Transport for NSW

Gasworks Bridge Remediation

Review of Environmental Factors

July 2023

NSW GOVERNMENT

transport.nsw.gov.au

Acknowledgement of Country

Transport for NSW acknowledges the Darug Aboriginal people, the traditional custodians of the land on which the Gasworks Bridge Remediation is proposed.

We pay our respects to their Elders past and present and celebrate the diversity of Aboriginal people and their ongoing cultures and connections to the lands and waters of NSW.

Many of the transport routes we use today – from rail lines, to roads, to water crossings – follow the traditional Songlines, trade routes and ceremonial paths in Country that our nation's First Peoples followed for tens of thousands of years.

Transport for NSW is committed to honouring Aboriginal peoples' cultural and spiritual connections to the land, waters and seas and their rich contribution to society.

Approval and authorisation

Title	Gasworks Bridge Remediation | Review of Environmental Factors
Accepted on behalf of Transport for NSW by:	Chris Gatehouse – Contract Manager, Fulton Hogan SRAPC River Zone
Signed	
Date:	10/07/2023

Executive summary

The proposal

Fulton Hogan on behalf of Transport for NSW (TfNSW) propose to complete remedial works on the Gasworks Bridge (the bridge) which is located over the Parramatta River on Macarthur Street in the suburb of Parramatta.

The proposal would include:

- pavement works consisting of the sealing of the concrete deck of the bridge structure
- rehabilitation of Gasworks Bridge which would include:
  - removal of the existing lead paint coating from all wrought iron and steel elements of the bridge
  - application of a new protective paint and coating of all wrought iron and steel elements of the bridge (priming and coating works)
- bridge repair works (structural and non-structural) throughout the bridge structure.

Subject to approval, construction activities associated with the proposal are expected to commence in Quarter 3 2023 and the proposal would take around four months to complete.

Need for the proposal

The proposal is located within the City of Parramatta Local government Area (LGA), around 18 kilometres west of Sydney's Central Business District (CBD) and adjacent to the Parramatta CBD. The bridge forms a crucial link in the road infrastructure network in the Parramatta LGA, providing vehicle and pedestrian access between the Parramatta CBD and residential areas to the north of the Parramatta River. As such, it is important to Transport for NSW that the bridge always remains in a serviceable condition.

Assessment of the bridge using the bridge health index (BHI), a performance measure used to assess the condition of the bridge elements and assist asset owners to understand the risk profile of bridges, identified the bridge as having a 'poor' rating. The 'poor' rating was a result of surface corrosion of the buckle plates, which require remedial works.

Proposal objectives

The objectives of the proposal are:

- remediate the bridge structure including the removal of hazardous materials (lead-based paint) from the existing bridge surface and completing structural works
- reduce future maintenance requirements
- retain the heritage value of the bridge.

Options considered

Options for the remedial works were considered during the design of the proposal. These included:

- Option 1 –Full rehabilitation works - the complete de-leading, corrosion rehabilitation, and repairs (both structural and non-structural) and repainting of the bridge (the preferred option)
- Option 2 – Partial rehabilitation works - involves hotspot remediation only; that is selected de-leading, corrosion rehabilitation and re-painting of the critical elements that were rated poorly
- Option 3 – Do nothing - The Do-Nothing option involves leaving the bridge in its current state and not undertaking any strengthening works or any removal of hazardous lead based paint.

Option 1 was the preferred option for the proposal as it best meets the objectives and criteria. Option 1 would result in a complete removal of lead and corrosion from the bridge structure, and repair of both structural and non-structural elements of the bridge, with the benefits of option 1 including:

- extending the life of the bridge and reducing future maintenance frequency which would reduce long term environmental, socio-economic, and health risk impacts by reducing the frequency of maintenance works
- reduce the requirement for future establishment and removal of scaffolding and containment systems which is a considerable source of disruption to the community
- remove all residual risk from hazardous material on the bridge structure
- help maintain the heritage values of the bridge by removing existing corrosion and damaged paintwork
- an improved visual aesthetic, as it would not result in a patchwork painting effect due to the complete re painting of the bridge.

Statutory and planning framework

The proposal is for the maintenance of road infrastructure facilities and is to be carried out on behalf of TfNSW and can therefore be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979 (NSW)*. Development consent from council is not required.

The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974*.

Community and stakeholder consultation

Consultation has been carried out with Parramatta City Council, Property NSW (formerly the Sydney Harbour Foreshore Authority), TfNSW and Sydney Ferries during preparation of the REF.

Given the nature and scale of the proposal, community notification would occur at least 5 days prior to the commencement of the proposal and include:

- start of work letter distributed to community and stakeholders
- out of hours work project updates posted on-line
- traffic alerts
- pedestrian/cyclist detour signage
- parking and site changes at Rangihou Reserve signage
- variable message sign strategy in place.

This REF will be published on the project webpage at www.transport.nsw.gov.au/projects/current-projects/maintenance-work-on-gasworks-bridge.

Environmental impacts

The main environmental impacts of the proposal are:

Traffic, transport and access

Construction of the proposal would require the partial closure of the bridge (Macarthur Street) throughout the duration of the construction activities, which are expected to take around four months. This partial closure would restrict vehicle movements to the southbound direction only, with all northbound traffic diverted via alternative routes. In addition, during construction, up to twelve full weekend shutdowns of the bridge would be required from 7pm Friday to 5am Monday. During this time, additional travel time would increase by between 5 and 10 minutes.

The option of implementing a tidal flow operation was investigated. This option would mean southbound only movements during the morning peak, and northbound only movements during the afternoon peak. However, traffic modelling identified that this would result in excessive queuing within the Parramatta CBD during the afternoon peak and was therefore not preferred.

The proposal would also impact public transport which use the bridge to cross the Parramatta River. Public buses would be diverted in accordance with the outcomes of consultation with TfNSW. Pedestrians and cyclists using shared pathways would be managed during shutdowns with alternative routes (via the Charles Street

Weir) and the new Alfred Street bridge which is currently under construction with a tentative opening date of August 2023.

Installation of the scaffolding and containment system, required to complete the works, would result in a reduced clearance
of a maximum of 1.62 metres between the scaffolding and the high tide water level. The reduction in clearance would impact the ability of the F3 Parramatta Ferry services to pass safely beneath the bridge and access the Parramatta Ferry Wharf. Fulton Hogan would consult with Transdev regarding the potential for impacts associated with a reduction in the clearance. Any access restriction for ferries operating on the Parramatta River would require coordination with Transdev and the potential requirement to replace ferry services with bus services.

Noise and vibration

During standard construction hours, noise levels are predicted to exceed relevant noise management levels at the nearest sensitive receivers during some stages of construction. Site establishment and demobilisation works present the greatest impact to the nearest residential receivers to the north of the proposal, where one residential property is expected to be highly noise affected during site establishment. Exceedances of the relevant noise criteria by up to 22dBA and 19dBA respectively are expected during these activities. Other exceedances of between 1dBA and 7dBA are expected during other activities. Residential properties to the north of the proposal site would experience the greatest level of impact during these activities, due to the close proximity of the property to the proposed site compound.

Construction of the proposal would require out of hours work, which would be limited to traffic management set up, bridge sealing works, and the installation and removal of the scaffolding and containment system. During these activities noise impacts are predicted to exceed relevant noise management levels at the nearest sensitive receivers. Exceedances of up to 13dBA are predicted the setup of traffic management, 12 dBA during bridge sealing works and up to 16 dBA during the installation and removal of the scaffolding and containment system. Residential properties to the north of the proposal site would experience the greatest level of impact during these activities.

The noise levels presented in this REF are conservative as predictions assume the noisiest plant operating at any point within the construction footprint to the receiver. In reality noise impacts are likely to be lower as plant items may not be operating simultaneously at all times and may be operating at further distance from some receivers. Works are expected to take place intermittently over any construction period and considering the spatial distribution of noise sources, so these exceedances would not be expected to occur continuously over the duration of the proposal. Noise levels are expected to be considerably lower than the above predictions for most of the works when mitigation measures are in place.

As a result of the predicted exceedances during both standard and out of hours works, noise mitigation and management measures would be required to effectively manage impacts at receivers.

Air quality

The main air emissions generated during construction of the proposal would be dust, lead, combustion emissions, volatile organic compounds (VOCs) and odour. All lead removal works would be completed in accordance with relevant lead removal guidelines to ensure risks to the community are minimised. The proposal would include the establishment of a negative pressure encapsulation (containment) system, and air quality monitoring throughout the duration of the remediation works. With the installation of this containment system, and other mitigation measures, such as implementation of an air quality management plan, there is a low potential for impacts to air quality from the proposal.

Biodiversity

Construction of the proposal would result in direct impacts (via trimming) of up to 0.02ha of mangroves (which would impact 13 individual mangroves), which form part of Plant Community Type 920 *Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion*. These impacts are minor and temporary, and the mangroves are likely to regenerate following the removal of the scaffolding and containment system.

The proposal occurs within land identified as 'proximity area for coastal wetlands' under State Environmental Planning Policy (Resilience and Hazards) 2021 (Resilience and Hazards SEPP). Any area that occurs within the Resilience and Hazards SEPP is classified as Type 1 – highly sensitive key fish habitat. Impact to areas of Type 1 fish habitat is generally prohibited by the NSW Department of Primary Industry, thus consultation would be undertaken prior to the commencement of remediation activities. In addition, as mangroves are classified as

Marine Vegetation under the *Fisheries Management Act 1994*, any cutting, removing, destroying, transplanting, shading or damaging in any way requires a Part 7 Fisheries Management Act Permit.

Justification and conclusion

The need for the proposal was justified under TfNSW's Sydney Road Assets Performance (SRAP) contract as the existing structure does not comply with the minimum standards. The assessment of the environmental and social impacts has determined the proposal is not likely to have a major impact and therefore assessment under Division 5.2 of the EP&A Act is not required.

Table of contents

Tables

Figures

1. Introduction

This chapter introduces the proposal and provides context for 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

Fulton Hogan on behalf of Transport for NSW (TfNSW) propose to complete remedial works on the Gasworks Bridge (the bridge) which is located over the Parramatta River on Macarthur Street in the suburb of Parramatta (the proposal). The bridge is a crucial link in the local road infrastructure network, providing vehicle and pedestrian access between the Parramatta CBD and residential areas to the north of the Parramatta River.

The bridge, constructed in 1885, is an iron lattice design with an overall length of 110 metres and a width of 10.3 metres. It consists of five spans, with three main spans, and two steel approach spans (at each end of the bridge). The bridge is supported on large concrete and sandstone piers. It contains two traffic lanes, and a pedestrian and cycle pathway along the western side and is of local historic significance (listed on the Parramatta Local Environmental Plan (LEP)).

An assessment of the condition of the bridge identified that the ongoing use and load rating is reduced due to the failing of the protective coating and surface corrosion. The proposal is required to ensure the bridge remains serviceable and complies with the current road and safety requirements, maintain safety for road users and pedestrians, and protect the heritage values of the bridge. To do this, the proposal would include:

- pavement works consisting of the sealing of the concrete deck of the bridge structure
- rehabilitation of Gasworks Bridge which would include:
    - removal of the existing lead paint coating from all wrought iron and steel elements of the bridge
    - application of a new protective paint and coating of all wrought iron and steel elements of the bridge (priming and coating works)
- bridge repair works (structural and non-structural) throughout the bridge structure.

Further details of the proposal are provided in section 3.1 and a detailed methodology in included in section 3.3.1.

The proposal is located within the City of Parramatta Local Government Area (LGA), around 18 kilometres west of Sydney's Central Business District (CBD) and adjacent to the Parramatta CBD. The location of the proposal and key proposal areas are shown in Figure 1.1. A detailed description of the proposal, including figures showing where each work activity would be undertaken is included in Chapter 3.

The bridge and Macarthur Street, provide a major throughfare for the local community connecting the Parramatta CBD, located to the southeast with the residential area of Parramatta to the north. A shared pathway is present on the western side of the bridge (refer to Photo 1-1 and Photo 1-2).

The proposal site includes public/open space along the Parramatta River as well as road infrastructure. The area surrounding the proposal consists of predominantly commercial land use to the south (associated with the Parramatta CBD) and medium density residential and educational facilities (Macarthur Girls High School) to the north.

Refer to section 6.9 for further information regarding the land use of and surrounding the proposal.

Figure 1.1: Location of the proposal

Photo 1-1: Gasworks Bridge, looking north

Photo 1-2: Gasworks Bridge, looking south

1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by WSP for Fulton Hogan on behalf of TfNSW For the purposes of these works, Transport is the proponent and determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979 (NSW)* (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 proposal and assessment of associated environmental impacts has been undertaken in the context of Section 171 of the Environmental Planning and Assessment Regulation 2021, the factors in *Guidelines for Division 5.1 assessments (DPE 2022)*, *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 (Commonwealth)* (EPBC Act).

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

- section 5.5 of the EP&A Act including that TfNSW examine and take into account, to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

- whether the proposal is likely to have a major impacts on the environment and therefore the necessity for an environmental impact statement to be prepared and approval sought from the Minister for Planning under Division 5.2 of the EP&A Act
- the significance of any impact on threatened species as defined by the BC Act and/or FM Act, in section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report
- the significance of any impact on nationally-listed biodiversity matters under the EPBC Act (https://www.awe.gov.au/environment/epbc), including whether there is a real possibility that the

activity may threaten long-term survival of these matters, and if offsets are required and able to be secured.

The potential for the proposal to considerably 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 Department of Climate Change, Energy, the Environment and Water 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

The bridge is a crucial link in the road infrastructure network in the Parramatta LGA, providing vehicle and pedestrian access between the Parramatta CBD and residential areas to the north of the Parramatta River. It is important to TfNSW that the bridge remains in a serviceable condition at all times.

The bridge is one of the 178 bridges included as part of the SRAP (River Zone) Contract. To assess and manage the health of bridges within the river zone, TfNSW uses the Bridge Health Index (BHI). The BHI is a bridge performance measure used to assess the condition of the bridge elements and is a method for bridge asset owners to understand the condition of bridge structures, and thus understand the risk profiles associated with each bridge. It is also used to determine what work needs to be done to establish an acceptable level of performance of the bridge structure.

The BHI allows asset owners to make decisions on the priority of bridges for maintenance, and for the allocation of resources. To do this, the BHI examines the condition of certain elements of a bridge then applies an importance or critical factor weighting to each element to give a final condition rating. For example, structural elements have a higher importance factor, than elements such as paint condition.

The bridge is the last of the bridges in the River Zone with a 'Poor' rating on the BHI (discussed further in section 2.2).

The proposal is required to:

- ensure the bridge remains serviceable and complies with the current road and safety requirements
- maintain safety for road users and pedestrians
- protect the heritage values of the bridge.

TfNSW are responsible for managing road related transport infrastructure and providing safe and efficient access to the road network for the people of NSW. The proposal incorporates TfNSW's Transport Environment and Sustainability Policy (2020), which states that:

Transport is a key enabler of economic and social activity. We are committed to delivering transport which contributes to economic prosperity and social inclusion in an environmentally responsible and sustainable manner, consistent with the Future Transport Strategy 2056.

2.2 Limitations of existing infrastructure

A level two inspection report completed in 2020 determined that in accordance with the BHI, the protecting coating of the bridge is failing and requires remedial works. The report identified surface corrosion on around 234m^2 of the surface area of the bridge, resulting 'poor' BHI rating due to deteriorated condition. The main contributing 'poor' element being surface corrosion of the buckle plates. As a result, the bridge is currently operating under a reduced load limit, and not meeting current engineering and safety standards.

2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives

The objectives of the proposal include to:

- remediate the bridge structure including the removal of hazardous materials (lead-based paint) from the existing bridge surface and completing structural works
- reduce future maintenance requirements
- retain the heritage value of the bridge.

2.3.2 Development criteria

The development criteria for the proposal include:

- minimise the environmental impacts from carrying out the proposal, including having an appropriate system to contain and dispose of hazardous materials containing heavy metals such as lead, which has been identified in the existing paintwork
- minimise disruptions to the community including nearby residents, commuters, and businesses.

2.3.3 Urban design objectives

Urban design objectives for the proposal include:

- preserve the heritage details of the bridge
- contribute to the accessibility and connectivity of the community
- contribute to the overall quality of the public domain for the community.

2.4 Alternatives and options considered

2.4.1 Methodology for selection of preferred option

To assess alternatives and options for the proposal methodology, a level two bridge inspection report was initially completed in 2020. This level two inspection report provided options for an initial program of maintenance works to restore the bridge. These options were then assessed by TfNSW considering whole of life management for each option. On selection of a preferred option, a level three bridge inspection and structural assessment was undertaken by WSP (on behalf of Fulton Hogan). The purpose of the level three bridge inspection report was to gather additional information on the existing bridge condition and to further inform the preferred option selection process. The level three bridge inspection concluded that the bridge is not theoretically capable to carry the loads to which it is currently rated for in the 2-lane configuration that the bridge is operated under.

Three options have been investigated to remediate bridge that addressed existing design issues. These were assessed against the proposal objectives and development criteria. Options are detailed in section 2.4.2. The preferred option was selected based on the ability of the option to meet the objectives of the proposal as outlined in section 2.3.1 and the criteria outlined in section 2.3.2.

2.4.2 Identified options

Option 1 – Full rehabilitation works

Option 1 involves the complete de-leading, corrosion rehabilitation, repairs (both structural and non-structural) and repainting of the entire bridge. It would involve all the steps outlined in Section 3.3, with an approximate construction period of four months.

Option 2 – Partial rehabilitation works

Option 2 involves hotspot remediation only; that is selected de-leading, corrosion rehabilitation and re-painting of the critical elements that were rated poorly. This option would involve limited steps as outlined in Section 3.3, and would require a reduced construction period of around three months due to the reduced surface area of de-leading works, and a reduced program of structural and non-structural repairs.

Option 3 – Do-Nothing

The Do-Nothing option involves leaving the bridge in its current state and not undertaking any structural works or the removal of the existing bridge coating which contains hazardous lead-based paint.

2.4.3 Analysis of options

To determine the preferred option, the advantages and disadvantages of options identified in section 2.4.2 were identified and were assessed against the objectives and criteria refer to Table 2.1. These have been summarised below.

Option 1 – Full rehabilitation works

Advantages

Option 1 would meet the BHI performance standards by ensuring all remediated elements achieve at least a minimum 'good rating'. Option 1 would result in a complete removal of lead and corrosion from the bridge structure, and repair of both structural and non-structural elements of the bridge, with the benefits of option 1 including:

- extending the life of the bridge and reducing future maintenance frequency which would reduce long term environmental, socio-economic, and health risk impacts by reducing the frequency of maintenance works
- reducing the requirement for future establishment and removal of scaffolding and containment systems which is a considerable source of disruption to the community
- removing all residual risk from hazardous material on the bridge structure
- helping to maintain the heritage values of the bridge by removing existing corrosion and damaged paintwork
- providing an improved visual aesthetic, as it would not result in a patchwork painting effect due to the complete re painting of the bridge.

Disadvantages

Selecting option 1 would:

- increase the number of weekend shutdowns of the bridge and requirement for traffic detours due to the increased duration of the proposal, with an estimated program of four months, compared with a three-month program for Option 2.

Option 2 – Partial rehabilitation works

Advantages

Option 2 would meet the BHI performance standards in the short term, by repairing elements of the bridge that rated poorly only, such as the buckle plates and degraded protective paint where they had failed. This option would:

- extend the life of the bridge
- partially remove lead-based paint from the bridge and partially remove residual risk from hazardous material on the bridge structure
- reduce the disruption to the local community with a construction period of three months compared with four months for option 1.

Disadvantages

Selecting option 2 would:

- not remove the need for major corrective maintenance in the future to address untreated areas of the bridge which had limited service life
- may result in further degradation of structural elements of the bridge, which already has a reduced load rating while traffic demands such as loads and volume are increasing

- not repairing non-structural aspects of the bridge, resulting in continued deterioration of these elements
- not completely de-lead the bridge, work which would be required in the future
- result in a patchwork effect as only hotspots are remediated, which may impact the heritage value of the bridge.

Option 3 – Do-nothing

Advantages

Selecting option 3 would:

- eliminate the construction impacts of the proposal and result in no disruption to the community.

Disadvantages

Selecting option 3 would:

- result in continued further decay of the paintwork and corrosion of structural steel, and as a result would fail to maximise the service life of the bridge and fail to maintain a safe and connected road network
- potentially result in compromised functionality of the bridge where further structural strengthening would need to be considered in the future
- increase future maintenance and result in additional disruptions to the community during ongoing maintenance works
- result in a continued deterioration of the bridge which may impact heritage values.

2.5 Preferred option

Option 1 (as described in section 1.1 and in more detail in section 3 is the preferred option for the proposal as it best meets the objectives and criteria (refer to Table 2.1). This option was supported by TfNSW, based on the level 3 bridge inspection report, which recommended a complete de-lead and recoating of the entire bridge structure, as well as the repair of both structural and non-structural elements of the bridge.

Option 1 provided the greatest benefit by maximizing the service life of the bridge and maintaining its continued and safe operation. This option would result in a reduction in the frequency of future maintenance and improve and retain the heritage values of the bridge while removing hazardous materials from the bridge surface.

While there would be some temporary disruption to the local community, option 1 would reduce the need for further maintenance works in the near term, thereby reducing further disruption at a later date.

Table 2.1: Evaluation of the options against the proposal objectives and development criteria

Objective/criteria	Option 1: Complete de-leading and rehabilitation works	Option 2: Removal of hotspots only	Option 3: The 'do-nothing' option
Proposal objectives			
Remediate the bridge by removing hazardous materials from the existing bridge surface and completing structural works.	**This option would meet** the objective, all hazardous materials would be removed from the bridge structure, thereby eliminating the risk of hazardous materials impacting the environment or human health. In additional this option would result in the rehabilitation of structural elements of the bridge.	**This option would not fully meet** the objective, as it would result in a partial removal of hazardous materials from the bridge structure, and the structural repair of only elements rates as 'poor'.	**This option would not meet** the objective, as it would result in the continued deterioration of the existing coating system containing hazardous materials potentially exposing the environment and community to hazards. It would also leave areas of the bridge with deteriorating structural elements.
Reduce future maintenance requirements	**This option would meet** the objective, as it would result in a complete remediation and repair of both structural and non-structural elements, and a complete replacement of the existing paintwork. This would eliminate the need for additional maintenance works to maintain the integrity of the bridge.	**In the short term this option would meet** the objective, as it would result in remediation of hotspots, reducing short term maintenance requirements, however in the long term, this option would not meet the objective, as future maintenance activities would be required to maintain the integrity of the bridge.	**This option would not meet** the objective, as it would require ongoing maintenance activities to maintain the safe operation of the bridge.
Retain the heritage value of the bridge	**This option would meet** the objective, as it would result in repairs to the structural integrity of the bridge as well as improve its amenity by replacing the damaged paintwork.	**This option would partially** meet the objective, as it would result improvements to the structural integrity of the bridge as well as repair the deteriorating paintwork in certain locations. It may however result in a patchwork effect, that may impact the heritage values of the bridge.	**This option would not meet** the objective, as it would result in the continued deterioration of structural elements of the bridge, and existing coating system.
Development criteria			
Minimise the environmental impacts from carrying out the proposal, including having an	**This option would meet** the objective. This option would have environmental impacts during construction which have been minimised during design development and would be managed during construction to limit impact.	**This option would meet** the objective. This option would have environmental impacts during construction which have been minimised during design development and would be managed during construction to limit impact.	**This option would meet** the objective, as there would be no potential for impacts from construction activities.

Objective/criteria	Option 1: Complete de-leading and rehabilitation works	Option 2: Removal of hotspots only	Option 3: The 'do-nothing' option
appropriate system to contain and dispose of hazardous materials containing heavy metals such as lead, which has been identified in the existing paintwork.			
Minimise disruptions to the community including nearby residents, commuters, and businesses.	**In the short term this option would not meet** the objective, as there would be disruption to the community due to traffic and access and noise impacts over the four-month program. **In the long term** however, this option would reduce the need for ongoing maintenance activities that would result in periodic community disruption.	In the short term this option would **partially meet the objective**, while there would be a similar level of disruption to the community, the duration of that disruption would be over a three-month program vs a four-month program for Option 1. In the long term however, this option **would not meet the objective** as additional maintenance activities would be required over time, resulting in periodic community disruption.	**This option would meet** the objective in the short term, as there would be no disruption to the community. In the long term however, if remedial works were not undertaken the structural integrity of the bridge may be compromised, this would result in a major disruption to the community.

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

As described in Section 1.1, the proposal involves remediation works on the (the bridge) which is located over the Parramatta River on Macarthur Street in the suburb of Parramatta. The proposal would involve remedial works consisting of pavement repairs, removal the existing bridge coating (containing hazardous lead paint), repainting with a polyurethane paint system, and the repair of both structural and non-structural elements of the bridge. This includes:

- pavement works consisting of the sealing of the concrete deck of the bridge structure (Spans 1-5)
- staged removal of the existing lead paint coating from all wrought iron and steel elements of the bridge
- application of a new protective paint and coating (blasting, priming and coating works)
- bridge repair works (structural and non-structural) including:
    - remediation of structural steel elements of the bridge
    - repair/replacement of corroded rivets
    - treatment of flame cut holes
    - cleaning bridge scuppers (drainage)
    - removal and replacement of mesh screen on pedestrian walkway on western side of the bridge
    - removal and replacement of a 20m rail section on eastern side of the bridge(like-for-like)
    - replacement of timber planks (like for like) on walkway on western side of bridge including re-fixing loose timbers and removing splintering sections
    - removal and replacement of existing W beams on roadside truss
    - Removal of redundant gas main on eastern side of bridge, which would include the removal of bolts and lifting of sections of the pipe for offsite removal (in accordance with waste disposal guidelines)
    - cleaning and removal of moss, vegetation and graffiti from bridge piers
    - rectification of concrete spalling and cracks.

Figure 3.1 shows the layout of the proposal site with additional detail (including the location of specific activities) included in section 3.2.3 and shown on Figure 3.5 and Figure 3.6.

Figure 3.1: Key features of the proposal

3.2 Design

3.2.1 Design criteria

The design criteria for the proposal includes:

- Australian Bridge Design Code (Standards Australia,1996)
- Australian Standard (AS) AS5100 – *2017 Bridge Design*
- Roads and Maritime Services Technical Directions and Specification
- TfNSW Specifications B223 (*Management of Lead Chromium and Asbestos in Bridge Maintenance Painting*) and B220 (*Protective treatment of Bridge Steel Work*)
- *TfNSW B220 – Protective Treatment of Bridge Steelwork*
- *Australian Standard/New Zealand Standard (AS/NZS) 4576 Guidelines for scaffolding* and *AS/NZS 1576 Scaffolding – General requirements*
- *AS/NZS 4361.1: Guide to hazardous paint management, Part 1: Lead and other hazardous metallic pigments in industrial applications.*

The work involves the removal of lead-based paint. A containment system would be installed in accordance with *AS4361.1.* The required method for paint removal is by abrasive blasting using garnet. According to Table EI in Appendix E of the AS4361.1, the Emission Category is I. The containment system would be designed in accordance with the requirements of Table EI of the standard for this emissions category.

Final paint coat would closely match the existing colour scheme (RMS Bridge Grey as per TfNSW Specification B220).

3.2.2 Engineering constraints

Engineering constraints of the proposal primarily relate to the location of the bridge over a large water body and the requirement to completely contain the work due to the presence of lead-based paint. The proposal requires both partial and full closure of the bridge and portions of Macarthur Street, on a number of occasions during construction, with the use of alternative detour routes.

Access under the bridge by boats and other vessels would generally be maintained with some restrictions. The exception to this is during the installation and dismantling of scaffolding and the containment system on bridge span number 3 (refer to Figure 3.9), which would require the shutdown of ferry services. Pedestrian access would be maintained under restrictions. There may be periodic requirements to divert pedestrian and cycle traffic to alternative crossings of the Parramatta River (refer to Section 6.1).

3.2.3 Major design features

The major design features of the proposal are described in the following sections.

Pavement works

To prevent water from percolating though the bridge deck, all existing cracks on the concrete bridge deck would be sealed. These works would occur across the entire concrete bridge deck by applying a low viscosity liquid sealant (KBP Flex) (refer to Figure 3.2). This would be applied to the concrete bridge deck to fill in cracks and prohibit water entrapment which is currently leading to corrosion of the bridge buckle plates.

Figure 3.2: Location of the proposed pavement works

Blasting and re-painting works

A full de-lead and recoating of new protective paint would be undertaken as part of the proposal for all wrought iron and steel elements of the bridge structure. Elements of the bridge to be de-leaded include:

- longitudinal girders
- cross girders
- top chords
- bottom chords
- truss.

A typical section illustrating some of the steel elements of the bridge to be de-leaded is shown in Figure 3.3, and the extent of the bridge structure is shown in Figure 3.6

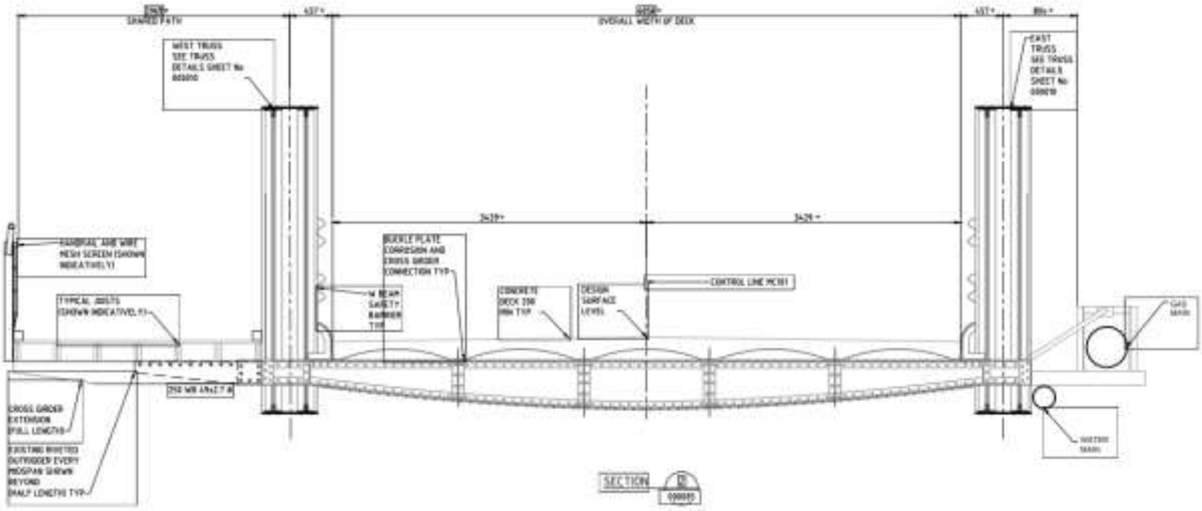


Figure 3.3: Typical section of the bridge steel elements

To ensure the protection of the public and the environment (including the Parramatta River), a containment system would be installed around the bridge structure. The scaffolding and containment system would be provided across all five spans of the bridge in a staged approach. The scaffolding would be designed in accordance with *AS/NZ 4576 Guidelines for scaffolding* and *AS/NZS 1576 Scaffolding – General requirements* and the design of the containment system will be in accordance with *AS/NZS 4361.1:2017 Guide to hazardous paint management*. Features of the scaffold and containment design include:

- ground based scaffolding system for spans over land
- hanging scaffolding system for spans over water
- fully encapsulated perimeter utilising HDPE as material for containment floor and marine ply hoarding and shrink wrap sheeting for containment walls and ceiling.

The indicative design of the scaffolding system is shown in Figure 3.4 and a preliminary design of the containment system is shown in Figure 3.5.

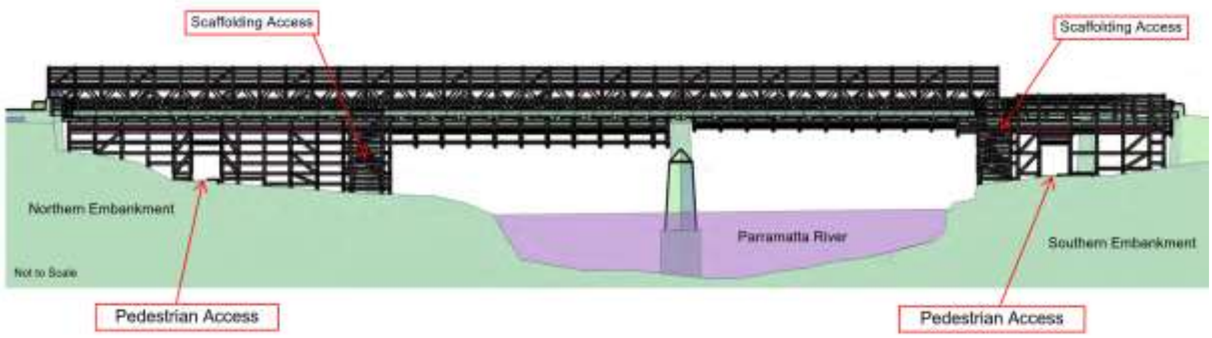


Figure 3.4: Indicative details of the scaffolding system

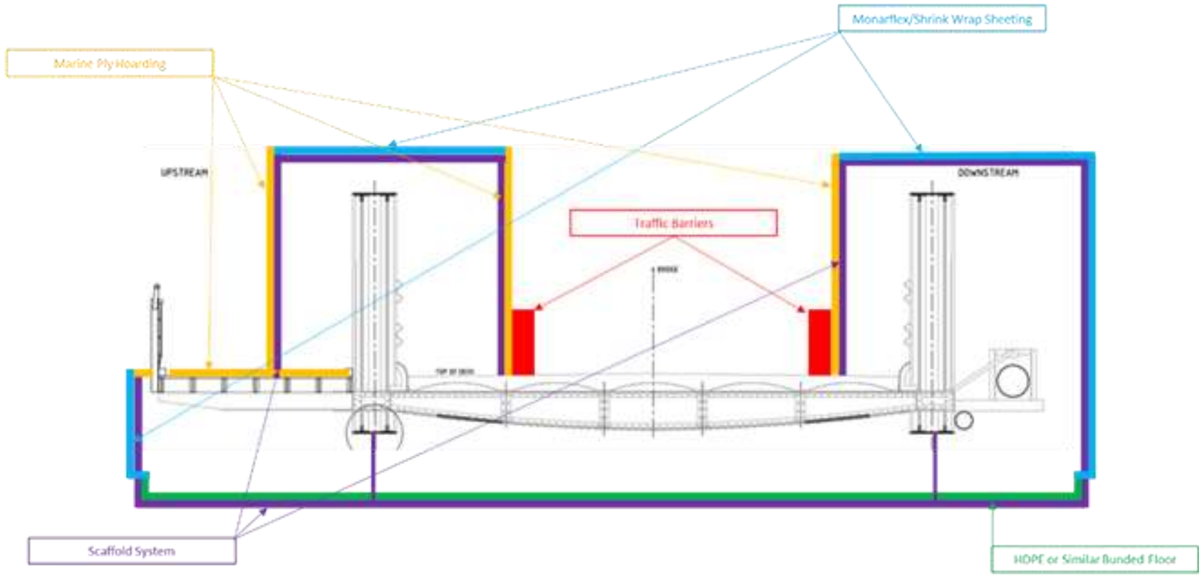


Figure 3.5: Preliminary design of the containment system

The final paint coat of the bridge would closely match the existing colour scheme which would be RMS Bridge Grey and would be carried out as per *TfNSW B220 – Protective Treatment of Bridge Steelwork*.

Bridge repair works

The bridge repair works proposed include both structural and non-structural works across a number of areas of the bridge structure. These works include:

- remediation of structural steel elements of the bridge would be carried out where section loss has impaired its structural integrity. The steel elements that require remediation works are located on bridge spans 1, 3 and 5. Examples of areas where remediation is required is show in Photo 3.1 and 3.2. Remediation of identified elements would be carried out by installing strengthening plates over the affected area
- repair/replacement of corroded rivets at various locations throughout the bridge structure
- the treatment of existing flame cut holes which are located primarily across the bottom chords of the bridge. The treatment of the flame cut holes would involve the drilling of oversized holes and grinding smooth the edges of the existing holes to prevent the possibility of crack propagation
- cleaning bridge scuppers (drainage)
- removal and replacement of mesh screen on pedestrian walkway on western side of the bridge
- the removal and replacement of a 20m rail section on eastern side of the bridge (like-for-like)
- replacement of timber planks (like for like) on walkway on western side of bridge including re-fixing loose timbers and removing splintering sections
- removal and replacement of existing W beams on roadside truss
- removal of redundant gas main on eastern side of bridge, which would include the removal of bolts and lifting of sections of the pipe for offsite removal (in accordance with waste disposal guidelines)
- cleaning and removal of moss, vegetation and graffiti from bridge piers
- rectification of concrete spalling and cracks at various locations within the bridge structure.

The location of each activity associated with the bridge repair works is shown on Figure 3.6

Photo 3-1: Example of section loss on edge of flange

Photo 3-2: Example of section loss on cross girder

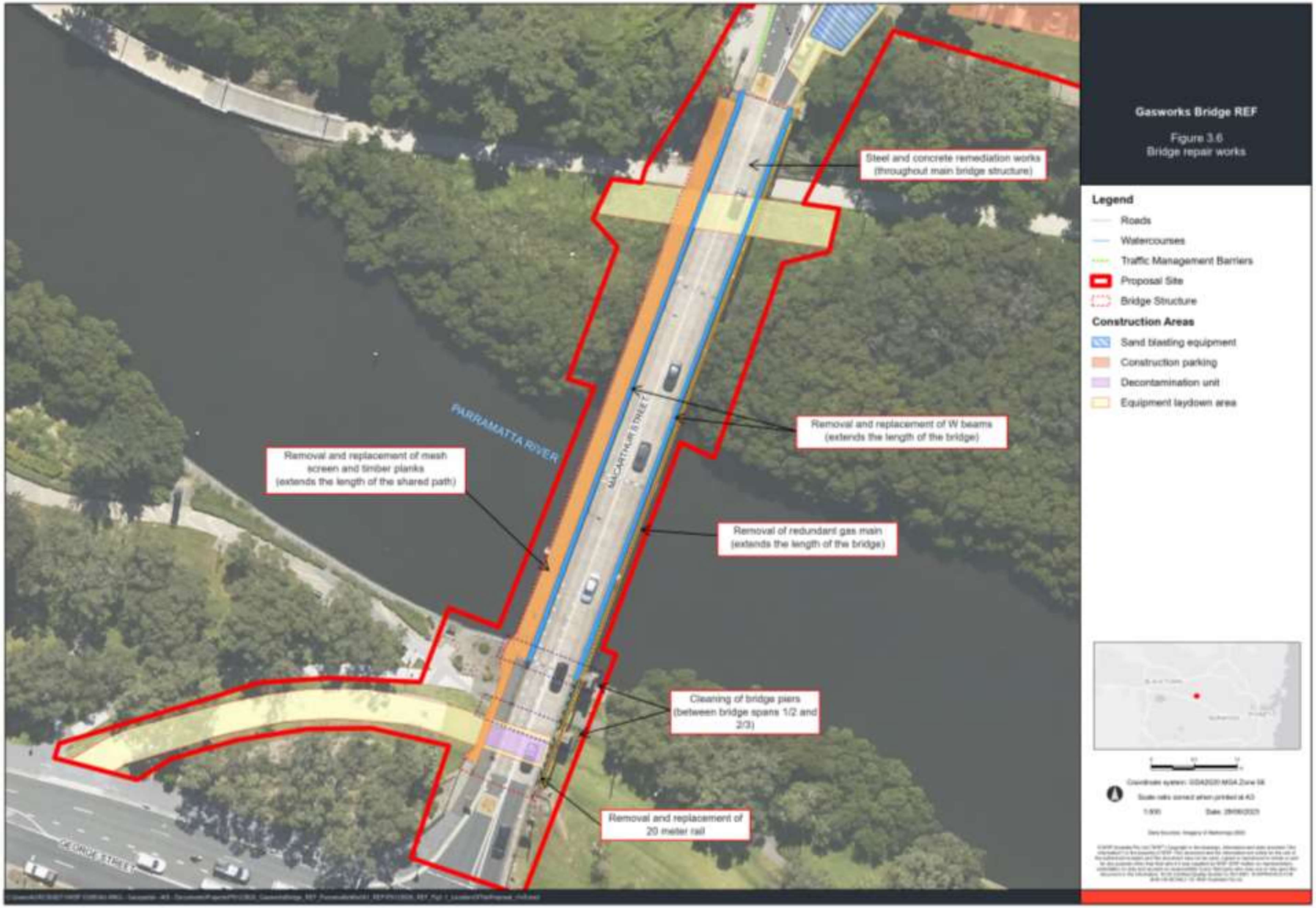


Figure 3.6: Location of the proposed bridge repair works

3.3 Construction activities

3.3.1 Work methodology

Subject to approval, the proposal is expected to commence in Quarter 3 2023 and take around four months to complete. The indicative proposed construction activities and approximate durations for the proposal are identified in Table 3.1 and further discussed in this section, noting there is likely to be some staging and overlap in the construction stages identified.

Table 3.1: Proposed staging and duration of construction activities

Stage	Activities	Approximate timing
Site establishment	• pre-construction soil sampling • delivery and installation of temporary fencing for site compound and laydown areas • establishment of environmental controls • clearing of surface vegetation for laydown areas • trimming of mangroves adjacent to the bridge • installation of hardstand at site compound and laydown areas • delivery and installation of site sheds and amenities to site compound • connection of temporary utilities (power, water etc) to side compound • installation of works zone signs (including, pedestrian controls and navigation signage as required on the Parramatta River) • installation of decontamination unit at site compound.	7 days
Bridge Deck sealing works	• complete sealing of the concrete bridge deck including any existing cracks.	3 days
Set up traffic management	• closure and temporary detour of Macarthur Street and the bridge • installation of temporary steel barriers • temporary relocation of the existing zebra crossing.	3 days
Scaffolding/ containment system installation	• installation of scaffolding system • installation of containment system • location and protection of existing services and utilities • installation of high-volume air samplers (air monitoring equipment).	30 days
Blasting, priming and coating works	• cleaning and surface preparation • water washing of surfaces and storage of waste materials • removal of existing lead-based coating system using abrasive blasting, power tools and hand tools • transfer and safe storage of spent abrasive and hazardous materials • removal of hazardous coatings to licenced disposal facility • priming and painting.	55 days

Stage	Activities	Approximate timing
Bridge repair works	• repair of structural elements of the bridge • repair/replacement of corroded rivets • treatment of flame cut holes • cleaning of bridge scuppers (drainage) • replacement of mesh railing on bridge walkway • replacement of 20 metres of rail on east side of bridge like-for-like • remove splinters and sand timber planks • remove and reinstall W beams on truss • remove redundant gas pipe on eastern side of bridge • cleaning of graffiti, moss and vegetation (using high pressure wash) on bridge piers on southern embankment • repair concrete spall (concrete which has broken away from the subsurface) • removal/disposal of waste materials.	15 days
Removal of containment system and dismantling of scaffolding	• cleaning and dismantling of scaffold • removal and disposal of containment system including ground based and hanging scaffold.	15 days

Demobilisation	• removal of steel barriers and vehicle crash protections (crash cushions)
	• removal of environmental controls
	• removal of all site sheds and facilities from site compound
	• removal of all plant and equipment from site compound/laydown areas
	• post-construction soil sampling
	• reinstate site compound and laydown areas to pre-construction condition, including:
	  ▪ removal of hardstand
	  ▪ import and install turf underlay
	  ▪ reinstate turf in affected areas
	• removal of site fencing from site compound and laydown areas
	• removal of temporary works signage and reinstate signage and line marking on the bridge
	• completion of site clean-up works
	• final inspection and handover.
		5 days

Site establishment

Site establishment works would include:

- a pre-construction survey of the proposal site, including a detailed photographic record of the existing site conditions, ground surfaces, vegetation, and infrastructure within the proposal site (refer to Figure 3.1)
- baseline soil testing for contaminants of concern within surface soils within the proposal site compound
- installation of temporary fencing around the perimeter of the proposal site (including the site compound and equipment laydown areas) in addition to temporary hoarding (plywood) to separate the public from work areas
- establishment of environmental controls
- clearing of surface turf and vegetation for equipment laydown areas
- trimming of up to 13 mangroves on the northern bank of the Parramatta River (either side of Span 4), to provide a 0.5 metre separation between the bridge structure and the mangroves along the edge of the bridge, and a 1.6 m separation from the underside of the bridge. This trimming would allow the installation of the scaffolding and containment system (refer to Section 6.4)
- installation of a hardstand at the site compound and equipment laydown areas
- establishment of a site office and amenities within the site compound area to the north of the bridge
- establishment of all equipment laydown areas (refer to Figure 3.1), including installation of the decontamination unit in the southern laydown area beneath span 1 of the bridge
- connection of temporary utilities (power, water etc) to the site compound
- installation of work zone signs and navigation signage on the Parramatta River, as required, and based on consultation with Transdev (the operator of Sydney Ferries).

Pavement works - Bridge deck sealing

The sealing of the concrete bridge deck would be undertaken following site establishment works. As outlined in Section 3.2.3 these works are required to prevent water from percolating through the bridge deck, which is contributing to the existing corrosion of the bridge buckle plates. To complete these works, following cleaning (to remove foreign materials), a low viscosity liquid sealant (KBP Flex) would be applied to the entire concrete bridge surface. Application would be via hand tools (as per the manufacturers specifications) using a squeegee, roller, broom of low-pressure sprayer to distribute the material evenly across the bridge deck. Due to the requirement to access the entire bridge surface, these works would be completed during a weekend shutdown of portions of Macarthur Street and closure of the bridge, with traffic detours in place (refer to Section 3.3.3 and 3.3.7).

Traffic management and set up of the final equipment laydown area

The installation of temporary steel barriers would be required to allow for the assembly of scaffolding on spans three, four and five of the bridge (refer to Figure 3.1). This would require:

- closure and temporary detour of Macarthur Street and the bridge
- delivery and installation of end treatments
- temporary relocation of the existing zebra crossing (around 50 metres to the north)
- adjustments to signage and line marking.

All traffic management would be undertaken in accordance with the Traffic Management Plan developed for the proposal.

On completion of this traffic management set up, the equipment laydown area to the north of the bridge, within the existing south bound lane of Macarthur Street would be established (refer to section 3.4). This laydown area would contain the blasting equipment required to complete the remediation works such as the dust collector, interceptor bin, blast hopper, compressor, generator and skip bin.

Installation of scaffolding and containment system

The scaffolding would be designed and installed to provide safe access suitable for the installation of the containment system and minimise disruption to traffic on the bridge, shared pathways beneath, and boat/ferry traffic on the Parramatta River.

The scaffold and containment system would include ground based scaffolding system for spans over land, hanging scaffolding system for spans over water. The scaffolding would then be fully encapsulated utilising HDPE as material for containment floor and marine ply hoarding and shrink wrap sheeting for containment walls and ceiling.

For spans of the bridge accessible from the ground, a traditional scaffolding system would be installed from the ground up. For spans over the waterway, a drop deck system (or similar) would be installed which would hang below the bridge structure. Access stairs would be installed at both bridge piers, and pedestrian access would be maintained on pedestrian and shared pathways on both the northern and southern banks of the river.

The scaffolding and containment system would be installed (and then dismantled) in stages, by qualified personnel and would be inspected on a regular basis throughout the duration of the Proposal. To maintain pedestrian access to the existing shared pathway beneath Spans 2 and 5, scaffolding would contain tunnel hoarding to maintain access, along with temporary lighting. Access would be managed during installation.

The purpose of the containment system is to ensure all hazardous materials generated (in this case, mostly waste lead paint from the bridge structure) are confined within the system, act as a secondary defence to prevent the release of hazardous materials to the environment and facilitate the controlled collection of waste for disposal. Once installed, all works involving the removal of lead-based paint (including pre-washing of surfaces) would be undertaken within this containment system.

The containment system would be constructed with a protective film (geofabric) laid on the entire working deck of the scaffold to act as a secondary defence to prevent escape of any lead waste including fugitive dust or paint flakes. The containment system would include:

- a layer of impermeable HDPE or VLDPE sheeting would be installed for the containment floor with the overlapping joints weld sealed to ensure a robust impermeable floor that would be easily cleaned of spent abrasive and lead paint residue
- the side walls would be comprised of impermeable heavy duty plastic sheeting. The transition of the side walls to the bridge deck and over the trusses will be pitched to prevent water ponding on the containment system
- airlocks would be installed at the access stair entrances to the containment system to ensure controlled entry and exit during the coating removal process to prevent the escape of the hazardous coating material to air
- the ventilation and extraction system for the removal and extraction of dust, lead and potentially VOCs would comply with the requirements prescribed in the *AS/NZS* 4361.1: 2017, Guide to hazardous paint management, Part 1: Lead and other hazardous metallic pigments in industrial applications, this would include dust collectors to ensure discharged air is free of hazardous materials. The air discharge point would be sited at a location to ensure adequate dispersion of air. The emission point height would be at least 3 metres above the height of the containment system.

To ensure the integrity of the containment system, a negative pressure test would be completed at the commencement of remediation works as per *AS/NZS* 4361. In addition, daily visual emission checks would be undertaken.

Indicative details of the scaffolding and containment system are shown in Figure 3.7.

Figure 3.7: Indicative details of the scaffolding and containment system

All bridge drainage would be cleaned of foreign material and then diverted through the containment system (for capture and disposal at a licensed facility), preventing the pooling of water and preventing any water escaping the system that would contaminate waterways or result in exposure to the public.

Remediation works (blasting)

The existing lead-based coating system would be removed from all wrought iron and steel elements of the bridge (refer to 3.2.3), using a dry abrasive blast cleaning method. The de-leading works will be carried out as per *AS/NZS 4361.1:2017 Guide to Hazardous Paint Management* and *TfNSW B223 Management of Lead, Chromium, and Asbestos in Bridge Maintenance Painting*.

All existing services located within the containment area of the bridge would be protected during the blasting to prevent damage. The dry abrasive blast cleaning method involves use of an abrasive blasting unit (which would be in the equipment laydown areas within the south bound lane of Macarthur Street) with hoses transporting blasting materials (Australian Garnet), and a vacuum system to extract the waste blast media, as well as a dust extraction system.

Pre-cleaning works will be carried out prior to blasting to remove all grease, oil and contaminants using neutral detergent, oil emulsifier-degreaser or similar. All cleaning activities would be undertaken within the containment system, with all water captured and disposed of in accordance with waste guidelines.

All nominated areas of the bridge would be blasted to a minimum blast class of SA 2½, which is a surface preparation grade resulting in thorough blast cleaning. This would remove all traces of lead-based paint, and other foreign matter from the steel surface, where accessible. To carry out repairs on the steel trusses from the bridge roadway and where the abrasive blasting method is not suitable, a range of vacuum shrouded abrasive blasting equipment or vacuum shrouded power tools would be used.

The removal of hazardous material would be undertaken daily using a vacuum loader to ensure the volume does not exceed load limits of the containment system. A vacuum loader hopper would collect the waste in bulk bags on pallets which would then be wrapped, labelled, and stored in the secured designated hazardous storage area within the equipment laydown areas A and C (refer to Section 3.4), depending on the area of the bridge works are occurring on. Waste materials would be stored in labelled bags prior to disposal at a licensed waste disposal facility. The removal and disposal of the lead-based paint would be completed in in accordance with NSW waste guidelines and regulations.

Remediation works (priming and coating)

On completion of blasting (the removal of the existing coating system) and following testing of the surface, water washing will take place to remove salt from the surface of the steel. All solid and liquid waste produced from this activity would be collected, stored, handled and disposed of in accordance with NSW regulations. Waste will be collected and stored in waste disposal bins, ready for removal and disposal to an approved waste facility.

A prime coat is preparatory coating applied to the surface before painting, to provide a better paint finishing. The application of the prime coat would be undertaken using spray painting equipment. The application and testing of the prime coat would be in accordance with TfNSW *Specification B220 - Protective Treatment of Bridge Steelwork* and the paint manufacturer's recommendations.

Stripe painting would be carried out after the prime coat has been applied using a combination of brushes and rollers. All welds, nuts, bolts, rivets, sharp edges, and hard-to-reach areas will have a stripe coat applied prior to the final spray coats.

The application of the final coat would be carried out using a combination of brushes, rollers, spray painting equipment. The final paint coat of the bridge will closely match the existing colour scheme which will be RMS Bridge Grey. The application and testing of the new coating system would be carried out in accordance with TfNSW *Specification B220* and the paint manufacturer's recommendations.

All existing services located within the containment area of the bridge would be protected during priming and coating activities.

Bridge repair works

Following the removal of the existing coating system, miscellaneous bridge repairs would be undertaken. These works would be undertaken concurrently with the priming and coating of the bridge structure. This stage of works would involve:

- the repair of structural elements of the bridge, via the installation of strengthening plates where the structural integrity of the bridge has been lost
- installation of new high strength M20 bolts to areas of the bridge with missing and heavily corroded rivets
- treatments to existing flame cut holes to prevent future corrosion by drilling oversized holes and grinding smooth the edges
- cleaning bridge scuppers (drainage) with waste materials collected and transfer to the waste storage area for offsite removal (in accordance with waste disposal guidelines)
- removal and replacement of mesh screen on pedestrian walkway on western side of the bridge
- removal and replacement of a 20m rail section on eastern side of the bridge, like-for-like
- like-for-like replacement of timber planks on walkway on western side of bridge including re-fixing loose timbers and removing splintering sections
- removal and replacement of existing W beams on roadside truss
- removal of redundant gas main on eastern side of bridge, which would include the removal of bolts and lifting of sections of the pipe for offsite removal (in accordance with waste disposal guidelines)
- removal of moss, vegetation and graffiti from sandstone bridge piers at Spans 1 and 2 via pressure washing
- repair concrete spall (concrete which has broken away from the subsurface).

All lead risk works (that is where lead coating system is present) would be completed within the containment system to avoid the potential for hazardous waste materials being released to the environment.

Removal of containment system and dismantling of scaffolding

On completion of remediation and bridge repair works on each bridge span, the scaffolding and containment system would be cleaned, dismantled and removed from the proposal site. This would occur in a staged approach as remedial works are completed on each bridge span.

Cleaning of the containment system and scaffolding would include vacuuming and wet wiping of all containment walls, floor covers, and scaffolding to collect paint flakes and settled dust. It would also include the cleaning of the hollows of scaffolding poles to remove all residual dust.

On completion of works on the final bridge span, this would also include the cleaning and removal of dust extractors, waste recovery equipment, the removal of all liquid waste from the decontamination units, and the transfer of all remaining general waste and hazardous waste materials to an appropriately licensed disposal facility in accordance with all relevant waste classification and waste transportation guidelines.

Demobilisation

Once works are completed, proposal site demobilisation would occur. Including the:

- removal of traffic management controls (steel barriers)
- removal of all environmental controls
- disconnection of temporary utilities (power, water etc) to the site compound
- removal of the site compound, laydown areas and all environmental and pedestrian controls (using traffic control)
- restoration of disturbed areas including the site compound areas to pre-construction condition, including the removal and disposal of hardstand and installation of turf to affected areas
- removal of site fencing and any temporary works zone signage and reinstate signage and line marking to allow for a resumption of two-way traffic flow
- completion of post construction clearance soil sampling
- completion of a final inspection and handover.

3.3.2 Construction workforce

The proposal would require a construction workforce of approximately 10-15 people depending on the stage of work and activities being undertaken.

3.3.3 Construction hours and duration

The proposal would be undertaken during standard (NSW) Environment Protection Authority (EPA) standard construction hours (SH), which are:

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

Out of hours works (OOHW) would be required to minimise disruptions to pedestrians, motorists, and nearby sensitive receivers; and to ensure the safety of the construction workers and operational assets.

The OOHW would include the installation and subsequent removal of scaffolding and the containment system, as well as bridge sealing works. These activities would be undertaken during weekend shutdowns (where the bridge and a portion of Macarthur Street is closed to vehicle traffic in both directions), extending from around 8pm Friday to 5am Monday. A total of twelve weekend shutdowns are expected to be required.

Additional details on the weekend shutdowns are included in Section 3.3.7.

3.3.4 Plant and equipment

The plant and equipment likely to be used during construction would include, but not be limited to:

- Ablution facilities
- Air compressors (large or small)
- Dust extraction unit(s)
- Decontamination unit
- Dust collector
- Delivery trucks
- Roller
- Crib sheds
- Excavator
- Elevated work platforms
- Floats
- Generators
- High volume air samplers (air monitors)
- High pressure wash
- HIAB/Franna crane
- Light vehicles (including traffic control vehicles)
- Lighting towers
- Other power tools (vacuum shrouded)
- Oxy-acetylene torches
- Airless pumps and paint equipment.

- Telescopic handlers
- Toilet blocks
- Trucks
- Vacuum
- Vacuum loading machines
- Water cart
- Water blaster

3.3.5 Earthworks

The proposal would not require any excavations or earthworks. Minor turf clearing and minor clearing of landscaped vegetation would be required at site compound and laydown areas (refer to Figure 3.1). These areas would be reinstated at the completion of the proposal.

3.3.6 Source and quantity of materials

The indicative materials to be used for the proposal would include, but not be limited to those shown in Table 3.2.

Table 3.2: Proposed materials required

Materials	Approximate Quantity
Blast material	70 tonnes
Paint	6,000 litres
Thinners	1,000 litres
Diesel	28,000 litres
Timber lengths	100 lineal metres
Marine ply board	96 square metres
Galvanised steel sheeting	240 square metres
Geotextile fabric	400 square metres
Plastic sheeting	500 square metres
Containment sheeting	5,280 square metres
Silicone/sealant	20 litres
Fasteners/screws	3000 units

3.3.7 Traffic management and access

Due to the narrow width of the traffic lanes, works on sections of the bridge that can only be accessed from the roadway would need to be undertaken under modified traffic arrangements to ensure compliance with applicable safety requirements. Accordingly, the proposal would require partial and full closures of Macarthur Street and the bridge at various times during construction, in addition to the closure of a number of parking spaces at the northern area of the proposal site.

An extended partial closure of the bridge would be required to facilitate construction access. This would require reducing traffic to a single lane in a southbound direction only, for the full duration of the proposal. All northbound traffic movements would be directed via two local detours (see further details below). No private property access would be impacted during this extended partial closure.

Full closure of the bridge would occur across twelve weekends throughout the construction period which would require detours for both northbound and southbound vehicles (see Figure 3.8). Detours during weekend shutdowns would include:

Northbound Detours

Due to the large traffic volumes on James Ruse Drive, two northbound traffic detour routes are proposed to split the demand of detoured vehicles accessing James Ruse Drive across two intersections, coupled with a communications and VMS strategy to encourage alternate routes or mode shifts throughout the works. The two northbound detours would use the following routes.

- one detour route which would travel down George Street, Alfred Street, River Road West, James Ruse Drive, Victoria Road and back to Macarthur Street
- an alternate detour route which would travel down George Street, Harris Street, Hassall Street, James Ruse Drive, Victoria Road and back to Macarthur Street.

Southbound Detour

- a southbound detour which would travel via Victoria Road / or Thomas and Elizabeth Street to Wilde Avenue and back onto George Street.

During the extended partial closure, northbound traffic would follow the same route described above, with southbound movements unaffected.

Figure 3.8: Traffic detour routes during weekend shutdowns of the Gasworks bridge

The proposal would require up to 15 heavy vehicle movements per day to deliver equipment and remove material during site establishment, installation and decommissioning of scaffolding and the containment system, and site demobilisation. These works are expected to take around 47 days to complete and would generally be undertaken on commencement of the proposal and at the end of the proposed works. Heavy vehicle haulage routes are shown on Figure 3.9.

During the installation and removal of scaffolding, due to access constraints from Macarthur Road, heavy vehicle access to the northern laydown area (beneath the bridge) would be required from Rangihou Crescent to the east of the proposal site, via the existing shared pathway. This access would require temporary pedestrian/cyclist management (refer to Figure 3.10).

During the remainder of the proposal, it is expected that 12 light vehicles would access the proposal site daily, with periodic heavy vehicle movements to remove waste materials.

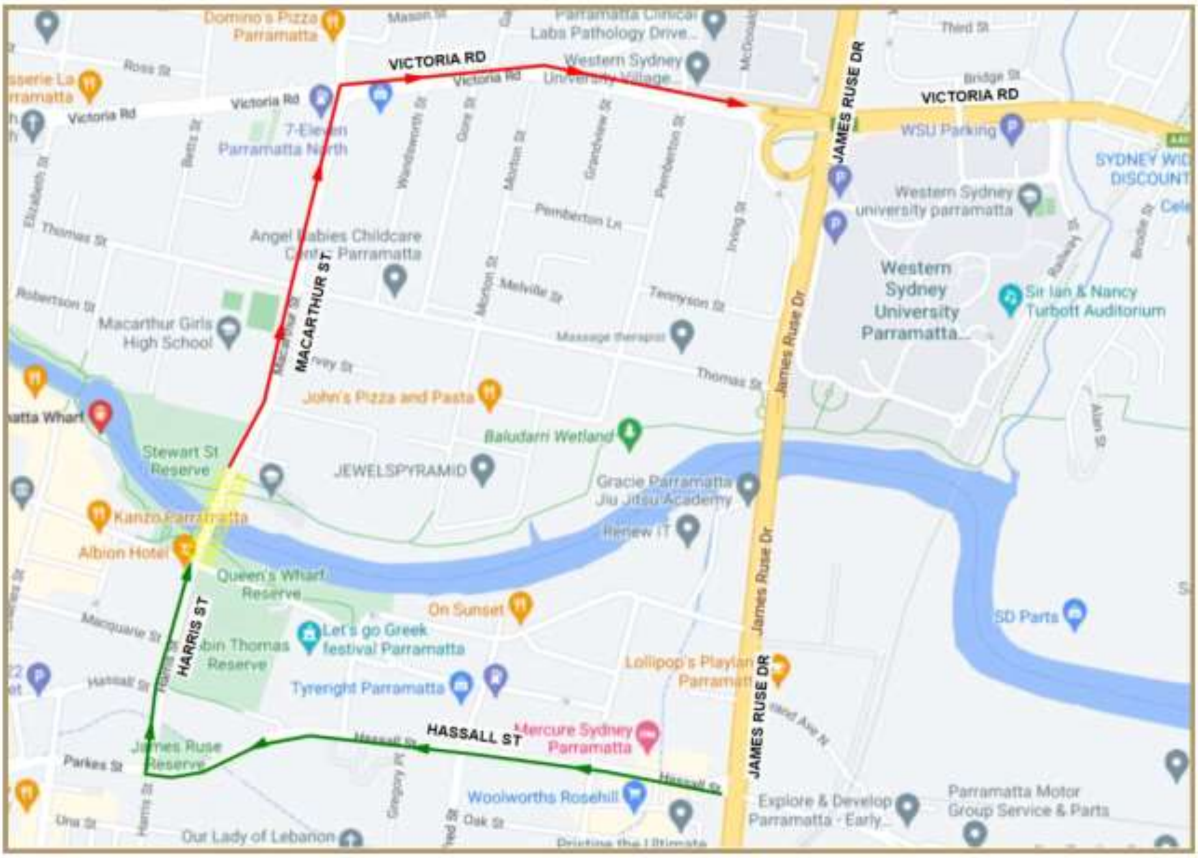


Figure 3.9: Heavy vehicle haulage routes

Further discussion of potential transport, traffic and access impacts is provided in Section 6.1.

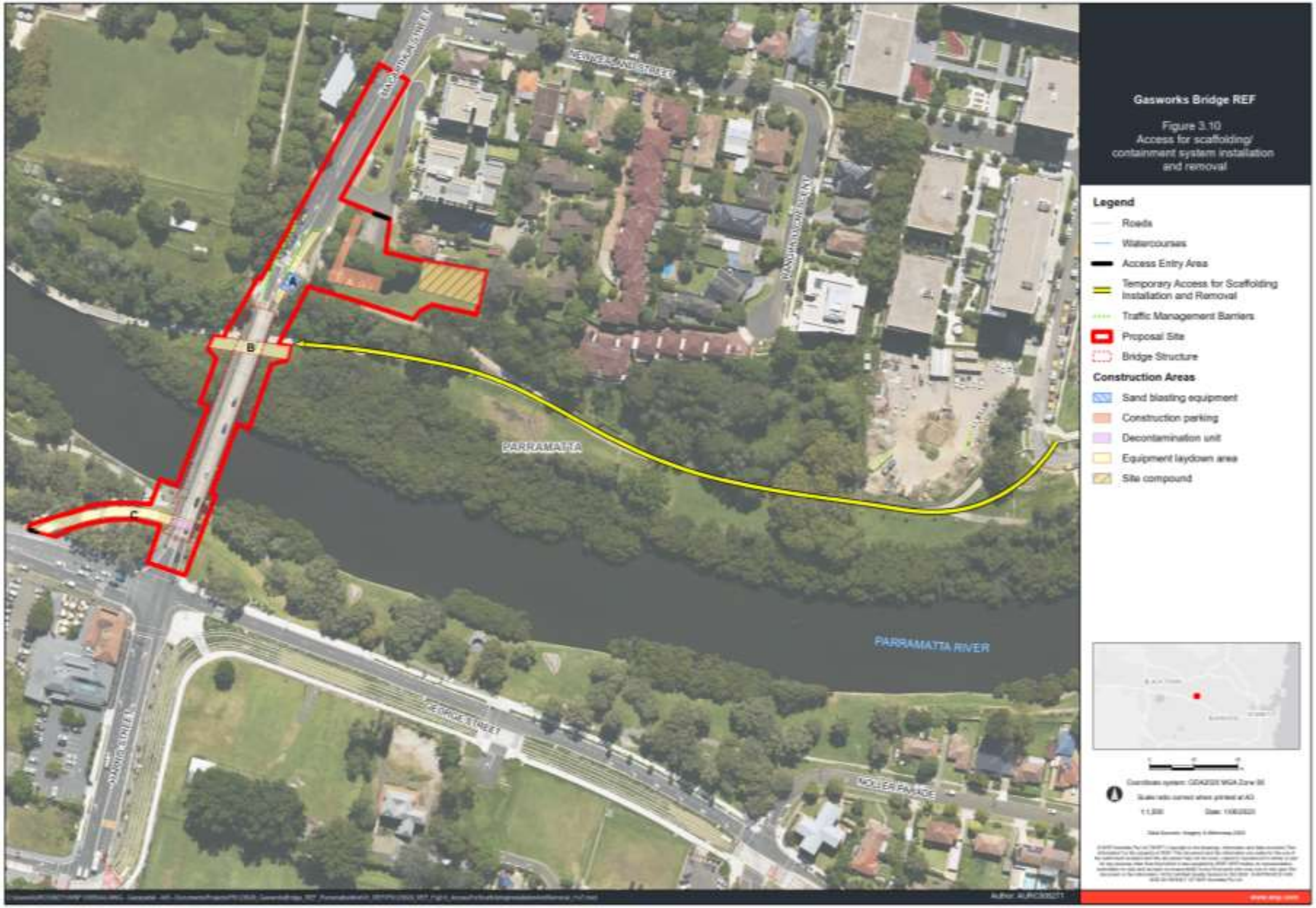


Figure 3.10: Access for scaffolding/containment system installation and removal

3.4 Ancillary facilities

Temporary construction site compound and laydown areas would be required to accommodate a site office, amenities, equipment laydown, on-site fabrication workshops and storage areas for materials (refer to Figure 3.1).

These areas comprise:

- one main site compound at the northern side of the bridge, east of Macarthur Street on cleared land, covering an area of around 420 square metres. The area is considered part of the Rangihou Reserve. Access to this site compound would be via the existing car parking area to the immediate north of the bridge. The site compound would contain crib sheds, site office and amenities
- an equipment laydown area (Area A) to be installed within the existing south bound lane of Macarthur Street and adjacent to the northern approach of the bridge. This area covers around 315 square metres and would be used to locate equipment required for blasting including the dust hopper, interceptor bin, blast hopper, compressor, generator and skip bin
- an equipment laydown area (Area B) on the northern side of the Parramatta River, adjacent to the active pathway which extends beneath the bridge. This area covers around 200 square metres, and currently consist of recently landscaped native vegetation. No mangroves are present within the is proposed area
- an equipment laydown area (Area C) at the southern side of (and extending beneath) the bridge, to the west of Macarthur Street. This laydown area (covering around 335 square metres) is located on a cleared and partially sealed section of the Queens Wharf Reserve, with access via George Street, and has most recently been utilised by the Parramatta Light Rail project (refer to Section 6.14) as a materials laydown area.

The use of the site compound and equipment laydown areas would be interchangeable, depending on the location of the work activities. However, the site office, and all amenities (toilets, change rooms, meal rooms, first aid) except for the decontamination unit, would be confined the site compound. The decontamination unit would be placed in equipment laydown area D, to eliminate the potential for exposure of contaminants to the public.

The equipment laydown area A would be used for materials handling and storage areas, as well as the siting the air extraction unit, ventilation system and other machinery required for containment and dry abrasive blasting. Hazardous waste storage bins would be confined to equipment laydown areas A and C (depending on the area of the bridge being remediated). The equipment laydown locations have been selected due to their proximity to the bridge. This would also eliminate the need to move hazardous waste between the equipment laydown areas, thus eliminating any potential contact with the public.

Hazardous and non-hazardous waste generated on site would be separated. Hazardous waste would be collected and stored in a bunded and secured area prior to collection, transport and disposal at a licensed waste facility.

The site compound would have acoustic screening/walls installed around the perimeter and/or noisy plant to mitigate noise impacts. Temporary fencing would be erected around the perimeter of the site compound and equipment laydown area. The temporary fencing would be manually erected and dismantled using hand tools.

Impacts associated with the utilisation of this area have been considered in the environmental impact assessment of this Review of Environmental Factors (Chapter 6).

As the laydown areas to the south of the Parramatta River are located on flood liable land, these areas would be vacated when floods are forecast. A flood contingency plan detailing how materials would be removed in the event of a flood would be included in the Construction Environmental Management Plan (CEMP).

An overview of the proposed site compound and equipment laydown areas are shown in Figure 3.1. These locations have been identified in consultation with the City of Parramatta and placed to avoid steep slopes which are present towards the Parramatta River as well as adjacent to George Street. The location has also considered nearby sensitive residential receivers to minimise the noise impacts of the proposal (refer to Section 6.2).

3.5 Public utility adjustment

The proposal has been designed to avoid relocation of services where feasible. Some services will likely require protection prior to remediation works, such as the water which is located on the eastern side of the Bridge (refer to Photo 3-4). A redundant gas line owned by Jemena would be removed as part of the proposal as described in Table 3.1 and section 3.3.1.

Photo 3-3:Redundant Jemena Gas main facing north

Photo 3-4: Water main facing south (smaller pipe)

3.6 Property acquisition

The proposal would not require the acquisition of any property, however, would require the temporary use of existing public open space (currently owned by the NSW Government/City of Parramatta) for the installation of the site compounds and ancillary facilities, as described in Section 3.4.

3.7 Operation and maintenance

On completion of the remediation works the proposal site would return to its pre-proposal operations.

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

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Transport and Infrastructure) 2021

State Environmental Planning Policy (Transport and Infrastructure) 2021 (Transport and Infrastructure SEPP) aims to facilitate the effective delivery of infrastructure across the State.

Section 2.109 of the Transport and Infrastructure SEPP 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 road infrastructure facilities and is to be carried out on behalf of TfNSW, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW). 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 (Resilience and Hazards) 2021
- State Environmental Planning Policy (Planning Systems) 2021
- State Environmental Planning Policy (Precincts – Central River City)
- State Environmental Planning Policy (Precincts – Eastern Harbour City)
- State Environmental Planning Policy (Precincts – Regional) 2021
- State Environmental Planning Policy (Precincts – Western Parkland City) 2021.

Section 2.10 to 2.15 of the Transport and Infrastructure SEPP 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 the Transport and Infrastructure SEPP (where applicable), is discussed in chapter 5 of this REF.

Other SEPPs

State Environmental Planning Policy (Biodiversity and Conservation) 2021

Chapter 6 of State Environmental Planning Policy (Biodiversity and Conservation) 2021 (Biodiversity and Conservation SEPP), includes development controls for certain lands (e.g. zoning, permissibility of development) within a number of river catchments in NSW, including the Sydney Harbour Catchment. Section 6.3(2) of Chapter 6 of the Biodiversity and Conservation SEPP relevantly provides:

> *"State Environmental Planning Policy (Transport and Infrastructure) 2021, Chapter 2, other than section 2.80(3), prevails to the extent of an inconsistency with this Chapter."*

As the provisions for 'Road and Road Infrastructure Facilities' is contained within Chapter 2 of the Transport and Infrastructure SEPP (Chapter 2, Division 17, Subdivision 1) identify that activities for road infrastructure facilities undertaken by or behalf of a public authority are permissible without consent on any land, the zoning controls provided by the Biodiversity and Conservation SEPP do not apply to the proposal. It is also noted that the bridge is not identified as an item of heritage significance under the Biodiversity and Conservation SEPP. Accordingly, further consideration of the SEPP is not required.

4.1.2 Local Environmental Plans

Parramatta Local Environmental Plan 2011

The landside component of the proposal is located within the City of Parramatta LGA. Local development control and land use zoning and planning in this LGA is currently governed under the City of Parramatta Local Environmental Plan 2011 (LEP) (refer to Figure 6.21).

Table 4.1: Relevant City of Parramatta LEP land use zoning policies

Aim	Proposal consistency
RE1 – Public recreation	
• to enable land to be used for public open space or recreational purposes. • to provide a range of recreational settings and activities and compatible land uses. • to protect and enhance the natural environment for recreational purposes. • to conserve, enhance and promote the natural assets and cultural heritage significance of Parramatta Park. • to create a riverfront recreational opportunity that enables a high-quality relationship between the built and natural environment.	• the proposal would not result in any permanent loss of recreational land. • the proposal would result in the loss of access to a small area of recreational land during the remediation works, however loss would be temporary and minor in nature.
R4 – High Density Residential	
• to provide for the housing needs of the community within a high-density residential environment. • To provide a variety of housing types within a high-density residential environment. • to enable other land uses that provide facilities or services to meet the day to day needs of residents. • to provide opportunity for high density residential development close to major transport nodes, services and employment opportunities. • to provide opportunities for people to carry out a reasonable range of activities from their homes if such activities will not adversely affect the amenity of the neighbourhood	• the proposal would not result in any impacts to the provisions of this land zoning.
W2 – Recreational waterways	
• to protect the ecological, scientific and recreation values of recreational waterways. • to allow for water-based recreation and related uses. • to provide for sustainable fishing industries and recreational fishing. To enable works associated with the rehabilitation of land towards its natural use.	• The proposal would not result in any impacts to the provisions of this land zoning and would not result in the loss of any ecological, scientific and recreation values of recreational waterways.

4.2 Other relevant NSW legislation

Table 4.2 provides a summary of the relevance of other NSW legislation to the proposal and any additional requirements under each act.

Table 4.2: Other relevant NSW legislation

Aim	Relevance to the Proposal and further requirements
National Parks and Wildlife Act 1974 (NPW Act) The NPW Act provides for the protection of Aboriginal heritage values, national parks and ecological values. Makes it an offence to harm Aboriginal objects, places or sites without permission.	The provisions of the NPW Act are unlikely to be triggered by the proposal. Indigenous heritage investigations found that the proposal is unlikely to have an impact on indigenous heritage. Work would cease if an artefact or place of significance is disturbed or encountered during the proposal and the appropriate local aboriginal land council (LALC) or DPIE would be notified.
Heritage Act 1977 (Heritage Act) The Heritage Act provides for the protection of conservation of buildings, works, maritime heritage (wrecks), archaeological relics and places of heritage value through their listing on various State and local registers. Makes it an offence to harm any non-Aboriginal heritage value without permission.	The proposal includes remediation works on the heritage listed 'Gasworks bridge', and the temporary use of land adjacent to the bridge. The bridge and areas of adjacent land are listed as local heritage items in Schedule 5 of the Parramatta LEP. A Historical Heritage Assessment (HHA) has been prepared by Austral heritage consultants (Appendix H) for the proposal and includes an assessment of potential impacts, and recommended safeguards to avoid any adverse heritage impacts.
Roads Act 1993 (Roads Act) The Roads Act provides for the construction and maintenance of public roads. Requires consent to dig up, erect a structure or carry out work in, on or over a road.	The proposal would require and extended partial closure of Macarthur Road for the duration of the works, and full closures during selected weekend periods. Road Occupancy Licences for these closures would be obtained from the relevant roads authority prior to the relevant closures.
Biodiversity Conservation Act 2016 (BC Act) The BC Act provides for a strategic approach to conservation in NSW. It includes provisions risk-based assessment of native plant and animal impacts, including a Biodiversity Assessment Method (BAM) to assess the impact of actions on threatened species, threatened ecological communities and their habitats.	Under the BC Act, an assessment of significance must be completed to determine the significance of impacts to threatened species, populations and/or communities or their habitat. There are unlikely to be any threatened species, populations or communities within the proposal, therefore no impact is expected and the need for an assessment of significance has not been triggered. As no native terrestrial vegetation would be cleared, or harmed, the proposal does not require further assessment under the BAM.
Protection of the Environment Operations Act 1997 (PoEO Act): Focuses on environmental protection and provisions for the reduction of water, noise and air pollution and the storage, treatment and disposal of waste. Introduces licencing provisions for scheduled activities that are of a nature and scale that have a potential to cause environmental pollution. Also, includes measures to limit pollution and manage waste.	The works to not fall under the definitions of Scheduled Activities or Scheduled Development Works under the PoEO Act. Accordingly, an Environment Protection Licence (EPL) is not required for the proposal. Under section 115, it is an offence to negligently dispose of waste in a manner that harms the environment. Waste would be managed in accordance with the *Waste Avoidance and Resource Recovery Act 2001*. The proposal would aim to reduce the environmental impact of dumping waste and include mechanisms to recover resources and reduce the production of waste where possible.

Aim	Relevance to the Proposal and further requirements
	Under section 120, it is an offence to pollute any waters of the State. The REF includes safeguards and mitigation measures to ensure that the proposal does not result in pollution of waters. Fulton Hogan, and/or contractors working on behalf of TfNSW are required to notify the Environment Protection Authority if a 'pollution incident' occurs that is likely to result in material harm to the environment.
Fisheries Management Act 1994 (FM Act): Provides for the protection of fishery resources and values for current and future generations. Makes it an offence to harm fisheries and resources without an appropriate assessment, inclusion of safeguards and/or the appropriate permissions to carry out certain work.	The proposal does not require any construction activities within a waterway. Access to the underside of the bridge would be undertaken via scaffolding to be installed beneath the structure. The proposal does not involve creating a barrier to fish movement and is not expected to have a major impact to mangroves, seagrass or marine vegetation (Section 6.4). Minor trimming of mangroves, to allow for the installation of scaffolding, would require a Section 205 permit to harm from DPI, under the FM Act, as mangroves are considered key fish habitat. Additional management and mitigation measures to protect the waterway are outlined in Section 6.5 of this REF.
Marine Pollution Act 2012: Sets out provisions to prevent pollution in the marine environment.	The proposal is unlikely to result in any oil, noxious liquid, pollutant, sewage or garbage discharge as controlled under this Act, providing relevant standard controls are implemented and monitored (refer to Section 6.5).
Ports and Maritime Administration Regulation 2012 (Ports and Maritime Regulation): Focuses on environmental protection and provisions for the reduction of water, noise and air pollution and the storage, treatment and disposal of waste. Introduces licencing provisions for scheduled activities that are of a nature and scale that have a potential to cause environmental pollution.	The proposal site does not fall within the definition of Sydney Harbour under the Ports and Maritime Administration Regulation.
Marine Safety Act 1998 (Marine Safety Act): Sets out the requirements for marine safety and the roles of the Harbour Master and marine pilots. Includes provisions relating to marine and navigational safety including collision prevention, spill limits, no-wash zones, shipping operation restrictions, and controls on reckless, dangerous or negligent navigation.	The proposal would reduce the clearance between the bridge and the high-water mark, potentially restricting access to the Parramatta Ferry Wharf for vessels. Section 6.1 includes a summary of mitigation and management measures including consultation with Transdev (the operator of Sydney Ferries) to manage this impact.
Biosecurity Act 2015: Provides a framework for the prevention, elimination and minimisation of biosecurity risks. It requires any person who deals with a biosecurity matter to ensure that in so far is reasonably practical, the potential biosecurity risk is prevented, eliminated or minimised.	Appropriate management methods would be implemented during construction if declared noxious weeds in the Parramatta LGA are identified. Section 6.4 provides a summary of noxious weeds listed in the Greater Sydney Local Land Service region, and mitigation measures to minimise the risk of its spread.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

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

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 Climate Change, Energy, the Environment and Water 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 substantial impact on relevant matters of national environmental significance. Chapter 6 of the REF describes the safeguards and management measures to be applied.

4.3.2 Native Title Act 1993

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

A search of the Native Title Tribunal Native Title Vision website was undertaken, with no Native Title holders/claimants identified.

TfNSW would provide a notice of the proposal to NTSCORP under section 24KA of the Act and would invite comment on the proposal.

4.4 Confirmation of statutory position

The proposal is categorised as development for the purpose of a road and/or road infrastructure facilities and is being carried out by or on behalf of a public authority. Under section 2.109 of the Transport and Infrastructure SEPP 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'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

Table 5.1 provides a summary of the proposed communication activities, and associated timeframes based on the current program start date of late July 2023. The collateral pack will be submitted prior to the commencement of works with all associated communication materials requiring approval by July 2023. This will enable four weeks' notice for the community to contact Fulton Hogan to discuss project details and raise any concerns with the project team.

Table 5.1: Proposed consultation strategy

Activity	Description	Timeframe
Early works notification	Letterbox drop notification describing work dates, scope and traffic impacts. Will also be emailed out to key stakeholders including Council, buses, ferries, Macarthur Girls High School and nearby businesses with available email addresses. Notification will clearly state the message to avoid the area during work times or to contact the team to discuss any particular circumstances. The notification will include a QR code to direct back to the project webpage which will host more information about the project including an FAQ.	Complete 4 weeks in advance of starting works.
Start of work notification	Letterbox drop notification describing work dates, scope and traffic impacts.	Complete 1 week in advance of starting works.
Mid-project update notification	Community update letterbox drop detailing the work completed so far and what to expect for the remainder of the project.	Approximately halfway through the project.
End of work letter	Letterbox drop notification informing the community that the project has been completed, what works have been undertaken, and thanking them for their patience.	Distributed at the completion of the project.
FAQ document	Will include answers to commonly asked questions about the project and will be hosted on the web page for stakeholders to refer to.	To be hosted on the dedicated webpage which will be developed prior to starting work.
Traffic alert	Describe traffic impacts to alert wider Transport for NSW internal network. This information will be used to inform Customer Journey Management (CJM) communications team to upload closure details and alternate routes on live traffic.	N/A.
Social media copy	Develop copy about work and traffic impacts to be posted on NSW Roads Facebook page and Transport for NSW	TfNSW social media to activate post as soon as notification approved.

	website. Copy may also be shared with local councils (Parramatta) and other key stakeholders to use on their social networks/ websites. Other organisations include: - Local Fire Station - Local Police Station - SES - Macarthur Girls High School - Sydney Ferries.	
Signage	Corflute signage will be installed at strategic locations near the work site and along the existing cycleway for the pedestrian detour. Signage will also be installed near the Rangihou Reserve on Macarthur Street to advise of the parking changes.	Installed in advance of starting.
VMS Strategy	This strategy will be submitted as a part of the Traffic Management Plan and endorsed by TMC. Both temporary VMS installed along the detour route and use of permanent VMS on key arterial roads in the region will display information about the closure. VMS will display Fulton Hogan's 1800 number.	To be deployed a minimum 5 days in advance of work.
Transport for NSW web page	Web page outlining scope of work including notifications that have gone out. To be developed by Transport for NSW with Fulton Hogan's assistance.	Developed prior to start of work.
Media release	Describing the work and traffic impacts. To be developed by TfNSW media team if deemed necessary.	Prior to start of work.
Direct Stakeholder interactions		
Email blast	All email addresses for all local stakeholders that are publicly available, primarily businesses and organisations will be compiled and added to the email distribution list. All notifications and updates prior and during the work will be sent out via email as well and community members and stakeholders will be offered to sign up for email updates during the work. We have a total of 153 stakeholders in our distribution lists for this area, with key contacts in emergency services, local councils, residents, and all businesses who have publicly available contact information.	Complete 4 weeks in advance of starting works with the early works notification and again at one week with the start of work notification.
Targeted emails	We will send specific emails with relevant information to community members who have requested to receive email alerts and key stakeholders including ferries (Transdev), local buses (CJM), Macarthur Girls High School and Parramatta City Council contacts.	Complete 4 weeks in advance of starting works and as needed through duration of project.

Meeting	Will take place if requested or required by a stakeholder.	As required.
Briefing call centre operators	Call centre operations at the River Zone and the Duty Manager will be providing briefing information to provide real time updates to all callers. They will have direct access to the supervisor to communication any stakeholder issues prior and during the work.	Once official notifications have been sent out.

5.2 Community involvement

The following consultation activities would be undertaken prior to the commencement of the works:

- Early works letter to be distributed to 4 weeks prior to starting to allow the community time to provide feedback before commencing work. The notification will also be emailed out to key stakeholders including Parramatta City council, Macarthur Girls High School, utility providers, emergency services, affected businesses, public transport providers including the 153 Stakeholders within the Fulton Hogan consultation manager database for this area.
- start of work letter distributed to the local community one week prior to starting and emailed to key stakeholders as per above
- traffic alerts
- Engagement with Macarthur Girls High School will be done via phone call, email and in person meeting
- Variable Message Sign (VMS) strategy in place.

This REF would be published following determination.

5.3 Aboriginal community involvement

As outlined in Section 6.12 Aboriginal cultural heritage impacts are not anticipated as a result of the proposal. An Aboriginal Heritage Information Management System (AHIMS) search was undertaken for the area covered by the proposal (the area around the site) plus a 200-metre radius, on 24 May 2023.

The results of this database search confirmed that there are five known Aboriginal heritage sites within 200 metres of the proposal. However, due to the nature of the works and location of these sites in relation to the proposal site, no impacts on Aboriginal heritage on this site are likely to occur.

The proposal does not require stage 1 PACHCI and as such a Stage 2 PACHCI or an Aboriginal Heritage Impact Permit under the *National Parks and Wildlife Act* 1974 would not be required.

5.4 SEPP (Transport and Infrastructure) consultation

Part 2.2, Division 1 of the Transport and Infrastructure SEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development.

Transport for NSW is required to notify local councils and other relevant Government agencies where development has the potential to impact on assets or environmental values managed by these authorities. These issues are identified through the checklist included as Appendix B.

In the case of the proposal, it triggers the notification requirements under section 2.10 and section 2.11 of the Transport and Infrastructure SEPP as it would:

- involve the installation of a temporary structure in the form of the construction compound and laydown area
- disrupt pedestrian and vehicle movements
- result in modifications to an existing local heritage item
- require the establishment of temporary laydown areas in a local heritage conservation area.

Fulton Hogan (on behalf of Transport for NSW) has - in addition to stakeholder consultation with the City of Parramatta Council, Parramatta Light Rail, Transdev (the operator of Sydney Ferries) and bus companies have been consulted through TfNSW Customer Journey Management Team - facilitated formal notification letters under the Transport and Infrastructure SEPP to the City of Parramatta and the NSW State Emergency Service for the proposal. Further, the Department of Primary Industries have been formally consulted through the submission of application of permit to harm marine vegetation under Part 7 of the *Fisheries Management Act 1994.*

Issues raised through stakeholder and the Transport and Infrastructure SEPP consultation are outlined in Table 5.2.

Table 5.2: Issues raised through stakeholder and SEPP (Transport and Infrastructure) consultation

Agency	Issue raised	Response/where addressed in REF

City of Parramatta	Stakeholder consultation: Management of traffic, including the preference for weekend closures of the bridge over weekday single lane closures.
	
	T&I SEPP consultation:
	Project REF provided was satisfactory and council would like:
	• to cite the Fisheries Permit prior to the commencement of works
	• notification of path detours / closures be installed at least two weeks before at each approach under or along the bridge showing both stepped and step-free diversions
	• pedestrian and cyclist access should be maintained both along and under the bridge unless critical for the works
	• where works preclude pedestrian and cyclist access:
	  ○ for works involving a prolonged closure to pedestrians, detours be proposed of minimal length, allowing for both stepped and step-free access, together with mobility accessible shuttle bus service(s)
	  ○ for works involving a prolonged closure to cyclists, the only feasible detour appears to be Noller Parade. However parking on the north verge is to be relocated to the south verge and a temporary one-way eastbound contra flow cycle lane provided
	• under the bridge works such as loading / unloading be done with traffic control (STOP / SLOW) for pedestrians and cyclists
	• that pedestrian and cyclist detour(s) prepared be provided for review and comment by Council officers 10 business days before planned implementation.
		The proposal would require the closure of the northbound lane of the bridge for around four months, and a total of 12 full weekend shutdowns. Achieving the preference for weekend closures over weekday single lane closures was unable to be accommodated due to the load limitations on the existing bridge structure. These limitations mean the structure is only able to safely sustain the loading (or weight) of one lane of operating traffic in combination with the weight of the scaffolding and containment system.
		A summary of traffic management and access for the proposal is included in Section 3.3.7.
		An assessment of traffic, transport and access impacts and proposed mitigation measures are included in Section 6.1.
		In addition to the Traffic Management Plan previously provided to Council, a pedestrian detour plan will be provided to council at least 10 business days prior to implementation.
		
		A copy of the Fisheries Permit obtained from *Department of Primary Industries* (PN23/294) will be provided to City of Parramatta Council prior to the commencement of works.

	Stakeholder consultation: The temporary storage of lead waste, and potential impacts associated with lead contamination of the proposal site.	The removal, storage, transfer, and disposal of hazardous wastes would be undertaken in accordance with relevant AS/NZS and waste disposal guidelines. Pre and post construction soil sampling would be undertaken to confirm the absence of site contamination prior to the final inspection and site handover.

Agency	Issue raised	Response/where addressed in REF
		A detailed works methodology is included in Section 3.3.1. An assessment of potential contamination, waste and hazard and risks impacts of the proposal and relevant mitigation measures are included in Sections 6.6, 6.7 and 6.11.
	Stakeholder consultation: Air quality and emissions monitoring during de-leading works, including concerns over the presence of the Macarthur Girls School nearby, and students using the bridge to cross the Parramatta River.	The proposal includes the establishment of a negative air pressure containment system, which contains a filtration system to remove all hazardous materials from the air. All works involving hazardous materials would be undertaken within this system. The installation of this system, and all works would be undertaken in accordance with relevant AS/NZS, which includes the requirement of air quality monitoring during the works. A detailed works methodology is included in Section 3.3.1. As assessment of air quality impacts and proposed mitigation measures are included in Section 6.3. An assessment of the hazards and risks of the proposal is included in Section 6.11
Transdev (Sydney Ferry Operator)	Stakeholder consultation: Assess constraints for passenger ferry services on the F3 – Parramatta River route, and safety risks during scaffolding installation from ferry movements.	Installation of the scaffolding required to complete the works would result in a reduced clearance of a maximum of 1.62 metres between the scaffolding and the high tide water level. The reduction in clearance would impact the ability of the F3 Parramatta Ferry services to pass beneath the bridge and access the Parramatta Ferry Wharf. Fulton Hogan would consult with Transdev regarding the impacts associated with a reduction in the clearance. Any access restriction for ferries operating on the Parramatta River would require coordination with Transdev and the potential requirement to replace ferry services with bus services during some tidal periods. An assessment of traffic, transport and access impacts and proposed mitigation measures is included in Section 6.1. This section includes an assessment of the impacts on public transport including the F3 Parramatta River route.
Parramatta Light Rail	Stakeholder consultation: Conflicts associated with the use of equipment laydown areas to the south of the bridge.	A discussion of cumulative impacts, including the use of the equipment laydown area is included in Section 6.14. It is noted however, Parramatta light rail are no longer using the area identified as Equipment laydown area C for their construction activities, thus there would be no issues with conflicting use of the area.

Agency	Issue raised	Response/where addressed in REF
Department of Primary Industries	T&I SEPP/ Permit under Part 7 of the Fisheries Management Act 1994 (FM Act): Impacts associated with the trimming of mangroves to establish scaffolding erection.	To facilitate the installation of the scaffolding and containment system, 13 individual mangroves would be trimmed beneath and directly adjacent to the bridge structure on the northern bank of the Parramatta River. A discussion of the impacts to mangroves is included in section 6.4. Prior to the commencement of construction, a permit under Part 7 of the Fisheries Management Act to harm marine vegetation would be lodged to the Department of primary industry for the works. Administrative conditions imposed as part of the permit issue (PN23/294) include: 1) Acceptance of conditions 2) Commencement of works notification at least three days prior to commencement of mangrove trimming 3) Active works notification at least one day prior to works being completed 4) Post works notification within 21 days of completion of mangrove trimming 5) Supply of CEMP prior to commencement of works
NSW State Emergency Service	T&I SEPP consultation: No issues raised and phone call facilitated. Requested that site contact details be provided prior to commencement of works.	Site contact details to be provided prior to commencement of works.

5.5 Ongoing or future consultation

The Project REF (this document) will be published by TfNSW. Fulton Hogan will continue to consult with the community and stakeholders prior to and during the works.

The following consultation would be ongoing:

- meetings with Parramatta City Council, Macarthur Girls High School, utility providers and other government agencies upon request
- regular email updates to residents and business that have requested to be kept updated throughout the project
- consultation with community stakeholders to help manage impacts during construction
- traffic alerts, VMS, media releases and social media advertisements
- notifying residents mid-way through the project and at the end to advise that the project is completed any changes to the access arrangements of Sydney Ferries would be made in consultation with Sydney Ferries.

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 Guideline for Division 5.1 assessments (DPE 2022) and as required under section 171 of the Environmental Planning and Assessment Regulation 2021 and the Roads and Related Facilities EIS Guideline (DUAP 1996). The factors specified in section 171 of the Environmental Planning and Assessment Regulation 2021 are also considered in Appendix A
- site-specific safeguards and management measures are provided to mitigate the identified potential impacts.

6.1 Traffic, transport and access

This section describes the review of potential traffic, transport and access impacts of the proposal.

6.1.1 Methodology

The assessment methodology for the traffic, transport and access assessment included a review of the *Transport Impact Assessment Gasworks Bridge Rehabilitation* (TIA) (Civlink Consulting Pty Ltd, 2023) which assessed the existing environment and impacts of the proposal on Traffic. The TIA included the following components:

- a desktop review of the road network and intersections, as well as calculations of background traffic volumes and traffic modelling of the impacts of the proposal on the local road network and car parking, including the need to close and divert elements of the road network
- the key intersections impacted by the detour routes were identified and Sydney Coordinated Adaptive Traffic System (SCATS) data was provided by TfNSW for these intersections. Traffic count data for bridge and Wilde Avenue bridges was also obtained from *RMS Traffic Volume Viewer*.

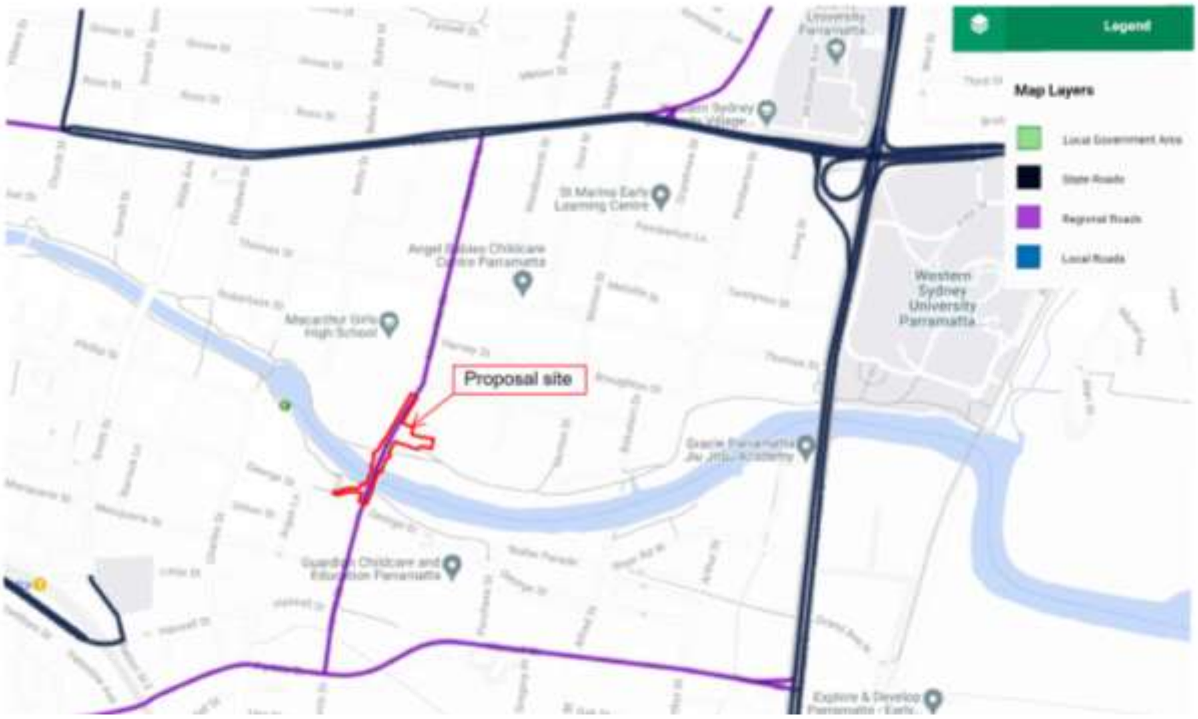
In addition to the TIA, a desktop assessment was undertaken to review and assess the impacts of the proposal on local public transport services, pedestrian and cyclist access, property access, parking conditions, and other relevant transport features.

