, improving travel times between the St Clair, Erskine Park, Colyton and Minchinbury, and Penrith.

On balance the proposal is considered justified and the following conclusions are made.

Significance of impact under NSW legislation

The proposal would be unlikely to cause a significant impact on the environment. Therefore it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Public Spaces under Division 5.2 of the EP&A Act. A Biodiversity Development Assessment Report or Species Impact Statement is not required. The proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from Council is not required.

Significance of impact under Australian legislation

The proposal is not likely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*. A referral to the Australian Department of Agriculture, Water and the Environment is not required.

9. Certification

This review of environmental factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.

Helen Lawrence

Senior Environmental Planner

AECOM

Date:

I have examined this review of environmental factors and accept it on behalf of Transport for NSW.

Anthony Cunningham

Senior Project Manager

Easing Sydney's Congestion Program Office

Date:

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Terms and acronyms used in this REF

Term / Acronym	Description
ABS	Australian Bureau of Statistics
AHD	Australian Height datum
AHIMS	Aboriginal Heritage Information System
AHIP	Aboriginal Heritage Impact Permit
AEP	Annual exceedance probability
AVATG	Assessing Vibration: A Technical Guideline
BC Act	<i>Biodiversity Conservation Act 2016</i> (NSW).
CBD	Central Business District
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CNVG	Construction Noise and Vibration Guideline
CNVMP	Construction Noise and Vibration Management Plan
CoRTN	Calculation of Road Traffic Noise
dB(A)	Decibels
DBYD	Dial Before You Dig
ECRTN	EPA's NSW Environment Criteria for Road Traffic Noise
EEC	Endangered Ecological Community
EIA	Environmental impact assessment
EPA	Environmental Protection Authority
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
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2000</i>
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.
ESCPO	Easing Sydney's Congestion Program Office
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased
FM Act	<i>Fisheries Management Act 1994</i> (NSW)
Heritage Act	<i>Heritage Act 1977</i> (NSW)

Term / Acronym	Description
ICNG	<i>Interim Construction Noise Guideline</i>
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
LALC	Local Aboriginal Land Council
LA _{eq}	Equivalent continuous sound level)
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.
M4SM OTM	M4 Smart Motorway Operational Traffic Model
MNES	Matters of national environmental significance under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
NCA	Noise Catchment Area
NCG	Roads and Maritime's Noise Criteria Guideline
NMG	Roads and Maritime's Noise Mitigation Guideline
NML	Noise Management Level
NPFI	EPA's Noise Policy for Industry
NPW Act	<i>National Parks and Wildlife Act 1974 (NSW)</i>
OEH	<i>Office of Environment and Heritage</i>
PACHCI	<i>Procedure for Aboriginal Cultural Heritage Consultation and Investigation</i>
PCT	Plant Community Types
PMF	Probable Maximum Flood
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
QA Specifications	Specifications developed by Transport for NSW for use with road work and bridge work contracts let by Transport for NSW.
RBL	Rating Background Levels
REF	
RNP	EPA's Road Noise Policy
Roads and Maritime	NSW Roads and Maritime Services, now known as Transport for NSW
ROL	Road Occupancy License
SEED	Sharing and Enabling Environmental Data in NSW
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
SIS	State Infrastructure Strategy

Term / Acronym	Description
STFM	Strategic Traffic Forecasting Model
SWL	Sound power levels
CM SEPP	State Environmental Planning Policy (Coastal Management) 2018
TEC	Threatened Ecological Communities
TMC	Traffic Management Centre
TMP	Traffic Management Plan
VHT	Vehicle Hours Travelled
VKT	Vehicle Kilometres Travelled
VMS	Variable Message Signs
VP	Viewpoint
WARR Act	<i>Waste Avoidance and Resource Recovery Act 2001</i>
WSEA	Western Sydney Employment Area