Further methodology details can be viewed in the TIA in Appendix C.

6.1.2 Existing environment

Road network

The proposal forms part of the local road network, being one of five vehicle crossings of the Parramatta River adjacent to the Parramatta CBD. Macarthur Street is classified as a regional road (refer to Figure 6.1) and acts as a key throughfare between the Parramatta CBD and the suburbs to the north of the Parramatta River. Macarthur Street provides a linkage to Victoria Road, and one linkage option for trips to and from James Ruse Drive (classified as a state road) to the Parramatta CBD.



Source: TfNSW, 2021

Figure 6.1: Road classifications near the proposal

Existing weekday traffic volumes on the bridge were estimated from the SCATS counts at the George Street / Harris Street and Macarthur Street intersections for the period between 26 June 2022 and 26 August 2022. This period spanned the latter part of the second term of the NSW school calendar, the full duration of the July school holidays (4 -15 July), and the initial portion of the 3rd term of the school calendar. The data was processed to determine average hourly traffic volume by the day of the week for three periods: The two-way traffic volumes for the three periods are shown in Figure 6.2 with weekday traffic volumes typically higher in Term 3.

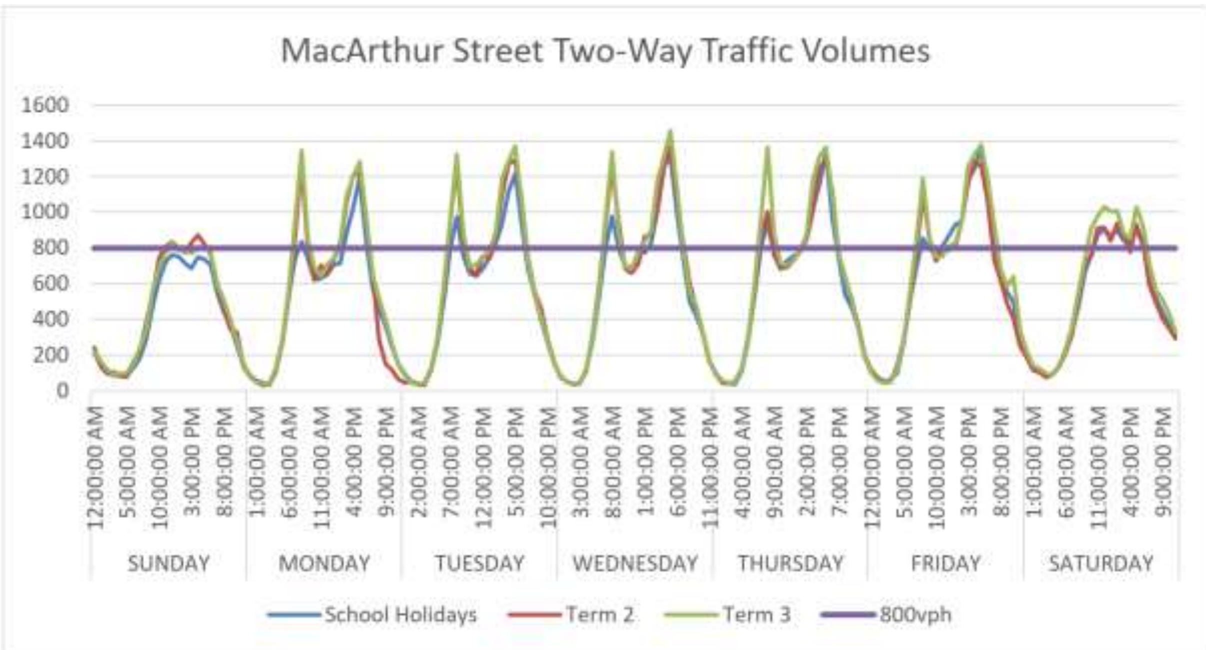


Figure 6.2: Macarthur Street Bridge Average Traffic Volumes: June – August 2022 (Civlink,2023b).

The Term 3 data was therefore used as the baseline level from which to assess the traffic impacts as a result of proposal. The respective northbound and southbound traffic volumes for this period were derived from this data as shown in Figure 6.3

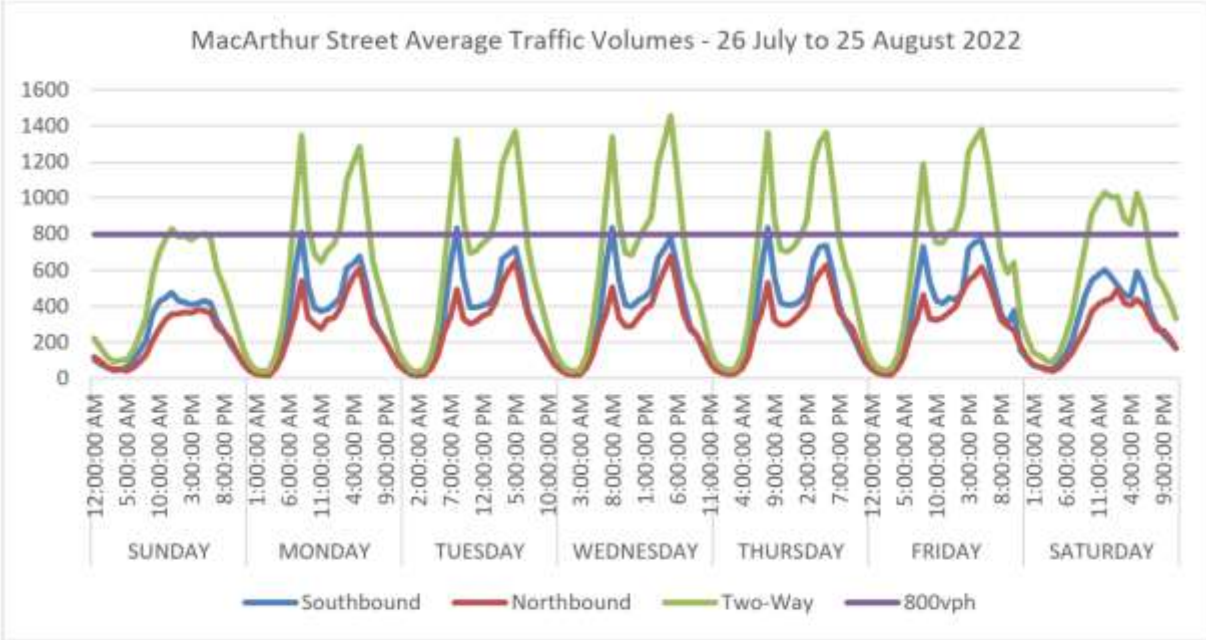


Figure 6.3: Macarthur Street Bridge Average Two Way Traffic Volumes (Civlink,2023b).

There is a notable disparity in the respective number of vehicle movements travelling in the northbound and southbound directions over the bridge, with northbound traffic volumes (depicted by the red line in Figure 6.3 above) being around 40 per cent lower than the southbound direction during the morning peak period, and 15-20 per cent lower than the southbound direction in the afternoon peak period (depicted by the blue line in Figure 6.3 above).

Weekday traffic volumes

The above figure shows the Gasworks Bridge traffic profile, estimated from SCATS counts at the Macarthur Street / Thomas Street and MacArthur Street / Harris Street / George Street intersection, taken as the average weekday counts from 26th July to 25th August 2022. The counts show the peak traffic volumes occur from 8:00 am to 9:00am, and 5:00 pm to 6.00 pm, which has been adopted as the basis for this assessment. Table 6.2 provides a summary of the estimated 2022 peak weekday traffic volumes for the bridge.

Table 6.1: Gasworks Bridge estimated traffic volumes (Weekday peak)

Period	Time	Northbound	Southbound
AM Peak	08:00-09:00	505	808
PM Peak	17:00-18:00	636	736

Weekend traffic volumes

Existing weekend traffic volumes across the bridge were similarly estimated from the SCATS data set identified above, taken as the average weekend counts from 31st July to 28th August 2022. The data indicated a peak vehicle count of 384 vehicles (northbound) and 601 vehicles (southbound) per hour, during weekend periods (midnight Friday to 10 pm Sunday). The peak traffic count was experienced between 12:00 pm and 1:00 pm on Saturdays. Table 6.2 provides a summary of the estimated 2022 peak weekend traffic volumes for the bridge.

Table 6.2: Gasworks Bridge estimated traffic volumes (Saturday peak)

Period	Time	2022 Estimate
Northbound	12:00-13:00	384

Southbound	12:00-13:00	601
Total	**12:00-13:00**	**985**

Car parking

An existing car park is located immediately to the north-east of the bridge. Car parking spaces are not marked but are estimated to accommodate around 12-13 cars. The car park is heavily used on weekdays as there is limited all-day paid parking locations in the surrounding area. On weekends, these car parks are not metered, consistent with kerbside parking on nearby roads including New Zealand Street and Harvey Street to the north. Parramatta CBD contains a number of commercial car parking stations. The nearest commercial parking station is around 250 metres to the southwest of the proposal on Hassell Street, while a large at grade car park is located immediately to the southwest of the proposal on George Street.

Pedestrian and cycle network

The bridge provides a pedestrian and cycle link between the Parramatta CBD and surrounding suburbs to the north of the Parramatta River (refer to Figure 6.4). The bridge also forms part of a dedicated cycle way connecting the southern side of the Parramatta River with active transport routes on the northern side of the river. This includes:

- the Parramatta Valley Cycleway, which is a regional cycle route which generally runs along the Parramatta River, providing a connection between Parramatta Park (1.2 kilometres to the west of the proposal) and Morrison Bay Park in Putney
- the Parramatta River Walk which commences on the northern side of the Parramatta River at Woolwich Wharf or on its the southern side at Birchgrove Wharf and ends in Parramatta at the junction of Toongabbie Creek and Darling Mills Creek, which is located 1.2 km upstream of the proposal.

The bridge contains a shared pathway (along its western side, as shown in Photo 6-1) which provides pedestrian and cycle access to these routes, along with residential areas and Macarthur Girls High School, which are located to the north of the Parramatta River. Connections from the bridge to the cycleway and river are via a staircase (on the western side of the bridge), and a footpath (to the east). Active routes pass beneath the bridge on both the northern and southern sides of the river (as shown in Photo 6-2.

Taken from: https://roads-waterways.transport.nsw.gov.au/maps/cycleway_finder/index.html)

Figure 6.4: Overview of shared pathways near proposal site (Source: Civlink 2022b)

Photo 6-1: Gasworks Bridge shared pathway

Photo 6-2: Pedestrian routes beneath the Gasworks Bridge – southern side

Public transport

Bus services

A total of six bus routes including five school bus routes and one public bus route (Route 545 – Parramatta to Macquarie Park) traverses the proposal. The nearest bus stops are located on George Street around 40 metres to the west of the proposed laydown area, and on Macarthur Street, around 135 metres to the north of the site compound. No other bus services are located on Macarthur Street or on surrounding streets that would be impacted by the proposal.

Table 6.3: Changes to level of service during proposed Gasworks Bridge shutdown (Saturday Peak)

Bus Route No.	Description	Direction of travel	Service frequency
545	Parramatta to Macquarie Park	Northbound and Southbound	• 5:45 am - 12:00 am Monday to Friday (every 10-15 minutes) • 6:30 am - 10:30 pm Saturday (every 20 minutes) • 8:00 am - 10:00 pm Sunday / Public holidays (every 30 minutes).
575W	Our Lady of Lebanon to Ryde Depot (School Bus)	Northbound and Southbound	• 7.28 am Monday to Friday (single AM service to school) • 3.23 pm Monday to Friday (single PM service from school).
717W	Parramatta Station to James Ruse Agricultural High School (School Bus)	Northbound only	• 7.40 am Monday to Friday (single AM service to school).
721W	Parramatta East Public School to Parramatta Station (School Bus)	Southbound Only	• 3.25 pm Monday to Friday (single PM service from school).
S423	Granville Station to Our Lady of Mercy College (School Bus)	Northbound only	• 8.07 am Monday to Friday (single AM service to school).
S427	Macarthur Girls High School to Granville Station	Southbound only	• 3.20 pm Monday to Friday (single PM service from school).

Bus Route No.	Description	Direction of travel	Service frequency
	(School Bus)		

Ferry services

Transdev operate the F3 - Parramatta Ferry, which provides passenger ferry services between Parramatta Wharf and Circular Quay in the Sydney CBD. Services operate hourly from Monday to Friday (6:30am to 7:00pm), and Saturday and Sunday (7:30am to 8:00pm).

The Parramatta Wharf is located 220 metres to the west of the proposal (refer to Figure 6.23), with ferry services passing directly beneath the Bridge. The Bridge has a listed clearance of 6.9 metres at highest astronomical tide of 2.1 metres. The air draft of the ferries operating on the F3 route is between 5.1 and 5.28 metres.

Shuttle buses currently replace ferry services between Rydalmere and Parramatta wharves during low tide (usually two hours either side of low tide), due to the shallow depth of this section of the Parramatta River. TfNSW provide customers of upcoming service changes associated with replacement bus services in the preceding month. Low tide generally impacts up to two services per day, 11 days of the month. Ferry services can also be impacted by flooding, which can restrict ferry access to Parramatta Wharf.

Train services

There are no train services near the proposal. The nearest train station is Parramatta Station around 800 metres to the southwest in the Parramatta CBD.

Commercial and recreational services

Private water taxi services, commercial recreational vessels and other recreational activities are not permitted within the upper Parramatta River to the utilise Parramatta Wharf, which is exclusively operated by Transdev for public passenger services.

6.1.3 Potential impacts

Construction

Construction traffic

Construction of the proposal would require up to 15 heavy vehicle movements per day at the beginning of the construction period, to deliver equipment and remove material as required. This would include during site preparation, site establishment as well as the installation and decommissioning of scaffolding and the containment system, and during landscaping works on compounds and equipment laydown areas. These works are expected to take around 12 days to complete and would be undertaken on commencement of the proposal and at the end of the proposed works.

During the remainder of the proposal, it is expected that 12 light vehicles would access the site daily, with periodic heavy vehicles movements to remove waste from the proposal site or deliveries to the site, approximately once a week.

Given the low number of construction vehicle movements, construction traffic is not expected to impact the local road network. All construction vehicles would be parked within the site compound, or equipment laydown areas, or in the existing carpark to the north of the bridge which would be occupied for the duration of the proposal. No construction vehicles would be parked in any public parking spaces.

Traffic detours

The proposal would require partial closure of the bridge (Macarthur Street), limiting traffic movements to one direction only throughout the duration of construction, which is expected to be around four months. The proposed partial closure would apply to northbound traffic, due to lower traffic volumes compared to southbound movements, and the higher capacity of detour routes that would avoid the Parramatta CBD, with unsignalised left turns at River Road West and James Ruse Drive.

During this time, traffic movements would be limited to southbound only, with all northbound vehicle traffic be diverted via two alternative routes. Detours would be implemented for all northbound traffic during this time, which would operate a 24 hours per day / 7 days per week basis.

Additionally, full bridge closures would be required across weekend periods (from 7:00 pm Friday to 5:00 am Monday) for approximately to 12 weekends throughout the construction period. Detours for southbound traffic movements would be implemented during these times for the twelve weekend shutdowns when the bridge is closed to all traffic.

Further details of the respective closures, and corresponding traffic detours required are provided below in Table 6.4.

Table 6.4: Changes to traffic due to the construction of the proposal

Closure type	Description	Timing and frequency	Direction of detours required
Partial Closure	• Vehicular traffic across bridge restricted to southbound movements only • Pedestrian and cycle access maintained in both directions (subject to some restrictions)	• The partial closure would be implemented for the full duration of construction	• Northbound vehicular traffic diversions only • No pedestrian and cyclist diversions required
Full Closure	• No vehicular traffic across bridge (northbound and southbound movements) • Pedestrian and cycle access maintained in both directions (subject to some restrictions)	• Full bridge closures would occur across weekend periods (nominally from 7 pm Friday to 5 am Monday) on twelve occasions across the construction period	• Northbound and Southbound diversions • No pedestrian and cyclist diversions required

The Traffic Impact Assessment (Civlink, 2023b) considered an option for a partial closure of the bridge which would permit both northbound and southbound vehicle movements via a shuttle flow operation (i.e. alternating use of a single lane on the bridge via a 'contra flow' arrangement). However, it was concluded that this option was not viable, as the existing two-way traffic volume exceeds the maximum capacity of a single lane shuttle flow operation of 800 vehicles per hour (refer to Figure 6.2), and insufficient vehicle queueing storage is available between the southern extent of the bridge worksite at the George Street intersection.

Detours (including signage) would be put in place for travel in both directions as applicable to the respective full or partial bridge closures. The proposed northbound and southbound detour routes are shown in Figure 6.5. No private property access would be impacted during construction.

Travel time for southbound vehicle trips across the bridge to a destination on or beyond Harris Street will increase during construction to a travel time of between 5 and 10 minutes, compared with a current travel time of 1 minute to complete.

Source: Civlink 2023b

Figure 6.5: Detour routes – Full Bridge closure

Traffic detours – Weekend Impacts

During weekend periods, traffic modelling undertaken as part of the TIA indicated that with changes to traffic light cycle times at some intersections, the proposed detour routes would operate at acceptable levels of service (LOS) at all key intersections with the addition of diverted traffic (refer to Table 6.5) which includes:

- Victoria Road and Macarthur Street
- Victoria Road and Wilde Avenue
- Wilde Avenue / Smith Street / Phillip Street
- Charles Street / George Street.

Table 6.5: Changes to level of service during proposed Gasworks Bridge shutdown (Saturday Peak)

Intersection / turn	Existing LOS / LOS during detour	Existing Average Delay / Proposed Average Delay (seconds)
Victoria Road / Macarthur Street	B / B	24.4 / 25.3
Victoria Road westbound left turn	A / A	8.1 / 8.2
Victoria Road / Wilde Avenue	A / B	13.8 / 15.5
Victoria Road westbound left turn	A / B	10.9 / 17.6
Wilde Ave / Smith Street / Phillip Street	B / B	21.4 / 24.8
Wilde Avenue southbound left turn	A / B	12.8 / 15.8
Charles Street / George Street	B / B	15.2 / 18.6
Charles Street southbound left turn	B / B	15.3 / 21.1
George Street / Harris Street / Macarthur Street	B / C	17.1 / 37.5

Intersection / turn	Existing LOS / LOS during detour	Existing Average Delay / Proposed Average Delay (seconds)
George Street eastbound right turn	B / C	26.6 / 38.5
Victoria Road / James Ruse Drive	A / A	11.5 / 13.8
James Ruse Drive northbound left turn	A / A	7.3 / 5.8
James Ruse Drive northbound right turn	B / B	27.9 / 22.2
James Ruse Drive / River Road West	N/A	18.1 / 18.2
River Road West Eastbound Left Turn	A / B	14.4 / 17.2
James Ruse Drive / Hassall Road / Grand Avenue	E / E	63.5 / 62.7
Hassall Road Eastbound Left Turn	B / B	19.8 / 24.8
Harris Street / Parkes Street	B / B	28.0 / 30.5
Parkes Street Northbound Right Turn	C / D	36.2 / 45.4

During the proposed weekend shutdowns, there would be some increase in queue lengths, with the worst performing intersection for the southbound detour being the George St / Harris Street / Macarthur Street intersection. The right turn at George Street is predicted to operate as LOS C with average delays of almost 40 seconds, and a queue length of up to 221 metres.

Traffic detours – Weekday Impacts

During weekday periods, traffic modelling undertaken as part of the TIA indicated that with changes to traffic light cycle times at some intersections, the proposed detour routes would operate at an acceptable LOS at the majority of the key intersections with the addition of diverted traffic (refer to Table 6.6) which includes:

- Victoria Road and Macarthur Street
- George Street / Harris Street / Macarthur Street
- Victoria Road / James Ruse Drive
- James Ruse Drive / River Road West
- James Ruse Drive / Hassall Road / Grand Avenue
- Harris Street / Parkes Street.

However, there are increases in queue lengths at specific points along the detour routes. Diverted northbound traffic would utilise James Ruse Drive to cross the Parramatta River, with the proposed detours routing via unsignalised left turns onto James Ruse Drive at River Road West and Hassall Street. The River Road West intersection operates at a LOS C during the morning peak; however, this decreases to LOS F during the afternoon peak, with the traffic modelling results indicating the left turn will experience an average delay of approximately 3 minutes and a 95th percentile queue of 524.8m.

The Hassall Street eastbound left turn is expected to decrease from LOS C to LOS F in both peak periods, with the average delay increasing by approximately 1 minute during the morning peak, with the 95th percentile queue increasing from 193.1m to 448.2m. The results show the average delay increases by approximately 2 minutes during the afternoon peak with the 95th percentile queue increasing from 222.3m to 675.2m. End of queue management such as additional VMS boards would therefore be implemented to provide drivers with information regarding expected delays.

Table 6.6: Changes to level of service during proposed Gasworks Bridge shutdown (Weekday peak periods)

	AM Peak		PM Peak	
Intersection / turn	Existing LOS / LOS during detour	Existing Average Delay / Proposed Average Delay (seconds)	Existing LOS / LOS during detour	Existing Average Delay / Proposed Average Delay (seconds)
Victoria Road / Macarthur Street	C / B	28.6 / 27.0	C / B	28.8 / 26.9
Victoria Road westbound left turn	A / A	8.1 / 8.7	A / A	8.1 / 8.9
George Street / Harris Street / Macarthur Street	B / C	20.3 / 28.8	B / C	23.9 / 35.2
Macarthur Street southbound	B / C	25.5 / 29.7	B / C	27.8 / 33.5
Victoria Road / James Ruse Drive	B / B	15.1 / 16.2	A / B	11.4 / 14.6
James Ruse Drive northbound left turn	A / A	7.8 / 9.7	A / A	7.5 / 10.8
James Ruse Drive northbound right turn	B / B	21.6 / 19.9	C / B	29.1 / 22.3
James Ruse Drive / River Road West	N/A	38.9 / 40.2	N/A	66.7 / 81.4
River Road West Eastbound Left Turn	B / C	15.8 / 37.3	B / F	20.1 / 181.1
James Ruse Drive / Hassall Road / Grand Avenue	E / F	68.7 / 74.4	F / F	95.5 / 112.7
Hassall Road Eastbound Left Turn	C / F	33.2 / 96.7	C / F	36.5 / 153.9
Harris Street / Parkes Street	C / C	31.1 / 36.5	C / C	36.3 / 38.6
Parkes Street Northbound Right Turn	D / D	47.4 / 46.3	D / D	47.9 / 54.1

It should be noted that also it is likely that some traffic may exit the detours early and take alternative routes. With greater communication (portable message signs and community notification) residents would opt to use alternative routes, especially O'Connell Street, which is an alternative means of crossing the Parramatta River.

Extended partial bridge closure – Tidal flow option

The option of implementing a tidal flow arrangement for the bridge closure was investigated as part of the traffic impact assessment (Civlink Consulting 2023). For this scenario, the bridge would be open in the southbound only vehicle movements direction during the morning peak, which would then alternate to northbound only vehicle movements for the afternoon peak (nominally 2:00 pm – 7:00pm). Outside of peak periods, the northbound traffic would be detoured at all times (i.e. permitting only southbound vehicle movements).

A traffic modelling assessment of this option was undertaken to identify the performance of a tidal flow operation. The results identified that while most intersections would be able to accommodate the detour with modification of traffic light timings (although at a reduced level of service), the performance of the intersection of George Street and Harris Street would be unacceptable. Notably, during the afternoon peak, the queue length of detoured traffic travelling eastbound on George St attempting to turn right at Harris Street would be approximately 700 metres (despite modification to traffic light timings). This queue would extend back along the detour route to Wilde Avenue.

When considered with the predicted queue at the intersections of George Street and Charles Street (280 metres), and Wilde Avenue and Phillip Street (220 metres), this section of the southbound detour route would likely be gridlocked. Accordingly, the tidal flow option was not preferred.

Parking

The proposal would require the partial closure of the existing car park on the northern side of Parramatta River, which would result in the temporary loss of around 12 car spaces (which allow 10-hour ticketed parking). While nearby streets such as New Zealand and Harvey Street allow free timed parking up to 2 hours, the nearest 10 hour paid parking is located on Stewart and Thomas streets around 400-500 metres to the north west of the proposal. Given the number of parking spaces impacted, and alternative parking options (including extended parking opportunities nearby as well as in the Parramatta CBD) their removal is not expected to cause a major disruption to the community. In addition, depending on pedestrian connectivity during the bridge closure, some commuters who utilise the area for parking, may opt to park elsewhere to ensure easier access to the Parramatta CBD.

Public transport

The proposal would result in impacts to public bus routes 545 (Parramatta to Macquarie Park) and 900 (Parramatta Ferry Wharf), as well as school bus routes 575W, 716W, 721W, S247, 717W and S423. These bus routes would be required to follow traffic detours during full and partial closures of the bridge. Consultation with TfNSW and potentially affected school would be undertaken to minimise disruption to passengers and students using these bus services.

Installation of the scaffolding required to complete the works would result in a reduced clearance of a maximum of 1.62 metres between the scaffolding and the high tide water level. The reduction in clearance would impact the ability of the F3 Parramatta Ferry services to pass beneath the bridge and access the Parramatta Ferry Wharf.

Fulton Hogan would consult with Transdev regarding the impacts associated with a reduction in the clearance. Any access restriction for ferries operating on the Parramatta River would require coordination with Transdev and the potential requirement to replace ferry services with bus services during some tidal periods. Reduced clearance of a maximum of 1.62 metres would occur between the installation and removal of scaffolding and throughout remedial works, which are expected to take around two months to complete.

Active transport

During construction, the walkway located on the bridge would be reduced in width to allow for the installation of scaffolding and the containment system. This reduced width would be maintained throughout the duration of the proposal and may result in some minor delays or inconveniences to active transport users, particularly cyclists who would be required to dismount before crossing the bridge.

Pedestrian and cyclist access to the bridge would be restricted during weekend shutdowns of the bridge and during the remediation of timber planks on the bridge walkway. During these times, a detour via the Charles Street weir or the Alfred Street bridge (currently under construction) would be implemented (refer to Figure 6.6). The walkway will be open at all other times during construction.

Source: City of Parramatta, Alfred St, context map (2023)

Figure 6.6: location of proposed active transport detours

Construction of the proposal would also result in some minor temporary delays to the Parramatta Cycle Way and active transport routes on the northern side of the Parramatta River, with signage installed to inform users of any detours, or restrictions. During site establishment and the installation of scaffolding and the containment system, minor delays would be experienced, particularly where scaffolding crosses pathways, or where fences are installed directly adjacent. During the remainder of the proposal, pedestrian management would be utilised to ensure the safe movement of workers and equipment to and from the site compound at the interface with the active transport route.

Active transport routes on the southern side of the Parramatta River would not be impacted by the proposal, except during the installation of scaffolding and the containment system, where access would cross the pathway at the bridge interface (refer to Photo 6-1) and pedestrian and cycle management would be implemented. Hoarding would be installed to improve separation between the proposal and adjacent active transport routes.

Operation

The proposal would not result in any material change to the operation of the bridge, therefore, there would be no change to the use of the bridge by vehicles, public transport or active transport users. Operational impacts relating to traffic, transport and access have not been considered further.

6.1.4 Safeguards and management measures

Table 6.7 provides a summary of the mitigation and management measures that will be implemented during the construction and operation of the proposal to minimise impacts traffic, transport and access.

Table 6.7: Traffic and transport safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Traffic and transport	A Traffic Management Plan (TMP) will be prepared and implemented for the project. The TMP will be prepared in accordance with the Transport for NSW *Traffic Control at Work Sites Manual* (RTA, 2010) and *QA Specification G10 Control of Traffic* (Transport for NSW, 2008). The TMP will include: • 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 compound and laydown sites 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 • details of end of queue management measures to be implemented (such as additional VMS boards) to provide drivers with information regarding expected delays along proposed vehicle detour routes.	Contractor	Pre-construction	Section 4.8 of QA *G36 Environment Protection*
Public Transport – Ferry Services	Passengers using the Parramatta Ferry would be notified at least five days prior to any service disruptions, and alternative arrangements advertised.	Contractor	Construction	
Public Transport – Bus Services	Passengers using impacted Bus Services would be notified at least five days prior to any service disruptions, and alternative arrangements advertised.	Contractor	Construction	
Emergency Services	Emergency service authorities would be notified at least five days prior to any access disruptions, and alternative arrangements advertised.	Contractor	Pre-Construction / Construction	

6.2 Noise and vibration

A *Noise and Vibration Impact Assessment* (NVIA) report was prepared by WSP in February 2023 (refer to Appendix D) with results summarised in this section.

6.2.1 Methodology

The noise and vibration assessment carried out to assess the impacts of the proposal included:

- identifying noise and vibration sensitive receivers
- determining the existing background noise levels within the proposal site area
- identification of relevant noise and vibration criteria
- identification of noise and vibration generating activities
- predicting the impacts on the construction of the proposal on the noise and vibration sensitive receivers
- identifying the adverse impact that would need safeguarding or management measures under the proposal.

The assessment has been conducted with consideration to the following guidelines:

- TfNSW's Construction Noise and Vibration Guideline (CNVG) (June 2022)
- NSW EPA Interim Construction Noise Guideline (ICNG) (July 2009)
- NSW EPA Assessing Vibration: a technical guideline (AVTG) (2006)
- NSW EPA Noise Policy for Industry (NPfI) (2017)
- NSW EPA *NSW Road Noise Policy* (RNP) (March 2011)
- German Standard DIN 4150: Part 3 – 1999: Structural Vibration in Buildings: Effects on Structures
- Australian Standard 1055:1997 and 2018 – Acoustics – Description and Measurement of Environmental Noise (AS 1055).

The objective of the NVIA was to outline the potential noise and vibration impacts associated with construction of the proposal. The assessment included identifying noise and vibration sensitive receivers, determining existing background noise environment at the proposal site (including by using previously completed noise modelling), establishing noise and vibration assessment criteria, predicting and assessing noise and vibration levels and identifying safeguards and management measures to be implemented to minimise potential impacts. The NVIA also assessed construction noise impacts associated with relevant construction activities, including construction related traffic. It is noted that as vibration during construction activities is generally associated with the use of heavy machinery and vibratory equipment, and due to the nature of the construction activities, impacts from vibration are anticipated to be negligible and have not been assessed further.

The Construction Noise and Vibration Guideline (CNVG) (Road and Maritime Services, 2016a) defines the method for noise assessment. A detailed noise assessment for construction of the proposal has been carried out as defined in the CNVG, as construction would take greater than 6 weeks and there are likely to be a number of sensitive receivers impacted by construction noise levels above the noise management levels (NMLs). NMLs are determined based on the measured rated background levels (RBL) at receivers as defined in the Interim Construction Noise Guideline (ICNG) (NSW EPA, 2009).

For the purpose of assessing the existing noise environment, sensitive receivers have been grouped into the four Noise Catchment Areas (NCAs), with the worst affected receivers in each NCA assessed (refer to 8 and Figure 6.7).

Table 6.8: Noise catchment areas

NCA	Description and Location	Receiver Types
NCA01	Receivers to the northeast of the site	Residential

NCA02	Receivers to the northwest of the site	Residential, educational, active recreation
NCA03	Receivers to the southwest of the site	Residential, commercial hotel
NCA04	Receivers to the southeast of the site	Residential, Active recreation, passive recreation, place of worship, commercial areas

The assessment provides analysis of the noise levels at these identified sensitive receivers and compares them with the relevant NML. In accordance with the ICNG, NMLs are determined based the RBL plus 10dB during standard hours and 5dB outside of standard hours. The ICNG also states that where construction noise levels are above 75dBA at residential receivers during standard hours, they are considered 'highly noise affected' and require additional considerations to mitigate potential impacts. Table 3.2 of Appendix D sets out the application of the NMLs at residential receivers. Details on construction scenarios, including the plant and equipment assumed to be used in each of the noise construction scenarios is included in Section 6.2.3.

To assess the impact of construction noise on sensitive receivers, construction scenarios were identified which included the identification of activities, equipment and plant to be used in each of the scenarios and the location of where these activities would occur. Prediction of construction noise impacts from the proposal has been completed using SoundPLAN noise modelling software to identify noise levels expected to be experienced at each sensitive receiver for each stage of construction.

Sleep disturbance impacts have also been assessed in accordance with the ICNG as some construction activities would be carried out during night-time periods (10pm to 7am) due to requirements for lane closures and shutdowns of the bridge on 12 weekends throughout the construction period.

As the proposal would not result in any material change to the operation of the bridge, no assessment of operational impacts was completed as part of this assessment.

6.2.2 Existing environment

The proposal is situated in an urban area which includes a mix of residential and non-residential land uses, which includes commercial, active recreation, education facilities and places of worship. The areas immediately surrounding the bridge are predominantly active recreational areas on the banks of the Parramatta River.

Nosie sensitive receivers

The noise sensitive receivers nearest to the proposal are listed in Table 6.9. The location of these sensitive receivers is shown in Figure 6.7. It is noted the nearest sensitive receivers include active and passive recreational areas and residential receivers located adjacent to the proposal site.

Table 6.9: Noise sensitive receivers

Receiver ID	Address	Receiver Type	Distance to proposal works boundary (metres)
R1	8 Macarthur Street	Residential	5
R2	10 Macarthur Street	Residential	15
R3	12 Macarthur Street	Residential	30
R4	1 Rangihou Crescent	Residential	50
R5	Macarthur Girls High School (sports field)	Active recreation	35
R6	3 Stewart Street	Residential	200
R7	135 George Street	Hotel[1]	25
R9	140 Argus Lane	Residential	170
R10	111 George Street	Residential	130

Receiver ID	Address	Receiver Type	Distance to proposal works boundary (metres)
R11	2 Noller Parade	Residential	270
R12	1a Noller Parade	Residential	230
R13	163 George Street	Place of worship	140
R14	153 George Street	Commercial	140
R15[2]	103 Harris Street	Passive Recreation[2]	100
R16	42 Hassall Street	Residential	250

(1) This receiver would generally be considered commercial, however as the premises has accommodation facilities, it has been assessed as a residential land use.

(2) It is noted this receiver includes an amenities building which is currently not in operation due to Parramatta Light Rail construction works. Impacts have been assessed for completeness.

Background noise environment

Due to the atypical noise environment as a result of the construction of the Parramatta Light Rail. Prevailing background and ambient noise levels were adopted from the *Parramatta Ferry Wharf Report* (WSP, 2018). Monitoring was conducted at three monitoring locations in general accordance with the AS1055:1997 – *Acoustics – Description and Measurement of Environmental Noise* (AS 1055) in February 2018.

It is noted that large scale works on the Parramatta Light Rail are now complete, with only commissioning trials remaining, however it is considered that the adoption of these 2018 noise levels is appropriate for the purpose of this assessment and are still representative of the current noise environment. The adopted background noise levels (rating background levels) are summarised in Table 6.10. The location of noise monitors is included in Figure 6.7.

Table 6.10: Summary of ambient noise levels

NCA	Noise monitoring (NM) Location	Background Noise Level (dBA RBL[1])		
		Day[2]	Evening[2]	Night[2]
NCA01	NM01 - Macarthur Street	46	44	39
NCA02	NM02 – 4-6 Queens Avenue	49	43	42
NCA03	NM03 – Charles Street	48	44	44
NCA04[3]	NM01 - MacArthur Street	46	46	39

(3) RBL – rating background level. The overall single-figure background level representing each assessment period (daytime/evening/night-time) as defined in the NPfI.

(4) Time periods defined in the NPfI – Day: 7am to 6 pm Monday to Saturday, 8 am to 6 pm Sunday; Evening: 6 pm to 10 pm; Night: the remaining periods.

(5) Noise levels adopted from NM03 for the purpose of this assessment.

Table 6.11 presents the NMLs for each assessment period for residential receivers in each NCA. The NMLs for Standard Hours (SH) and Out of Hours Work (OOHW) have been calculated from the measured and adopted RBLs in each NCA as shown in Table 6.10.

Table 6.11 NMLs for residential receivers

NCA	NM Location	RBL dBA			NML dBA Leq,15min[1]			
		DAY	EVENING	NIGHT	SH	OOHW 1	OOHW 2	HNA
NCA01	NM01	46	46	39	56	51	44	75
NCA02	NM02	49	43	42	59	54	47	75
NCA03	NM03	48	44	44	58	53	49	75
NCA04	NM01	46	46	39	56	51	44	75

(1) Time periods as defined in the NPfI – Day: 7am to 6pm Monday to Saturday, 8am to 6pm Sunday; Evening: 6pm to 10pm; Night: the remaining periods.

Figure 6.7: Noise sensitive receivers, noise catchment areas and noise monitoring locations

6.2.3 Potential impacts

Construction

The proposal would be constructed in stages which would occur at different times of the day, depending on the activity. Table 6.12 provides a summary of the assessed construction scenarios including the location, and time period assessed.

Table 6.12: Construction noise scenarios

Construction scenario	Construction activity	Location	Time period assessed
S01a	site establishment	Site compound and surrounds	Standard hours
SO1b	set up traffic management	Macarthur Street	OOHW
S02	pavement work - bridge deck sealing works	Bridge structure	OOHW
S03	scaffolding and containment system installation/removal	On ground, below and around the bridge structure	Standard hours OOHW
S04a	remediation works (including blasting, priming and coating activities) at the northern end of the bridge	Bridge spans 4 and 5	Standard hours
S04b	remediation works (including blasting, priming and coating activities) at the southern end of the bridge	Bridge spans 1, 2 and 3	Standard hours
S05	site demobilisation	Site compound and surroundings	Standard hours

Table 6.13 outlines the construction scenarios with relevant construction equipment and sound power level (SWL).

Table 6.13: Modelling scenarios and equipment levels

Equipment	Equipment per scenario						Sound power level (dBA)	Source
	S01a	S01b	S02	S03	S04a/ S04b	S05		
Ablution facilities and decontamination					X		72	WSP
Air compressors					X	X	109	CNVG
Dust extraction unit					X		107	DEFRA[3]
Delivery trucks	X	X	X	X	X	X	103	CNVG
Roller	X						109	CNVG
Excavator	X						110	CNVG
Elevated work platforms					X		98	CNVG
Floats			X				100	BS5228

Equipment	Equipment per scenario						Sound power level (dBA)	Source
	S01a	S01b	S02	S03	S04a/ S04b	S05		
Generators				X	X	X	103	CNVG
High volume air samplers					X		78	Manufacturer specifications[4]
High pressure wash					X		97	DEFRA
HIAB/Franna crane	X	X		X		X	98	CNVG
Light vehicles	X	X			X	X	88	CNVG
Lighting towers		X	X	X		X	80	CNVG
Other power tools	X	X	X	X	X	X	102	CNVG
Oxy-acetylene torches					X		105	CNVG
Airless pumps and paint equipment					X		117	WSP
Telescopic handlers				X			107	DEFRA
Vacuum loading machines					X		109	CNVG
Water cart					X		107	CNVG
Total SWL	113	106	107	111	119[1] [109]	112	-	
Maximum SWL (sleep disturbance)	N/A	111	108	115	N/A	113	-	

(1) S04 works are to occur within a containment area constructed of impermeable heavy-duty plastic sheeting. This sheeting is anticipated to provide a minimum 10 dB noise reduction. This reduced level is presented in brackets.

(1) Maximum noise levels have been calculated for periods where OOHW has been proposed. These are based on a typical short term maximum noise level for operation of the proposed equipment.

(2) Department for Environment, Food & Rural Affairs (DEFRA), Update of noise database for prediction of noise on construction and open sites.

(3) Ecotech, HiVol3000 High Volume Air Sampler, User Manual (with muffler)

Predicted construction noise impacts

Noise levels were precited for the construction scenarios (outlined in Table 6.12), with modelled nose levels for each sensitive receiver, as defined in Table 6.9. Worst case noise impacts are presented for each construction sensitive receiver. Results presented consider the following features that will reduce the transmission of construction noise:

- Construction compound site shed placement or acoustic screening adjacent receiver R1 which would act as a noise barrier for high noise generating works during S04a and S04b
- Noise attenuation of the encapsulation area (such as plywood hoarding and acoustic screening) and surrounding acoustically significant plant items for S04a and S04b.

The formatting of the construction noise assessment results (Table 6.14) indicates the following:

- The orange shaded cells show exceedances of the Standard Hours day period
- The yellow shaded cells show exceedances of the OOHW 1 period
- The blue shaded cells exceedances of the OOHW 2 period
- The cells with red text show exceedances of highly noise affected NMLs.

Where a predicted noise level exceeds a less stringent NML (Standard Hours), it follows that the more stringent NMLs (OOHW) are also exceeded.

Table 6.14 Maximum predicted construction noise levels and indicative exceedances per scenario

NCA	Receiver ID	Receiver type	NML dBA $L_{eq,15\ min}$ 1,2,3				Modelled maximum noise level per scenario at closest point to receiver, dBA $L_{eq,15\ min}$ 2,3 (Sleep disturbance L_{MAX} 3)						
			SH	OOHW 1	OOHW 2	HNA	S01 (SH)	S01b (SH and OOHW)	S02 (OOHW)	S03 (SH and OOHW)	S04a (SH)	S04b (SH)	S05 (SH and OOHW)
3	R1	Residential	56	51	44	75	78	56 (61)	56 (57)	57 (61)	59	56	75 (76)
	R2	Residential	56	51	44	75	74	54 (59)	55 (56)	57 (61)	57	58	71 (72)
	R3	Residential	56	51	44	75	71	57 (62)	51 (52)	53 (57)	55	50	67 (68)
	R4	Residential	56	51	44	75	66	48 (53)	54 (55)	56 (60)	56	55	64 (65)
2	R5	Educational Institution	55	N/A	N/A	N/A	60	63 (-)	57 (-)	58 (-)	61	56	61 (-)
	R6	Residential	59	54	47	75	46	46 (51)	47 (48)	48 (52)	50	49	46 (47)
1	R7	Hotel	58	53	49	75	58	50 (-)	60 (-)	65 (-)	59	64	57 (-)
	R8	Commercial	70	N/A	N/A	N/A	56	50 (-)	- (-)	60 (-)	58	61	56 (-)
	R9	Residential	58	53	49	75	52	45 (50)	49 (50)	53 (57)	51	52	51 (52)
	R10	Mixed Use	58	53	49	75	51	45 (50)	50 (51)	55 (59)	48	54	51 (52)
4	R11	Residential	56	51	44	75	54	43 (48)	46 (47)	50 (54)	48	48	52 (53)
	R12	Residential	56	51	44	75	54	44 (49)	47 (48)	50 (54)	49	49	53 (54)
	R13	Place of worship	55	55	55	55	54	45 (-)	46 (-)	48 (-)	50	47	53 (-)
	R14	Commercial	70	N/A	N/A	N/A	57	47 (-)	- (-)	55 (-)	53	55	56 (-)
	R15	Passive Recreation	60	60	60	60	52	44 (-)	50 (-)	53 (-)	50	53	51 (-)
	R16	Residential	56	51	44	75	53	43 (48)	47 (48)	49 (53)	48	50	51 (52)

(1) Time periods as defined in Table 6.8, HNA – Highly noise affected.

(2) Predicted noise levels are represented by a single point for nearest receivers per noise catchment area for this assessment.

(3) Where a predicted noise level exceeds a less stringent management level (SH), it follows that the more stringent (OOHW) management levels would also be exceeded.

(4) Results include 10 dB attenuation from containment unit.

Predicted construction noise impacts – Standard Hours

Noise levels are predicted to exceed relevant NMLs during standard construction hours at the nearest sensitive noise receivers in NCA01 and at the hotel in NCA03, with site establishment and demobilisation presenting the greatest impact in NCA01 and the installation and removal of scaffolding in NCA03.

Noise levels are predicted to exceed relevant criteria during the following scenarios, by:

- up to 22dBA during S01 (site establishment). This exceedance to the NMLs is due to the proximity of the site compound to sensitive receivers
- up to 1dBA during S01b (traffic management set up)
- up to 2dBA during S02 (bridge deck sealing)
- up to 7dBA during S03 (installation and removal of scaffolding and the containment system)
- up to 1dBD during S04a (remedial works)
- up to 6dBD during S04b (remedial works)
- up to 19dBA during S05 (site demobilisation), which consistent with S01 (site establishment) is due to the proximity of the site compound to sensitive receivers.

The construction equipment which generates the highest noise emissions is the spray pump and paint equipment (S04). Noise predictions include the noise reduction of the containment unit, which is assumed to result in a 10 dB reduction in noise levels. These activities are not expected to operate over the full construction period, however, are expected to last for up to 55 days and require noise management and mitigation measures to effectively manage impacts at receivers.

The closest residences to the construction work in NCA01 (R1) is predicted to be highly noise affected when works are at their closest during the establishment of the site compound (S01).

Where exceedances of the NML are anticipated, a combination of mitigation, management and consultation with receivers would be implemented to manage and minimise impacts.

Predicted construction noise impacts – Out of hours works

Out of hours works would occur during:

- S01b (traffic management set up)
- S02 (Pavement works), and
- S03 (scaffolding and containment system installation).

Construction noise impacts during out of hours works are predicted to exceed relevant NMLs at the nearest sensitive receivers in during all activities. During out of hours works in period 2, exceedances of up to 13dBA are predicted during S01b, up to 12 dBA during S02 and up to 16 dBA during S03.

The closest residences to the construction work in NCA01 (R1 and R2) are predicted to be the most impacted when works are at their closest during S03. Sensitive receiver R2 is predicted to be the most impacted during S01b.

Based on the current available information regarding the proposed construction activities, noise impacts may be intrusive outside standard hours at the nearest receivers to the works areas.

No exceedances of sleep awakening criteria are predicted to occur during any of the work stages S01b, S02 or S03, however exceedances of the sleep disturbance screening criteria may occur during each work stage. Mitigation measures and respite periods will be implemented during these work stages.
The results are (shown in Figure 6.8 to Figure 6.14) present the predicted noise level, which are then applied to the NML to determine noise level exceedances as outlined in outlined in Table 6.14.

Figure 6.8: Noise maps – Scenario 1a (Standard hours)

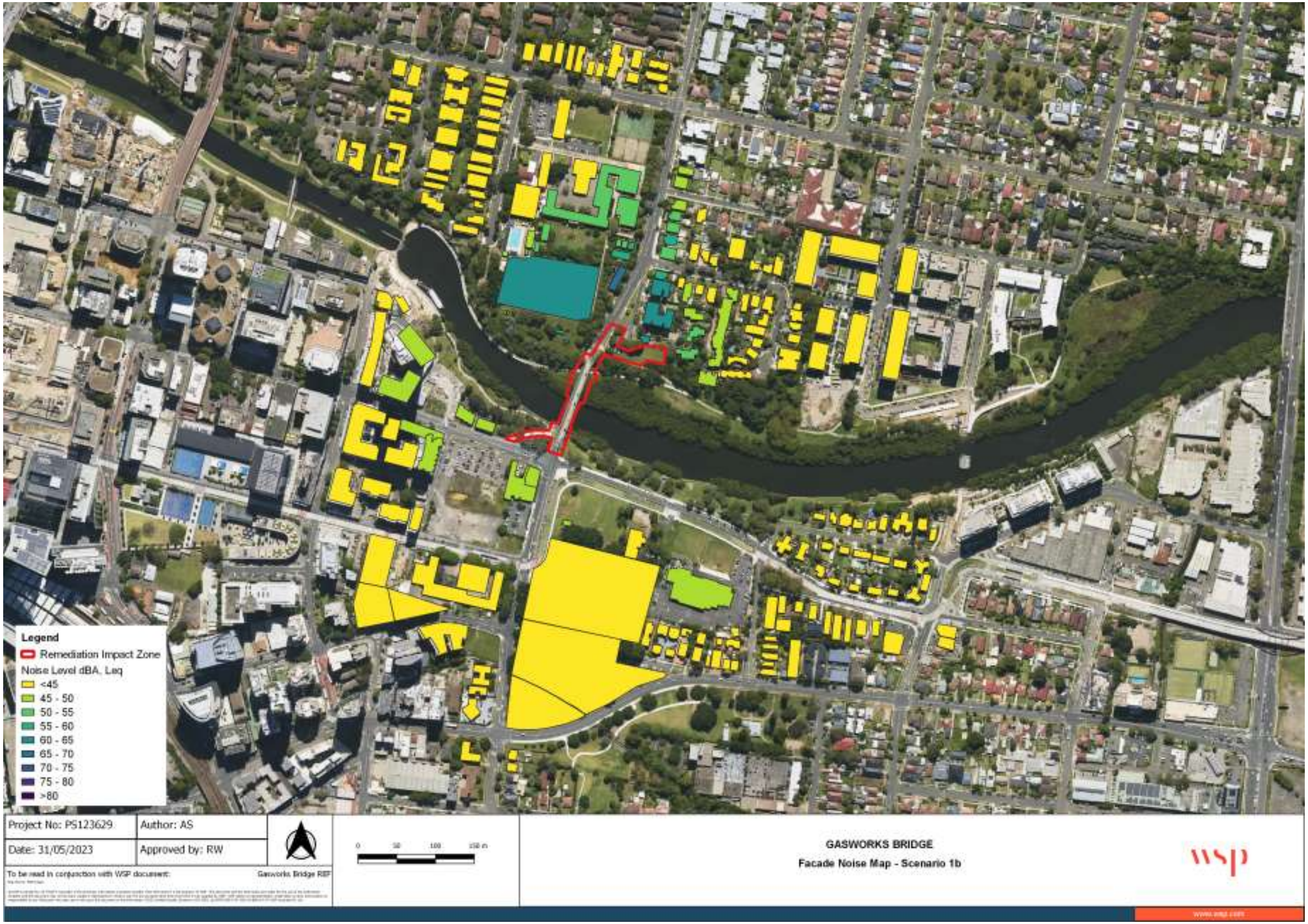


Figure 6.9: Noise maps – Scenario 1b (Standard hours)

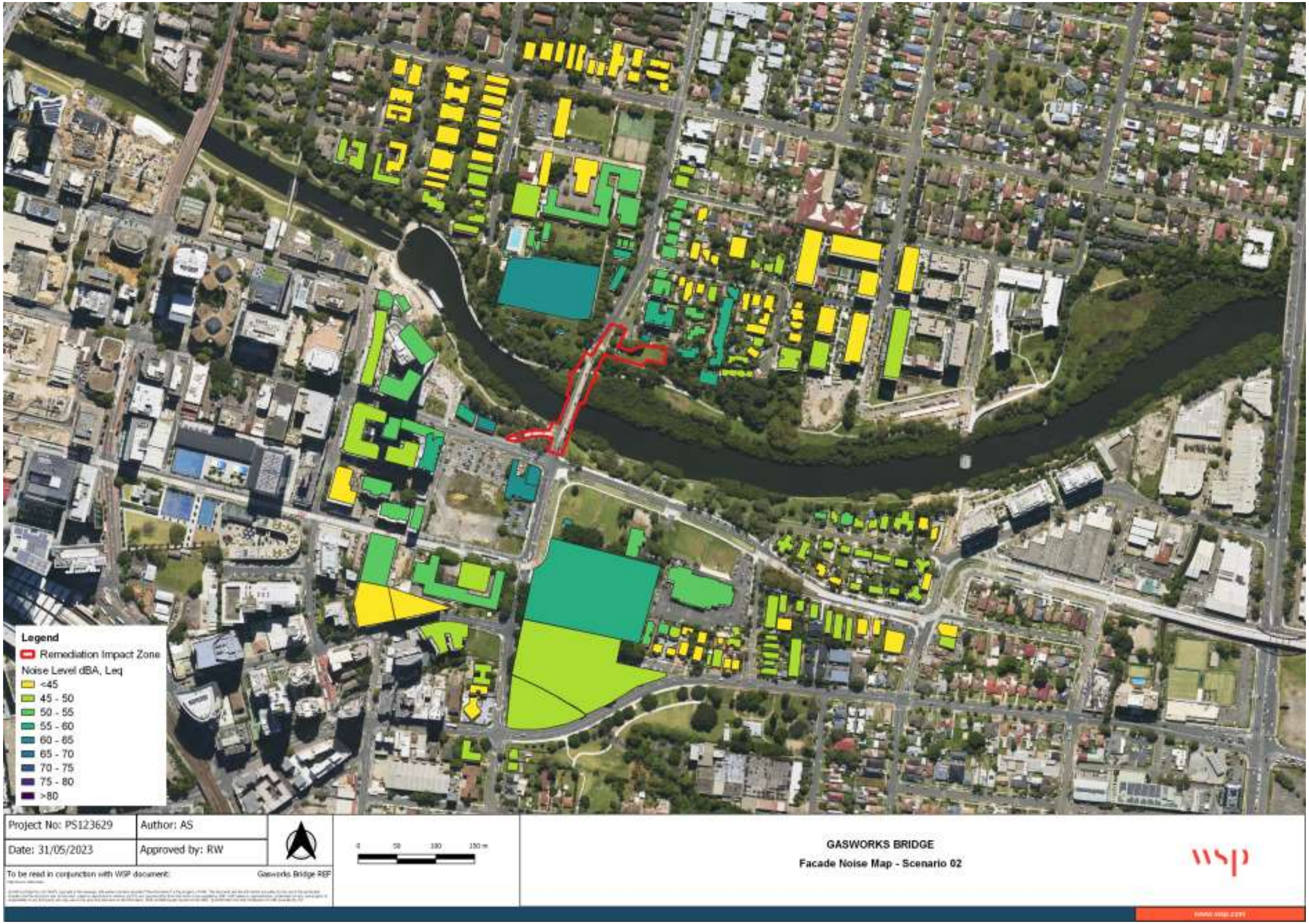


Figure 6.10: Noise maps – Scenario 02 (Out of hours works)

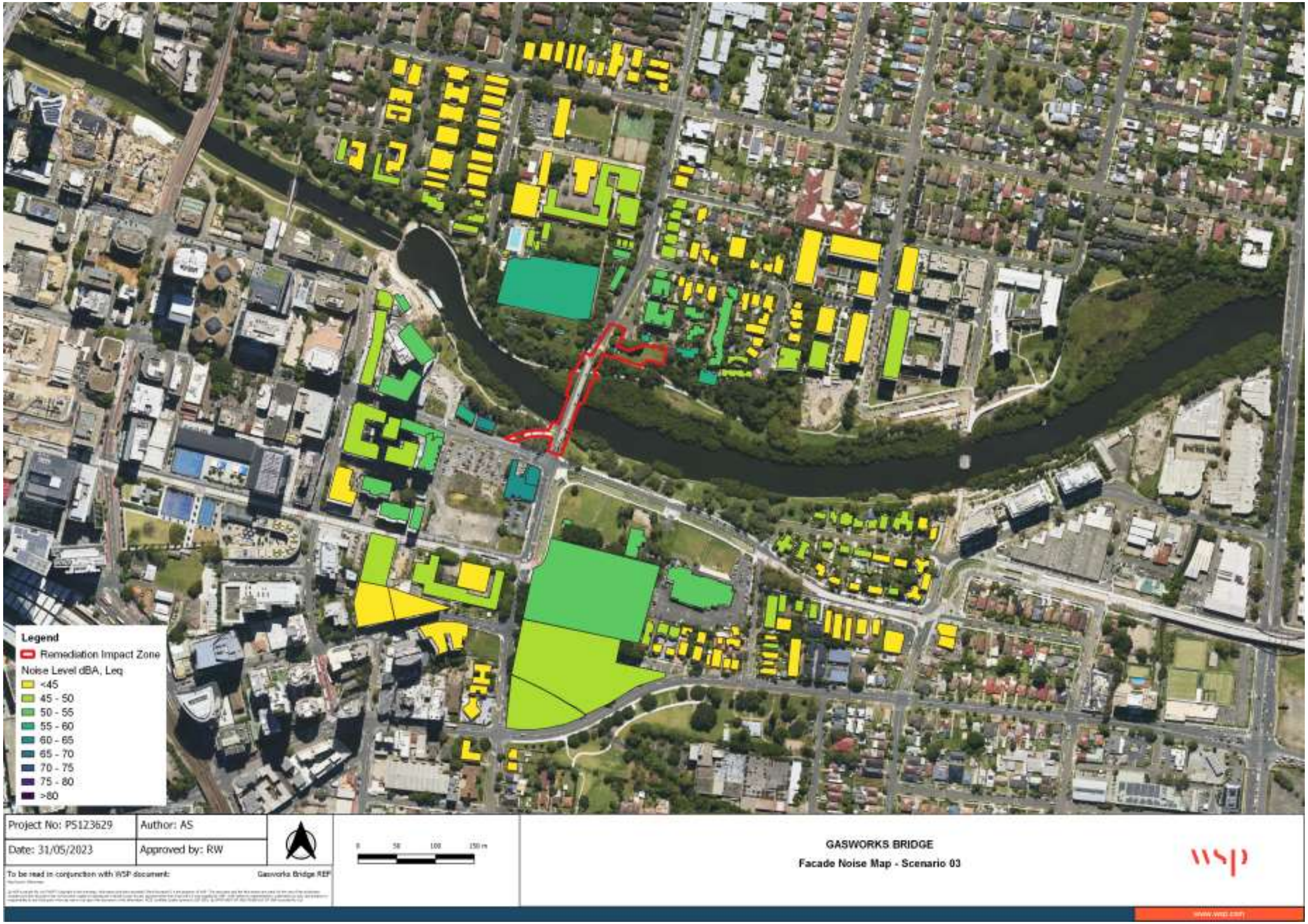


Figure 6.11: Noise maps – Scenario 03 (Standard and Out of hours works)

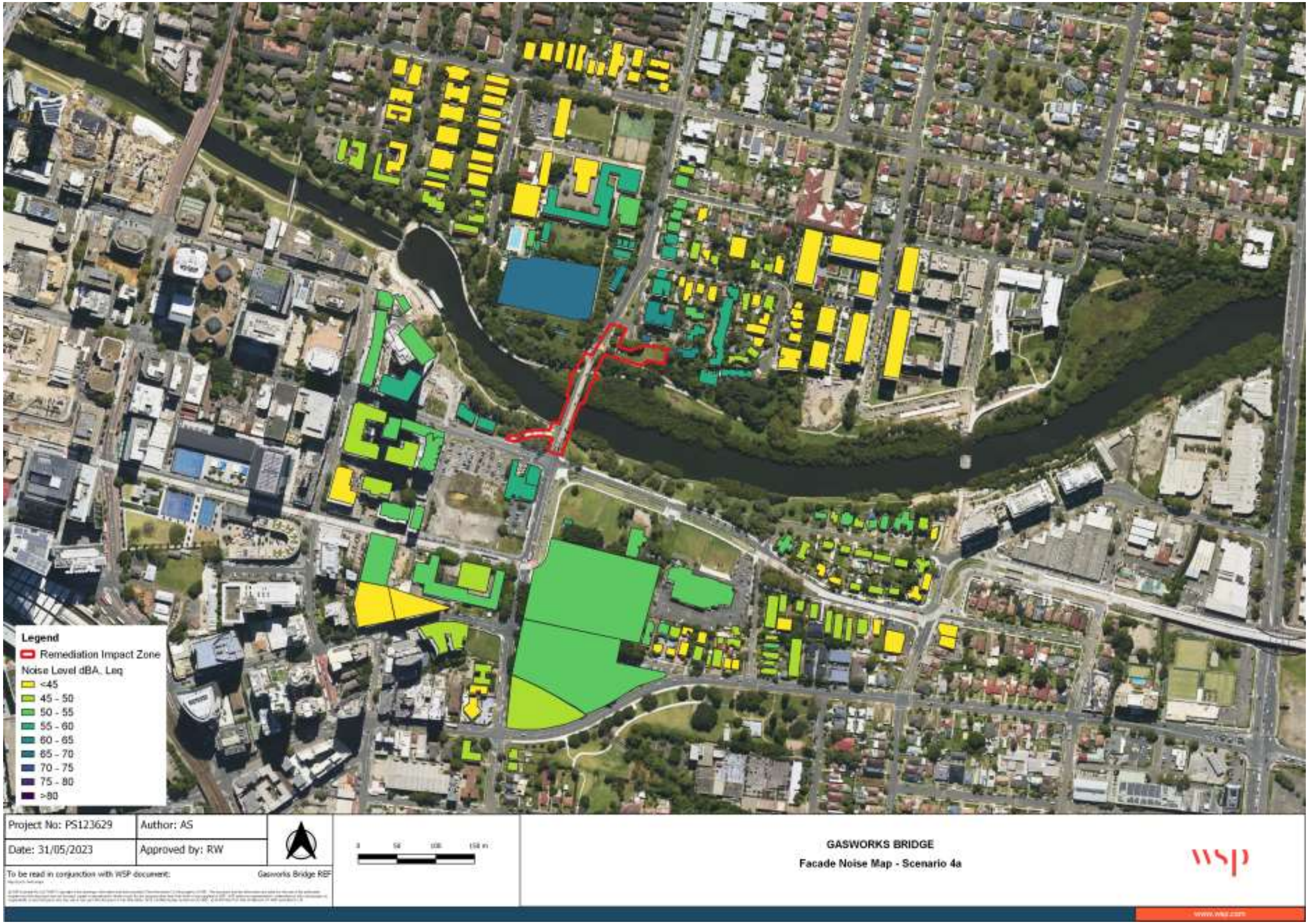


Figure 6.12: Noise maps – Scenario 04a (Standard hours)

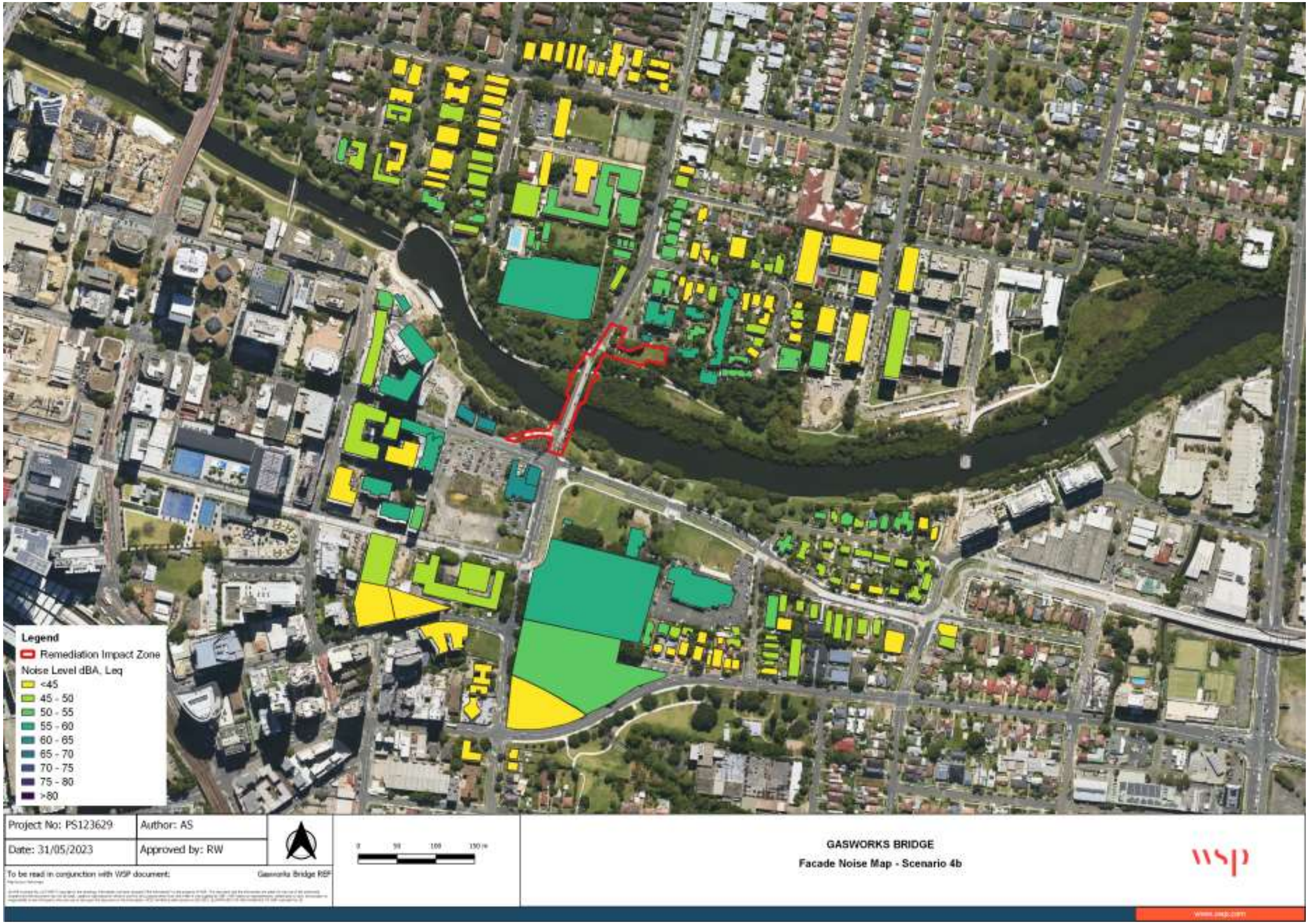


Figure 6.13: Noise maps – Scenario 04b (Standard hours)

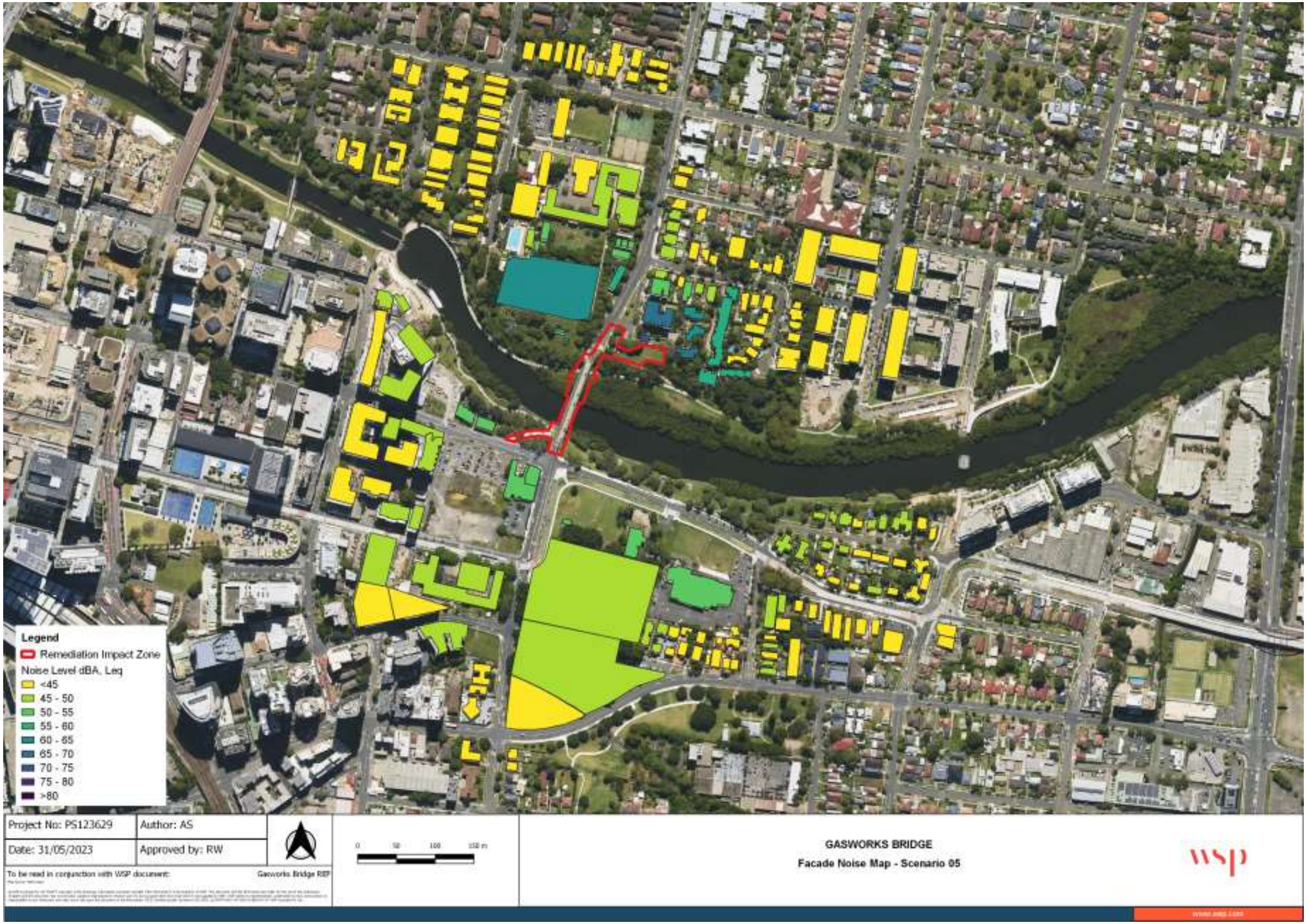


Figure 6.14: Noise maps – Scenario 05 (Standard hours)

Construction traffic/traffic noise

Construction vehicles would be required to access the site via a number of access routes to complete the proposal, which would temporarily increase the number of traffic movements along the traffic network. It is understood that construction traffic would access the proposal site compound and laydown areas from Victoria Road via Macarthur Street to the north, and Hassall Street via Harris Street to the south. A summary of construction traffic is included in Section 3.3.7 and Section 6.1.2 provides a summary of estimated traffic volumes used in this assessment.

An increase of around 60 per cent in traffic is required to increase traffic noise levels by more than 2 dB. Traffic generated by the construction of the proposal is expected to be negligible considering the existing traffic volumes on Macarthur Street and surrounding roads. As such noise impacts from to construction traffic are not anticipated to result in a 2 dB increase on existing traffic noise levels and have not been considered further. It is recommended that heavy vehicle movements to and from the site be restricted to standard (daytime) hours.

Based on the assessed traffic volumes, it is noted that the diversion during weekend periods is anticipated to result in notable traffic impacts on the surrounding traffic network. Diverted traffic will result in a doubling or tripling in peak hourly volumes on Victoria Road, Wilde Avenue and Charles Street.

Traffic management would be required on local roads to manage the impacts of traffic diversions during construction. However, in consideration of diversion traffic volumes, proposal construction traffic volumes are likely to be negligible.

Operation

The proposal would not result in any material change to the operation of the bridge, therefore, changes to the existing noise environment are not expected and have not been considered further.

6.2.4 Safeguards and management measures

The NCVG provides a summary of the mitigation and management measures that will be implemented during the construction and operation of the proposal to minimise noise impacts.

Following the implementation of these mitigation measures additional measures may be required where exceedances are still identified. Table 6.16 outlines these additional management measures, and when to implement the additional noise management measures.

Table 6.15: Noise and vibration safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Construction noise	Prior to commencement of works, a Construction Noise and Vibration Management Plan (CNVMP) would be prepared and implemented in accordance with the requirements of the Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009), Construction Noise and Vibration Strategy (Transport for NSW, 2019c) and the Noise and Vibration Impact Assessment for the proposal (WSP, 2023), and include: • 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 working hours (including implementation of EPA Interim Construction Noise Guidelines (DECCW, 2009) • a risk assessment to determine potential risk for activities likely to affect receivers (for activities undertaken during and outside of standard working hours) • mitigation measures to avoid noise 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 issues and complaints • a construction staging program incorporating a program of noise monitoring for sensitive receivers • a process for updating the plan when activities affecting construction noise and vibration change • identify in toolbox talks where noise and vibration management are required.	Contractor	Pre-construction	n/a
Construction noise	The CNVMP would take into consideration measures for reducing the source noise levels of construction equipment by construction planning and equipment selection. Noise mitigation measures which would be considered, include; • regularly training workers and contractors (such as at the site induction and toolbox talks) on the importance of minimising noise emissions and how to use equipment in ways to minimise noise • avoiding unnecessary noise when carrying out manual operations and when operating plant or equipment • avoiding/limiting simultaneous operation of noisy plant or equipment with discernible range of a sensitive receiver • switching off any equipment not in use for extended periods of time • avoiding deliveries at night/evenings	Contractor	Pre-construction	n/a

Impact	Environmental safeguards	Responsibility	Timing	Reference
	• no idling of delivery trucks • keeping truck drivers informed of designated routes, parking locations and acceptable delivery hours for the site • compounds and equipment laydown areas designed to promote one-way traffic so that vehicle reversing movements are minimised • minimising talking loudly; no swearing or unnecessary shouting, or loud stereos/radios onsite; no dropping of materials from height, no throwing of metal items and slamming of doors • maximising the offset distance between noisy plant and adjacent sensitive receivers • directing noise-emitting plant away from sensitive receivers • regularly inspecting and maintaining plant to avoid increased noise levels from rattling hatches, loose fittings etc.			
OOHW	Out of Hours Works (OOHW) measures will be incorporated into the CEMP. The plan would include but not be limited to: • process for preparing Out of Hours Application (OOHA) for all works outside normal hours including environmental and community consultation requirements • the works that would be undertaken including machinery • conducting and noise assessment for the proposed works / activities in accordance with RMS procedures • mitigation measures identified by these assessments are to comply with those specified within the RMS Noise Management Manual – Practice Note VII • method for assessing the adequacy of the noise assessment • process for noise monitoring during works.	Contractor	Pre-construction / Construction	n/a
Construction noise	Where the $L_{Aeq,15min}$ construction noise levels are predicted to exceed 75 dBA and/or 30 dB above the Rating Background Level at nearby affected sensitive receivers, respite periods would be observed, in accordance with the CNVS.	Contractor	Construction	n/a
Construction noise	All sensitive receivers (e.g. schools, local residents) likely to be affected would be notified at least five working days prior to commencement of any works associated with the activity that may have an adverse noise impact. The notification will provide details of: • the project • the construction period and construction hours • contact information for project management staff • complaint and incident reporting and how to obtain further information.	Contractor	Detailed design / pre-construction	n/a

Impact	Environmental safeguards	Responsibility	Timing	Reference
Site Establishment	During site establishment works (site compound), the installation of all site fencing with shade c is to take into consideration the location of sensitive receivers to ensure that there is no direct 'line of sight'.	Contractor	Construction	n/a
Abrasive Blasting	During abrasive blasting activities (undertaken during Standard Hours) and when equipment is to be used near sensitive receivers, the noise reduction properties of the containment system would be confirmed via noise monitoring to achieve the mitigation reductions as outlined in this report. Temporary noise screens or enclosures will be placed around the equipment and the containment area.	Contractor	Construction	n/a
Abrasive Blasting	When the spray pump and paint equipment is to be used near sensitive receivers, the noise reduction properties of the containment system be confirmed via noise monitoring to achieve the mitigation reductions. Temporary noise screens or enclosures will be placed around the equipment and the containment area.	Contractor	Construction	n/a
Construction noise	The positioning of plant and equipment in Laydown Area A (north of the bridge) would ensure noisiest items are located furthest away from noise sensitive receivers. Positioning these items at the southern end of the laydown area will provide increased separation from source to receiver and also offers the potential for other equipment to provide shielding.	Contractor	Construction	n/a
Construction noise	Appropriate respite periods would be adopted during work stages where exceedances of criteria are predicted.	Contractor	Construction	n/a

Table 6.16: Implementation of additional management measures

Construction Hours	Receiver perception	dBA above NML	Additional management measures[1]
Standard Hours	Noticeable	0	-
Monday-Friday (7.00 am-6.00 pm)	Clearly audible	< 10	-
Saturday (8.00 am-1.00 pm)	Moderately intrusive	> 10 to 20	PN, V
	Highly intrusive	> 30	PN, V
	75dBA or greater	N/A	PN, V, SN
OOHW Period 1	Noticeable	< 5	-
Monday-Friday (6.00 pm-10.00 pm)	Clearly audible	5 to 15	PN
Saturday (7.00 am-8.00 am, 1.00 pm-10.00 pm)	Moderately intrusive	> 15 to 25	PN, V, SN, RO
Sunday/PH (8.00 am-6.00 pm)	Highly intrusive	> 25	PN, V, SN, RP[2], DR[2]
OOHW Period 2	Noticeable	< 5	PN
Monday-Saturday (12.00 am-7.00 am, 10.00 pm-12.00 am)	Clearly audible	5 to 15	PN, V
Sunday/PH (12.00 am-8.00 am, 6.00 pm-12.00 am)	Moderately intrusive	> 15 to 25	PN, V, SN, RP, DR
	Highly intrusive	> 25	PN, V, SN, AA, RP, DR

(5) PN = Periodic notification, AA = alternative accommodation, V = verification, IB = individual briefing, N = notification, R2 = respite period, DR = duration respite, R1 = respite period 1, PC = phone calls, SN = specific notifications

(6) Respite periods and duration reduction are not applicable when works are carried out during OOHW Period 1 (Daytime periods only)

6.3 Air quality

An Air Quality Assessment (AQA) report was prepared by WSP in September 2021 (refer to Appendix E), with results summarised in this section.

6.3.1 Methodology

The assessment methodology for the air quality impact assessment involved:

- a desk top review of existing environmental conditions relevant to air quality, including the existing ambient air quality
- identifying sensitive receivers near the proposal
- identifying the potential sources of air quality emissions from the proposal
- a qualitative assessment of the air quality impacts on sensitive receivers located near the proposal
- identifying mitigation measures to manage the potential impacts identified.

6.3.2 Existing environment

Regional air quality

The air quality monitoring network within the Sydney North-West monitoring region provides the most representative air quality monitoring results for Parramatta and includes air quality monitoring sites at Parramatta North, Penrith, Prospect, Richmond, Rouse Hill and St Marys. The nearest monitoring site to the proposal is the Parramatta North air quality monitoring station, which is located at Cumberland Hospital, around 2.2 kilometres to the northwest of the proposal site. Given the nearby location of this monitoring station, similar meteorological and air quality conditions are likely to be experienced at the proposal site with likely variances due to distance and topography.

The Parramatta North air quality monitoring station site recorded on average light winds and calm conditions across all seasons with winds most frequently coming from the north-west and south-east. The particulate matter ($PM_{2.5}$ and PM_{10}) levels recorded at the station generally met the criteria set out in the National Environment Protection (Ambient Air Quality) Measure (Air NEPM). The exceedances recorded were generally due to bushfire smoke (refer to Table 6.17).

Table 6.17: Ambient air quality data at Parramatta North AAQMS (2018-2022)

Year	Annual average (µg/m3)		Maximum 24-hour Average (µg/m3)		
	PM10	PM2.5	PM10	PM2.5	Number and date of maximum exceedances
2018	21.6	9.2	107.4	42.1	PM10: 8 (maximum on 22 November) PM2.5: 4 (maximum on 29 May)
2019	25.5	10.5	195.3	130.1	PM10: 22 (maximum on 10 December) PM2.5: 21 (maximum on 10 December)
2020	19.3	8.2	188.9	72.9	PM10: 9 (maximum on 23 January) PM2.5: 10 (maximum on 8 January)
2021	17.1	6.6	42.5	17.1	0
2022	14.1	5.2	42.7	16.9	0
Air NEPM standard	25	8	50	25	0

Air pollutant sources

Based on the land uses surrounding the proposal, the existing air quality is likely to be characteristic of an urban environment. The predominant sources of localised air pollution are likely to be vehicle exhaust fumes, and manufacturing in nearby suburbs (predominantly to the east and southeast).

A search of the National Pollution Inventory (NPI) database 2020/21 indicates there are a total of 12 facilities reporting emissions within the Parramatta LGA. Most of these sites are located to the east and southeast of the proposal site in the suburbs of Rosehill, Camellia and Silverwater north of the M4 motorway. The closest facility which has reported pollution is 1.6 kilometres to the east and is a metal product manufacturing facility.

Sensitive receivers

The sensitive receivers nearest to the proposal (as related to Air Quality) are described in Table 6.18 and shown in Figure 6.15. The nearest residential sensitive receivers are located between 5 and 50 metres from the proposal site to the north of the bridge. Additionally, potentially sensitive receivers near the proposal may include users of adjacent recreational / open space areas, pedestrians and commuters using the bridge to cross the Parramatta River. Sensitive receivers located downwind of the prevailing wind directions (i.e. south-east and north-west) may potentially be most affected from air emissions from the proposal.

Table 6.18: Sensitive receivers identified near the proposal

Receptor ID	Address	Receptor Type	Distance to proposal (m)	Direction from proposal
R1	135 George Street	Albion Hotel	20	South
R2	190 George Street	Commercial	15	West
R3	Stewart Street reserve	Recreational	5	North-east
R4	Macarthur Girls High School (sports field)	School	35	North-west
R5	8 MacArthur Street	Residential	5	North-east
R6	10 MacArthur Street	Residential	5	East
R7	Rangihou Reserve	Recreational	5	East
R8	Queen's Wharf Reserve	Recreational	5	East
R9	1a Noller Parade	Residential	230	East
R10	2 Noller Parade	Residential	270	East
R11	153 George Street	Commercial	70	South-east
R12	163 George Street east	Guardian childcare/education centre	140	South-east
R13	103 Harris Street	Robin Thomas Reserve	100	South

Figure 6.15: Air Quality – Sensitive receivers

6.3.3 Potential impacts

Construction

During construction of the proposal, the main impact to air quality is the potential for the generation of dust (containing hazardous materials) from the abrasive blasting required to remove the existing lead-based paint from the bridge structure. Without the installation of the containment system, this activity would result in high potential for impacts to nearby sensitive receivers.

Section 3.3.1 provides a detailed methodology for the safe removal of hazardous materials during the proposal. It includes the requirement for all works involving hazardous materials to be completed with a fully encapsulated, negative pressure containment system, which contains a dust collection system to capture all dust and lead particles. The correct use of this containment system will reduce the impact of the proposed works on nearby receivers.

In addition to the containment system, high volume air quality monitoring as well as visual inspections during de-leading works would be undertaken as a secondary, and tertiary level of mitigation to further minimise the potential for impacts. The use of this containment system and the additional measures outlined in Table 6.19 would mean impacts to nearby sensitive receivers are unlikely.

Other activities with potential air quality impacts include:

- the potential for dust to be generated during site establishment works, specifically during clearing and grubbing of surface materials, and the installation and use of site compounds, and equipment laydown areas. It is expected that the generation of dust would be minor, due to the small areas impacted, minimal movements of construction traffic, and the installation of hardstand areas within the site compound, and equipment laydown area B. Other equipment laydown areas (A and C) are located on existing sealed surfaces and would not require any ground disturbance
- emission associated with vehicle, plant and machinery use and movements, however these are expected to be minor given the small number of construction plant and heavy vehicles required to be used daily (around 15 movements), in addition emissions would likely be offset by the reduction in vehicle traffic using Macarthur Street and the bridge during construction. The main source of stationary emissions would be as a result of the use of diesel-powered generators to provide electricity onsite. It is expected these would be located within the site compound area, however, to minimise the potential impacts on sensitive receivers, these would be located as far away as possible from residential receivers to the north of the site compound
- VOCs and odour may be emitted during repainting of the bridge and from the storage of liquid paint in equipment laydown areas. However impacts would be negligible, as the primer, stripe and final coats would be water based with low levels of VOCs present.

With the implementation of proposed mitigation measures in Table 6.19 the proposal would have a low potential for impacts.

Operation

The operation of the proposal would not result in any material changes that would impact air quality. Therefore, these have not been considered further.

6.3.4 Safeguards and management measures

Table 6.19 provides a summary of the mitigation and management measures that will be implemented during the construction of the proposal to minimise impacts to air quality identified in Section 6.3.3.

Table 6.19: Air quality safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Air Quality	An Air Quality Management Plan (AQMP) would be prepared and implemented as part of the CEMP. The AQMP would outlining the type and nature of emission sources, potential impact on nearby sensitive receptors and management measures to minimise and reduce emissions. The AQMP would include, but not be limited to: • a map identifying the location of sensitive receivers • identification of potential sources of air pollution • identification of potential risks/impacts to the work/activities as dust generation activities • air quality management objectives consistent with any relevant published EPA and/or other guidelines • mitigation and suppression measures to be implemented • methods to manage work during strong winds or other adverse weather conditions, including restricting activities with high dust generating potential during periods of high winds (> 10 m/s) • an air quality monitoring plan to include as a minimum: o the requirements detailed in AS 4361.1:2017 (including high volume air quality sampling) o the requirements of TfNSW Specification B220 o emission monitoring for dust fractions (PM_{10} and $PM_{2.5}$) and lead to demonstrate the removal efficiency of the dust extraction system as per the manufacturer's specification requirements o ambient air quality monitoring of dust fractions and lead prior to and for the duration of the abrasive blasting activity o visual dust monitoring would be undertaken to verify the effectiveness of controls and enable early intervention.	Contractor	Pre-construction / Construction	n/a
Dust emissions	Cover or stabilise potentially dust-generating materials during transport to/from the proposal site to the compound and laydown areas.	Contractor	Construction	n/a
Combustion emissions	Maintain vehicles and equipment to facilitate efficient operation.	Contractor	Construction	n/a
	Minimise diesel engine idle times and locate away from the ambient air quality monitoring equipment and sensitive receptors. Minimise idling time of all plant and machinery and switch off when not in use for more than 15 minutes. Locate away from the ambient air quality monitoring equipment and sensitive receptors.	Contractor	Construction	n/a
Combustion emissions	The location of site generators would take into consideration nearby sensitive receivers as well as the location of air quality monitoring equipment. Generators would be switched off when not in use.	Contractor	Construction	n/a

Impact	Environmental safeguards	Responsibility	Timing	Reference
Liquid paint	Use water-based paints or paints with low levels of VOCs and use of the paints sparingly.	Contractor	Construction	n/a
Spent abrasive and hazard material waste	The removal of all hazardous materials would be conducted in accordance with TfNSW Specification B233 and AS 4361.1: 2017.	Contractor	Construction	TfNSW Specification B233 and AS 4361.1: 2017

6.4 Biodiversity

A *Biodiversity Assessment Report* (BAR), which assessed the existing environment and impacts of the proposal on the biodiversity was prepared by WSP in February 2023 (refer to Appendix F). This section provides a summary of the BAR.

6.4.1 Methodology

The BAR was undertaken in accordance with the Biodiversity Assessment Method (BAM) (NSW DPIE, 2020). The BAR addresses the requirements for assessment of significance under the NSW BC Act and the Commonwealth EPBC Act. To assess the proposal's potential impact to biodiversity, the study area includes the proposal site (refer to **Figure 6.16**) and includes a 20 metre buffer.

The assessment methodology included a desktop assessment of relevant publicly available databases as well as a field survey, which was undertaken during daylight hours by a qualified WSP ecologist on 3 September 2021. The field survey sought primarily to identify key ecological constraints by assessing the type, extent and condition of vegetation and fauna habitat, especially as it pertained to threatened species and ecological communities. Further details of the desktop assessment and field survey methodologies is included in Chapter 2 of the BAR in Appendix F.

6.4.2 Existing environment

The proposal is in a heavily disturbed area of open space associated with the Parramatta River, and road infrastructure associated with the bridge and Macarthur Street.

Vegetation

One plant community type (PCT), PCT 920 *Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion* was recorded in the proposal study area. PCT 920 does not form part of any listed Threatened Ecological Community (TEC) under the BC or EPBC Act, however, is protected, and mapped as key fish habitat under the FM Act. Two non-native vegetation types were also identified within the study area and assigned to a miscellaneous ecosystem class, Miscellaneous ecosystem – Planted Native Vegetation, and Exotic grassland.

- Miscellaneous ecosystem – Planted Native Vegetation does not align to any recognised plant community type in NSW and is the result of planted native vegetation by City of Parramatta. This is the dominant vegetation on the southern side of Parramatta River. Small areas of planted vegetation occur to the north of the Parramatta River adjoining the shared pathways (refer to Photo 6-4 and Photo 6-6)
- Miscellaneous ecosystem – Exotic grassland does not align to any recognised plant community type in NSW due to its limited native vegetation and degraded condition. This vegetation is occurring within parklands and adjoins the shared pathways (refer to Photo 6-5).

A summary of PCT and non-native vegetation recorded is presented in Table 6.20. The extent and distribution are shown in Figure 6.16.

Table 6.20: Plant community types

Plant community type (PCT)	Condition class	Threatened ecological community?	Area (ha) study area	Area (ha) impacted
PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Intact	No (Note: they are protected in New South Wales (NSW) under the Fisheries Management Act 1994)	0.18	0.02 of trimming mangroves (13 individuals)
		Total extent of native vegetation	**0.18**	**0.02**

Miscellaneous ecosystem – Planted Native and exotic vegetation	n/a	No	0.38	0.4
Miscellaneous ecosystem – Exotic grassland	n/a	No	0.66	0.62
Total extent of non-native vegetation			1.03	0.66
Total native and non-native vegetation			1.22	0.68

Photo 6-3: PCT 920 on the northern bank of the Parramatta River under the Gasworks Bridge on the northern bank

Photo 6-4: Miscellaneous ecosystem – Planted Native Vegetation to the north of George Street

Photo 6-5: Miscellaneous ecosystem – Exotic Grassland

Photo 6-6: Planted sedges adjoining mangroves on the northern side of the Parramatta River

Figure 6.16: Plant Community Types

Threatened flora species

No threatened flora species listed under the BC Act or EPBC Act have a moderate or higher likelihood of occurring within the study area.

Priority and high threat weeds

Of the 29 recorded exotic species, one species is listed as Priority Weeds under the NSW *Biosecurity Act 2015* (Biosecurity Act) for the Greater Sydney Local Land Service region and is listed in Weeds of National Significance (WONs). Under the Biosecurity Act, land managers are required to follow the regional and non-regional duties which have been allocated to each Priority Weed.

Table 6.21: Weeds of concern recorded within the study area

Scientific name	Common name	Priority weed duty	WONs
Senecio madagascariensis	Fireweed	**Prohibition on dealings** Must not be imported into the State or sold	Yes

Fauna

Threatened fauna

53 threatened fauna species listed under the BC Act as known or predicted to occur in the locality of which two have been identified as having a moderate or higher likelihood of occurring within the study area.

A site survey, conducted September 2021, included inspections for threatened microbat roosting potential inside infrastructure associated with the OEH (2018) *'Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method.* While no nocturnal microchiropteran bat surveys were undertaken as part of the field surveys, the initial site survey did not identify any hollow bearing trees and no suitable roosting habitat was observed on the bridge structure (manmade habitat). As such no further surveys were required.

No threatened fauna species listed under the EPBC Act have a moderate or higher likelihood of occurring within the study area.

Endangered fauna

No endangered fauna populations were recorded within or have habitat in the study area.

Listed migratory species

18 terrestrial and wetland migratory species that are known or predicted to occur within the locality. None of these migratory species have habitat within the study area.

Fauna habitats

Aquatic habitat

The proposal is in the Parramatta catchment, adjoining the Parramatta River, and includes mangroves, associated mudflats and the Parramatta River. The Parramatta River is mapped as Key Fish Habitat within the proposal site (refer to Figure 6.17).

No threatened aquatic species or threatened communities listed under the FM Act were identified by the data base searches or was recorded within the study area.

The study area occurs within land identified as 'proximity area for coastal wetlands' under the Resilience and Hazards SEPP. Any area that occurs within the Resilience and Hazards SEPP is classified as Type 1 – highly sensitive key fish habitat as outlined in the Department of Primary Industries (DPI) *Policy and guidelines for habitat and conservation management* (2013). Impact to any areas of Type 1 fish habitat is generally prohibited by the DPI.

No wetlands of international importance occur within or adjoining the proposal.

Figure 6.17: Key fish habitat

6.4.3 Potential impacts

Construction

Direct impacts

Construction of the proposal would result in minor direct impacts to mangroves which form part of PCT 920 *Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion.*

The proposal would require the trimming of up to 0.02 ha of mangroves (consisting of 13 mangroves) to allow for the installation of the scaffolding and containment system directly beneath and adjacent to the bridge and bridge piers on the northern side of the Parramatta River (refer to Table 6.20). This estimate of impact is considered conservative, as the trimming of mangroves would be limited to branches which are currently extending towards the bridge structure and are impeding the ability to install the scaffolding and containment system. The trimming of mangroves would be limited to 0.5m either side of the bridge structure and up to 1.6 metres from beneath the bridge structure at Span 4 only (refer to Figure 6.18) on the northern bank of the Parramatta River. No individual mangroves would be completely removed (refer to Photo 6.3). Refer to Appendix H for mangrove identification and trimming details.

These impacts are unlikely to place the population at risk of extinction as the trimming extent is minor and the mangroves are likely to regenerate following the removal of the scaffolding and containment system. However, as described in Section 6.4.2, while direct impacts to fish habitat are unlikely, any impact to any areas of Type 1 fish habitat is generally prohibited by the DPI. As a result, consultation would be undertaken prior to the commencement of construction activities to approve the mangrove trimming activities. In addition, as mangroves are classified as Marine Vegetation under the FM Act. Any cutting, removing, destroying, transplanting, shading or damaging in any way requires a Part 7 Fisheries Management Act Permit from NSW DPI (refer to Section 1.10).

In addition to direct impacts to PCT 920, around 0.38 ha of miscellaneous ecosystem – planted native vegetation and 0.66 ha of miscellaneous ecosystem – exotic grassland would be directly impacted by the establishment and use of the site compound and equipment laydown area B respectively. The establishment of equipment laydown area B would not impact mangroves.

Around 0.02 ha of impacted vegetation (13 individual mangrove trees), provides suitable habitat for the two threatened fauna species identified as having a moderate or higher likelihood of occurring within the study area (refer to Section 6.4.2). However, as discussed in Section 6.4.2, no hollow bearing trees were identified within the proposal site. Therefore, any impacts during construction would be temporary and minimised where possible using standard safeguards as outlined in Section 6.4.4 and include the need for visual inspections prior to trimming of the mangroves.

As such, direct impacts to habitat for threatened fauna species (although it is only moderate to poor quality) would occur during construction. These impacts, while temporary, would be minimised where possible, by utilising existing sealed surfaces within the laydown areas, and all areas would be rehabilitated on completion of the proposal. Vegetation would also be visually inspected prior to trimming to ensure no threatened fauna are present.

Figure 6.18: Mangrove trimming requirements

Indirect impacts

The Proposal is unlikely to result in any indirect impacts to biodiversity. Any impacts would be minor and temporary in nature. Impact are unlikely to result in the introduction of any edge effects which are not already occurring, or exacerbate habitat fragmentation. The proposal is unlikely to result in the establishment of weed species, as mangroves present are in good condition, and the surrounding environmental contains areas of mown lawns with exotic pasture weeds. proposal activities have the potential to disperse pest species out of the subject land across the surrounding landscape due to disturbance, however the magnitude of this impact would be low and mitigation measures would not be necessary.

The proposal may result in some minor alteration to the hydrology of the study area due to the removal of surface vegetation (exotic grass), resulting in an increase in surface runoff. However, these changes would be relatively minor and is not expected to create a major impact with the implementation of mitigation measures in Table 6.22. The proposal would not result in the exacerbation of any key threatening processes, including the alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.

The following pathogens are considered to have potential to affect the biodiversity within the study area and are the subject of Key Threatening Process listings:

- Amphibian Chytrid Fungus (*Batrachochytrium dendrobatidis*)
- Exotic Rust Fungi (order Pucciniales, e.g. Myrtle rust fungus *Uredo rangelii*)
- Phytophthora Root Rot Fungus (*Phytophthora cinnamomi*).

The construction and operation of the proposal may increase the risk of disturbing and spreading these pathogens. With the implementation of mitigation measures in Table 6.22, the risk of introducing these pathogens would be low.

Operation

The operation of the proposal would not result in any material change that would impact biodiversity with any temporary impacts from construction reducing over time with re-growth of trimmed mangroves.

Conclusion on significance of impacts

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

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

Is there a real chance that the activity threatens the long-term survival of nationally-listed biodiversity matters?	No
Has the consistency of the activity with relevant recovery plans, threat abatement plans, conservation advices and guidelines provided by the Australian Government been considered?	No
Can suitable offsets be secured?	Not Applicable

6.4.4 Safeguards and management measures

Table 6.22: Biodiversity safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity	Flora and Fauna mitigation measures will be prepared in accordance with Transport for NSW's *Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects* (RMS, 2011) and implemented as part of the CEMP. It will include, but not be limited to: • a site walk with appropriate site personnel including TfNSW representatives to confirm clearing boundaries and sensitive location prior to commencement of works • identification (marking) of the clearing boundary and identification (marking) of habitat features to be protected. E.g. – use of flagging tape • a map which clearly shows vegetation clearing boundaries and sensitive areas/no go zones • pre clearing survey requirements including the requirement for an arborist to tie back and/or trim mangroves • requirements set out in the *Landscape Guideline* (RMS, 2008) • procedures for unexpected threatened species finds and fauna handling • procedures addressing relevant matters specified in the *Policy and guidelines for fish habitat conservation and management* (DPI Fisheries, 2013) • protocols to manage weeds and pathogens.	Contractor	pre-construction	Section 4.8 of QA *G36 Environment Protection* *Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects* (RMS, 2011)
Trimming of mangroves	Further consultation with the Department of Primary Industries would be undertaken prior to the commencement of construction activities to approve mangrove trimming activities.	Contractor	pre-construction	Fisheries Management Act 1997
	Native vegetation removal will be minimised where possible during the installation of the scaffolding. Exclusion zones will be set up at the limit of clearing in accordance with *Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Pre-construction / Construction	*Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).

Impact	Environmental safeguards	Responsibility	Timing	Reference
	Trimming of mangroves will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bush rock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Construction	*Guide 4: Clearing of vegetation and removal of bush rock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).
Unexpected finds	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	Contractor	Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011)
Aquatic Habitat	Aquatic habitat will be protected in accordance with *Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) and section 3.3.2 Standard precautions and mitigation measures of the *Policy and guidelines for fish habitat conservation and management Update 2013* (DPI (Fisheries NSW) 2013).	Contractor	Construction	*Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) *Policy and guidelines for fish habitat conservation and management update* 2013 (DPI (Fisheries NSW) 2013).
Weed management	Weed species will be managed in accordance with *Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Construction	*Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).

6.4.5 Biodiversity offsets

Implementation of the Transport for NSW *No Net Loss Guidelines* (July 2022) indicates that offsets are not required for this proposal as the impacts do not exceed biodiversity offset thresholds.

The proposal will impact 0.02 ha of native vegetation and 0.66 ha of planted native vegetation and exotic grassland. Works conducted on plantations and exotic vegetation are exempt and as the native vegetation being cleared is less than 1 ha, no offset is required.

6.5 Surface water, hydrology and water quality

This section provides a summary of the impacts of the proposal on surface water, hydrology and water quality.

6.5.1 Methodology

The assessment was based on a desktop review of information related to surface water, hydrology and water quality including publicly available resources, such as the NSW Government E-Planning portal, City of Parramatta Flood mapping and topographic and tidal information.

6.5.2 Existing environment

The proposal is in the catchment of the Parramatta River, directly over and adjacent to the tidal area of the Parramatta River. The Parramatta River is the main tributary of Sydney Harbour with secondary tributaries including the smaller Lane Cove and Duck rivers located downstream of the proposal. The site topography is generally flat, with sloping banks towards the Parramatta River, with lower lying open space immediately adjacent to the waterway.

Stormwater from the proposal collects and is passed into small pipes that enter the road gutters. This water enters drainage pits before being conveyed underground along piped drains within the Parramatta LGA. The water is transported into the natural creeks or open channels that form the river catchment. From here, stormwater ends up in the Parramatta River and then subsequently Sydney Harbour (City of Parramatta, 2021).

Tides

The Parramatta River is tidally influenced to the Charles Street Weir, approximately 300 metres upstream of the proposal. The tidal cycles are semi-diurnal, meaning there is 12.5 hours between tides. Tidal heights are measured at Fort Denison near the Sydney CBD, where the conditions are as follows:

- mean spring tide is approximately 1.2 metres above Australian Height Datum (AHD)
- mean neap tide is approximately 0.8 metres above AHD
- mean high water is approximately 0.5 metres above AHD
- mean low tide is approximately one metre below AHD
- the highest-high tide that would occur once every 50 years is approximately 1.6 metres above AHD.

The mean sea level trend is 0.65 millimetres per year (with +/-0.10 millimetres per year) based on monthly mean sea level data. This is equivalent to a change of 0.21 feet in 100 years. There is likely to be variation between the tidal conditions at Fort Denison and the proposal, given the masking from the river inflow. However, the above conditions are indicative and suitable for this assessment.

The tidal range affects how quickly water flows in and out of the area, and given the relatively small tidal range, water flow in the area would be typically low.

Flooding

A search on the NSW ePlanning database on 19 August 2021 found no flood prone land on or within close proximity to the proposal, however a review of the City of Parramatta flood maps (NSW Government, 2020) (refer Figure 6.19) identified a small portion of the proposal (associated with the proposed equipment laydown areas) being impacted by a 20% Annual Exceedance Probability (AEP) flood level or 1 in 5 year flooding event.

While works on the bridge structure itself are unlikely to be impacted by any flooding, flood levels during a 20% AEP have the potential to inundate a small portion of the proposed laydown area to the south of the Parramatta River. Flooding also has the potential to impact the bridge foundations, which would include any scaffolding installed to undertake the proposed activities. Given the location of the scaffolding on the banks of the river, and adjacent to the areas protected by mangroves and vegetation, the risk of impacts from high velocity flow to scaffolding is low, however these areas are to be inspected following periods of high rainfall to ensure no undermining of scaffolding has occurred.

Water Quality

Much of the catchment of the Parramatta River has been developed for urban and agricultural purposes, with the existing water quality impacted by stormwater discharge and altered flow regimes. Pollutants commonly associated with stormwater discharge include:

- sediment from erosion and stormwater inflows, impacting turbidity
- pathogens such as faecal coliforms
- litter and other wastes
- pesticides from agricultural land uses
- nutrients and pathogens from fertilizers and sewage overflows
- heavy metals (in river sediments)
- other contaminants such as hydrocarbons from oil and fuel leaks.

The proposal is located within the upper estuary and is influenced by a mix of freshwater and saline waters from rainfall and freshwater inflows.

6.5.3 Potential impacts

Construction

During construction of the proposal there are number of activities which have the potential, if not managed appropriately, to result in impacts the water quality of the Parramatta River.

During site establishment works the proposal would require the clearing and grubbing of areas for the location of the site compound and equipment laydown area B. These activities have the potential to mobilise sediment, which could enter local stormwater drains or result in sediment laden water entering directly to the Parramatta River. To minimise the potential impacts from the mobilisation of sediments, prior to the commencement of ground disturbance, all environmental controls would be installed (in accordance with the site-specific Erosion and Sediment Control Plan to be prepared for the proposal). In addition, disturbed areas would have hardstands installed during this stage of work to minimise the exposure of surface materials to erosion and sedimentation during the construction of the proposal. With the implementation of these measures impacts from the mobilisation of sediments is expected to be negligible.

The proposal would require the use, handling and storage of fuels, chemicals, and wastewater which in the event of an accidental spills could potentially enter stormwater drains or the Parramatta River and cause environmental harm. However, with the implementation of standard management measures described in Section 6.5.4 impacts are considered unlikely.

During remedial works (specifically the removal of the existing lead-based paint), contaminants (including trace amounts of heavy metals and lead paint flakes) associated with the dry abrasive blasting media have potential to enter the Parramatta River, impacting water quality. However, as outlined in section 3.3, all remedial works would be undertaken in accordance with *AS/NZS 4361.1: Guide to hazardous paint management, Part 1: Lead and other hazardous metallic pigments in industrial applications*. All works involving the removal of hazardous materials (including de-leading and washdown activities) would be completed within the containment system to prevent the release of hazardous materials into the waterway. The waste blast media would be collected in a vacuum loader's hoppers and transferred into bulk bags on pallets, which are then wrapped and labelled, and stored in a designated hazardous waste storage area (refer to section 6.7). With the implementation of the containment system, and appropriate procedures and housekeeping during the transfer of hazardous materials (such as the immediate clean-up of any spillage), impacts to the water quality of the parramatta river, or stormwater are unlikely.

In the event of a flood event during remedial works, flooding has the potential to impact the equipment laydown areas located in Queen Wharf Reserve, beneath the northern end of the bridge and scaffolding installed in lower lying areas adjacent to the bridge structure. Any flooding would increase the risk of plant, equipment and materials used during construction entering the river and be swept downstream, potentially resulting in pollution from diesel or other hazardous materials. Flooding also has the potential to undermine scaffolding resulting in a safety risk to workers and the public.

Operation

Operation of the proposal would not result in any materials changes to the flood risk, including the bridge, site compound and equipment laydown areas. There is no change to the bridge, or surrounding area that would result in changes to existing flooding levels or water flows which would result in an increased flood risk to any downstream receivers.

Operation of the proposal would not change the existing landside infrastructure or change the risks of erosion and sedimentation from the existing use.

Figure 6.19: Flood levels near the Proposal

6.5.4 Safeguards and management measures

Table 6.23 provides a summary of the mitigation and management measures that will be implemented during the construction and operation of the proposal to minimise impacts to surface water, hydrology and water quality identified in Section 6.5.

Table 6.23: Surface water, hydrology and water safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Soil and water	A site-specific Erosion and Sediment Control Plan will be prepared and implemented for the duration of the proposal. The Plan will include arrangements for managing wet weather events, including monitoring of potential high-risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.	Contractor/ Project Manager	Detailed design / Pre-construction	Section 2.2 of QA *G38 Soil and Water Management*
Flood impacts	Adequate measures would be provided to ensure the proposal would avoid any increase in existing flood impacts to surrounding areas and minimise flood risks to the proposal. This would include: • consideration of flood risk in the design and location of site equipment • appropriate waste storage, including in areas away from flood risk • daily weather monitoring to provide adequate warning of heavy rainfall events and allow adequate time for the removal of site equipment prior to heavy rainfall events.	Contractor	Detailed design / pre-construction / construction	n/a
Flood impacts	Following high rainfall events which result in flooding of the proposal site, including bridge foundations, inspections would be undertaken of scaffolding systems to ensure no undermining has occurred, and scaffolding is safe and secure.	Contractor	Construction	n/a
Stormwater drainage and flooding	Consultation with City of Parramatta Council and incorporation of relevant council standards regarding stormwater drainage and flooding.	Contractor	Detailed design/ pre-construction	n/a
Lead paint removal	All lead removal would be undertaken in accordance with AS/NZS 4361.1: Guide to hazardous paint management, Part 1: Lead and other hazardous metallic pigments in industrial applications.	Contractor	Pre-construction / Construction	n/a
Plant and equipment	All fuels, chemicals and hazardous liquids would be stored away from drainage lines, within an impervious bunded area in accordance with Australian Standards, EPA Guidelines and the Transport for NSW Chemical Storage and Spill Response Guidelines (Transport for NSW, 2015).	Contractor	Construction	Australian Standards, EPA Guidelines and the Transport for NSW Chemical Storage and Spill Response Guidelines (Transport for NSW, 2015).

6.6 Soils and contamination

This section provides a summary of the impacts of the proposal to and from soils and contamination.

6.6.1 Methodology

The soils and contamination assessment involved:

- assessment of current land use and permissible land use under the zoning
- review of desktop information on soils and geology (including review of maps of ASS and saline soils), hydrology and hydrogeology (including as summary of local bores)
- searches of relevant databases, including the NSW EPA Contaminated Sites Register, a list of sites which have been notified to the EPA, and environment protection licences held under the POEO Act
- online search of the Department of Defence unexploded ordnance (UXO) database and the per- and poly-fluoroalkyl substances (PFAS) Investigation database
- assessment of potential risks from contamination to human health and the environment from contamination, salinity, erosion during construction and operation of the proposal.

6.6.2 Existing environment

Topography and hydrology

In general, the proposal site is relatively flat, when considering the bridge structure, with an elevation of around 10-12 metres Australian Height Datum (AHD). The proposed site compound is in a flat area; however, a steep slope is present to the south towards the Parramatta River and to the active transport routes which run along its banks. Two of the three proposed equipment laydown areas are also lower in elevation than the bridge and are located on the Parramatta River flood plain (refer to Section 6.5).

The area surrounding the proposal site consists of the tributaries and head of the Parramatta River which dominate the landscape in the central and eastern portion of the Parramatta LGA. The topography rises to the north to a main ridge which extends from Beecroft in the east through to Seven Hills in the west. This ridge falls away to Westmead in the west and Dundas Valley in the east (City of Parramatta, 2019).

All surface drainage from the proposal site and surrounding area would travel through the local stormwater drainage and into Parramatta River and subsequently Sydney Harbour.

Soils

A review of the NSW Government eSpade soils mapping database (NSW Government SEED database 2021) found the proposal site soils are Anthroposol (Australian Soils Classification (ASC)) and are underlain by Ashfield Shale of the Wianamatta Group, described as black to dark grey shale and laminate, and sandstone.

Soils within the proposal area are likely to contain localized alluvial deposits comprising sands, sandy clays and clayey sands of variable depths overlying weathered sandstone. The soil profile in the proposal site is moderately permeable and well drained, with free water at 1.70 metres below the soil surface. Run on is moderate and run off is low. There is a slight erosion hazard.

Acid Sulfate Soils are widespread in estuarine environments such as mangrove tidal flats and low-lying swamp areas in NSW. The proposal site is classified Class 2 and Class 4 ASS as mapped on the NSW ePlanning database (accessed February 2023). Acid Sulfate Soils in a Class 2 area are likely to be found below the natural ground surface, and Acid Sulfate Soils in a Class 4 area are likely to be found beyond two metres below the natural ground surface.

Contamination

A search on the EPA list of potentially contaminated sites on 27 September 2021 found no notified contaminated sites within 500 metres of the proposal. The nearest notified contaminated site is the 7-eleven service station at 81 Victoria Road, around 600 metres to the north of the proposal. The proposal site is not listed or within close proximity (one kilometre) to a listed contaminated site subject to regulation under the *Contaminated Land Management Act 1997*. The proposal site is not in or near a NSW EPA PFAS investigation site, or in an area identified as having potential for UXOs.

Given the existing use of the proposal site, there is a low likelihood of potential contamination in surface materials. Any contaminants are likely to be selected heavy metals or pesticides due to runoff from roadways or use in open spaces and would be localised and minor in nature.

The surface of the bridge contains hazardous materials including lead and potential low levels of VOCs (refer to Section 6.3). The removal and temporary storage of hazardous materials (predominantly lead) during the proposed works needs to be considered during the remedial works.

6.6.3 Potential impacts

Construction

The key impacts relating to soils and contamination that may occur during the proposal include impacts to the soil environment from the removal of surface materials, as well as activities which may expose or result in additional sources of contaminants to the proposal site.

Soils

The proposal does not require any excavation of earthworks; however, some areas of existing turf and landscaped surface vegetation would be removed to accommodate a hardstand area in the site compound, and equipment laydown areas A and B. The remaining equipment laydown area contain existing concrete or road surface and would not require any works to facilitate the use of these areas.

The installation and site compounds and laydown areas which require ground disturbance may result in following potential impacts:

- minor erosion of soils exposed surface soils
- potential dust generation if soils are exposed due to vehicle use or wind
- potential increase in sediments entering the stormwater system and/or Parramatta River due to local run off.

If not managed appropriately, these impacts could lead to reduced water quality or harm to biodiversity through the introduction of sediment into local waterways. However, with safeguards and mitigation measures outlined in Section 6.6.4 these impacts are expected to be minor in nature due to the limited level of ground disturbance required for the proposal and the relatively flat topography of these areas. Biodiversity risks and safeguards and management measures are outlined in Section 6.4.4.

Since no excavation is needed for the proposal, it is unlikely that ASS would be encountered. However, if ASS are exposed to oxidation, or spoil is generated during construction activities, further assessment for ASS and waste classification is to be undertaken.

Contamination

The use of the site compound and equipment laydown areas during construction is unlikely to expose large areas of soils or result in encountering contaminated materials. Equipment laydown areas A and C are located on areas with existing hardstand (either road surface, or existing concrete), the establishment of the site compound and equipment laydown area B would however require the clearing and grubbing of surface materials. If contaminants are found or exposed, and not managed appropriately, this could present a risk to the health of construction workers or the Parramatta River and local waterways. Should contaminated material be identified during construction, the safeguards and management measures would be implemented to mitigate any potential impacts.

The removal of hazardous materials such as lead from the bridge during remedial works, has the greatest potential to contaminate surrounding soils and the Parramatta River if not managed correctly. As described in section chapter 3 all construction activities which involve the removal of lead-based paint (dry abrasive blasting) would be undertaken with the containment system which would be progressively installed, cleaned and removed as the de-leading works progress over the bridge structure. An abrasive blasting unit (located in the equipment laydown area A) would be used to transport blasting materials (Australian Garnet) via hoses to the bridge structure, and a vacuum system would then extract the waste blast media to a storage location within equipment laydown areas A or C (depending on the location of the works on the bridge).

The waste blast media would then be collected in a vacuum loader's hoppers and transferred into bulk bags on pallets. These pallets are then wrapped, labelled, and stored in a designated hazardous waste storage area (or regulated area).

To minimise the potential for the contamination of the surrounding environment, all work would be undertaken according to RMS Specifications B223 (*Management of Lead Chromium and Asbestos in Bridge Maintenance Painting*) and B220 (*Protective treatment of Bridge Steel Work*) and AS4361.1: *Guide to lead paint management, Part 1: Industrial application*. In addition, the hazardous materials transfer and storage areas within the equipment laydown areas would be secured and installed in an area of hardstand to minimise the risk of contaminating surrounding soils. Any spillages would be cleaned up immediately.

With the implementation of the proposed works methodology (as outlined in section 3) and the safeguards and management measures outlined in Section 6.5.4 the proposal would unlikely result the contamination of soils or water.

Operation

The operation of the proposal would not result in any material changes that would impact geology, soils or contamination. Nor would the changes result in any impacts to or from the flooding.

6.6.4 Safeguards and management measures

Table 6.24 provides a summary of the mitigation and management measures that will be implemented during the construction and operation of the proposal to minimise impacts to and from soils and contamination. Where specific mitigation measures associated with other assessments are required, these have been included in the mitigation and management measures in the relevant chapter.

Table 6.24: Soil and contamination safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Contamination of soils	Soil sampling would be undertaken before and after remedial activities for a pre and post works contamination assessment. These samples would be collected and analysed for heavy metals prior to site establishment and prior to the final inspection and hand over during demobilisation activities. If post work contamination is identified, remediation of the site would be required prior to complete demobilisation and hand over of the site.	Contractor	Pre-construction / Construction	n/a
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 Transport for NSW and/or EPA as applicable.	Contractor	Detailed design / Pre-construction	Section 4.2 of QA *G36 Environment Protection*
Contaminated land – unexpected finds	An appropriate unexpected contamination finds protocol, considering asbestos containing materials and other potential contaminants, would be included in the CEMP. Procedures for handling asbestos containing materials, including licensed contractor involvement as required, record keeping, site personnel awareness and waste disposal to be undertaken in accordance with SafeWork NSW requirements.	Contractor	Construction	n/a
Accidental spill	A site-specific emergency spill plan would be developed and would include spill management measures in accordance with the Transport for NSW *Code of Practice for Water Management* (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 Environment Protection*
Plant and equipment	Vehicles and machinery would be properly maintained and routinely inspected to minimise the risk of fuel/oil leaks. Construction plant, vehicles and equipment would also be refuelled offsite, or in a designated refuelling area.	Contractor	Construction	n/a
Pollution	In the event of a pollution incident, works would cease in the immediate vicinity and the Contractor would immediately notify the Transport for NSW Project Manager and Transport for NSW	Contractor	Construction	n/a

Impact	Environmental safeguards	Responsibility	Timing	Reference
	Environment and Sustainability representative. The EPA would be notified by Transport for NSW in accordance with Part 5.7 of the POEO Act.			
Safe removal of hazardous material, such as lead	All works would be undertaken in accordance with RMS Specifications B223 (*Management of Lead Chromium and Asbestos in Bridge Maintenance Painting*) and B220 (*Protective treatment of Bridge Steel Work*) and AS4361.1: *Guide to lead paint management, Part 1: Industrial application.*	Contractor/ Project Manager	Construction	n/a

6.7 Waste

This section provides a summary of the waste impacts of the proposal.

6.7.1 Methodology

The assessment of waste management and minimisation from the proposal included:

- identification of potential waste generating activities and types of wastes from the proposal
- classification of potential waste types identified and an estimation of quantities of each
- identification of potential impacts associated with waste arising from the proposal
- Identification of waste mitigation measures.

6.7.2 Existing environment

Waste in NSW is regulated under the POEO Act and the Waste Avoidance and Resource Recovery Act 2001 (WARR Act). The purpose of these Acts is 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, in order of priority:

- avoidance of waste – minimising unnecessary resource consumption in construction, operations, maintenance, and management
- resource recovery – reusing, recycling, reprocessing and energy recovery of waste products during construction and operations to minimise the amount of waste for disposal
- disposal - where resources cannot be recovered, they would be appropriately managed and disposed of to minimise the potential adverse environmental impacts likely to be associated with their disposal.

Transport is committed to ensuring the responsible management of unavoidable waste and promotes the reuse of such waste in accordance with the resource management hierarchy principles outlined in the WARR Act. Adopting the waste hierarchy principles aims to efficiently use and reduce resources, reduce costs, and reduce environmental harm in accordance with the principles of ESD.

Minimal waste is currently generated by the proposal, as an operational roadway and bridge. Any current waste generation would be as a result the discarding of personal waste by commuters using the bridge, or active transport users in local public open spaces.

6.7.3 Potential impacts

Construction

The activities undertaken by the proposal are expected to generate waste streams including:

- green waste generated from the clearing and grubbing of surface vegetation, including grass, timber, shrubs, leaves and weeds
- green waste from the trimming of mangroves
- general domestic waste including food waste, packaging, paper and cardboard
- blast media contaminated with hazardous materials (mostly lead)
- geo-textile, plastics, disposable overalls potentially contaminated with hazardous materials, as well as lead paint flakes and lead coated steel elements
- sewage from compound sites and amenities
- hazardous liquid waste from the decontamination unit.

The waste volumes associated with the waste streams generated by the proposal include:

- around 12 tonnes of general solid waste

- around 75 tonnes of hazardous solid waste
- around 42,000 litres of hazardous wastewater.

If improperly managed, waste generated during construction of the project has the potential to contaminate soils, pollute water, create odours and dust as well as result in associated environmental, health and safety risks. The potential impacts of the proposal associated with the improper management of waste would include, but not limited to:

- human health risks to workers due to handling of hazardous materials
- human health risks to the general public to handling of hazardous materials
- cross contamination of wastes due to improper segregation and storage
- regulatory non-compliance.

The proposal would be undertaken to ensure minimal impacts are generated from waste material produced by ensuring all waste is collected and disposed of or recycled in accordance with accordance with the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act).

A Waste Management Plan would be prepared to identify all potential waste streams associated with the work and outline methods of disposal of waste that cannot be reused or recycled at appropriately licensed facilities along with other onsite management practices such as keeping the area tidy and free of rubbish. The Waste Management Plan would consider NSW waste guidelines and regulations as well as TfNSW and Fulton Hogan disposal protocols and guidelines. No materials would be used in a manner that poses a risk to public safety.

The proposal would generate waste blast media contaminated with hazardous materials (mostly materials containing lead). This material would be removed from the containment system on a daily basis to ensure the volume does not exceed load limits of the system.

The waste blast media would be collected in a vacuum loader's hoppers and transferred into bulk bags on pallets, which are then wrapped and labelled, and stored in a designated hazardous waste storage area (or regulated area). In addition to the blast media, the proposal would also generate hazardous waste as a result of contaminated geo-textile, plastics, disposable overalls, contaminated paint flakes and coated steel elements. This waste would be treated as hazardous materials.

Hazardous waste would be separated from other waste on site which would subsequently reduce the risk of contamination of non-hazardous waste streams. Separation on site also reduces the volume of waste to be stored on site and assists with secure storage of waste, which in-turn reduces the risk of contamination of the surrounding environment due to loss of containment of waste.

To further reduce risks associated with waste, the total volume of waste stored on site would be limited to 10-12 tonnes (including a maximum of 5 tonnes of hazardous lead paint removal waste), an amount which could be removed from site within one to two days, thereby allowing for complete removal of all waste in the event of a flood warning (refer to section 6.5).

The handling, storage, transport and disposal of hazardous waste would be in accordance with the requirements of relevant EPA and Safe Work NSW guidelines.

Operation

The proposal would not result in any material change to the operation of the bridge, therefore, there are no waste generating activities, beyond the discarding of personal waste by commuters, during the operation of the proposal.

6.7.4 Safeguards and management measures

Table 6.25 provides a summary of the mitigation and management measures that will be implemented during the construction and operation of the proposal with respect with waste management identified in Section 6.11.3.

Table 6.25: Waste safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
General waste management	The following resource management hierarchy principles would be followed: • avoid unnecessary resource consumption as a priority • avoidance would be followed by resource recovery (including reuse of materials, reprocessing, and recycling and energy recovery) • disposal would be undertaken as a last resort (in accordance with the *Waste Avoidance and Resource Recovery Act, 2001*).	Contractor	Construction	*Waste Avoidance and Resource Recovery Act, 2001*).
General waste management	A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to support minimising the amount of waste produced and appropriately handle and dispose of unavoidable waste. The WMP will include but not be limited to: • 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. The WMP will be prepared taking into account the Environmental Procedure - Management of Wastes on Transport for NSW Land (Transport for NSW, 2014) and relevant Transport for NSW Waste Fact Sheets.	Contractor	Detailed design / pre-construction	Section 4.2 of QA *G36 Environment Protection*
Hazardous Waste Management	A Lead Management Plan (LMP) would be prepared by an appropriately qualified person. This plan would detail the containment, storage, decontamination and disposal	Contractor	Pre-construction	n/a

Impact	Environmental safeguards	Responsibility	Timing	Reference
	processes for hazardous waste associated with the lead removal works conducted as part of the project.			
Housekeeping	Working areas are to be maintained, kept free of rubbish and cleaned up at the end of each working day.	Contractor	Construction	n/a
Hazardous waste storage	Potentially contaminated waste/hazardous waste is to be stored separately from other waste streams generated at the site.	Contractor	Construction	n/a
Hazardous waste storage	The quantity of hazardous waste stored in equipment laydown areas is not to exceed the volume of waste that can be removed in one to two days.	Contractor	Construction	n/a
Hazardous waste storage	Storage of hazardous waste (i.e. removed lead paint flakes and dust), restricted solid waste or liquid waste (or a combination of these) on-site at any time is not to exceed five tonnes otherwise an Environment Protection Licence (EPL) under the POEO Act is required.	Contractor	Construction	n/a
Hazardous waste storage	Temporary storage of contaminated waste is to be in sealed containers within a self-safe storage container and double bunded and sign posted as hazardous waste.	Contractor	Construction	n/a
Waste disposal	Non-recyclable wastes are to be collected and disposed of at licensed waste facilities only.	Contractor	Construction	n/a
Waste disposal	Any contaminated waste generated by the proposal is to be disposed of in accordance with the EPA approved methods of waste disposal.	Contractor	Construction	n/a
Spoil removal	All spoil to be removed from site would be tested to confirm the presence of any contamination. Any contaminated spoil would be disposed of at an appropriately licensed facility.	Contractor	Construction	n/a
Waste classification	All waste (including hazardous waste) must be classified in accordance with the *Waste Classification Guidelines Part 1: Classifying waste* (EPA, 2014) prior to disposal.	Contractor	Construction	n/a

6.8 Non-Aboriginal heritage

This section provides a summary of the *Historical Heritage Assessment* (HHA) prepared by Austral Archaeology (Austral Archaeology, 2021).

6.8.1 Methodology

The methodology used to undertake this assessment is provided in the HHA and has been summarised in Section 6.1.1.

The objectives of the historical heritage assessment (HHA) were to:

- identify any potential historical heritage and/or archaeological values within or in the vicinity of the study area
- produce an archaeological predictive model and sensitivity map to guide any management decisions regarding the study area
- make a statement of significance regarding any historical heritage values that may be impacted by the proposed development
- assess the impact of the proposed works on any identified heritage values
- make appropriate management and mitigation recommendations.

6.8.2 Existing environment

The proposal is located near the first landing site of Governor Phillip in Parramatta during his search for more fertile land in 1788. In 1872 a gasworks was constructed in the area and to facilitate travel to and from the gasworks, along with communications between communities across the Parramatta River, a new bridge, then known as the “Newlands Bridge” (now the Gasworks Bridge), was constructed.

Construction of the bridge took place between 1878 and 1885. Soon after its construction, it became known as ‘Gasworks Bridge’ after the nearby gasworks. John A MacDonald was responsible for the design of both this, and all other iron lattice bridges constructed in Australia between 1881 and 1893. The bridge is one of 32 lattice girder bridges in the state of NSW and at the time was considered to be of a technically sophisticated design and engineering.

Table 6.26 provides a summary of the heritage items within or near the proposal site. The location of each item is included in Figure 6.20.

Table 6.26: Heritage items near the proposal site

Heritage Item	Listing	Significance	Location
Queens Wharf Reserve and stone wall and potential archaeological site, situated within Parramatta Archaeological Management Unit (PAMU) 2895	Parramatta LEP Item No. I489	Local / State	To the east of the proposal site on the southern bank of the Parramatta River
Gasworks Bridge	Parramatta LEP Item No. I487	Local	Within the proposal site, with works being undertaken on the bridge structure.
Wetlands	Parramatta LEP Item No. I735	Local	Partially located within the proposal site at two locations, one adjacent to the eastern edge of the bridge on the northern embankment of the Parramatta River, the other on the southern embankment of the Parramatta River to the west of the bridge structure.

Newlands gates and trees	Parramatta LEP – Item No. I544	Local	To the north and northwest of the proposal site, within the Macarthur Girls High School
Newlands archaeological site	Parramatta LEP - Item No. A3	Local	To the north and northwest of the proposal site, within the Macarthur Girls High School

Archaeological remains of interest were also identified, which are associated with:

- Queens Wharf, the earliest land site along the Parramatta River
- Howells Water Mill, evidence of early industry in Parramatta
- The former AGL Gasworks.

Of the heritage sites above, only the Wetland, Queens Wharf Reserve, PAMU 2895 and the Gasworks Bridge were identified as having the potential to be impacted by the proposal. These heritage items have been briefly described below.

No part of the proposal site or surrounding area is listed on the Commonwealth heritage list, the National Heritage List, or the state heritage register.

Gasworks Bridge

The Gasworks Bridge is the subject of the proposal (refer to Chapter 3) and is of historical significance because it provides evidence of the history of amenities and services in the local area. The barrier formed by the river was a major factor in development as late as 1880, at which time it was only bridged at Church Street, Parramatta. In the 1880's both the Newlands (Gasworks) and Gladesville bridges were opened. The proposal site therefore contains historical and archaeological significance at a State and local level.

Wetlands

In addition to the bridge, the land immediately to the east of the bridge along the northern bank is listed for its heritage values as a wetland. Impacts (associated the trimming of mangroves) to this area are minor, and unlikely to impact the heritage values of the wetland. Any impact would be short term, and the regrowth of the vegetation will eliminate any long-term changes to the area.

Queens Wharf Reserve

The Queens Wharf Reserve, listed on the Parramatta LEP, is of local historical significance because it provides evidence of the history of amenities and services in the local area. The item is rare in local terms. The Queens Wharf Reserve is located adjacent the proposal to the south of the Parramatta River, with its boundary located immediately to the east of the bridge embankment.

PAMU 2895

This Archaeological Management Unit (AMU) has been identified as having exceptional archaeological research potential. This area was the site of an early river landing established in 1790, later to be known as Queens Wharf. This area was developed by the Australia Gas Light Company in the 1870s, providing a gas supply for the town of Parramatta.

The physical archaeological evidence within this area may include build landforms, structural features, intact subfloor deposits, open deposits and scatters, ecological samples and individual artefacts which have potential to yield information relating to major historic themes including Environment, Utilities, Transport, Technology, and Industry.

Archaeological evidence at this site is likely to be subject to minor disturbance, with some areas of major disturbance. However, it is noted that the description of impacts within the AMU does not include the road alignment constructed under Gasworks Bridge in the 1960s. The overall AMU is of State significance.

Figure 6.20: Heritage items near the Proposal

6.8.3 Potential impacts

Construction

The construction impacts of the proposal have been assessed for its main areas: the bridge, site compound, and equipment laydown areas.

Gasworks Bridge

The proposal involves remedial works on the heritage listed 'Gasworks Bridge' and would involve the removal of lead-based paint, rehabilitation of corroded surface metals, replacement with suitable polyurethane alternatives and various replacement of damaged bridge elements (refer to Section 3.3).

The proposal does not change the fabric of the bridge. The proposed remediation works would ensure the continued use of the bridge, through preventative maintenance and removal of hazardous contaminants, the final paint coat would closely match the existing colour scheme (RMS Bridge Grey as per TfNSW Specification B220), and the replacement of elements such as the wooden planks and rails would be like for like.

Any visual impacts to surrounding heritage items caused by the installation of the scaffolding and containment system would be temporary in nature and removed following the completion of the proposal. The proposal would have no potential to negatively impact known historic heritage values associated with the bridge and would result in positive impacts on the heritage significance of the item.

The proposed works also require the trimming of around 0.02 hectares of branches from mangrove trees in the adjacent wetlands to allow for the installation of the scaffolding and containment system in the general vicinity of the bridge and bridge piers on the northern side of the Parramatta River. These impacts are unlikely to be major as the impact is minor and temporary, and the mangroves are likely to regenerate following the removal of the scaffolding and containment system. As such the proposed works have low potential to impact on the heritage values associated with the wetlands area, and the subsequent regrowth of vegetation will mitigate any short-term impact.

Site compound

The site compound area has been assessed as having no historical archaeological potential, and no heritage items have been identified. Any visual impacts to surrounding heritage items caused by construction activities will be temporary in nature and removed following the completion of the proposal. The proposed works at this location would have no potential to impact known historic heritage or archaeological values.

Laydown areas

Works within the proposed equipment laydown areas (refer to Figure 3.1) would be limited to minimal ground preparation works and installation of temporary above ground structure, including fencing. The proposed equipment laydown areas north of Parramatta River (Areas A and B), would have no potential to impact known historic heritage or archaeological values. Equipment laydown area A is located within the existing road reserve, while equipment laydown area B is located within a previously disturbed area and would require minimal ground disturbance beyond surface clearing and grubbing. The proposed equipment laydown areas have been assessed as having no historical archaeological potential, and no heritage items have been identified.

The proposed equipment laydown areas south of Parramatta River are partially located within PAMU 2895 and the LEP listed 'Queens Wharf Reserve and stone wall and potential archaeological site' (Queens Wharf Reserve site), which are known to have potential to contain archaeological remains of state significance.

In addition, potential archaeological remains associated with the Queens Wharf, the Queens Wharf Reserve site retains the potential to contain archaeological remains relating to Howell's Water Mill and the former AGL Gasworks, which are of local significance. It is noted, however, that the proposed equipment laydown areas are within the corridor of a mid-20th century road alignment which was constructed to serve as an underpass below the bridge. Construction of this road would have considerably impacted on any archaeological remains present within this part of the PAMU.

Although the wider area retains high archaeological potential, this is not the case in the location of the equipment laydown areas, and therefore the proposal would not result in ground disturbance beyond clearing and grubbing of surface materials. Any visual impacts to surrounding heritage items caused by construction of the equipment laydown area would be temporary in nature and removed following the completion of the proposal. The proposed construction activities at this location have low potential to impact known historic heritage or archaeological values. Any potential impacts can be managed with standard safeguards and management measures.

Operation

The operation of the proposal would not result in any material change that would impact non-aboriginal heritage.

6.8.4 Safeguards and management measures

Table 6.27: Non-Aboriginal heritage safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Non-Aboriginal heritage	Non-Aboriginal Heritage mitigation measures will be incorporated and implemented as part of the CEMP. The CEMP would include but not be limited to the following: • a map identifying locations of items or sites (including curtilages) which are to be protected and those which are to be destroyed/impacted and no-go zones • identification of potential environmental risks/impacts due to the works/activities • management measures to minimise the potential risk • mitigation measures to avoid risk of harm and the interface with work activities on site • implementation of mitigation measures to protect identified heritage items or areas • identify in toolbox talks where management of non-aboriginal heritage is required such as identification of no-go zones and responsibilities under the Heritage Act 1977 and any obtained permits or exemptions • a stop works procedure in the event of actual or suspected potential harm to a heritage feature/place.	Contractor	Pre-construction/Construction	GEN1
Non-Aboriginal heritage	Identified heritage areas would be marked as no-go zones (except for the bridge), no materials would be stored in identified heritage areas.	Contractor	Pre-construction / Construction	
Non-Aboriginal heritage	The Standard Management Procedure - Unexpected Heritage Items (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.	Contractor	Pre-construction/Construction	Unexpected Heritage Items (Transport for NSW, 2015)

6.9 Property and land use

This section provides a summary of the impacts of the proposal to land use and property.

6.9.1 Methodology

The assessment methodology included:

- a review of relevant desktop information on land use within and adjacent to the proposal site including relevant land use and planning controls (land use zones)
- identifying properties located in, and adjacent to, the proposal, and assessing the potential impacts of construction and operation, including temporary and permanent land requirements
- identifying measures to avoid, minimise and manage the potential impacts identified.

6.9.2 Existing environment

Land within the southern side of the proposal (south of the bridge) is zoned RE1 – public open space areas and land used for recreational activities. Land within the northern side of the proposal (north of the bridge) is zoned R4 – high density residential. The Parramatta River is zoned W2 – recreational waterways.

Land zoning surrounding the proposal site is shown in Figure 6.21, which indicates:

- land to the north is predominantly zoned residential and includes R2, R3 and R4 (low, medium, and high density residential) zoning respectively
- land to the southeast is zoned RE1 – Public Recreation
- land to the southwest is zoned B4 Mixed Use.

Property

The proposal is located on land within the public domain. Residential properties are located immediately to the north of the proposal site. The Macarthur Girls High School is located to the northwest of the proposal with an access gate located immediately to the northwest of the bridge. The proposal includes the existing car park located at the northern end of the bridge.

Land use

The proposal is located approximately 200 metres from Parramatta CBD (as shown in Figure 6.2), which includes the following land uses:

- a large car park located to the south of the proposal, on the opposite side of George Street to the south of the Albion Hotel, which is directly to the south of the proposal
- a commercial precinct to the southwest of the Proposal, including food and retail shops
- Guardian Childcare and education centre located approximately 200 metres southeast of the proposal site.

Other land use within near the proposal include:

- Macarthur Girls High School, located directly north of the proposal site (around 160 metres to school buildings)
- high density residential area, comprising mainly houses and some highly residential apartment blocks located approximately 65 metres northeast of the proposal site.

There are a number of recreational areas near the proposal. These are public open spaces (such as parks) which are used by people while also protecting and enhancing the natural environment. Recreational areas near and within the proposal include:

- Robin Thomas Reserve located approximately 100 metres southeast
- James Ruse Water Playground located approximately 240 metres southeast
- Queens Wharf Reserve located approximately 50 metres southeast
- Rangihou Reserve located approximately 100 metres east
- Stewart Street Reserve located approximately 100 metres northwest.

These public open spaces also contain active transport routes (as described in Section 6.1.2).

Land use surrounding the proposal site can be seen in Figure 6.22.

Figure 6.21: Land zoning

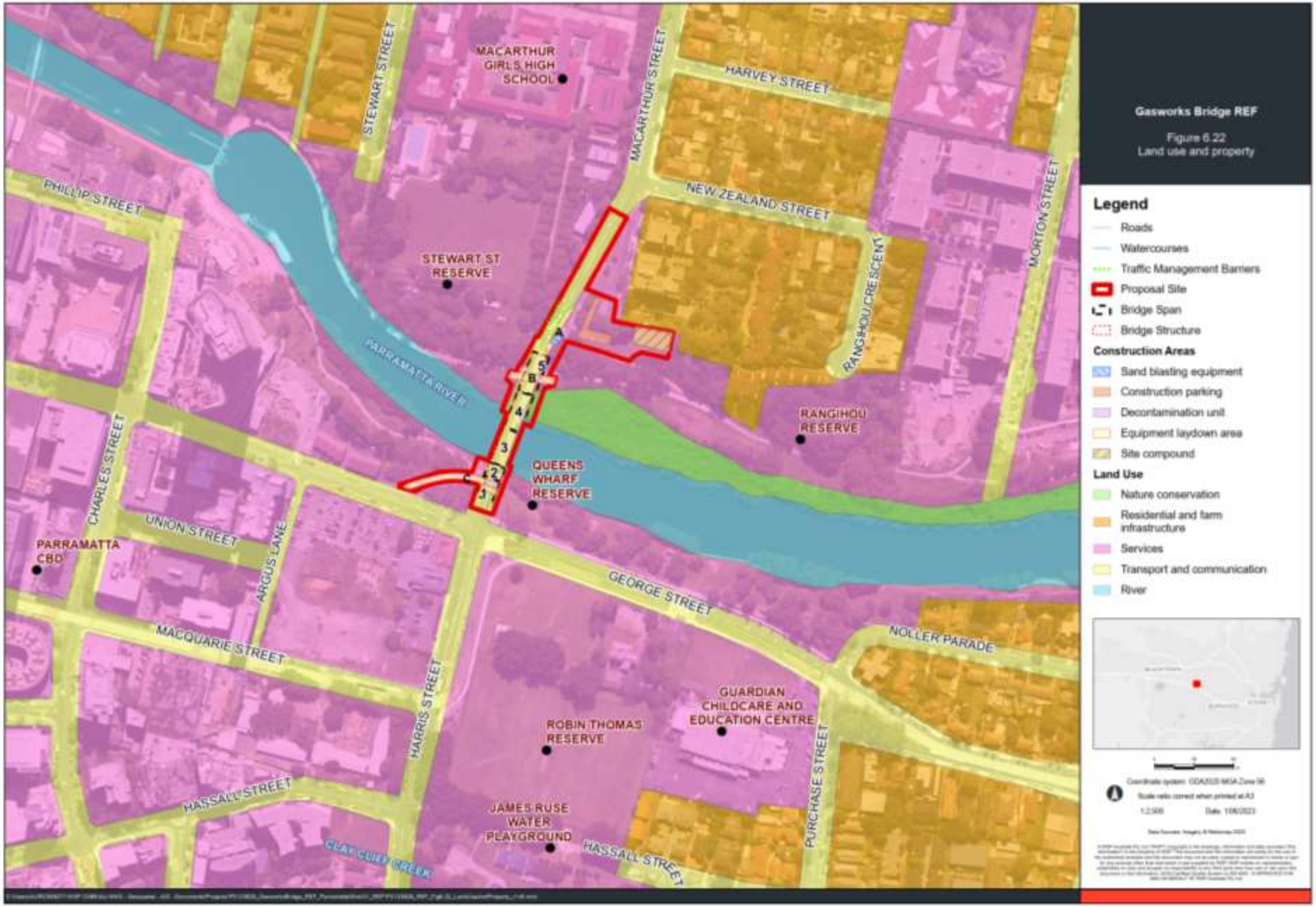


Figure 6.22: Land use and property

6.9.3 Potential impacts

Construction

The proposal would require the temporary closure of north bound lane of the Bridge during construction. During the proposed weekend shutdowns (refer to Section 6.1.3) the south bound lane of the bridge would also be closed (resulting in a full bridge shutdown). The proposal would also require the temporary use of some public recreational (RE1) land for the site compound and equipment laydown areas (refer to Figure 3.1).

Alternative transport and route options would operate during up to seven weekend periods for the duration of the construction works, which is further discussed in Section 6.1.

The impacts to recreational areas during construction of the proposal would be temporary and minor in nature, and therefore are not expected to have a major impact on residents and businesses.

While it is expected there would be some minor disruption to active transport routes during the installation and decommissioning of the scaffolding and containment system and other site establishment works, these are expected to be minor and temporary in nature. Active transport routes on both northern and southern side of the Parramatta River would be maintained through the construction of the proposal.

Construction of the proposal would not require the acquisition of any private property or residences.

Operation

Operation of the proposal would not result in any material change to land use and property of the proposal site or the surrounding area.

6.9.4 Safeguards and management measures

Table 6.28: Property and land use safeguards and land use

Impact	Environmental safeguards	Responsibility	Timing	Reference
Property	A dilapidation survey would be undertaken for the existing carpark located adjacent to the site compound before the commencement of the site establishment. Copies of the survey would be provided to Parramatta City Council at least one week prior to the commencement of the proposal (site establishment).	Contractor	Pre-Construction	n/a

6.10 Community and socio-economic

This section provides an assessment of the socio-economic impacts of the proposal.

6.10.1 Methodology

The socio-economic assessment methodology included:

- a desktop review of secondary-source quantitative data such as a review of the Australian Bureau of Statistics – Census Quick Stats, 2016 and publicly available information on local community structure and patterns
- a review of the outcome of other assessments containing relevant community and socio-economic themes including but not limited to traffic and access (Section 6.1, noise and vibration (Section 6.2), air quality (Section 6.3), contamination (Section 6.6) and waste (Section 6.7)
- consideration of land use, property information as well as social infrastructure within 500 metres of the proposal
- consideration of construction and operational phase impacts including:
    - amenity related issues (e.g. noise, dust, visual)
    - impacts to community and social infrastructure
    - changes in travel patterns and access (i.e. construction traffic management requirements).

6.10.2 Existing environment

Demographics

The proposal is situated within the suburb of Parramatta, within the City of Parramatta LGA. A review of the 2016 Australian Bureau of Statistics (ABS) Census data was undertaken for Parramatta. Key demographics in the suburb included:

- Parramatta had a population of 25,798 with a median age of 31
- children aged 0-14 years made up 16.2% of the population and people aged 65 years and over made up 6.8% of the population
- of those recorded being in the labour force, aged 15 and over, 65.4% were employed full time, 21.2% part time, with predominant method of travel being car (31.7%), train only (29.6%), walking only (9.8%) and bus only (6.9%)
- the suburb has a large proportion of people born overseas, with 29.8% identifying India as their place of birth, and 78.3% identifying both parents being born overseas
- the percentage of households speaking only English at home was 23.5%, with 11.8% speaking Mandarin, 9.8% speaking Hindi and 4.5% speaking Cantonese
- housing in the suburb was predominantly separate housing (10.2%), and semi-detached (6.7%), with 68.4% renting.

Social infrastructure

Social infrastructure refers to the community facilities, services and networks that help individuals, families, groups and communities meet their social needs, maximise their potential for development, and enhance their community wellbeing. It includes things such as educational facilities, health, emergency and aged-care services, sports, recreational and cultural facilities, community support services and transport facilities.

The social infrastructure within 500 metres of the proposal includes:

- educational institution and outdoor passive recreation associated with Macarthur Girls High School and Guardian Childcare and Education
- the Parramatta Ferry Wharf which provides means for passengers to travel between key locations in Sydney Harbour and along the Parramatta River

- parks and reserves including Queens Wharf Reserve, Stewart Street Reserve and River Foreshore Reserve
- the Parramatta Valley Cycleway, which provides a shared user path for cyclists and pedestrians which is generally aligned along the foreshore of the Parramatta River
- places of worship: Parramatta Central Seventh-day Adventist, Maximise Church, St John Creek Orthodox Church and St Ioannis Greek Orthodox Church.

The locations of these community facilities are shown on Figure 6.23.

Local businesses

Local business and services adjacent to the proposal site are primarily commercial zones, associated with the Parramatta CBD. Local businesses within 500 metres of the proposal site, within the CBD, include:

- cafes and restaurants
- a variety of services including banks, industrial facilities, government agencies, carwash, legal centres, fitness centres and educational centres.

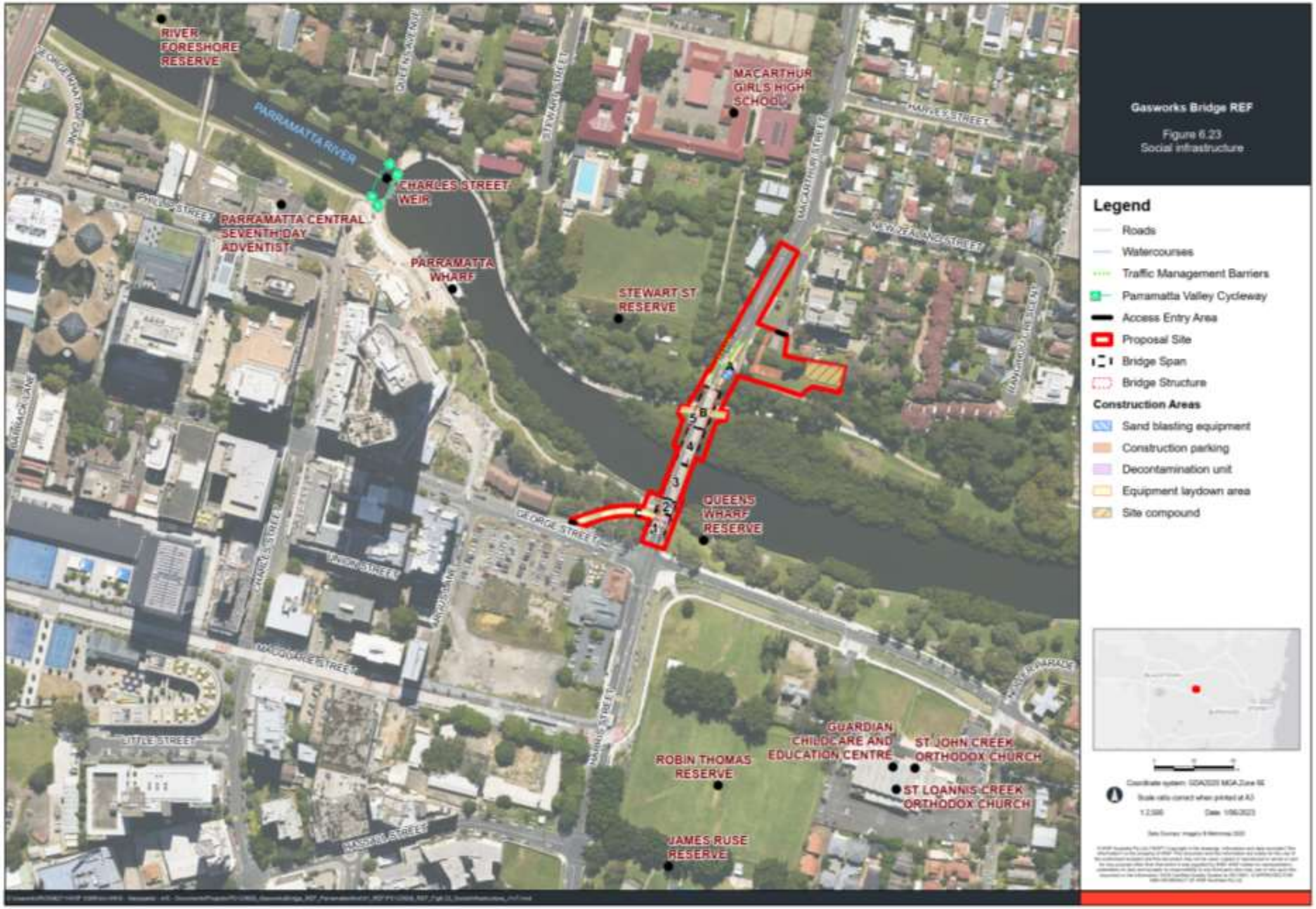


Figure 6.23: Social infrastructure

6.10.3 Potential impacts

Construction

Construction of the proposal has the potential to temporarily impact residents, businesses, and commuters due to:

- the closure of the bridge on up to seven weekends to facilitate the installation and subsequent removal of the scaffolding and containment system, as well as undertake bridge sealing works
- temporary disruptions to pedestrian access on active transport routes along the Parramatta River foreshore
- temporary visual, noise and air quality impacts to sensitive receivers including recreational, education, and active transport uses.

Construction activities would be confined to the proposal site which includes the site compound and equipment laydown areas, as well as the bridge structure. To facilitate some construction activities, the proposal would require both the partial closure of the bridge (impacting the northbound lane for the duration of the proposal), and full closure of the bridge on up to seven weekends (refer to Section 3.3.7 and 6.1.3) resulting in temporary loss of bridge access to vehicles in both directions. The potential disruption to traffic may have an impact on residents and commuters who use the bridge to access Parramatta CBD from residential suburbs on the northern side of the Parramatta River.

Residents, businesses, City of Parramatta and other relevant stakeholders would be notified of the proposed construction works, and consulted about construction timing, and any traffic management arrangements including detours. Traffic and transport management is discussed in Section 6.1 and consultation for the proposal is described in Chapter 5.

The proposal would result in a temporary impact to visual amenity (refer to Section 6.12) these impacts are likely to be minor in nature and have minimal impacts to the local community.

The proposal would result in some local nearby residents experiencing a considerable increase in noise during, mainly during site establishment and demobilisation works, as well as some remedial works. The proposal also requires some activities (including the installation and removal of scaffolding and the containment system, and bridge deck sealing) to be undertaken during OOHW, these would be undertaken during weekend shutdowns of the bridge (refer to Section 6.2). Noise impacts would be managed in accordance with mitigation measures outlined in Section 6.2.4.

Landside construction areas such as compound areas would result in temporary loss of amenity along that section of the Parramatta River. However, these impacts would be temporary and minor and therefore are not expected to have considerable impacts on local residents or commuters.

Socio-economic management measures are described in Section 6.10.4.

Operation

There would be no material change to the operation of the bridge, however the proposal would benefit the community by removing hazardous materials from the bridge structure (i.e. lead paint) and providing a new coat of paint and materials to rectify any safety issues which may be present.

6.10.4 Safeguards and management measures

Mitigation and management measures would be implemented to avoid, minimise or manage potential socio-economic impacts during construction of the proposal. Where specific mitigation measures associated with other assessments are required, these have been included in the mitigation and management measures in the relevant chapter.

Table 6.29: Socio economic safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Socio-economic	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): • mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions • contact name and number for complaints. The CP will be prepared in accordance with the *Community Involvement and Communications Resource Manual* (RTA, 2008).	Contactor	pre-construction	n/a
Stakeholder and community notification	All businesses, residential properties and other key stakeholders (e.g. schools, council, bus operators) affected by the activity would be notified at least 10 working days prior to commencement of the activity. Project / community updates would be provided throughout the duration of works as relevant. Notification would utilise both digital and conventional (non-digital) modes of communication (e.g. media release, letter box drops, newsletters and regular updates to a project website). Notification would include an information package, including contact name and number for enquiries or complaints, the expected timeframe of works and any planned or potential disruptions to utilities/ services and changed road and traffic conditions. The package is also to include details on the bridge closure, the available detours alternative transport and pedestrian access. As part of the notification process, advanced warning signage would be established prior to and during the work to ensure road users are aware of the road closure and detours. Directional signage is to be placed along the detour routes.	Project Manager and Communications Officer	Pre-construction and construction	n/a
Consultation	Ongoing stakeholder consultation would be undertaken. Consultation would include: • Parramatta City Council • residents and businesses within 500 metres of the proposal • fire and Emergency services • bus operators	Project Manager	Pre-construction and construction	n/a

Impact	Environmental safeguards	Responsibility	Timing	Reference
	• local schools • Transdev (the operator of Sydney Ferries) • operators or community services and facilities • Parramatta Light Rail • operators or community services and facilities.			
Waterway	As required, advanced warning signage and/or beacons (appropriate for any applicable day and night time maritime requirements) would be established prior to and during the work to ensure any users of the local waterway(s) are aware of restricted access, changed navigational conditions or hazards within the work area and waterway.	Project Manager	Pre-construction and construction	n/a
Project contacts / Complaints	A website and free-call number would be established for enquiries regarding the proposal for the duration of construction. Contact details would be clearly displayed at the entrance to the site. All enquiries and complaints would be tracked through a tracking system and acknowledged within 24 hours of being received.	Contractor, Project Manager and Complaints Manager	Pre-construction and construction	n/a
Health and safety	Suitable site induction relating to site specific hazards would be undertaken for all contractors. The work would be undertaken in accordance with all NSW health and safety legislative requirements and relevant Australian Standards.	Contractor	Pre-construction and construction	n/a
Security	The construction areas would be always secured.	Contractor	Construction	n/a

6.11 Hazard and risk

This section outlines the potential hazards and risks associated with the proposal and provides an assessment of these risks along with relevant mitigation measures.

6.11.1 Methodology

To assess the hazard and risk of the proposal, this REF has been reviewed to understand the existing environment as linked to hazards and risks associated with

- Traffic and access (Section 6.1)
- Noise and vibration (Section 6.2)
- Air quality (Section 6.3)
- Contamination (Section 6.6)
- Waste (Section 6.7).

In considering more general hazards and risk, the study area and sensitive receivers are considered site workers, members of the community travelling near or residents and businesses within 100 metres of the proposal.

6.11.2 Existing environment

A review of the existing environment including sensitive receivers specific to noise and vibration, air quality, contamination, traffic, transport and access and community and socio-economic impacts are described in the relevant sections of this REF.

The proposal is in a public space, with frequent traffic and pedestrian movements utilising the bridge to access the residential and educational areas, to and from the Parramatta CBD and key transport connections. The proposal site also contains a number of active transport routes (refer to Section 6.1.2 and 6.10.1.

A small section of the proposal site is mapped as flood prone land (refer to Section 6.5.1). However, in general the site contains a very low hazard and risk profile.

6.11.3 Potential impacts

Construction

Hazards and risks associated with the construction of the proposal are included in Table 6.30.

Table 6.30: Summary of potential hazard and risks during construction

Impact	Summary of impact
Removal storage and handling of hazardous materials (lead)	The removal, storage and handling of hazardous materials such as lead from the bridge during construction has potential to result in a hazard to workers and the community, through the exposure of lead waste, via leaks, spills or emissions to air. As outlined in Section 3.3.1, the removal of lead-based paint and repair of the streel trusses involves a dry abrasive blasting method (within the containment system). The removal method would use a range of vacuum shrouded equipment. Where the abrasive blasting method is not suitable for certain areas, a range of alternative tools (also vacuum shrouded) would be used. Hazardous materials would be removed from the containment system daily, using a vacuum loader, and transferred to a designated hazardous material storage area within the equipment laydown areas (refer to Section 3.4), where it is contained in labelled bags prior to being disposed at a licensed waste facility. To manage the hazard and risk associated with the removal of the lead-based paint, the proposal would be undertaken in accordance with TfNSW Specifications B223 *(Management of Lead Chromium and Asbestos in Bridge Maintenance Painting)* and *AS/NZS 4361.1: Guide to hazardous paint management, Part 1: Lead and other hazardous metallic pigments in industrial applications.*

Impact	Summary of impact
Storage, handling and transport of dangerous goods and hazardous materials (other)	In general, low volumes of dangerous goods and hazardous materials would be stored in the site compound and equipment laydown areas. The quantity of goods stored would be commensurate with the demand for those goods so that excess goods are not sitting idle. All dangerous goods and hazardous material would be stored in a designated, secure storage location. The CEMP would outline plans for the removal of hazardous materials in the event of an increased risk of flooding (refer to Section 6.5)
Noise	The proposal has the potential to result in noise exceedances to some nearby sensitive receivers during some construction activities. An assessment of these noise impacts is included in Section 6.2. The proposal may also result in exposure to high levels of noise for pedestrians using the bridge to cross the Parramatta River. This exposure is likely to be experienced during remedial works (blasting activities) assessed as Scenario 04a and S04b in Section 6.2. These activities would be undertaken during standard hours. Pedestrians would be managed to avoid excessive exposure; this would require active pedestrian management (when required). (Refer to Section 6.1.3).
Fire	Potential ignition sources relevant to the proposal include the discarding of cigarettes and domestic rubbish (such as glass bottles) by construction workers.
Flooding	The proposal site contains areas of flood prone land (refer to Figure 6.19). There is a risk the proposal site (including the equipment laydown area) could become inundated during a high rainfall event which could put personnel and equipment at risk. Assessment of flood risk is provided in Section 6.5.
Utilities	The rupture or contact with services poses a risk to the safety of workers, the public, and could result in short term outages. Given the scope of work, there is a low risk of impacts to utilities. Further consultation with Sydney water may be required determine any protection measures for the water main which is located on the bridge (refer to Section 3.5). A redundant gas line owned by Jemena would be removed as part of the proposal as described in 3.3.1 and 3.5. Health and safety impacts associated with encountering or adjusting utilities would be minimised by undertaking utilities investigations, and consultation with service providers.
Potential contamination	The main contaminant of concern relating to the proposal is lead contained in the existing paintwork on the bridge. The proposal would also require the use of hydrocarbons and paints containing VOCs. Exposure to lead could cause health and safety impacts to the community through inhalation and/or direct contact or impacts to the environment due to contamination of land or release of lead to the Parramatta River. Assessment of the potential impacts of the proposal related to contaminants is addressed in in Section 6.3, 6.5 and 6.6. Impacts associated with potential contaminants would be managed through the implementation of a proposal CEMP which would include a spill response plan, and a WMP which would be incorporated into the CEMP.
Emergency vehicle movement	Construction of the proposal would result in up to seven weekend shutdowns of the bridge and partial closure of a portion of Macarthur Street. In addition, the proposal could require the closure of the northbound land of the bridge throughout the duration of the proposal. Traffic detours would be implemented during these shutdowns and during the closure of the northbound lane (refer to Section 6.1.3). Impacts from weekend shutdowns and closure of the northbound lane would be managed through the implementation of a TMP as part of the CEMP and appropriate traffic controls, which would consider emergency vehicle access and movements. Ongoing liaison with local councils, TfNSW and emergency services would be undertaken when preparing the CEMP.
Other health and safety risks	Construction activities during the construction of the proposal could result in impacts to the health and safety of site workers, users, visitors, and the local community if improperly managed. These include: • working in an operational road environment with vehicle movements

Impact	Summary of impact
	• operation of vehicles and construction equipment onsite • transport of equipment and material to and from site including collisions at the interface with public roads, and heavy vehicle movements on public roads such as Macarthur Street and the surrounding road network • potential risk for pedestrians and public safety resulting from unauthorised access to the construction site • potential risk for pedestrians and public safety resulting from de-leading and the associated health risks from exposure to lead-based materials.

Operations

The proposal would result in the removal of lead-based paint from the bridge and therefore the elimination of an existing hazard which currently requires ongoing management. The proposal would also maximise the service life of the bridge structure and maintain a safe and connected road network. Outside of these improvements, the operation of the proposal would not result in a change in the hazard and risk profile of the bridge.

6.11.4 Safeguards and management measures

Table 6.31 provides a summary of the mitigation and management measures that will be implemented during the construction and operation of the proposal to minimise hazards and risks identified in Section 6.11.3. Where specific mitigation measures associated with other assessments are required, these have been included in the mitigation and management measures in the relevant chapter.

Table 6.31: Hazard and risk safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Adjustment and / or removal of public utilities	Prior to the commencement of works the location of existing utilities will be confirmed. Consultation with Sydney Water and Jemena would be undertaken to manage any impacts to the existing water main and gas main on the bridge.	Contractor	Pre-construction / Construction	n/a

6.12 Aboriginal heritage

This section outlines the potential impacts to Aboriginal heritage from the proposal along with relevant mitigation measures.

6.12.1 Methodology

A search of the Aboriginal Heritage Information Management System (AHIMS) (Heritage NSW 2023) was performed.

6.12.2 Existing environment

The proposal is located in a highly modified area (refer to the HHA in Appendix G), and given the extensive landscape modification and development, and low archaeological potential of the surrounding area, intact evidence of Aboriginal land use would be unlikely to occur within the proposal.

The AHIMS search identified five known Aboriginal heritage items within 200 metres of the proposal, however, these sites are located outside the Proposal, beyond existing road infrastructure and would not be impacted by the proposed works. Two sites are located within Robin Thomas reserve, one within the Queens Wharf Park, and two sites are located within commercial and parking areas to the south behind George Street.

The closest identified Aboriginal heritage item is approximately 60m away from the proposal area and therefore will not be impacted as a resulted of the proposal.

A snapshot of the location of these five known Aboriginal heritage items is shown in Figure 6.24.

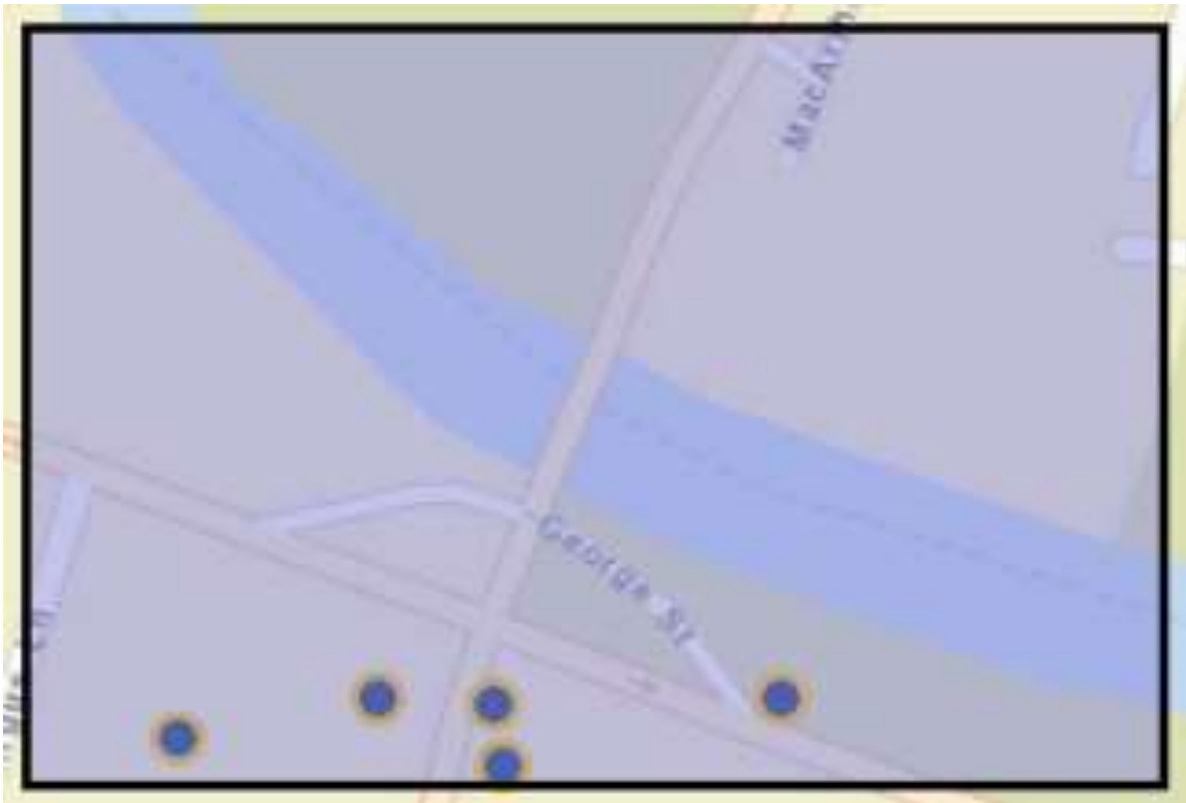


Figure 6.24: AIHMS Search *Source: AIHMS 2023*

6.12.3 Potential impacts

Construction

Construction of the proposal does not involve any ground disturbing activities beyond the establishment of the site compound and laydown areas, which require minor surface modifications.

The laydown areas are located on the northern side of the Parramatta River approximately 180m away from the closest Aboriginal heritage items and therefore will not result in any potential impact.

There are no identified Aboriginal heritage sites within the proposal site, and no high-risk landscape features are located in or near the proposal. It is unlikely that the proposal would affect Aboriginal heritage during construction.

The *Standard Management Procedure - Unexpected Heritage Items* (Transport, 2015) will be followed if an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction.

Operation

The proposal would not result in any changes to the operation of the bridge and proposal site. Therefore, it is not expected that there would be any risks to aboriginal heritage from the operation of the proposal.

6.12.4 Safeguards and management measures

Table 6.32: Aboriginal heritage safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Aboriginal heritage	The *Standard Management Procedure - Unexpected Heritage Items* (Transport, 2015) will be followed if an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	During construction	Section 4.9 of QA *G36 Environment Protection*

6.13 Other impacts

The proposal is expected to have a negligible to minor impact in relation to Hydrogeology, and Landscape character / visual amenity.

6.13.1 Existing environment and potential impacts

Table 6.33: Other impacts existing environment and potential impacts

Environmental factor	Existing environment	Potential impacts
Hydrogeology	A search on the Australian Groundwater explorer database (BOM, 2021) identified one registered borehole within a 500-metre radius of the proposal site. The groundwater bore is for monitoring purposes and is located directly adjacent to Gregory Place, Parramatta, and is approximately 460 metres southeast of the proposal site. Three additional boreholes for water supply are mapped approximately 670 metres north of the proposal site, on the corner of Victoria Road and Betts Street.	There would be no impacts to groundwater due to the construction or operation of the proposal.
Landscape Character and Visual amenity	The proposal is located at the existing bridge on Macarthur Street along and crossing the Parramatta River. The proposal site comprises the bridge as well as three areas of open space / active recreational areas along the banks of the river. Commercial and residential properties are present on the northern and southern sides of the Bridge. The Macarthur Girls High School is located northwest of the proposal. The Parramatta CBD is approximately 200 metres from the proposal, which includes businesses, industrial and commercial buildings.	**Construction** The Construction of the proposal would require the following: • temporary installation of a site compound • temporary installation of equipment laydown areas • temporary installation of scaffolding and a containment system. These installations would be temporary and therefore would be unlikely to have a considerable impact on the surrounding community. **Operation** Operation of the proposal would not result in any considerable impacts to landscape character and visual amenity during the operation of the proposal, and there would be no material change to local viewpoints. The proposal would improve the visual appearance of the bridge through the removal of surface corrosion and re-painting of the bridge structure. Final paint coat would closely match the existing colour scheme (RMS Bridge Grey as per TfNSW Specification B220). The proposal would also include the like for like replacement of damaged railings, which would improve the visual amenity of the bridge and maintain the existing character of the surrounding area.

6.13.2 Safeguards and management measures

There are no specific safeguards related to the management of hydrogeology, or Landscape Character and Visual amenity which have not been addressed in other sections of the REF.

6.14 Cumulative impacts

Under Clause 171 of the EP&A Regulation 2020, any cumulative environmental effect with other existing or likely future activities must be taken into account when assessing the impact of an activity for the purposes of Division 5.1 of the EP&A Act.

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 undertaken in isolation. Multiple projects undertaken at a similar time/similar location may also lead to construction fatigue, particularly around noise, traffic and air quality impacts, if not appropriately managed.

6.14.1 Study area

For the purposes of considering cumulative impacts, the study area for the project includes all relevant projects within a 1 km radius of the proposal. In addition, the study area also includes projects greater than 1 km from the proposal which utilise the bridge as a construction/haulage route.

6.14.2 Methodology

The methodology used to assess the cumulative impacts of the proposal and any other projects nearby, included:

- a review of the residual impacts of the proposal
- identification of projects to be included in the cumulative impact assessment, considering:
  - 'State significant' or 'strategic' projects that are being planned, constructed or operated at the time of this REF which are publicly listed on:
    - the NSW major projects website (NSW government, 2021)
    - Australian government – Department of Agriculture, Water and the Environment, EPBC Public notices list (Australian Government, 2021)
    - any other adjacent major projects such as projects on the City of Parramatta development application register
  - the temporal boundaries for the projects
  - special boundaries of each issue being considered
  - the significance of potential cumulative impacts
- identify suitable mitigation measures for cumulative impacts.

6.14.3 Other projects and developments

Table 6.34: Present and future projects

Project	Potential Construction impacts	Potential Operational impacts
Parramatta Light Rail – Stage 1 Stage 1 of the Parramatta Light Rail will connect Westmead to Carlingford, via Parramatta CBD and Camellia. Enabling works began in early 2019, with light rail services expected to commence in 2024. The project is located within and immediately to the south of the proposal. Major works for the construction of the project in the vicinity of bridge have been completed. Commissioning trials may occur concurrently with the proposal, however the	• increased noise and vibration impacts to sensitive receivers • traffic and road changes/disruptions to the local area • potential vegetation clearance.	• slight increase in noise and vibration along the light rail route, although this would be minimal • permanent changes or disruptions to road use and traffic • change in visual amenity due to the new light rail.

Project	Potential Construction impacts	Potential Operational impacts
cumulative impacts are expected to be negligible.		
Parramatta Light Rail – Stage 2 Stage 2 of the Parramatta Light Rail will provide 10 kilometres of new light rail track, extending Parramatta Light Rail Stage 1 at Grand Ave Camellia to Sydney Olympic Park. At its closest point, the proposal is approximately 950 metres to the west of the light rail project. An Environmental Impact Statement (EIS) for the project was placed on display in late 2022. Subject to approval, construction is expected to commence in the third quarter of 2024. The EIS identifies that none of the indicative construction traffic routes are proposed to utilise Macarthur Street. Subject to approval, the proposal is scheduled to be completed before the commencement of construction for the Parramatta Light Rail Stage 2 project. Accordingly, no cumulative impacts are expected.	• increased noise and vibration impacts to sensitive receivers • traffic and road changes/disruptions to the local area • potential vegetation clearance.	• slight increase in noise and vibration along the light rail route, although this would be minimal • permanent changes or disruptions to road use and traffic • change in visual amenity due to the new light rail.
Sydney Metro West The Sydney Metro West project includes the construction and operation of a new 24-kilometre metro line between Westmead and Sydney CBD, including a new metro station in Parramatta. The Sydney Metro West project in this area was approved by way of two State Significant Infrastructure applications, for major civil construction between Westmead and The Bays and rail infrastructure, stations, precincts and operations (respectively). Construction of the project is underway and is expected to be completed in 2030. For major civil construction activities, the primary in and out bound haulage routes occur via streets on the west side of the Parramatta CBD. An alternative haulage route is identified as passing via the intersection of George Steet and Harris Streets (i.e. at the southern end of the bridge). For rail infrastructure, stations, precincts and operations construction, the primary inbound and outbound construction haulage routes pass via the George Street/Harris Street intersection. While there would be overlap in the construction programs for the Metro West major civil construction works and the proposal, the would be no overlap for the with the station construction and operations.	• temporary increased noise and vibration impacts • temporary traffic and road changes/disruptions to the local area • Temporary disruption to local roads and/or local traffic due to increase in construction vehicles, including the potential use of George Street and Harris Street as an alternative haulage route for the major civil construction portion of the project (which abuts the southern boundary of the proposal).	• permanent changes or disruptions to road use and traffic.

Project	Potential Construction impacts	Potential Operational impacts
Meriton Apartments Located at 180 George Street, Parramatta, the construction of the twin 67-level mixed use towers is currently underway. The project is located around 110 metres from the proposal. Levels 5-35 of the building are complete and able to be occupied. Levels 36 and above are scheduled to be ready for occupation in early-mid 2023	• increased noise and vibration impacts to sensitive receivers • temporary disruption to local roads and/or local traffic due to increase in construction vehicles, including the use of George Street as the departure haulage route for the project • visual amenity impacts.	• change in visual amenity due the new development.
2A Gregory Place – Build to rent housing The project comprises a Concept State Significant Development Application (SSDA) for the redevelopment of a former industrial site for residential uses approximately 500 metres southeast of the proposal. Public exhibition of the SSDA has been completed, with assessment of the application currently under consideration. As the SSDA is for a concept, further approvals would therefore be required for construction to commence. It is therefore unlikely to be any construction overlap with the proposal.	• increased noise and vibration impacts to sensitive receivers • temporary disruption to local roads and/or local traffic due to increase in construction vehicles • visual amenity impacts.	• change in visual amenity due the new development.
River Road West – Build to rent housing The project comprises a Concept State Significant Development Application (SSDA) for the redevelopment of an existing industrial site for residential uses approximately 700 metres east of the proposal. The Planning Secretary's Environmental Assessment Requirements were issued for the project in November 2022. Determination of the proposal would therefore not occur until after completion of the proposal, and therefore no cumulative impacts are expected.	• increased noise and vibration impacts to sensitive receivers • temporary disruption to local roads and/or local traffic due to increase in construction vehicles • visual amenity impacts.	• change in visual amenity due the new development.
12 Hassell St Parramatta – Build to rent housing The project comprises a State Significant Development Application (SSDA) for construction development of a 61 storey residential tower with 385 apartments approximately 500 metres south west of the proposal. Determination is not expected until December 2023, and therefore no cumulative impacts are expected	• increased noise and vibration impacts to sensitive receivers. • temporary disruption to local roads and/or local traffic due • visual amenity impacts.	• change in visual amenity due the new development.
	•	•

6.14.4 Potential impacts

As detailed in Table 6.34 above, there are a number of projects at various stages of delivery within the Parramatta area. Most of these are in the early planning approval stages and are not expected to have any overlap with the construction program for the proposal. Projects currently under construction include the Parramatta Light Rail Stage 1, Sydney Metro West Project (major civil construction only) and Meriton Apartments. The potential cumulative impacts between these projects and the proposal are described in Table 6.35 below.

It is noted that construction activities for Parramatta Light Rail Stage 1 adjacent to bridge are essentially complete. While commissioning trials for the light rail rolling stock may occur concurrently with the proposal, cumulative impacts are expected to be negligible and are therefore not considered further.

Table 6.35 Potential cumulative impacts

Environmental factor	Construction impacts	Operational impacts
Traffic, transport and access	A review of the Sydney Metro West -Concept and Stage 1 (major civil construction between Westmead and The Bays) Environmental Impact Statement (NSW Government, 2020) identified Macarthur Street as both an inbound and outbound construction haulage route. While this haulage route may be used by the West Metro project, vehicles would only travel past the southern edge of the proposal worksite, and not pass over bridge itself, and would not be affected by temporary closures of the bridge. In addition a large proportion of construction traffic movements for the proposal would occur to and from the construction compound located on the north (i.e. opposite) side of the bridge. Given the proposed restriction of traffic to limit movements to a southbound direction on the bridge during construction, the majority of construction traffic would only occur on the north side of the river. A review of the CEMP for the Meriton Apartments project indicates that peak construction traffic is around 40 movements per day with 20-30 of those taking place outside peak hours. The departure haulage route includes George Street, towards James Ruse Drive. As detailed in Table 6.34 above, occupation of the buildings has commenced, with the remainder of works limited to the completion of Levels 36 and above. Traffic generation for the remainder of the construction period is likely to decline prior to the commencement of works for the proposal. Accordingly, in consideration of the above, together with the low number of construction traffic movements associated with the proposal, cumulative construction traffic impacts are expected to be low.	Pre-construction traffic flows would be reinstated following the completion of construction. Accordingly, there would be no cumulative impacts as a result of the operation of the proposal.
Noise	The project is located approximately 110 metres from the Meriton Apartments development and over 500m from the Sydney West Metro project. The Meriton Apartments is likely to have been completed prior to construction of the proposal and would therefore not contribute to cumulative impacts. Works will occur concurrently with the Sydney West Metro Project. Given the separation distance between the worksites, cumulative noise impacts would be negligible. However, as noted in Table 6.34, the alternative (secondary) haulage route for the Sydney passes via the intersection of George Steet and Harris Streets (i.e. at the southern end of the bridge). Notwithstanding, the proposal is expected to have around 15 heavy vehicle movements per day at the beginning of	Pre-construction traffic flows would be reinstated following the completion of construction. While the rectification of cracks in the bridge deck have potential to slightly change the character of wheel/road interface noise in these locations, the overall change in noise

Environmental factor	Construction impacts	Operational impacts
	construction, and around 12 light vehicle movements per day thereafter. Given the small number of vehicular movements generated by the proposal, the cumulative noise impacts are expected to be negligible.	impact would be negligible. Accordingly, there would be no cumulative impacts as a result of the operation of the proposal.
Air quality	The highest risk period for air quality impacts risks associated with the Meriton Apartments would primarily occur during bulk excavation (i.e. dust generation). As earthworks have been completed on site, the risk of dust emissions is low. Truck movements for the Sydney Metro West project would also have their loads covered to minimise potential for dust emissions during transport. Given that the proposal includes only minor excavations associated with the erection for the site compound, and that lead paint removal activities would take place in a fully contained negative pressure environment, the potential cumulative air quality impacts is considered to be low.	The bridge would return to its pre-construction operating conditions following the completion of the works. Accordingly, no cumulative impacts are expected.
Biodiversity	The proposal would require minor disturbance of existing grassed areas, and some minor trimming of mangroves to facilitate the erection of the lead paint removal containment infrastructure. Cumulative impacts for biodiversity are therefore expected to be negligible.	The bridge would return to its pre-construction operating conditions following the completion of the works. Accordingly, no cumulative impacts are expected.
Surface water, hydrology and water quality	Ground disturbance for the proposal will be limited to a relatively small area for the site compound. Erosion and sediment controls would be implemented and maintained or the duration of construction and removed following stabilisation of applicable areas. Other projects in the vicinity of the proposal are also required to ensure that their respective surface water and water quality risks are properly managed, including the requirement to ensure that the worksites are managed in accordance with the requirements of Managing Urban Stormwater: Soils and Construction (Landcom 2004) (the 'Blue Book) Accordingly, cumulative surface water, hydrology and water quality impacts would be low.	The bridge would return to its pre-construction operating conditions following the completion of the works. Accordingly, no cumulative impacts are expected.
Soils and Contamination	All projects would be required to ensure that construction is carried out in accordance with applicable legislation to minimise the risk of soil contamination, or disturbance of existing contamination. Soil disturbance works for the proposal would be limited to the site compound area, and hazardous materials stored in accordance with applicable NSW EPA guidelines. Similarly, removal of existing lead paint would be undertaken using a fully enclosed lead containment system. Cumulative impacts associated with the proposal and other nearby project would be low.	The bridge would return to its pre-construction operating conditions following the completion of the works. Accordingly, no cumulative impacts are expected.
Waste	Waste volumes generated by the proposal are expected to very low in comparison relative to the those generated by the Meriton	The bridge would return to its pre-construction

Environmental factor	Construction impacts	Operational impacts
	and Sydney Metro West projects. Cumulative impacts would therefore be negligible.	operating conditions following the completion of the works. Accordingly, no cumulative impacts are expected.
Non-Aboriginal heritage	As detailed in Section 6.8.3, non-aboriginal heritage impacts associated with the site compound and laydown areas are expected to be minor and temporary in nature. The remediation of the bridge would not result in major impacts to the fabric of the bridge. The proposal would ensure the continued use of the bridge, through preventative maintenance and removal of hazardous contaminants. Heritage impacts have been assessed and approved for both the Meriton Apartments and Sydney Metro West projects. Accordingly, cumulative impacts would be low.	The bridge would return to its pre-construction operating conditions following the completion of the works. Accordingly, no cumulative impacts are expected.
Property and land use	Property impacts for the proposal would be temporary and would revert to the pre-existing condition(s) following the completion of the works. Accordingly, the contribution of the proposal to the property impacts associated with the Meriton Apartments and Sydney West Metro projects would be negligible.	The bridge would return to its pre-construction operating conditions following the completion of the works. Accordingly, no cumulative impacts are expected.
Community and Socio-economic	The proposal would result in community and socio impacts during construction, particularly for the vehicle diversions and pedestrian disruptions. However these impacts would be temporary in nature and would revert to the pre-existing condition(s) following the completion of the works. Given the offset distances to the Meriton Apartments and Sydney Metro West projects, cumulative impacts are expected be low.	The bridge would return to its pre-construction operating conditions following the completion of the works. Accordingly, no cumulative impacts are expected.
Hazard and risk	Hazards and risks for the proposal are described in Table 6.30. Similar potential hazards would be applicable at the Meriton and Sydney Metro West worksites, including fire, flooding, noise dangerous goods handling and storage, contamination, utilities and safety. With the implementation of applicable mitigation measures, cumulative impacts are not expected.	The bridge would return to its pre-construction operating conditions following the completion of the works. Accordingly, no cumulative impacts are expected.
Other impacts	No other cumulative impacts to those described above are anticipated during construction.	No other cumulative impacts to those described above are anticipated during operation.

Mitigation measures stated in Table 6.36 aim to minimise the extent to which the proposal contributes to cumulative adverse environmental impacts.

6.14.5 Safeguards and management measures

The potential cumulative impacts associated with the proposal would be further considered as the design develops and as further information regarding the location and timing of potential developments is released. Environmental management measures would be developed and implemented as appropriate.

Table 6.36: Cumulative impact safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Cumulative construction impacts	A community and stakeholder consultation plan will be included in the CEMP, which outlines key stakeholders and nearby projects with potential for cumulative impacts.	Project Manager	Pre-construction and construction	n/a
Cumulative construction traffic impacts	Consultation would be undertaken with the Sydney Metro Parramatta Station construction contractor (transport infrastructure components), and Meriton Apartments prior to the commencement of construction to confirm the number of construction vehicle movements that would utilise the George St haulage route and appropriate controls put in place to ensure these movements are properly managed.	Project Manager	Pre-construction and construction	n/a

7. Environmental management

This chapter describes how the proposal will be managed to reduce potential environmental impacts during detailed design, construction and operation. A framework for managing 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 listed.

7.1 Environmental management plans (or system)

Safeguards and management measures have been identified in the REF in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

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

The CEMP will be prepared prior to construction of the proposal and must be reviewed and certified by the Transport for NSW Environment and Sustainability Officer, Sydney Region, prior to the commencement of any on-site works. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements, including:

- QA Specification G38 – Soil and Water Management (Soil and Water Plan)
- QA Specification G10 – Traffic Management
- QA Specification G40 – Clearing and Grubbing
- QA specification G22 – Work health and safety
- *AS/NZS 4361.1: Guide to hazardous paint management, Part 1: Lead and other hazardous metallic pigments in industrial applications*
- TfNSW Specifications B223 (Management of Lead Chromium and Asbestos in Bridge Maintenance Painting) and B220 (Protective treatment of Bridge Steel Work).

In addition, the following sub plans would be developed (refer to Table 7.1):

- Traffic Management Plan (TMP) – TTA1
- Construction Noise and Vibration Management Plan (CNVMP) – NV1
- Air Quality Management Plan (AQMP) – AQ1
- Flora and Fauna Management Plan (FFMP) – BD1
- Communication Plan – SE1
- Waste Management Plan – W2
- Hazardous Waste Management Plan - W3.

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	A CEMP will be prepared and submitted for review and endorsement of the Transport for NSW prior to commencement of the activity. As a minimum, the CEMP will address the following: • 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.	Contractor / Fulton Hogan	Pre-construction	n/a
GEN2	General - minimise environmental impacts during construction	An Environmental Work Method Statement (EWMS) would be prepared for the following activities: • trimming of the mangroves • removal of the existing coating system (blasting) • repainting activities, and • dismantling and cleaning the containment system As a minimum, the EWMS will include the following: • detailed description of the work activity, including plant and equipment to be used	Contractor / Fulton Hogan	Pre-construction	n/a

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• timing and staging of the activity, including the relationship to other activities • identify environmentally sensitive sites, risks and mitigation measures or safeguards to be applied • procedures for assessing the performance of mitigation measures or safeguards, and taking remedial action to address any shortcomings • procedures for regular review and, if necessary, updating of the EWMS.			
GEN3	General - notification	All businesses, residential properties and other key stakeholders (e.g. schools, local councils) affected by the activity will be notified at least five days prior to commencement of the activity.	Contractor / Fulton Hogan	Pre-construction	n/a
GEN4	General – environmental awareness	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. Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include: • threatened species habitat • adjoining residential areas requiring particular noise management measures.	Contractor / Fulton Hogan	Pre-construction	n/a
TTA1	Traffic, transport and Access	A Traffic Management Plan (TMP) will be prepared and implemented for the project. The TMP will be prepared in accordance with the Transport for NSW *Traffic Control at Work Sites Manual* (RTA, 2010) and *QA Specification G10 Control of Traffic* (Transport for NSW, 2008). The TMP will include: • 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 compound and laydown sites and measures to prevent construction vehicles queuing on public roads • final access and parking arrangements and measures to ensure light vehicle parking is strictly in accordance with Parramatta City	Contractor	Pre-construction	Section 4.8 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		Council requirements and prevents parking on footpaths and grassed areas adjacent the site • 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 • details of end of queue management measures to be implemented (such as additional VMS boards) to provide drivers with information regarding expected delays along proposed vehicle detour routes.			
TTA2	Public Transport – Ferry Services	Passengers using the Parramatta Ferry would be notified at least five days prior to any service disruptions, and alternative arrangements.	Contractor	Pre-Construction / Construction	n/a
TTA3	Public Transport – Bus Services	Passengers using the Bus Services would be notified at least five days prior to any service disruptions, and alternative arrangements.	Contractor	Pre-Construction / Construction	n/a
TTA4	Emergency Services	Emergency service authorities would be notified at least five days prior to any access disruptions, and alternative arrangements advertised.	Contractor	Pre-Construction / Construction	
NV1	Construction noise	Prior to commencement of works, a Construction Noise and Vibration Management Plan (CNVMP) would be prepared and implemented in accordance with the requirements of the Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009), Construction Noise and Vibration Strategy (Transport for NSW, 2019c) and the Noise and Vibration Impact Assessment for the proposal (WSP, 2023), and include: • 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 working hours (including implementation of EPA Interim Construction Noise Guidelines (DECCW, 2009)	Contractor	Pre-construction	n/a

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• a risk assessment to determine potential risk for activities likely to affect receivers (for activities undertaken during and outside of standard working hours) • mitigation measures to avoid noise 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 issues and complaints • a construction staging program incorporating a program of noise monitoring for sensitive receivers • a process for updating the plan when activities affecting construction noise and vibration change • identify in toolbox talks where noise and vibration management is required.			
NV2	Construction noise	The CNVMP would take into consideration measures for reducing the source noise levels of construction equipment by construction planning and equipment selection. Noise mitigation measures which would be considered, include; • regularly training workers and contractors (such as at the site induction and toolbox talks) on the importance of minimising noise emissions and how to use equipment in ways to minimise noise • avoiding unnecessary noise when carrying out manual operations and when operating plant or equipment • avoiding/limiting simultaneous operation of noisy plant or equipment with discernible range of a sensitive receiver • switching off any equipment not in use for extended periods of time • avoiding deliveries at night/evenings • no idling of delivery trucks • keeping truck drivers informed of designated routes, parking locations and acceptable delivery hours for the site • compounds and equipment laydown areas designed to promote one-way traffic so that vehicle reversing movements are minimised • minimising talking loudly; no swearing or unnecessary shouting, or loud stereos/radios onsite; no dropping of materials from height, no throwing of metal items and slamming of doors	Contractor	Pre-construction	n/a

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• maximising the offset distance between noisy plant and adjacent sensitive receivers • directing noise-emitting plant away from sensitive receivers • regularly inspecting and maintaining plant to avoid increased noise levels from rattling hatches, loose fittings etc.			
NV3	OOHW	An Out of Hours Works (OOHW) management plan is to be prepared as a part of the CEMP. The plan would include but not be limited to: • process for preparing Out of Hours Assessments (OOHA) for all works outside normal hours including environmental and community consultation requirements • the works that would be undertaken including machinery • conducting and noise assessment for the proposed works / activities in accordance with RMS procedures • mitigation measures identified by these assessments are to comply with those specified within the RMS Noise Management Manual – Practice Note VII • method for assessing the adequacy of the noise assessment • process for noise monitoring during works.	Contractor	Pre-construction / Construction	n/a
NV5	Noise	Where the $L_{Aeq,15min}$ construction noise levels are predicted to exceed 75 dBA and/or 30 dB above the Rating Background Level at nearby affected sensitive receivers, respite periods would be observed and in accordance with the CNVS. This would include restricting the hours that very noisy activities can occur.	Contractor	Construction	n/a
NV6	Noise	All sensitive receivers (e.g. schools, local residents) likely to be affected will be notified at least five 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: • the proposal • the construction period and construction hours • contact information for project management staff • complaint and incident reporting • how to obtain further information.	Contractor	Pre-construction	n/a

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NV7	Site Establishment	During site establishment works, the installation of all construction hoarding is to take into consideration the location of sensitive receivers to ensure that there is no direct 'line of sight'.	Contractor	Construction	n/a
NV8	Abrasive Blasting	During abrasive blasting activities (undertaken during Standard Hours) and when equipment is to be used near sensitive receivers, the noise reduction properties of the containment system would be confirmed via noise monitoring to achieve the mitigation reductions as outlined in this report. Temporary noise screens or enclosures will be placed around the equipment to be placed around the containment area.	Contractor	Construction	n/a
NV9	Abrasive Blasting	When the spray pump and paint equipment is to be used near sensitive receivers, the noise reduction properties of the containment system be confirmed via noise monitoring to achieve the mitigation reductions. Temporary noise screens or enclosures will be placed around the equipment to be placed around the containment area.	Contractor	Construction	n/a
NV10	Construction noise	The positioning of plant and equipment in Laydown Area A (north of the bridge) would ensure noisiest items are located furthest away from noise sensitive receivers. Positioning these items at the southern end of the laydown area will provide increased separation from source to receiver and also offers the potential for other equipment to provide shielding.	Contractor	Construction	n/a
NV11	Construction noise	Appropriate respite periods would be adopted during work stages where exceedances of criteria are predicted.	Contractor	Construction	n/a
AQ1	Air Quality	An Air Quality Management Plan (AQMP) would be prepared and implemented as part of the CEMP. The AQMP would outlining the type and nature of emission sources, potential impact on nearby sensitive receptors and management measures to minimise and reduce emissions. The AQMP would include, but not be limited to: • a map identifying the location of sensitive receivers • identification of potential sources of air pollution • identification of potential risks/impacts to the work/activities as dust generation activities • air quality management objectives consistent with any relevant published EPA and/or other guidelines • mitigation and suppression measures to be implemented	Contractor	Pre-construction / Construction	n/a

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• methods to manage work during strong winds or other adverse weather conditions, including restricting activities with high dust generating potential during periods of high winds (> 10 m/s) • an air quality monitoring plan to include as a minimum: o the requirements detailed in AS 4361.1:2017 (including high volume air quality sampling) o the requirements of TfNSW Specification B220 o emission monitoring for dust fractions (PM_{10} and $PM_{2.5}$) and lead to demonstrate the removal efficiency of the dust extraction system as per the manufacturer's specification requirements o ambient air quality monitoring of dust fractions and lead prior to and for the duration of the abrasive blasting activity o visual dust monitoring would be undertaken to verify the effectiveness of controls and enable early intervention.			
AQ2	Materials transport	Cover or stabilise potentially dust-generating materials during transport to/from the proposal site to the compound and laydown areas.	Contractor	Construction	n/a
AQ3	Materials transport	Maintain vehicles and equipment to facilitate efficient operation.	Contractor	Construction	n/a
AQ4	Materials transport	Minimise diesel engine idle times and locate away from the ambient air quality monitoring equipment and sensitive receptors. Minimise idling time of all plant and machinery and switch off when not in use for more than 15 minutes. locate away from the ambient air quality monitoring equipment and sensitive receptors.	Contractor	Construction	n/a
AQ5	Generator Emissions	The location of site generators would take into consideration nearby sensitive receivers as well as the location of air quality monitoring equipment. Generators would be switched off when not in use.	Contractor	Construction	n/a
AQ6	Removal of hazardous materials	The containment system would operate under negative pressure with airlock doors. Airlocks would be installed at the access stair entrances to the containment system to ensure controlled entry and exit during the coating removal process to prevent the escape of the hazardous coating material to air. The ventilation system for the removal and extraction of dust, lead and potentially VOCs would comply with the requirements prescribed in the *AS/NZS 4361.1: 2017, Guide to hazardous paint management, Part 1: Lead and other hazardous metallic pigments in industrial applications*. The extraction	Contractor	Construction	*AS/NZS 4361.1: 2017, Guide to hazardous paint management, Part 1: Lead and other*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		system will capture and contain particles (lead impacted garnet) within sealed receptacles for management as hazardous waste. In addition to the containment system, vacuum shrouded abrasive blasting equipment or vacuum shrouded power tools would be used.			*hazardous metallic pigments in industrial applications*
AQ7	Use of hazardous materials	Use of paints with low levels of VOCs and use of the paints sparingly.	Contractor	Construction	n/a
AQ10	Spent abrasive and hazard material waste	All hazardous removal would be conducted in accordance with TfNSW Specification B233 and AS 4361.1: 2017.	Contractor	Construction	TfNSW Specification B233 and AS 4361.1: 2017
BD1	Biodiversity	Flora and Fauna mitigation measures will be prepared in accordance with Transport for NSW's *Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects* (RMS, 2011) and implemented as part of the CEMP. It will include, but not be limited to: • a site walk with appropriate site personnel including TfNSW representatives to confirm clearing boundaries and sensitive location prior to commencement of works • identification (marking) of the clearing boundary and identification (marking) of habitat features to be protected. E.g. – use of flagging tape • a map which clearly shows vegetation clearing boundaries and sensitive areas/no go zones • pre clearing survey requirements including the requirement for an arborist to tie back and/or trim mangroves • requirements set out in the *Landscape Guideline* (RMS, 2008) • procedures for unexpected threatened species finds and fauna handling • procedures addressing relevant matters specified in the *Policy and guidelines for fish habitat conservation and management* (DPI Fisheries, 2013) • protocols to manage weeds and pathogens.	Contractor	pre-construction	Section 4.8 of QA *G36 Environment Protection* *Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects* (RMS, 2011)
BD2	Impacts to mangroves	Prior to the commencement of activities, a Part 7 FM Act Permit would be obtained for the trimming of 0.02 ha of marine vegetation (mangroves) or 13 individual mangrove trees.	Fulton Hogan	Pre-construction	Fisheries Management Act 1997

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
BD3	Impacts to Key Fish Habitat	Further consultation with the Department of Primary Industries would be undertaken prior to the commencement of construction activities to approved mangrove trimming activities.	Fulton Hogan	Pre-construction	n/a
BD4	Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented.	Contactor	Pre-construction	n/a
BD5	Trimming of mangroves	Native vegetation removal will be minimised where possible during the installation of the scaffolding. Exclusion zones will be set up at the limit of clearing in accordance with *Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contactor	Pre-construction / Construction	n/a
BD6	Trimming of mangroves	Vegetation removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bush rock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contactor	Construction	n/a
BD7	Unexpected finds	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	Contactor	Construction	n/a
BD8	Aquatic Habitat	Aquatic habitat will be protected in accordance with *Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) and section 3.3.2 Standard precautions and mitigation measures of the *Policy and guidelines for fish habitat conservation and management Update 2013* (DPI (Fisheries NSW) 2013).	Contactor	Construction	n/a
BD9	Weed management	Weed species will be managed in accordance with *Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contactor	Construction	n/a
SW1	Soil and water	A site-specific Erosion and Sediment Control Plan will be prepared and implemented for the duration of the proposal. The Plan will include arrangements for managing wet weather events, including monitoring of potential high-risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.	Contractor/ Project Manager	Pre-construction	Section 2.2 of QA *G38 Soil and Water Management*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SW2	Flood impacts	Adequate measures would be provided to ensure the proposal would avoid any increase in existing flood impacts to surrounding areas and minimise flood risks to the proposal. This would include: • consideration of flood risk in the design and location of site equipment • appropriate waste storage, including in areas away from flood risk • daily weather monitoring to provide adequate warning of heavy rainfall events and allow adequate time for the removal of site equipment prior to heavy rainfall events.	Contractor	Pre-construction	n/a
SW4	Flood impacts	Following high rainfall events which result in flooding of the proposal site, including bridge foundations, inspections would be undertaken of scaffolding systems to ensure no undermining has occurred, and scaffolding is safe and secure.	Contractor	Construction	n/a
SW5	Stormwater drainage and flooding	Consultation with City of Parramatta Council and incorporation of relevant council standards regarding stormwater drainage and flooding.	Contractor	Pre-construction	n/a
SW6	Lead paint removal	All lead removal would be undertaken in accordance with AS/NZS 4361.1: Guide to hazardous paint management, Part 1: Lead and other hazardous metallic pigments in industrial applications.	Contractor	Pre-construction / Construction	n/a
SW7	Plant and equipment	All fuels, chemicals and hazardous liquids would be stored away from drainage lines, within an impervious bunded area in accordance with Australian Standards, EPA Guidelines and the Transport for NSW Chemical Storage and Spill Response Guidelines (Transport for NSW, 2015).	Contractor	Construction	n/a
SC1	Contamination of soils	Soil sampling would be undertaken before and after remedial activities for a pre and post work contamination assessment. These samples would be collected and analysed for heavy metals prior to site establishment and prior to the final inspection and hand over during demobilisation activities. If post work contamination is identified, remediation of the site would be required prior to complete demobilisation and hand over of the site.	Contractor	Pre-construction / Construction	n/a
SC2	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	Contractor	Pre-construction	Section 4.2 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		and any necessary site-specific controls or further actions identified in consultation with the Transport and/or EPA.			
SC3	Contaminated land – unexpected finds	An appropriate unexpected contamination finds protocol, considering asbestos containing materials and other potential contaminants, would be included in the CEMP. Procedures for handling asbestos containing materials, including licensed contractor involvement as required, record keeping, site personnel awareness and waste disposal to be undertaken in accordance with SafeWork NSW requirements.	Contractor	Construction	n/a
SC4	Accidental spill	A site-specific emergency spill plan would be developed and include spill management measures in accordance with the Transport for NSW *Code of Practice for Water Management* (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	Pre-construction	Section 4.3 of QA *G36 Environment Protection*
SC5	Plant and equipment	Vehicles and machinery would be properly maintained and routinely inspected to minimise the risk of fuel/oil leaks. Construction plant, vehicles and equipment would also be refuelled offsite, or in a designated refuelling area.	Contractor	Construction	n/a
SC6	Plant and equipment	All fuels, chemicals and hazardous liquids would be stored away from drainage lines, within an impervious bunded area in accordance with Australian Standards, EPA Guidelines and the Transport for NSW Chemical Storage and Spill Response Guidelines (Transport for NSW, 2015).	Contractor	Construction	n/a
SC7	Pollution	In the event of a pollution incident, works would cease in the immediate vicinity and the Contractor would immediately notify the Transport for NSW Project Manager and Transport for NSW Environment and Planning Manager. The EPA would be notified by Transport for NSW in accordance with Part 5.7 of the POEO Act.	Contractor	Construction	n/a
SC8	Safe removal of hazardous material, such as lead	All works would be undertaken in accordance with RMS Specifications B223 (*Management of Lead Chromium and Asbestos in Bridge Maintenance Painting*) and B220 (*Protective treatment of Bridge Steel Work*) and AS4361.1: *Guide to lead paint management, Part 1: Industrial application*.	Contractor/ Project Manager	Construction	n/a
W1	General waste management	The following resource management hierarchy principles would be followed: • avoid unnecessary resource consumption as a priority	Contractor	Construction	*Waste Avoidance and Resource*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• 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 *Waste Avoidance and Resource Recovery Act, 2001*).			*Recovery Act, 2001*).
W2	Waste	A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to support minimising the amount of waste produced and appropriately handle and dispose of unavoidable waste. The WMP will include but not be limited to: • 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. The WMP will be prepared taking into account the Environmental Procedure - Management of Wastes on Transport for NSW Land (Transport for NSW, 2014) and relevant Transport for NSW Waste Fact Sheets.	Contractor	Pre-construction	Section 4.2 of QA *G36 Environment Protection*
W3	Hazardous Waste Management	A Lead Management Plan (LMP) would be prepared by an appropriately qualified person. This plan would detail the containment, storage,	Contractor	Pre-construction	n/a

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		decontamination and disposal processes for hazardous waste associated with the lead removal works conducted as part of the project.			
W4	Housekeeping	Working areas are to be maintained, kept free of rubbish and cleaned up at the end of each working day.	Contractor	Construction	n/a
W5	Hazardous waste storage	Potentially contaminated waste/hazardous waste is to be stored separately from other waste streams generated at the site.	Contractor	Construction	n/a
W6	Hazardous waste storage	The quantity of hazardous waste stored in equipment laydown areas is not to exceed the volume of waste that can be removed in one to two days.	Contractor	Construction	n/a
W7	Hazardous waste storage	Storage of hazardous waste (i.e. removed lead paint flakes and dust), restricted solid waste or liquid waste (or a combination of these) on-site at any time is not to exceed five tonnes otherwise an Environment Protection Licence (EPL) under the POEO Act is required.	Contractor	Construction	n/a
W8	Hazardous waste storage	Temporary storage of contaminated waste is to be in sealed containers within a self-safe storage container and double bunded and sign posted as hazardous waste.	Contractor	Construction	n/a
W9	Waste disposal	Non-recyclable wastes are to be collected and disposed of at licensed waste facilities only.	Contractor	Construction	n/a
W10	Waste disposal	Any contaminated waste generated by the proposal is to be disposed of in accordance with the EPA approved methods of waste disposal.	Contractor	Construction	n/a
W11	Spoil removal	All spoil to be removed from site would be tested to confirm the presence of any contamination. Any contaminated spoil would be disposed of at an appropriately licensed facility.	Contractor	Construction	n/a
W12	Waste classification	All waste (including hazardous waste) must be classified in accordance with the *Waste Classification Guidelines Part 1: Classifying waste* (EPA, 2014) prior to disposal.	Contractor	Construction	n/a
H1	Non-Aboriginal heritage	Non-Aboriginal Heritage mitigation measures will be incorporated and implemented as part of the CEMP. The CEMP would include but not be limited to the following: • a map identifying locations of items or sites (including curtilages) which are to be protected and those which are to be destroyed/impacted and no-go zones	Contractor	Pre-construction / Construction	n/a

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• identification of potential environmental risks/impacts due to the works/activities • management measures to minimise the potential risk • mitigation measures to avoid risk of harm and the interface with work activities on site • implementation of mitigation measures to protect identified heritage items or areas • identify in toolbox talks where management of non-aboriginal heritage is required such as identification of no go zones and responsibilities under the Heritage Act 1977 and any obtained permits or exemptions • a stop works procedure in the event of actual or suspected potential harm to a heritage feature/place.			
H2	Non-Aboriginal heritage	Identified heritage areas would be marked as no-go zones (except for the bridge), no materials would be stored in identified heritage areas.	Contractor	Pre-construction / Construction	
H1	Non-Aboriginal heritage	The Standard Management Procedure - Unexpected Heritage Items (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 the procedure have been satisfied.	Contactor	Pre-construction	Section 4.10 of QA *G36 Environment Protection*
H3	Aboriginal heritage	The Standard Management Procedure - Unexpected Heritage Items (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.	Contactor	Pre-construction	Section 4.9 of QA *G36 Environment Protection*
LU1	Property	A dilapidation survey would be undertaken for the existing Carpark located adjacent to the site compound before the commencement of the site preparation. Copies of the survey would be provided to Parramatta Council at least one week prior to the commencement of the proposal.	Contractor	Pre-Construction / Construction	n/a

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SE1	Socio-economic	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): • mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions • contact name and number for complaints The CP will be prepared in accordance with the *Community Involvement and Communications Resource Manual* (RTA, 2008).	Contactor	Pre-construction	n/a
SE2	Stakeholder and community notification	All businesses, residential properties and other key stakeholders (e.g. schools, council, bus operators) affected by the activity would be notified at least 10 working days prior to commencement of the activity. Project / community updates would be provided throughout the duration of works as relevant. Notification would utilise both digital and conventional (non-digital) modes of communication (e.g. media release, letter box drops, newsletters and regular updates to a project website). Notification would include an information package, including contact name and number for enquiries or complaints, the expected timeframe of works and any planned or potential disruptions to utilities/ services and changed road and traffic conditions. The package is also to include details on the bridge closure, the available detours alternative transport and pedestrian access. As part of the notification process, advanced warning signage would be established prior to and during the work to ensure road users are aware of the road closure and detours. Directional signage is to be placed along the detour routes.	Project Manager and Communications Officer	Pre-construction / construction	n/a
SE3	Consultation	Ongoing stakeholder consultation would be undertaken. Consultation would include: • Parramatta City Council • residents and businesses within 500 m of the proposal • fire and Emergency services • bus operators • local schools • Transdev (the operator of Sydney Ferries)	Project Manager	Pre-construction / construction	n/a

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• Maritime (TfNSW) • Parramatta Light Rail • operators or community services and facilities.			
SE4	Waterway	As required, advanced warning signage and/or beacons (appropriate for any applicable day and night time maritime requirements) would be established prior to and during the work to ensure any users of the local waterway(s) are aware of restricted access, changed navigational conditions or hazards within the work area and waterway.	Project Manager	Pre-construction / construction	n/a
SE5	Project contacts / Complaints	A website and free-call number would be established for enquiries regarding the proposal for the entirety of construction. Contact details would be clearly displayed at the entrance to the site. All enquiries and complaints would be tracked through a tracking system and acknowledged within 24 hours of being received.	Contractor	Pre-construction / construction	n/a
SE6	Health and safety	Suitable site induction relating to site specific hazards would be undertaken for all contractors. The work would be undertaken in accordance with all NSW health and safety legislative requirements and relevant Australian Standards.	Contractor	Pre-construction / construction	n/a
SE7	Security	The construction areas would be secured at all times.	Contractor	Construction	n/a
HR2	Adjustment and / or removal of public utilities	Prior to the commencement of works the location of existing utilities will be confirmed. Consultation with Sydney Water and Jemena would be undertaken to manage any impacts to the existing water main and gas main on the bridge.	Contractor	Pre-construction / construction	n/a
AH1	Aboriginal heritage	The Standard Management Procedure - Unexpected Heritage Items (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 the procedure have been satisfied.	Contractor	Pre-construction	Section 4.9 of QA *G36 Environment Protection*
CL1	Cumulative construction impacts	A community and stakeholder consultation plan will be included in the CEMP, which outlines key stakeholders and nearby projects with potential for cumulative impacts.	Project Manager	Pre-construction / construction	n/a

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
CL2	Cumulative construction traffic impacts	Consultation would be undertaken with the Sydney Metro Parramatta Station construction contractor (transport infrastructure components), and Meriton Apartments prior to the commencement of construction to confirm the number of construction vehicle movements that would utilise the George St haulage route and appropriate controls put in place to ensure these movements are properly managed.	Project Manager	Pre-construction / construction	n/a

7.3 Licensing and approvals

Table 7.2: Summary of licensing and approvals required

Instrument	Requirement	Timing
Fisheries Management Act 1994 (s205)	Part 7 Permit to harm marine vegetation from the Department of Primary Industries.	Prior to start of the activity.
Environmentally Hazardous Chemicals Act 1985 (s28)	A licence to carry on any prescribed activity with respect to an environmentally hazardous chemical or a declared chemical waste from the EPA.	Prior to start of the activity.
Roads Act 1993	Road Occupancy Permit.	Prior to start of the activity.
Work Health and Safety Regulation 2017 (s403)	Notification of Lead risk work.	Prior to start of the activity.

8. Conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Section 193 of the Environmental Planning and Assessment Regulation 2021.

8.1 Justification

The bridge is a crucial link in the road infrastructure network in the Parramatta LGA, providing vehicle and pedestrian access between the Parramatta CBD and residential areas to the north of the Parramatta River. It is important to TfNSW that the bridge remains in a serviceable condition at all times. In its current condition, the bridge does not comply with the minimum standards, due to failing protective coating, and surface corrosion. A number of options have been considered for the proposal; however, the do-nothing approach would result in the bridge falling into a state of disrepair and as a consequence become unsafe for motorists and pedestrians

The proposal would provide the following benefits:

- maximise the service life of the bridge and maintain a safe and connected road network for the local community and road users accessing the Parramatta CBD from the suburbs to the north
- reduce future bridge maintenance requirements and associated community disruption
- retain the heritage value of the bridge and improve the visual amenity of the bridge through the removal of surface corrosion and re-painting of the bridge structure
- remove hazardous materials from the bridge by removing lead-based paint from the bridge surface.

Overall, the proposal would result in some short-term disruption to the local community as a result of the temporary and intermittent closure of the bridge to traffic and pedestrians. The proposal would also result in noise impacts during high noise generating activities at nearby sensitive receivers. These impacts are expected to be temporary and intermittent in nature, and manageable with the implementation of appropriate mitigation measures, and advanced planning, notification with local residents. The impacts of the proposal can be managed by mitigation and management measures presented in this REF, and the subsequent CEMP (and sub plans).

8.2 Objects of the EP&A Act

Table 8.1 Objects of the *Environmental Planning and Assessment Act 1979*

Instrument	Requirement
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.	Not relevant to the proposal.
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	Not relevant to the proposal.
1.3(c) To promote the orderly and economic use and development of land.	Not relevant to the proposal.
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the proposal.

1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	Not relevant to the proposal.
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	Not relevant to the proposal.
1.3(g) To promote good design and amenity of the built environment.	The proposal would result in an improvement to the overall amenity of the built environment through the removal of the existing lead-based paint and areas of surface corrosion, and the surface repainting.
1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	The proposal would improve the health and safety of the local community, specifically users of the bridge by removing hazardous lead-based paint from the existing bridge surface.
1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	Not relevant to the proposal.
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	This REF provides details on the public consultation regarding the proposal. The public will have an opportunity to comment on the final REF.

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.

Specialist studies were incorporated into the assessment of the impacts of the proposal, to gain a detailed understanding of the existing environmental as well as the potential impacts associated with carrying out the proposed activity, and mitigation measures to reduce these impacts. These assessments have applied conservative modelling to determine potential impacts, and the proposal has been designed to minimise potential impacts during the construction and operation of the proposal, and the nest available technical information, environmental standards and measures have been used to minimise environmental risks.

Intergenerational equity

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Inter-generational equity introduces a temporal element with a focus on minimising the distribution of costs to future generations.

The proposal would benefit future generations by improving road safety and reduce maintenance costs over a 30 year lifespan of the new bridge protective coating system. The proposal would also eliminate the release of hazardous material within the existing coating system into the environment and exposure to the community. The preservation of the bridge heritage for future generations will be enhanced. Implementation of the safeguards contained in this REF would ensure the health, diversity and productivity of the environment is maintained for the benefit of future generations.

Should the proposal not proceed, the bridge coating system would continue to fail at an accelerated rate resulting in further exposure of hazardous lead material, increased rate of section loss leading to reduced structural integrity and hence safety concerns of the structure and the diminished heritage preservation for future generations.

Conservation of biological diversity and ecological integrity

A BAR has been undertaken to identify potential adverse impacts on biodiversity and ecological values, either directly, such as impacts of the proposal on threatened ecological communities or indirectly such as the assessment of impacts to water quality, which have the potential to impact sensitive receivers.

Section 6.4 outlines the BAR for the proposal, which was undertaken in accordance, and where applicable, with the Biodiversity Assessment Method (OEH, 2020) to identify potential adverse impacts on biodiversity. As identified, the proposal would result in direct impacts (trimming) of up to 0.02ha of mangroves (impacting 13 individual mangroves) which form part of PCT 920 Mangrove Forests in estuaries of the *Sydney Basin Bioregion and South East Corner Bioregion*.

These impacts are unlikely to be major or place a population at risk of extinction as they the impact is minor and temporary, and the mangroves are likely to regenerate following the removal of the scaffolding and containment system. However, as described in Section 6.4.2 impact to any areas of Type 1 fish habitat is generally prohibited by the DPI, thus consultation would be undertaken prior to the commencement of construction activities to approve the trimming activities. In addition, as mangroves are classified as Marine Vegetation under the FM Act. Any cutting, removing, destroying, transplanting, shading or damaging in any way requires a Part 7 Fisheries Management Act Permit (refer to Section 1.1).

Improved valuation, pricing and incentive mechanisms

The principle of internalising environmental costs into decision making requires consideration of all environmental resources that may be affected by the carrying out of a project, including air, water, land and living things.

The assessment has identified the environmental and other consequences of the proposal, and identified mitigation measures, where appropriate, to manage potential impacts. If approved, the construction and operation of the proposal would be in accordance with relevant legislation, and construction management plans (as required). These requirements would result in an economic cost to the proponent. The implementation of mitigation measures would increase the capital cost of the proposal, signifying that the environmental resources is also inherently considered in the development of the design or activities that avoids and minimised impacts. In addition, the value of the proposal to the community, by removing an existing hazard, and improving the safety and economic outcomes of the proposal have been recognised in selecting the design of proposed activities.

8.3 Conclusion

The proposed remedial works on the Gasworks bridge at Parramatta 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 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 traffic and access, noise, and land use to local residents, road users, and users of active transport routes. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also result in safety improvements of Gasworks bridge, the removal of an existing hazardous material coating on the bridge structure, and also improve the visual amenity and heritage value of the bridge.

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 nor approval to be sought from the Minister for Planning 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 nor the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999 (*Commonwealth). A referral to the Australian Department of Climate Change, Energy, the Environment and Water 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.

Name:	Morgan Cardiff
Position:	Associate Environmental Scientist
Company name:	WSP
Date:	03/07/2023

Name:	Ellese O'Sullivan
Position:	Environmental Management Representative
Company name:	Fulton Hogan
Date:	10/07/2023

I certify that I have reviewed and endorsed the contents of this REF and, to the best of my knowledge, it is in accordance with the EP&A Act, the EP&A Regulation and the Guidelines approved under Section 170 of the EP&A Regulation, and the information is neither false nor misleading. I accept it on behalf of Transport for NSW.

Name:	Justin Lo
Position:	Senior Contract Relationship Manager
Transport region/program:	River Zone, Sydney Roads Asset Performance
Date:	16/07/2023

10. EP&A Regulation publication requirement

Table 10.1: EP&A Regulation publication requirement

Requirement	Yes/No
Does this REF need to be published under section 171(4) of the EP&A Regulation?	Yes

11. References

Austral Archaeology 2023, Gasworks Bridge Parramatta New South Wales Historical Heritage Assessment

Civlink Consulting 2022b, Traffic Management Plan, prepared for Fulton Hogan

Civlink Consulting 2023, Traffic Impact Assessment, prepared for Fulton Hogan

Landcom, 2004, Managing Urban Stormwater: Soils and Construction, Volume - 4th Edition, Sydney

NSW Department of Planning, Industry and Environment, 2020, Biodiversity Assessment Method, Sydney

NSW Department of Environment and Climate Change, 2009, Interim Construction Noise Guideline, Sydney'

NSW Department of Environment and Conservation, 2006, Assessing Vibration: A Technical Guideline, Sydney

NSW Department of Environment, Climate Change and Water, 2011, NSW Road Noise Policy, Sydney

NSW Department of Environment and Heritage 2021, Aboriginal Heritage Information Management System web search tool, accessed 24 September 2021

NSW EPA, 2014, Waste Classification Guidelines, Sydney

Transport for NSW, 2018, Future Transport 2056, Transport for NSW, Sydney

Transport for NSW, 2019, Unexpected Heritage Finds Guideline, Sydney

WSP, 2018, Sydney Wharf Upgrade Parramatta Construction Noise and Vibration Impact Statement, prepared for TfNSW, Sydney

WSP, 2023, Gasworks Bridge Remediation – Air Quality Assessment, prepared for Fulton Hogan

WSP, 2023a, Gasworks Bridge Remediation – Biodiversity Assessment Report, prepared for Fulton Hogan

WSP, 2023b, Gasworks Bridge Remediation – Noise and Vibration Impact Assessment, prepared for Fulton Hogan

Terms and acronyms used in this REF

Table 11.1: Terms and acronyms used in this REF

Term / Acronym	Description
AusLink	Mechanism to facilitate cooperative transport planning and funding by Commonwealth and state and territory jurisdictions
BC Act	*Biodiversity Conservation Act 2016 (NSW)*
CEMP	Construction environmental management plan
EIA	Environmental impact assessment
EP&A Act	*Environmental Planning and Assessment Act 1979 (NSW)*. Provides the legislative framework for land use planning and development assessment in NSW
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)*. Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process
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
EWMS	Environmental Work Method Statement
FM Act	*Fisheries Management Act 1994 (NSW)*
Heritage Act	*Heritage Act 1977 (NSW)*
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act
LoS	Level of Service. A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers
MNES	Matters of national environmental significance under the *Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)*
NPW Act	*National Parks and Wildlife Act 1974 (NSW)*
OEH	Office of Environment and Heritage within the Department of Planning and Environment
PEA Act	*Protection of the Environment Administration Act 1991*
QA Specifications	Specifications developed by Transport for use with road work and bridge work contracts let by Transport
RMS	NSW Roads and Maritime Services, now Transport for NSW
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act
SEPP (Biodiversity and Conservation)	State Environmental Planning Policy (Biodiversity and Conservation) 2021
SEPP (Planning Systems)	State Environmental Planning Policy (Planning Systems) 2021

Term / Acronym	Description
SEPP (Precincts – Eastern Harbour City)	State Environmental Planning Policy (Precincts – Eastern Harbour City) 2021
SEPP (Precincts – Regional)	State Environmental Planning Policy (Precincts – Regional) 2021
SEPP (Resilience and Hazards)	State Environmental Planning Policy (Resilience and Hazards) 2021
SEPP (Transport and Infrastructure)	State Environmental Planning Policy (Transport and Infrastructure) 2021
Transport	Transport for NSW

Appendix A – Consideration of section 171 factors and matters of national environmental significance and Commonwealth land

Section 171 Factors

In addition to the requirements of the Guideline for Division 5.1 assessments (DPE 2022) and the Roads and Related Facilities EIS Guideline (DUAP 1996) as detailed in the REF, the following factors, listed in section 171 of the Environmental Planning and Assessment Regulation 2021, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

Factor	Impact
• Any environmental impact on a community?	The proposal would result in some temporary construction impacts to the local community, particularly in relation to construction noise and impacts to the movement of traffic and pedestrian access. These impacts would mainly affect nearby residents. Some construction activities are also planned to take place outside of standard working hours, which would increase impacts on the community, particularly as a result of excessive noise. These impacts would be managed through the implementation of mitigation measures outlined in Chapter 7 of the REF. Once complete, the use of the bridge and surrounding area that makes up the proposal site would continue to operate as a road and pedestrian bridge.
• Any transformation of a locality?	The proposal would result in modifications to the existing road infrastructure in a road corridor and a public space. During construction activities there would a minor, temporary and short-term change to the existing locality through the establishment of a construction site. The permanent modifications due to the proposal are commensurate with the existing use of the site as an operational road bridge and would not likely transform the locality beyond minor change to the bridge appearance as a result of re-painting works.
• Any environmental impact on the ecosystems of the locality?	Construction of the proposal would result in direct impacts (via trimming) of up to 0.02ha of mangroves which form part of PCT 920 *Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion.* These impacts are unlikely to be major or place a population at risk of extinction as they the impact is minor and temporary, and the mangroves are likely to regenerate following the removal of the scaffolding and containment system. Impact to any areas of Type 1 fish habitat is generally prohibited by the DPI, thus consultation would be undertaken prior to the commencement of construction activities to approve the trimming activities. In addition, as mangroves are classified as Marine Vegetation under the FM Act. Any cutting, removing, destroying, transplanting, shading or damaging in any way requires a Part 7 Fisheries Management Act Permit (refer to Section 1.1).
• Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?	There would be a temporary reduction in aesthetic and recreational values of the local area due to presence of a construction site and the anticipated noise impacts during construction. The proposal site is located within an existing road corridor / bridge. Considering the location, and the temporary nature of expected impacts, the risk of a reduction of aesthetic, recreational, scientific or other environmental quality or values are low.
• Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or	The proposal is not anticipated to have an effect on the aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance of the locality. There are no aboriginal heritage sites in or immediate adjacent to the Proposal site, and the proposal site is in an area of considerable historical disturbance. The Gasworks

Factor	Impact
other special value for present or future generations?	Bridge is a locally listed historical item. A heritage assessment (refer to section 6.8) found the proposal would not substantially impact the item, and no further assessment or permit would be required.
• Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act 1974*)?	The proposal will require the removal (via trimming) of approximately 0.02ha of mangroves which form part of PCT 920 *Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion.* Measures to mitigate the impacts of construction and operation of the proposal are described in section 6.4
• Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?	As discussed in (c) and (f) there would be a requirement for the trimming of native vegetation for the proposal. This vegetation is not consistent with threatened ecological communities or potential fauna and flora species. Mitigation measures to mitigate the impacts of construction of the proposal are described in Chapter 7.
• Any long-term effects on the environment?	The proposal is not likely to have any long-term risk to the environment.
• Any degradation of the quality of the environment?	The proposal has the potential to result in a minor and temporary degradation of environmental quality during construction. During construction this is likely as a result of direct impacts such as noise and disturbance of areas of open space. The potential of these impacts would be minimised and managed through the implementation of mitigation and management measures outlined in Chapter 7 of this REF.
• Any risk to the safety of the environment?	The proposal would remove existing hazardous materials form the bridge surface. All construction works related to the removal of the lead-based materials would be undertaken in accordance with relevant guidelines as outlined in Section 3.3.1 and in accordance with mitigation measures outlined in Chapter 7 of this REF. with the implementation of these measures the risk to the safety of the environment is considered low.
• Any reduction in the range of beneficial uses of the environment?	The proposal site mainly located in an existing road corridor and therefore is not likely to reduce the beneficial use of the environment. Areas of open space to be temporarily utilised during construction would be landscaped and returned to their previous use on completion. During operation the proposal site would return to its previous use.
• Any pollution of the environment?	During construction, there is a risk of noise, water and air pollution. These risks would be managed through the implementation of proposed control measures outlined in Chapter 7 of this REF.
• Any environmental problems associated with the disposal of waste?	All waste requiring off-site disposal would be classified in accordance with the NSW Waste Classification Guidelines: Part 1 – Classifying Waste (EPA, 2014b) prior to disposal. This would include hazardous waste generated through the removal of lead-based paint from the bridge surface. All waste would be stored appropriately, and handled in accordance with guidelines outlined in Chapter 7 of this REF.
• Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply?	Materials required for the construction of the proposal are readily available and would volumes and amounts required would not increase demand on natural resources that are in short supply.
• Any cumulative environmental effect with other existing or likely future activities?	Construction of the proposal has the potential to result in cumulative impacts associated with the construction of other nearby projects. Ongoing consultation with nearby projects outlined in Section 5 would be undertaken to manage the potential cumulative impacts of the proposal.

Factor	Impact
• Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?	The proposal is not likely to have any impacts to coastal processes or coastal hazards.
• Applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1,	The proposal would contribute to ongoing improvements and maintenance of existing infrastructure, ensuring the continued safe use of the gasworks bridge as a key transport link to and from Parramatta CDB. The proposal supports objective 1 of C1 of the Central City District Plan which identifies the importance of radial transport links to and from the Parramatta CBD. In addition, maintaining safe access to the Parramatta CBD from residential areas to the north, would continue to support the '30 minute city' concept by maintaining the link of vehicle and active transport links which utilise the bridge. The removal of hazardous materials and improvements to the visual amenity of the bridge would support the City of Parramatta's regional planning priority of enhancing heritage and cultural assets within the LGA.
• Other relevant environmental factors.	In considering the potential impacts of this proposal all relevant environmental factors have been considered, refer to Chapter 6 of this REF.

Matters of National Environmental Significance and Commonwealth land

Under the environmental assessment provisions of the EPBC Act, the following matters of national environmental significance and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Department of Climate Change, Energy, the Environment and Water.

A referral is not required for proposed actions that may affect nationally-listed threatened species, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Factor	Impact
• Any impact on a World Heritage property?	Nil
• Any impact on a National Heritage place?	Nil
• Any impact on a wetland of international importance?	Nil
• Any impact on a listed threatened species or communities?	Nil
• Any impacts on listed migratory species?	Nil
• Any impact on a Commonwealth marine area?	Nil
• Does the proposal involve a nuclear action (including uranium mining)?	Nil
• Additionally, any impact (direct or indirect) on the environment of Commonwealth land?	Nil

Appendix B – Statutory consultation checklists

Transport and Infrastructure SEPP

Certain development types

Development type	Description	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Car Park	Does the project include a car park intended for the use by commuters using regular bus services?	No	City of Parramatta and adjoining occupiers of land	Section 2.110
Bus Depots	Does the project propose a bus depot?	No	City of Parramatta and adjoining occupiers of land	Section 2.110
Permanent road maintenance depot and associated infrastructure	Does the project propose a permanent road maintenance depot or associated infrastructure such as garages, sheds, tool houses, storage yards, training facilities and workers' amenities?	No	City of Parramatta and adjoining occupiers of land	Section 2.110

Development within the Coastal Zone

Development type	Description	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Development with impacts on certain land within the coastal zone	Is the proposal within a coastal vulnerability area and is inconsistent with a certified coastal management program applying to that land?	No	City of Parramatta	Section 2.14

Council related infrastructure or services

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Stormwater	Are the works likely to have a *substantial* impact on the stormwater management services which are provided by council?	No	City of Parramatta	Section 2.10
Traffic	Are the works likely to generate traffic to an extent that will *strain* the capacity of the existing road system in a local government area?	No	City of Parramatta	Section 2.10
Sewerage system	Will the works involve connection to a council owned sewerage system? If so, will this connection have a *substantial* impact on the capacity of any part of the system?	No	City of Parramatta	Section 2.10

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Water usage	Will the works involve connection to a council owned water supply system? If so, will this require the use of a *substantial* volume of water?	No	City of Parramatta	Section 2.10
Temporary structures	Will the works involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, will this cause more than a *minor* or *inconsequential* disruption to pedestrian or vehicular flow?	Yes	City of Parramatta	Section 2.10
Road & footpath excavation	Will the works involve more than *minor* or inconsequential excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	No	City of Parramatta	Section 2.10

Local heritage items

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Local heritage	Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the works? If yes, does a heritage assessment indicate that the potential impacts to the heritage significance of the item/area are more than minor or inconsequential?	No	City of Parramatta	Section 2.11

Flood liable land

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Flood liable land	Are the works located on flood liable land? If so, will the works change flood patterns to more than a *minor* extent?	No	State Emergency Service erm@ses.nsw.gov.au	Section 2.12

Flood liable land	Are the works located on flood liable land? (to any extent). If so, do the works comprise more than minor alterations or additions to, or the demolition of, a building, emergency works or routine maintenance?	No	State Emergency Service erm@ses.nsw.gov.au	Section 2.13

Public authorities other than councils

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
National parks and reserves	Are the works adjacent to a national park or nature reserve, or other area reserved under the *National Parks and Wildlife Act 1974*, or on land acquired under that Act?	No	Environment and Heritage Group, DPE	Section2.15
National parks and reserves	Are the works on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?	No	Environment and Heritage Group, DPE	Section 2.15
Navigable waters	Do the works include a fixed or floating structure in or over navigable waters?	Yes	Transport for NSW - Maritime	Section 2.15
Bush fire prone land	Are the works for the purpose of residential development, an educational establishment, a health services facility, a correctional centre or group home in bush fire prone land?	No	Rural Fire Service (RFS)	Section 2.15
Artificial light	Would the works increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map? (Note: the dark sky region is within 200 kilometres of the Siding Spring Observatory)	No	Director of the Siding Spring Observatory	Section 2.15
Defence communications buffer land	Are the works on buffer land around the defence communications facility near Morundah?	No	Secretary of the Commonwealth Department of Defence	Section 2.15
Mine subsidence land	Are the works on land in a mine subsidence district within the meaning of the *Mine Subsidence Compensation Act 1961*?	No	Mine Subsidence Board	Section 2.15

SEPP (Precincts – Central River City) 2021 and SEPP (Precincts – Western Parkland City) 2021

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP section
Clearing native vegetation	Do the works involve clearing native vegetation (as defined in the *Local Land Services Act 2013*) on land that is not **subject land** (as defined in cl 17 of schedule 7 of the *Threatened Species Conservation Act 1995*)?	No	Department of Planning and Environment	Section 3.24

Appendix C – Traffic impact assessment

TRAFFIC IMPACT ASSESSMENT

GASWORKS BRIDGE REHABILITATION

MACARTHUR STREET CLOSURE AND DETOUR – TRAFFIC ANALYSIS (GASWORKS BRIDGE, PARRAMATTA)

CIVLINK CONSULTING

Civlink Consulting Pty Ltd
ABN 64 633 194 948
Telephone +61 432 544 458
Email alex@civlink-consulting.com.au
Website www.civlink-consulting.com.au

CONTENTS

TRAFFIC IMPACT ASSESSMENT

GASWORKS BRIDGE REHABILITATION – GASWORKS BRIDGE CLOSURE & DETOUR

Document Control

Title:	Description
Ref No.:	TIA-FH-RP-0001
Description:	Traffic impact assessment of proposed closure of Macarthur Street bridge at the Parramatta River
Discipline:	Traffic Management / Traffic Engineering

Role	Name	Position	Date	Signed
Author:	Alex Gosper	Director	13.09.2021	
Approved by:				

Document Revisions

No.	Date	Issue / Description	Approved
00	13.09.21	Initial Draft for Stakeholder Review	AG
01	17.10.22	Updated	AG
02	24.05.23	Updated	AG
04	31.05.23	Updated	AG

Author: Angela Wetton

Approved by: Alex Gosper

Date: 31st May 2023

Distribution: Fulton Hogan

Executive Summary

As part of the Gasworks Bridge Upgrade an extended weekend closure of Macarthur Street at the Gasworks bridge is required, typically requiring the detour traffic which would otherwise cross the bridge. The closures would be required for several weekend closures, from Friday night through to Monday morning.

This report outlines the proposed detour options, the modelled and anticipated impacts, and assumptions of such closures across several periods through the week. The analysis involved collecting traffic data from a variety of locations, reviewing the data, applying some assumptions for reduction and displacement, and finally modelling the key critical intersections in SIDRA Intersection.

The results of modelling normal traffic periods for the southbound detour suggests that it would perform at a reasonable level however some queuing and delays are expected for the intersections within the Parramatta CBD during peak periods.

Additionally, a long-term lane closure over the bridge is required, which restricts traffic over the bridge to a single lane. This updated report reviews the traffic impacts of the proposed lane closure and considers whether a long term detour of one direction, or traffic controlled shuttle flow operation is preferred. The traffic volumes during peak periods exceed the capacity of a shuttle flow operation, so a long term detour is required. The preferred detour is for northbound traffic as traffic volumes are lower than southbound and the detour route avoids the Parramatta CBD. Due to the large traffic volumes on James Ruse Drive Northbound, two detour routes via River Road West and Hassall Street are recommended to split the demand on each intersection, with a communications and VMS strategy to encourage alternate routes or mode shifts throughout the works.

1. Introduction

1.1 Project

The Gasworks Bridge Rehabilitation (The Project) involves maintenance and refurbishment to the existing heritage listed Gasworks Bridge over the Parramatta River. The works include removing the existing coating form the bridge and installing a new protective coating as well as other improvements.

The works are being rolled out as part of the NSW Governments Transport Access Program to provide better experience for public transport customers.

This report specifically looks at the proposed Gasworks bridge closures to occur over several extended weekend closures, and their potential impacts on the surrounding road network.

Impacts have been assessed during the weekend peak and detour routes for closure of northbound and southbound have been considered independently along with their respective benefits and challenges.

This updated report also assesses the operation of a long-term lane closure over the bridge, including whether shuttle flow or single direction detour is more appropriate.

1.2 Purpose

As outlined in Section 1.1, this report outlines the assessed impacts of the proposed Gasworks bridge closure. The closure is a necessary element of the maintenance and refurbishment works and is proposed to facilitate several key activities. The works are planned to be conducted as outlined in the project Traffic Management Plan.

The full bridge closures are proposed to commence from August 2023 and will be carried out during planned weekend shutdowns of the Gasworks Bridge. There are a proposed 12 weekend shutdowns planned for the works between August 2023 and December 2023.

The long-term single lane closure over the bridge to commence in August 2023 and is proposed to be implemented for several weeks, with the work site switching from the western to eastern side of the bridge. The assessment considers whether a shuttle flow, tidal flow or one-way road closure is the most appropriate method of providing the required work area to complete the bridgeworks for the long-term arrangement.

2. Assessment Scope

The scope of the report was to collect and process traffic data to identify the anticipated traffic volumes on the detour routes and to assess the operation of the key impacted intersections with this additional traffic.

The proposed detour route operates as a loop with the majority left turns. The northbound detour would take George Street, River Road West and James Ruse Drive to Victoria Road with the majority unsignalised left turns. An alternate detour via Hassall Street to James Ruse Drive has also been assessed.

The southbound detour would take Victoria Road and Wilde Avenue to the Parramatta CBD, and therefore would impact several signalised intersections. Traffic would continue on the detour to Harris Street via Phillip Street and George Street.

The key intersections impacted by these detour routes are as follows:

- Victoria Street / Macarthur Street
- Victoria Street / Wilde Avenue
- Wilde Avenue / Smith Street / Phillip Street
- George Street / Charles Street
- George Street / Harris Street / MacArthur Street
- Victoria Road / James Ruse Drive
- James Ruse Drive / River Road West
- James Ruse Drive / Hassall Street
- Harris Street / Parkes Street

2.1 Data Collection

2.1.1 SCATS Data – Signalised Intersections (TfNSW supplied)

SCATS data was provided by TfNSW for the following key intersections, where the proposed detour would impact during the closures.

- MacArthur Street / Thomas Street
- MacArthur Street/ Harris Street / George Street
- Victoria Street / Macarthur Street
- Victoria Street / Wilde Avenue
- Wilde Avenue / Smith Street / Phillip Street
- George Street / Charles Street
- Victoria Road / James Ruse Drive
- James Ruse Drive / River Road West
- James Ruse Drive / Hassall Street
- Harris Street / Parkes Street

These signalised intersections are key points shown on the detour routes below in the red circles, in Figure 1, below:

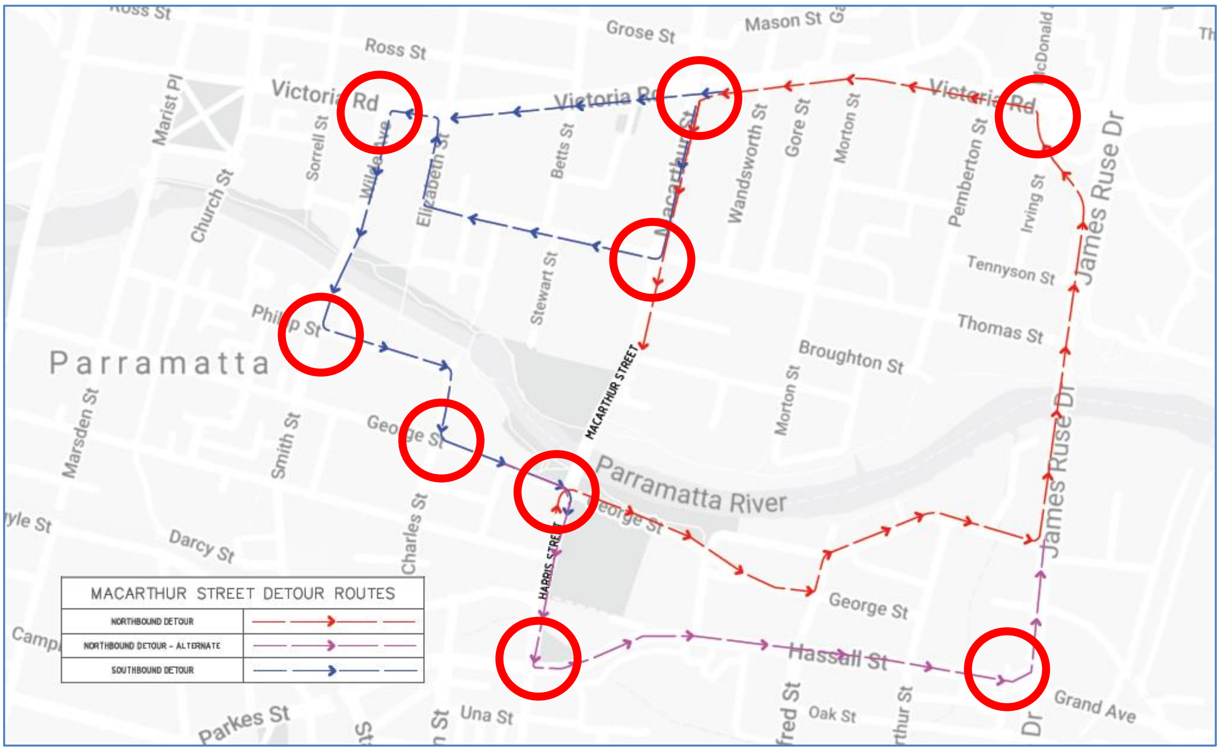


Figure 1 - SCATS Data obtained for intersections shown

The SCATS data provided for these intersections were from 26 June to 26 August 2022. The dates selected for the traffic assessment were the weekends following the July school holidays, from 31st July to 28th August 2022.

The weekday peak periods used for the extended closure were the average weekday peak from 31st July to 28th August 2022.

2.1.2 Intersection Counts

Short term classification counts for the James Ruse Drive/ River Road West intersection were provided from Tuesday 3rd November 2015, with morning and afternoon peak periods.

3. Assumptions

3.1 Reduction

3.1.1 Community Notification / Advertising

It is expected there will be a reduction in traffic simply due to community members in close proximity to the bridge work site being familiar with the work and opting to take an alternate route all together or abstain from driving during any proposed closures.

No reduction due to community notification has been adopted in this instance.

It is expected that some traffic may continue straight on Victoria Street to access the west end of the Parramatta CBD via O'Connell Street however the conservative scenario has been modelled with all traffic turning left at Wilde Avenue. It has also has been assumed that 100% of the southbound traffic would follow the detour and turn left into Phillip Street to follow the signed detour route back to

George Street and Harris Street, however some traffic may opt to continue southbound to Smith Street.

All northbound traffic has assumed to turn left on to James Ruse Drive and Victoria Street and left back to MacArthur Street however local traffic may opt to take any of the many side roads into the residential catchment that provide a more direct route to their homes or destination.

3.1.2 Covid-19 Travel Patterns

No reduction to the base intersection or detour traffic volumes have been included in this updated assessment. It is noted that the weekend traffic volumes were taken from the last four weekends of the data provided, to account for traffic increasing following the peak of the winter covid wave and any school holiday related travel reductions.

3.1.3 Annual Growth

SCATS data was provided for periods which are less than 2 months old and have therefore not been modified to account for any annual growth.

The intersection counts for the James Ruse Drive / River Road West provided were from November 2015.

To estimate the traffic growth between 2015 and 2022, the James Ruse Drive traffic volumes were compared with the July / August 2022 SCATS counts at the adjacent James Ruse Drive / Hassall Street / Grand Avenue intersection, see Table 2. It is noted that the comparison does not consider any traffic that enters and local car parks or Tramway Ave and Grand Avenue North, therefore a 10% increase has been applied to all movements. There were also fewer than 10 vehicles per hour that were shown to turn right from River Road West to James Ruse Drive Southbound. This movement has since been banned, so these movements have been added to the left turn. The Saturday peak volumes turning into and out of River Road west have been taken as the weekday morning peak volumes, as these were the higher of the weekday peak hour volumes..

Table 1 – River Road West intersection count comparison

DISPLACED VOLUMES - GASWORKS BRIDGE				
Period	**Direction**	**2015 Volume**	**2022 Volume**	**Difference**
AM Peak	Northbound	2118	2491	+17.6%
	Southbound	2525	2362	-6%
PM Peak	Northbound	2319	2670	+15%
	Southbound	2203	2416	+10%

3.2 Extended Closure Equilibrium

It is expected that although analysis may suggest delays which are in cases greater than will be acceptable in the short term, where there is an extended closure; motorists will utilise alternative routes after experiencing delay in the first few days of closure and operation. It is anticipated after one to two weeks an equilibrium will be reached where some motorists will opt to adopt a different route and avoid the congestion.

It is noted that there is some expected congestion at River Road West, however after a few days there is a high likelihood of motorists opting to use alternate routes that would avoid the area. There are numerous alternative options, however at this point a 40% of northbound traffic has been assumed to use River Road West with another 40% using the Hassal Street intersection at James Ruse Drive.

3.3 SCATS Detector Splits

Where SCATS detector counts have been provided for lanes with shared through and turning movements, or inactive detectors, the following assumptions have been made. The bus traffic volumes were assumed by counting the number of departures from the bus stops to the south of Phillip Street from 12 – 1pm on Saturday 29th October 2022, and confirmed for the weekday peaks from 8-9am and 5-6pm on Monday 22 May 2023

Table 2 – SCATS Detector Volume Assumptions

SCATS DETECTOR ASSUMPTIONS				
Intersection	**Detector**	**Lane**	**Issue**	**Assumptions**
Victoria Rd / Macarthur Street	3	Eastbound Lane 1	Shared Through and Left	12No. Buses straight through, balance Left Turn
	9	Southbound Lane 1	Shared Through and Left	50% Left Turn, 50% Through
	12	Northbound Lane 1	Shared Through and Left	60% Left Turn, 40% Through
	10/11	Northbound Lane 2	Shared Through and Right	50% Right Turn, 50% Through
Victoria Rd / Wilde Ave	10	Westbound Lane 1	Missing left turn detector	Southbound total at Phillip Street minus detector 7, WB right turn from Victoria Road
Wilde Ave / Smith St / Phillip St	2	Northbound Lane 1	Shared Through and Left	11No. Buses straight through, balance Left Turn
	6	Southbound Lane 1	Shared Through and Left	12No. Buses straight through, balance Left Turn
	9	Eastbound Lane 2	Shared Through and Right	50% Right Turn, 50% Through
	10	Eastbound Lane 1	Shared Through and Left	70% Left Turn, 30% Though (parking on departure side)
	11	Westbound Lane 2	Shared Through and Right	70% Through, 30% Right Turn
	12	Westbound Lane 1	Shared Through and Left	40% Through, 60% Left Turn
George St / Charles St	1	Eastbound Lane 1	Shared Through and Left	100% Left Turn (work zone on departure side)
	3/4	Westbound Lane 2	Shared Through and Right	50% Right Turn, 50% Through
	5	Westbound Lane 1	Shared Through and Left	100% Left Turn (parking on departure side)
	6	Southbound Lane 2	Detector disabled - Shared Through and Right	Estimated Southbound approach volume from Wilde Ave / Smith Street / Phillip Street Eastern departure – 160vph, assumed 25% left turn, 50% southbound through and 25% right turn
	7	Southbound Lane 1	Detector disabled - Shared Through and Left	
	8	Northbound Lane 1	Missing detector	Estimated Northbound approach volume from Wilde Ave / Smith Street / Phillip

SCATS DETECTOR ASSUMPTIONS				
Intersection	**Detector**	**Lane**	**Issue**	**Assumptions**
	9	Northbound Lane 2	Missing detector	Street Eastern approach – 125vph, assumed 55vph northbound through plus 100vph internal traffic between George St and Smith Street. Left turn traffic estimated from eastern approach at George Street / Smith Street. Right turn traffic estimated as 50% of through traffic.
George St / Harris Street / MacArthur Street	6	Eastbound Lane 2	Missing detector	Western approach volume estimated from George Street / Charles Street eastern departure volume. 80vph from Lane 1 turning left to MacArthur Street, balance split 65% through to George Street and 5% right turn to Harris Street.
	7	Eastbound Lane 3	Missing detector	
Victoria Road/ James Ruse Drive	10	Westbound Lane 1	Mislabelled detector	Detector 9 traffic volumes substituted for Detector 10, left slip lane to James Ruse Drive
Parkes Street / Harris Street	1	Eastbound Lane 1	Shared Through and Left	50% Left, 50% Through
	2	Eastbound Lane 2	Shared Through and Right (Buses only)	Buses estimated from bus stop departures on Harris Street, south of the intersection. 2 buses during Saturday peak, 4 buses during weekday peaks, balance straight through
	3/4	Westbound Lane 2	Shared Through and Right	Volume taken as higher of two values 75% Through, 25% Right
	5	Westbound Lane 1	Shared Through and Left	25% Left, 75% Through
	6	Southbound Lane 2	Shared Through and Right	50% Through, 50% Right
	7	Southbound Lane 1	Shared Through and Left	25% Left, 75% Through
	8	Northbound Lane 1	Shared Through and Left	25% Left, 75% Through
	9	Northbound Lane 2	Shared Through and Right	50% Through, 50% Right
James Ruse Drive/ Hassall Street / Grand Avenue	11	Westbound Lane 2	Shared Through and Right	50% Through, 50% Right
	15	Eastbound Lane 3	Shared Through and Right	25% Through, 75% Right

3.4 SIDRA Model Calibration

The gap acceptance parameters were overridden for the James Ruse Drive / River Road West intersection, due to unrealistic results from the default settings, and to more accurately reflect Sydney driver behaviour. The Critical Gap values were reduced from 4.5 seconds to 4 seconds for the right turns and from 5 seconds to 4.5 seconds for the left turn. The follow-up Headway values were reduced from 2.5 seconds to 2 seconds for the right turns and from 3 seconds to 2.5 seconds for the left turn. The Apply Two-way Sign Control Calibration tab was deselected. The Extra Bunching setting for the southern approach was set to 25% due to the proximity to the Hassall Street signalised intersection. It is noted that the results for the southbound right turn into River Road West still appear to be worse than the actual observed performance.

4. Data Analysis

4.1 Displaced Traffic - Weekend

Figure 2 below shows the Gasworks Bridge traffic profile, estimated from SCATS counts at the MacArthur Street / Thomas Street and MacArthur Street / Harris Street / George Street intersection, taken as the average weekend counts from 31st July to 28th August 2022.

The southbound detour volume is estimated from detector 1 at MacArthur Street / Harris Street / George Street.

The northbound detour volume has been estimated as the sum of detectors 3 and 5 at George Street. This has been checked against the northbound traffic at the MacArthur Street / Thomas Street intersection, which is the sum of detector 4 and the larger of detector 5 and 6. It is noted that there are approximately 160 residential properties between Gasworks Bridge and Thomas Street that would generate some of traffic between George Street and Thomas Street. The two-way traffic generation is estimated to be in the order of approximately 90 to 100vph based on a weekday peak generation rates of 0.5 for apartments and 0.85 for single detached dwellings, which aligns with the additional 52 vehicles at the northbound approach at Thomas Street.

The counts show the peak detour volume occurs from 12pm – 1pm on Saturday, which has been assessed.

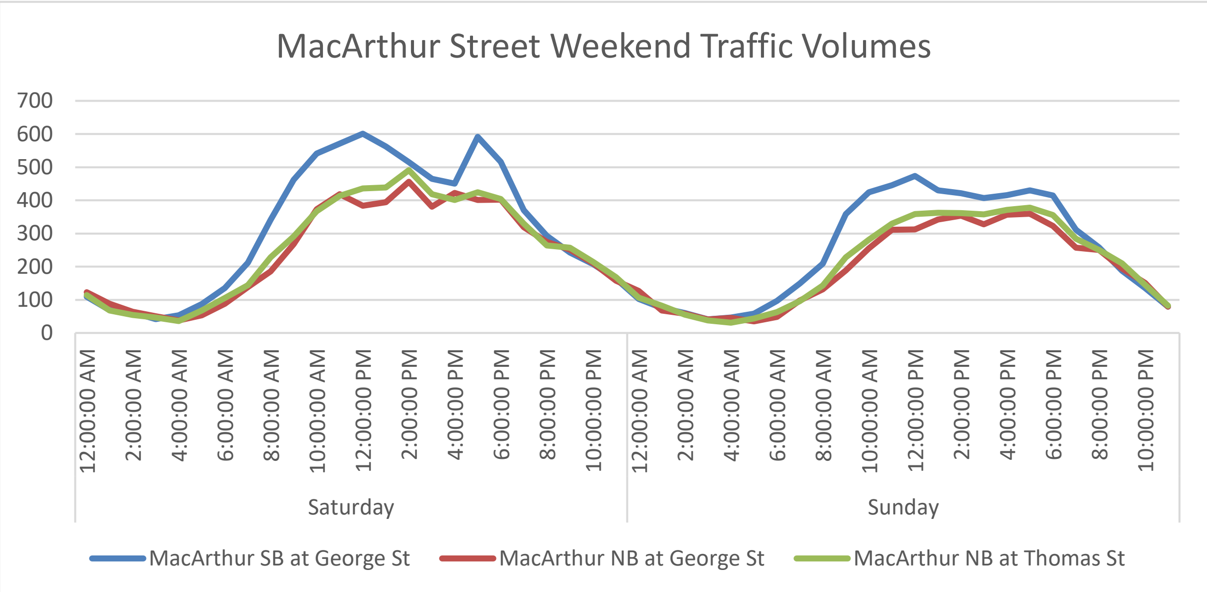


Figure 2 – Gasworks Bridge (Macarthur Street) Weekend Traffic Volume Profile – July / August 2022 SCATS

Table 3 – Gasworks Bridge Displaced Volumes – Saturday Peak 12-1pm

DISPLACED VOLUMES - GASWORKS BRIDGE		
Direction	**Time**	**Volume (vph)**
Northbound	1200-1300	384
Southbound	1200-1300	601
Total	**1200-1300**	**985**

The displaced southbound traffic will be added to the traffic turning left at Victoria Road and Wilde Street intersection, to the left-turn movement at Phillip Street and to the left turn from Charles Street to George Street, and to the right turn at Harris Street.

For the northbound detour the displaced traffic is assumed to travel via George Street and River Road West to turn left to the unsignalised left turn at James Ruse Drive, north to the left turn at Victoria Road. It is assumed that 50% of the northbound traffic will turn left at the Victoria Road / Macarthur intersection, with 50% turning right at the Victoria Road / Macarthur intersection. It is expected that some traffic will disperse into the residential catchment via other side roads from James Ruse Drive / Thomas Street and from Victoria Road, however for the purposes of this assessment, 100% of the detoured traffic has been assigned to the assessed intersections .

4.1 Displaced Traffic - Weekday

Figure 3 above shows the Gasworks Bridge traffic profile, estimated from SCATS counts at the MacArthur Street / Thomas Street and MacArthur Street / Harris Street / George Street intersection, taken as the average weekday counts from 26th July to 25th August 2022.

The southbound detour volume is estimated from detector 1 at MacArthur Street / Harris Street / George Street.

The northbound detour volume has been estimated as the sum of detectors 3 and 5 at George Street.

The counts show the peak detour volume occurs from 8-9am and 5-6pm, which has been assessed.

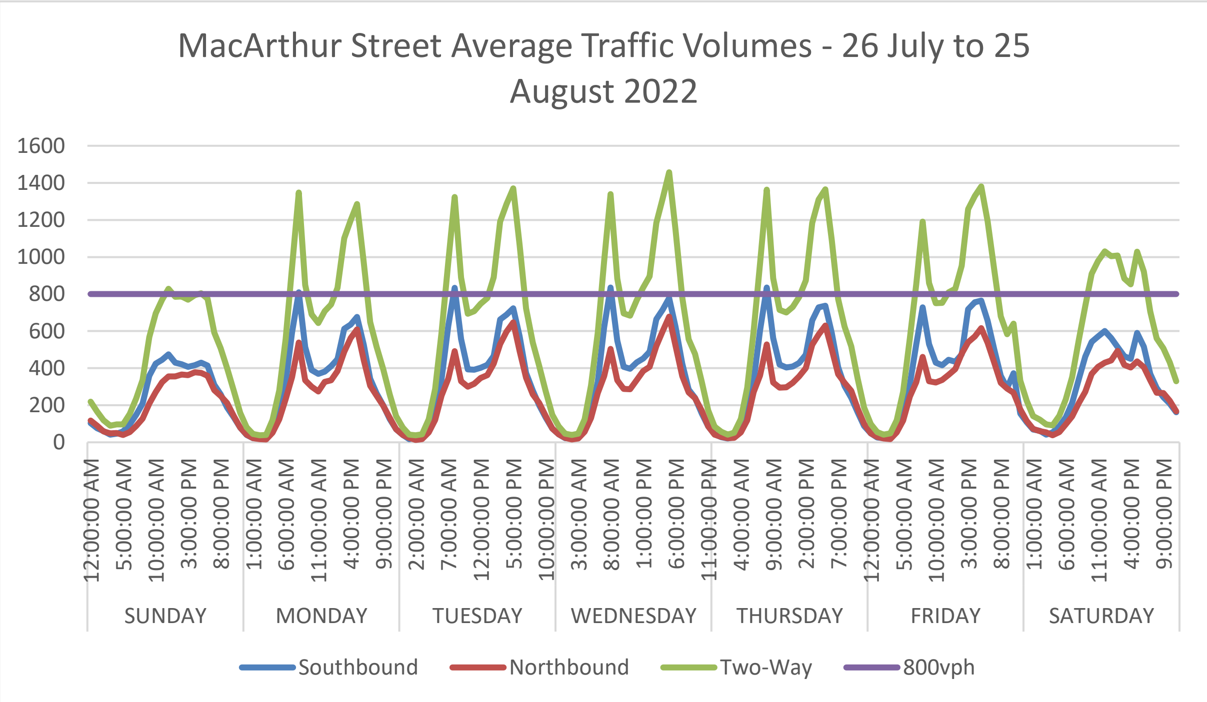


Figure 3 – Gasworks Bridge (Macarthur Street) Weekend Traffic Volume Profile – July / August 2022 SCATS

Table 4 – Gasworks Bridge Displaced Volumes – Weekday Peak

DISPLACED VOLUMES - GASWORKS BRIDGE			
Period	**Time**	**Northbound**	**Southbound**
AM Peak	0800-0900	505	808

PM Peak	1700-1800	636	736

As detailed in Section 6.2, the proposed closure is the northbound closure, due to lower traffic volumes than southbound, and the higher capacity detour route that avoids the Parramatta CBD, with unsignalised left turns at River Road West and James Ruse Drive.

A 20% reduction has been applied to the northbound detour volume, assuming that some traffic takes alternate routes to James Ruse Drive to the south of Hassall Street, or to alternate river crossings to the east of Macarthur Street. The assessed detour routes assume 40% of traffic travels via George Street and River Road West to turn left to the unsignalised left turn at James Ruse Drive, and 40% travels via Parkes Street at Hassall Street to the unsignalised left turn at James Ruse Drive. From James Ruse Drive, both detours continue north to Victoria Road, where it is assumed that 50% of the northbound traffic will turn left at the Victoria Road / Macarthur intersection, with 50% turning right. It is expected that some traffic will disperse into the residential catchment via other side roads from James Ruse Drive / Thomas Street and from Victoria Road.

5. Anticipated Impacts

5.1 Closure & Detour – Full Closure

The proposed closure including the closure of the entire bridge is shown below. The northbound detour would travel via George Street and River Road West, north on James Ruse Drive and left into Victoria Road and left to Macarthur Street to the northern side of the Gasworks Bridge.

The red detour route shown below is for the southbound detour via Victoria Road, with traffic travelling southbound on Macarthur Street and eastbound on Victoria Road continuing through the intersection as normal, and then turning right on Thomas Street and right on Elizabeth Street to join the detour on Victoria Road. The left turn from Elizabeth Street to Victoria Road is unsignalised, and as the westbound kerbside lane is a bus lane to the east of Elizabeth Street, this left turn is expected to operate well with sufficient gaps for the detoured traffic. Traffic travelling westbound on Victoria Road will continue straight through the Macarthur Street intersection, tuning left on Wilde Ave. From there, traffic destined for the Parramatta CBD may disperse to various attractors, while the signed detour will direct traffic to turn left at Phillip Street, continuing to Charles Street, and turning left to George Street and continuing eastbound to the southern side of the Gasworks Bridge at Harris Street.

It is likely people heading north will not turn left at Macarthur but may continue enter the residential area by any of the side streets on James Ruse Drive or Victoria Street

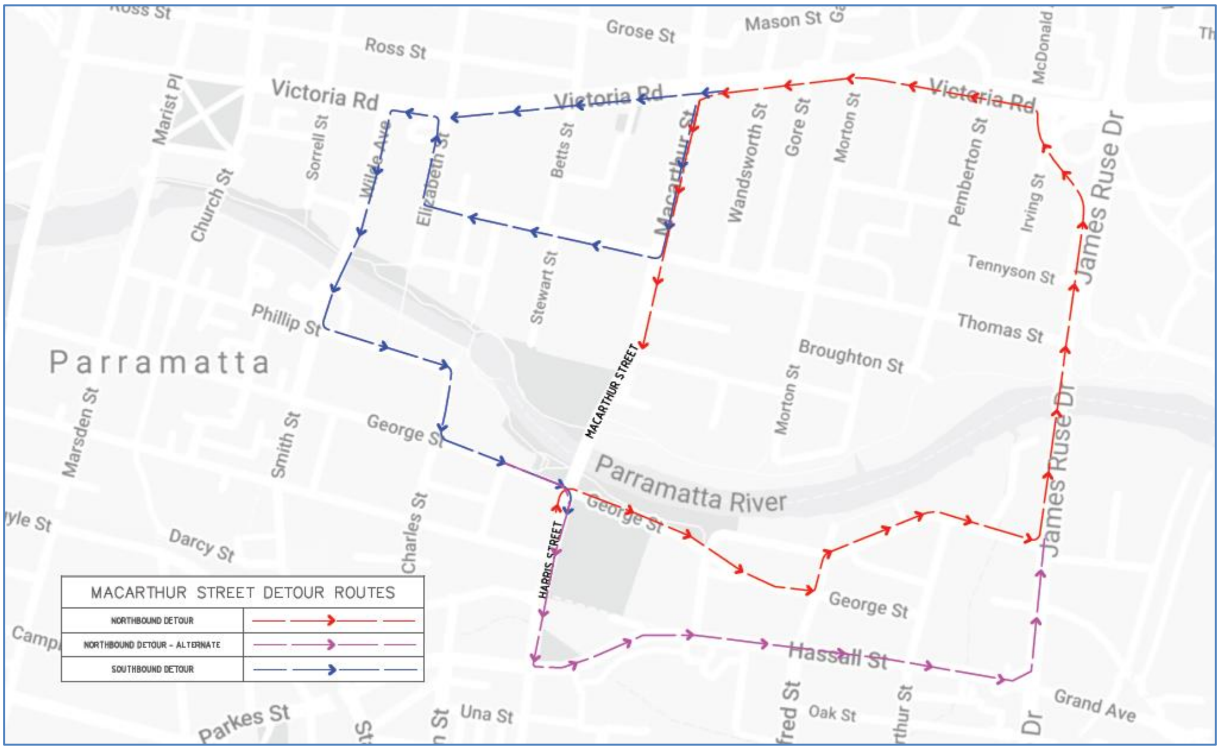


Figure 4 - Detour routes - full bridge closure

5.2 Additional Travel Time - Distance

The existing travel time for those experiencing the greatest impact would be those proposed to cross the bridge from the north to a destination on Harris Street in the Wahroonga station and business area which would currently only take approximately 1 minute, with the proposed detour increasing that travel time to between 5 and 10 minutes (depending on traffic). It is estimated that most would experience a delay of around 5 minutes to Harris Street or George Street where travelling by car however a number of the vehicles who are displaced as part of the works are likely to be destined for the Parramatta CBD or directed towards the Western Motorway or Great Western Highway, and are unlikely to follow the northbound or southbound detour in its entirety, which will contribute to the displaced traffic and supports the multiple routes being adopted by traffic.

Table 5 – Detour Delays – Macarthur Street Southbound to Harris Road via Wilde Avenue and George Street

Macarthur Street Southbound						
Period	**Normal Travel Time**	**Delay**	**Total Travel Time**	**Normal Travel Distance**	**Detoured Travel Distance**	**Additional Travel Distance**
SAT 1200-1300	**5 min**	**1 min**	**6 min**	**300m**	**2.3km**	**2.0km**

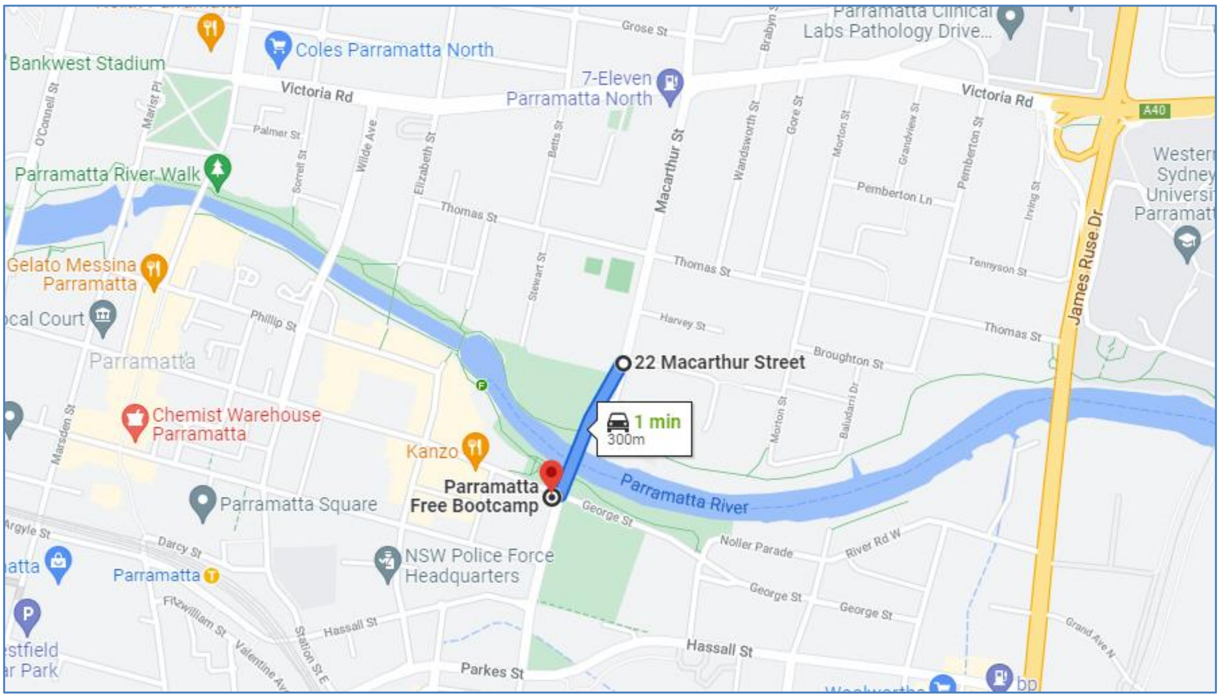


Figure 5 - Existing southbound travel time - 1 minute

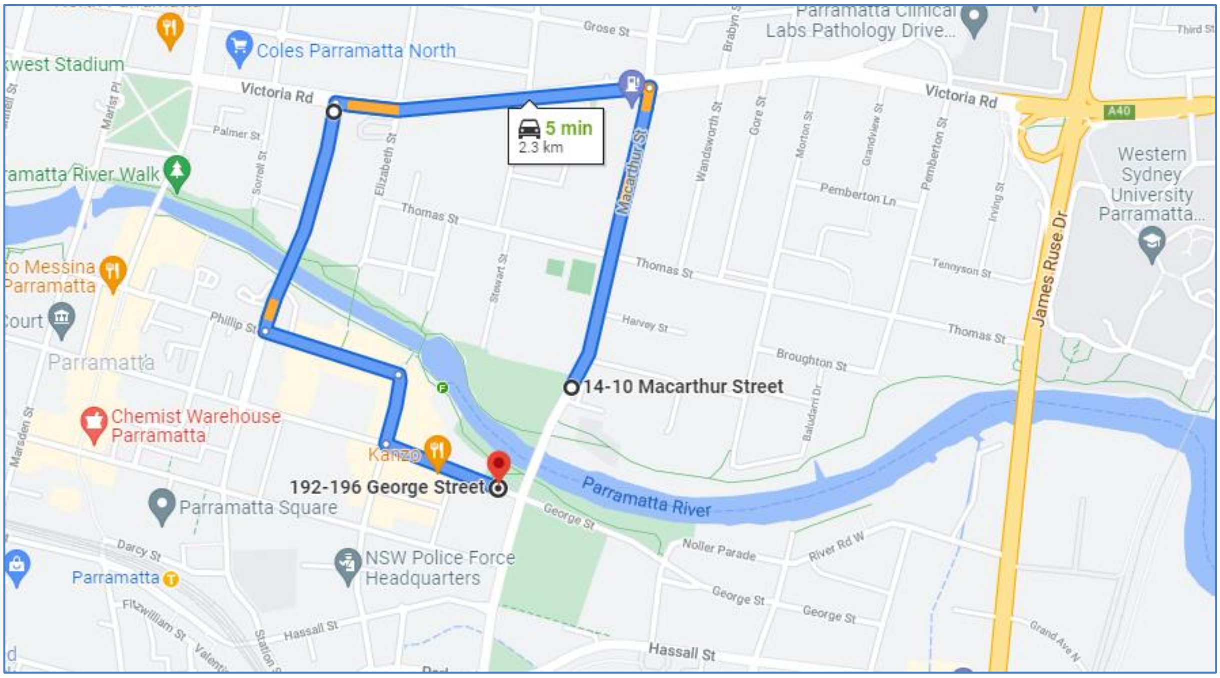


Figure 6 - Proposed travel time via southbound detour - 5 minutes (depending on traffic)

Table 6 – Detour Delays – Macarthur Street Northbound to Thomas Street via James Ruse Drive and Victoria Road

Macarthur Street Northbound						
Period	**Normal Travel Time**	**Delay**	**Total Travel Time**	**Normal Travel Distance**	**Detoured Travel Distance**	**Additional Travel Distance**
SAT 1200-1300	**6 min**	**1 min**	**7 min**	**300m**	**3.3km**	**3.0km**

Table 7 – Detour Delays – Macarthur Street Northbound to Thomas Street via Hassall Street, James Ruse Drive and Victoria Road

Macarthur Street Northbound Alternate						
Period	**Normal Travel Time**	**Delay**	**Total Travel Time**	**Normal Travel Distance**	**Detoured Travel Distance**	**Additional Travel Distance**
SAT 1200-1300	**7 min**	**1 min**	**8 min**	**300m**	**3.8km**	**3.5km**

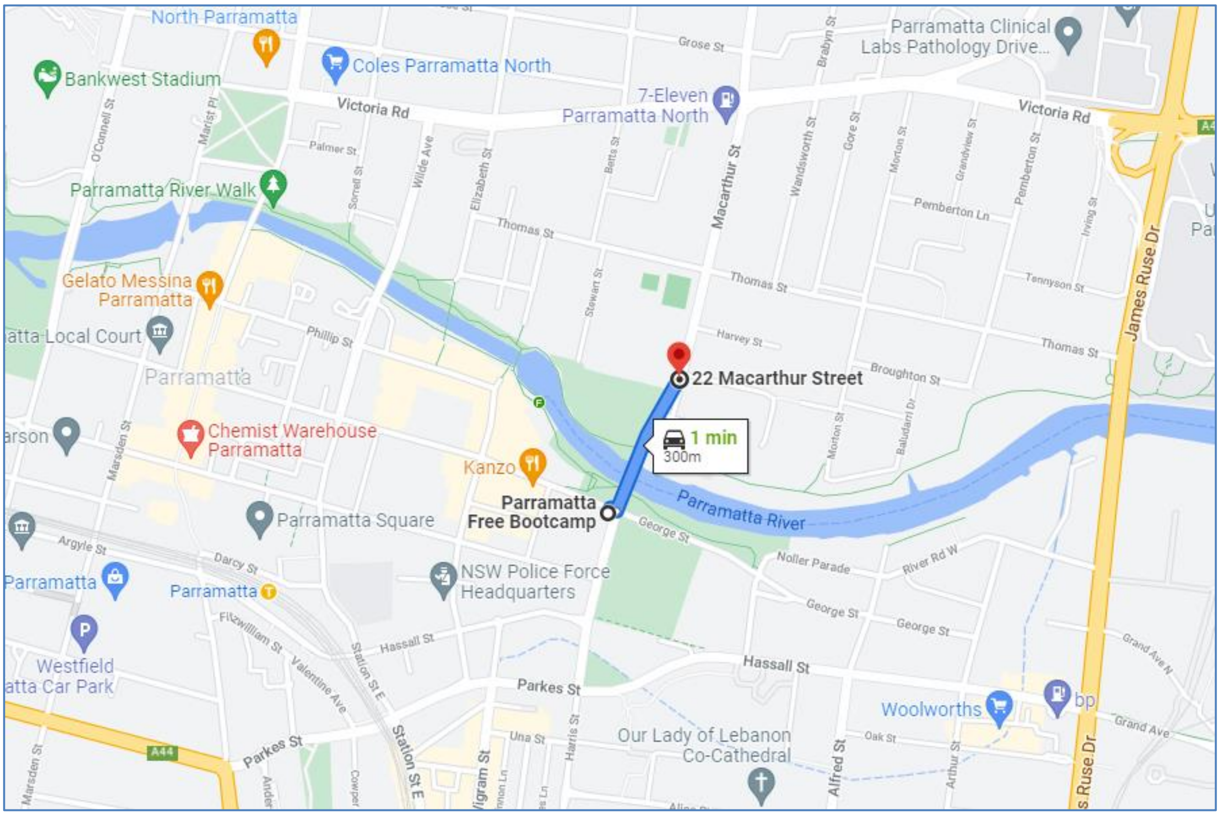


Figure 7 - Existing southbound travel time - 1 minute

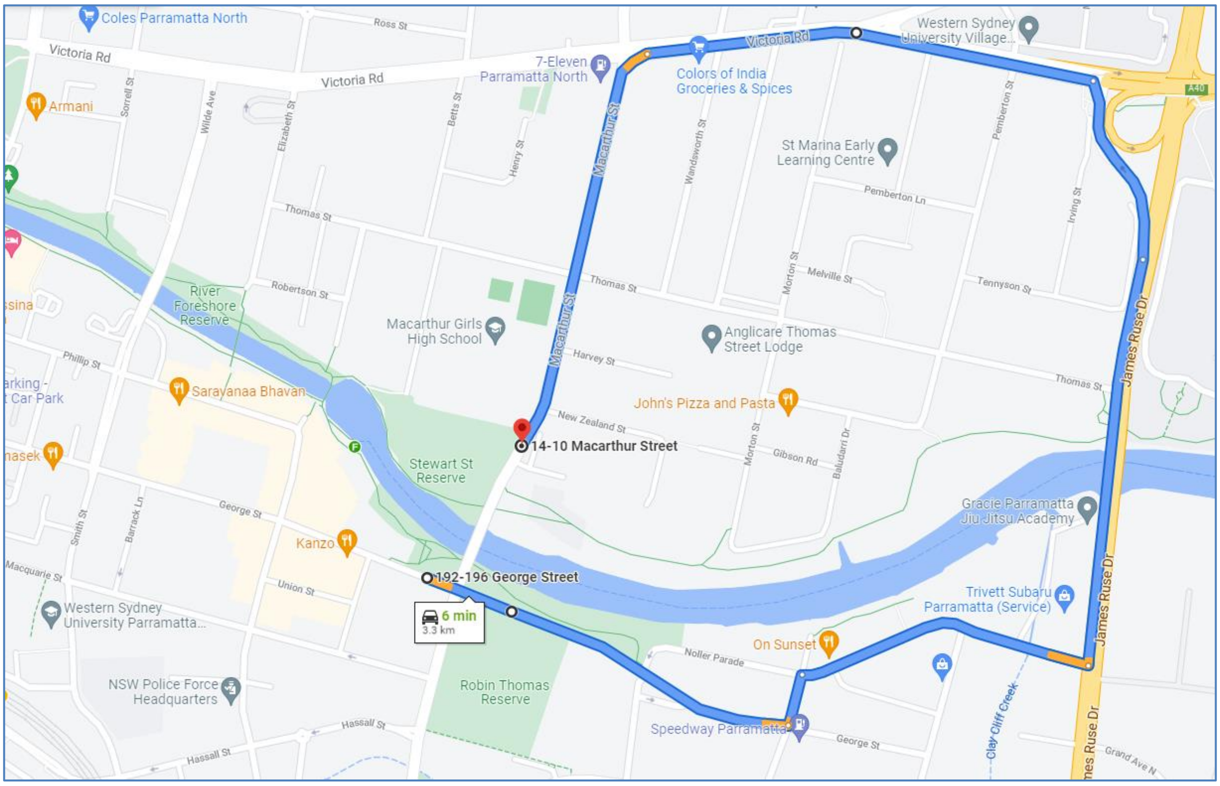


Figure 8 - Proposed travel time via northbound detour - 6 minutes (depending on traffic)

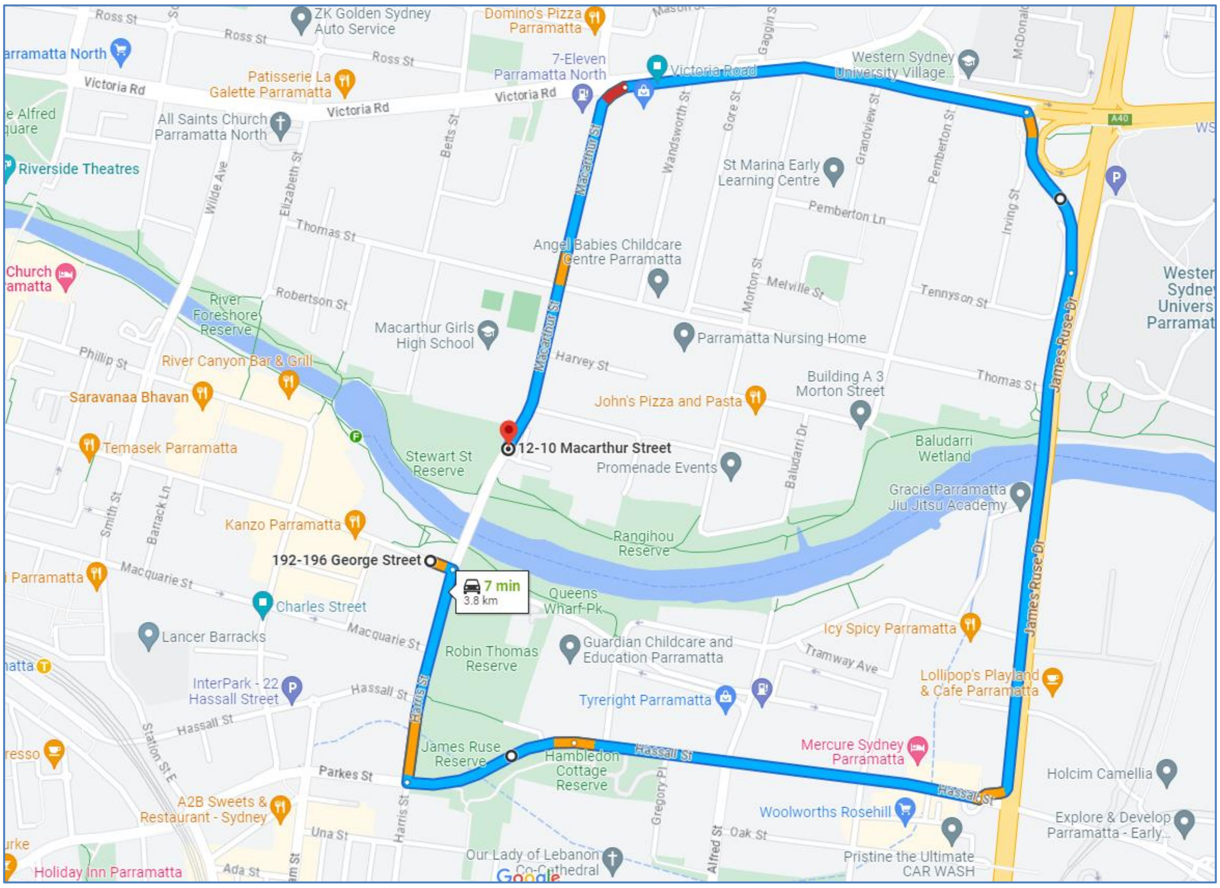


Figure 9 - Proposed travel time via northbound alternate detour - 7 minutes (depending on traffic)

6. Results

6.1 Level of Service

Urban street LOS is based on average through-vehicle travel speed for the segment, section, or entire urban street under consideration. The following general statements characterise LOS along urban streets.

LOS A describes primarily free-flow operations at average travel speeds, usually about 90 percent of the Free-flow speed (FFS) for the given street class, with vehicles completely unimpeded. LOS B describes reasonably unimpeded operations at about 70 percent of the FFS for the street class. LOS C describes stable operations; however, ability to manoeuvre and change lanes in midblock locations may be more restricted than at LOS B and average travel speeds of about 50 percent of the FFS. LOS D experiences increased in delay, decreases in travel speeds to about 40 percent of the FFS. LOS E is characterised by 33 percent or less of the FFS and LOS F is characterised by urban street flow at extremely low speeds, typically 25 percent or less of the FFS as well as high delays, high volumes and extensive queueing.

6.1 SIDRA Results Summary- Weekend Closures

Table 8 - SIDRA Modelled Results – Victoria Road and Macarthur Street

			Intersection			Victoria Road Westbound Left Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
SAT Peak 12:00 – 1:00pm	**Existing**	**56s**	**B**	**24.4s**	**70.8m**	**A**	**8.1s**	**11.4m**
	Proposed	**62s**	**B**	**25.3s**	**98.1m**	**A**	**8.2s**	**15.3m**

Table 9 - SIDRA Modelled Results – Victoria Road and Wilde Avenue

			Intersection			Victoria Road Westbound Left Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
SAT Peak 12:00 – 1:00pm	**Existing**	**38s**	**A**	**13.8s**	**43.9m**	**A**	**10.9s**	**12.9m**
	Proposed	**38s**	**B**	**15.5s**	**102.5m**	**B**	**17.6s**	**102.5m**

Table 10 - SIDRA Modelled Results – Wilde Avenue/ Smith Street / Phillip Street

			Intersection			Wilde Avenue Southbound Left Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
SAT Peak 12:00 – 1:00pm	**Existing**	**56s**	**B**	**21.4s**	**25.8m**	**A**	**12.8s**	**8.4m**
	Proposed (SIDRA Cycle Time)	**120s**	**B**	**24.8s**	**126.5m**	**B**	**15.8s**	**126.5m**
	Proposed (cycle time set to 56s)	**56s**	**F**	**154.4s**	**620.8m**	**F**	**294.0s**	**620.8m**

Table 11 - SIDRA Modelled Results – Charles Street / George Street

			Intersection			Charles Street Southbound Left Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
SAT Peak 12:00 – 1:00pm	**Existing**	**38s**	**B**	**15.2s**	**29.6m**	**B**	**15.3s**	**11.2m**
	Proposed	**38s**	**B**	**18.6s**	**102.4m**	**B**	**21.1s**	**102.4m**

Table 12 - SIDRA Modelled Results – George Street / Harris Street / MacArthur Street

			Intersection			George Street Eastbound Right Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
SAT Peak 12:00 – 1:00pm	**Existing**	**50s**	**B**	**17.1s**	**129.2m**	**B**	**26.6s**	**10.1m**
	Proposed (North approach shown closed)	**80s**	**C**	**37.5s**	**220.9m**	**C**	**38.5s**	**220.9m**
	Proposed (North approach shown open with 1vph)	**84s**	**C**	**37.2s**	**227.7m**	**C**	**39.3s**	**227.7m**

Table 13 - SIDRA Modelled Results – Victoria Road / James Ruse Drive – Northbound detour 50% Left and 50% Right

			Intersection			James Ruse Drive Northbound Left Turn			James Ruse Drive Northbound Right Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
SAT Peak 12:00 – 1:00pm	**Existing**	**70s**	**A**	**11.5s**	**50.0m**	**A**	**7.3s**	**2.2m**	**B**	**27.9s**	**43.4m**
	Proposed	**70s**	**A**	**13.8s**	**63.1m**	**A**	**5.8s**	**0.0m**	**B**	**22.2s**	**57.2m**

Table 14 - SIDRA Modelled Results – James Ruse Drive / River Road West

			Intersection			River Road West Eastbound Left Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
SAT Peak 12:00 – 1:00pm	**Existing**	**N/A**	**N/A**	**18.1s**	**312.0m**	**A**	**14.4s**	**30.1m**
	Proposed	**N/A**	**N/A**	**18.2s**	**312.0m**	**B**	**17.2s**	**61.1m**

Table 15 - SIDRA Modelled Results – James Ruse Drive / Hassall Road / Grand Avenue

			Intersection			Hassall Road Eastbound Left Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
SAT Peak 12:00 – 1:00pm	**Existing**	**150s**	**E**	**63.5s**	**502.6m**	**B**	**19.8s**	**123.0m**
	Proposed	**150s**	**E**	**62.7s**	**502.6m**	**B**	**24.8s**	**230.3m**

Table 16 - SIDRA Modelled Results – Harris Street / Parkes Street

			Intersection			Parkes Street Northbound Right Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
SAT Peak 12:00 – 1:00pm	**Existing**	**61s**	**B**	**28.0s**	**76.1m**	**C**	**36.2s**	**30.2m**
	Proposed	**38s**	**B**	**30.5s**	**85.7m**	**D**	**44.0s**	**45.4m**

The results indicate that the proposed detour routes will operate at an acceptable level of service at all of the key intersections. There is some increase in queue lengths for the detour movements, so consideration to end of queue management such as additional VMS boards may be required.

The worst performing intersection for the southbound detour is the Wilde Avenue / Smith Street / Philip Street intersection. The required cycle time for the intersection increases from 56s to 120s to allow sufficient green time for the detoured traffic in the southbound left turn. The southbound left turn at the Phillip Street is predicted to operate at LOS B with average delays of approximately 16s, and 95%ile queue of approximately 170m, which is approximately 130m to the south of where the bus lane commences. It is recommended that additional VMS messaging be installed to the north of the Parramatta River to direct traffic into the correct lane for the CBD or for the detour to Harris Street. Where the cycle time is set to match the existing scenario of 56s, the southbound left turn reduces to LOS F, with an average delay of approximately 5 minutes, and a 95%ile queue of 620m, which would extend beyond Victoria Road. It is recommended that signal TRIMS are programmed prior to the closure and TfNSW monitor the operation of the intersection during peak periods of the closure to make manual adjustments if necessary to ensure the efficient operation of the impacted intersections during the closures.

The northbound detour utilises James Ruse Drive to cross the Parramatta River, with the proposed detours via unsignalised left turns at River Road West or Hassall Road. Both left turns operate at an acceptable Level of Service B with minor increases to average delay and queuing. It is recommended that both detour routes be signed during the closures, as well as increased wider network VMS messaging to encourage drivers to take alternate routes or mode of travel during the works.

The full results of each of these modelled scenarios is provided in Appendix B for reference.

6.2 Extended Partial Bridge Closure

The existing traffic volume on the MacArthur Street bridge has been estimated from the SCATS counts at the George Street / Harris Street and MacArthur Street intersection. The northbound traffic volume has been estimated as the sum of detectors 3 and 5, with detector 3 corresponding with the eastbound lane 1 and detector 5 corresponding with the northbound lane 2. It has been assumed conservatively that all westbound lane 1 traffic will turn left over the bridge. The southbound traffic volume has been estimated from detector 1, which is the southbound approach. The SCATS data provided was from the 26th June 2022 to 26th August 2022. The July school holidays in NSW were from 4th to 15th July.

The data was processed to determine average hourly traffic volume by day of the week for three periods:

- Term 2 – Sunday 26th June to Saturday 3rd July 2022
- Winter School Holidays – Average of Saturday 3rd July to Sunday 18th July 2022
- Term 3 – Average of Tuesday 26th July to Thursday 25th August 2022

The two-way traffic volumes for the three periods is shown in Figure 8, and shows that weekday traffic volumes were typically higher in Term 3 than in Term 2 or in the school holidays.

The figure shows that the combined traffic volume on the MacArthur Street bridge typically exceeds the 800vph shuttle flow capacity during the peak periods, typically from 7am to 10am during weekday AM peak periods, from 2pm to 7pm during weekday PM peak periods, and for several hours during weekend peak periods, from 10am to 7pm on Saturdays and 11am to 6pm on Sundays.

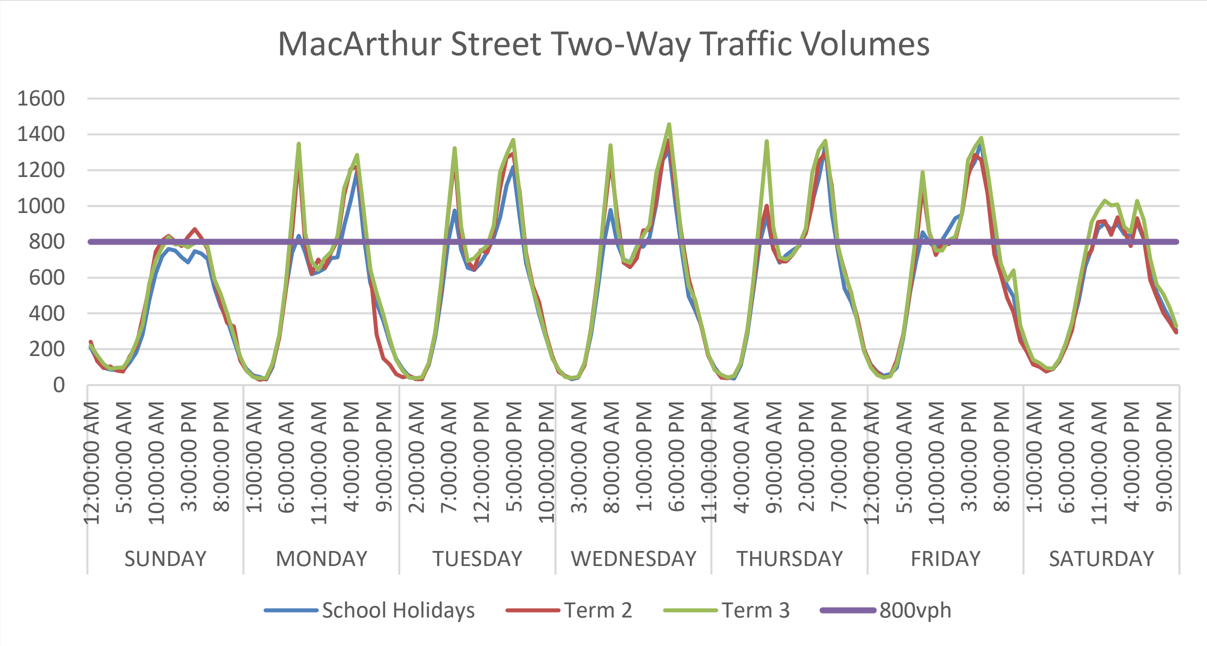


Figure 10 – MacArthur Street Bridge Two-Way Traffic Volumes (SCATS, June – August 2022)

Figure 9 shows the average northbound, southbound and two-way traffic volumes over the MacArthur Street bridge, taken from the Term 3 data set noted above. As a shuttle flow operation is not recommended due to the two-way traffic volume exceeding the 800vph capacity, and with insufficient storage available between the southern extent of the bridge worksite at the George Street intersection, a one-way road closure is recommended to accommodate the single lane closure. The traffic volume in the northbound direction is approximately 40% lower than the southbound direction during the morning peak period, and 15-20% lower than the southbound direction in the afternoon peak period. For this reason, as well as the northbound detour having all unsignalised left turns, it is recommended to detour northbound traffic for the duration of the extended partial bridge closures. The expected delays for the detour are similar to those shown in Table 5 for the weekend closures, with an additional 7 minutes of travel time.

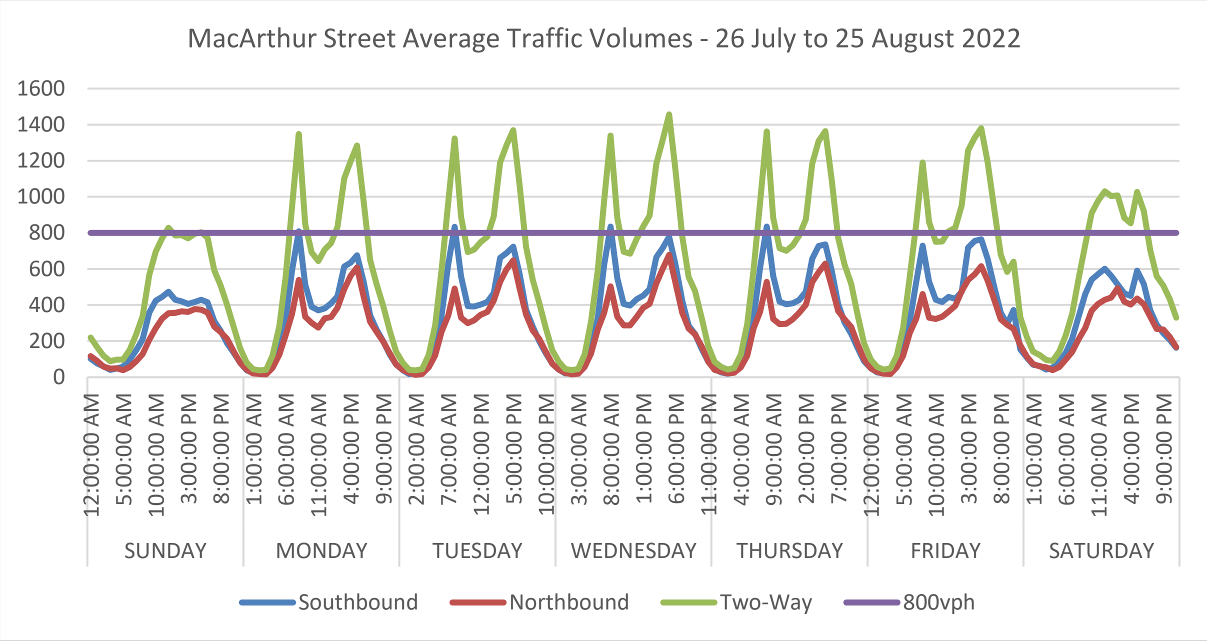


Figure 11 – MacArthur Street Bridge Traffic Volumes (SCATS, July – August 2022)

6.3 SIDRA Results Summary- Extended Northbound Closure

Table 17 - SIDRA Modelled Results – Victoria Road and Macarthur Street

			Intersection			Victoria Road Westbound Left Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
AM Peak 8:00 – 9:00am	**Existing**	**68s**	**C**	**28.6s**	**119.1m**	**A**	**8.1s**	**18.6m**
	Proposed	**68s**	**B**	**27.0s**	**119.1m**	**A**	**8.7s**	**44.3m**
PM Peak 5:00 – 6:00pm	**Existing**	**62s**	**C**	**28.8s**	**96.7m**	**A**	**8.1s**	**18.8m**
	Proposed	**62s**	**B**	**26.9s**	**96.7m**	**A**	**8.9s**	**52.5m**

Table 18 - SIDRA Modelled Results – George Street / Harris Street / MacArthur Street

			Intersection			MacArthur St Southbound		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
AM Peak 8:00 – 9:00am	**Existing**	**66s**	**B**	**20.3s**	**223.7m**	**B**	**25.5s**	**223.7m**
	Proposed	**62s**	**C**	**28.8s**	**234.3m**	**C**	**29.7s**	**234.3m**
PM Peak 5:00 – 6:00pm	**Existing**	**66s**	**B**	**23.9s**	**209.9m**	**B**	**27.8s**	**209.9m**
	Proposed	**74s**	**C**	**35.2s**	**244.3m**	**C**	**33.5s**	**244.3m**

Table 19 - SIDRA Modelled Results – Victoria Road / James Ruse Drive – Northbound detour 50% Left and 50% Right

			Intersection			James Ruse Drive Northbound Left Turn			James Ruse Drive Northbound Right Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
AM Peak 8:00 –	**Existing**	**70s**	**B**	**15.1s**	**64.5m**	**A**	**7.8s**	**1.8m**	**B**	**21.6s**	**59.2m**
	Proposed	**70s**	**B**	**16.2s**	**82.4m**	**A**	**9.7s**	**24.5m**	**B**	**19.9s**	**82.4m**

9:00am											
PM Peak 5:00 – 6:00pm	Existing	70s	A	11.4s	57.9m	A	7.5s	1.6m	C	29.1s	47.3m
	Proposed	70s	B	14.6s	77.4m	A	10.8s	37.3m	B	22.3s	73.6m

Table 20 - SIDRA Modelled Results – James Ruse Drive / River Road West

			Intersection			River Road West Eastbound Left Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
AM Peak 8:00 – 9:00am	**Existing**	**N/A**	**N/A**	**38.9s**	**624.5m**	**B**	**15.8s**	**36.1m**
	Proposed	**N/A**	**N/A**	**40.2s**	**624.5m**	**C**	**37.3s**	**155.2m**
PM Peak 5:00 – 6:00pm	**Existing**	**N/A**	**N/A**	**66.7s**	**841.2m**	**B**	**20.1s**	**41.9m**
	Proposed	**N/A**	**N/A**	**81.4s**	**841.2m**	**F**	**181.1s**	**524.8m**

Table 21 - SIDRA Modelled Results – James Ruse Drive / Hassall Road / Grand Avenue

			Intersection			Hassall Road Eastbound Left Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
AM Peak 8:00 – 9:00am	**Existing**	**150s**	**E**	**68.7s**	**535.5m**	**C**	**33.2s**	**193.1m**
	Proposed	**150s**	**F**	**74.4m**	**535.5m**	**F**	**96.7s**	**448.2m**
PM Peak 5:00 – 6:00pm	**Existing**	**150s**	**F**	**95.5s**	**667.2m**	**C**	**36.5s**	**222.3m**
	Proposed	**150s**	**F**	**112.7s**	**694.7m**	**F**	**153.9s**	**675.2m**

Table 22 - SIDRA Modelled Results – Harris Street / Parkes Street

			Intersection			Parkes Street Northbound Right Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
AM Peak 8:00 – 9:00am	**Existing**	**73s**	**C**	**31.1s**	**99.0m**	**D**	**47.4s**	**50.3m**
	Proposed	**78s**	**C**	**36.5s**	**127.2m**	**D**	**46.3s**	**61.9m**
PM Peak 5:00 – 6:00pm	**Existing**	**83s**	**C**	**36.3s**	**146.3m**	**D**	**47.9s**	**43.8m**
	Proposed	**88s**	**C**	**38.6s**	**157.1m**	**D**	**54.1s**	**59.3m**

The results indicate that the proposed detour routes will operate at an acceptable level of service at the majority of the key intersections. There is some increase in queue lengths for the detour movements, so consideration to end of queue management such as additional VMS boards may be required.

The northbound detour utilises James Ruse Drive to cross the Parramatta River, with the proposed detours via unsignalised left turns at River Road West or Hassall Road. The River Road West intersection operates at a LOS C during the morning peak, however this decreases to LOS F during the afternoon peak, with the SIDRA results indicating the left turn will experience an average delay of approximately 3 minutes and a 95%ile queue of 524.8m.

The Hassall Street eastbound left turn is expected to decrease from LOS C to LOS F in both peak periods, with the average delay increasing by approximately 1 minute during the morning peak, with the 95%ile queue increasing from 193.1m to 448.2m. The results show the average delay increases by approximately 2 minutes during the afternoon peak with the 95%ile queue increasing from 222.3m to 675.2m.

The full results of each of these modelled scenarios is provided in Appendix B for reference.

6.4 Extended Partial Bridge Closure – Tidal Flow Option

The option of implementing a tidal flow arrangement for the bridge closure was investigated, with the bridge open in the southbound direction in the morning peak and changing to the northbound direction in the afternoon peak. It would be recommended to detour southbound traffic from 2pm to 7pm to avoid school pick up periods and the afternoon peak period, with northbound traffic detoured at all other times.

The southbound detour for the afternoon peak is the same as that modelled for the weekend closure, with some traffic captured by VMS signage on Victoria Road, and the majority of southbound traffic turning right from Macarthur Street to Thomas Street, right at Elizabeth Street, left at Victoria Road. From Victoria Road, the southbound detour turns left at Wilde Avenue, left to Phillip Street, continuing to Charles Street and turning left at George Street to turn right to Harris Street.

The SIDRA results show the detoured traffic turning right at Harris Street opposing the open northbound traffic on Harris Street, with a 95%ile queue of approximately 700m. This queue extends back along the detour route to Wilde Avenue. In addition to the 280m queue at Charles Street, and 220m queue at Wilde Avenue, this section of the southbound detour route is appears to be gridlocked. Additionally, these three intersections require signal timing modifications and increased cycle times to accommodate the detour movements.

Table 23 - SIDRA Modelled Results – Victoria Road and Macarthur Street

			Intersection			Victoria Road Westbound Through		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
PM Peak 17:00-18:00	**Existing**	**62**	**C**	**28.8s**	**96.7m**	**C**	**36.9s**	**96.5m**
	Proposed	**74s**	**C**	**33.4s**	**166.4m**	**D**	**44.0s**	**166.4m**

Table 24 - SIDRA Modelled Results – Victoria Road and Wilde Avenue

			Intersection			Victoria Road Westbound Left Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
PM Peak 5:00 – 6:00pm	**Existing**	**38s**	**B**	**17.9s**	**59.8m**	**A**	**11.1s**	**17.9m**
	Proposed (SIDRA Cycle Time	**44s**	**B**	**19.8s**	**191.5m**	**B**	**26.4s**	**191.5m**

Table 25 - SIDRA Modelled Results – Wilde Avenue/ Smith Street / Phillip Street

			Intersection			Wilde Avenue Southbound Left Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
PM Peak 5:00 – 6:00pm	**Existing**	**56s**	**B**	**22.9s**	**43.7m**	**A**	**12.6s**	**11.9m**
	Proposed (SIDRA Cycle Time)	**120s**	**C**	**30.7s**	**223.1m**	**B**	**25.5s**	**223.1m**
	Proposed (cycle time set to 56s)	**56s**	**F**	**275.6s**	**1168.9m**	**F**	**572.1s**	**1168.9m**

Table 26 - SIDRA Modelled Results – Charles Street / George Street

			Intersection			Charles Street Southbound Left Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
PM Peak 5:00 – 6:00pm	**Existing**	**38s**	**B**	**17.5s**	**41.1m**	**B**	**18.1s**	**18.8m**
	Proposed (SIDRA Cycle Time	**84s**	**C**	**34.3s**	**279.9m**	**C**	**33.8s**	**279.9m**
	Proposed (Cycle Time set to 38s)	**38s**	**F**	**91.8s**	**461.0m**	**F**	**143.6m**	**461.0m**

Table 27 - SIDRA Modelled Results – George Street / Harris Street / MacArthur Street

			Intersection			George Street Eastbound Right Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
PM Peak 5:00 – 6:00pm	**Existing**	**66s**	**B**	**23.9s**	**209.9m**	**D**	**47.2s**	**83.1m**
	Proposed (SIDRA Cycle Time	**120s**	**F**	**76.6s**	**699.4m**	**F**	**86.8s**	**699.4m**
	Proposed (Cycle Time set to 66s)	**66s**	**F**	**105.9s**	**679.5m**	**F**	**143.8s**	**679.5m**

The Wilde Avenue and Phillip Street intersection was also modelled during the morning peak period to determine the feasibility of implementing a southbound detour for the full extended closure. The SIDRA results indicate that the detour would queue beyond Victoria Road, and is therefore not an ideal arrangement.

Table 28 - SIDRA Modelled Results – Wilde Avenue/ Smith Street / Phillip Street

			Intersection			Wilde Avenue Southbound Left Turn		
Period	**Arrangement**	Cycle Time	Level of Service	Ave Delay	95%ile queue	Level of Service	Ave Delay	95%ile queue
AM Peak 8:00 – 9:00am	**Existing**	**56s**	**B**	**21.2a**	**49.4m**	**A**	**12.2s**	**28.6m**
	Proposed (SIDRA Cycle Time)	**120s**	**F**	**81.5s**	**744.6m**	**F**	**126.3s**	**744.6m**
	Proposed (SIDRA Cycle Time)	**150s**	**D**	**56.3s**	**673.8m**	**F**	**74.4s**	**673.8m**
	Proposed (cycle time set to 56s)	**56s**	**F**	**500.3s**	**1862.3m**	**F**	**922.4s**	**1862.3m**

7. Conclusion

The result of the proposed closures and the delays during weekend peak periods appear to be manageable, with some queuing and delays expected at the Wilde Avenue / Smith Street / Philip Street intersection, however this can be mitigated by adjusting cycle and phase times to allow additional green time for the southbound left turn. It is likely that some traffic may exit the detour early and take alternate routes. With a greater display of communication devices (portable message signs, community notification collateral) the residents in the area will opt to utilise alternative routes, especially that of O'Connell Street.

The northbound detour is expected to operate well, with all intersections unsignalised left turns. It is expected that a proportion of traffic heading north may leave the detour route early enter the residential area by any of the side streets on James Ruse Drive or Victoria Street. There may be some minor delays for traffic turning left on to James Ruse Drive. It is demonstrated with the traffic modelling that the displaced traffic assumptions results in extended delays for River Road West traffic turning left onto James Ruse Drive, similarly for an increase delay at James Ruse Drive and Hassall Street however it is expected that most movements using the detours will be local traffic or regular commuters. They are unlikely to sit in a 3 minute queue to exit River Road West and will seek an alternate route which avoids this turn movement.

For the proposed extended partial bridge closure, the two-way traffic volume over the MacArthur Street bridge exceeds the 800vph capacity of a shuttle flow arrangement for several hours each day, during the morning and afternoon peak periods on weekdays and during the midday peak on weekends. The northbound traffic is lower than that of the southbound, and with fewer impacts with the detour via unsignalised left turns away from the Paramatta CBD, it is recommended to implement a northbound closure and detour, with southbound traffic remaining open. Two detour routes towards James Ruse Drive are recommended to split the demand for the unsignalised left turns, with a a route via George Street and River Road West, and on Harris Street, Parkes Street and Hassall Street. Additional VMS signage is recommended on Harris Road northbound prior to the Parkes Street intersection to direct local traffic to take alternate side roads towards James Ruse Drive to minimise queueing on River Road West and Hassall Street.

A tidal flow option was investigated, with southbound traffic detoured during the afternoon peak period from approximately 2pm to 7pm and northbound traffic detoured at all other times. Due to the northbound traffic to Macarthur Street bridge opposing the detoured southbound traffic turning right from George Street to Harris Street, there is excessive queueing at this intersection that appears to extend back to the Wilde Avenue and Phillip Street intersection. The implementation of the tidal flow arrangement would require an effective communications strategy to ensure drivers are not confused by the arrangement and to encourage a reduction in trips to improve the detour route performance. The Wilde Avenue/ Phillip Street, Charles Street / George Street and George Street /Harris Street / Macarthur Street intersections may also require signal timing changes to accommodate the detoured traffic and monitoring to ensure performance during the closures.

The tidal flow is expected to change the closure methodology and likely require additional controls and additional traffic control resources to implement and manage with varying access arrangements being provided. Public confusion may also be an issue with an increased safety risk of people trying to navigate northbound during a northbound closure and similarly with southbound traffic.

The Wilde Avenue and Phillips Street intersection was modelled during the morning peak to determine whether a southbound detour might be possible. The queues extended beyond Victoria Road so this option was not further investigated.

The preferred option is to close the northbound traffic over the bridge for the duration of the extended closure as this provides a more consistent arrangement and does not impact the Parramatta CBD.

APPENDIX A – TRAFFIC CONTROL PLAN - DETOUR

APPENDIX B – SIDRA RESULTS – WEEKEND CLOSURE & DETOUR

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Gasworks Bridge Closure 2022 update

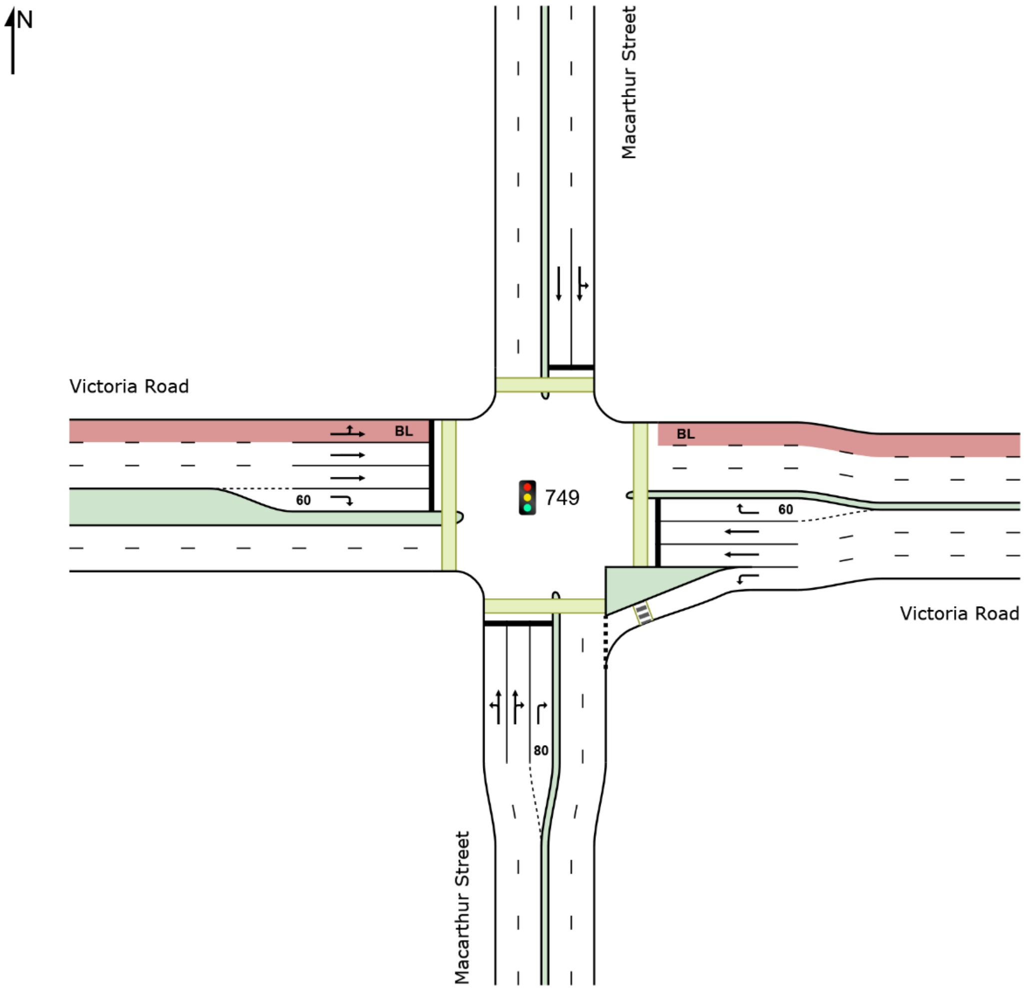
Site: 749 [TCS 749 Victoria Road MacArthur Street - SAT 1200-1300 (Site Folder: General)]

Victoria Road / Macarthur Street Parramatta - SAT Peak Existing 1200-1300 30 July - 20 Aug Average
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 56 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance															
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Macarthur Street														
1	L2	77	4	81	5.0	0.302	17.8	LOS B	4.1	30.2	0.71	0.66	0.71	47.5
2	T1	148	7	156	5.0	0.302	12.4	LOS A	4.1	30.2	0.73	0.66	0.73	48.4
3	R2	186	12	196	6.5	* 0.302	20.4	LOS B	2.1	15.3	0.88	0.75	0.88	44.6
Approach		411	23	433	5.7	0.302	17.0	LOS B	4.1	30.2	0.80	0.70	0.80	46.4
East: Victoria Road														
4	L2	197	10	207	5.0	0.168	8.1	LOS A	1.6	11.4	0.41	0.66	0.41	52.2
5	T1	578	40	608	7.0	* 0.830	29.5	LOS C	9.6	70.1	1.00	1.01	1.35	40.5
6	R2	141	7	148	5.0	* 0.772	36.7	LOS C	4.6	33.3	1.00	0.92	1.34	36.9
Approach		916	57	964	6.2	0.830	26.0	LOS B	9.6	70.8	0.87	0.92	1.15	41.9
North: Macarthur Street														
7	L2	52	3	55	5.0	0.493	28.4	LOS B	4.2	30.6	0.94	0.77	0.94	41.8
8	T1	245	12	258	5.0	* 0.493	23.8	LOS B	4.2	30.6	0.95	0.77	0.95	42.9
Approach		297	15	313	5.0	0.493	24.6	LOS B	4.2	30.6	0.95	0.77	0.95	42.7
West: Victoria Road														
10	L2	62	3	65	5.0	0.231	27.0	LOS B	1.8	14.8	0.88	0.74	0.88	41.2
11	T1	497	34	523	6.9	0.691	24.8	LOS B	7.1	51.9	0.98	0.86	1.09	42.7
12	R2	111	6	117	5.0	0.608	34.1	LOS C	3.4	24.6	1.00	0.82	1.10	37.9
Approach		670	43	705	6.4	0.691	26.5	LOS B	7.1	51.9	0.97	0.85	1.07	41.6
All Vehicles		2294	138	2415	6.0	0.830	24.4	LOS B	9.6	70.8	0.90	0.84	1.04	42.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

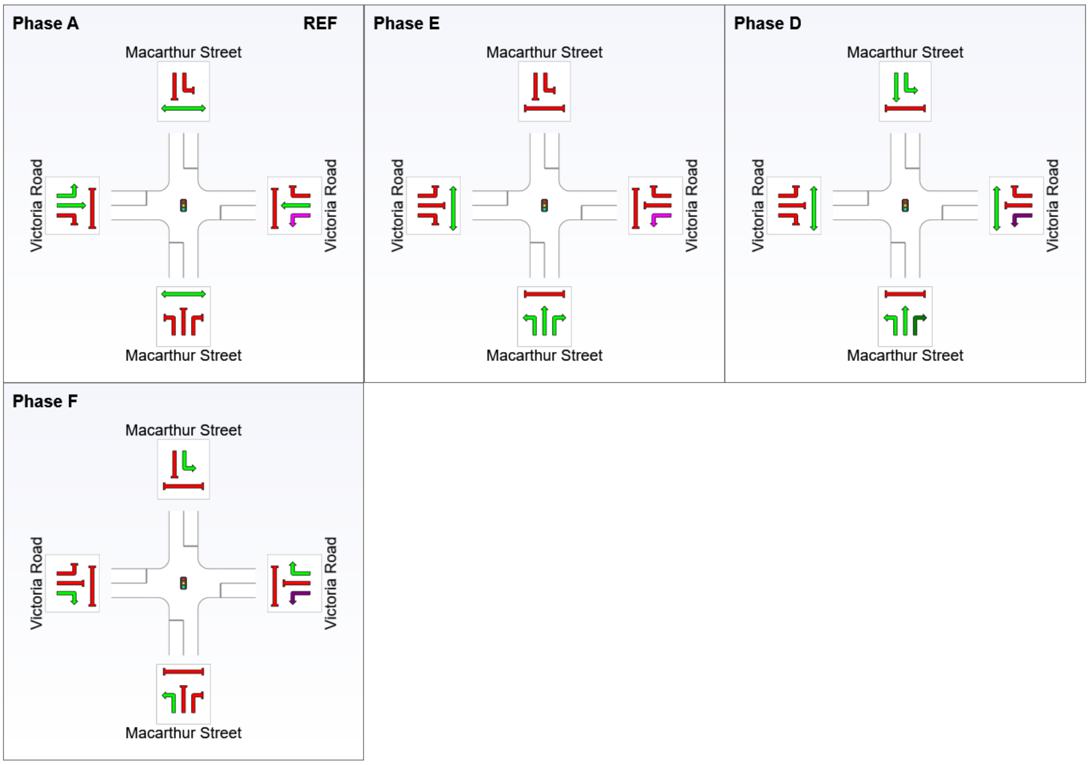
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Macarthur Street												
P1	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	191.2	219.5	1.15
East: Victoria Road												
P2	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	193.8	222.8	1.15
North: Macarthur Street												
P3	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	188.7	216.2	1.15
West: Victoria Road												
P4	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	194.5	223.8	1.15
All Pedestrians		200	211	22.4	LOS C	0.1	0.1	0.89	0.89	192.0	220.6	1.15

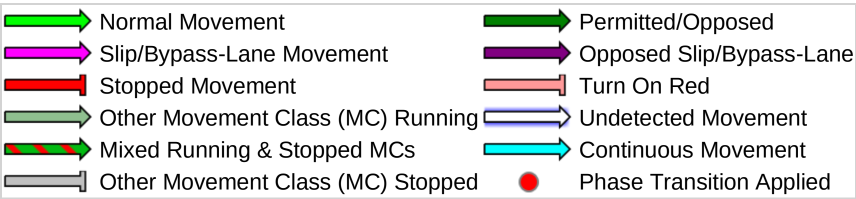
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F



REF: Reference Phase
VAR: Variable Phase



Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	17	29	44
Green Time (sec)	11	6	9	6
Phase Time (sec)	17	12	15	12
Phase Split	30%	21%	27%	21%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Gasworks Bridge Closure 2022 update

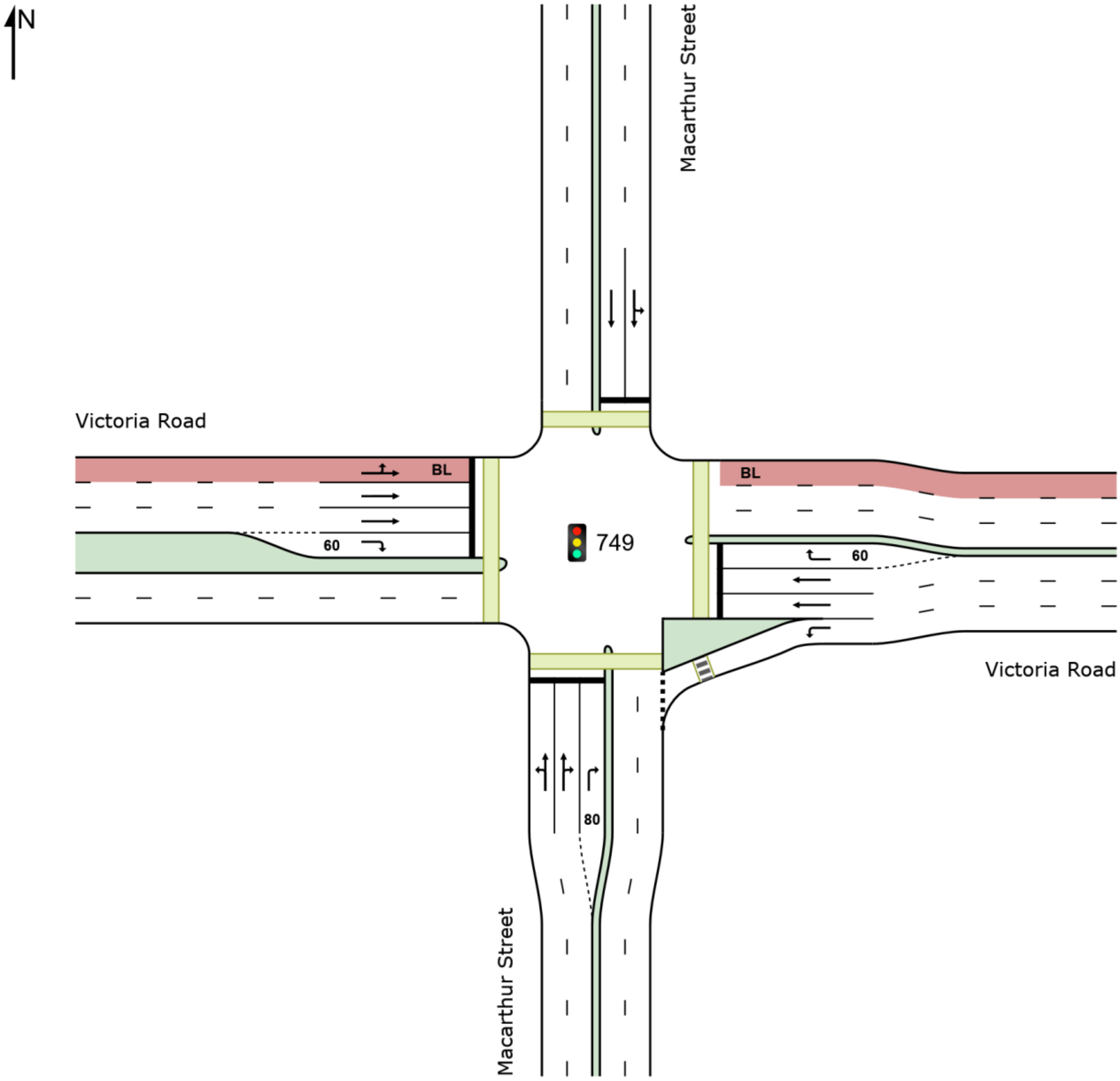
Site: 749 [TCS 749 Victoria Road MacArthur Street - SAT 1200-1300 - NB Detour (Site Folder: Detour)]

Victoria Road / Macarthur Street Parramatta - SAT Peak Existing 1200-1300 30 July - 20 Aug Average
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 62 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Macarthur Street														
1	L2	129	6	136	4.5	0.353	19.7	LOS B	5.4	39.5	0.74	0.70	0.74	45.8
2	T1	148	7	156	5.0	0.353	14.9	LOS B	5.4	39.5	0.78	0.71	0.78	46.4
3	R2	186	12	196	6.5	* 0.353	23.0	LOS B	2.7	20.2	0.91	0.75	0.91	43.4
Approach		463	25	487	5.5	0.353	19.5	LOS B	5.4	39.5	0.82	0.73	0.82	45.0
East: Victoria Road														
4	L2	240	11	253	4.5	0.200	8.2	LOS A	2.1	15.3	0.40	0.66	0.40	52.1
5	T1	726	48	764	6.7	* 0.845	31.4	LOS C	13.3	97.2	1.00	1.03	1.32	39.7

6	R2	141	7	148	5.0	0.733 *	38.4	LOS C	4.9	35.7	1.00	0.89	1.24	36.3
Approach		1107	66	1165	6.0	0.845	27.2	LOS B	13.3	98.1	0.87	0.93	1.11	41.3
North: Macarthur Street														
7	L2	52	3	55	5.0	0.494	30.9	LOS C	4.6	33.6	0.94	0.77	0.94	40.7
8	T1	245	12	258	5.0	0.494 *	26.2	LOS B	4.6	33.6	0.95	0.77	0.95	41.7
Approach		297	15	313	5.0	0.494	27.0	LOS B	4.6	33.6	0.95	0.77	0.95	41.5
West: Victoria Road														
10	L2	62	3	65	5.0	0.187	26.3	LOS B	1.9	15.2	0.83	0.73	0.83	41.5
11	T1	497	34	523	6.9	0.561	23.0	LOS B	7.1	51.5	0.93	0.77	0.93	43.6
12	R2	111	6	117	5.0	0.577	36.2	LOS C	3.7	26.7	0.99	0.80	1.05	37.1
Approach		670	43	705	6.4	0.577	25.5	LOS B	7.1	51.5	0.93	0.77	0.94	42.1
All Vehicles		2537	149	2671	5.9	0.845	25.3	LOS B	13.3	98.1	0.89	0.83	0.99	42.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

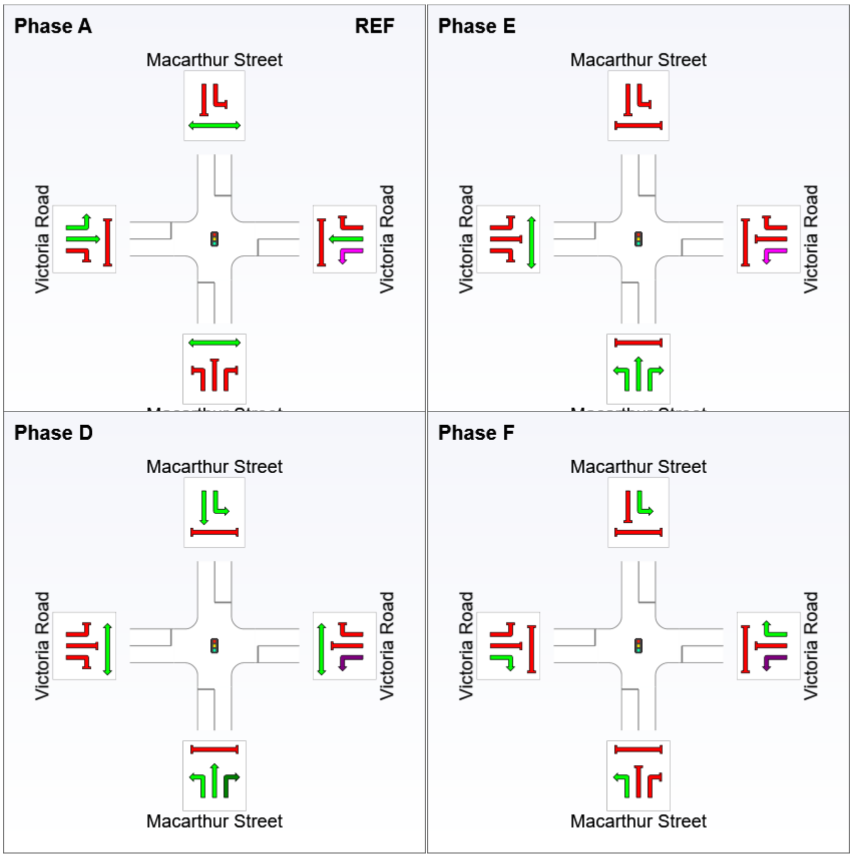
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Macarthur Street												
P1	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	194.2	219.5	1.13
East: Victoria Road												
P2	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	196.7	222.8	1.13
North: Macarthur Street												
P3	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	191.7	216.2	1.13
West: Victoria Road												
P4	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	197.5	223.8	1.13
All Pedestrians		200	211	25.3	LOS C	0.1	0.1	0.91	0.91	195.0	220.6	1.13

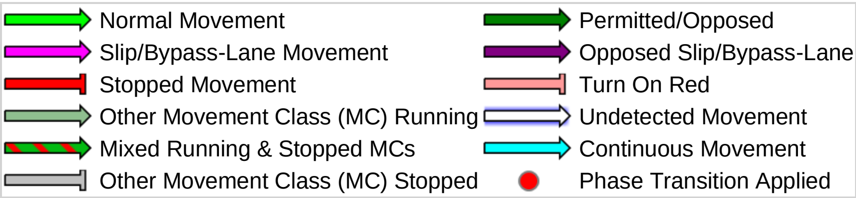
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F



REF: Reference Phase
VAR: Variable Phase



Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	21	33	49
Green Time (sec)	15	6	10	7
Phase Time (sec)	21	12	16	13
Phase Split	34%	19%	26%	21%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Gasworks Bridge Closure 2022 update

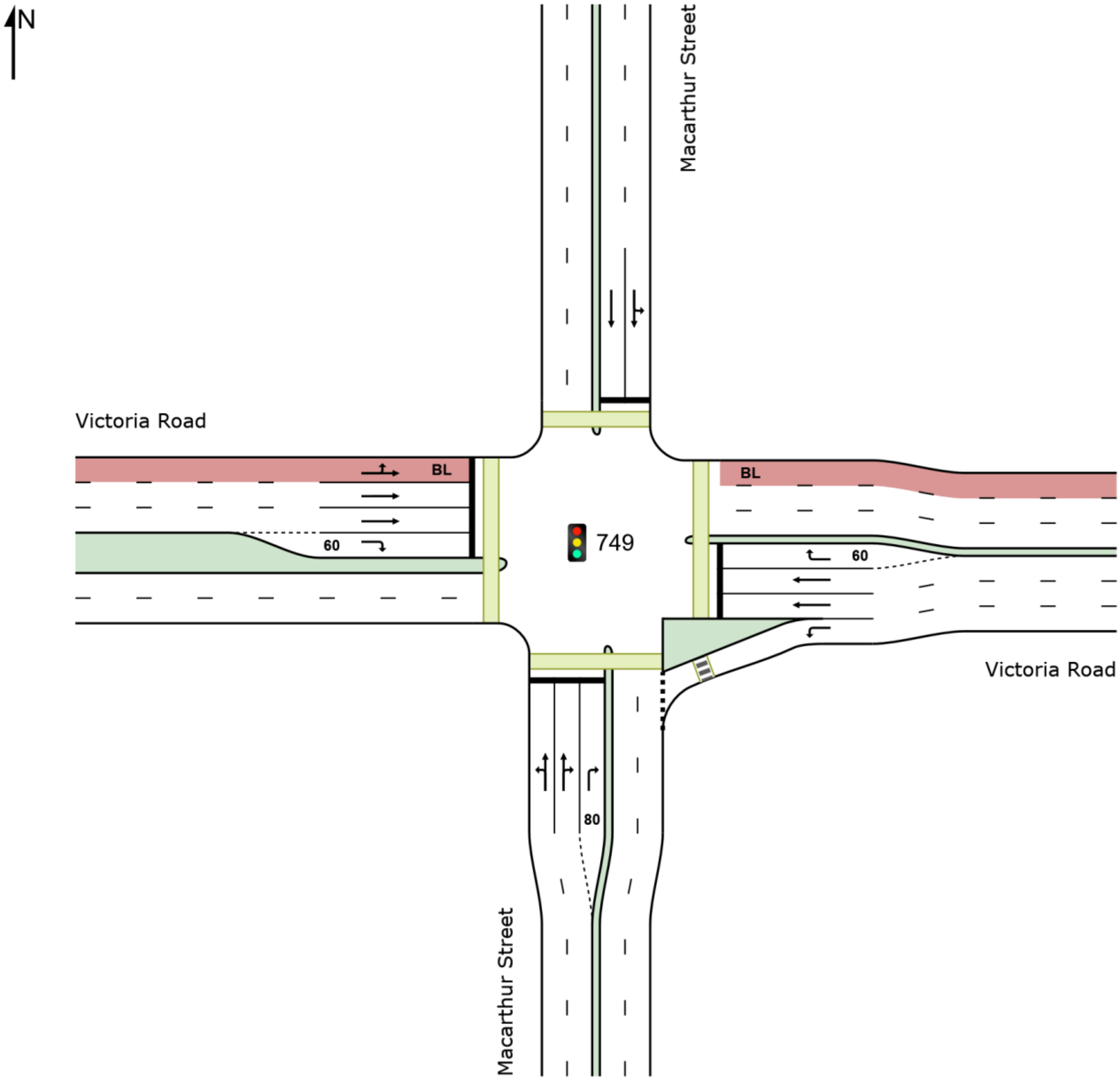
Site: 749 [TCS 749 Victoria Road MacArthur Street - SAT 1200-1300 - NB Detour (Site Folder: Detour)]

Victoria Road / Macarthur Street Parramatta - SAT Peak Existing 1200-1300 30 July - 20 Aug Average
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 62 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Macarthur Street														
1	L2	129	6	136	4.5	0.353	19.7	LOS B	5.4	39.5	0.74	0.70	0.74	45.8
2	T1	148	7	156	5.0	0.353	14.9	LOS B	5.4	39.5	0.78	0.71	0.78	46.4
3	R2	186	12	196	6.5	* 0.353	23.0	LOS B	2.7	20.2	0.91	0.75	0.91	43.4
Approach		463	25	487	5.5	0.353	19.5	LOS B	5.4	39.5	0.82	0.73	0.82	45.0
East: Victoria Road														
4	L2	240	11	253	4.5	0.200	8.2	LOS A	2.1	15.3	0.40	0.66	0.40	52.1
5	T1	726	48	764	6.7	* 0.845	31.4	LOS C	13.3	97.2	1.00	1.03	1.32	39.7

6	R2	141	7	148	5.0	* 0.733	38.4	LOS C	4.9	35.7	1.00	0.89	1.24	36.3
Approach		1107	66	1165	6.0	0.845	27.2	LOS B	13.3	98.1	0.87	0.93	1.11	41.3
North: Macarthur Street														
7	L2	52	3	55	5.0	0.494	30.9	LOS C	4.6	33.6	0.94	0.77	0.94	40.7
8	T1	245	12	258	5.0	* 0.494	26.2	LOS B	4.6	33.6	0.95	0.77	0.95	41.7
Approach		297	15	313	5.0	0.494	27.0	LOS B	4.6	33.6	0.95	0.77	0.95	41.5
West: Victoria Road														
10	L2	62	3	65	5.0	0.187	26.3	LOS B	1.9	15.2	0.83	0.73	0.83	41.5
11	T1	497	34	523	6.9	0.561	23.0	LOS B	7.1	51.5	0.93	0.77	0.93	43.6
12	R2	111	6	117	5.0	0.577	36.2	LOS C	3.7	26.7	0.99	0.80	1.05	37.1
Approach		670	43	705	6.4	0.577	25.5	LOS B	7.1	51.5	0.93	0.77	0.94	42.1
All Vehicles		2537	149	2671	5.9	0.845	25.3	LOS B	13.3	98.1	0.89	0.83	0.99	42.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

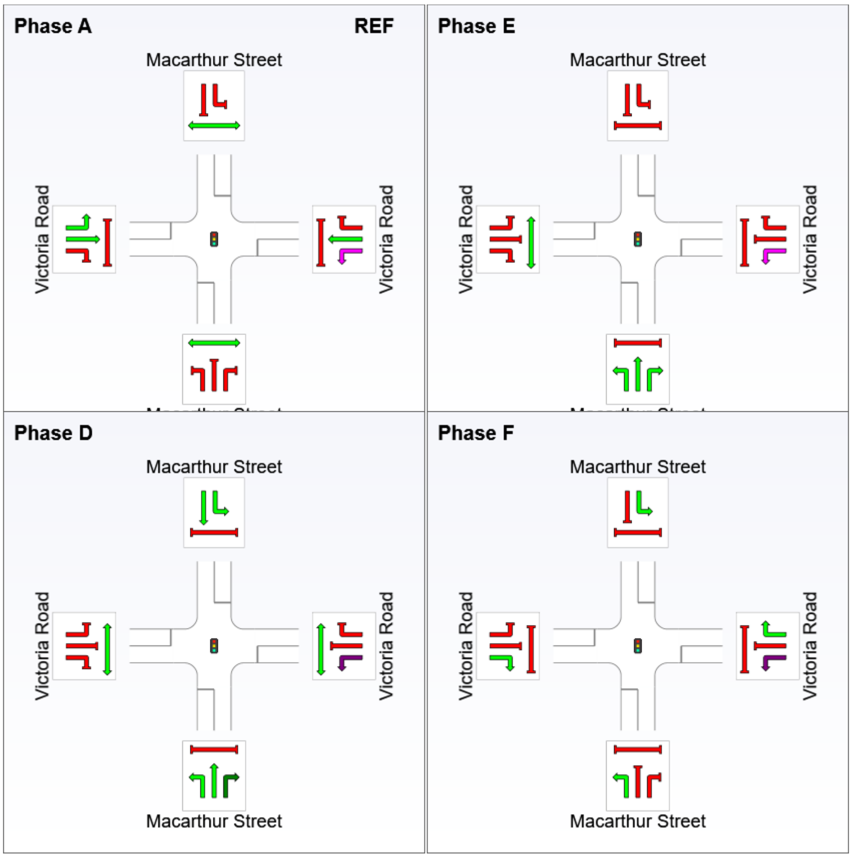
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Macarthur Street												
P1	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	194.2	219.5	1.13
East: Victoria Road												
P2	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	196.7	222.8	1.13
North: Macarthur Street												
P3	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	191.7	216.2	1.13
West: Victoria Road												
P4	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	197.5	223.8	1.13
All Pedestrians		200	211	25.3	LOS C	0.1	0.1	0.91	0.91	195.0	220.6	1.13

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Reference Sequence: TCS 749 - Split plan 3 Phase: Phase A
Input Phase Sequence: A, E, D, F



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	21	33	49
Green Time (sec)	15	6	10	7
Phase Time (sec)	21	12	16	13
Phase Split	34%	19%	26%	21%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Organisation: CIVLINK | Licence: NETWORK / 1PC | Created: Sunday, 21 May 2023 5:25:43 PM
Project: E:\Civlink\Gasworks Bridge Rehabilitation\00_2022 Update\Gasworks Bridge Closure 2022 update.sip9

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Gasworks Bridge Closure 2022 update

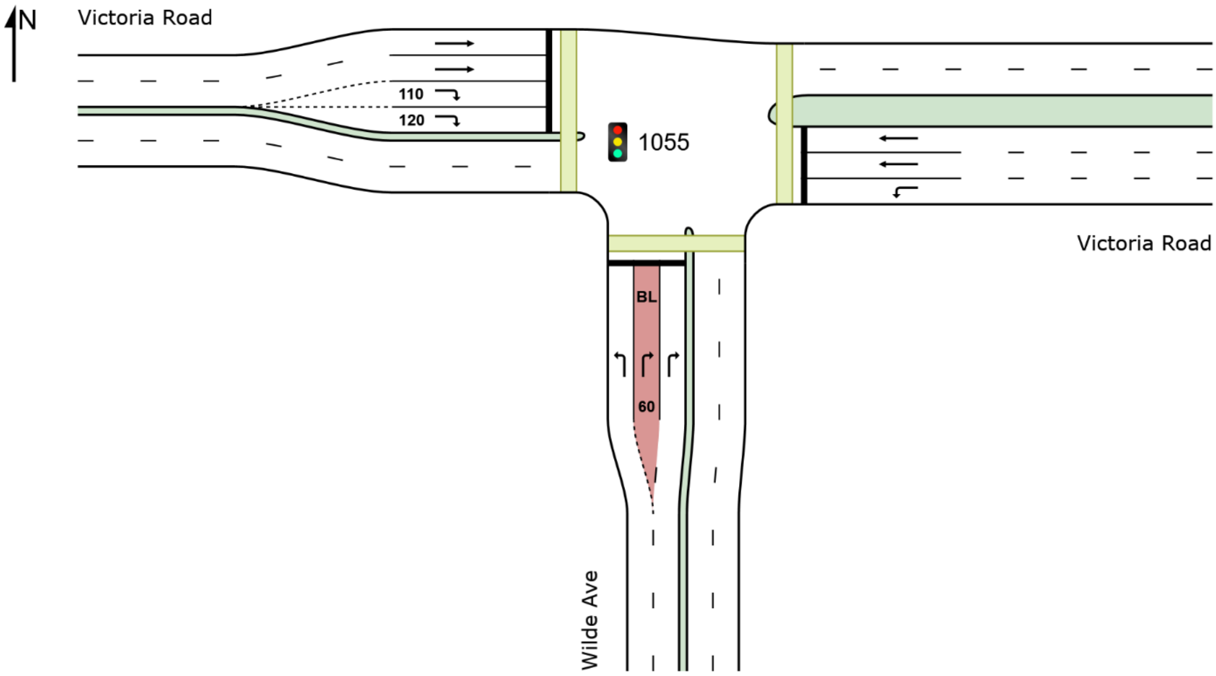
Site: 1055 [TCS 1055 Victoria Road Wilde Ave - SAT 1200-1300 - Detour (Site Folder: Detour)]

Victoria Road / Wilde Ave Parramatta - SAT Peak Existing
1200-1300 30 July - 20 Aug Average
(estimated WB left turn LVs -missing detector 10)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 38 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS1055
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Wilde Ave														
1	L2	74	4	78	5.0	0.092	11.6	LOS A	0.8	5.9	0.58	0.69	0.58	49.1
3	R2	135	17	142	12.7	* 0.461	22.7	LOS B	2.4	17.6	0.94	0.77	0.94	42.9
Approach		209	21	220	10.0	0.461	18.8	LOS B	2.4	17.6	0.81	0.74	0.81	44.9
East: Victoria Road														
4	L2	705	46	742	6.5	0.794	17.6	LOS B	13.9	102.5	0.87	0.93	1.07	45.5
5	T1	565	28	595	5.0	* 0.748	18.3	LOS B	6.0	43.9	0.99	0.93	1.25	46.2
Approach		1270	74	1337	5.8	0.794	17.9	LOS B	13.9	102.5	0.93	0.93	1.15	45.8
West: Victoria Road														
11	T1	540	27	568	5.0	0.286	5.5	LOS A	3.0	22.0	0.59	0.50	0.59	55.0
12	R2	218	11	229	5.1	* 0.406	22.6	LOS B	2.1	15.3	0.94	0.77	0.94	43.0
Approach		758	38	798	5.0	0.406	10.4	LOS A	3.0	22.0	0.69	0.58	0.69	50.9
All Vehicles		2237	133	2355	5.9	0.794	15.5	LOS B	13.9	102.5	0.84	0.79	0.96	47.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

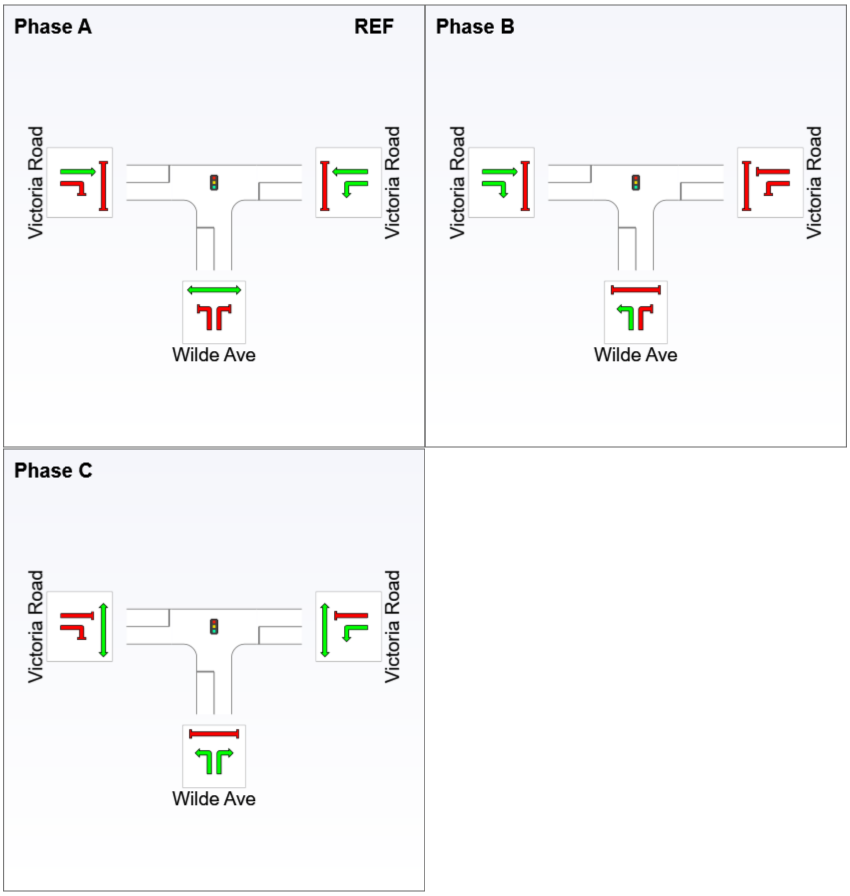
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Wilde Ave												
P1	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	182.3	219.5	1.20
East: Victoria Road												
P2	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	184.7	222.5	1.20
West: Victoria Road												
P4	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	184.9	222.8	1.21
All Pedestrians		150	158	13.5	LOS B	0.0	0.0	0.84	0.84	184.0	221.6	1.20

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS1055
Reference Phase: Phase A
Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	14	26
Green Time (sec)	8	6	6
Phase Time (sec)	14	12	12
Phase Split	37%	32%	32%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

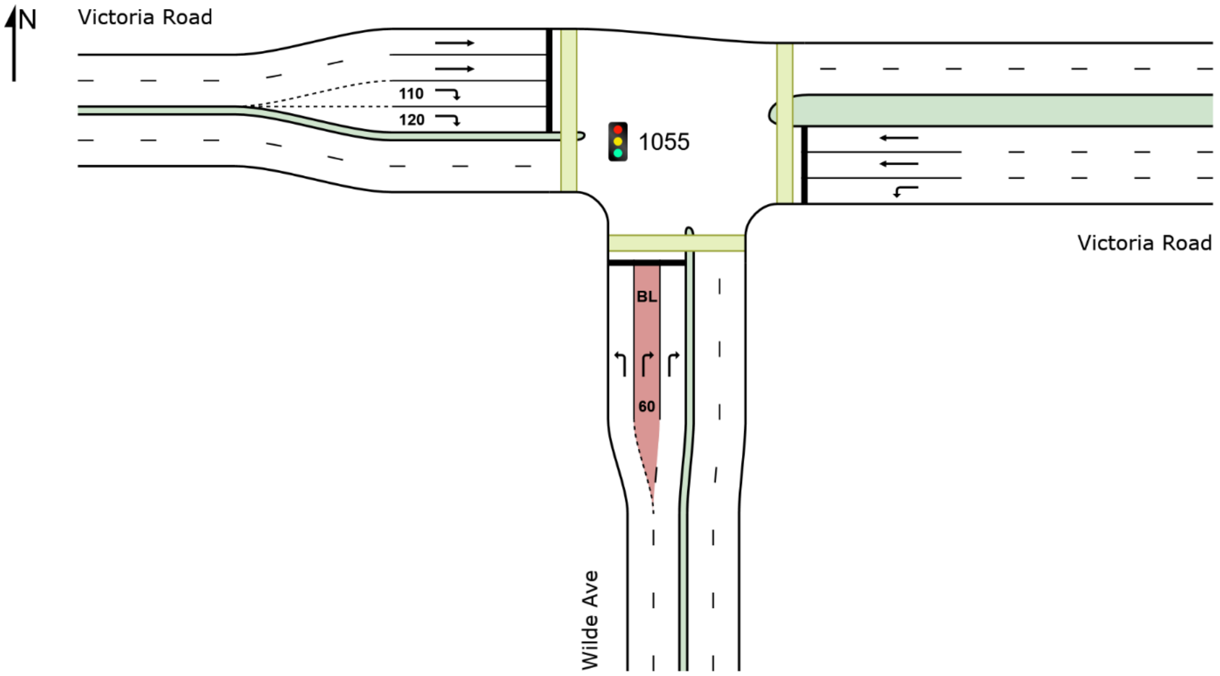
Site: 1055 [TCS 1055 Victoria Road Wilde Ave - SAT 1200-1300 (Site Folder: General)]

Victoria Road / Wilde Ave Parramatta - SAT Peak Existing
1200-1300 30 July - 20 Aug Average
(estimated WB left turn LVs -missing detector 10)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 38 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS1055
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total	HV]	[Total	HV]				[Veh.	Dist]				
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Wilde Ave														
1	L2	74	4	78	5.0	0.092	11.6	LOS A	0.8	5.9	0.58	0.69	0.58	49.1
3	R2	135	17	142	12.7	* 0.461	22.7	LOS B	2.4	17.6	0.94	0.77	0.94	42.9
Approach		209	21	220	10.0	0.461	18.8	LOS B	2.4	17.6	0.81	0.74	0.81	44.9
East: Victoria Road														
4	L2	159	19	167	11.7	0.186	10.9	LOS A	1.7	12.9	0.55	0.71	0.55	49.6
5	T1	565	28	595	5.0	* 0.748	18.3	LOS B	6.0	43.9	0.99	0.93	1.25	46.2
Approach		724	47	762	6.5	0.748	16.7	LOS B	6.0	43.9	0.89	0.88	1.10	46.9
West: Victoria Road														
11	T1	540	27	568	5.0	0.286	5.5	LOS A	3.0	22.0	0.59	0.50	0.59	55.0
12	R2	163	8	172	5.0	* 0.303	22.2	LOS B	1.5	11.2	0.92	0.75	0.92	43.2
Approach		703	35	740	5.0	0.303	9.4	LOS A	3.0	22.0	0.67	0.56	0.67	51.7
All Vehicles		1636	103	1722	6.3	0.748	13.8	LOS A	6.0	43.9	0.79	0.72	0.88	48.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

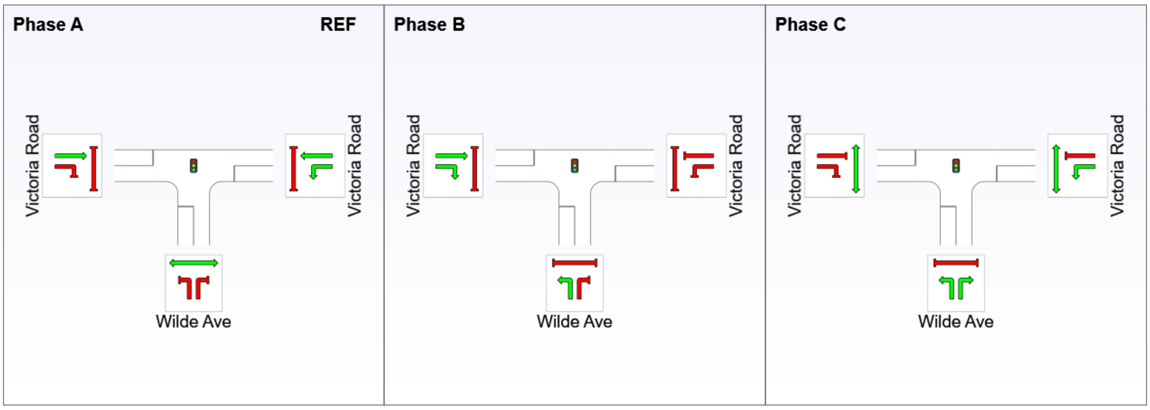
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
						[Ped	Dist]					
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Wilde Ave												
P1	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	182.3	219.5	1.20
East: Victoria Road												
P2	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	184.7	222.5	1.20
West: Victoria Road												
P4	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	184.9	222.8	1.21
All Pedestrians		150	158	13.5	LOS B	0.0	0.0	0.84	0.84	184.0	221.6	1.20

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS1055
Reference Phase: Phase A
Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	14	26
Green Time (sec)	8	6	6
Phase Time (sec)	14	12	12
Phase Split	37%	32%	32%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

USER REPORT FOR SITE

All Movement Classes — **Template: Report**

Project: Gasworks Bridge Closure 2022 update

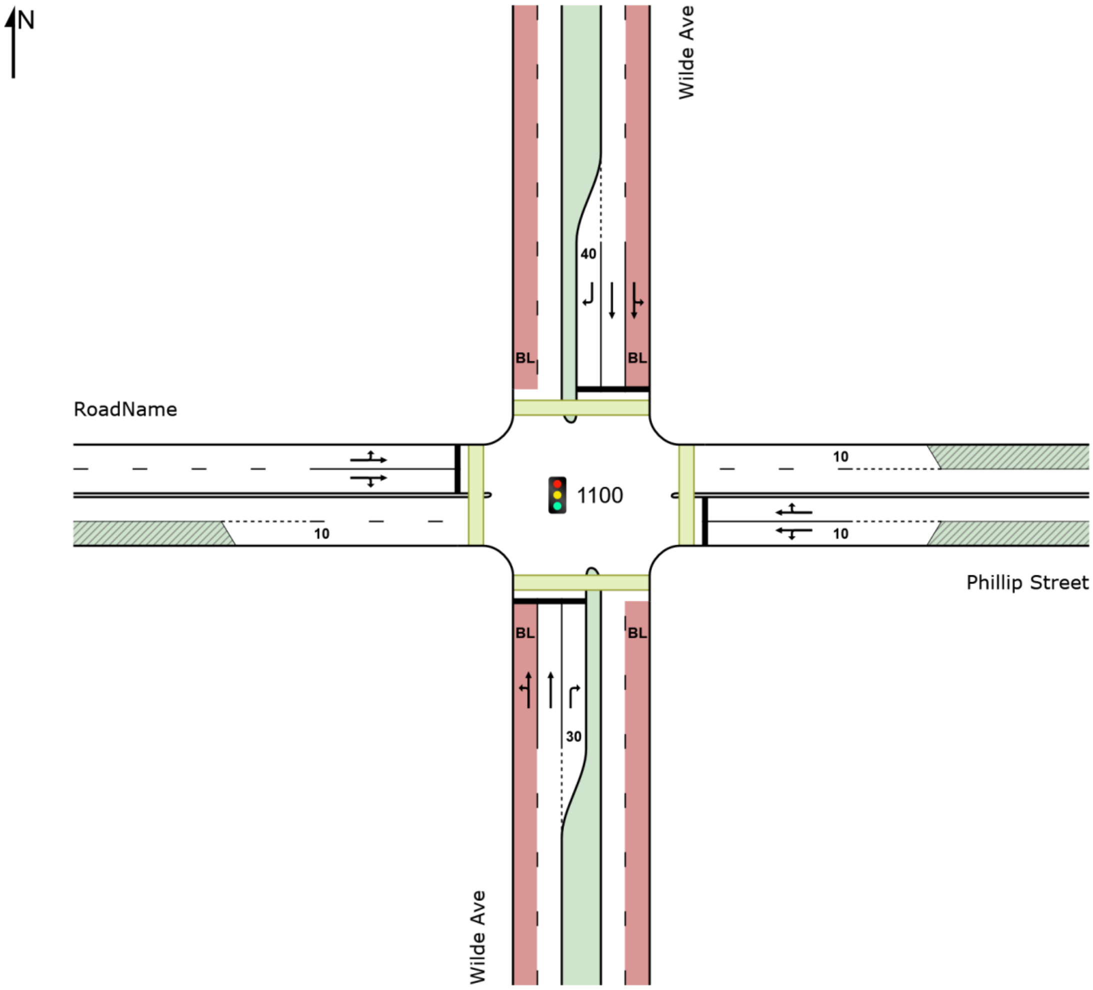
Site: 1100 [TCS 1100 - Wilde Ave Phillip St - SAT 1200-1300 (Site Folder: General)]

Wilde Ave Phillip St Parramatta, SAT Peak Existing
1200-1300 30 July - 20 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 56 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, D, E, F
Output Phase Sequence: A, D, E, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Wilde Ave														
1	L2	40	2	42	5.0	0.126	21.1	LOS B	1.1	9.8	0.79	0.68	0.79	32.9
2	T1	122	17	128	13.6	* 0.433	24.5	LOS B	3.1	22.7	0.94	0.74	0.94	31.5
3	R2	14	1	15	5.0	0.039	17.4	LOS B	0.3	2.0	0.82	0.65	0.82	33.7
Approach		176	19	185	10.9	0.433	23.1	LOS B	3.1	22.7	0.90	0.72	0.90	32.0
East: Phillip Street														
4	L2	14	1	15	5.0	0.071	22.9	LOS B	0.6	4.4	0.83	0.64	0.83	32.5
5	T1	81	4	85	5.0	* 0.357	23.3	LOS B	2.7	19.7	0.92	0.72	0.92	31.6
6	R2	30	2	32	5.0	0.357	27.2	LOS B	2.7	19.7	0.93	0.74	0.93	31.7
Approach		125	6	132	5.0	0.357	24.2	LOS B	2.7	19.7	0.91	0.72	0.91	31.7
North: Wilde Ave														
7	L2	72	4	76	5.0	0.199	12.8	LOS A	1.0	8.4	0.81	0.70	0.81	35.4
8	T1	109	17	115	15.5	0.378	23.2	LOS B	2.7	19.6	0.93	0.73	0.93	31.9
9	R2	141	7	148	5.0	* 0.403	19.3	LOS B	3.1	22.8	0.92	0.76	0.92	33.1
Approach		322	28	339	8.5	0.403	19.1	LOS B	3.1	22.8	0.90	0.74	0.90	33.2
West: RoadName														
10	L2	57	3	60	5.0	0.125	12.4	LOS A	0.7	5.0	0.79	0.69	0.79	35.3
11	T1	74	4	78	5.0	* 0.454	24.3	LOS B	3.5	25.8	0.95	0.76	0.95	31.2
12	R2	54	3	57	5.0	0.454	27.7	LOS B	3.5	25.8	0.95	0.76	0.95	31.4
Approach		185	9	195	5.0	0.454	21.6	LOS B	3.5	25.8	0.90	0.74	0.90	32.4
All Vehicles		808	62	851	7.7	0.454	21.4	LOS B	3.5	25.8	0.90	0.73	0.90	32.5

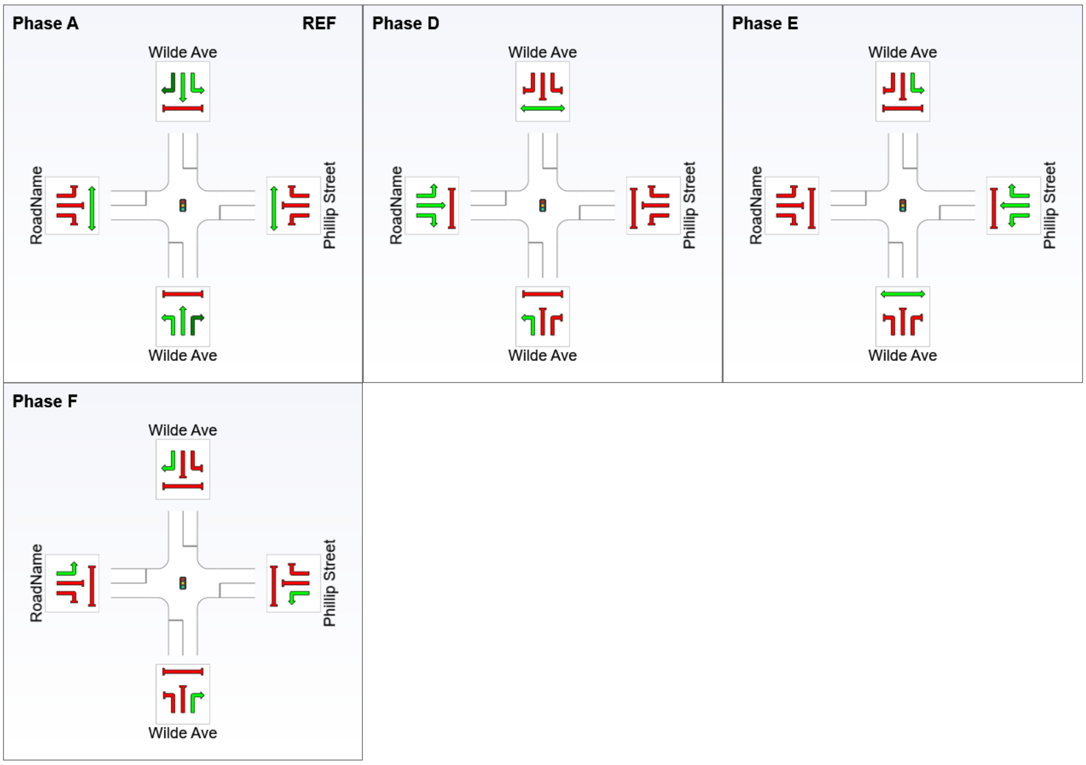
Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Wilde Ave												
P1	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	192.0	220.5	1.15
East: Phillip Street												
P2	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	188.3	215.7	1.15
North: Wilde Ave												
P3	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	192.0	220.5	1.15
West: RoadName												
P4	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	188.3	215.7	1.15
All Pedestrians		200	211	22.4	LOS C	0.1	0.1	0.89	0.89	190.1	218.1	1.15

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, D, E, F



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	D	E	F
Phase Change Time (sec)	0	14	29	44
Green Time (sec)	8	9	9	6
Phase Time (sec)	14	15	15	12
Phase Split	25%	27%	27%	21%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

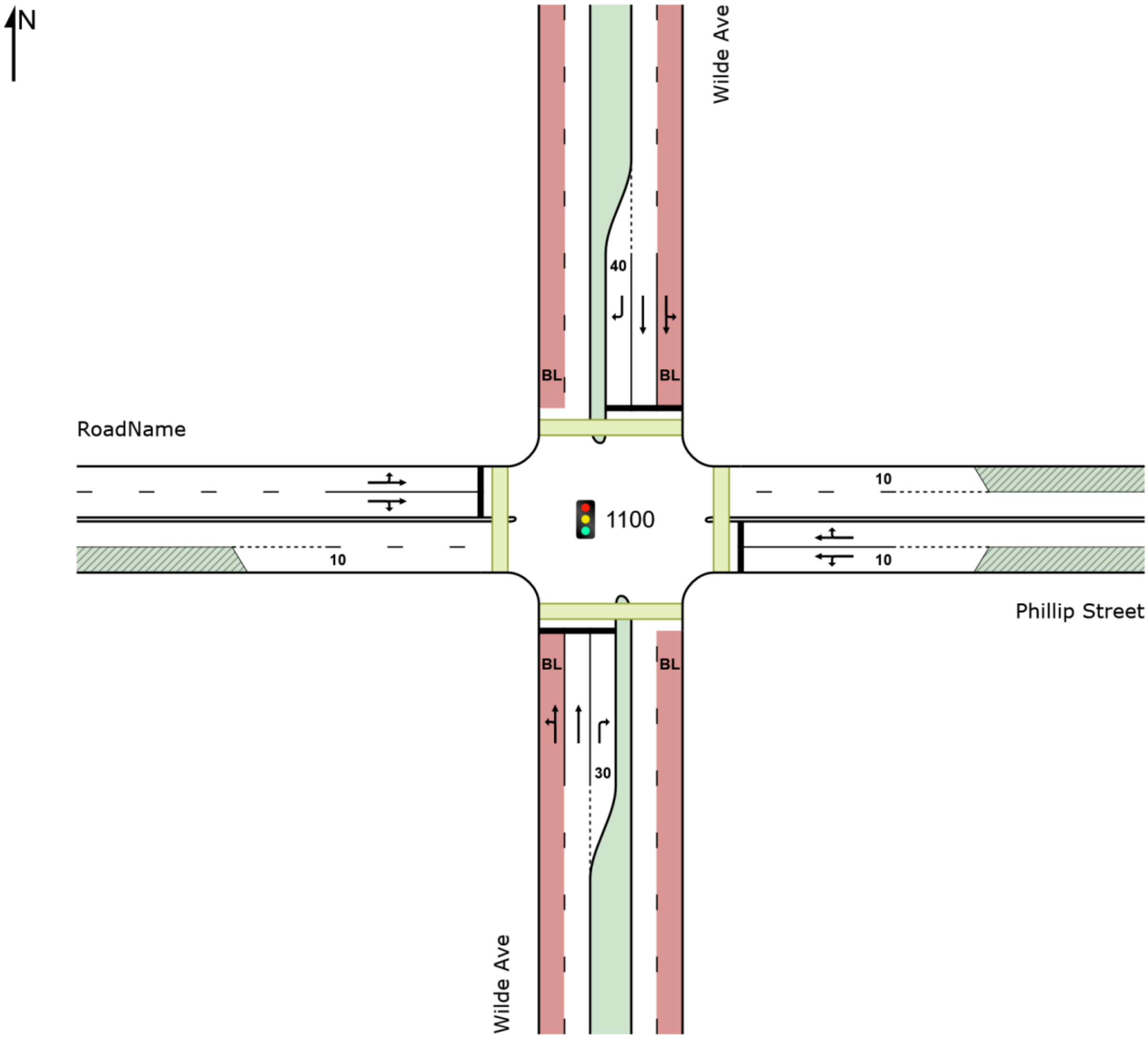
Site: 1100 [TCS 1100 - Wilde Ave Phillip St - SAT 1200-1300 - Detour (Site Folder: Detour)]

Wilde Ave Phillip St Parramatta, SAT Peak Existing
1200-1300 30 July - 20 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, D, E, F
Output Phase Sequence: A, D, E, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Wilde Ave														
1	L2	40	2	42	5.0	0.077	25.5	LOS B	1.8	15.7	0.62	0.62	0.62	31.7
2	T1	122	17	128	13.6	0.169	26.8	LOS B	4.6	33.3	0.70	0.58	0.70	30.9
3	R2	14	1	15	5.0	0.050	23.0	LOS B	0.5	3.4	0.71	0.63	0.71	32.0
Approach		176	19	185	10.9	0.169	26.2	LOS B	4.6	33.3	0.69	0.59	0.69	31.1
East: Phillip Street														
4	L2	14	1	15	5.0	0.057	40.0	LOS C	1.1	8.3	0.79	0.64	0.79	28.2
5	T1	81	4	85	5.0	0.286	40.7	LOS C	5.1	37.3	0.85	0.70	0.85	27.5
6	R2	30	2	32	5.0	0.286	44.6	LOS D	5.1	37.3	0.86	0.71	0.86	27.5
Approach		125	6	132	5.0	0.286	41.6	LOS C	5.1	37.3	0.85	0.69	0.85	27.6
North: Wilde Ave														
7	L2	673	34	708	5.0	* 0.707	15.8	LOS B	17.1	126.5	0.77	0.82	0.77	45.4
8	T1	109	17	115	15.5	* 0.707	25.2	LOS B	17.1	126.5	0.71	0.60	0.71	31.8
9	R2	141	7	148	5.0	* 0.275	23.5	LOS B	5.1	37.5	0.69	0.70	0.69	31.9
Approach		923	58	972	6.2	0.707	18.0	LOS B	17.1	126.5	0.75	0.78	0.75	40.7
West: RoadName														
10	L2	57	3	60	5.0	0.161	25.8	LOS B	1.7	12.7	0.85	0.72	0.85	31.3
11	T1	74	4	78	5.0	* 0.547	53.8	LOS D	7.6	55.4	0.98	0.79	0.98	25.0
12	R2	54	3	57	5.0	0.547	57.2	LOS E	7.6	55.4	0.98	0.79	0.98	25.1
Approach		185	9	195	5.0	0.547	46.2	LOS D	7.6	55.4	0.94	0.77	0.94	26.7
All Vehicles		1409	92	1483	6.5	0.707	24.8	LOS B	17.1	126.5	0.78	0.75	0.78	35.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: SIDRA Standard.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

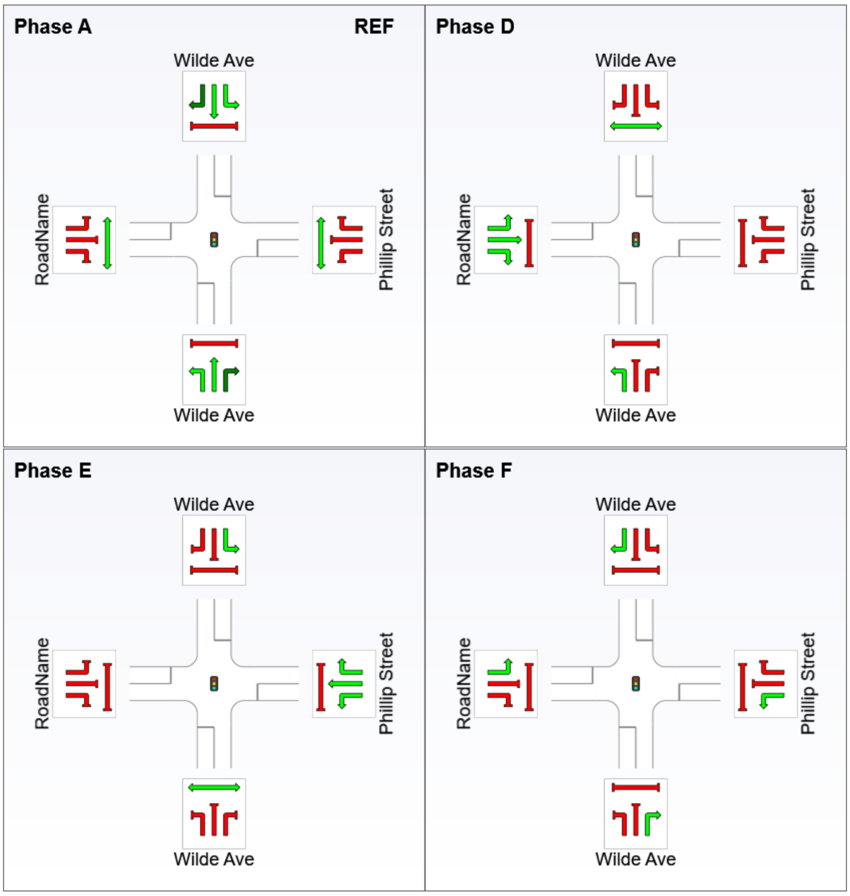
* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Wilde Ave												
P1	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	223.9	220.5	0.98
East: Phillip Street												
P2	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	220.2	215.7	0.98
North: Wilde Ave												
P3	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	223.9	220.5	0.98
West: RoadName												
P4	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	220.2	215.7	0.98
All Pedestrians		200	211	54.3	LOS E	0.2	0.2	0.95	0.95	222.0	218.1	0.98

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, D, E, F



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	D	E	F
Phase Change Time (sec)	0	50	72	105
Green Time (sec)	44	16	27	9
Phase Time (sec)	50	22	33	15
Phase Split	42%	18%	28%	13%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

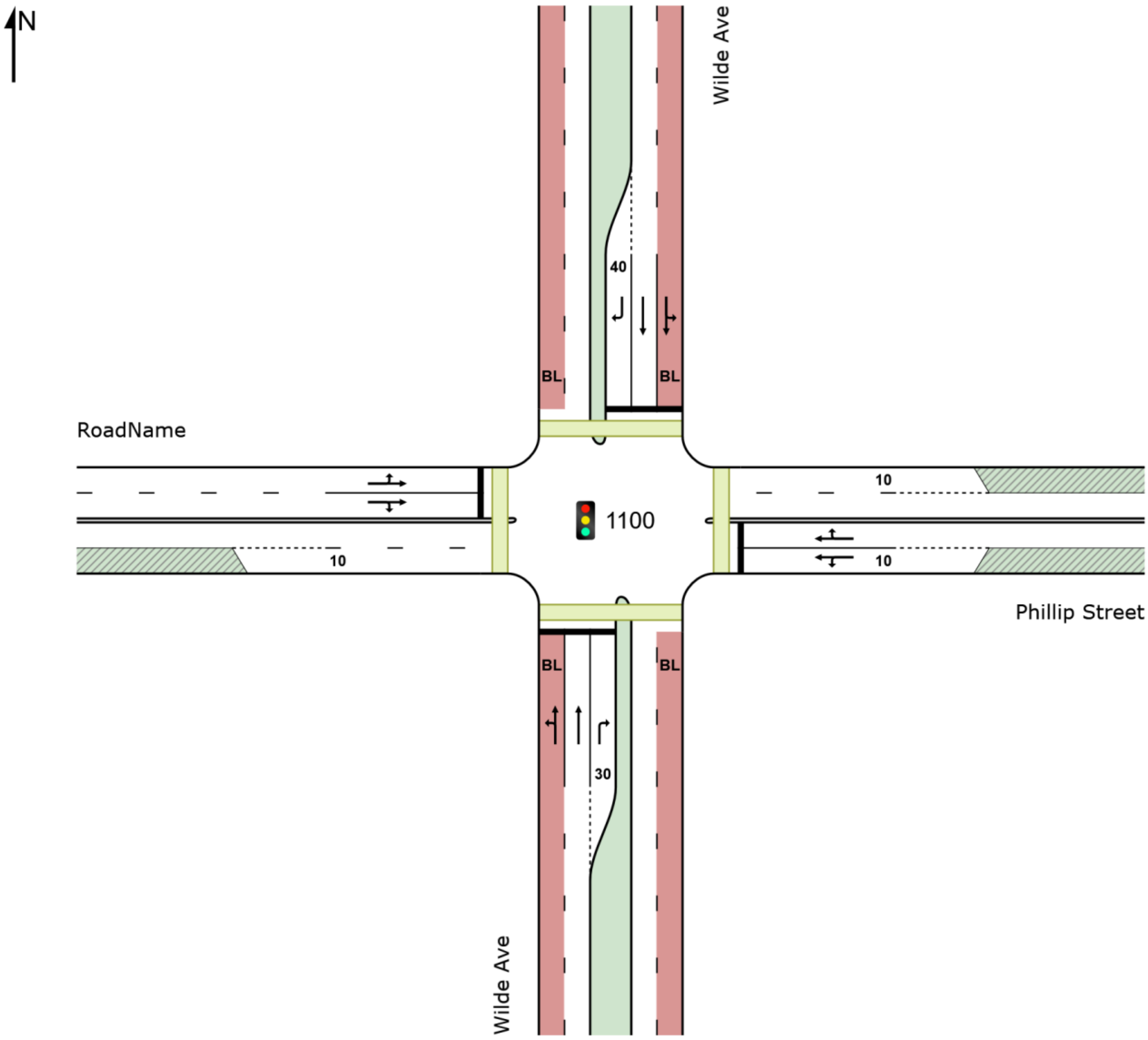
Site: 1100 [TCS 1100 - Wilde Ave Phillip St - SAT 1200-1300 - Detour - 56s cycle time (Site Folder: Detour)]

Wilde Ave Phillip St Parramatta, SAT Peak Existing
1200-1300 30 July - 20 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 56 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, D, E, F
Output Phase Sequence: A, D, E, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Wilde Ave														
1	L2	40	2	42	5.0	0.126	21.1	LOS B	1.1	9.8	0.79	0.68	0.79	32.9
2	T1	122	17	128	13.6	0.433	24.5	LOS B	3.1	22.7	0.94	0.74	0.94	31.5
3	R2	14	1	15	5.0	0.045	18.0	LOS B	0.3	2.0	0.87	0.66	0.87	33.5
Approach		176	19	185	10.9	0.433	23.2	LOS B	3.1	22.7	0.90	0.72	0.90	32.0
East: Phillip Street														
4	L2	14	1	15	5.0	0.071	22.9	LOS B	0.6	4.4	0.83	0.64	0.83	32.5
5	T1	81	4	85	5.0	0.357	23.3	LOS B	2.7	19.7	0.92	0.72	0.92	31.6
6	R2	30	2	32	5.0	0.357	27.2	LOS B	2.7	19.7	0.93	0.74	0.93	31.7
Approach		125	6	132	5.0	0.357	24.2	LOS B	2.7	19.7	0.91	0.72	0.91	31.7
North: Wilde Ave														
7	L2	673	34	708	5.0	* 1.293	294.0	LOS F	83.9	620.8	1.00	2.57	4.99	9.8
8	T1	109	17	115	15.5	* 1.293	53.9	LOS D	83.9	620.8	0.95	0.94	1.39	29.0
9	R2	141	7	148	5.0	* 0.403	19.3	LOS B	3.1	22.8	0.92	0.76	0.92	33.1
Approach		923	58	972	6.2	1.293	223.7	LOS F	83.9	620.8	0.98	2.10	3.94	12.0
West: RoadName														
10	L2	57	3	60	5.0	0.125	12.4	LOS A	0.7	5.0	0.79	0.69	0.79	35.3
11	T1	74	4	78	5.0	* 0.454	24.3	LOS B	3.5	25.8	0.95	0.76	0.95	31.2
12	R2	54	3	57	5.0	0.454	27.7	LOS B	3.5	25.8	0.95	0.76	0.95	31.4
Approach		185	9	195	5.0	0.454	21.6	LOS B	3.5	25.8	0.90	0.74	0.90	32.4
All Vehicles		1409	92	1483	6.5	1.293	154.4	LOS F	83.9	620.8	0.95	1.63	2.89	15.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

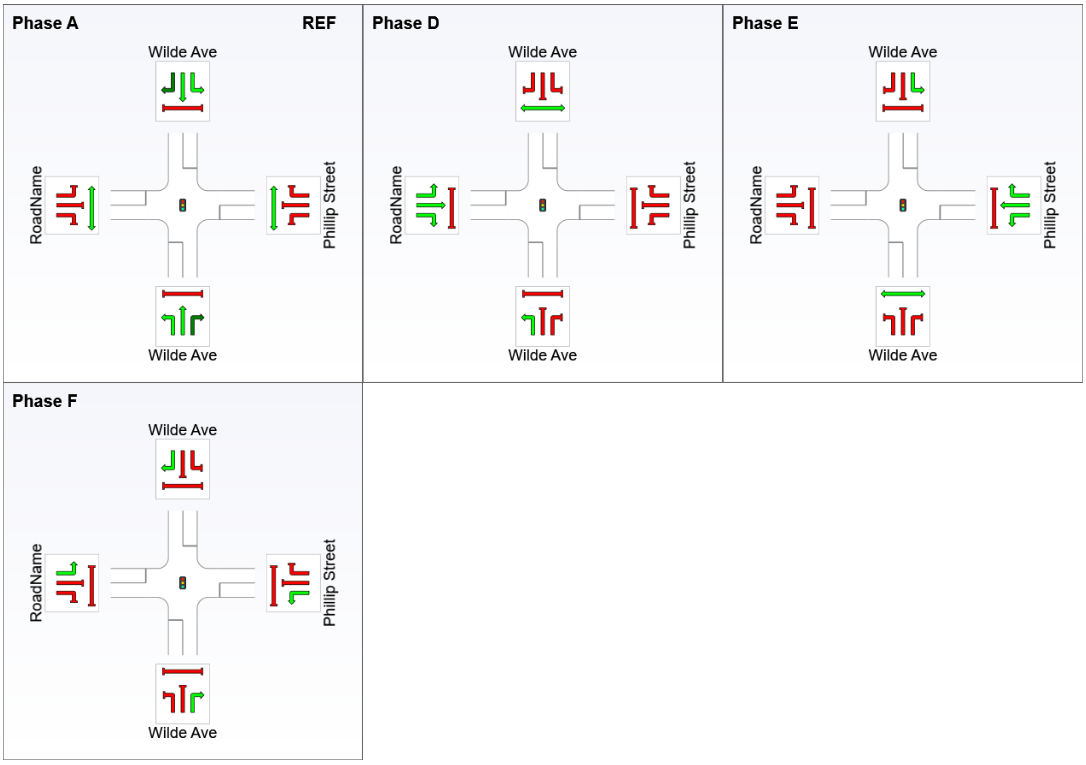
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Wilde Ave												
P1	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	192.0	220.5	1.15
East: Phillip Street												
P2	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	188.3	215.7	1.15
North: Wilde Ave												
P3	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	192.0	220.5	1.15
West: RoadName												
P4	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	188.3	215.7	1.15
All Pedestrians		200	211	22.4	LOS C	0.1	0.1	0.89	0.89	190.1	218.1	1.15

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, D, E, F



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	D	E	F
Phase Change Time (sec)	0	14	29	44
Green Time (sec)	8	9	9	6
Phase Time (sec)	14	15	15	12
Phase Split	25%	27%	27%	21%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Gasworks Bridge Closure 2022 update

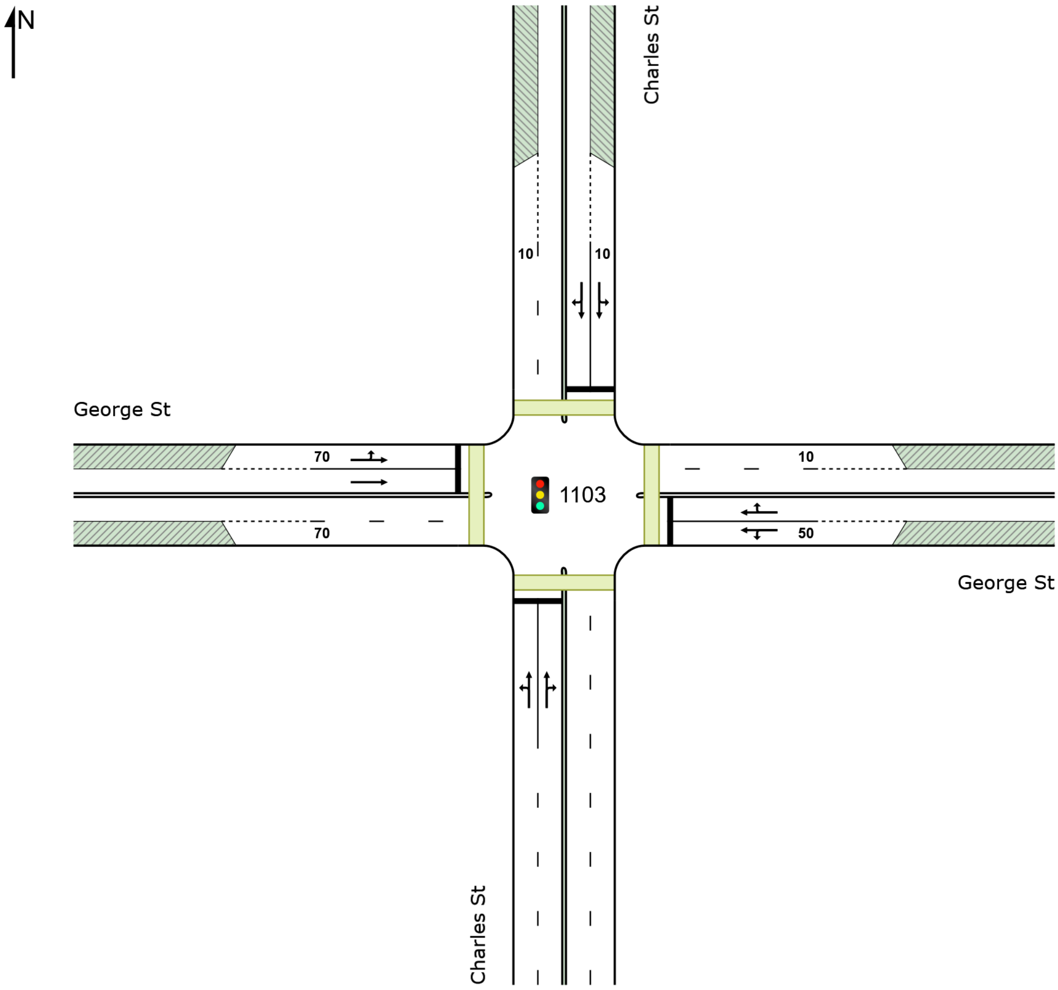
Site: 1103 [TCS 1103 - George St Charles St - SAT 1200-1300 (Site Folder: General)]

George St Charles St Parramatta, SAT Peak Existing
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 38 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Charles St															
1	L2	21	5.0	22	5.0		0.124	17.3	LOS B	0.8	5.6	0.84	0.66	0.84	34.3
2	T1	155	5.0	163	5.0	*	0.620	16.1	LOS B	4.1	29.6	0.94	0.82	1.02	33.6
3	R2	75	5.0	79	5.0		0.620	19.9	LOS B	4.1	29.6	0.96	0.85	1.06	33.6
Approach		251	5.0	264	5.0		0.620	17.3	LOS B	4.1	29.6	0.94	0.81	1.02	33.7
East: George St															
4	L2	31	5.0	33	5.0		0.058	9.3	LOS A	0.5	3.7	0.56	0.56	0.56	36.8
5	T1	47	5.0	49	5.0		0.140	7.0	LOS A	0.9	6.9	0.67	0.59	0.67	36.3
6	R2	45	5.0	47	5.0	*	0.140	11.0	LOS A	0.9	6.9	0.72	0.61	0.72	36.2
Approach		123	5.0	129	5.0		0.140	9.0	LOS A	0.9	6.9	0.66	0.59	0.66	36.4
North: Charles St															
7	L2	60	5.0	63	5.0		0.201	15.3	LOS B	1.5	11.2	0.79	0.68	0.79	34.9
8	T1	90	5.0	95	5.0		0.201	13.0	LOS A	1.5	11.2	0.83	0.67	0.83	34.6
9	R2	15	5.0	16	5.0		0.201	17.7	LOS B	1.1	8.2	0.86	0.67	0.86	34.4
Approach		165	5.0	174	5.0		0.201	14.3	LOS A	1.5	11.2	0.82	0.68	0.82	34.7
West: George St															
10	L2	25	5.0	26	5.0		0.094	19.5	LOS B	0.5	3.3	0.88	0.68	0.88	33.2
11	T1	133	5.0	140	5.0	*	0.469	17.1	LOS B	2.6	18.8	0.95	0.75	0.95	33.7
Approach		158	5.0	166	5.0		0.469	17.5	LOS B	2.6	18.8	0.94	0.74	0.94	33.6
All Vehicles		697	5.0	734	5.0		0.620	15.2	LOS B	4.1	29.6	0.86	0.72	0.89	34.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

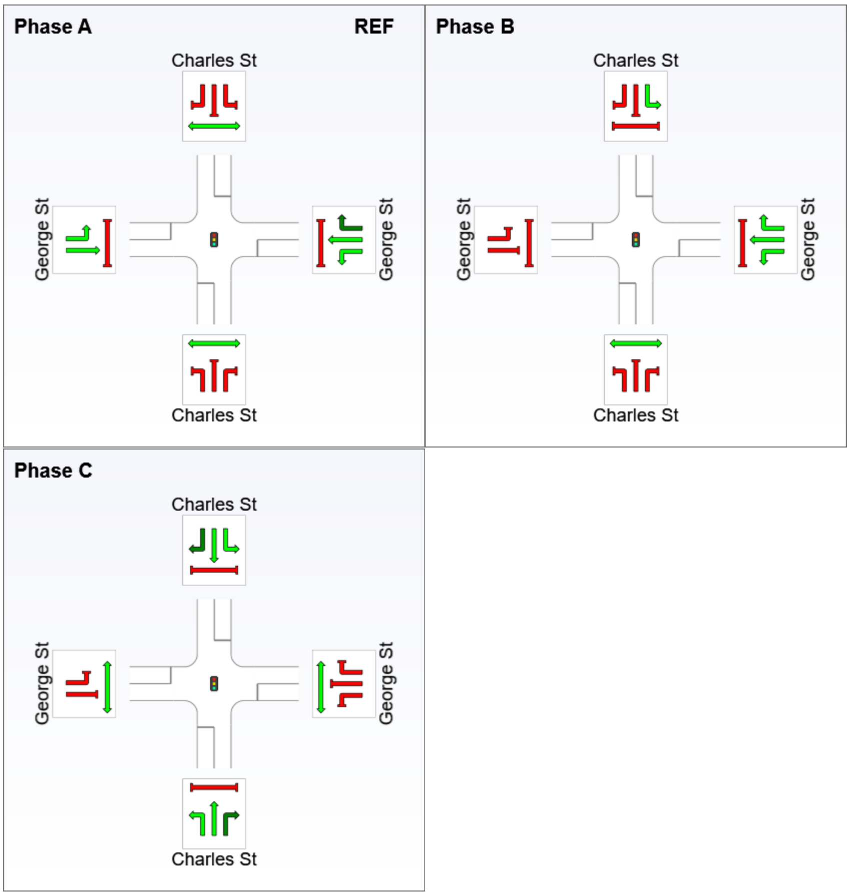
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Charles St												
P1	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20
East: George St												
P2	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20
North: Charles St												
P3	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20
West: George St												
P4	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20
All Pedestrians		200	211	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	12	24
Green Time (sec)	6	6	8
Phase Time (sec)	12	12	14
Phase Split	32%	32%	37%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

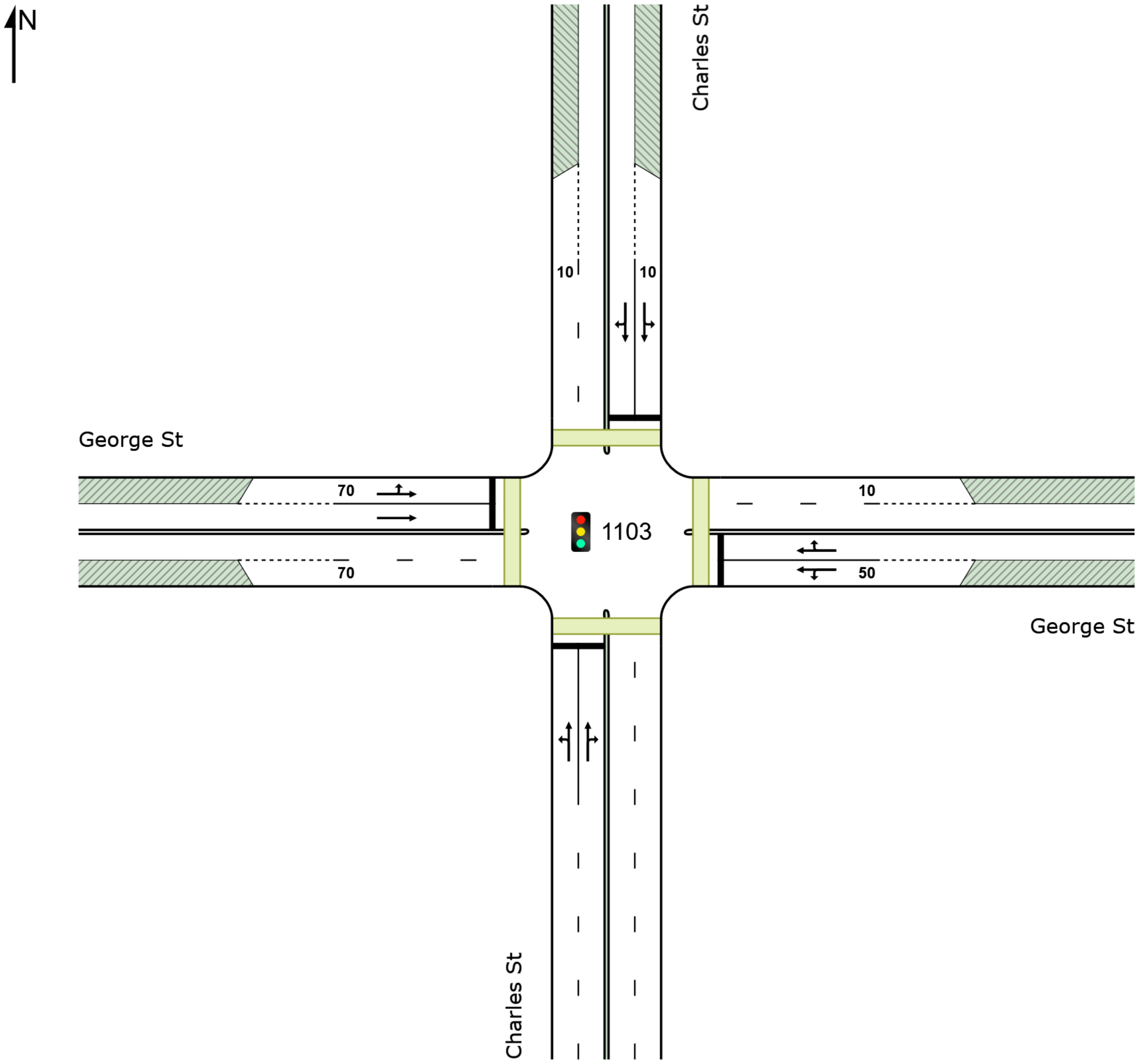
Site: 1103 [TCS 1103 - George St Charles St - SAT 1200-1300 - Detour (Site Folder: Detour)]

George St Charles St Parramatta, SAT Peak Existing
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 38 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Charles St														
1	L2	21	1	22	5.0	0.143	17.4	LOS B	0.9	6.5	0.85	0.66	0.85	34.4
2	T1	155	8	163	5.0	0.715	17.5	LOS B	4.2	31.0	0.95	0.89	1.16	33.2
3	R2	75	4	79	5.0	0.715	21.8	LOS B	4.2	31.0	0.98	0.95	1.25	33.0
Approach		251	13	264	5.0	0.715	18.8	LOS B	4.2	31.0	0.95	0.89	1.16	33.2
East: George St														
4	L2	31	2	33	5.0	0.058	9.3	LOS A	0.5	3.7	0.56	0.56	0.56	36.8
5	T1	47	2	49	5.0	0.140	7.0	LOS A	0.9	6.9	0.67	0.59	0.67	36.3
6	R2	45	2	47	5.0	0.140	11.0	LOS A	0.9	6.9	0.72	0.61	0.72	36.2
Approach		123	6	129	5.0	0.140	9.0	LOS A	0.9	6.9	0.66	0.59	0.66	36.4
North: Charles St														
7	L2	661	33	696	5.0	* 0.841	21.1	LOS B	14.0	102.4	0.83	0.97	1.16	43.0
8	T1	90	5	95	5.0	0.307	14.6	LOS B	1.9	13.6	0.88	0.70	0.88	34.3
9	R2	15	1	16	5.0	0.307	18.1	LOS B	1.9	13.6	0.88	0.70	0.88	34.4
Approach		766	38	806	5.0	0.841	20.3	LOS B	14.0	102.4	0.84	0.94	1.13	41.6
West: George St														
10	L2	25	1	26	5.0	0.094	19.5	LOS B	0.5	3.3	0.88	0.68	0.88	33.2
11	T1	133	7	140	5.0	* 0.469	17.1	LOS B	2.6	18.8	0.95	0.75	0.95	33.7
Approach		158	8	166	5.0	0.469	17.5	LOS B	2.6	18.8	0.94	0.74	0.94	33.6
All Vehicles		1298	65	1366	5.0	0.841	18.6	LOS B	14.0	102.4	0.86	0.87	1.07	38.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

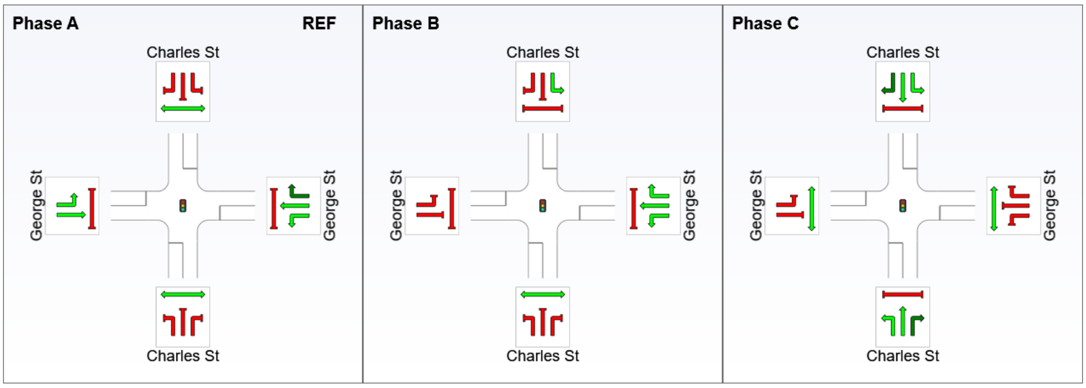
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Charles St												
P1	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20
East: George St												
P2	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20
North: Charles St												
P3	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20
West: George St												
P4	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20
All Pedestrians		200	211	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	12	24
Green Time (sec)	6	6	8
Phase Time (sec)	12	12	14
Phase Split	32%	32%	37%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Gasworks Bridge Closure 2022 update

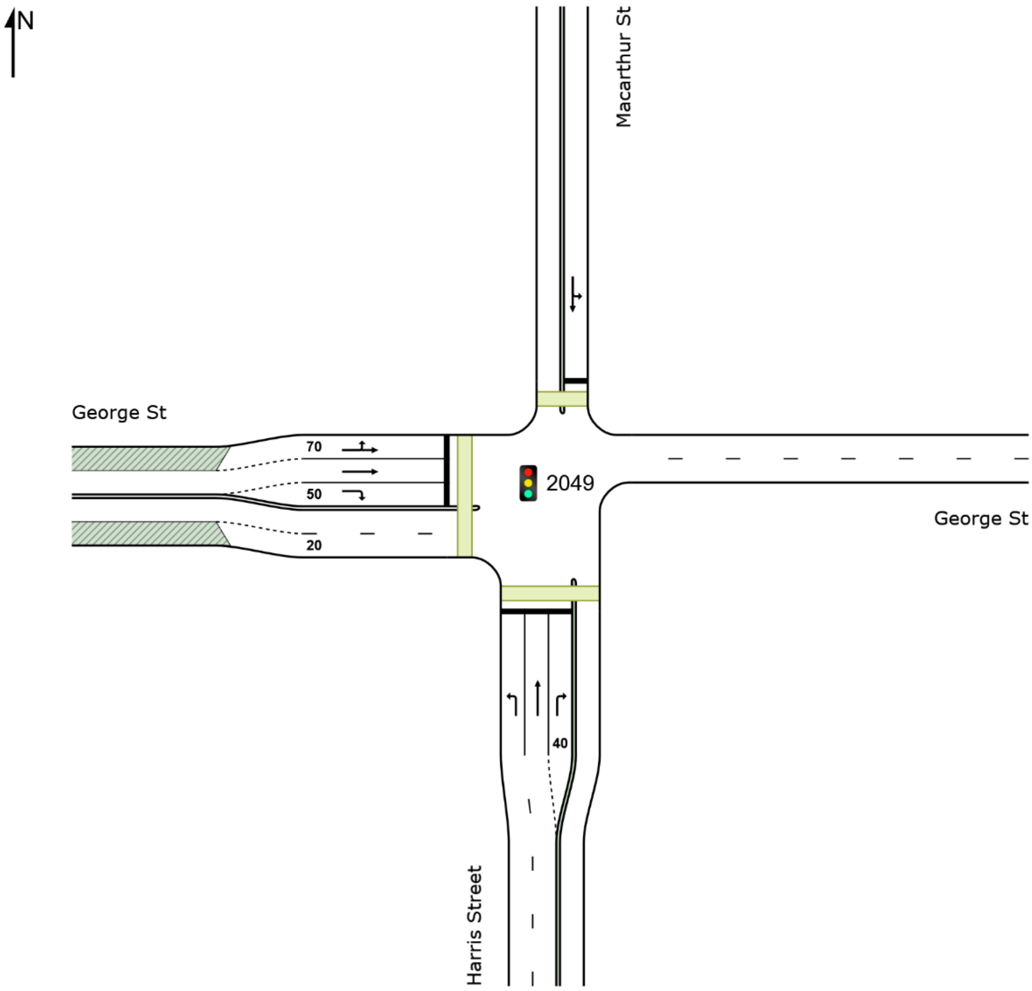
Site: 2049 [TCS 2049 - George St Harris St Macarthur St - SAT1200-1300 - Detour - North shown open (Site Folder: Detour)]

George St Charles St Parramatta, SAT Peak Existing
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 84 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Harris Street														
1	L2	115	6	121	5.0	0.177	22.0	LOS B	3.3	24.0	0.70	0.70	0.70	24.1
2	T1	1	0	1	5.0	0.001	16.8	LOS B	0.0	0.2	0.63	0.38	0.63	30.4
3	R2	368	18	387	5.0	0.908 *	54.4	LOS D	19.6	143.2	1.00	1.00	1.42	17.3
Approach		484	24	509	5.0	0.908	46.7	LOS D	19.6	143.2	0.93	0.93	1.25	18.5
North: Macarthur St														
7	L2	1	0	1	5.0	0.016	43.9	LOS D	0.1	0.6	0.95	0.59	0.95	24.9
8	T1	1	0	1	5.0	0.016 *	40.5	LOS C	0.1	0.6	0.95	0.59	0.95	22.3
Approach		2	0	2	5.0	0.016	42.2	LOS C	0.1	0.6	0.95	0.59	0.95	23.7
West: George St														
10	L2	80	4	84	5.0	0.155	16.7	LOS B	3.1	22.6	0.60	0.60	0.60	32.6
11	T1	180	9	189	5.0	0.155	13.3	LOS A	3.2	23.3	0.60	0.52	0.60	31.2
12	R2	656	33	691	5.0	0.891 *	39.3	LOS C	31.2	227.7	0.92	0.98	1.16	20.6
Approach		916	46	964	5.0	0.891	32.2	LOS C	31.2	227.7	0.83	0.86	1.00	23.9
All Vehicles		1402	70	1476	5.0	0.908	37.2	LOS C	31.2	227.7	0.86	0.88	1.09	21.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

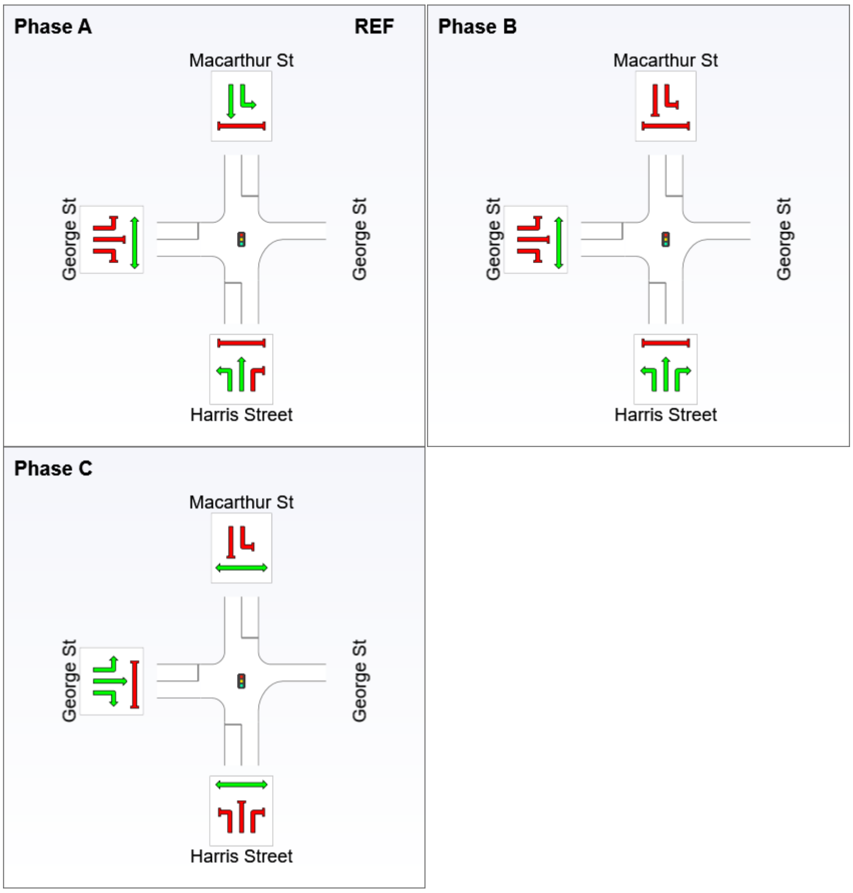
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Harris Street												
P1	Full	50	53	36.3	LOS D	0.1	0.1	0.93	0.93	202.2	215.7	1.07
North: Macarthur St												
P3	Full	50	53	36.3	LOS D	0.1	0.1	0.93	0.93	197.1	209.1	1.06
West: George St												
P4	Full	50	53	36.3	LOS D	0.1	0.1	0.93	0.93	204.8	219.0	1.07
All Pedestrians		150	158	36.3	LOS D	0.1	0.1	0.93	0.93	201.4	214.6	1.07

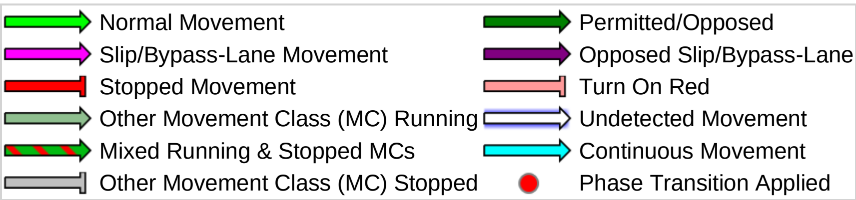
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase



Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	12	38
Green Time (sec)	6	20	40
Phase Time (sec)	12	26	46
Phase Split	14%	31%	55%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

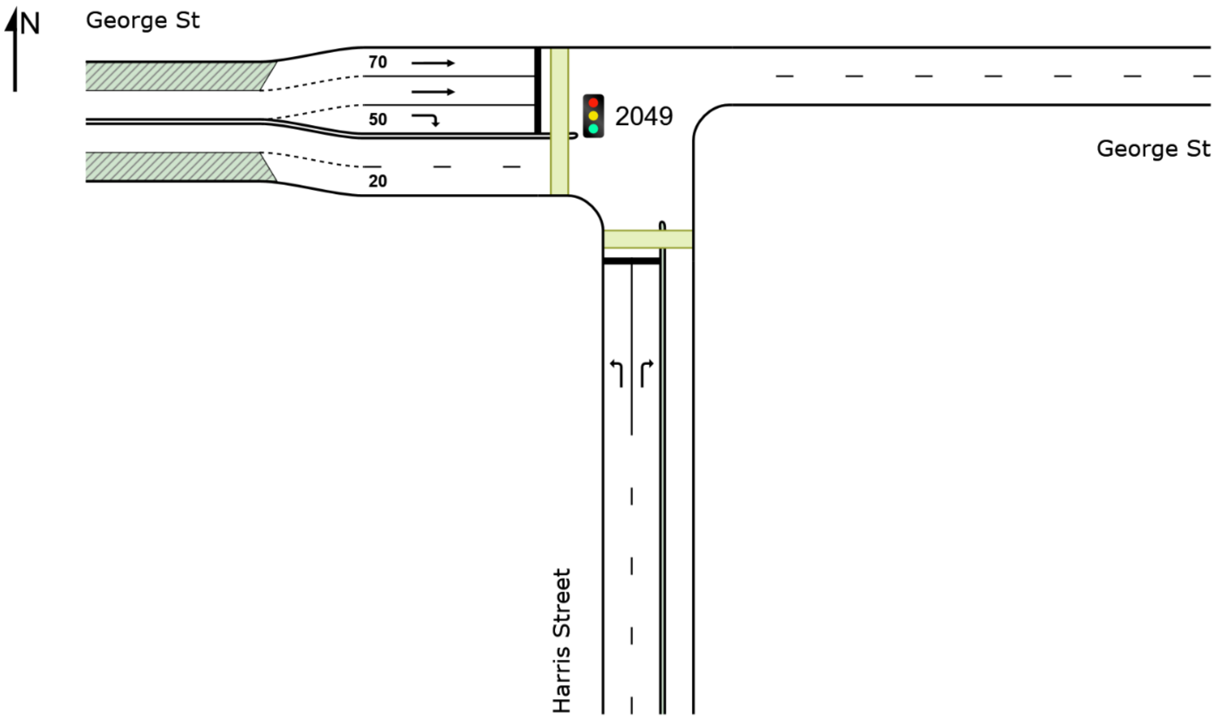
Site: 2049 [TCS 2049 - George St Harris St Macarthur St - SAT1200-1300 - Detour - North shown closed (Site Folder: Detour)]

George St Charles St Parramatta, SAT Peak Existing
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Harris Street														
1	L2	115	6	121	5.0	0.174	20.8	LOS B	3.1	22.7	0.69	0.70	0.69	24.7
3	R2	368	18	387	5.0	* 0.910	53.0	LOS D	18.9	137.9	1.00	1.01	1.44	17.7
Approach		483	24	508	5.0	0.910	45.3	LOS D	18.9	137.9	0.93	0.93	1.26	18.9
West: George St														
11	T1	180	9	189	5.0	0.108	13.0	LOS A	2.1	15.1	0.60	0.47	0.60	31.6
12	R2	656	33	691	5.0	* 0.888	38.5	LOS C	30.3	220.9	0.94	0.98	1.19	21.0
Approach		836	42	880	5.0	0.888	33.0	LOS C	30.3	220.9	0.87	0.87	1.06	23.2
All Vehicles		1319	66	1388	5.0	0.910	37.5	LOS C	30.3	220.9	0.89	0.90	1.14	21.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

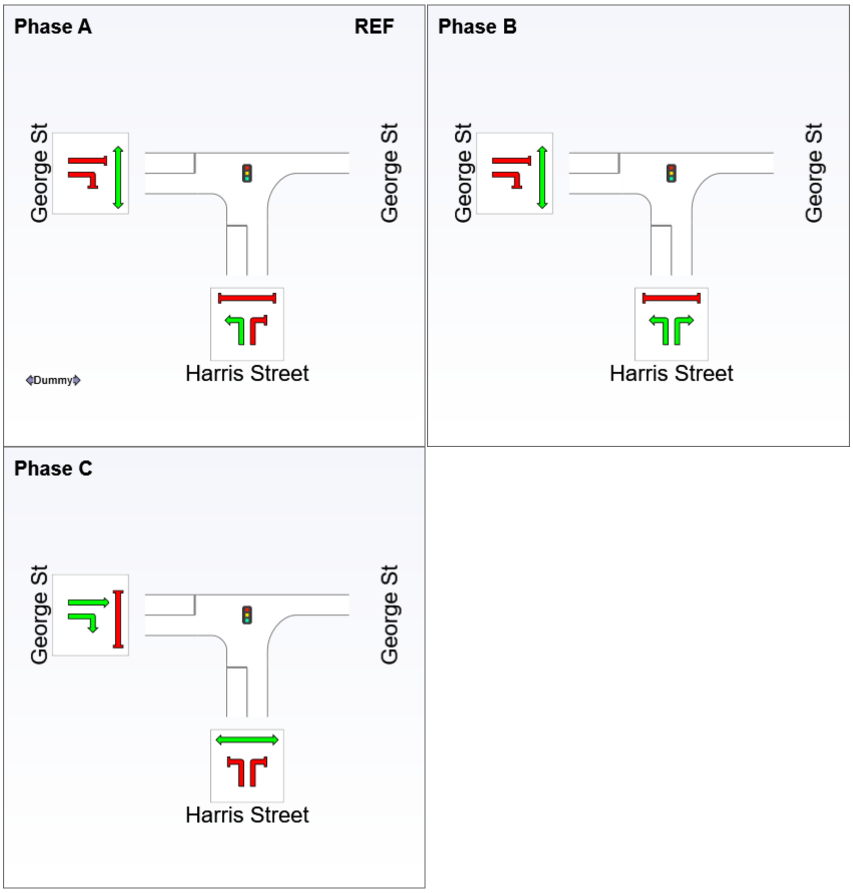
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Harris Street												
P1	Full	50	53	34.3	LOS D	0.1	0.1	0.93	0.93	197.7	212.4	1.07
West: George St												
P4	Full	50	53	34.3	LOS D	0.1	0.1	0.93	0.93	202.8	219.0	1.08
All Pedestrians		100	105	34.3	LOS D	0.1	0.1	0.93	0.93	200.2	215.7	1.08

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase

Normal Movement
Slip/Bypass-Lane Movement
Stopped Movement
Other Movement Class (MC) Running
Mixed Running & Stopped MCs
Other Movement Class (MC) Stopped
Permitted/Opposed
Opposed Slip/Bypass-Lane
Turn On Red
Undetected Movement
Continuous Movement
Phase Transition Applied

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	12	37
Green Time (sec)	6	19	37
Phase Time (sec)	12	25	43
Phase Split	15%	31%	54%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

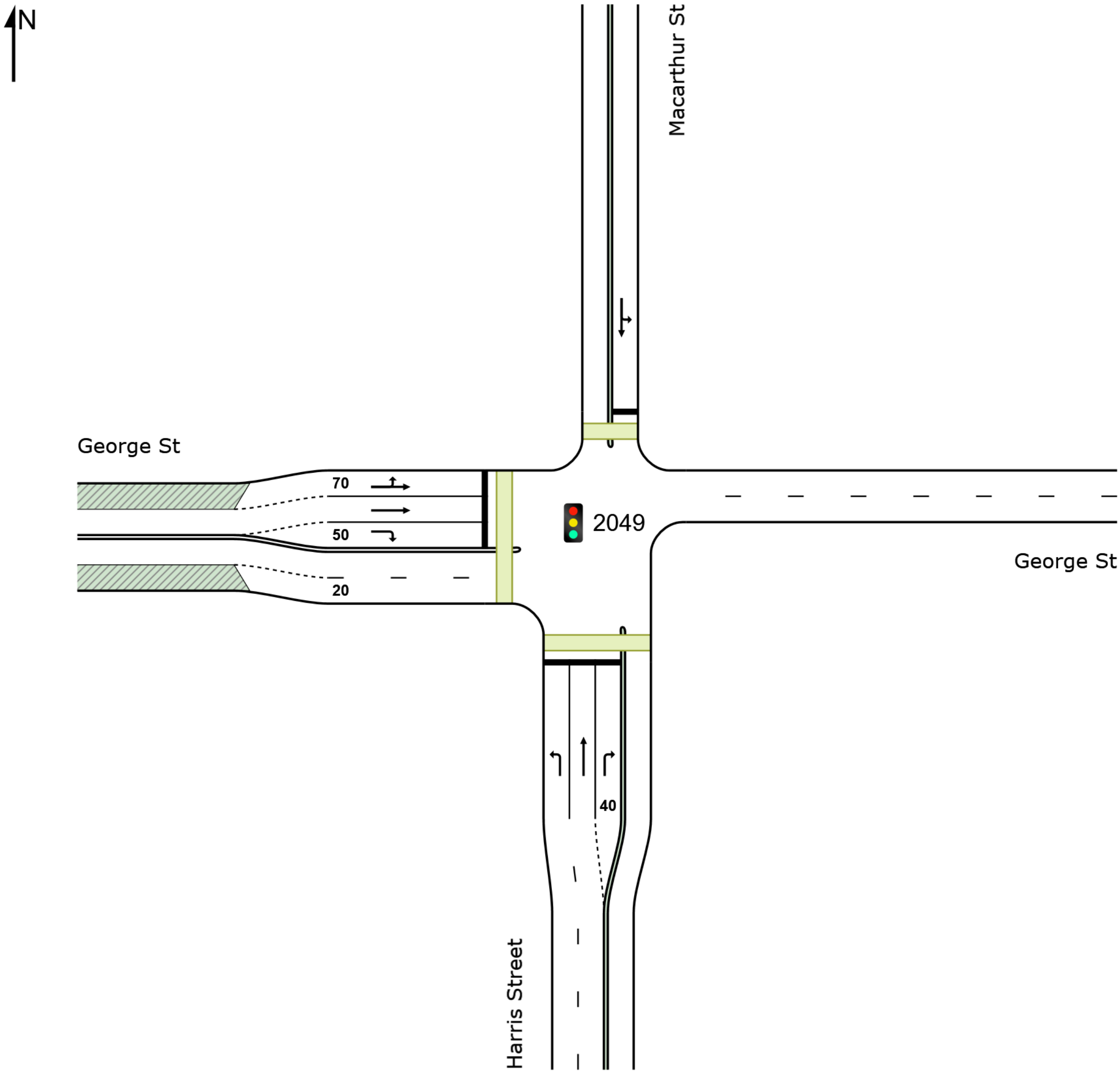
Site: 2049 [TCS 2049 - George St Harris St Macarthur St - SAT1200-1300 (Site Folder: General)]

George St Charles St Parramatta, SAT Peak Existing
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 50 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Harris Street														
1	L2	115	5.0	121	5.0	0.105	7.2	LOS A	1.1	8.3	0.41	0.60	0.41	33.1
2	T1	350	5.0	368	5.0	0.305	4.4	LOS A	4.0	29.5	0.48	0.41	0.48	37.0
3	R2	18	5.0	19	5.0	* 0.088	26.3	LOS B	0.4	3.2	0.92	0.69	0.92	22.6
Approach		483	5.0	508	5.0	0.305	5.8	LOS A	4.0	29.5	0.48	0.47	0.48	35.7
North: Macarthur St														
7	L2	145	5.0	153	5.0	0.848	25.4	LOS B	17.7	129.2	0.97	1.07	1.26	30.2
8	T1	456	5.0	480	5.0	* 0.848	22.0	LOS B	17.7	129.2	0.97	1.07	1.26	28.0
Approach		601	5.0	633	5.0	0.848	22.8	LOS B	17.7	129.2	0.97	1.07	1.26	28.6
West: George St														
10	L2	80	5.0	84	5.0	0.428	27.3	LOS B	2.3	16.6	0.97	0.76	0.97	28.5
11	T1	100	5.0	105	5.0	* 0.428	23.8	LOS B	2.4	17.4	0.97	0.75	0.97	26.9
12	R2	55	5.0	58	5.0	0.269	26.6	LOS B	1.4	10.1	0.95	0.73	0.95	22.4
Approach		235	5.0	247	5.0	0.428	25.7	LOS B	2.4	17.4	0.96	0.75	0.96	26.7
All Vehicles		1319	5.0	1388	5.0	0.848	17.1	LOS B	17.7	129.2	0.79	0.79	0.92	30.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

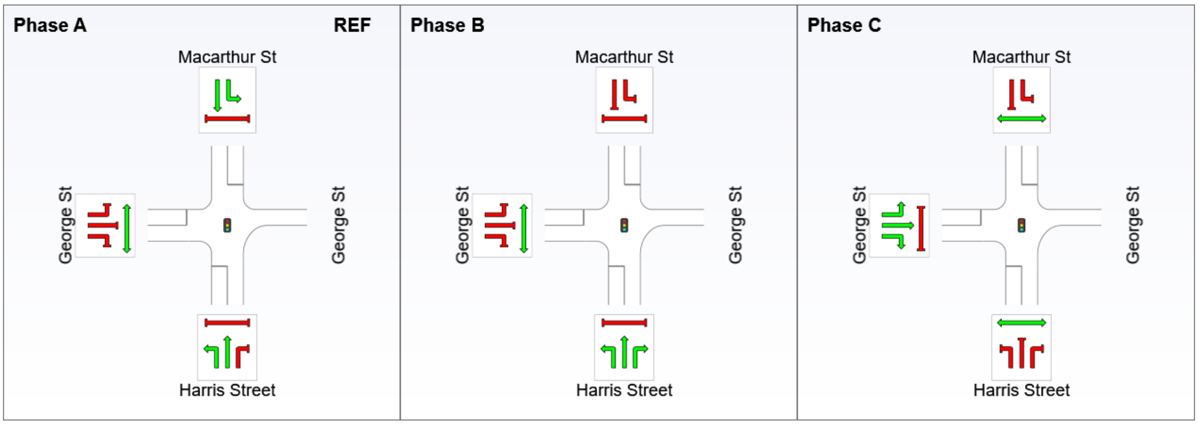
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Harris Street												
P1	Full	50	53	19.4	LOS B	0.1	0.1	0.88	0.88	185.3	215.7	1.16
North: Macarthur St												
P3	Full	50	53	19.4	LOS B	0.1	0.1	0.88	0.88	180.2	209.1	1.16
West: George St												
P4	Full	50	53	19.4	LOS B	0.1	0.1	0.88	0.88	187.9	219.0	1.17
All Pedestrians		150	158	19.4	LOS B	0.1	0.1	0.88	0.88	184.5	214.6	1.16

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	26	38
Green Time (sec)	20	6	6
Phase Time (sec)	26	12	12
Phase Split	52%	24%	24%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Organisation: CIVLINK | Licence: NETWORK / 1PC | Created: Thursday, 3 November 2022 2:52:31 PM
Project: E:\Civlink\Gasworks Bridge Rehabilitation\00_2022 Update\Gasworks Bridge Closure 2022 update.sip9

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Gasworks Bridge Closure 2022 update

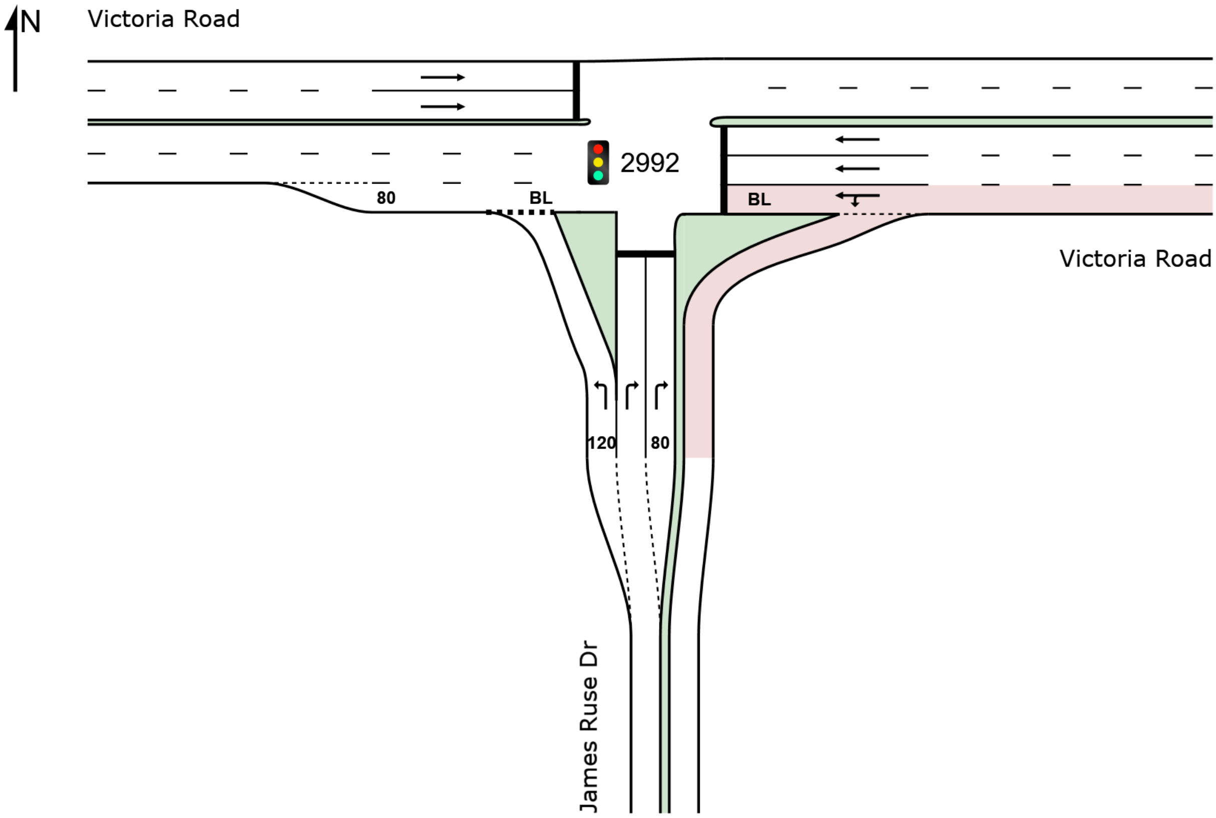
Site: 2992 [TCS 2992 Victoria Road James Ruse Dr - SAT 1200-1300 (Site Folder: General)]

Victoria Road / James Ruse Dr Parramatta - SAT Peak Existing 1200-1300 30 July - 20 Aug Average
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, B
Output Phase Sequence: A, B

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



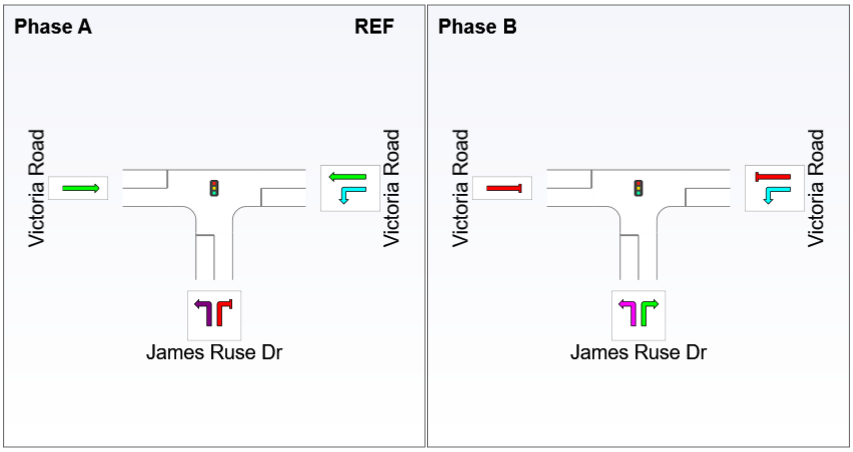
Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: James Ruse Dr														
1	L2	42	2	44	5.0	0.048	7.3	LOS A	0.3	2.2	0.30	0.61	0.30	52.7
3	R2	399	20	420	5.0	* 0.410	27.9	LOS B	5.9	43.4	0.86	0.79	0.86	40.3
Approach		441	22	464	5.0	0.410	25.9	LOS B	5.9	43.4	0.80	0.77	0.80	41.3
East: Victoria Road														
4	L2	697	35	734	5.0	0.409	5.8	LOS A	0.0	0.0	0.00	0.52	0.00	54.6
5	T1	676	35	712	5.1	* 0.347	9.7	LOS A	6.8	50.0	0.60	0.52	0.60	51.8
Approach		1373	70	1445	5.1	0.409	7.7	LOS A	6.8	50.0	0.30	0.52	0.30	53.2
West: Victoria Road														
11	T1	620	31	653	5.0	0.318	9.5	LOS A	6.2	44.9	0.59	0.51	0.59	51.9
Approach		620	31	653	5.0	0.318	9.5	LOS A	6.2	44.9	0.59	0.51	0.59	51.9
All Vehicles		2434	123	2562	5.0	0.410	11.5	LOS A	6.8	50.0	0.46	0.56	0.46	50.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Input Phase Sequence

Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, B



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	B
Phase Change Time (sec)	0	44
Green Time (sec)	38	20
Phase Time (sec)	44	26
Phase Split	63%	37%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Gasworks Bridge Closure 2022 update

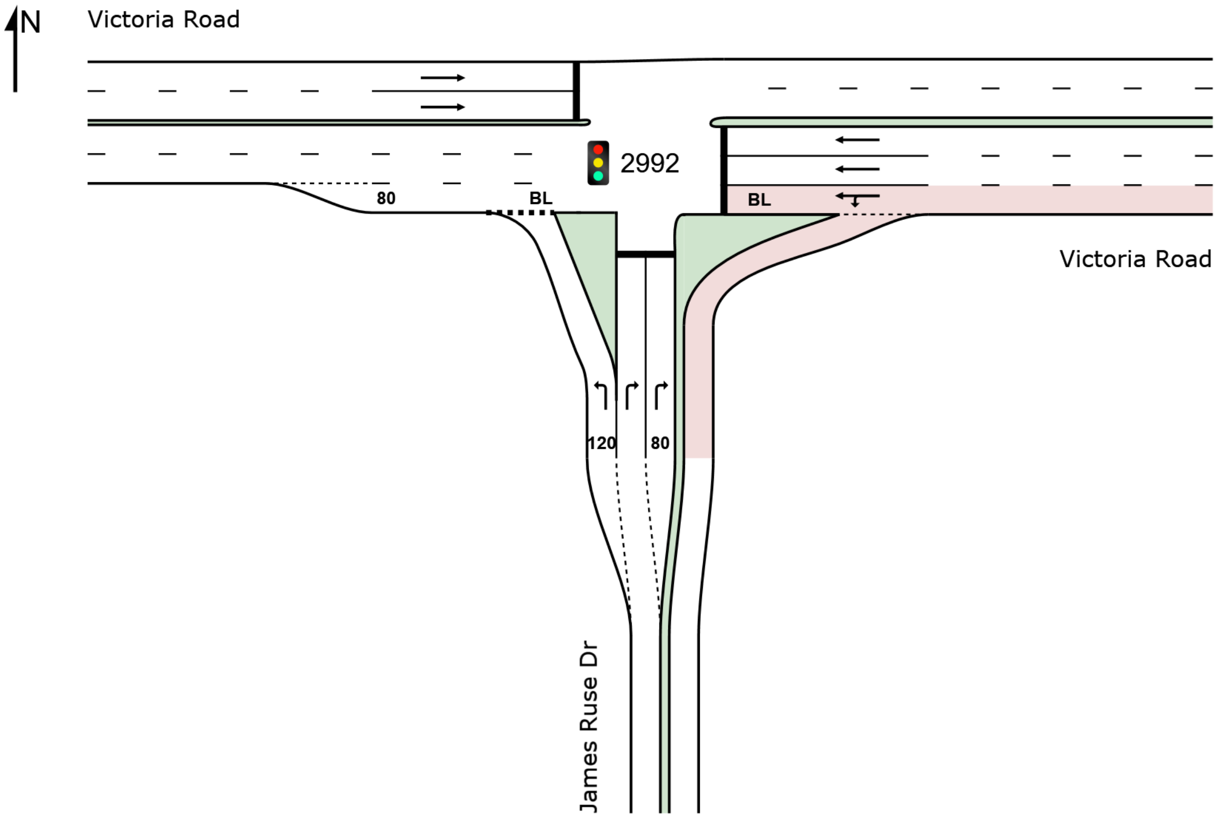
Site: 2992 [TCS 2992 Victoria Road James Ruse Dr - SAT 1200-1300 - Detour 50% Left 50% Right (Site Folder: Detour)]

Victoria Road / James Ruse Dr Parramatta - SAT Peak Existing 1200-1300 30 July - 20 Aug Average
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, B
Output Phase Sequence: A, B

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

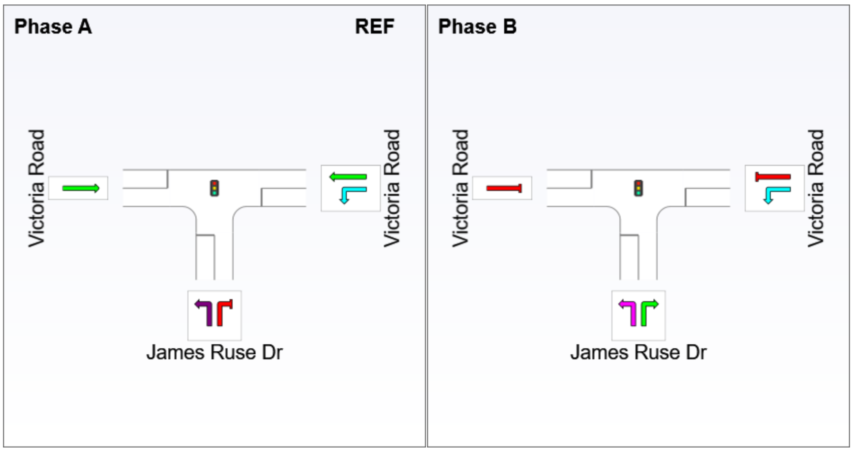
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed

		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: James Ruse Dr														
1	L2	233	11	245	4.8	0.239	9.2	LOS A	2.5	18.2	0.40	0.67	0.40	51.9
3	R2	592	30	623	5.1	* 0.435	22.2	LOS B	7.8	57.2	0.77	0.79	0.77	43.0
Approach		825	41	868	5.0	0.435	18.5	LOS B	7.8	57.2	0.67	0.76	0.67	45.2
East: Victoria Road														
4	L2	697	35	734	5.0	0.409	5.8	LOS A	0.0	0.0	0.00	0.52	0.00	54.6
5	T1	676	35	712	5.1	* 0.440	15.3	LOS B	8.6	63.0	0.75	0.65	0.75	48.0
Approach		1373	70	1445	5.1	0.440	10.5	LOS A	8.6	63.1	0.37	0.58	0.37	51.1
West: Victoria Road														
11	T1	620	31	653	5.0	0.403	15.0	LOS B	7.8	56.6	0.74	0.63	0.74	48.2
Approach		620	31	653	5.0	0.403	15.0	LOS B	7.8	56.6	0.74	0.63	0.74	48.2
All Vehicles		2818	142	2966	5.0	0.440	13.8	LOS A	8.6	63.1	0.54	0.64	0.54	48.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Input Phase Sequence

Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, B



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement

	Mixed Running & Stopped MCs		Continuous Movement
	Other Movement Class (MC) Stopped		Phase Transition Applied

Phase Timing Summary

Phase	A	B
Phase Change Time (sec)	0	36
Green Time (sec)	30	28
Phase Time (sec)	36	34
Phase Split	51%	49%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

USER REPORT FOR SITE

All Movement Classes **Template: Report**

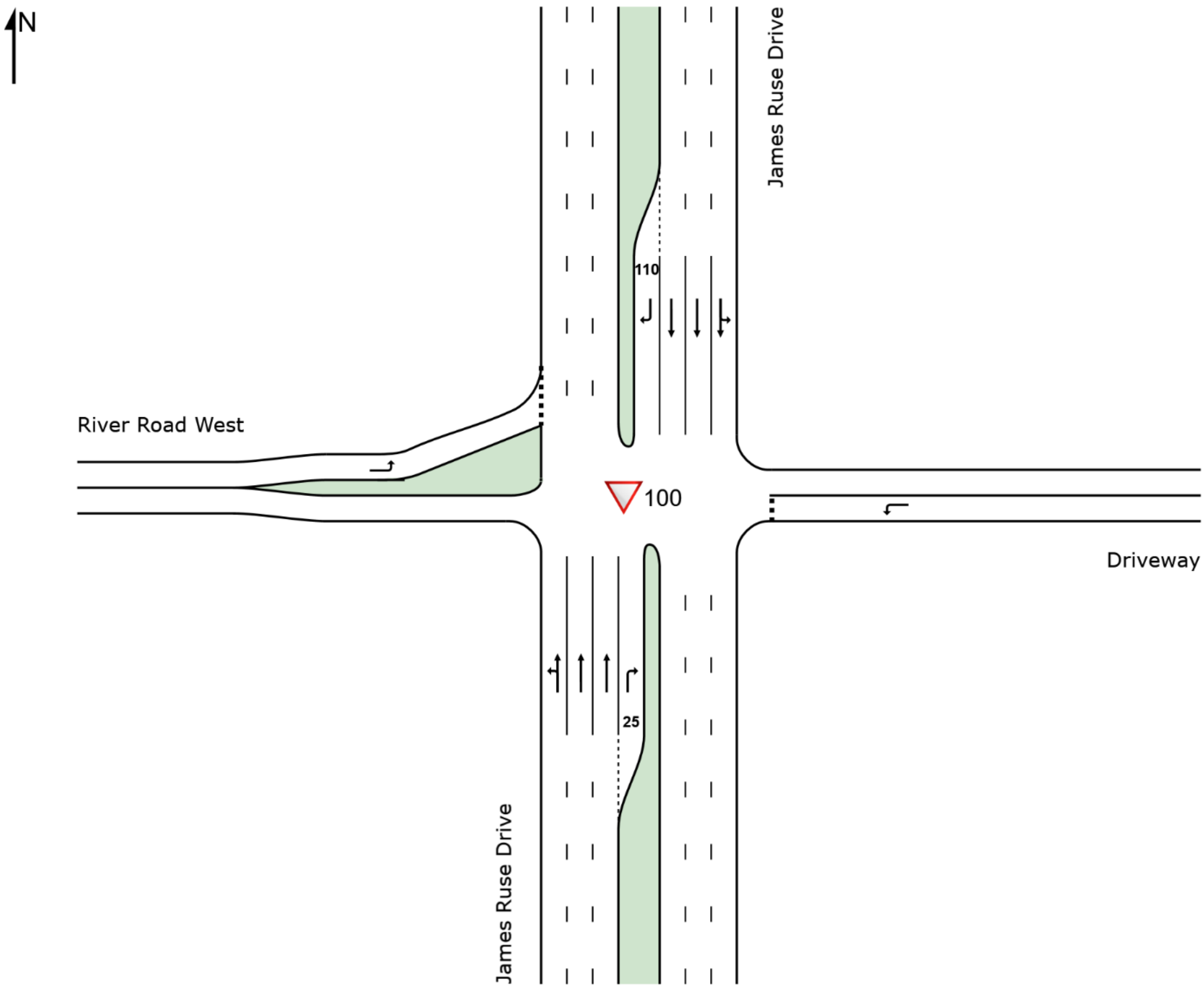
Project: Gasworks Bridge Closure 2022 update

Site: 100 [James Ruse Drive / River Road West -SAT Peak (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h

South: James Ruse Drive														
1	L2	50	5.0	51	5.0	0.370	5.6	LOS A	0.0	0.0	0.00	0.04	0.00	56.8
2	T1	2020	5.0	2040	5.0	0.370	0.1	LOS A	0.0	0.0	0.00	0.01	0.00	59.6
3	R2	1	5.0	1	5.0	0.007	30.3	LOS C	0.0	0.1	0.92	0.92	0.92	27.8
Approach		2071	5.0	2092	5.0	0.370	0.2	NA	0.0	0.1	0.00	0.01	0.00	59.5
East: Driveway														
4	L2	1	5.0	1	5.0	0.003	14.9	LOS B	0.0	0.1	0.73	0.74	0.73	37.0
Approach		1	5.0	1	5.0	0.003	14.9	LOS B	0.0	0.1	0.73	0.74	0.73	37.0
North: James Ruse Drive														
7	L2	1	5.0	1	5.0	0.467	5.8	LOS A	0.0	0.0	0.00	0.00	0.00	56.6
8	T1	1920	5.0	1939	5.0	0.467	1.5	LOS A	2.6	19.1	0.08	0.00	0.10	58.0
9	R2	301	5.0	304	5.0	1.224	250.6	LOS F	42.7	312.0	1.00	3.57	10.67	11.5
Approach		2222	5.0	2244	5.0	1.224	35.3	NA	42.7	312.0	0.20	0.48	1.53	34.2
West: River Road West														
10	L2	340	5.0	343	5.0	0.632	14.4	LOS A	4.1	30.1	0.70	1.05	1.28	47.9
Approach		340	5.0	343	5.0	0.632	14.4	LOS A	4.1	30.1	0.70	1.05	1.28	47.9
All Vehicles		4634	5.0	4681	5.0	1.224	18.1	NA	42.7	312.0	0.15	0.32	0.83	43.2

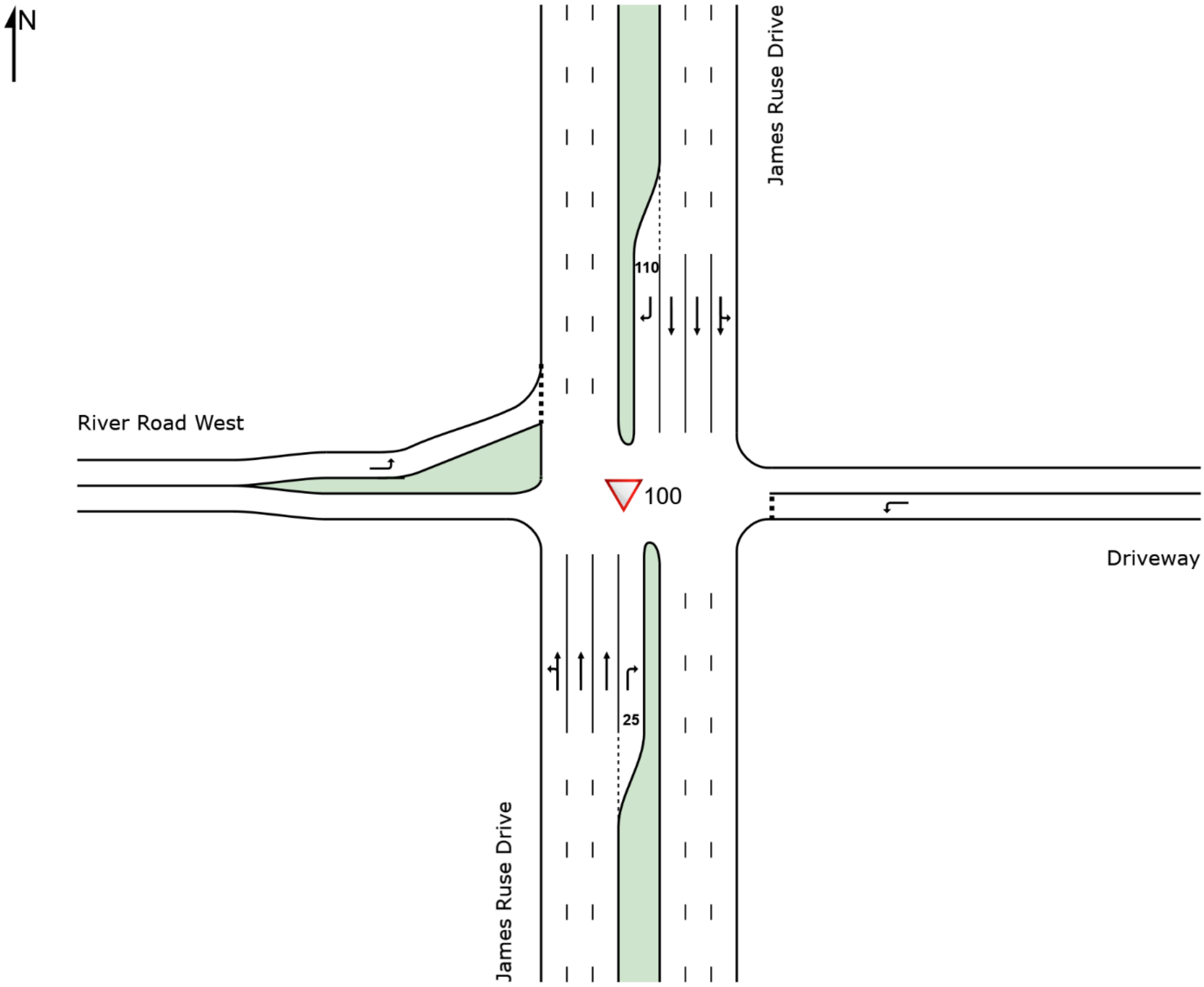
Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Site: 100 [James Ruse Drive / River Road West -SAT Peak - 40% NB Detour (Site Folder: Detour)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: James Ruse Drive														
1	L2	50	3	51	5.0	0.370	5.6	LOS A	0.0	0.0	0.00	0.04	0.00	56.8
2	T1	2020	101	2040	5.0	0.370	0.1	LOS A	0.0	0.0	0.00	0.01	0.00	59.6
3	R2	1	0	1	5.0	0.007	30.3	LOS C	0.0	0.1	0.92	0.92	0.92	27.8
Approach		2071	104	2092	5.0	0.370	0.2	NA	0.0	0.1	0.00	0.01	0.00	59.5
East: Driveway														
4	L2	1	0	1	5.0	0.003	14.9	LOS B	0.0	0.1	0.73	0.74	0.73	37.0
Approach		1	0	1	5.0	0.003	14.9	LOS B	0.0	0.1	0.73	0.74	0.73	37.0
North: James Ruse Drive														
7	L2	1	0	1	5.0	0.467	5.8	LOS A	0.0	0.0	0.00	0.00	0.00	56.6
8	T1	1920	96	1939	5.0	0.467	1.5	LOS A	2.6	19.1	0.08	0.00	0.10	58.0
9	R2	301	15	304	5.0	1.224	250.6	LOS F	42.7	312.0	1.00	3.57	10.67	11.5
Approach		2222	111	2244	5.0	1.224	35.3	NA	42.7	312.0	0.20	0.48	1.53	34.2
West: River Road West														

10	L2	494	25	506	5.1	0.713	17.2	LOS B	8.4	61.1	0.82	1.27	1.78	46.3
Approach		494	25	506	5.1	0.713	17.2	LOS B	8.4	61.1	0.82	1.27	1.78	46.3
All Vehicles		4788	240	4843	5.0	1.224	18.2	NA	42.7	312.0	0.18	0.36	0.89	43.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: SIDRA Standard.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CIVLINK | Licence: NETWORK / 1PC | Created: Wednesday, 24 May 2023 6:36:18 PM

Project: E:\Civlink\Gasworks Bridge Rehabilitation\00_2022 Update\Gasworks Bridge Closure 2022 update.sip9

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Gasworks Bridge Closure 2022 update

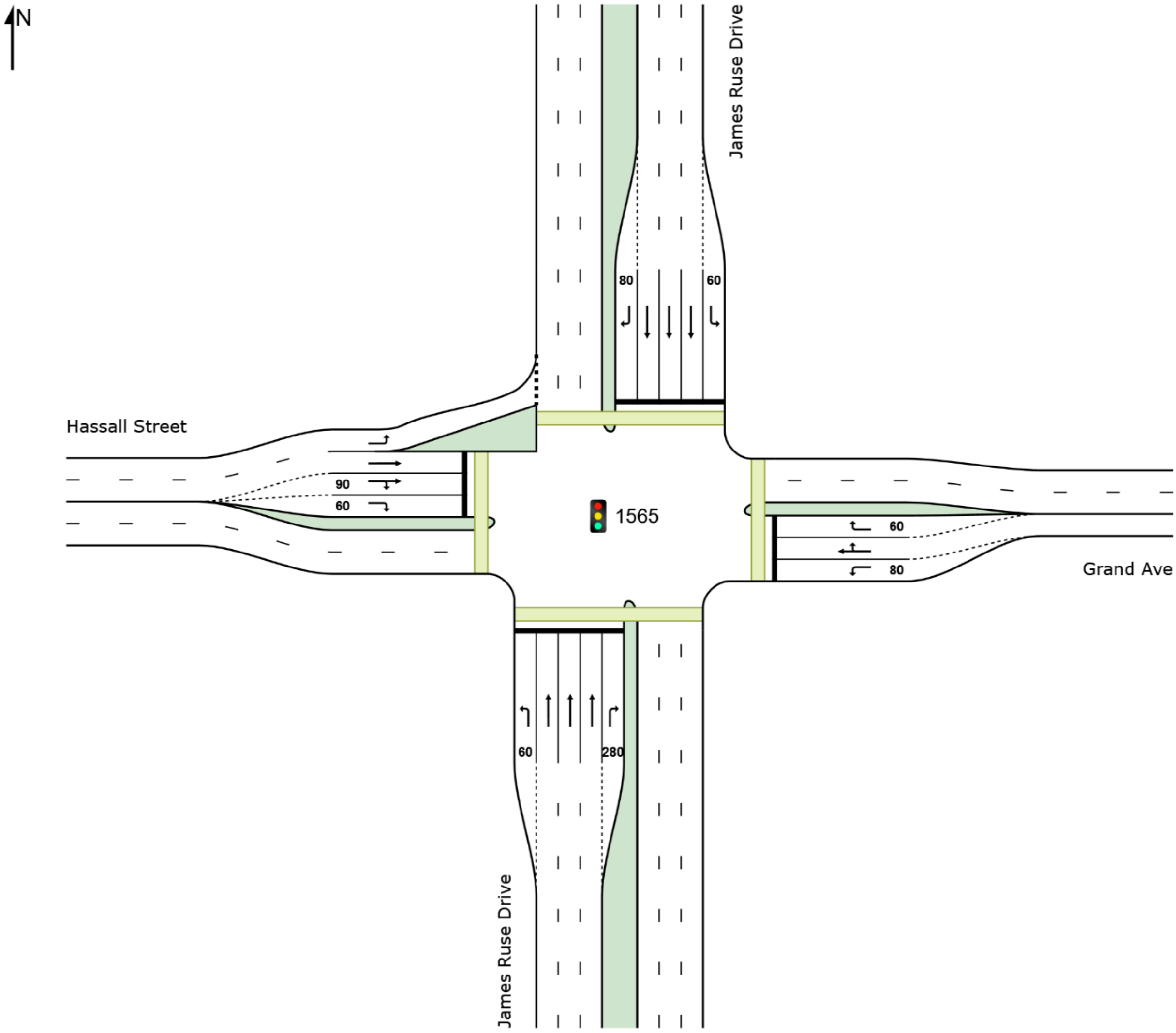
Site: 1565 [TCS1565 - James Ruse Drive / Hassall St / Grand Ave - SAT Peak 1200-1300 - 40% NB Detour (Site Folder: Detour)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance															
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: James Ruse Drive														
1	L2	220	11	222	5.0	0.211	20.9	LOS B	7.5	54.6	0.50	0.72	0.50	38.6
2	T1	1502	75	1517	5.0	0.759	42.2	LOS C	34.3	250.6	0.92	0.82	0.92	35.3
3	R2	86	4	87	5.0	0.382	71.5	LOS F	5.9	43.4	0.96	0.78	0.96	27.1
Approach		1808	90	1826	5.0	0.759	41.0	LOS C	34.3	250.6	0.87	0.80	0.87	35.0
East: Grand Ave														
4	L2	133	7	134	5.0	0.225	43.9	LOS D	7.0	51.0	0.76	0.76	0.76	34.0
5	T1	37	2	37	5.0	* 0.222	58.4	LOS E	4.3	31.6	0.91	0.73	0.91	25.0
6	R2	96	5	97	5.0	0.222	64.1	LOS E	4.3	31.6	0.91	0.75	0.91	29.4
Approach		266	13	269	5.0	0.225	53.2	LOS D	7.0	51.0	0.83	0.75	0.83	31.0
North: James Ruse Drive														
7	L2	68	3	69	5.0	0.070	14.2	LOS A	1.3	9.5	0.49	0.68	0.49	47.4

8	T1	1920	96	1939	5.0	0.985 *	90.8	LOS F	68.8	502.6	0.99	1.18	1.36	23.9
9	R2	222	11	224	5.0	0.987 *	116.2	LOS F	21.6	157.6	1.00	1.09	1.56	16.2
Approach		2210	111	2232	5.0	0.987	91.0	LOS F	68.8	502.6	0.97	1.16	1.35	23.5
West: Hassall Street														
10	L2	576	29	589	5.1	0.739	24.8	LOS B	31.5	230.3	0.85	0.86	0.85	37.6
11	T1	81	4	82	5.0	0.260	58.8	LOS E	5.2	38.2	0.91	0.72	0.91	25.6
12	R2	301	15	304	5.0	0.509 *	67.6	LOS E	10.2	74.8	0.96	0.81	0.96	22.9
Approach		958	48	975	5.0	0.739	41.0	LOS C	31.5	230.3	0.89	0.83	0.89	30.4
All Vehicles		5242	262	5302	5.0	0.987	62.7	LOS E	68.8	502.6	0.92	0.96	1.07	28.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: James Ruse Drive												
P1	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	246.5	230.4	0.93
East: Grand Ave												
P2	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	238.9	220.5	0.92
North: James Ruse Drive												
P3	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	246.5	230.4	0.93
West: Hassall Street												
P4	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	238.9	220.5	0.92
All Pedestrians		200	211	69.3	LOS F	0.2	0.2	0.96	0.96	242.7	225.5	0.93

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: Leading Right Turn
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F

REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	63	94	125
Green Time (sec)	57	25	25	19
Phase Time (sec)	63	31	31	25
Phase Split	42%	21%	21%	17%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

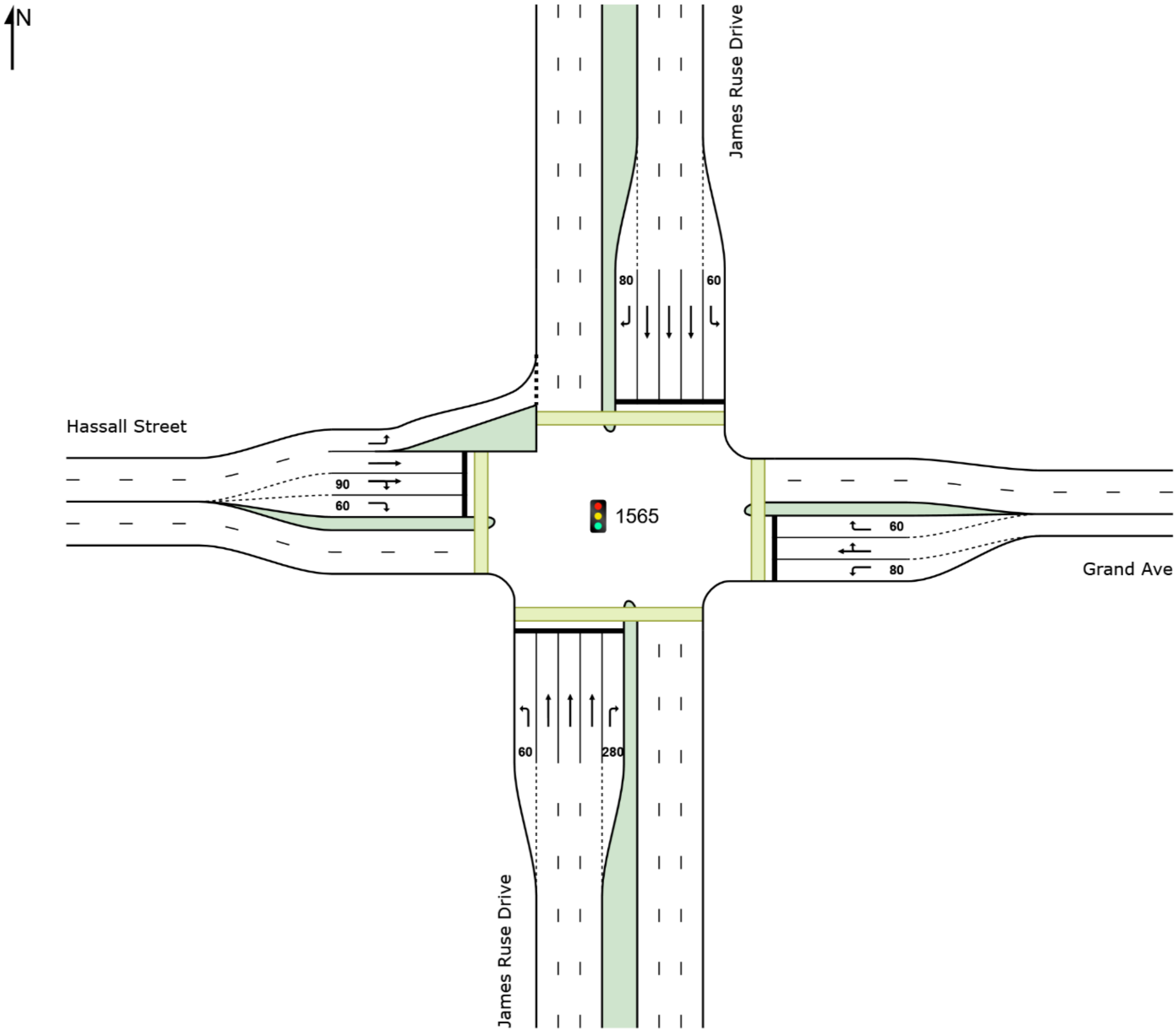
Site: 1565 [TCS1565 - James Ruse Drive / Hassall St / Grand Ave - SAT Peak 1200-1300 (Site Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: James Ruse Drive														
1	L2	220	5.0	222	5.0	0.211	20.9	LOS B	7.5	54.6	0.50	0.72	0.50	38.6
2	T1	1502	5.0	1517	5.0	0.759	42.2	LOS C	34.3	250.6	0.92	0.82	0.92	35.3
3	R2	86	5.0	87	5.0	0.382	71.5	LOS F	5.9	43.4	0.96	0.78	0.96	27.1

Approach		1808	5.0	1826	5.0	0.759	41.0	LOS C	34.3	250.6	0.87	0.80	0.87	35.0
East: Grand Ave														
4	L2	133	5.0	134	5.0	0.225	43.9	LOS D	7.0	51.0	0.76	0.76	0.76	34.0
5	T1	37	5.0	37	5.0	* 0.222	58.4	LOS E	4.3	31.6	0.91	0.73	0.91	25.0
6	R2	96	5.0	97	5.0	0.222	64.1	LOS E	4.3	31.6	0.91	0.75	0.91	29.4
Approach		266	5.0	269	5.0	0.225	53.2	LOS D	7.0	51.0	0.83	0.75	0.83	31.0
North: James Ruse Drive														
7	L2	68	5.0	69	5.0	0.070	14.2	LOS A	1.3	9.5	0.49	0.68	0.49	47.4
8	T1	1920	5.0	1939	5.0	* 0.985	90.8	LOS F	68.8	502.6	0.99	1.18	1.36	23.9
9	R2	222	5.0	224	5.0	* 0.987	116.2	LOS F	21.6	157.6	1.00	1.09	1.56	16.2
Approach		2210	5.0	2232	5.0	0.987	91.0	LOS F	68.8	502.6	0.97	1.16	1.35	23.5
West: Hassall Street														
10	L2	422	5.0	426	5.0	0.535	19.8	LOS B	16.8	123.0	0.64	0.77	0.64	40.5
11	T1	81	5.0	82	5.0	0.260	58.8	LOS E	5.2	38.2	0.91	0.72	0.91	25.6
12	R2	301	5.0	304	5.0	* 0.509	67.6	LOS E	10.2	74.8	0.96	0.81	0.96	22.9
Approach		804	5.0	812	5.0	0.535	41.6	LOS C	16.8	123.0	0.79	0.78	0.79	30.2
All Vehicles		5088	5.0	5139	5.0	0.987	63.5	LOS E	68.8	502.6	0.90	0.95	1.06	28.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

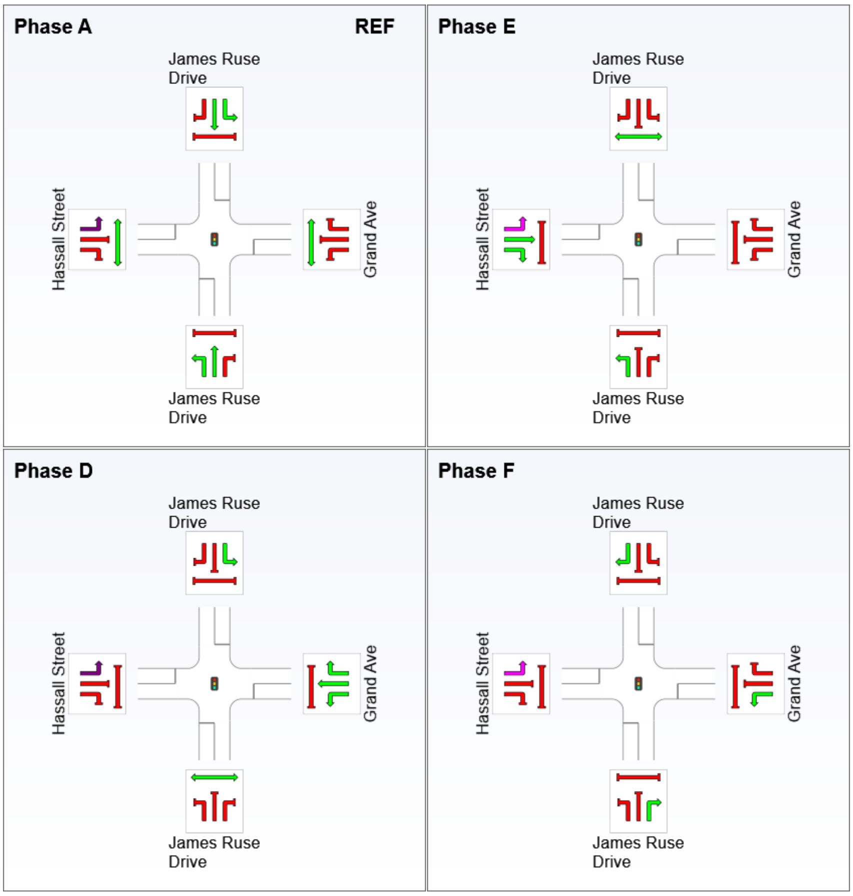
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: James Ruse Drive												
P1	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	246.5	230.4	0.93
East: Grand Ave												
P2	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	238.9	220.5	0.92
North: James Ruse Drive												
P3	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	246.5	230.4	0.93
West: Hassall Street												
P4	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	238.9	220.5	0.92
All Pedestrians		200	211	69.3	LOS F	0.2	0.2	0.96	0.96	242.7	225.5	0.93

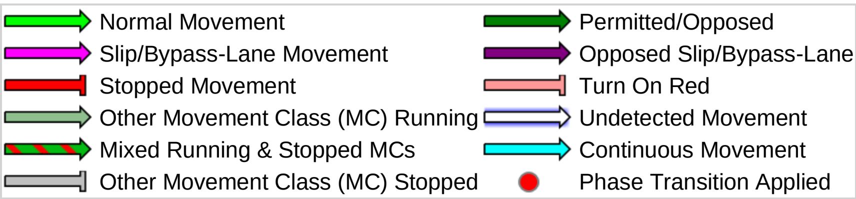
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: Leading Right Turn
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F



REF: Reference Phase
VAR: Variable Phase



Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	63	94	125
Green Time (sec)	57	25	25	19
Phase Time (sec)	63	31	31	25
Phase Split	42%	21%	21%	17%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Organisation: CIVLINK | Licence: NETWORK / 1PC | Created: Wednesday, 24 May 2023 6:36:52 PM
Project: E:\Civlink\Gasworks Bridge Rehabilitation\00_2022 Update\Gasworks Bridge Closure 2022 update.sip9

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Gasworks Bridge Closure 2022 update

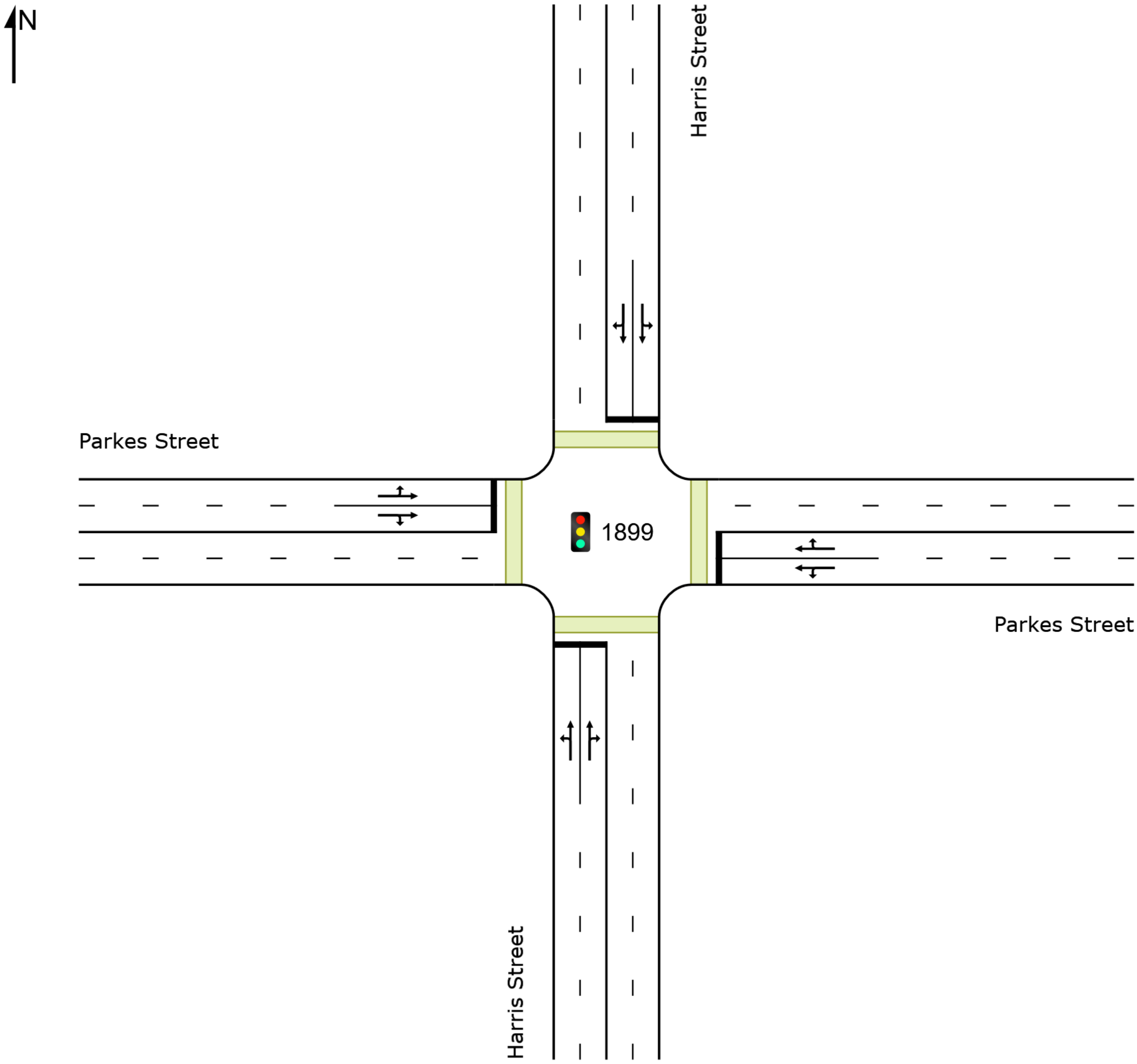
Site: 1899 [TCS 1899 - Harris Street Parkes Street - SAT Peak (Site Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 61 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Harris Street														
1	L2	21	5.0	22	5.0	0.633	36.1	LOS C	4.2	30.9	1.00	0.83	1.10	22.6
2	T1	149	5.0	157	5.0	* 0.633	30.5	LOS C	4.2	30.9	1.00	0.83	1.10	21.8
3	R2	85	5.0	89	5.0	0.633	36.2	LOS C	4.1	30.2	1.00	0.83	1.11	27.0
Approach		255	5.0	268	5.0	0.633	32.8	LOS C	4.2	30.9	1.00	0.83	1.10	23.9
East: Parkes Street														
4	L2	55	5.0	58	5.0	0.428	21.1	LOS B	6.8	49.7	0.79	0.69	0.79	36.8
5	T1	342	5.0	360	5.0	0.428	17.1	LOS B	6.8	49.7	0.82	0.70	0.82	35.8
6	R2	60	5.0	63	5.0	* 0.428	26.1	LOS B	4.7	34.2	0.89	0.72	0.89	30.6

Approach		457	5.0	481	5.0	0.428	18.7	LOS B	6.8	49.7	0.83	0.70	0.83	35.2
North: Harris Street														
7	L2	46	5.0	48	5.0	0.616	30.3	LOS C	7.0	50.8	0.96	0.81	0.98	28.8
8	T1	277	5.0	292	5.0	0.616	24.7	LOS B	7.0	50.8	0.96	0.81	0.98	24.6
9	R2	138	5.0	145	5.0	0.616	30.3	LOS C	6.8	49.9	0.96	0.82	0.98	20.8
Approach		461	5.0	485	5.0	0.616	26.9	LOS B	7.0	50.8	0.96	0.81	0.98	23.9
West: Parkes Street														
10	L2	165	5.0	174	5.0	* 0.869	35.2	LOS C	10.4	76.1	1.00	1.07	1.43	19.0
11	T1	434	5.0	457	5.0	* 0.869	33.1	LOS C	10.4	76.1	1.00	1.06	1.44	26.7
12	R2	2	100.0	2	100.0	0.869	41.7	LOS C	10.4	76.1	1.00	1.06	1.45	19.4
Approach		601	5.3	633	5.3	0.869	33.7	LOS C	10.4	76.1	1.00	1.06	1.44	24.9
All Vehicles		1774	5.1	1867	5.1	0.869	28.0	LOS B	10.4	76.1	0.94	0.87	1.11	26.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

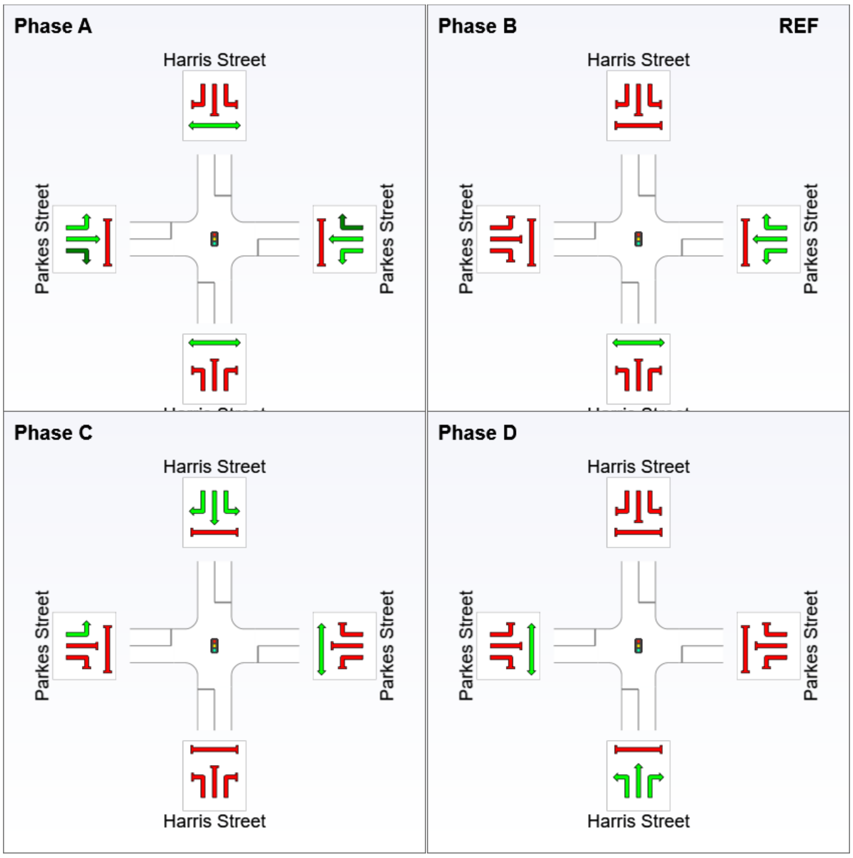
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Harris Street												
P1	Full	50	53	24.8	LOS C	0.1	0.1	0.90	0.90	190.4	215.2	1.13
East: Parkes Street												
P2	Full	50	53	24.8	LOS C	0.1	0.1	0.90	0.90	190.4	215.2	1.13
North: Harris Street												
P3	Full	50	53	24.8	LOS C	0.1	0.1	0.90	0.90	190.4	215.2	1.13
West: Parkes Street												
P4	Full	50	53	24.8	LOS C	0.1	0.1	0.90	0.90	190.4	215.2	1.13
All Pedestrians		200	211	24.8	LOS C	0.1	0.1	0.90	0.90	190.4	215.2	1.13

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: Leading Right Turn
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	B	C	D
Phase Change Time (sec)	44	0	12	31
Green Time (sec)	11	6	13	7
Phase Time (sec)	17	12	19	13
Phase Split	28%	20%	31%	21%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

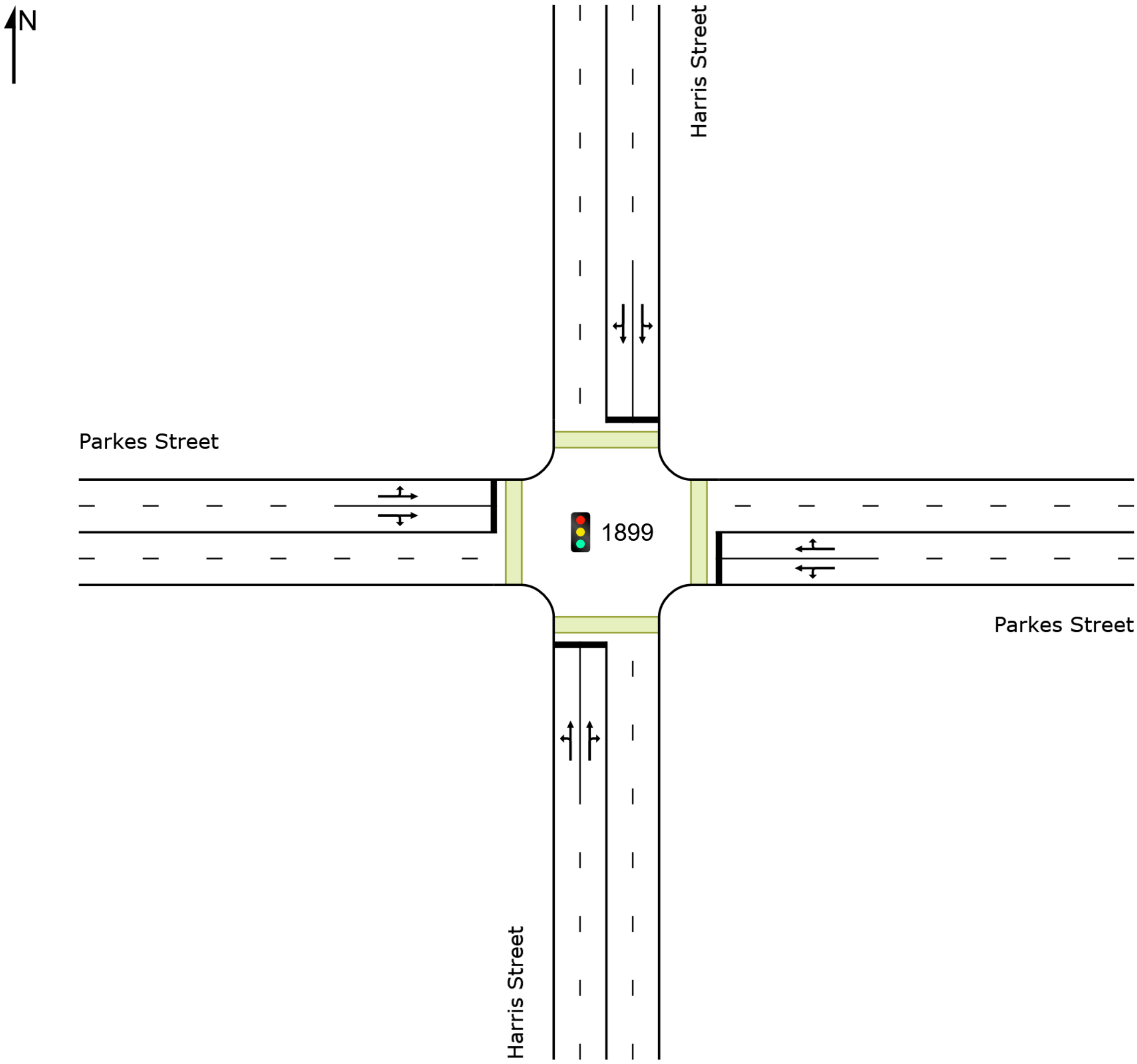
Site: 1899 [TCS 1899 - Harris Street Parkes Street - AM Peak - NB Detour (Site Folder: Detour)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 64 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Harris Street														

1	L2	21	1	22	5.0	0.495	36.6	LOS C	3.2	23.3	0.98	0.76	0.98	22.2
2	T1	75	4	79	5.0	0.495	31.0	LOS C	3.2	23.3	0.98	0.76	0.98	21.8
3	R2	160	8	168	5.0	0.859 *	44.0	LOS D	6.2	45.4	1.00	1.01	1.53	23.6
Approach		256	13	269	5.0	0.859	39.6	LOS C	6.2	45.4	0.99	0.92	1.32	23.1
East: Parkes Street														
4	L2	55	3	58	5.0	0.439	22.0	LOS B	7.3	53.3	0.79	0.70	0.79	36.2
5	T1	342	17	360	5.0	0.439	18.2	LOS B	7.3	53.3	0.83	0.71	0.83	35.0
6	R2	60	3	63	5.0	0.439 *	27.8	LOS B	4.8	35.4	0.90	0.73	0.90	29.5
Approach		457	23	481	5.0	0.439	19.9	LOS B	7.3	53.3	0.83	0.71	0.83	34.4
North: Harris Street														
7	L2	66	4	69	6.5	0.586	29.9	LOS C	7.3	53.7	0.94	0.79	0.94	28.7
8	T1	277	14	292	5.0	0.586	24.3	LOS B	7.3	53.7	0.94	0.80	0.94	24.6
9	R2	138	7	145	5.0	0.586	29.9	LOS C	7.2	52.9	0.94	0.80	0.94	21.0
Approach		481	25	506	5.2	0.586	26.7	LOS B	7.3	53.7	0.94	0.80	0.94	24.2
West: Parkes Street														
10	L2	83	4	87	5.0	0.882 *	41.9	LOS C	11.7	85.7	1.00	1.10	1.46	17.2
11	T1	517	26	544	5.0	0.882 *	37.0	LOS C	11.7	85.7	1.00	1.09	1.47	25.3
12	R2	2	2	2	100.0	0.882	44.2	LOS D	11.6	85.5	1.00	1.08	1.47	18.6
Approach		602	32	634	5.3	0.882	37.7	LOS C	11.7	85.7	1.00	1.09	1.47	24.3
All Vehicles		1796	93	1891	5.2	0.882	30.5	LOS C	11.7	85.7	0.94	0.89	1.14	26.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

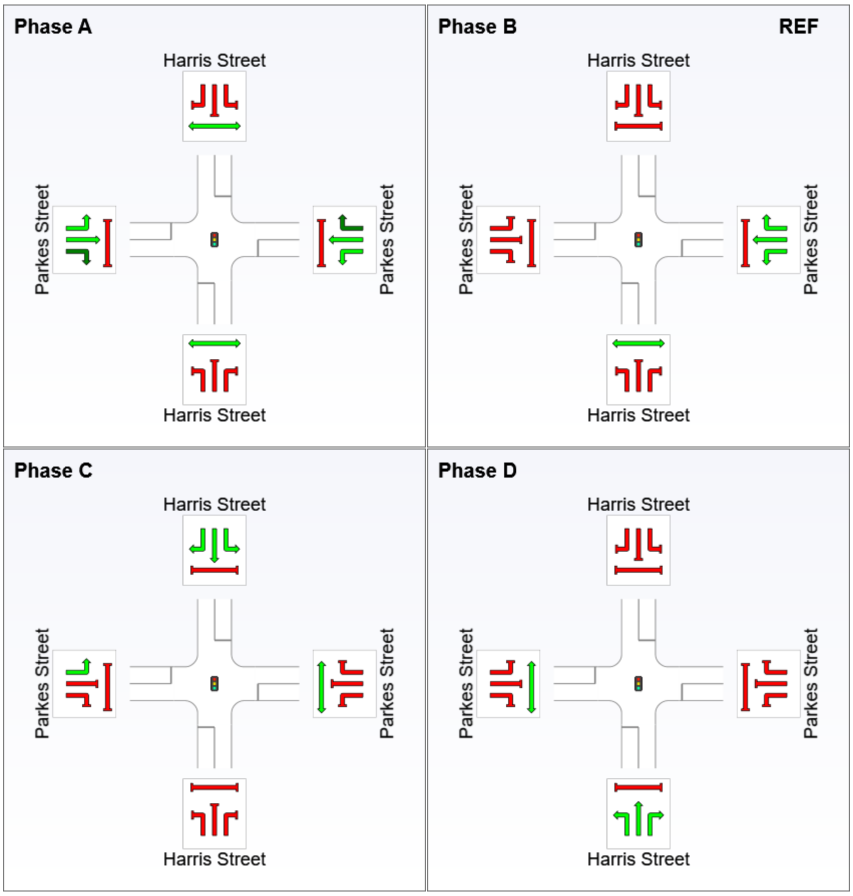
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Harris Street												
P1	Full	50	53	26.3	LOS C	0.1	0.1	0.91	0.91	191.9	215.2	1.12
East: Parkes Street												
P2	Full	50	53	26.3	LOS C	0.1	0.1	0.91	0.91	191.9	215.2	1.12
North: Harris Street												
P3	Full	50	53	26.3	LOS C	0.1	0.1	0.91	0.91	191.9	215.2	1.12
West: Parkes Street												
P4	Full	50	53	26.3	LOS C	0.1	0.1	0.91	0.91	191.9	215.2	1.12
All Pedestrians		200	211	26.3	LOS C	0.1	0.1	0.91	0.91	191.9	215.2	1.12

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: Leading Right Turn
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	**A**	**B**	**C**	**D**
Phase Change Time (sec)	46	0	12	33
Green Time (sec)	12	6	15	7
Phase Time (sec)	18	12	21	13
Phase Split	28%	19%	33%	20%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

APPENDIX C – SIDRA RESULTS – WEEKDAY NB CLOSURE & DETOUR

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Weekday NB Closure

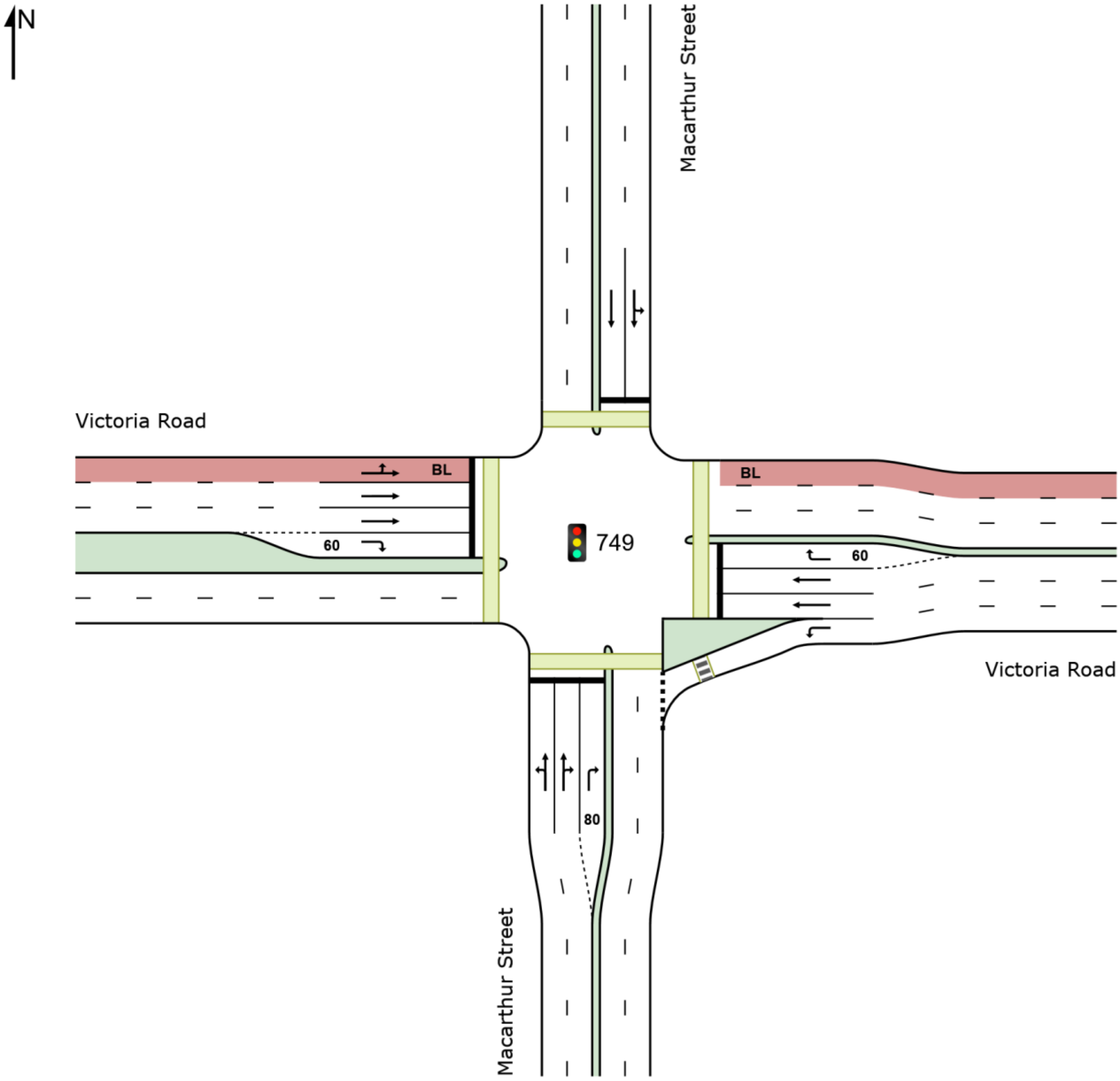
Site: 749 [TCS 749 Victoria Road MacArthur Street - Weekday AM Peak (Site Folder: Weekday - OK)]

Victoria Road / Macarthur Street Parramatta - Weekday AM Peak Existing 0800-0900 26 July - 26 Aug Average
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 68 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Macarthur Street														
1	L2	110	6	116	5.0	0.392	23.0	LOS B	6.5	47.4	0.78	0.72	0.78	44.3
2	T1	162	8	171	5.0	0.392	17.7	LOS B	6.5	47.4	0.80	0.72	0.80	45.0
3	R2	199	13	209	6.5	* 0.392	25.7	LOS B	3.0	22.6	0.93	0.76	0.93	42.0
Approach		471	27	496	5.6	0.392	22.3	LOS B	6.5	47.4	0.85	0.74	0.85	43.5
East: Victoria Road														
4	L2	280	14	295	5.0	0.232	8.1	LOS A	2.5	18.6	0.38	0.66	0.38	52.2
5	T1	784	42	825	5.4	* 0.876	36.4	LOS C	16.3	118.8	1.00	1.07	1.37	37.6

6	R2	218	11	229	5.0	0.870 *	45.5	LOS D	9.0	66.0	1.00	1.03	1.48	33.9
Approach		1282	67	1349	5.2	0.876	31.8	LOS C	16.3	119.1	0.86	0.98	1.17	39.3
North: Macarthur Street														
7	L2	50	3	53	5.0	0.554	34.4	LOS C	5.7	41.5	0.96	0.79	0.96	39.3
8	T1	281	14	296	5.0	0.554 *	29.3	LOS C	5.7	41.5	0.97	0.78	0.97	40.3
Approach		331	17	348	5.0	0.554	30.1	LOS C	5.7	41.5	0.96	0.78	0.96	40.2
West: Victoria Road														
10	L2	53	3	56	5.0	0.167	27.6	LOS B	1.8	15.2	0.82	0.72	0.82	41.0
11	T1	534	38	562	7.1	0.582	24.8	LOS B	8.3	60.3	0.93	0.78	0.93	42.6
12	R2	91	5	96	5.0	0.363	35.3	LOS C	3.0	22.0	0.94	0.77	0.94	37.4
Approach		678	45	714	6.7	0.582	26.4	LOS B	8.3	60.3	0.92	0.77	0.92	41.7
All Vehicles		2762	156	2907	5.6	0.876	28.6	LOS C	16.3	119.1	0.89	0.86	1.03	40.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

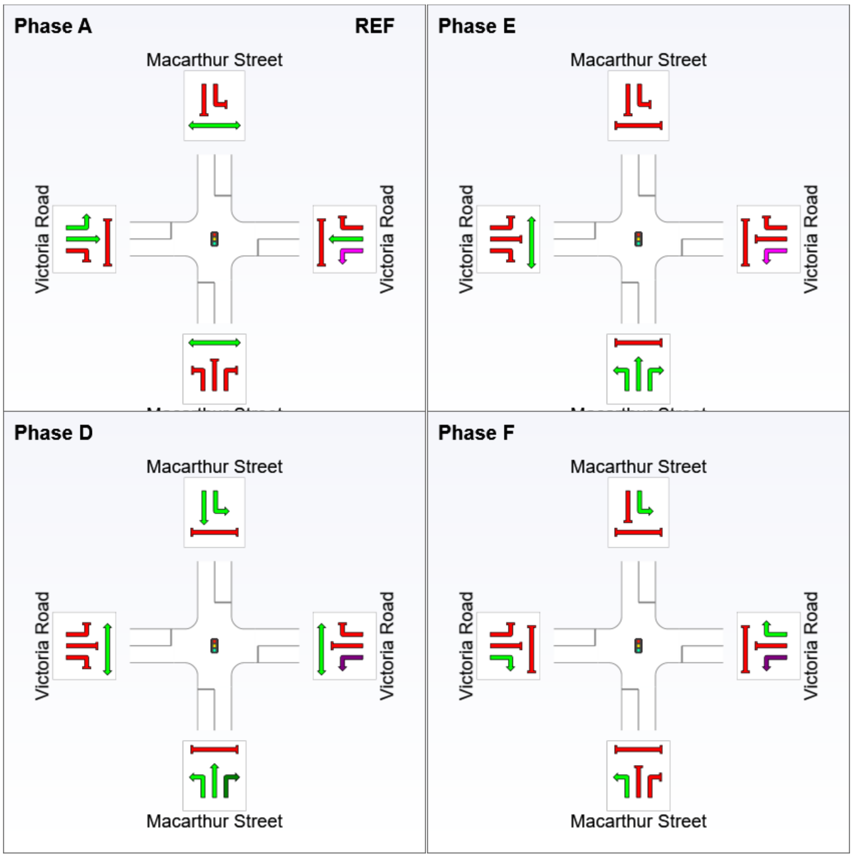
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Macarthur Street												
P1	Full	50	53	28.3	LOS C	0.1	0.1	0.91	0.91	197.2	219.5	1.11
East: Victoria Road												
P2	Full	50	53	28.3	LOS C	0.1	0.1	0.91	0.91	199.7	222.8	1.12
North: Macarthur Street												
P3	Full	50	53	28.3	LOS C	0.1	0.1	0.91	0.91	194.6	216.2	1.11
West: Victoria Road												
P4	Full	50	53	28.3	LOS C	0.1	0.1	0.91	0.91	200.5	223.8	1.12
All Pedestrians		200	211	28.3	LOS C	0.1	0.1	0.91	0.91	198.0	220.6	1.11

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	23	35	52
Green Time (sec)	17	6	11	10
Phase Time (sec)	23	12	17	16
Phase Split	34%	18%	25%	24%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

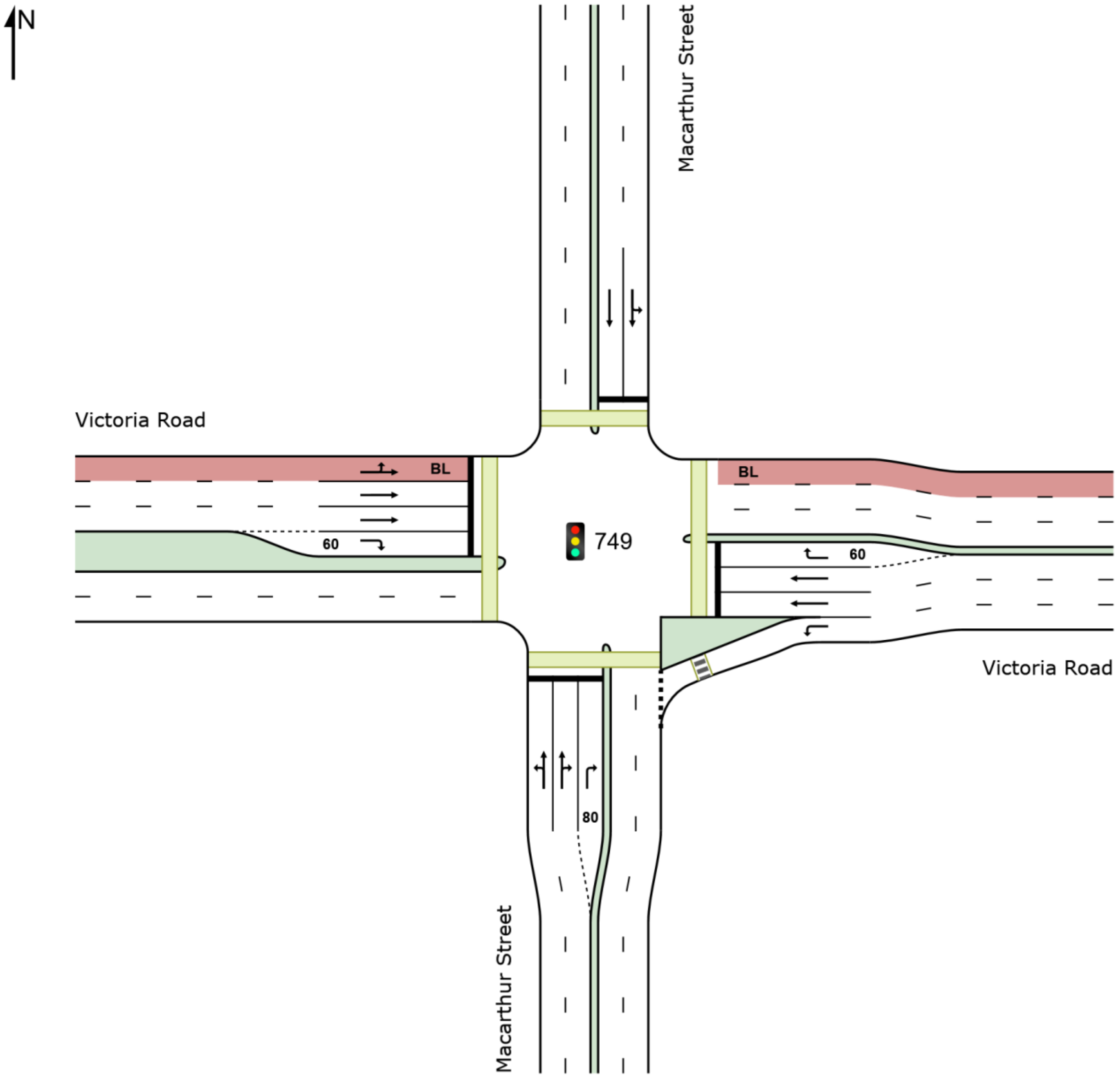
Site: 749 [TCS 749 Victoria Road MacArthur Street - AM Peak 0800-0900 - NB Detour (Site Folder: Weekday - OK)]

Victoria Road / Macarthur Street Parramatta - Weekday AM Peak Existing 0800-0900 26 July - 26 Aug Average
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 68 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h

South: Macarthur Street														
1	L2	110	6	116	5.0	0.392	23.0	LOS B	6.5	47.4	0.78	0.72	0.78	44.3
2	T1	162	8	171	5.0	0.392	17.7	LOS B	6.5	47.4	0.80	0.72	0.80	45.0
3	R2	199	13	209	6.5	* 0.392	25.7	LOS B	3.0	22.6	0.93	0.76	0.93	42.0
Approach		471	27	496	5.6	0.392	22.3	LOS B	6.5	47.4	0.85	0.74	0.85	43.5
East: Victoria Road														
4	L2	532	26	560	4.9	0.440	8.7	LOS A	6.1	44.3	0.47	0.70	0.47	51.8
5	T1	784	42	825	5.4	* 0.876	36.4	LOS C	16.3	118.8	1.00	1.07	1.37	37.6
6	R2	218	11	229	5.0	* 0.870	45.5	LOS D	9.0	66.0	1.00	1.03	1.48	33.9
Approach		1534	79	1615	5.2	0.876	28.1	LOS B	16.3	119.1	0.82	0.94	1.07	40.9
North: Macarthur Street														
7	L2	50	3	53	5.0	0.554	34.4	LOS C	5.7	41.5	0.96	0.79	0.96	39.3
8	T1	281	14	296	5.0	* 0.554	29.3	LOS C	5.7	41.5	0.97	0.78	0.97	40.3
Approach		331	17	348	5.0	0.554	30.1	LOS C	5.7	41.5	0.96	0.78	0.96	40.2
West: Victoria Road														
10	L2	53	3	56	5.0	0.167	27.6	LOS B	1.8	15.2	0.82	0.72	0.82	41.0
11	T1	534	38	562	7.1	0.582	24.8	LOS B	8.3	60.3	0.93	0.78	0.93	42.6
12	R2	91	5	96	5.0	0.363	35.3	LOS C	3.0	22.0	0.94	0.77	0.94	37.4
Approach		678	45	714	6.7	0.582	26.4	LOS B	8.3	60.3	0.92	0.77	0.92	41.7
All Vehicles		3014	168	3173	5.6	0.876	27.0	LOS B	16.3	119.1	0.86	0.85	0.99	41.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

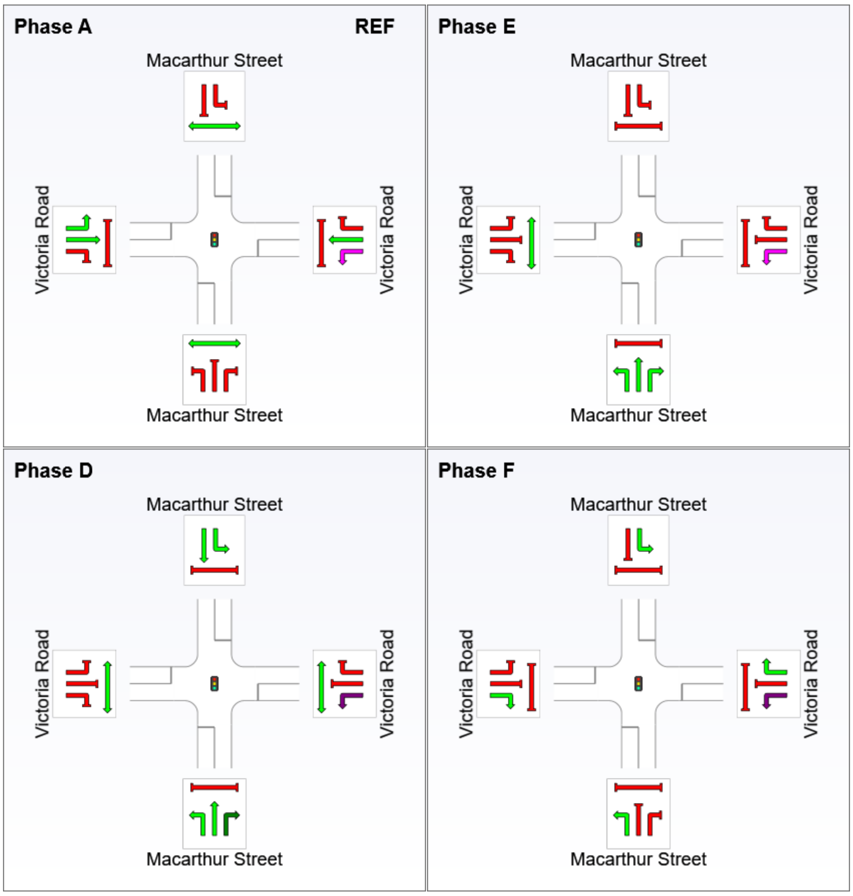
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Macarthur Street												
P1	Full	50	53	28.3	LOS C	0.1	0.1	0.91	0.91	197.2	219.5	1.11
East: Victoria Road												
P2	Full	50	53	28.3	LOS C	0.1	0.1	0.91	0.91	199.7	222.8	1.12
North: Macarthur Street												
P3	Full	50	53	28.3	LOS C	0.1	0.1	0.91	0.91	194.6	216.2	1.11
West: Victoria Road												
P4	Full	50	53	28.3	LOS C	0.1	0.1	0.91	0.91	200.5	223.8	1.12
All Pedestrians		200	211	28.3	LOS C	0.1	0.1	0.91	0.91	198.0	220.6	1.11

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	23	35	52
Green Time (sec)	17	6	11	10
Phase Time (sec)	23	12	17	16
Phase Split	34%	18%	25%	24%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

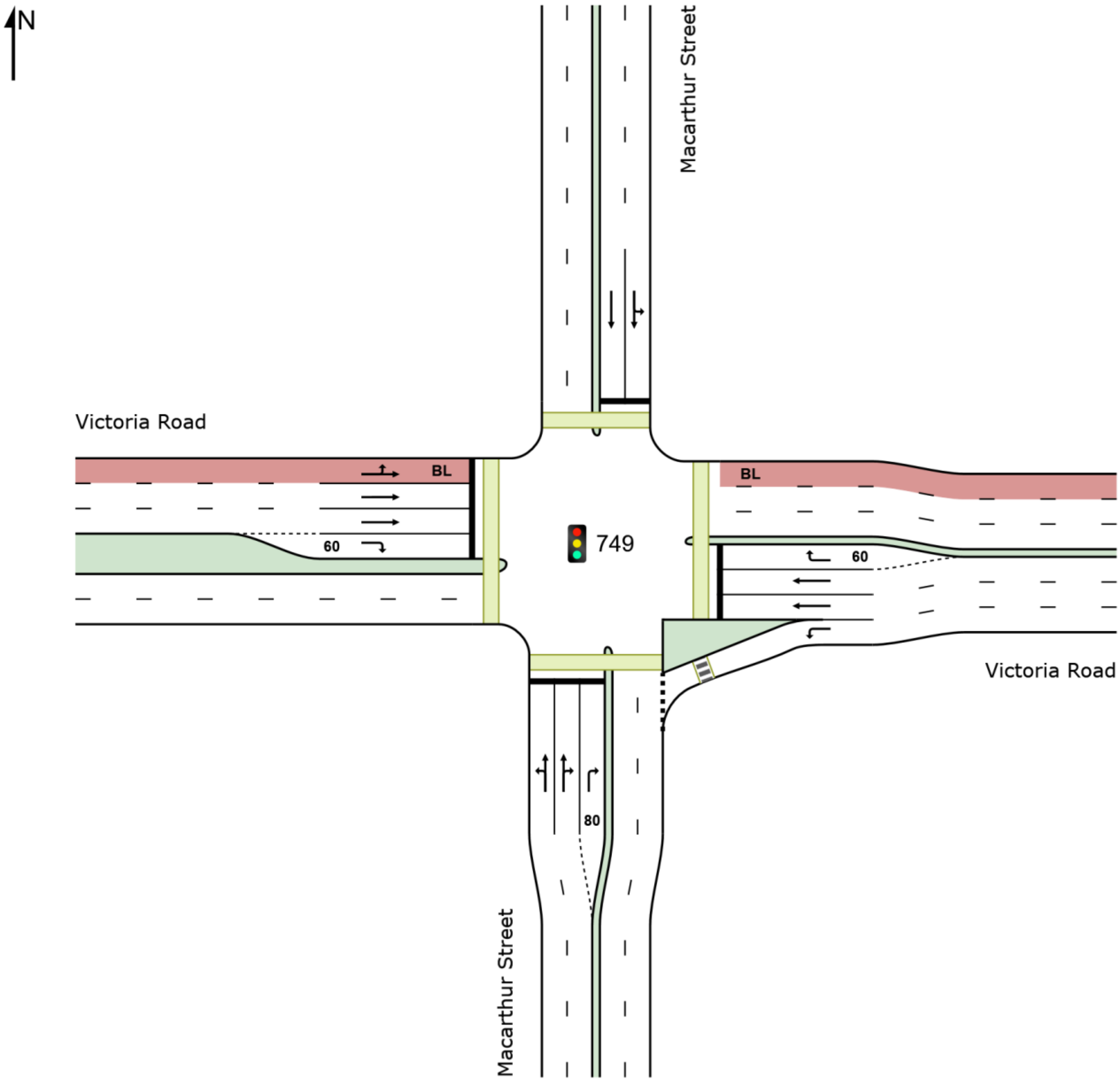
Site: 749 [TCS 749 Victoria Road MacArthur Street - Weekday PM Peak (Site Folder: Weekday - OK)]

Victoria Road / Macarthur Street Parramatta - Weekday PM Peak Existing 1700-1800 26 July - 26 Aug Average
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 62 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Macarthur Street														
1	L2	134	7	141	5.0	0.416	20.8	LOS B	6.6	48.2	0.78	0.72	0.78	45.3
2	T1	192	10	202	5.0	0.416	15.8	LOS B	6.6	48.2	0.81	0.73	0.81	46.0
3	R2	230	15	242	6.5	0.416 *	23.2	LOS B	3.5	25.9	0.91	0.76	0.91	43.3
Approach		556	31	585	5.6	0.416	20.0	LOS B	6.6	48.2	0.84	0.74	0.84	44.7
East: Victoria Road														
4	L2	299	15	315	5.0	0.251	8.1	LOS A	2.6	18.8	0.40	0.67	0.40	52.2
5	T1	669	36	704	5.4	0.891 *	36.9	LOS C	13.2	96.5	1.00	1.10	1.49	37.4
6	R2	206	10	217	5.0	0.833 *	40.2	LOS C	7.5	55.0	1.00	0.99	1.40	35.6
Approach		1174	61	1236	5.2	0.891	30.1	LOS C	13.2	96.7	0.85	0.97	1.20	40.0
North: Macarthur Street														
7	L2	63	3	66	5.0	0.414	30.3	LOS C	4.0	29.1	0.92	0.76	0.92	40.6
8	T1	193	10	203	5.0	0.414 *	25.8	LOS B	4.0	29.1	0.93	0.75	0.93	41.8
Approach		256	13	269	5.0	0.414	26.9	LOS B	4.0	29.1	0.93	0.75	0.93	41.5
West: Victoria Road														
10	L2	86	4	91	5.0	0.292	28.7	LOS C	2.7	21.9	0.88	0.76	0.88	40.3
11	T1	660	44	695	6.7	0.861	33.6	LOS C	12.1	88.4	1.00	1.04	1.38	38.7
12	R2	127	6	134	5.0	0.514	33.7	LOS C	4.0	29.0	0.97	0.79	0.97	38.0
Approach		873	55	919	6.3	0.861	33.1	LOS C	12.1	88.4	0.98	0.98	1.27	38.7
All Vehicles		2859	160	3009	5.6	0.891	28.8	LOS C	13.2	96.7	0.90	0.91	1.13	40.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Pedestrian Movement Performance

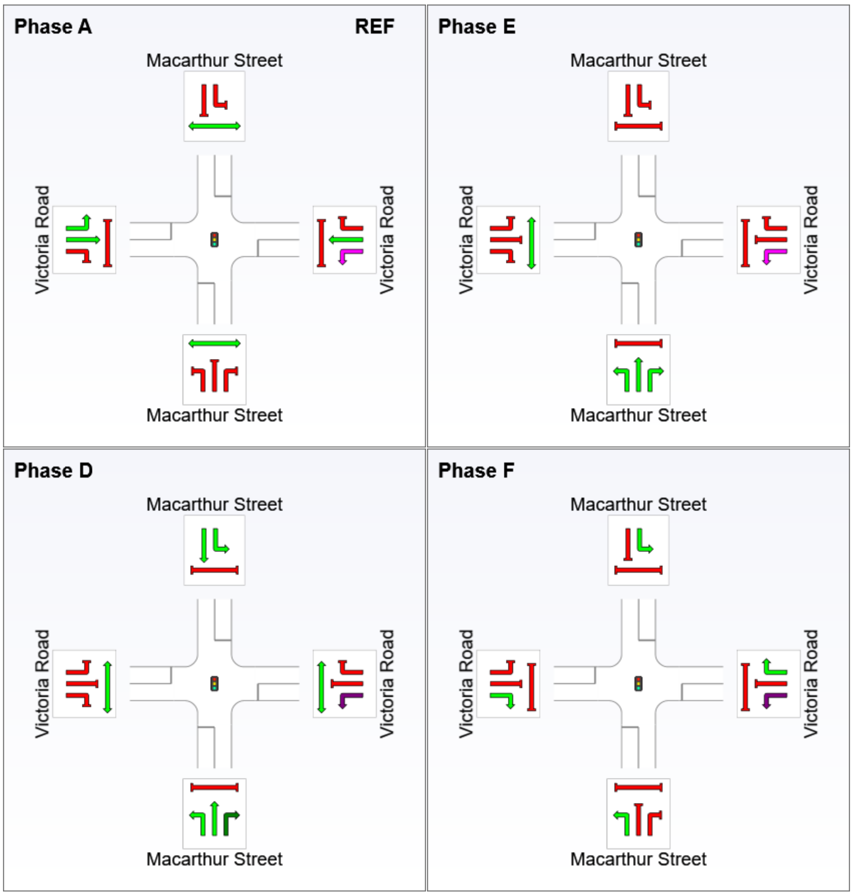
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Macarthur Street												
P1	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	194.2	219.5	1.13
East: Victoria Road												
P2	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	196.7	222.8	1.13
North: Macarthur Street												
P3	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	191.7	216.2	1.13
West: Victoria Road												

P4	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	197.5	223.8	1.13
All Pedestrians		200	211	25.3	LOS C	0.1	0.1	0.91	0.91	195.0	220.6	1.13

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	19	31	47

Green Time (sec)	13	6	10	9
Phase Time (sec)	19	12	16	15
Phase Split	31%	19%	26%	24%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

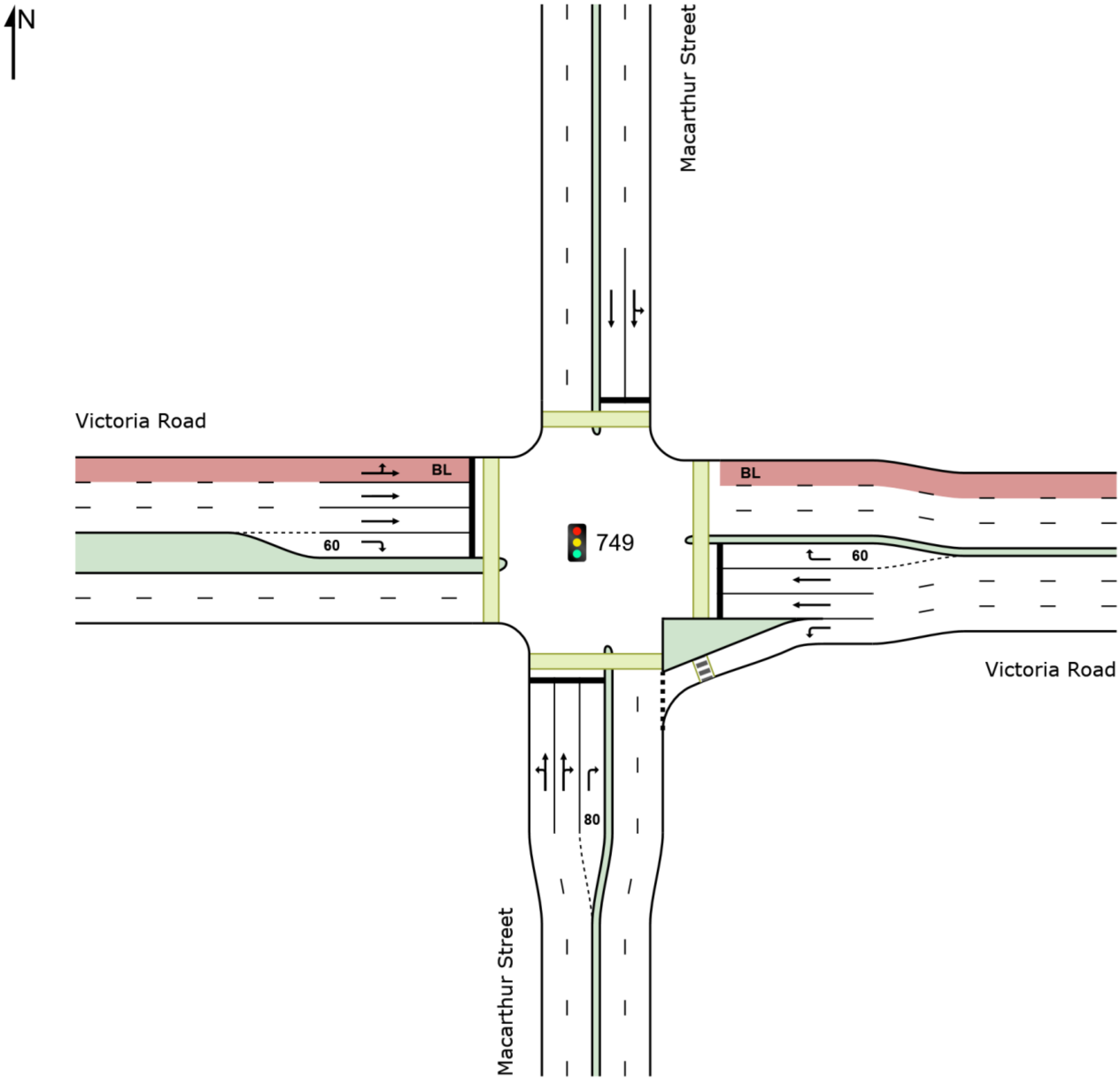
Site: 749 [TCS 749 Victoria Road MacArthur Street - PM Peak 1700-1800 - NB 50% Detour (Site Folder: Weekday - OK)]

Victoria Road / Macarthur Street Parramatta - Weekday PM Peak Existing 1700-1800 26 July - 26 Aug Average
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 62 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Macarthur Street														
1	L2	134	7	141	5.0	0.416	20.8	LOS B	6.6	48.2	0.78	0.72	0.78	45.3
2	T1	192	10	202	5.0	0.416	15.8	LOS B	6.6	48.2	0.81	0.73	0.81	46.0
3	R2	230	15	242	6.5	* 0.416	23.2	LOS B	3.5	25.9	0.91	0.76	0.91	43.3
Approach		556	31	585	5.6	0.416	20.0	LOS B	6.6	48.2	0.84	0.74	0.84	44.7
East: Victoria Road														
4	L2	617	31	649	5.0	0.518	8.9	LOS A	7.2	52.5	0.53	0.72	0.53	51.6
5	T1	669	36	704	5.4	* 0.891	36.9	LOS C	13.2	96.5	1.00	1.10	1.49	37.4

6	R2	206	10	217	5.0	0.833 *	40.2	LOS C	7.5	55.0	1.00	0.99	1.40	35.6
Approach		1492	77	1571	5.2	0.891	25.8	LOS B	13.2	96.7	0.81	0.93	1.08	41.9
North: Macarthur Street														
7	L2	63	3	66	5.0	0.414	30.3	LOS C	4.0	29.1	0.92	0.76	0.92	40.6
8	T1	193	10	203	5.0	0.414 *	25.8	LOS B	4.0	29.1	0.93	0.75	0.93	41.8
Approach		256	13	269	5.0	0.414	26.9	LOS B	4.0	29.1	0.93	0.75	0.93	41.5
West: Victoria Road														
10	L2	86	4	91	5.0	0.292	28.7	LOS C	2.7	21.9	0.88	0.76	0.88	40.3
11	T1	660	44	695	6.7	0.861	33.6	LOS C	12.1	88.4	1.00	1.04	1.38	38.7
12	R2	127	6	134	5.0	0.514	33.7	LOS C	4.0	29.0	0.97	0.79	0.97	38.0
Approach		873	55	919	6.3	0.861	33.1	LOS C	12.1	88.4	0.98	0.98	1.27	38.7
All Vehicles		3177	176	3344	5.6	0.891	26.9	LOS B	13.2	96.7	0.87	0.90	1.08	41.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

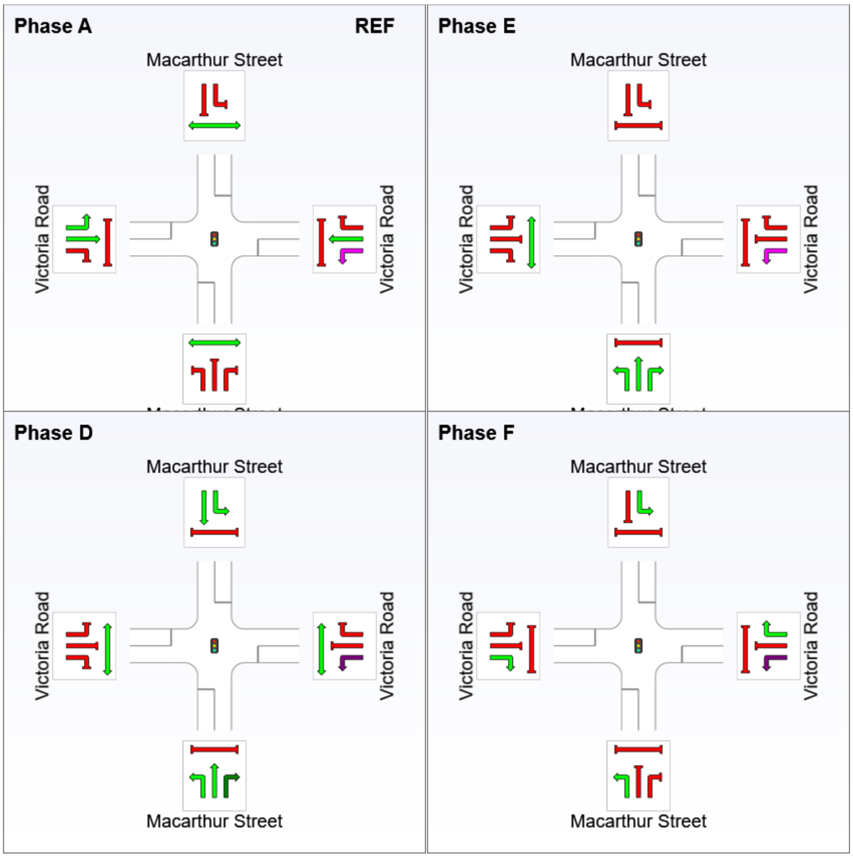
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Macarthur Street												
P1	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	194.2	219.5	1.13
East: Victoria Road												
P2	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	196.7	222.8	1.13
North: Macarthur Street												
P3	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	191.7	216.2	1.13
West: Victoria Road												
P4	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	197.5	223.8	1.13
All Pedestrians		200	211	25.3	LOS C	0.1	0.1	0.91	0.91	195.0	220.6	1.13

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	19	31	47
Green Time (sec)	13	6	10	9
Phase Time (sec)	19	12	16	15
Phase Split	31%	19%	26%	24%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Weekday NB Closure

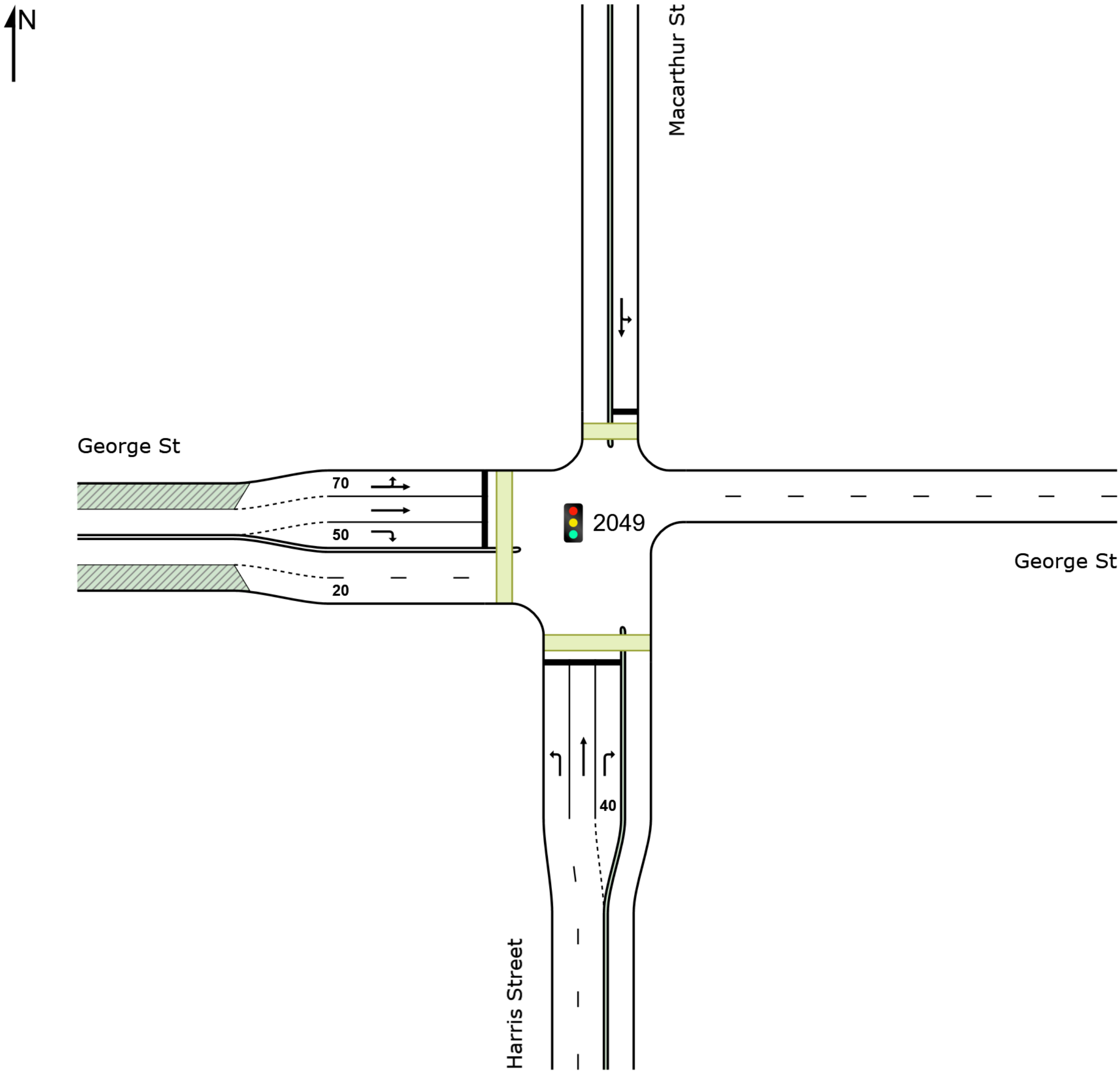
Site: 2049 [TCS 2049 - George St Harris St Macarthur St - AM 0800-0900 (Site Folder: Weekday - OK)]

George St Charles St Parramatta, Weekday AM Peak Existing 0800-0900 26 July - 26 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 66 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Harris Street														
1	L2	257	5.0	271	5.0	0.216	7.3	LOS A	3.1	22.5	0.38	0.61	0.38	33.1
2	T1	382	5.0	402	5.0	0.305	4.1	LOS A	5.0	36.2	0.41	0.36	0.41	37.1
3	R2	21	5.0	22	5.0	* 0.136	35.6	LOS C	0.7	5.1	0.95	0.70	0.95	19.7
Approach		660	5.0	695	5.0	0.305	6.3	LOS A	5.0	36.2	0.42	0.47	0.42	35.1
North: Macarthur St														
7	L2	100	5.0	105	5.0	0.876	28.5	LOS C	30.6	223.7	0.95	1.04	1.17	29.3
8	T1	704	5.0	741	5.0	* 0.876	25.1	LOS B	30.6	223.7	0.95	1.04	1.17	27.0

Approach		804	5.0	846	5.0	0.876	25.5	LOS B	30.6	223.7	0.95	1.04	1.17	27.3
West: George St														
10	L2	116	5.0	122	5.0	0.562	35.1	LOS C	4.0	29.1	0.99	0.80	1.02	26.2
11	T1	80	5.0	84	5.0	0.368	30.5	LOS C	2.6	19.3	0.96	0.74	0.96	24.7
12	R2	150	5.0	158	5.0	* 0.726	37.3	LOS C	5.5	39.9	1.00	0.92	1.20	19.0
Approach		346	5.0	364	5.0	0.726	35.0	LOS C	5.5	39.9	0.99	0.84	1.08	23.2
All Vehicles		1810	5.0	1905	5.0	0.876	20.3	LOS B	30.6	223.7	0.76	0.79	0.88	28.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

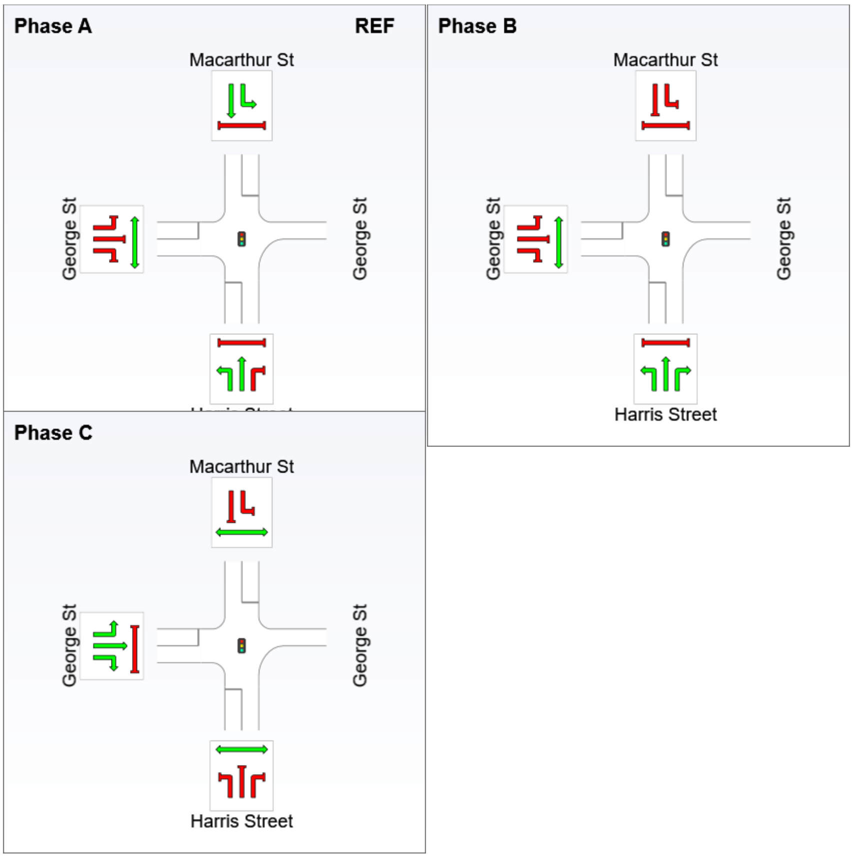
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Harris Street												
P1	Full	50	53	27.3	LOS C	0.1	0.1	0.91	0.91	193.3	215.7	1.12
North: Macarthur St												
P3	Full	50	53	27.3	LOS C	0.1	0.1	0.91	0.91	188.2	209.1	1.11
West: George St												
P4	Full	50	53	27.3	LOS C	0.1	0.1	0.91	0.91	195.8	219.0	1.12
All Pedestrians		150	158	27.3	LOS C	0.1	0.1	0.91	0.91	192.4	214.6	1.12

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	40	52
Green Time (sec)	34	6	8
Phase Time (sec)	40	12	14
Phase Split	61%	18%	21%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

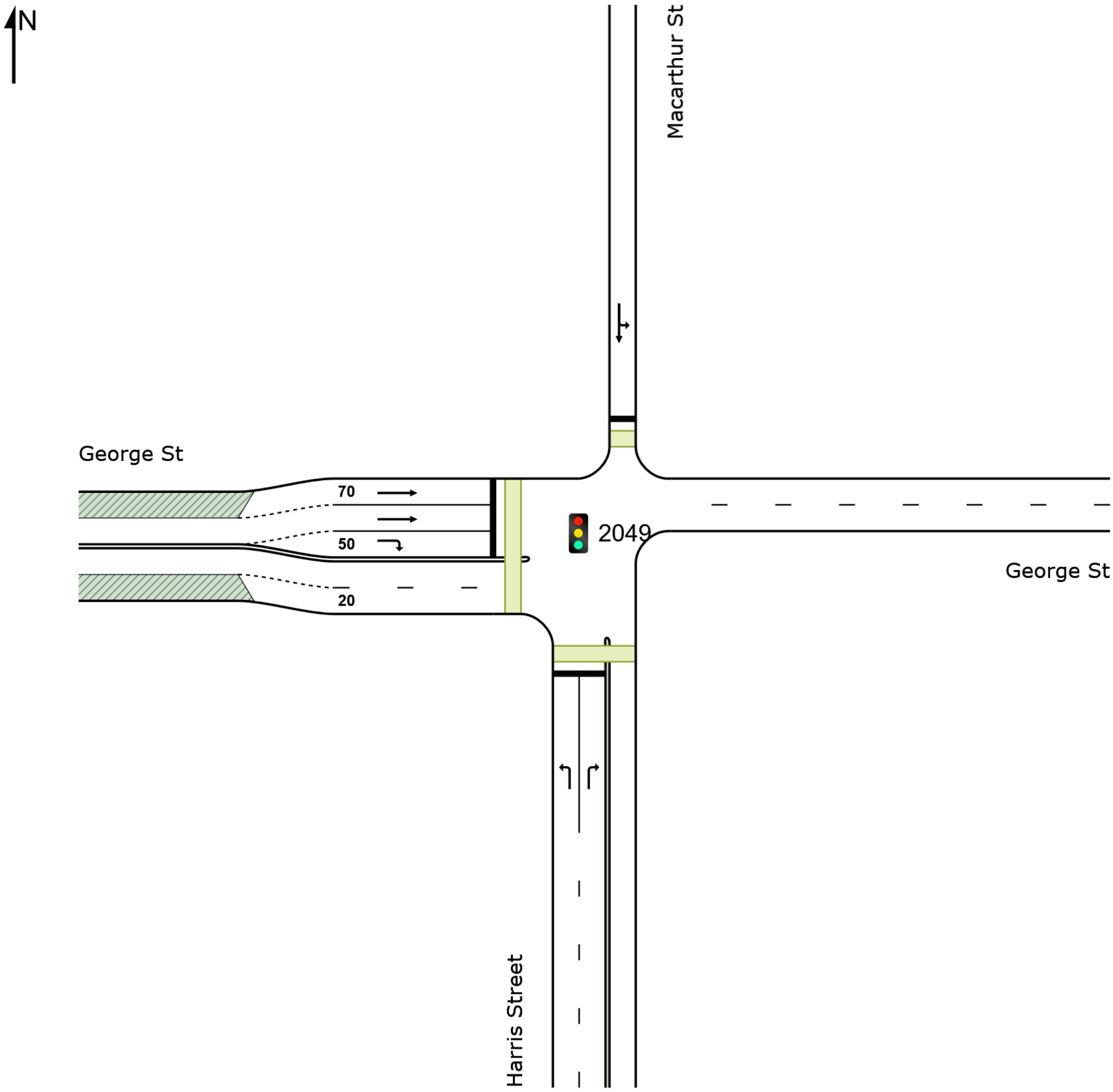
Site: 2049 [TCS 2049 - George St Harris St Macarthur St - AM 0800-0900 - NB Closed - 50% Detour (Site Folder: Weekday - OK)]

George St Charles St Parramatta, Weekday AM Peak Existing 0800-0900 26 July - 26 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 62 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h

South: Harris Street														
1	L2	257	13	271	5.0	0.213	6.7	LOS A	2.8	20.3	0.36	0.60	0.36	33.5
3	R2	158	8	166	5.1	* 0.822	40.9	LOS C	5.8	42.2	1.00	0.94	1.42	20.7
Approach		415	21	437	5.0	0.822	19.7	LOS B	5.8	42.2	0.61	0.73	0.77	26.9
North: Macarthur St														
7	L2	100	5	105	5.0	0.902	32.7	LOS C	32.1	234.3	0.98	1.14	1.31	28.1
8	T1	704	35	741	5.0	* 0.902	29.3	LOS C	32.1	234.3	0.98	1.14	1.31	25.6
Approach		804	40	846	5.0	0.902	29.7	LOS C	32.1	234.3	0.98	1.14	1.31	26.0
West: George St														
11	T1	196	10	206	5.1	0.565	31.5	LOS C	3.3	23.8	1.00	0.79	1.05	28.3
12	R2	150	8	158	5.0	* 0.910	45.6	LOS D	6.0	44.1	1.00	1.20	1.78	16.8
Approach		346	18	364	5.1	0.910	37.6	LOS C	6.0	44.1	1.00	0.97	1.37	23.0
All Vehicles		1565	79	1647	5.0	0.910	28.8	LOS C	32.1	234.3	0.89	0.99	1.18	25.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

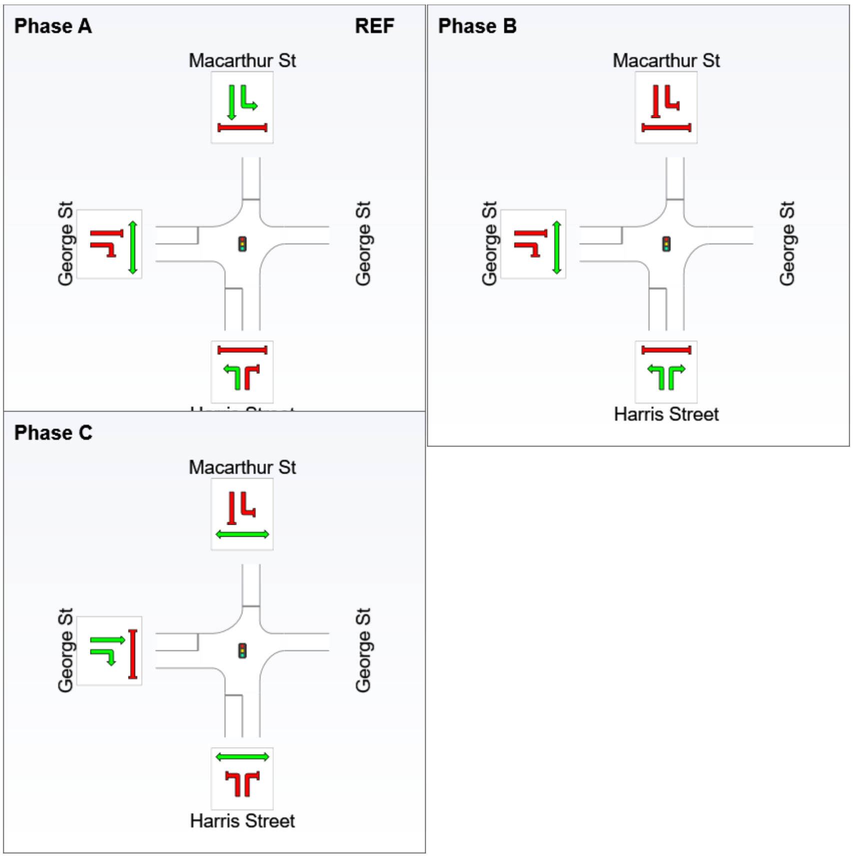
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Harris Street												
P1	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	188.7	212.4	1.13
North: Macarthur St												
P3	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	183.3	205.3	1.12
West: George St												
P4	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	193.8	219.0	1.13
All Pedestrians		150	158	25.3	LOS C	0.1	0.1	0.91	0.91	188.6	212.2	1.13

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Reference Phase: Phase A
Sequence: TCS 1100
Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	37	50
Green Time (sec)	31	7	6
Phase Time (sec)	37	13	12
Phase Split	60%	21%	19%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

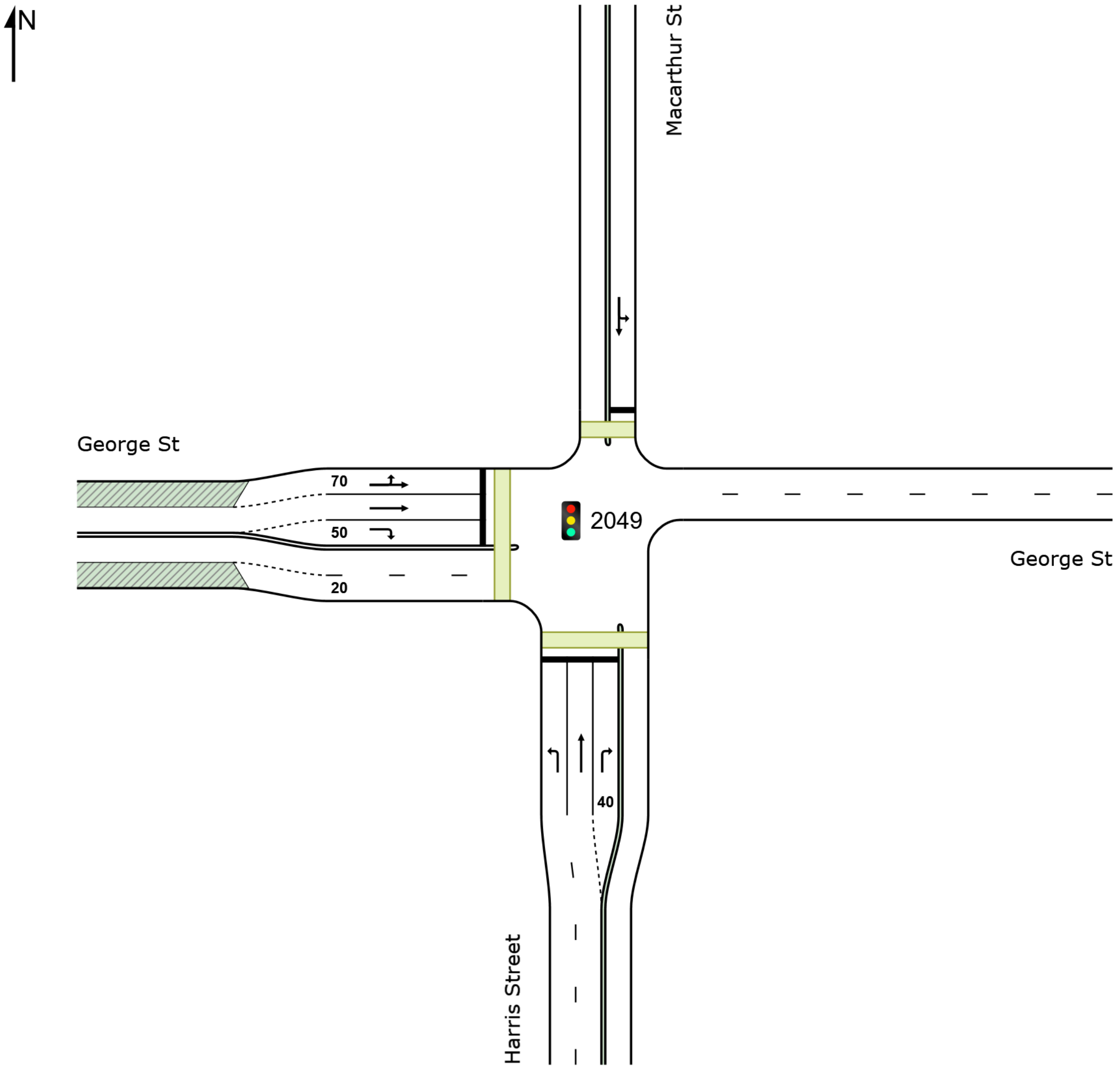
Site: 2049 [TCS 2049 - George St Harris St Macarthur St - PM 1700-1800 (Site Folder: Weekday - OK)]

George St Charles St Parramatta, Weekday AM Peak Existing 0800-0900 26 July - 26 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 66 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h

South: Harris Street														
1	L2	146	5.0	154	5.0	0.132	8.1	LOS A	1.9	13.7	0.40	0.60	0.40	32.3
2	T1	478	5.0	503	5.0	0.409	5.9	LOS A	7.7	56.1	0.51	0.45	0.51	36.0
3	R2	31	5.0	33	5.0	* 0.200	35.9	LOS C	1.0	7.6	0.96	0.72	0.96	19.6
Approach		655	5.0	689	5.0	0.409	7.8	LOS A	7.7	56.1	0.51	0.50	0.51	34.4
North: Macarthur St														
7	L2	80	5.0	84	5.0	0.878	30.8	LOS C	28.8	209.9	0.97	1.07	1.22	28.6
8	T1	656	5.0	691	5.0	* 0.878	27.4	LOS B	28.8	209.9	0.97	1.07	1.22	26.3
Approach		736	5.0	775	5.0	0.878	27.8	LOS B	28.8	209.9	0.97	1.07	1.22	26.6
West: George St														
10	L2	158	5.0	166	5.0	0.556	32.1	LOS C	5.2	37.9	0.97	0.80	0.97	27.0
11	T1	100	5.0	105	5.0	0.334	27.3	LOS B	3.1	22.8	0.92	0.72	0.92	25.7
12	R2	260	5.0	274	5.0	* 0.916	47.2	LOS D	11.4	83.1	1.00	1.21	1.63	16.6
Approach		518	5.0	545	5.0	0.916	38.8	LOS C	11.4	83.1	0.97	0.99	1.29	21.9
All Vehicles		1909	5.0	2009	5.0	0.916	23.9	LOS B	28.8	209.9	0.81	0.85	1.00	27.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

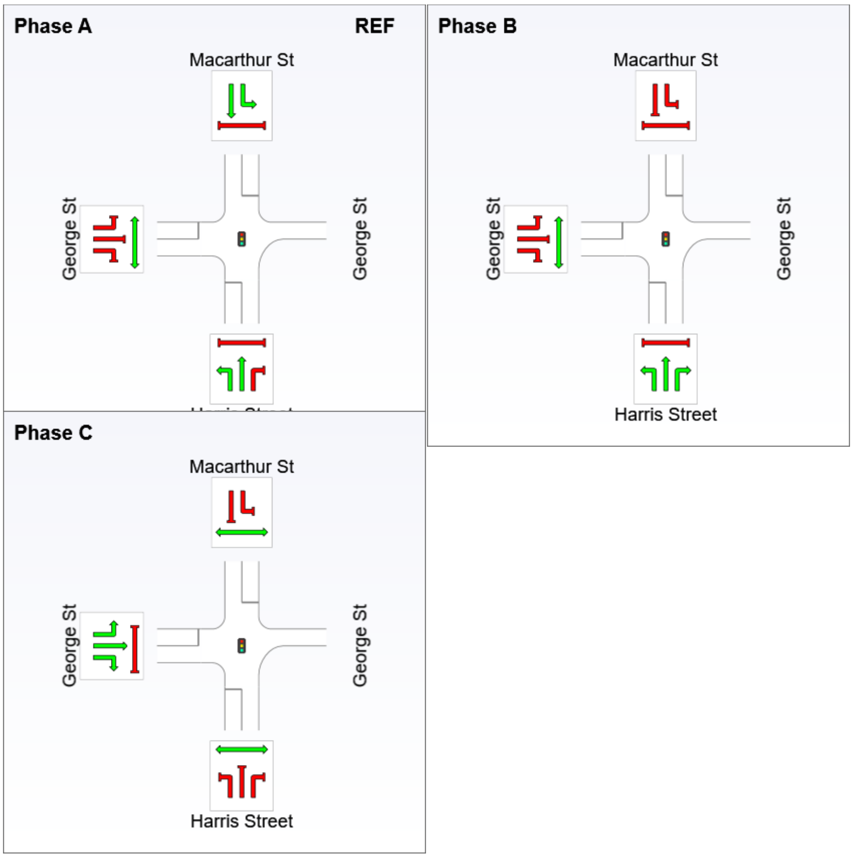
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Harris Street												
P1	Full	50	53	27.3	LOS C	0.1	0.1	0.91	0.91	193.3	215.7	1.12
North: Macarthur St												
P3	Full	50	53	27.3	LOS C	0.1	0.1	0.91	0.91	188.2	209.1	1.11
West: George St												
P4	Full	50	53	27.3	LOS C	0.1	0.1	0.91	0.91	195.8	219.0	1.12
All Pedestrians		150	158	27.3	LOS C	0.1	0.1	0.91	0.91	192.4	214.6	1.12

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Reference Sequence: Phase: TCS Phase 1100 A
Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	37	49
Green Time (sec)	31	6	11
Phase Time (sec)	37	12	17
Phase Split	56%	18%	26%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

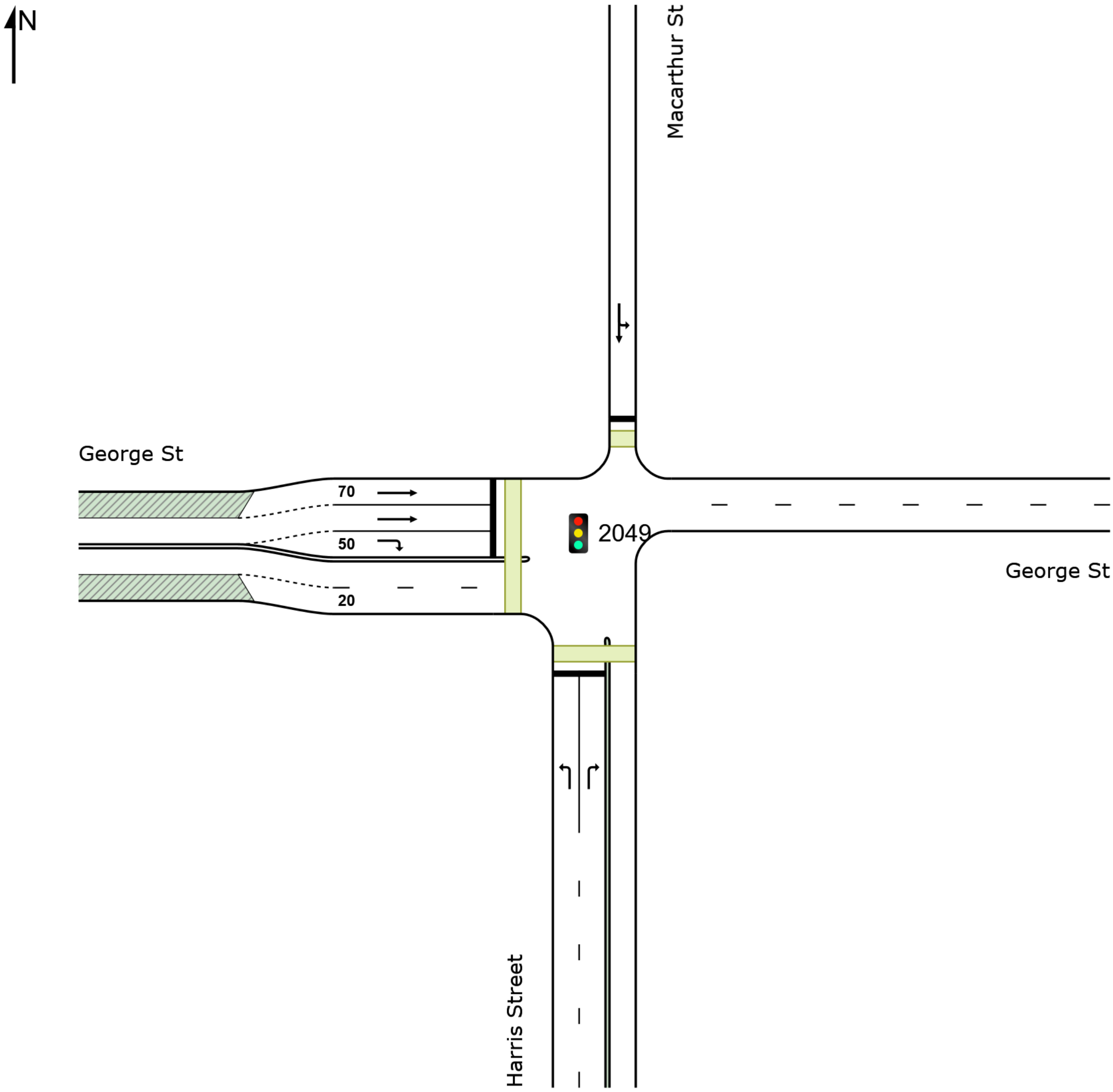
Site: 2049 [TCS 2049 - George St Harris St Macarthur St - PM 1700-1800 - NB Closed - 50% Detour (Site Folder: Weekday - OK)]

George St Charles St Parramatta, Weekday AM Peak Existing 0800-0900 26 July - 26 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 74 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h

South: Harris Street														
1	L2	146	7	154	5.0	0.129	8.3	LOS A	2.0	14.8	0.39	0.60	0.39	32.2
3	R2	191	10	201	5.0	0.922 *	55.4	LOS D	9.2	67.4	1.00	1.05	1.68	17.0
Approach		337	17	355	5.0	0.922	35.0	LOS C	9.2	67.4	0.74	0.85	1.12	21.2
North: Macarthur St														
7	L2	80	4	84	5.0	0.898	36.6	LOS C	33.5	244.3	0.99	1.11	1.26	27.0
8	T1	656	33	691	5.0	0.898 *	33.1	LOS C	33.5	244.3	0.99	1.11	1.26	24.5
Approach		736	37	775	5.0	0.898	33.5	LOS C	33.5	244.3	0.99	1.11	1.26	24.8
West: George St														
11	T1	258	13	272	5.0	0.409	30.3	LOS C	4.5	33.0	0.93	0.74	0.93	28.9
12	R2	260	13	274	5.0	0.869 *	45.0	LOS D	11.6	84.5	1.00	1.06	1.40	17.0
Approach		518	26	545	5.0	0.869	37.7	LOS C	11.6	84.5	0.97	0.90	1.17	22.5
All Vehicles		1591	80	1675	5.0	0.922	35.2	LOS C	33.5	244.3	0.93	0.99	1.20	23.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

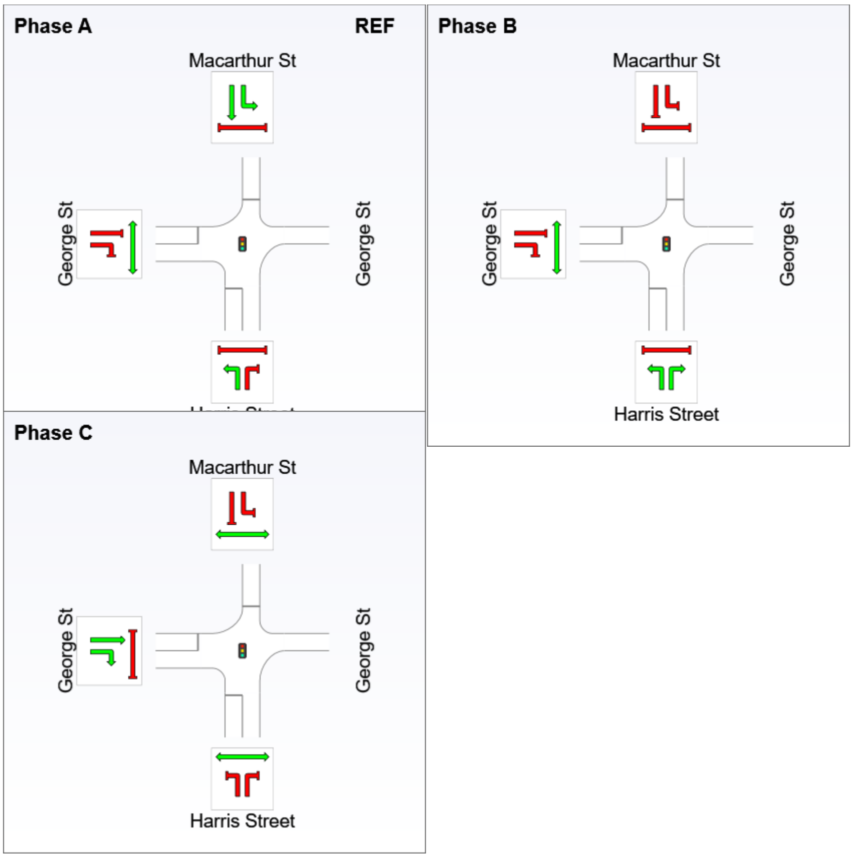
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Harris Street												
P1	Full	50	53	31.3	LOS D	0.1	0.1	0.92	0.92	194.7	212.4	1.09
North: Macarthur St												
P3	Full	50	53	31.3	LOS D	0.1	0.1	0.92	0.92	189.2	205.3	1.08
West: George St												
P4	Full	50	53	31.3	LOS D	0.1	0.1	0.92	0.92	199.8	219.0	1.10
All Pedestrians		150	158	31.3	LOS D	0.1	0.1	0.92	0.92	194.6	212.2	1.09

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Reference Phase: **Sequence: TCS 1100** **Phase A**
Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	40	55
Green Time (sec)	34	9	13
Phase Time (sec)	40	15	19
Phase Split	54%	20%	26%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Weekday NB Closure

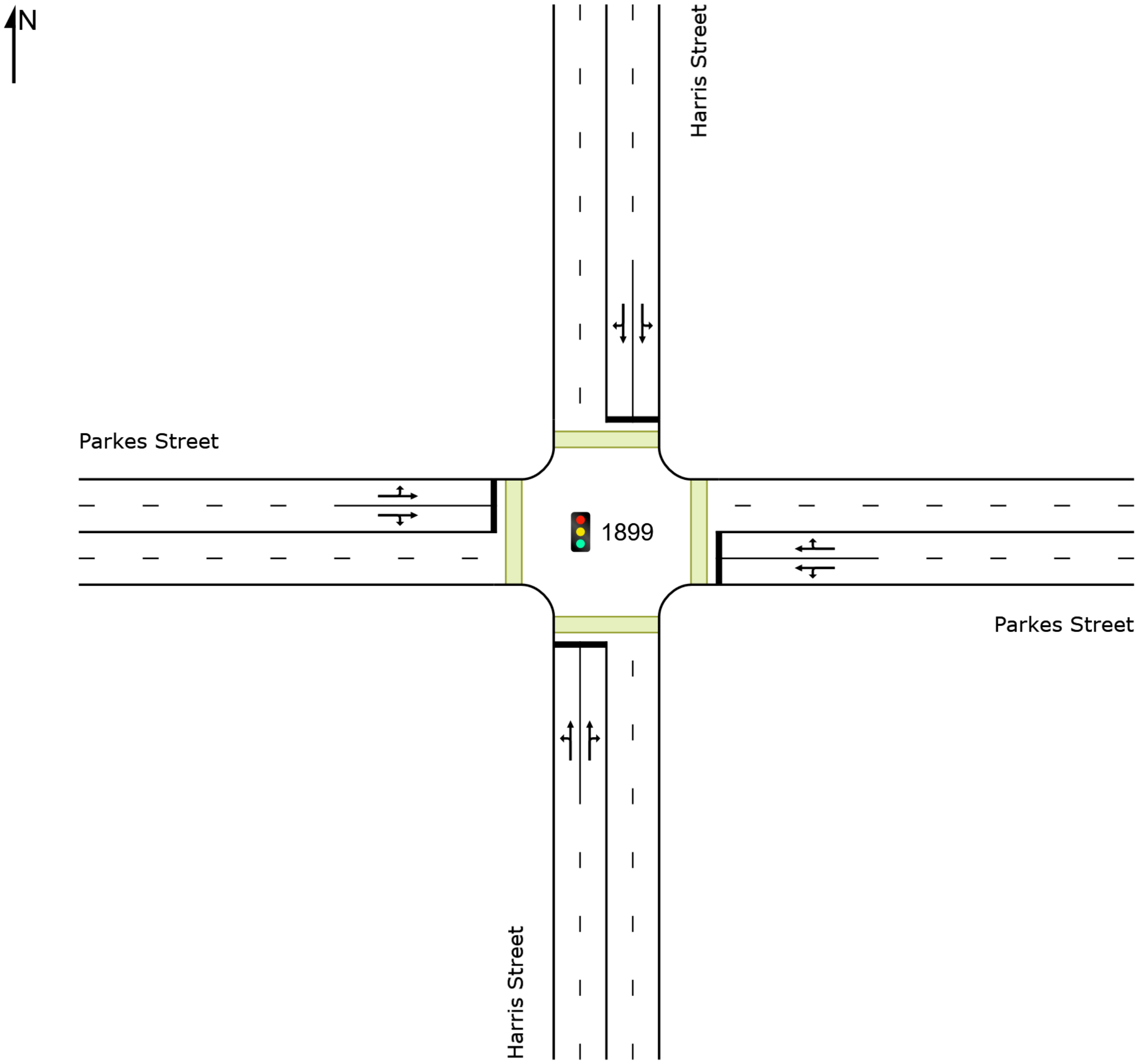
Site: 1899 [TCS 1899 - Harris Street Parkes Street - AM Peak (Site Folder: Weekday - OK)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 73 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance															
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Harris Street														
1	L2	34	5.0	36	5.0	0.841	47.3	LOS D	7.0	51.2	1.00	0.98	1.41	18.6
2	T1	195	5.0	205	5.0	* 0.841	41.7	LOS C	7.0	51.2	1.00	0.98	1.42	17.8
3	R2	95	5.0	100	5.0	0.841	47.4	LOS D	6.9	50.3	1.00	0.98	1.42	23.2
Approach		324	5.0	341	5.0	0.841	44.0	LOS D	7.0	51.2	1.00	0.98	1.42	19.7
East: Parkes Street														
4	L2	65	5.0	68	5.0	0.468	23.3	LOS B	9.3	67.6	0.79	0.70	0.79	35.2
5	T1	384	5.0	404	5.0	0.468	19.8	LOS B	9.3	67.6	0.82	0.71	0.82	33.8
6	R2	63	5.0	66	5.0	* 0.468	30.2	LOS C	6.0	43.6	0.90	0.74	0.90	28.3

Approach		512	5.0	539	5.0	0.468	21.6	LOS B	9.3	67.6	0.83	0.72	0.83	33.2
North: Harris Street														
7	L2	63	5.0	66	5.0	0.649	33.2	LOS C	9.9	72.4	0.95	0.82	0.97	27.2
8	T1	344	5.0	362	5.0	0.649	27.6	LOS B	9.9	72.4	0.95	0.82	0.97	23.0
9	R2	156	5.0	164	5.0	0.649	33.2	LOS C	9.8	71.2	0.95	0.83	0.97	19.6
Approach		563	5.0	593	5.0	0.649	29.8	LOS C	9.9	72.4	0.95	0.82	0.97	22.6
West: Parkes Street														
10	L2	190	5.0	200	5.0	* 0.818	34.4	LOS C	13.2	96.7	1.00	1.00	1.21	19.3
11	T1	509	5.0	536	5.0	0.818	32.4	LOS C	13.4	99.0	1.00	0.99	1.22	27.0
12	R2	4	100.0	4	100.0	* 0.818	41.1	LOS C	13.4	99.0	1.00	0.98	1.23	19.7
Approach		703	5.5	740	5.5	0.818	33.0	LOS C	13.4	99.0	1.00	0.99	1.22	25.2
All Vehicles		2102	5.2	2213	5.2	0.841	31.1	LOS C	13.4	99.0	0.95	0.88	1.09	25.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

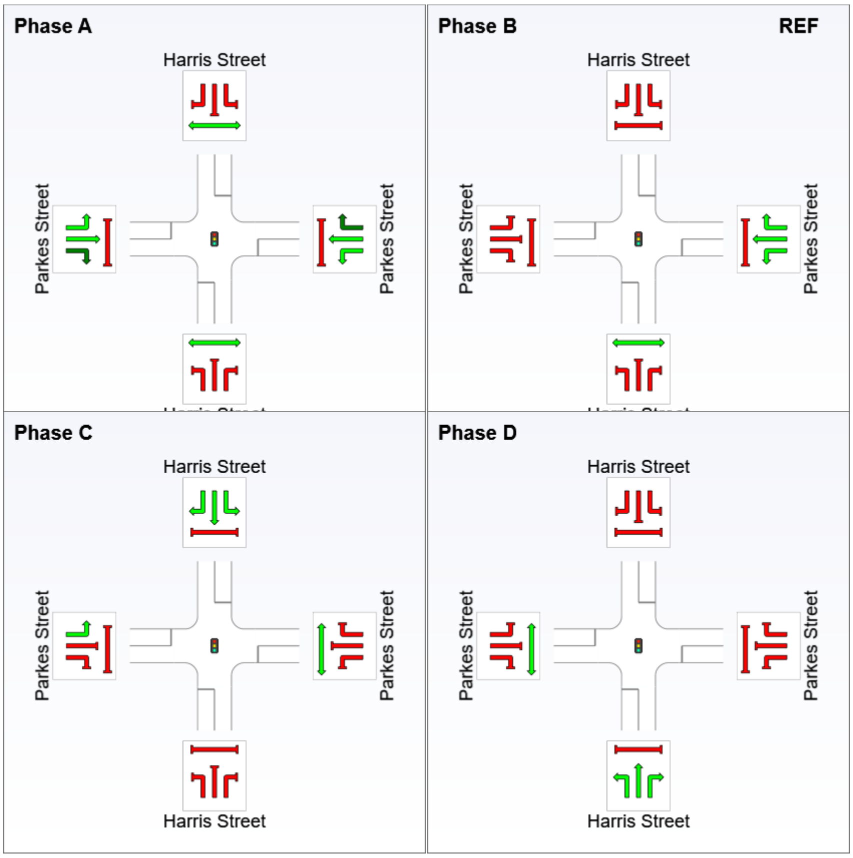
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Harris Street												
P1	Full	50	53	30.8	LOS D	0.1	0.1	0.92	0.92	196.4	215.2	1.10
East: Parkes Street												
P2	Full	50	53	30.8	LOS D	0.1	0.1	0.92	0.92	196.4	215.2	1.10
North: Harris Street												
P3	Full	50	53	30.8	LOS D	0.1	0.1	0.92	0.92	196.4	215.2	1.10
West: Parkes Street												
P4	Full	50	53	30.8	LOS D	0.1	0.1	0.92	0.92	196.4	215.2	1.10
All Pedestrians		200	211	30.8	LOS D	0.1	0.1	0.92	0.92	196.4	215.2	1.10

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Reference Sequence: Leading Right Turn Phase: Phase B
Input Phase Sequence: A, B, C, D



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	B	C	D
Phase Change Time (sec)	50	0	12	36
Green Time (sec)	17	6	18	8
Phase Time (sec)	23	12	24	14
Phase Split	32%	16%	33%	19%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

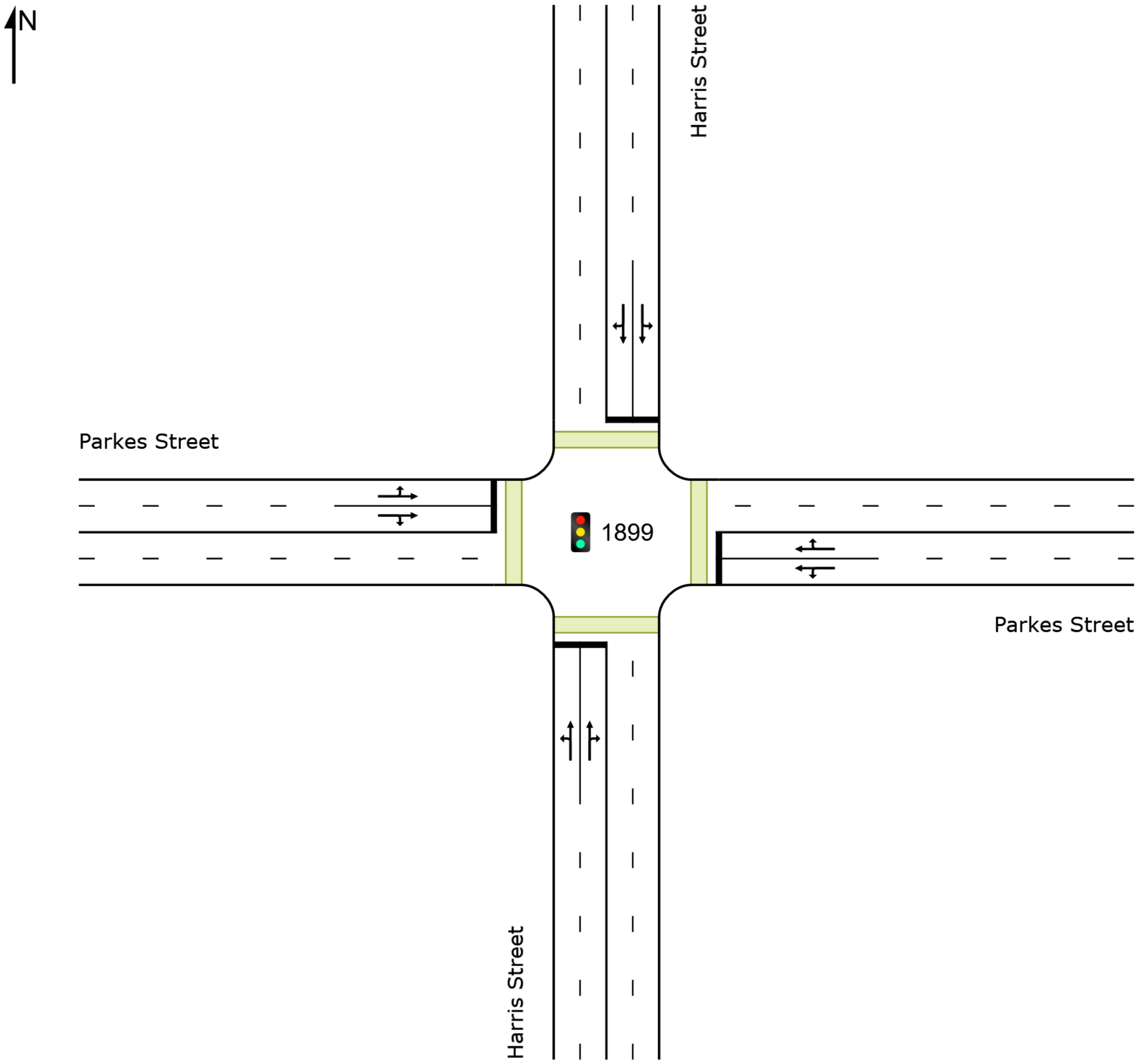
Site: 1899 [TCS 1899 - Harris Street Parkes Street - AM Peak - NB Detour (Site Folder: Weekday - OK)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 78 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Harris Street														

1	L2	34	2	36	5.0	0.529	40.7	LOS C	5.2	37.6	0.97	0.78	0.97	20.6
2	T1	98	5	103	5.0	0.529	35.1	LOS C	5.2	37.6	0.97	0.78	0.97	20.1
3	R2	193	10	203	5.0	0.803 *	46.3	LOS D	8.5	61.9	1.00	0.93	1.27	22.9
Approach		325	16	342	5.0	0.803	42.4	LOS C	8.5	61.9	0.99	0.87	1.15	22.0
East: Parkes Street														
4	L2	65	3	68	5.0	0.521	26.4	LOS B	10.9	79.3	0.83	0.73	0.83	33.2
5	T1	384	19	404	5.0	0.521	23.3	LOS B	10.9	79.3	0.86	0.74	0.86	31.6
6	R2	63	3	66	5.0	0.521 *	35.6	LOS C	6.3	45.6	0.94	0.77	0.94	25.7
Approach		512	26	539	5.0	0.521	25.2	LOS B	10.9	79.3	0.87	0.75	0.87	31.0
North: Harris Street														
7	L2	93	5	98	5.5	0.659	34.5	LOS C	11.0	80.7	0.95	0.82	0.97	26.4
8	T1	344	17	362	5.0	0.659	28.9	LOS C	11.0	80.7	0.95	0.83	0.97	22.3
9	R2	156	8	164	5.0	0.659	34.5	LOS C	10.9	79.8	0.95	0.83	0.97	19.2
Approach		593	30	624	5.1	0.659	31.3	LOS C	11.0	80.7	0.95	0.83	0.97	22.2
West: Parkes Street														
10	L2	95	5	100	5.0	0.906 *	50.7	LOS D	17.4	127.2	1.00	1.13	1.44	14.9
11	T1	604	30	636	5.0	0.906 *	45.8	LOS D	17.4	127.2	1.00	1.12	1.45	22.2
12	R2	4	4	4	100.0	0.906	53.0	LOS D	16.9	124.3	1.00	1.12	1.45	16.5
Approach		703	39	740	5.5	0.906	46.5	LOS D	17.4	127.2	1.00	1.12	1.45	21.3
All Vehicles		2133	111	2245	5.2	0.906	36.5	LOS C	17.4	127.2	0.95	0.91	1.13	23.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

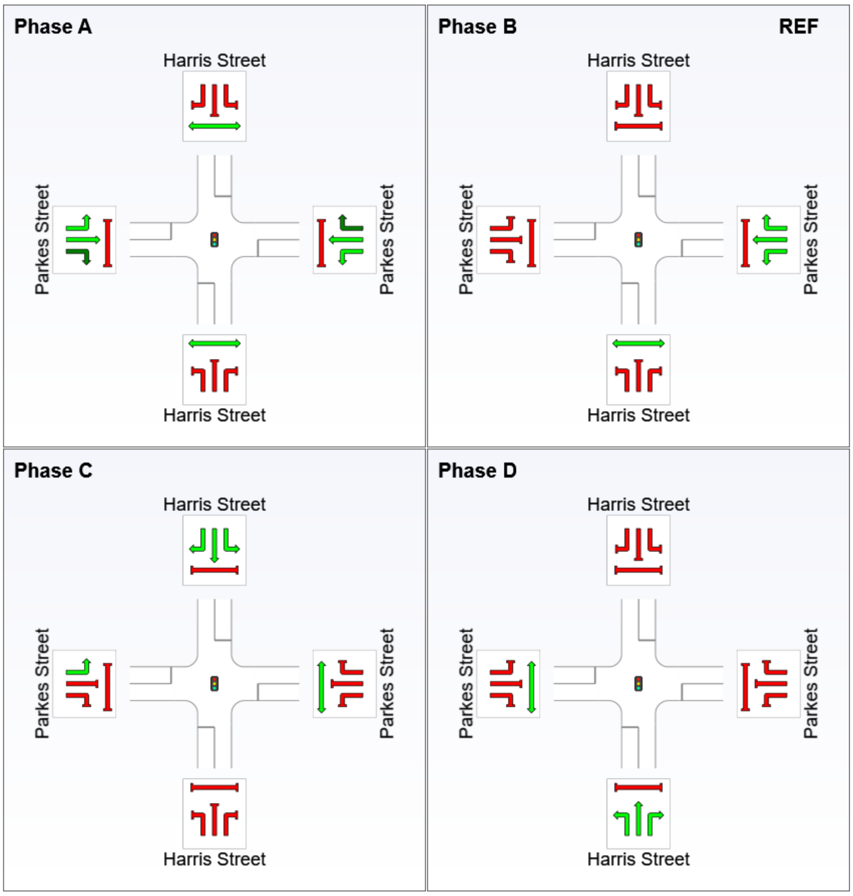
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Harris Street												
P1	Full	50	53	33.3	LOS D	0.1	0.1	0.93	0.93	198.8	215.2	1.08
East: Parkes Street												
P2	Full	50	53	33.3	LOS D	0.1	0.1	0.93	0.93	198.8	215.2	1.08
North: Harris Street												
P3	Full	50	53	33.3	LOS D	0.1	0.1	0.93	0.93	198.8	215.2	1.08
West: Parkes Street												
P4	Full	50	53	33.3	LOS D	0.1	0.1	0.93	0.93	198.8	215.2	1.08
All Pedestrians		200	211	33.3	LOS D	0.1	0.1	0.93	0.93	198.8	215.2	1.08

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: Leading Right Turn
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	B	C	D
Phase Change Time (sec)	55	0	12	38
Green Time (sec)	17	6	20	11
Phase Time (sec)	23	12	26	17
Phase Split	29%	15%	33%	22%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

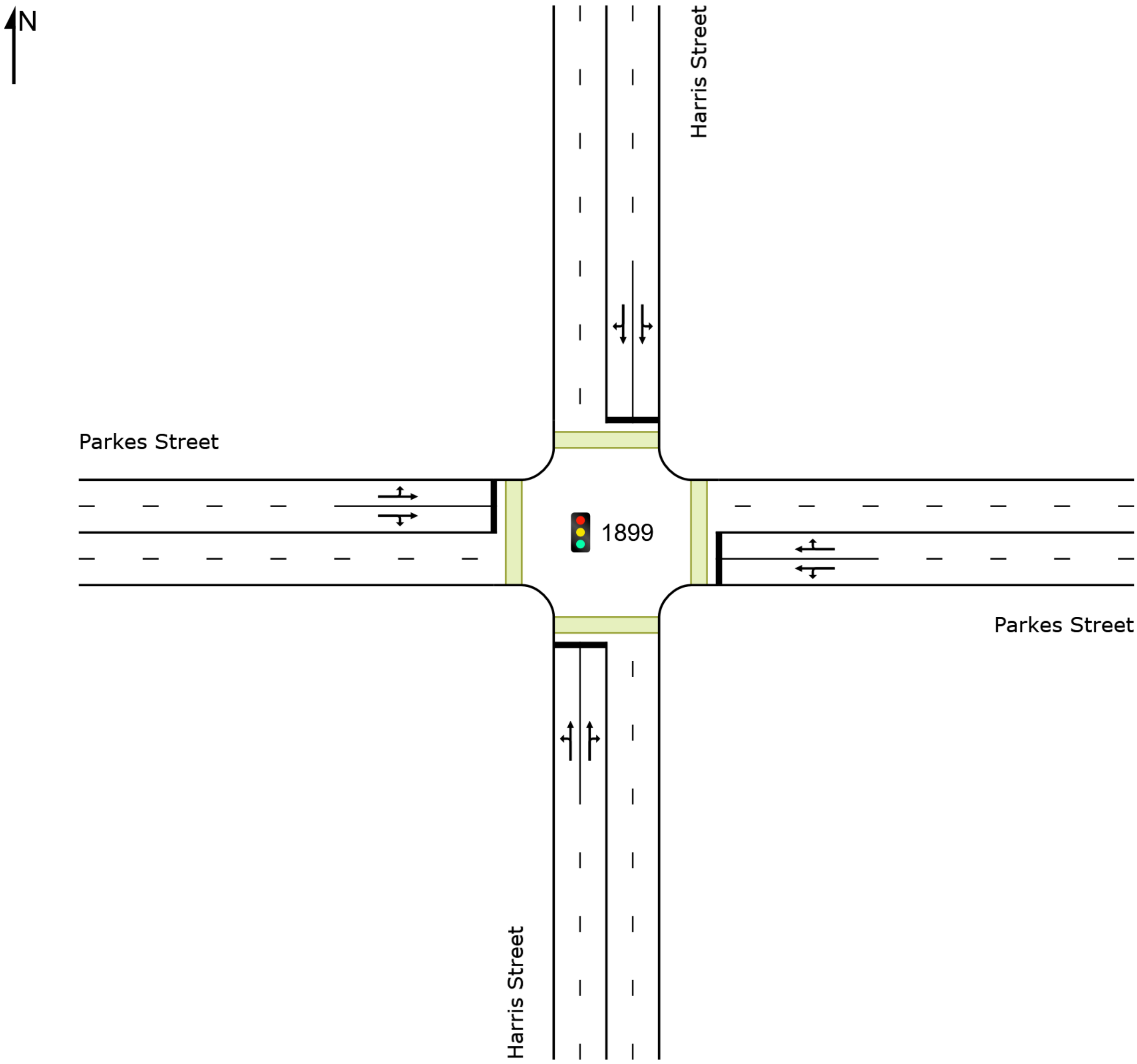
Site: 1899 [TCS 1899 - Harris Street Parkes Street - PM Peak (Site Folder: Weekday - OK)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 83 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Harris Street														
1	L2	28	5.0	29	5.0	0.709	47.8	LOS D	6.1	44.7	1.00	0.86	1.15	18.5
2	T1	162	5.0	171	5.0	0.709 *	42.2	LOS C	6.1	44.7	1.00	0.86	1.15	17.7
3	R2	80	5.0	84	5.0	0.709	47.9	LOS D	6.0	43.8	1.00	0.86	1.15	23.1
Approach		270	5.0	284	5.0	0.709	44.5	LOS D	6.1	44.7	1.00	0.86	1.15	19.6
East: Parkes Street														
4	L2	52	5.0	55	5.0	0.411	25.1	LOS B	9.0	65.3	0.77	0.68	0.77	34.1
5	T1	311	5.0	327	5.0	0.411	22.3	LOS B	9.0	65.3	0.80	0.69	0.80	32.2
6	R2	52	5.0	55	5.0	0.411 *	37.1	LOS C	4.8	35.4	0.92	0.74	0.92	25.0
Approach		415	5.0	437	5.0	0.411	24.5	LOS B	9.0	65.3	0.81	0.70	0.81	31.4
North: Harris Street														
7	L2	75	5.0	79	5.0	0.636	34.5	LOS C	11.9	87.0	0.93	0.80	0.93	26.6
8	T1	384	5.0	404	5.0	0.636	28.9	LOS C	11.9	87.0	0.93	0.81	0.93	22.4
9	R2	161	5.0	169	5.0	0.636	34.5	LOS C	11.7	85.7	0.93	0.82	0.93	19.2
Approach		620	5.0	653	5.0	0.636	31.0	LOS C	11.9	87.0	0.93	0.81	0.93	22.2
West: Parkes Street														
10	L2	218	5.0	229	5.0	0.889 *	45.4	LOS D	20.0	146.3	1.00	1.09	1.33	15.8
11	T1	596	5.0	627	5.0	0.889 *	42.8	LOS D	20.0	146.3	1.00	1.08	1.34	23.1
12	R2	4	100.0	4	100.0	0.889	51.0	LOS D	19.6	144.3	1.00	1.08	1.35	16.9
Approach		818	5.5	861	5.5	0.889	43.5	LOS D	20.0	146.3	1.00	1.08	1.33	21.3
All Vehicles		2123	5.2	2235	5.2	0.889	36.3	LOS C	20.0	146.3	0.94	0.90	1.09	23.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Pedestrian Movement Performance

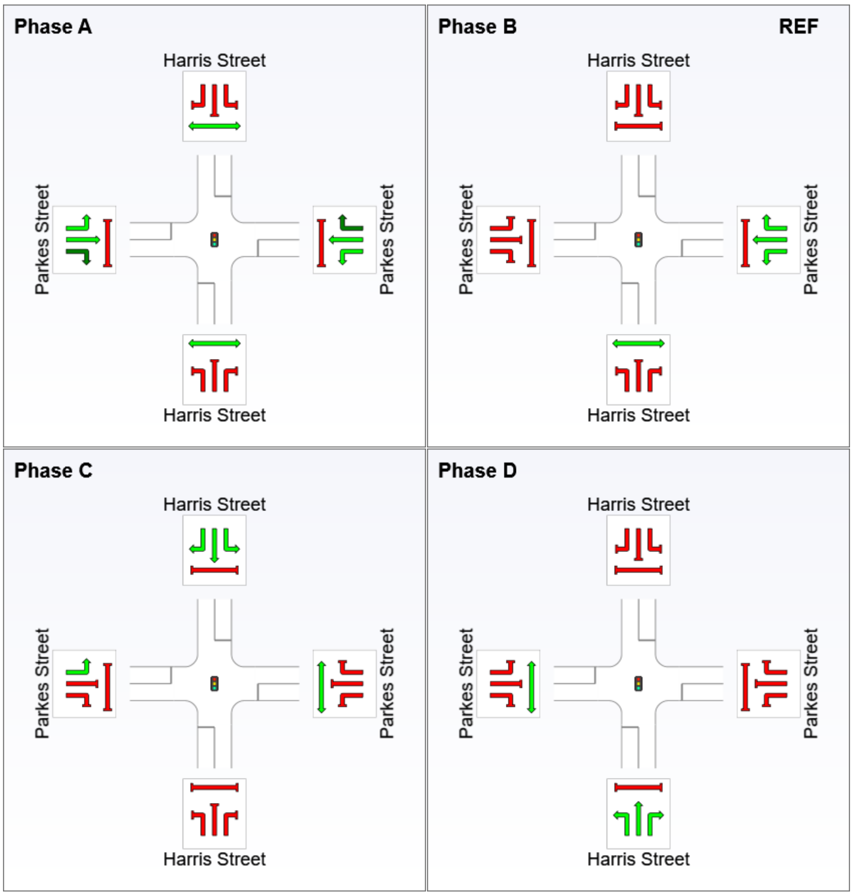
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Harris Street												
P1	Full	50	53	35.8	LOS D	0.1	0.1	0.93	0.93	201.3	215.2	1.07
East: Parkes Street												
P2	Full	50	53	35.8	LOS D	0.1	0.1	0.93	0.93	201.3	215.2	1.07
North: Harris Street												
P3	Full	50	53	35.8	LOS D	0.1	0.1	0.93	0.93	201.3	215.2	1.07
West: Parkes Street												
P4	Full	50	53	35.8	LOS D	0.1	0.1	0.93	0.93	201.3	215.2	1.07

All Pedestrians	200	211	35.8	LOS D	0.1	0.1	0.93	0.93	201.3	215.2	1.07

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: Leading Right Turn
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	B	C	D
Phase Change Time (sec)	56	0	12	41
Green Time (sec)	21	6	23	9

Phase Time (sec)	27	12	29	15
Phase Split	33%	14%	35%	18%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

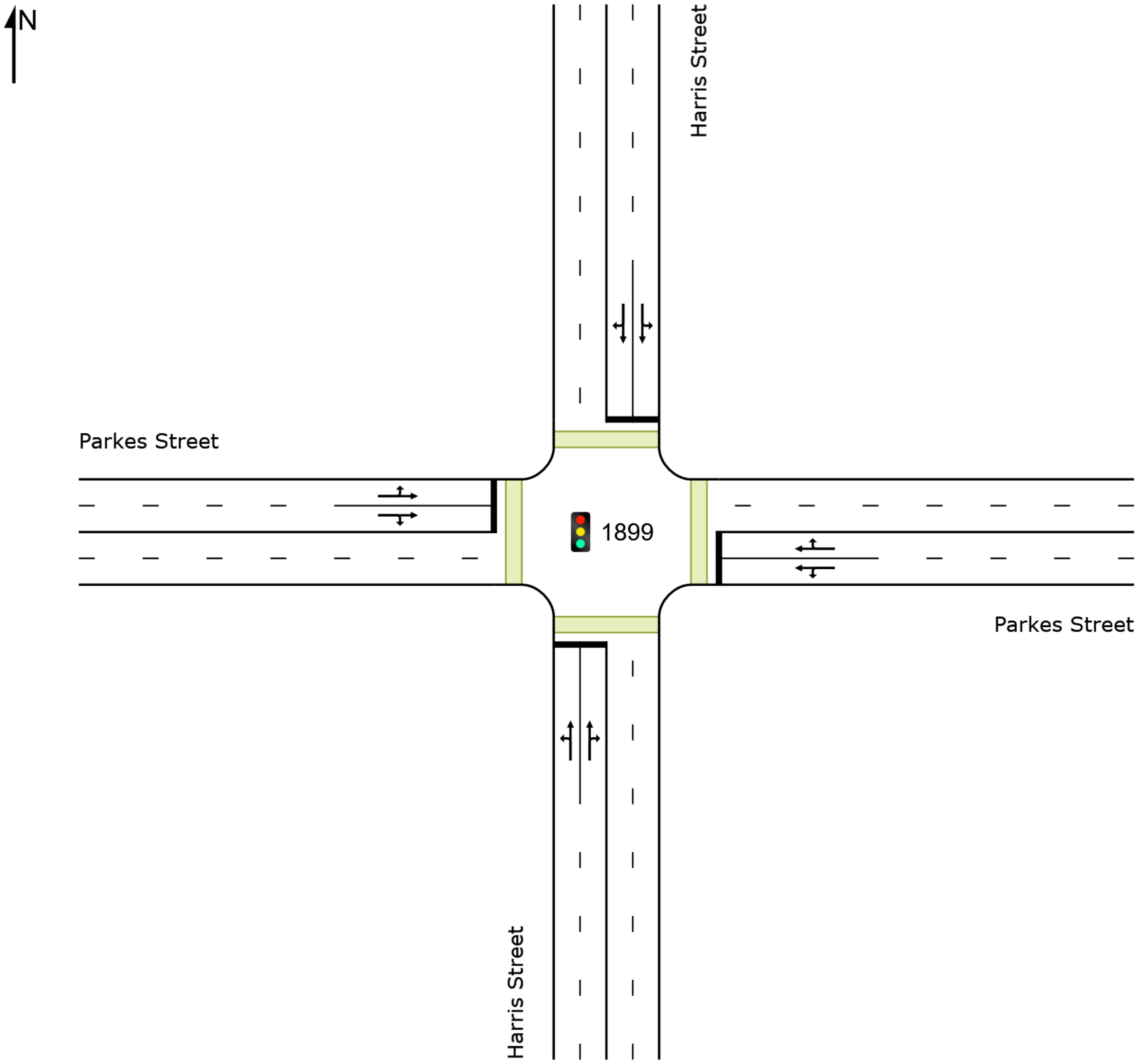
Site: 1899 [TCS 1899 - Harris Street Parkes Street - PM Peak - NB Detour (Site Folder: Weekday - OK)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 88 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Harris Street														
1	L2	28	1	29	5.0	0.542	47.3	LOS D	4.9	35.8	0.99	0.78	0.99	18.5
2	T1	81	4	85	5.0	0.542	41.7	LOS C	4.9	35.8	0.99	0.78	0.99	17.9
3	R2	161	8	169	5.0	0.832 *	54.1	LOS D	8.1	59.3	1.00	0.94	1.34	20.8
Approach		270	14	284	5.0	0.832	49.7	LOS D	8.1	59.3	1.00	0.88	1.20	19.9
East: Parkes Street														
4	L2	52	3	55	5.0	0.421	26.3	LOS B	9.8	71.2	0.77	0.68	0.77	33.3
5	T1	311	16	327	5.0	0.421	23.6	LOS B	9.8	71.2	0.81	0.70	0.81	31.4
6	R2	52	3	55	5.0	0.421 *	40.2	LOS C	4.9	35.9	0.94	0.75	0.94	23.7

Approach		415	21	437	5.0	0.421	26.0	LOS B	9.8	71.2	0.82	0.70	0.82	30.5
North: Harris Street														
7	L2	145	7	153	5.0	0.693	36.8	LOS C	14.3	104.4	0.95	0.84	0.97	25.1
8	T1	384	19	404	5.0	0.693	31.2	LOS C	14.3	104.4	0.95	0.84	0.97	21.2
9	R2	161	8	169	5.0	0.693	36.8	LOS C	14.3	104.2	0.95	0.84	0.97	18.5
Approach		690	35	726	5.0	0.693	33.7	LOS C	14.3	104.4	0.95	0.84	0.97	21.5
West: Parkes Street														
10	L2	109	5	115	5.0	* 0.884	49.9	LOS D	21.5	157.1	1.00	1.09	1.30	15.1
11	T1	705	35	742	5.0	0.884	44.9	LOS D	21.5	157.1	1.00	1.08	1.30	22.5
12	R2	4	4	4	100.0	* 0.884	52.1	LOS D	20.9	153.9	1.00	1.07	1.31	16.7
Approach		818	45	861	5.5	0.884	45.6	LOS D	21.5	157.1	1.00	1.08	1.30	21.6
All Vehicles		2193	113	2308	5.2	0.884	38.6	LOS C	21.5	157.1	0.95	0.91	1.09	22.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

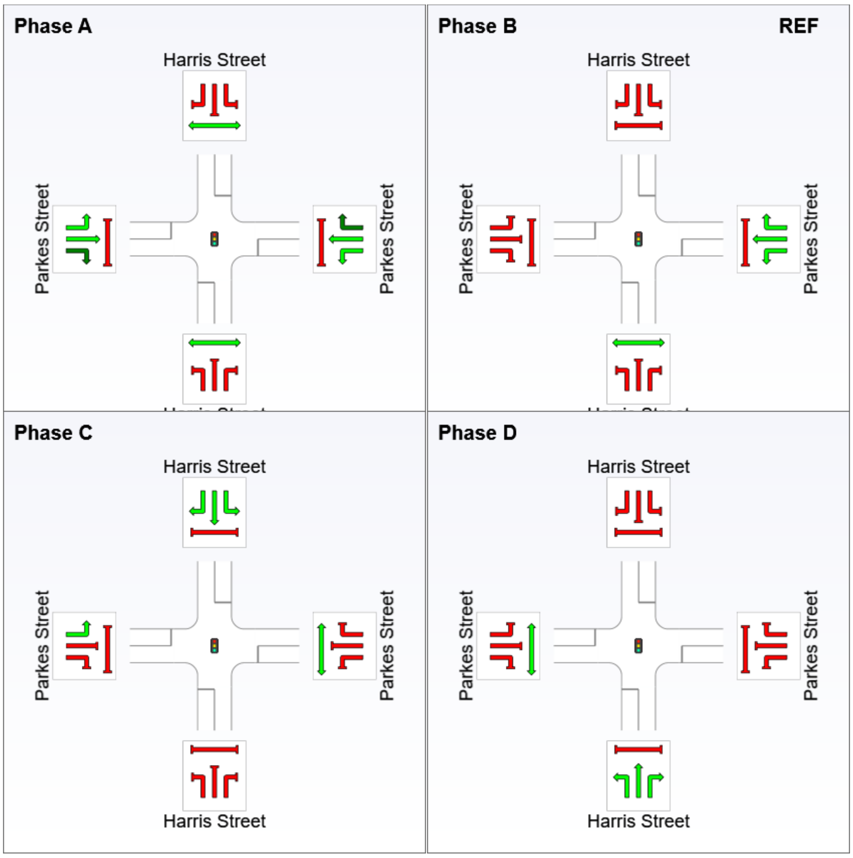
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Harris Street												
P1	Full	50	53	38.3	LOS D	0.1	0.1	0.93	0.93	203.8	215.2	1.06
East: Parkes Street												
P2	Full	50	53	38.3	LOS D	0.1	0.1	0.93	0.93	203.8	215.2	1.06
North: Harris Street												
P3	Full	50	53	38.3	LOS D	0.1	0.1	0.93	0.93	203.8	215.2	1.06
West: Parkes Street												
P4	Full	50	53	38.3	LOS D	0.1	0.1	0.93	0.93	203.8	215.2	1.06
All Pedestrians		200	211	38.3	LOS D	0.1	0.1	0.93	0.93	203.8	215.2	1.06

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: Leading Right Turn
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	B	C	D
Phase Change Time (sec)	59	0	12	43
Green Time (sec)	23	6	25	10
Phase Time (sec)	29	12	31	16
Phase Split	33%	14%	35%	18%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Weekday NB Closure

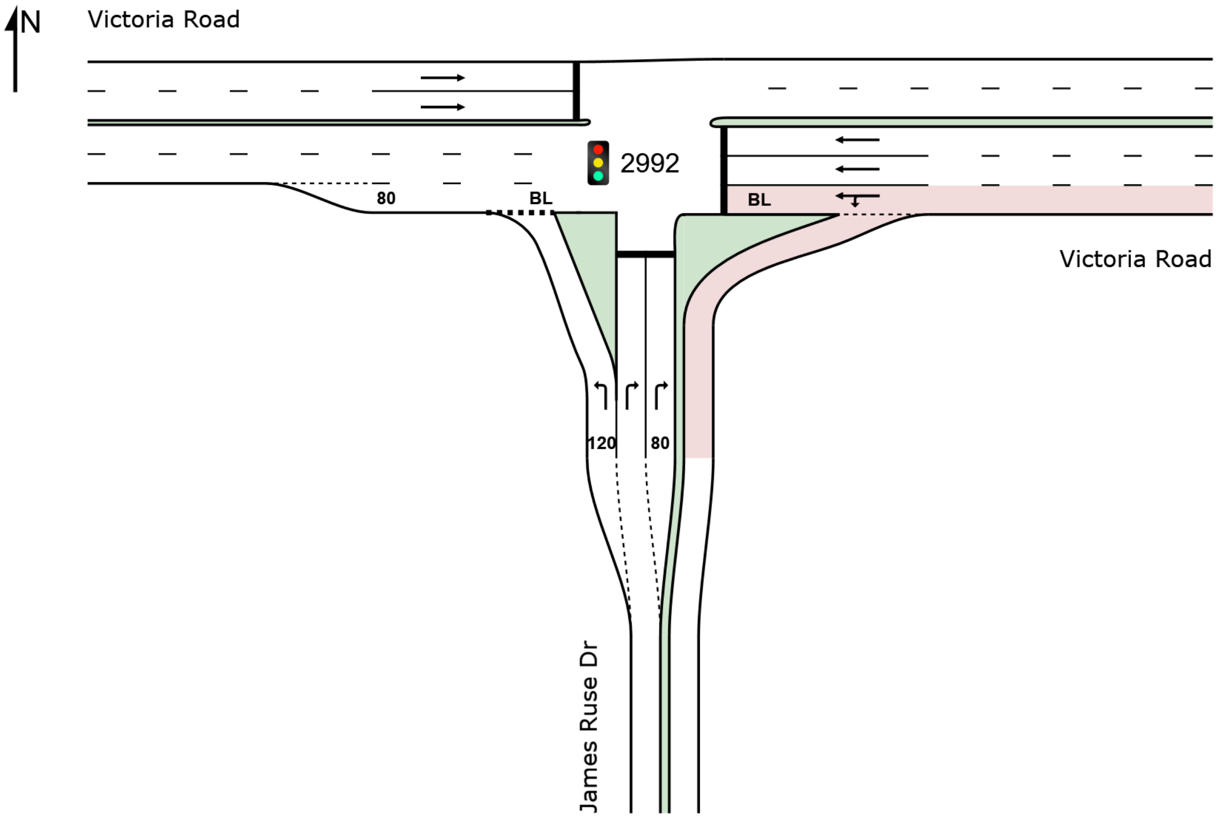
Site: 2992 [TCS 2992 Victoria Road James Ruse Dr - AM Peak 0800-0900 (Site Folder: Weekday - OK)]

Victoria Road / James Ruse Dr Parramatta - Weekday AM Peak Existing 0800-0900 26 July - 26 Aug Average
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, B
Output Phase Sequence: A, B

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

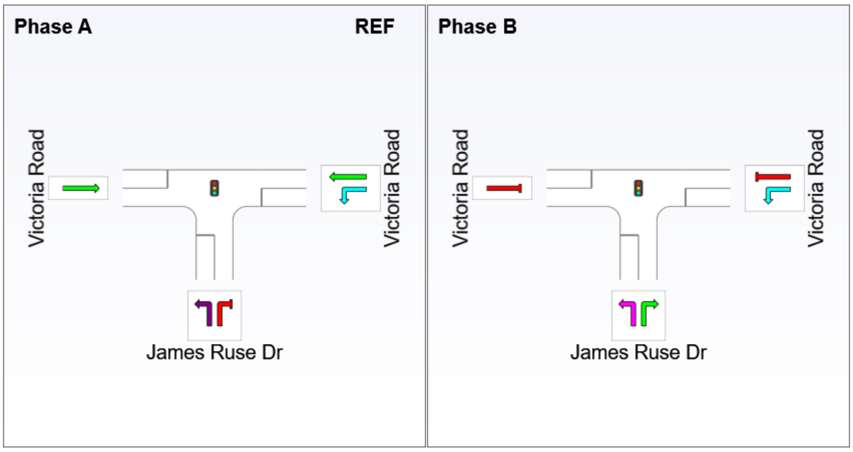
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed

		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: James Ruse Dr														
1	L2	30	5.0	32	5.0	0.030	7.8	LOS A	0.2	1.8	0.32	0.61	0.32	52.4
3	R2	622	5.0	655	5.0	* 0.441	21.6	LOS B	8.1	59.2	0.76	0.79	0.76	43.3
Approach		652	5.0	686	5.0	0.441	21.0	LOS B	8.1	59.2	0.74	0.78	0.74	43.7
East: Victoria Road														
4	L2	507	5.0	534	5.0	0.298	5.7	LOS A	0.0	0.0	0.00	0.53	0.00	54.6
5	T1	674	5.1	709	5.1	* 0.454	16.1	LOS B	8.8	64.5	0.77	0.66	0.77	47.5
Approach		1181	5.1	1243	5.1	0.454	11.6	LOS A	8.8	64.5	0.44	0.60	0.44	50.3
West: Victoria Road														
11	T1	612	5.0	644	5.0	0.412	15.7	LOS B	7.8	57.2	0.75	0.64	0.75	47.7
Approach		612	5.0	644	5.0	0.412	15.7	LOS B	7.8	57.2	0.75	0.64	0.75	47.7
All Vehicles		2445	5.0	2574	5.0	0.454	15.1	LOS B	8.8	64.5	0.60	0.66	0.60	47.8

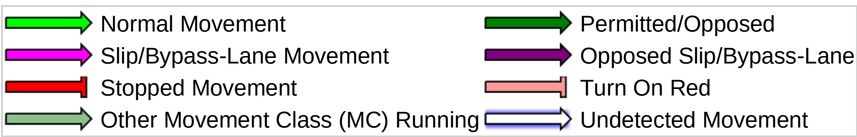
Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Input Phase Sequence

Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, B



REF: Reference Phase
VAR: Variable Phase



Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	B
Phase Change Time (sec)	0	35
Green Time (sec)	29	29
Phase Time (sec)	35	35
Phase Split	50%	50%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

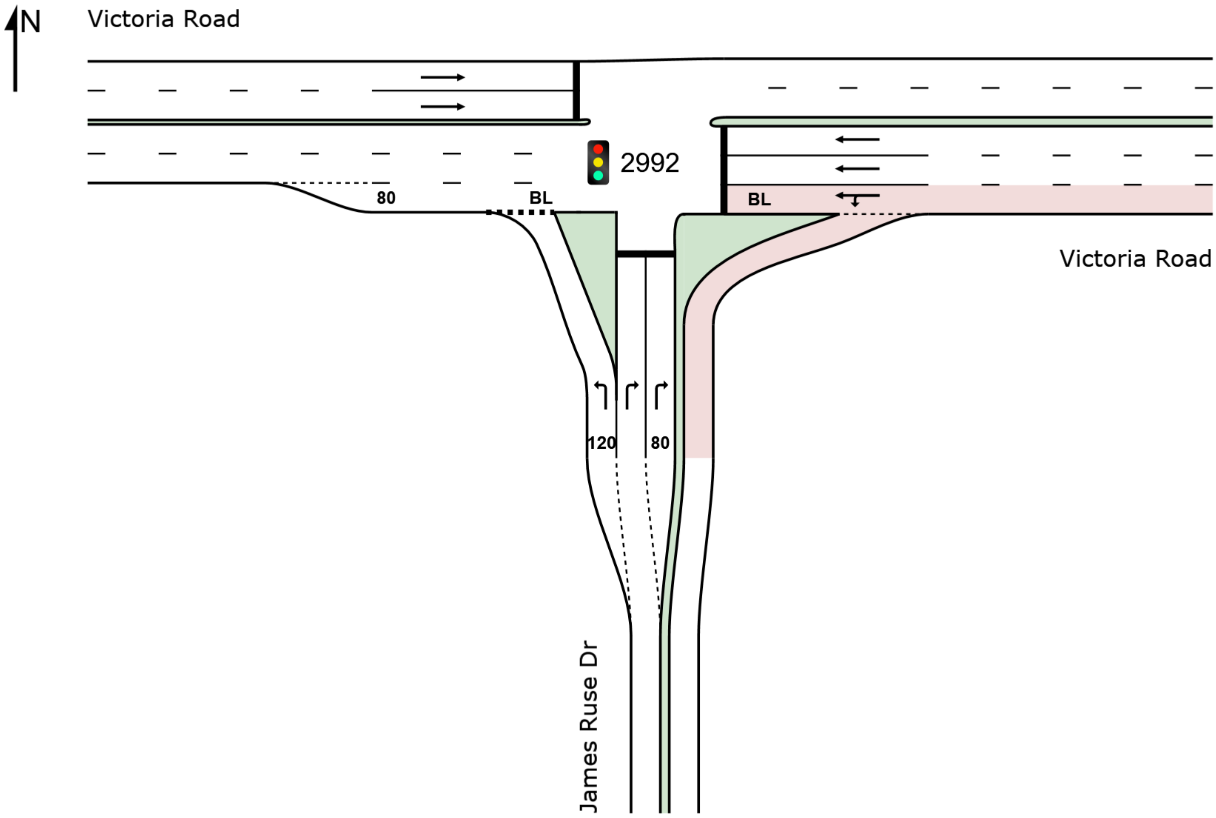
Site: 2992 [TCS 2992 Victoria Road James Ruse Dr - AM Peak 0800-0900 - NB Detour - 50% Left 50% Right (Site Folder: Weekday - OK)]

Victoria Road / James Ruse Dr Parramatta - Weekday AM Peak 0800-0900 26 July - 26 Aug Average
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, B
Output Phase Sequence: A, B

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: James Ruse Dr														
1	L2	282	14	297	4.8	0.272	9.7	LOS A	3.4	24.5	0.44	0.68	0.44	51.6
3	R2	875	44	921	5.0	* 0.545	19.9	LOS B	11.3	82.4	0.76	0.80	0.76	44.2
Approach		1157	58	1218	5.0	0.545	17.4	LOS B	11.3	82.4	0.68	0.77	0.68	45.8
East: Victoria Road														
4	L2	507	25	534	5.0	0.298	5.7	LOS A	0.0	0.0	0.00	0.53	0.00	54.6
5	T1	674	35	709	5.1	* 0.526	19.5	LOS B	9.8	71.2	0.84	0.72	0.84	45.5
Approach		1181	60	1243	5.1	0.526	13.6	LOS A	9.8	71.2	0.48	0.64	0.48	49.0
West: Victoria Road														
11	T1	612	31	644	5.0	0.478	19.1	LOS B	8.7	63.2	0.82	0.70	0.82	45.7
Approach		612	31	644	5.0	0.478	19.1	LOS B	8.7	63.2	0.82	0.70	0.82	45.7
All Vehicles		2950	148	3105	5.0	0.545	16.2	LOS B	11.3	82.4	0.63	0.70	0.63	47.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

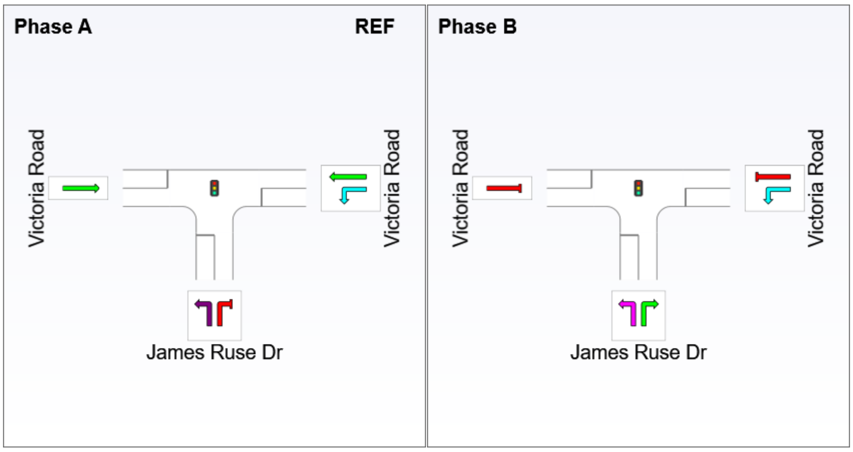
Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Input Phase Sequence

Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, B



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	B
Phase Change Time (sec)	0	31
Green Time (sec)	25	33
Phase Time (sec)	31	39
Phase Split	44%	56%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Site: 2992 [TCS 2992 Victoria Road James Ruse Dr - PM Peak 1700-1800 (Site Folder: Weekday - OK)]

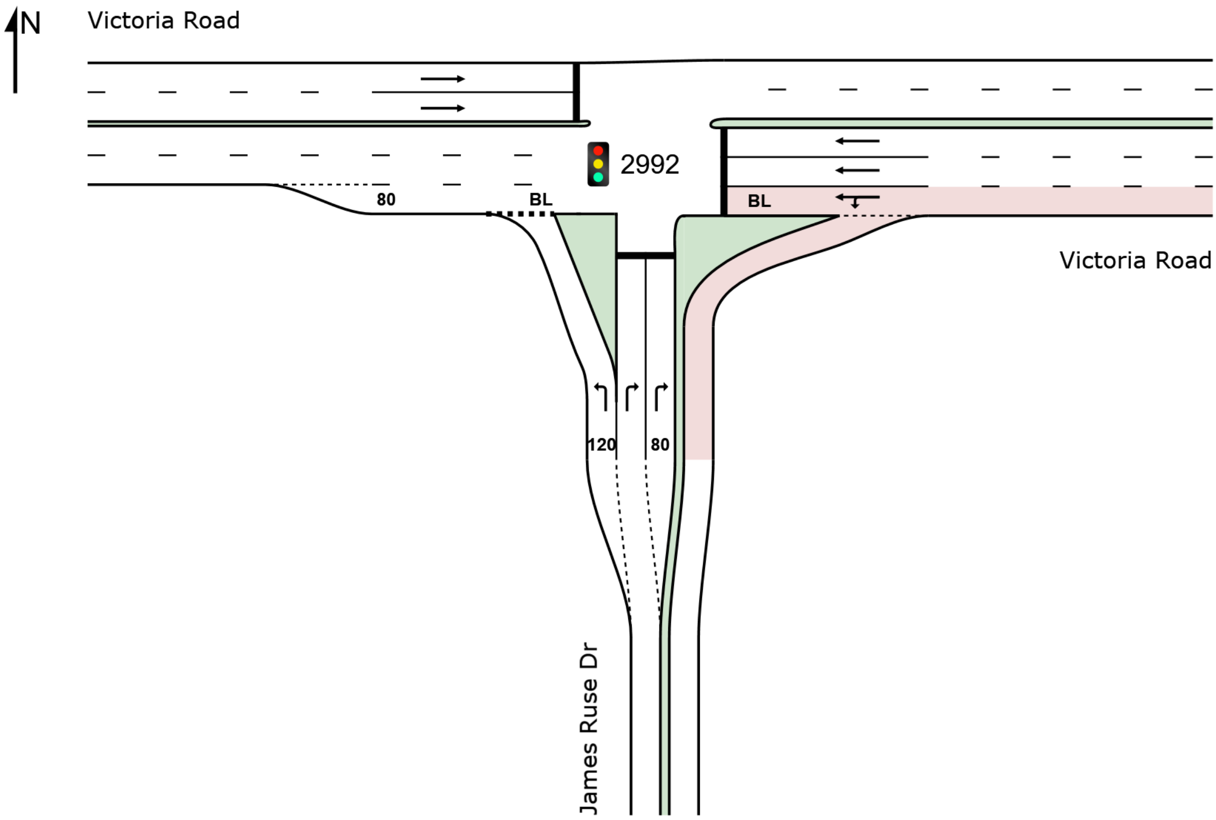
Victoria Road / James Ruse Dr Parramatta - Weekday PM Peak Existing 1700-1800 26 July - 26 Aug Average
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A

Input Phase Sequence: A, B
Output Phase Sequence: A, B

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

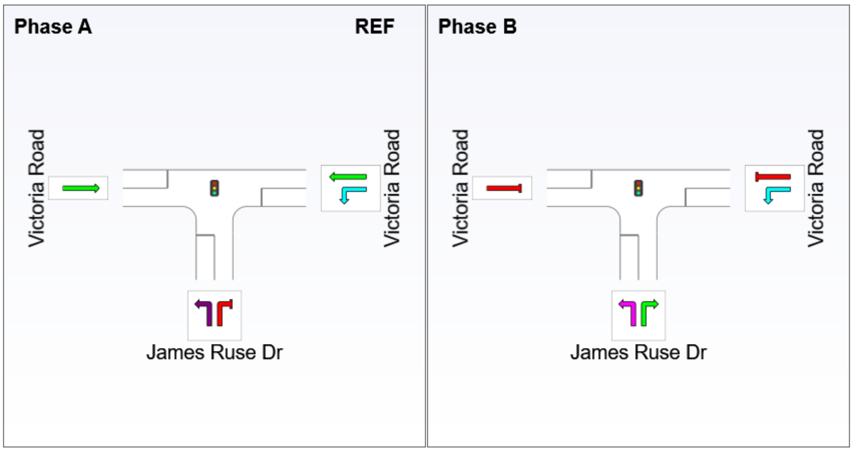
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: James Ruse Dr														
1	L2	28	5.0	29	5.0	0.034	7.5	LOS A	0.2	1.6	0.31	0.61	0.31	52.5
3	R2	422	5.0	444	5.0	* 0.456	29.1	LOS C	6.5	47.3	0.88	0.80	0.88	39.8
Approach		450	5.0	474	5.0	0.456	27.7	LOS B	6.5	47.3	0.84	0.79	0.84	40.4
East: Victoria Road														
4	L2	761	5.0	801	5.0	0.447	5.8	LOS A	0.0	0.0	0.00	0.52	0.00	54.5
5	T1	779	5.1	820	5.1	* 0.390	9.4	LOS A	7.9	57.9	0.61	0.53	0.61	52.0
Approach		1540	5.1	1621	5.1	0.447	7.6	LOS A	7.9	57.9	0.31	0.53	0.31	53.2
West: Victoria Road														
11	T1	612	5.0	644	5.0	0.306	8.9	LOS A	5.9	42.8	0.57	0.49	0.57	52.4
Approach		612	5.0	644	5.0	0.306	8.9	LOS A	5.9	42.8	0.57	0.49	0.57	52.4

All Vehicles	2602	5.0	2739	5.0	0.456	11.4	LOS A	7.9	57.9	0.46	0.56	0.46	50.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Input Phase Sequence

Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, B



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	**A**	**B**
Phase Change Time (sec)	0	45
Green Time (sec)	39	19
Phase Time (sec)	45	25
Phase Split	64%	36%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

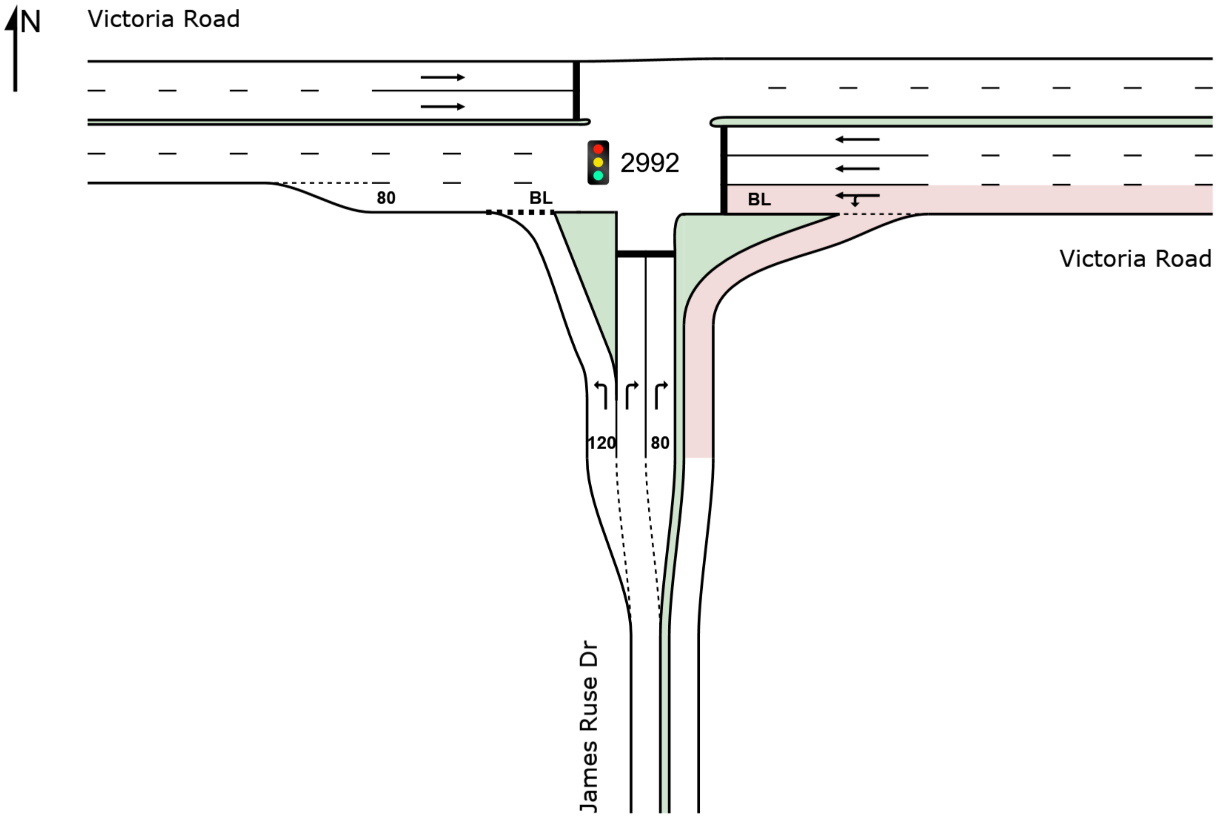
Site: 2992 [TCS 2992 Victoria Road James Ruse Dr - PM Peak 1700-1800 - NB Detour - 50% Left 50% Right (Site Folder: Weekday - OK)]

Victoria Road / James Ruse Dr Parramatta - Weekday PM Peak 1700-1800 26 July - 26 Aug Average
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, B
Output Phase Sequence: A, B

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

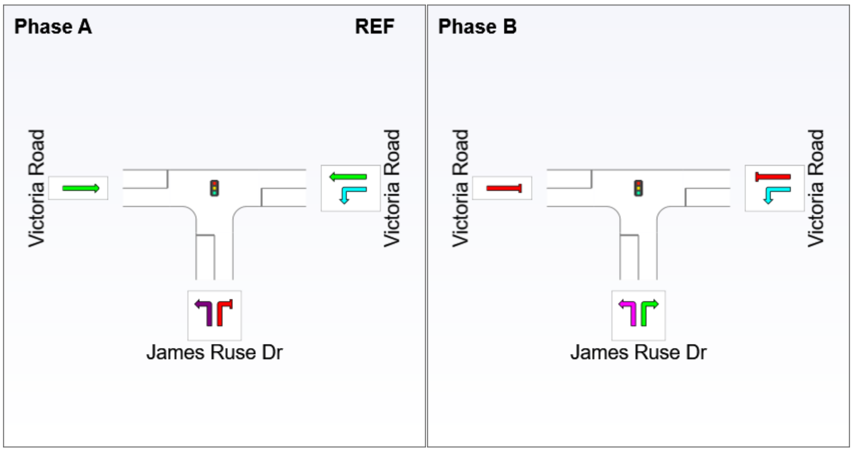
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: James Ruse Dr														
1	L2	346	17	364	5.0	0.364	10.8	LOS A	5.1	37.3	0.52	0.72	0.52	50.9
3	R2	740	37	779	5.0	* 0.524	22.3	LOS B	10.1	73.6	0.80	0.81	0.80	43.0
Approach		1086	55	1143	5.0	0.524	18.7	LOS B	10.1	73.6	0.71	0.78	0.71	45.2
East: Victoria Road														
4	L2	761	38	801	5.0	0.447	5.8	LOS A	0.0	0.0	0.00	0.52	0.00	54.5

5	T1	779	40	820	5.1	* 0.524	16.7	LOS B	10.6	77.4	0.80	0.69	0.80	47.1
Approach		1540	78	1621	5.1	0.524	11.3	LOS A	10.6	77.4	0.40	0.61	0.40	50.5
West: Victoria Road														
11	T1	612	31	644	5.0	0.412	15.7	LOS B	7.8	57.2	0.75	0.64	0.75	47.7
Approach		612	31	644	5.0	0.412	15.7	LOS B	7.8	57.2	0.75	0.64	0.75	47.7
All Vehicles		3238	163	3408	5.0	0.524	14.6	LOS B	10.6	77.4	0.57	0.67	0.57	48.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Input Phase Sequence

Phase Sequence: TCS 749 - Split plan 3 Reference Phase: Phase A
Input Phase Sequence: A, B



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	B
Phase Change Time (sec)	0	35
Green Time (sec)	29	29
Phase Time (sec)	35	35

Phase Split	50%	50%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Weekday NB Closure

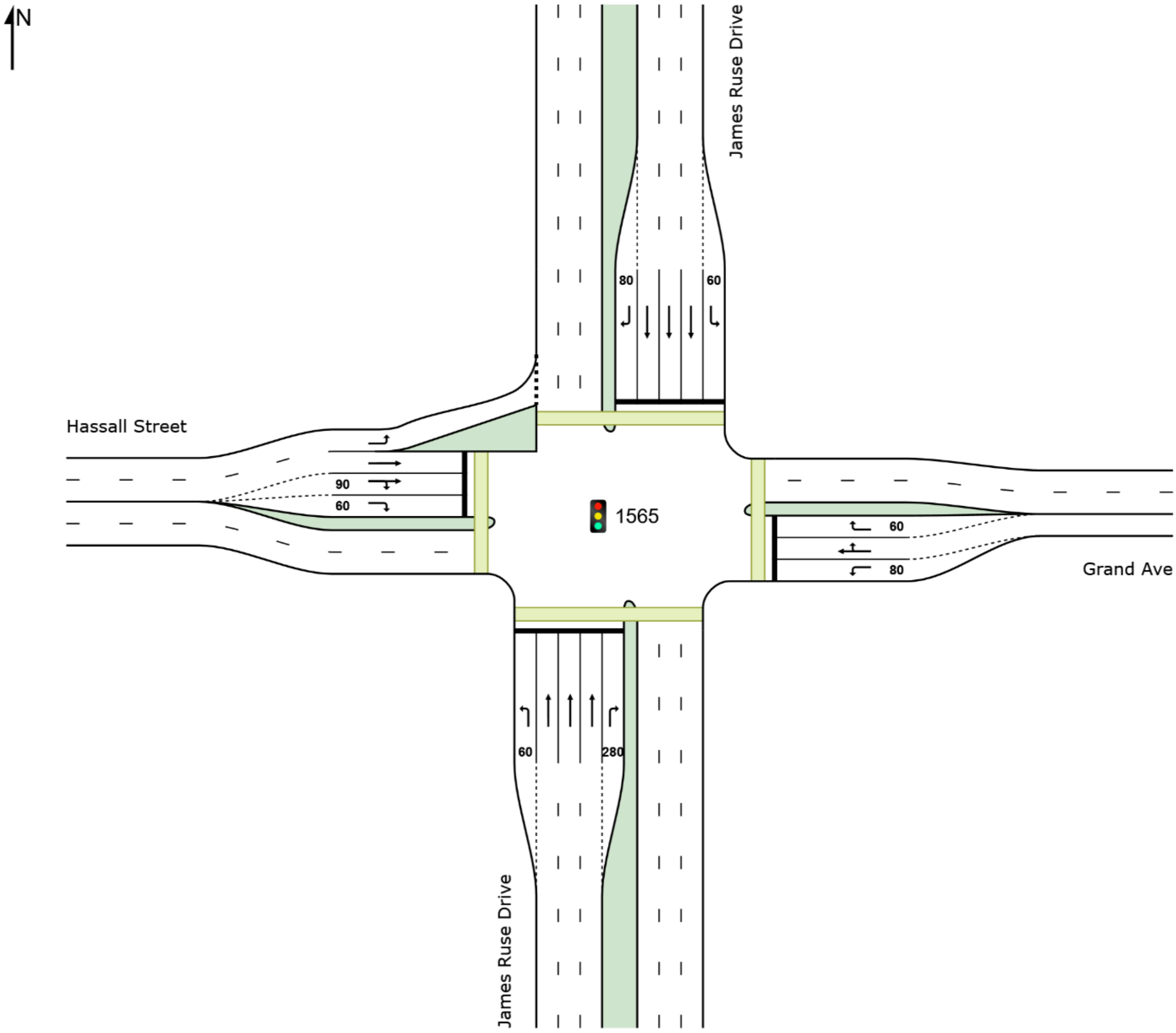
Site: 1565 [TCS1565 - James Ruse Drive / Hassall St / Grand Ave - AM Peak 0800-0900 (Site Folder: New Folder)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: James Ruse Drive														
1	L2	355	5.0	359	5.0	0.326	20.3	LOS B	12.4	90.4	0.52	0.73	0.52	38.9
2	T1	1917	5.0	1936	5.0	0.942	68.5	LOS E	61.9	452.1	0.96	1.05	1.19	28.1
3	R2	138	5.0	139	5.0	0.777	82.1	LOS F	10.6	77.6	1.00	0.87	1.15	25.1
Approach		2410	5.0	2434	5.0	0.942	62.2	LOS E	61.9	452.1	0.90	1.00	1.09	28.7
East: Grand Ave														
4	L2	117	5.0	118	5.0	0.215	46.7	LOS D	6.3	46.3	0.78	0.76	0.78	33.1
5	T1	48	5.0	48	5.0	0.263	58.9	LOS E	5.2	37.9	0.91	0.74	0.91	25.0
6	R2	110	5.0	111	5.0	0.263	64.6	LOS E	5.2	37.9	0.91	0.76	0.91	29.3
Approach		275	5.0	278	5.0	0.263	56.0	LOS D	6.3	46.3	0.86	0.76	0.86	30.1
North: James Ruse Drive														
7	L2	186	5.0	188	5.0	* 0.183	14.0	LOS A	3.8	28.0	0.51	0.71	0.51	47.6

8	T1	2001	5.0	2021	5.0	0.984 *	88.1	LOS F	73.4	535.5	0.98	1.17	1.33	24.4
9	R2	175	5.0	177	5.0	0.986 *	116.4	LOS F	16.8	122.8	1.00	1.09	1.59	16.2
Approach		2362	5.0	2386	5.0	0.986	84.3	LOS F	73.4	535.5	0.94	1.13	1.29	24.7
West: Hassall Street														
10	L2	464	5.0	469	5.0	0.678	33.2	LOS C	26.4	193.1	0.88	0.86	0.88	33.5
11	T1	167	5.0	169	5.0	0.536	62.2	LOS E	11.4	83.3	0.97	0.79	0.97	24.8
12	R2	320	5.0	323	5.0	0.541 *	68.0	LOS E	11.0	80.0	0.97	0.81	0.97	22.8
Approach		951	5.0	961	5.0	0.678	50.0	LOS D	26.4	193.1	0.92	0.83	0.92	27.5
All Vehicles		5998	5.0	6059	5.0	0.986	68.7	LOS E	73.4	535.5	0.92	1.01	1.13	26.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: James Ruse Drive												
P1	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	246.5	230.4	0.93
East: Grand Ave												
P2	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	238.9	220.5	0.92
North: James Ruse Drive												
P3	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	246.5	230.4	0.93
West: Hassall Street												
P4	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	238.9	220.5	0.92
All Pedestrians		200	211	69.3	LOS F	0.2	0.2	0.96	0.96	242.7	225.5	0.93

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Reference Sequence: Leading Phase: Right Phase Turn A
Input Phase Sequence: A, E, D, F

REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	67	98	129
Green Time (sec)	61	25	25	15
Phase Time (sec)	67	31	31	21
Phase Split	45%	21%	21%	14%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

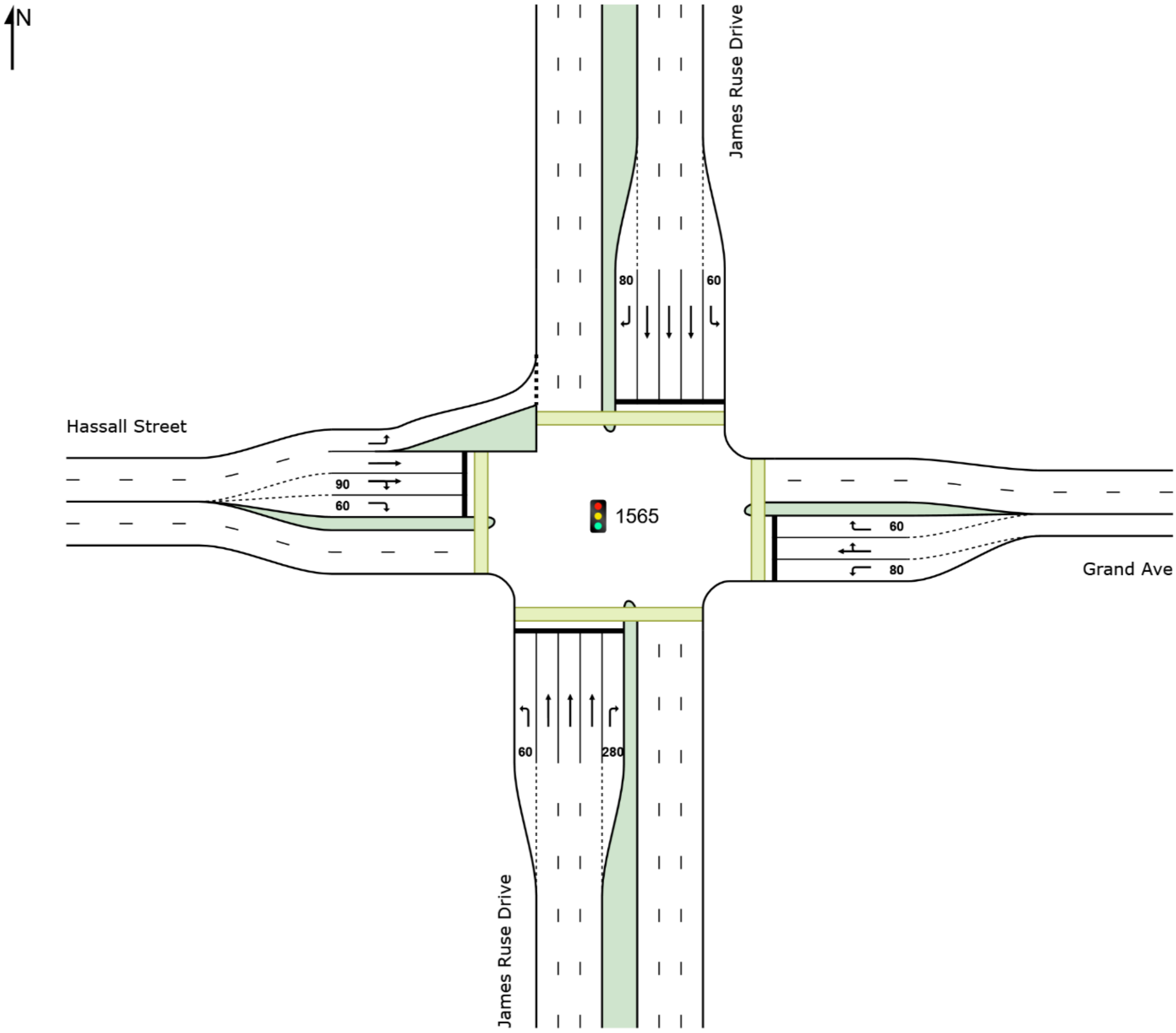
Site: 1565 [TCS1565 - James Ruse Drive / Hassall St / Grand Ave - AM Peak 0800-0900 - 40% NB Detour (Site Folder: New Folder)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: James Ruse Drive														
1	L2	355	18	359	5.0	0.326	20.3	LOS B	12.4	90.4	0.52	0.73	0.52	38.9
2	T1	1917	96	1936	5.0	0.942	68.5	LOS E	61.9	452.1	0.96	1.05	1.19	28.1
3	R2	138	7	139	5.0	0.777	82.1	LOS F	10.6	77.6	1.00	0.87	1.15	25.1

Approach		2410	121	2434	5.0	0.942	62.2	LOS E	61.9	452.1	0.90	1.00	1.09	28.7
East: Grand Ave														
4	L2	117	6	118	5.0	0.215	46.7	LOS D	6.3	46.3	0.78	0.76	0.78	33.1
5	T1	48	2	48	5.0	0.263	58.9	LOS E	5.2	37.9	0.91	0.74	0.91	25.0
6	R2	110	6	111	5.0	0.263	64.6	LOS E	5.2	37.9	0.91	0.76	0.91	29.3
Approach		275	14	278	5.0	0.263	56.0	LOS D	6.3	46.3	0.86	0.76	0.86	30.1
North: James Ruse Drive														
7	L2	186	9	188	5.0	0.183 *	14.0	LOS A	3.8	28.0	0.51	0.71	0.51	47.6
8	T1	2001	100	2021	5.0	0.984 *	88.1	LOS F	73.4	535.5	0.98	1.17	1.33	24.4
9	R2	175	9	177	5.0	0.986 *	116.4	LOS F	16.8	122.8	1.00	1.09	1.59	16.2
Approach		2362	118	2386	5.0	0.986	84.3	LOS F	73.4	535.5	0.94	1.13	1.29	24.7
West: Hassall Street														
10	L2	666	33	681	5.0	0.985	96.7	LOS F	61.4	448.2	1.00	1.18	1.37	18.5
11	T1	167	8	169	5.0	0.536	62.2	LOS E	11.4	83.3	0.97	0.79	0.97	24.8
12	R2	320	16	323	5.0	0.541 *	68.0	LOS E	11.0	80.0	0.97	0.81	0.97	22.8
Approach		1153	58	1173	5.0	0.985	83.8	LOS F	61.4	448.2	0.99	1.02	1.20	20.3
All Vehicles		6200	310	6271	5.0	0.986	74.4	LOS F	73.4	535.5	0.93	1.04	1.18	25.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

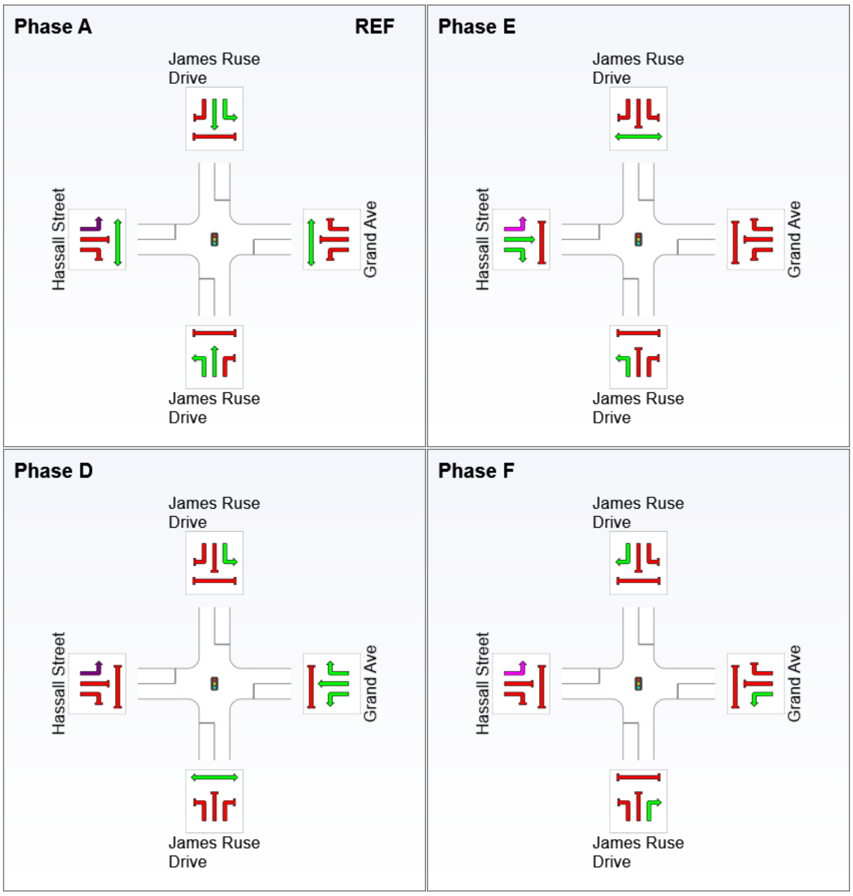
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: James Ruse Drive												
P1	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	246.5	230.4	0.93
East: Grand Ave												
P2	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	238.9	220.5	0.92
North: James Ruse Drive												
P3	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	246.5	230.4	0.93
West: Hassall Street												
P4	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	238.9	220.5	0.92
All Pedestrians		200	211	69.3	LOS F	0.2	0.2	0.96	0.96	242.7	225.5	0.93

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: Leading Right Turn
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	67	98	129
Green Time (sec)	61	25	25	15
Phase Time (sec)	67	31	31	21
Phase Split	45%	21%	21%	14%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

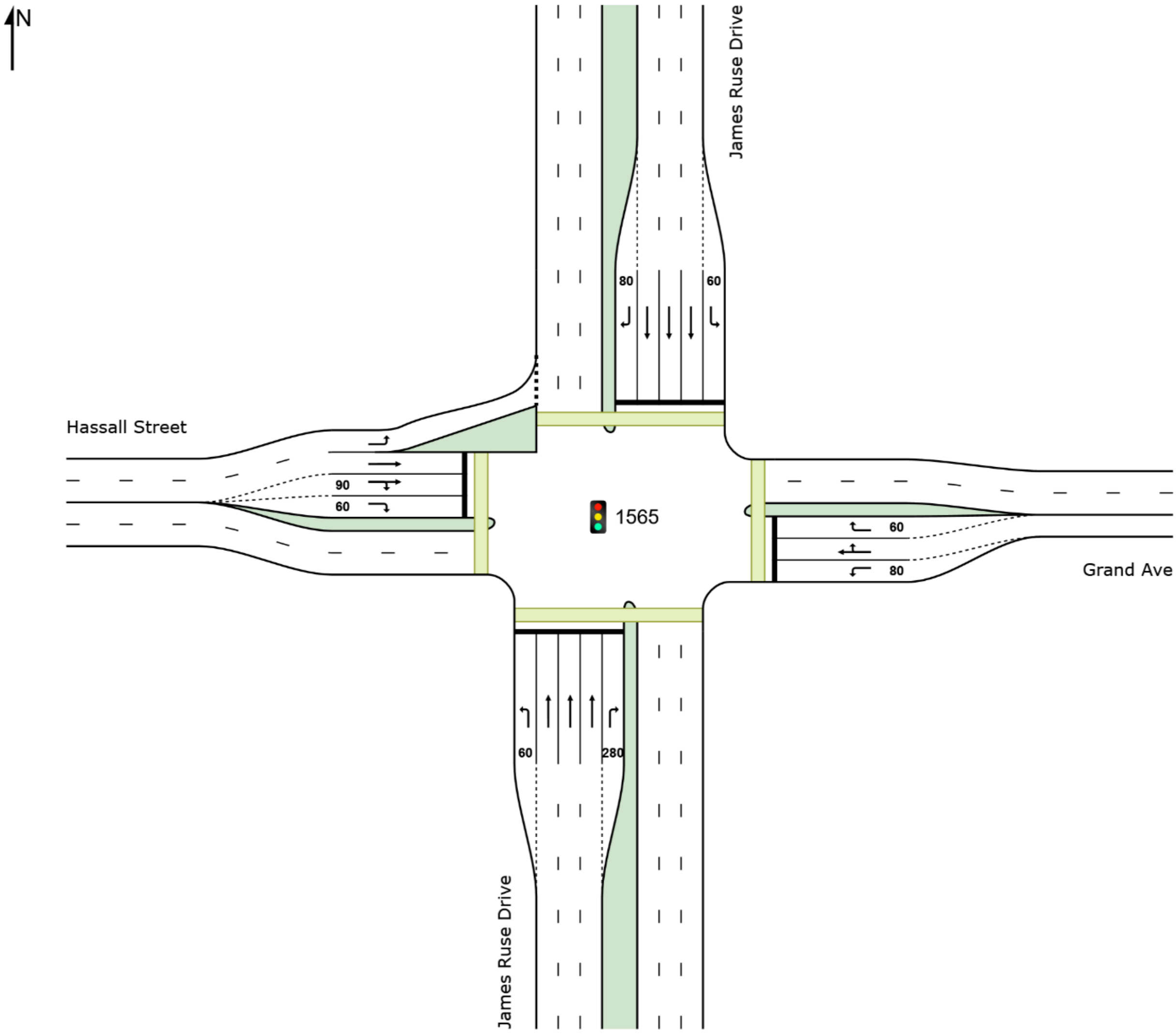
Site: 1565 [TCS1565 - James Ruse Drive / Hassall St / Grand Ave - PM Peak 1700-1800 (Site Folder: New Folder)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed

		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: James Ruse Drive														
1	L2	206	5.0	208	5.0	0.193	19.8	LOS B	6.7	49.0	0.48	0.71	0.48	39.2
2	T1	1978	5.0	1998	5.0	0.962	77.9	LOS F	64.9	474.1	0.98	1.11	1.26	26.1
3	R2	61	5.0	62	5.0	0.303	72.7	LOS F	4.2	30.8	0.96	0.76	0.96	26.9
Approach		2245	5.0	2268	5.0	0.962	72.4	LOS F	64.9	474.1	0.94	1.07	1.18	26.8
East: Grand Ave														
4	L2	166	5.0	168	5.0	0.292	46.3	LOS D	9.1	66.5	0.80	0.78	0.80	33.2
5	T1	66	5.0	67	5.0	* 0.408	60.7	LOS E	8.3	60.4	0.94	0.77	0.94	24.5
6	R2	179	5.0	181	5.0	0.408	66.4	LOS E	8.3	60.4	0.94	0.79	0.94	28.9
Approach		411	5.0	415	5.0	0.408	57.4	LOS E	9.1	66.5	0.88	0.78	0.88	29.8
North: James Ruse Drive														
7	L2	51	5.0	52	5.0	0.051	13.7	LOS A	1.0	7.0	0.47	0.67	0.47	47.8
8	T1	2162	5.0	2184	5.0	* 1.054	134.6	LOS F	91.4	667.2	1.00	1.40	1.62	18.3
9	R2	203	5.0	205	5.0	* 1.009	127.4	LOS F	20.7	150.9	1.00	1.13	1.65	15.1
Approach		2416	5.0	2440	5.0	1.054	131.5	LOS F	91.4	667.2	0.99	1.36	1.59	18.3
West: Hassall Street														
10	L2	513	5.0	518	5.0	0.736	36.5	LOS C	30.4	222.3	0.92	0.88	0.92	32.2
11	T1	114	5.0	115	5.0	0.366	60.1	LOS E	7.5	55.0	0.93	0.75	0.93	25.3
12	R2	493	5.0	498	5.0	* 1.004	125.7	LOS F	25.4	185.7	1.00	1.13	1.61	15.0
Approach		1120	5.0	1131	5.0	1.004	78.2	LOS F	30.4	222.3	0.96	0.97	1.23	21.1
All Vehicles		6192	5.0	6255	5.0	1.054	95.5	LOS F	91.4	667.2	0.96	1.15	1.33	21.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Pedestrian Movement Performance

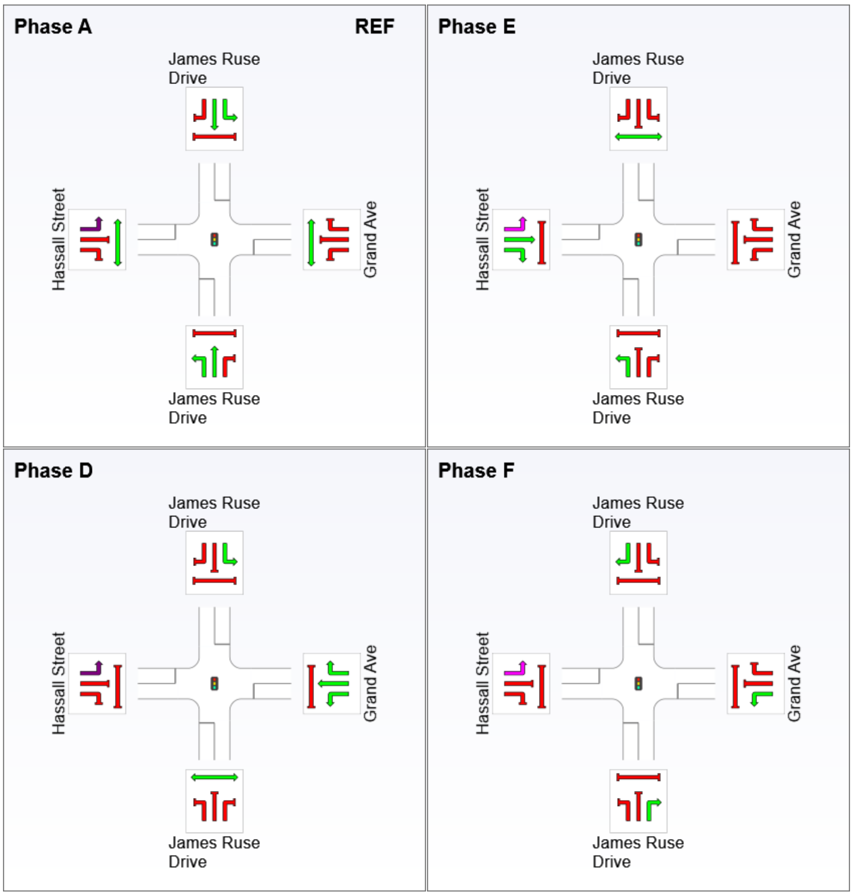
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: James Ruse Drive												
P1	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	246.5	230.4	0.93
East: Grand Ave												
P2	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	238.9	220.5	0.92
North: James Ruse Drive												
P3	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	246.5	230.4	0.93
West: Hassall Street												
P4	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	238.9	220.5	0.92
All Pedestrians		200	211	69.3	LOS F	0.2	0.2	0.96	0.96	242.7	225.5	0.93

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: Leading Right Turn
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	65	96	127
Green Time (sec)	59	25	25	17
Phase Time (sec)	65	31	31	23
Phase Split	43%	21%	21%	15%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

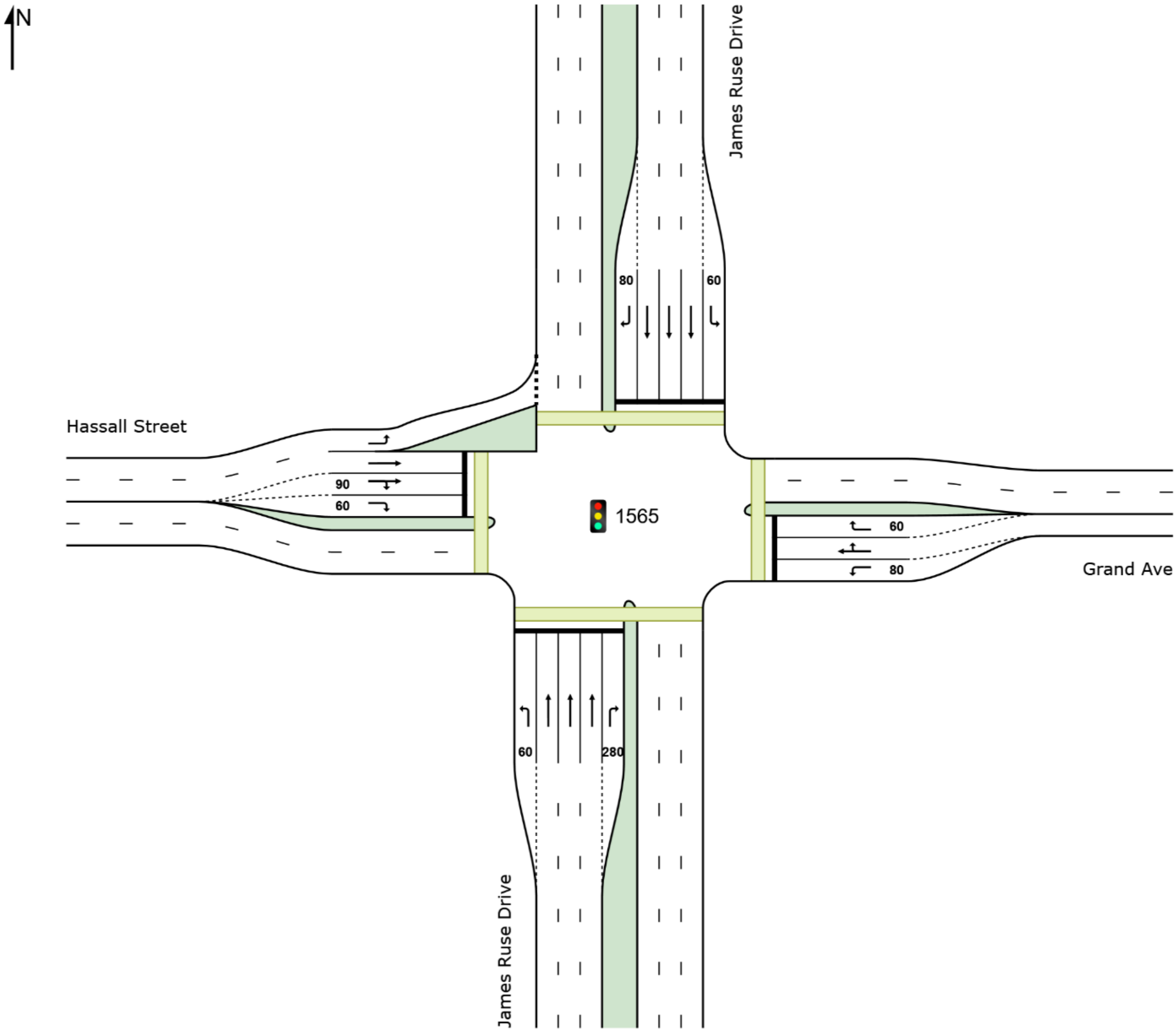
Site: 1565 [TCS1565 - James Ruse Drive / Hassall St / Grand Ave - PM Peak 1700-1800 - 40% NB Detour (Site Folder: New Folder)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: James Ruse Drive														
1	L2	206	10	208	5.0	0.191	19.4	LOS B	6.6	48.2	0.47	0.71	0.47	39.5
2	T1	1978	99	1998	5.0	0.978	86.7	LOS F	68.2	498.0	0.98	1.16	1.32	24.6
3	R2	61	3	62	5.0	0.322	73.9	LOS F	4.3	31.2	0.97	0.76	0.97	26.6
Approach		2245	112	2268	5.0	0.978	80.2	LOS F	68.2	498.0	0.94	1.11	1.23	25.3
East: Grand Ave														
4	L2	166	8	168	5.0	0.298	47.2	LOS D	9.2	67.2	0.80	0.78	0.80	32.9
5	T1	66	3	67	5.0	0.408 *	60.7	LOS E	8.3	60.4	0.94	0.77	0.94	24.5
6	R2	179	9	181	5.0	0.408	66.4	LOS E	8.3	60.4	0.94	0.79	0.94	28.9
Approach		411	21	415	5.0	0.408	57.7	LOS E	9.2	67.2	0.89	0.78	0.89	29.8
North: James Ruse Drive														
7	L2	51	3	52	5.0	0.052	14.1	LOS A	1.0	7.4	0.48	0.67	0.48	47.5
8	T1	2162	108	2184	5.0	1.071 *	147.5	LOS F	95.2	694.7	1.00	1.46	1.69	17.1
9	R2	203	10	205	5.0	1.072 *	166.0	LOS F	24.0	175.2	1.00	1.23	1.87	12.1
Approach		2416	121	2440	5.0	1.072	146.3	LOS F	95.2	694.7	0.99	1.42	1.68	16.9
West: Hassall Street														
10	L2	766	37	784	4.8	1.096	153.9	LOS F	92.7	675.2	1.00	1.29	1.79	11.9
11	T1	114	6	115	5.0	0.339	58.0	LOS E	7.4	53.9	0.92	0.74	0.92	25.8
12	R2	493	25	498	5.0	0.921 *	89.5	LOS F	20.9	152.2	1.00	1.01	1.35	19.1
Approach		1373	67	1398	4.9	1.096	123.1	LOS F	92.7	675.2	0.99	1.14	1.56	14.4
All Vehicles		6445	321	6521	5.0	1.096	112.7	LOS F	95.2	694.7	0.97	1.21	1.45	19.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Pedestrian Movement Performance

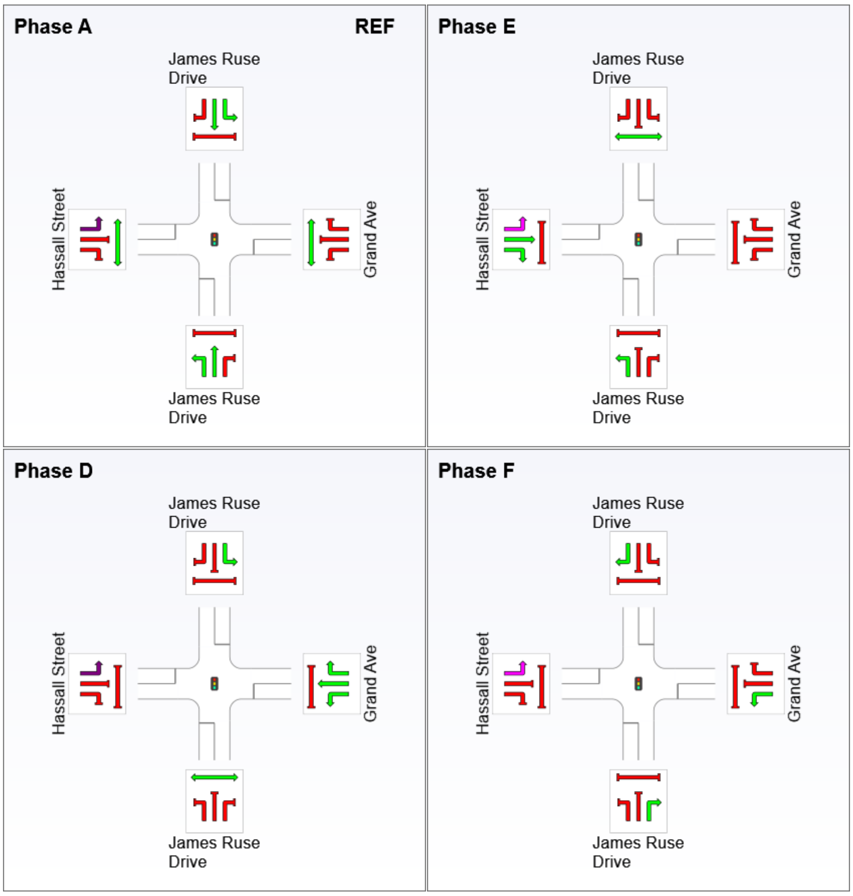
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: James Ruse Drive												
P1	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	246.5	230.4	0.93
East: Grand Ave												
P2	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	238.9	220.5	0.92
North: James Ruse Drive												
P3	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	246.5	230.4	0.93

West: Hassall Street												
P4	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	238.9	220.5	0.92
All Pedestrians		200	211	69.3	LOS F	0.2	0.2	0.96	0.96	242.7	225.5	0.93

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: Leading Right Turn
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	E	D	F

Phase Change Time (sec)	0	64	97	128
Green Time (sec)	58	27	25	16
Phase Time (sec)	64	33	31	22
Phase Split	43%	22%	21%	15%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Organisation: CIVLINK | Licence: NETWORK / 1PC | Created: Wednesday, 24 May 2023 6:24:51 PM
Project: E:\Civlink\Gasworks Bridge Rehabilitation\00_2022 Update\Rev 3\Weekday NB Closure.sip9

USER REPORT FOR SITE

All Movement Classes **Template: Report**

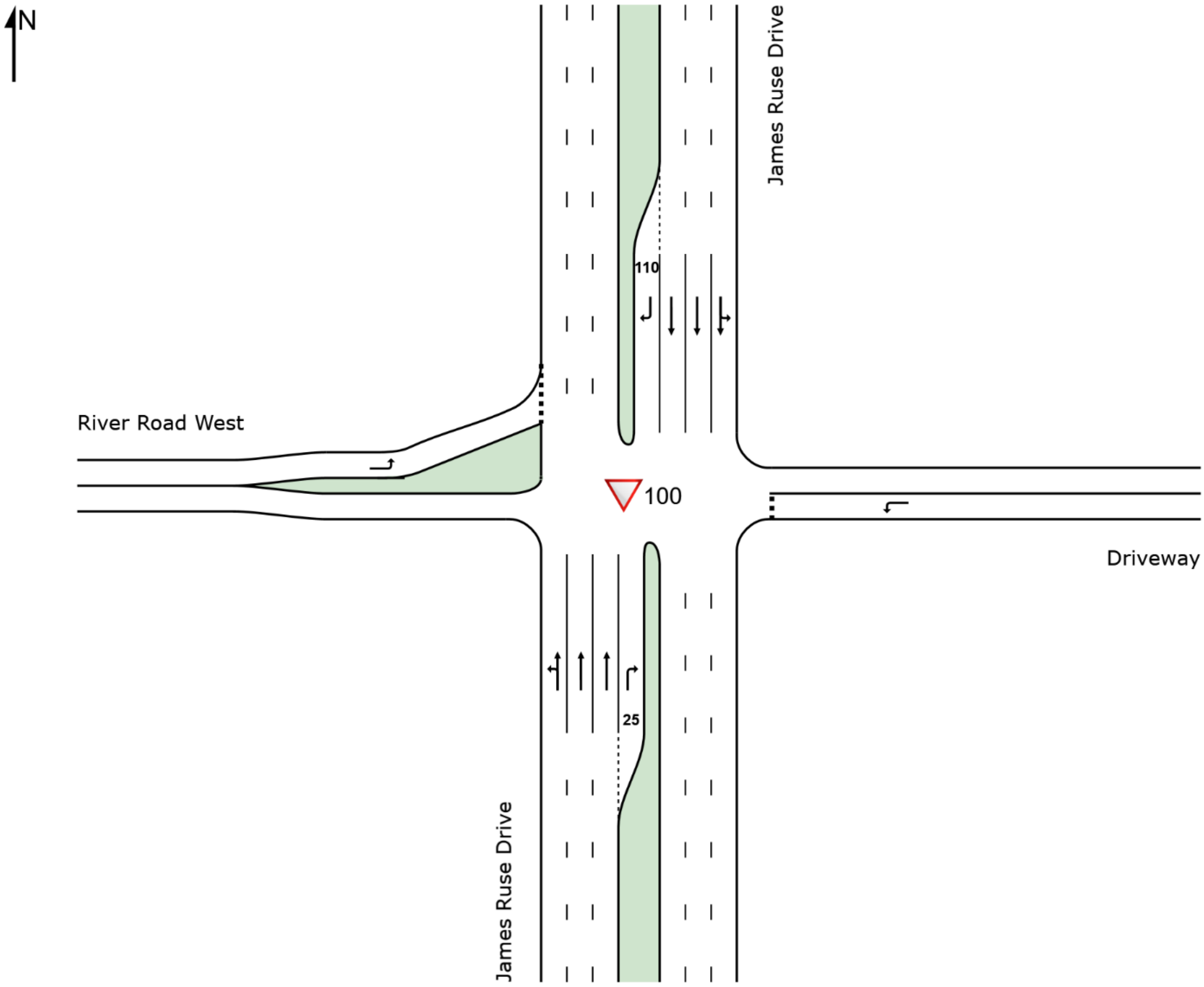
Project: Weekday NB Closure

Site: 100 [James Ruse Drive / River Road West - PM Peak - 2015 + 10% (Site Folder: New Folder)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: James Ruse Drive														
1	L2	13	5.0	13	5.0	0.455	5.7	LOS A	0.0	0.0	0.00	0.01	0.00	57.1
2	T1	2538	5.0	2563	5.0	0.455	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
3	R2	1	5.0	1	5.0	0.023	82.8	LOS F	0.1	0.4	0.98	0.99	0.98	14.9
Approach		2552	5.0	2578	5.0	0.455	0.2	NA	0.1	0.4	0.00	0.00	0.00	59.6
East: Driveway														
4	L2	1	5.0	1	5.0	0.007	27.2	LOS B	0.0	0.1	0.87	0.91	0.87	29.2
Approach		1	5.0	1	5.0	0.007	27.2	LOS B	0.0	0.1	0.87	0.91	0.87	29.2
North: James Ruse Drive														
7	L2	1	5.0	1	5.0	0.615	5.9	LOS A	0.0	0.0	0.00	0.00	0.00	56.4
8	T1	2415	5.0	2439	5.0	0.615	2.1	LOS A	3.1	22.4	0.05	0.00	0.06	57.3
9	R2	301	5.0	304	5.0	2.296	1202.9	LOS F	115.2	841.2	1.00	5.04	17.32	2.8
Approach		2717	5.0	2744	5.0	2.296	135.2	NA	115.2	841.2	0.15	0.56	1.97	15.4
West: River Road West														

10	L2	351	5.0	354	5.0	0.668	20.1	LOS B	5.7	41.9	0.83	1.21	1.72	44.7
Approach		351	5.0	354	5.0	0.668	20.1	LOS B	5.7	41.9	0.83	1.21	1.72	44.7
All Vehicles		5621	5.0	5678	5.0	2.296	66.7	NA	115.2	841.2	0.13	0.35	1.06	24.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: SIDRA Standard.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

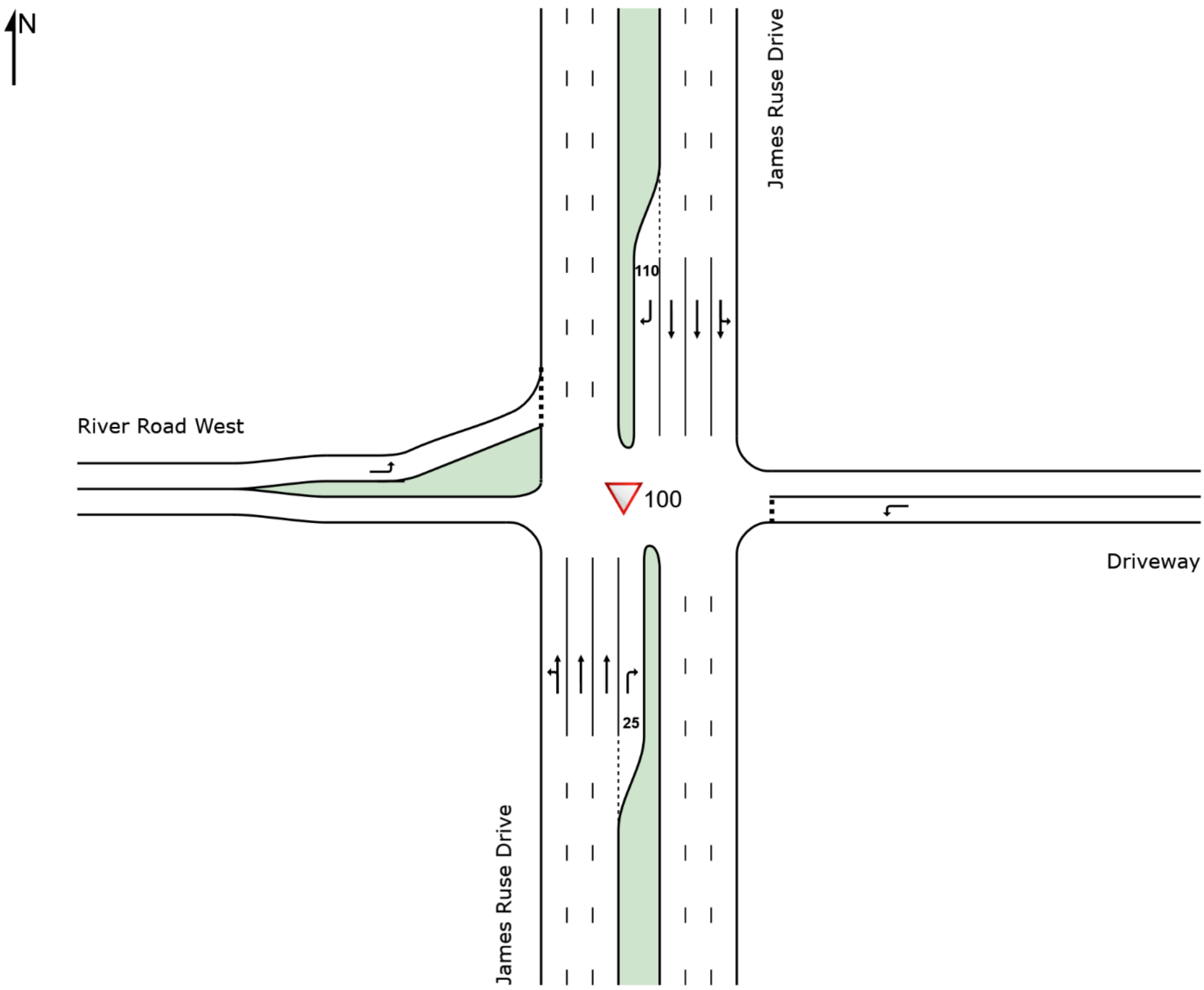
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Site: 100 [James Ruse Drive / River Road West - AM Peak - 2015 +10% (Site Folder: New Folder)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: James Ruse Drive														
1	L2	51	5.0	52	5.0	0.416	5.6	LOS A	0.0	0.0	0.00	0.04	0.00	56.8
2	T1	2279	5.0	2302	5.0	0.416	0.1	LOS A	0.0	0.0	0.00	0.01	0.00	59.6
3	R2	1	5.0	1	5.0	0.028	100.8	LOS F	0.1	0.5	0.98	0.99	0.98	12.8
Approach		2331	5.0	2355	5.0	0.416	0.2	NA	0.1	0.5	0.00	0.01	0.00	59.4
East: Driveway														
4	L2	1	5.0	1	5.0	0.007	28.9	LOS C	0.0	0.2	0.88	0.92	0.88	28.3
Approach		1	5.0	1	5.0	0.007	28.9	LOS C	0.0	0.2	0.88	0.92	0.88	28.3
North: James Ruse Drive														
7	L2	1	5.0	1	5.0	0.628	5.9	LOS A	0.0	0.0	0.00	0.00	0.00	56.4
8	T1	2520	5.0	2545	5.0	0.628	2.5	LOS A	3.9	28.6	0.07	0.00	0.09	56.9
9	R2	301	5.0	304	5.0	1.704	671.9	LOS F	85.6	624.5	1.00	4.90	16.29	4.9
Approach		2822	5.0	2851	5.0	1.704	73.9	NA	85.6	624.5	0.17	0.52	1.82	23.2
West: River Road West														
10	L2	370	5.0	373	5.0	0.593	15.8	LOS B	5.0	36.1	0.77	1.11	1.39	47.1
Approach		370	5.0	373	5.0	0.593	15.8	LOS B	5.0	36.1	0.77	1.11	1.39	47.1
All Vehicles		5524	5.0	5579	5.0	1.704	38.9	NA	85.6	624.5	0.14	0.35	1.02	32.7

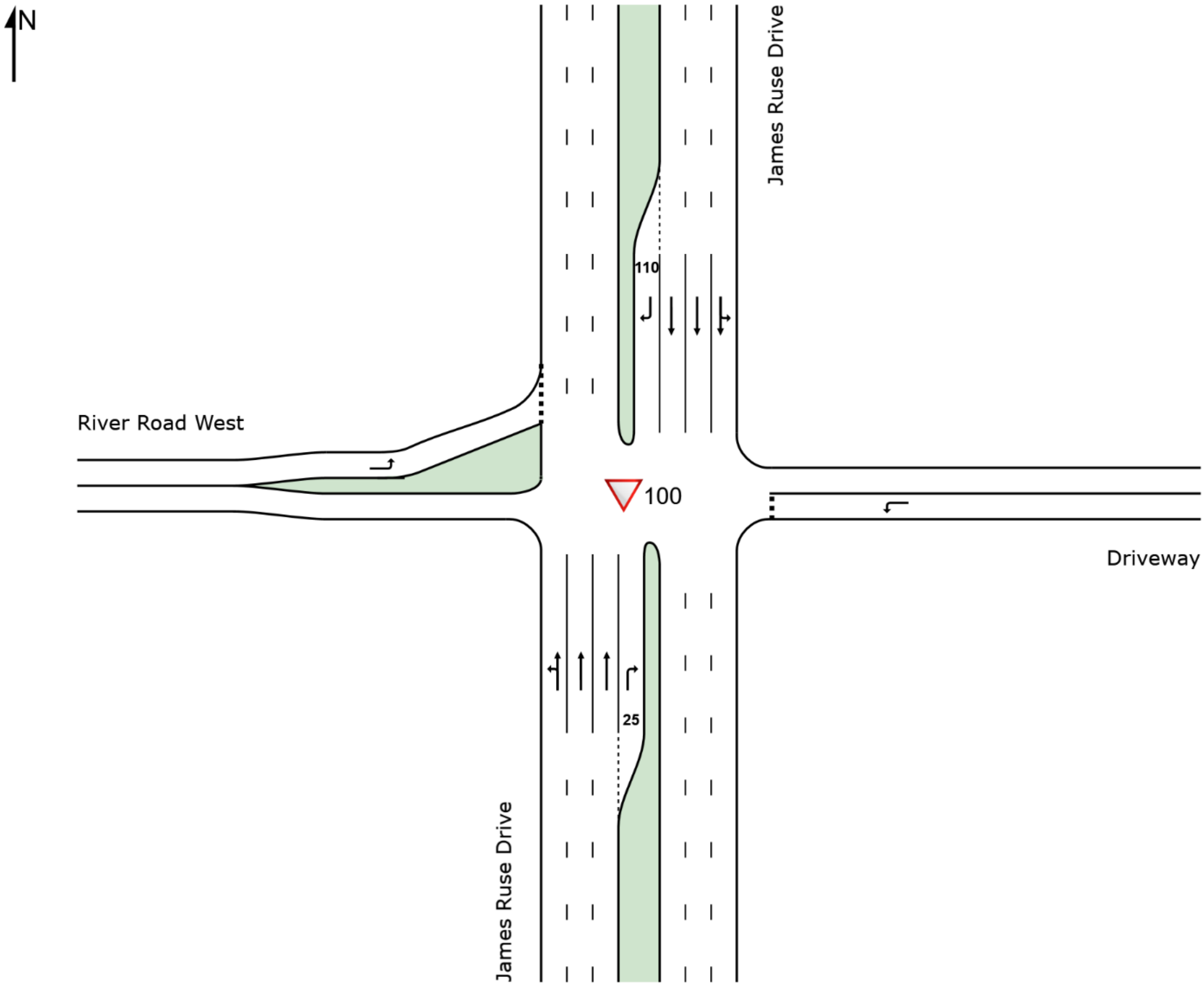
Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

▽Site: 100 [James Ruse Drive / River Road West - AM Peak - 2015+10% - 40% NB Detour (Site Folder: New Folder)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: James Ruse Drive														
1	L2	51	5.0	52	5.0	0.416	5.6	LOS A	0.0	0.0	0.00	0.04	0.00	56.8
2	T1	2279	5.0	2302	5.0	0.416	0.1	LOS A	0.0	0.0	0.00	0.01	0.00	59.6
3	R2	1	5.0	1	5.0	0.028	100.8	LOS F	0.1	0.5	0.98	0.99	0.98	12.8
Approach		2331	5.0	2355	5.0	0.416	0.2	NA	0.1	0.5	0.00	0.01	0.00	59.4
East: Driveway														
4	L2	1	5.0	1	5.0	0.007	28.9	LOS C	0.0	0.2	0.88	0.92	0.88	28.3
Approach		1	5.0	1	5.0	0.007	28.9	LOS C	0.0	0.2	0.88	0.92	0.88	28.3
North: James Ruse Drive														
7	L2	1	5.0	1	5.0	0.628	5.9	LOS A	0.0	0.0	0.00	0.00	0.00	56.4
8	T1	2520	5.0	2545	5.0	0.628	2.5	LOS A	3.9	28.6	0.07	0.00	0.09	56.9
9	R2	301	5.0	304	5.0	1.704	671.9	LOS F	85.6	624.5	1.00	4.90	16.29	4.9
Approach		2822	5.0	2851	5.0	1.704	73.9	NA	85.6	624.5	0.17	0.52	1.82	23.2
West: River Road West														

10	L2	572	5.0	586	5.0	0.930	37.3	LOS C	21.3	155.2	0.95	2.08	4.18	36.9
Approach		572	5.0	586	5.0	0.930	37.3	LOS C	21.3	155.2	0.95	2.08	4.18	36.9
All Vehicles		5726	5.0	5792	5.0	1.704	40.2	NA	85.6	624.5	0.18	0.47	1.32	32.3

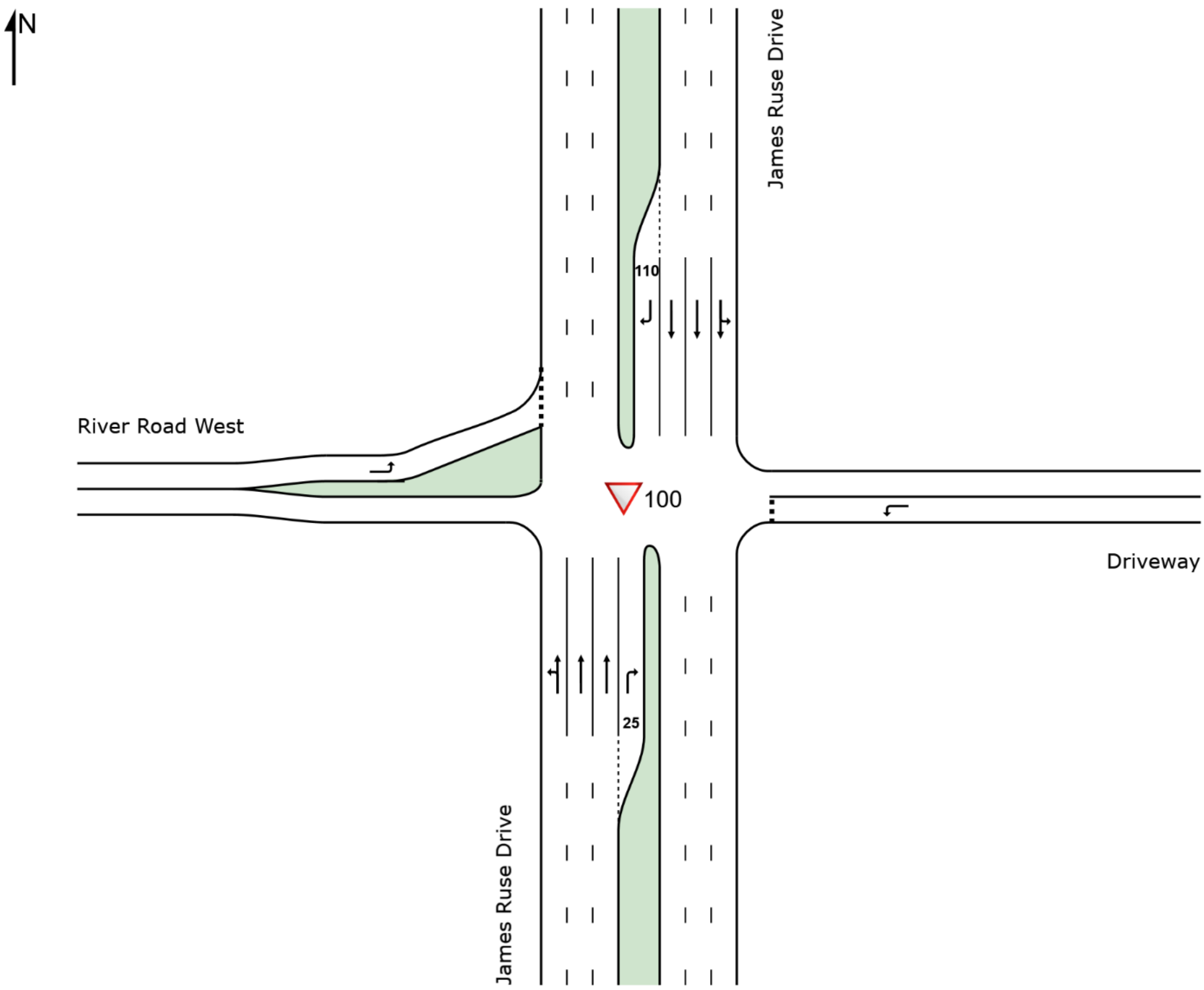
Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Site: 100 [James Ruse Drive / River Road West - PM Peak - 2015 + 10% - 40% NB Detour (Site Folder: New Folder)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: James Ruse Drive														
1	L2	13	1	13	5.0	0.455	5.7	LOS A	0.0	0.0	0.00	0.01	0.00	57.1
2	T1	2538	127	2563	5.0	0.455	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
3	R2	1	0	1	5.0	0.023	82.8	LOS F	0.1	0.4	0.98	0.99	0.98	14.9
Approach		2552	128	2578	5.0	0.455	0.2	NA	0.1	0.4	0.00	0.00	0.00	59.6
East: Driveway														
4	L2	1	0	1	5.0	0.007	27.2	LOS B	0.0	0.1	0.87	0.91	0.87	29.2
Approach		1	0	1	5.0	0.007	27.2	LOS B	0.0	0.1	0.87	0.91	0.87	29.2
North: James Ruse Drive														
7	L2	1	0	1	5.0	0.615	5.9	LOS A	0.0	0.0	0.00	0.00	0.00	56.4
8	T1	2415	121	2439	5.0	0.615	2.1	LOS A	3.1	22.4	0.05	0.00	0.06	57.3
9	R2	301	15	304	5.0	2.296	1202.9	LOS F	115.2	841.2	1.00	5.04	17.32	2.8
Approach		2717	136	2744	5.0	2.296	135.2	NA	115.2	841.2	0.15	0.56	1.97	15.4
West: River Road West														
10	L2	604	29	621	4.7	1.166	181.1	LOS F	72.1	524.8	1.00	4.57	12.10	15.0
Approach		604	29	621	4.7	1.166	181.1	LOS F	72.1	524.8	1.00	4.57	12.10	15.0
All Vehicles		5874	292	5944	5.0	2.296	81.4	NA	115.2	841.2	0.18	0.74	2.17	22.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Project: E:\Civlink\Gasworks Bridge Rehabilitation\00_2022 Update\Rev 3\Weekday NB Closure.sip9

APPENDIX D – WEEKDAY PM PEAK – SB TIDAL FLOW OPTION

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Weekday PM - SB Closure

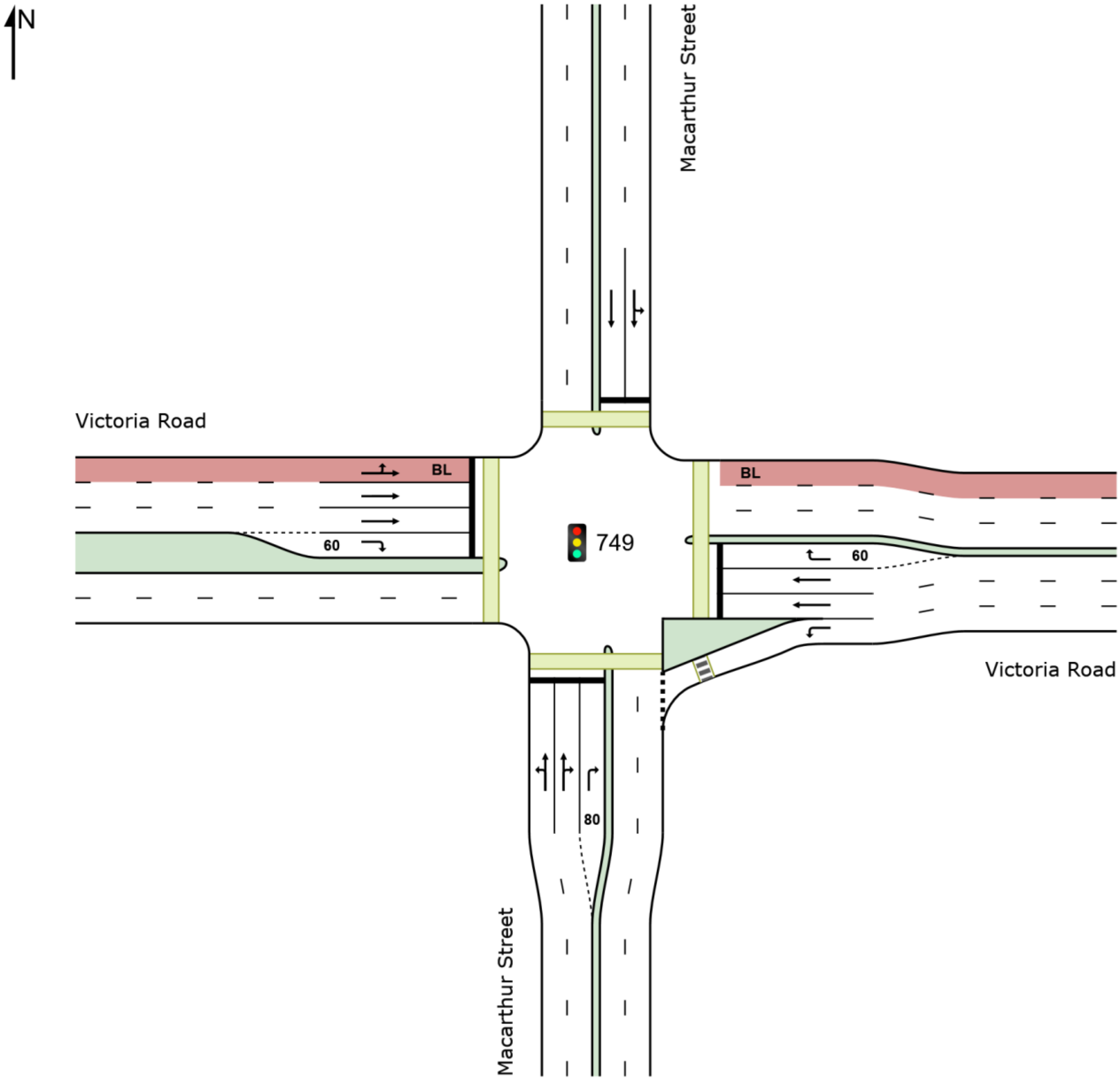
Site: 749 [TCS 749 Victoria Road MacArthur Street - Weekday PM Peak (Site Folder: 749)]

Victoria Road / Macarthur Street Parramatta - Weekday PM Peak Existing 1700-1800 26 July - 26 Aug Average
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 62 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Macarthur Street														
1	L2	134	5.0	141	5.0	0.416	20.8	LOS B	6.6	48.2	0.78	0.72	0.78	45.3
2	T1	192	5.0	202	5.0	0.416	15.8	LOS B	6.6	48.2	0.81	0.73	0.81	46.0
3	R2	230	6.5	242	6.5	* 0.416	23.2	LOS B	3.5	25.9	0.91	0.76	0.91	43.3
Approach		556	5.6	585	5.6	0.416	20.0	LOS B	6.6	48.2	0.84	0.74	0.84	44.7
East: Victoria Road														
4	L2	299	5.0	315	5.0	0.251	8.1	LOS A	2.6	18.8	0.40	0.67	0.40	52.2
5	T1	669	5.4	704	5.4	* 0.891	36.9	LOS C	13.2	96.5	1.00	1.10	1.49	37.4

6	R2	206	5.0	217	5.0	0.833 *	40.2	LOS C	7.5	55.0	1.00	0.99	1.40	35.6
Approach		1174	5.2	1236	5.2	0.891	30.1	LOS C	13.2	96.7	0.85	0.97	1.20	40.0
North: Macarthur Street														
7	L2	63	5.0	66	5.0	0.414	30.3	LOS C	4.0	29.1	0.92	0.76	0.92	40.6
8	T1	193	5.0	203	5.0	0.414 *	25.8	LOS B	4.0	29.1	0.93	0.75	0.93	41.8
Approach		256	5.0	269	5.0	0.414	26.9	LOS B	4.0	29.1	0.93	0.75	0.93	41.5
West: Victoria Road														
10	L2	86	5.0	91	5.0	0.292	28.7	LOS C	2.7	21.9	0.88	0.76	0.88	40.3
11	T1	660	6.7	695	6.7	0.861	33.6	LOS C	12.1	88.4	1.00	1.04	1.38	38.7
12	R2	127	5.0	134	5.0	0.514	33.7	LOS C	4.0	29.0	0.97	0.79	0.97	38.0
Approach		873	6.3	919	6.3	0.861	33.1	LOS C	12.1	88.4	0.98	0.98	1.27	38.7
All Vehicles		2859	5.6	3009	5.6	0.891	28.8	LOS C	13.2	96.7	0.90	0.91	1.13	40.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

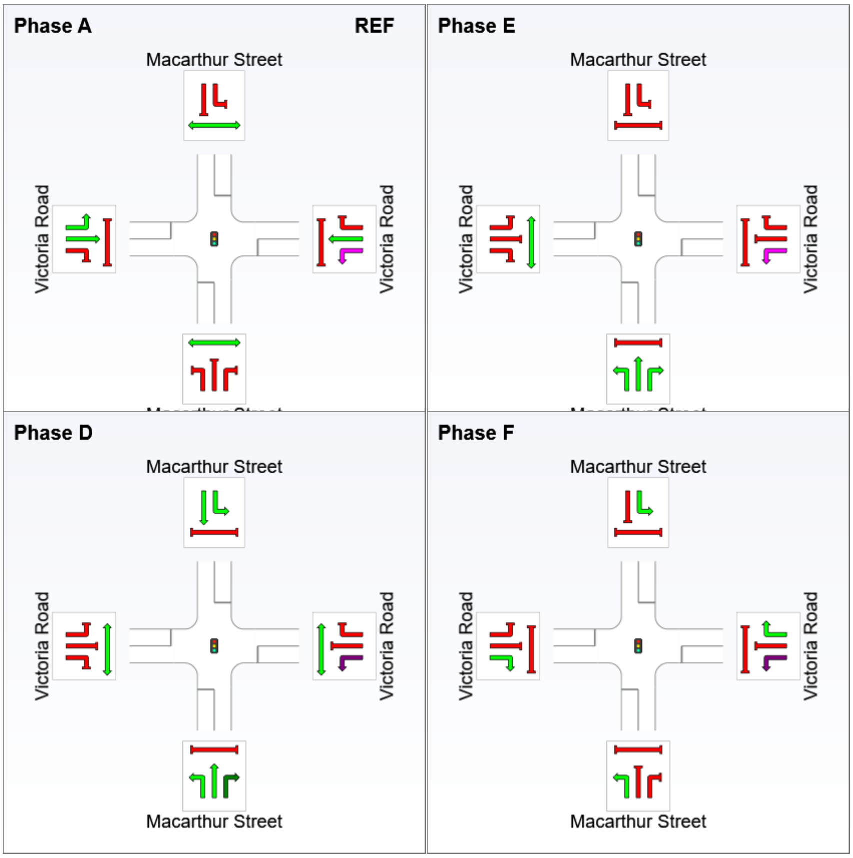
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Macarthur Street												
P1	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	194.2	219.5	1.13
East: Victoria Road												
P2	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	196.7	222.8	1.13
North: Macarthur Street												
P3	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	191.7	216.2	1.13
West: Victoria Road												
P4	Full	50	53	25.3	LOS C	0.1	0.1	0.91	0.91	197.5	223.8	1.13
All Pedestrians		200	211	25.3	LOS C	0.1	0.1	0.91	0.91	195.0	220.6	1.13

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	19	31	47
Green Time (sec)	13	6	10	9
Phase Time (sec)	19	12	16	15
Phase Split	31%	19%	26%	24%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

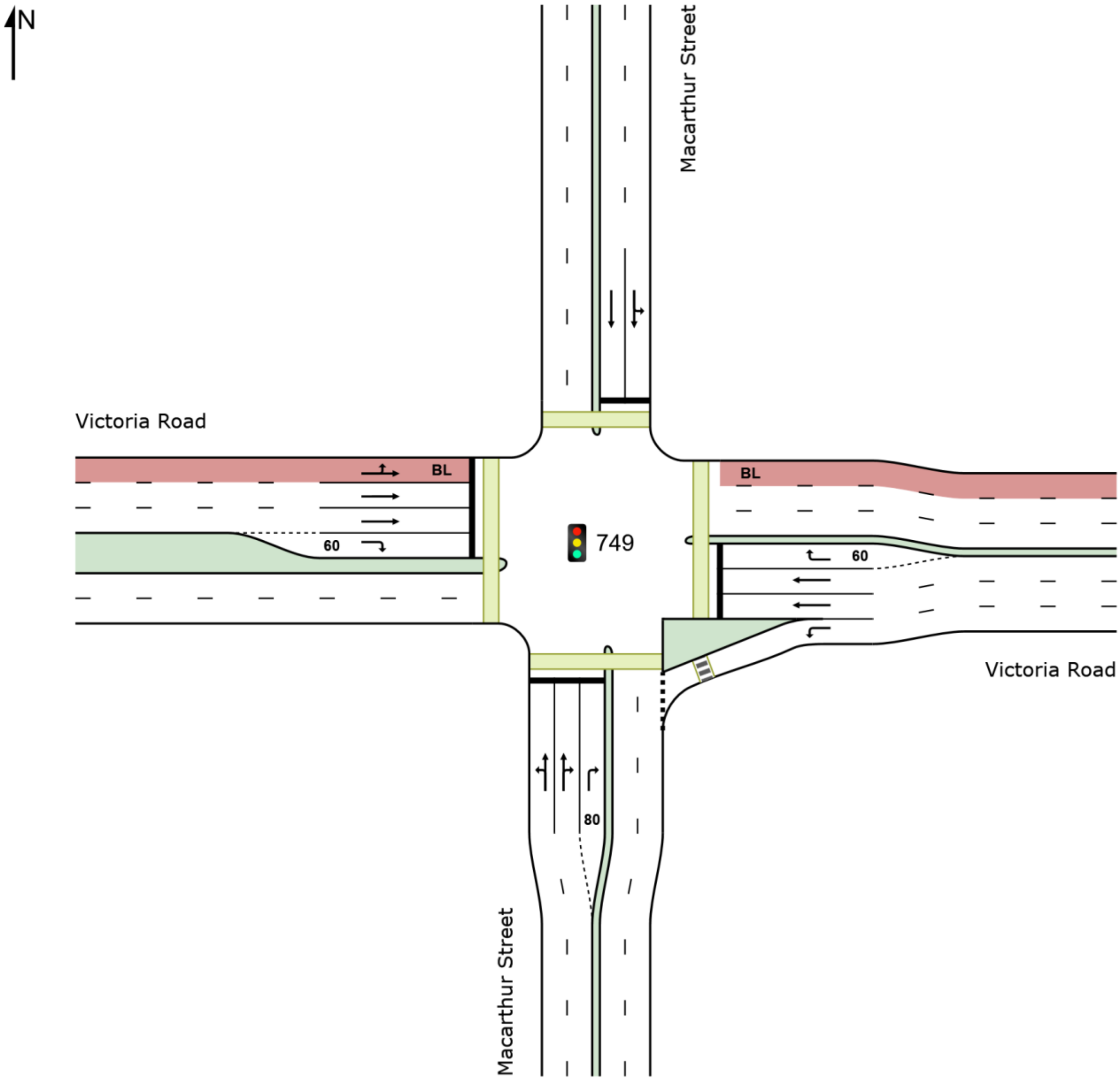
Site: 749 [TCS 749 Victoria Road MacArthur Street - Weekday PM Peak - SB Detour (Site Folder: 749)]

Victoria Road / Macarthur Street Parramatta - Weekday PM Peak Existing 1700-1800 26 July - 26 Aug Average
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 74 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h

South: Macarthur Street														
1	L2	197	10	207	4.9	0.468	23.8	LOS B	8.9	64.9	0.79	0.76	0.79	43.2
2	T1	192	10	202	5.0	0.468	19.6	LOS B	8.9	64.9	0.84	0.76	0.84	43.7
3	R2	230	15	242	6.5	* 0.468	27.4	LOS B	4.9	36.3	0.92	0.77	0.92	41.4
Approach		619	34	652	5.5	0.468	23.9	LOS B	8.9	64.9	0.86	0.76	0.86	42.7
East: Victoria Road														
4	L2	75	4	79	5.0	0.061	7.8	LOS A	0.6	4.5	0.31	0.62	0.31	52.4
5	T1	893	47	940	5.3	* 0.917	44.0	LOS D	22.7	166.4	1.00	1.16	1.46	34.9
6	R2	206	10	217	5.0	* 0.895	51.4	LOS D	9.5	69.5	1.00	1.05	1.55	32.1
Approach		1174	61	1236	5.2	0.917	43.0	LOS D	22.7	166.4	0.96	1.10	1.40	35.1
North: Macarthur Street														
7	L2	63	3	66	5.0	0.416	35.1	LOS C	4.7	34.2	0.93	0.76	0.93	38.6
8	T1	193	10	203	5.0	* 0.416	30.6	LOS C	4.7	34.2	0.94	0.75	0.94	39.6
Approach		256	13	269	5.0	0.416	31.7	LOS C	4.7	34.2	0.93	0.76	0.93	39.4
West: Victoria Road														
10	L2	86	4	91	5.0	0.216	27.8	LOS B	2.9	23.2	0.80	0.74	0.80	40.8
11	T1	660	44	695	6.7	0.636	25.5	LOS B	11.0	80.4	0.93	0.79	0.93	42.3
12	R2	127	6	134	5.0	0.552	39.7	LOS C	4.8	34.8	0.98	0.79	0.98	35.8
Approach		873	55	919	6.3	0.636	27.7	LOS B	11.0	80.4	0.92	0.79	0.92	41.1
All Vehicles		2922	163	3076	5.6	0.917	33.4	LOS C	22.7	166.4	0.92	0.91	1.10	38.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

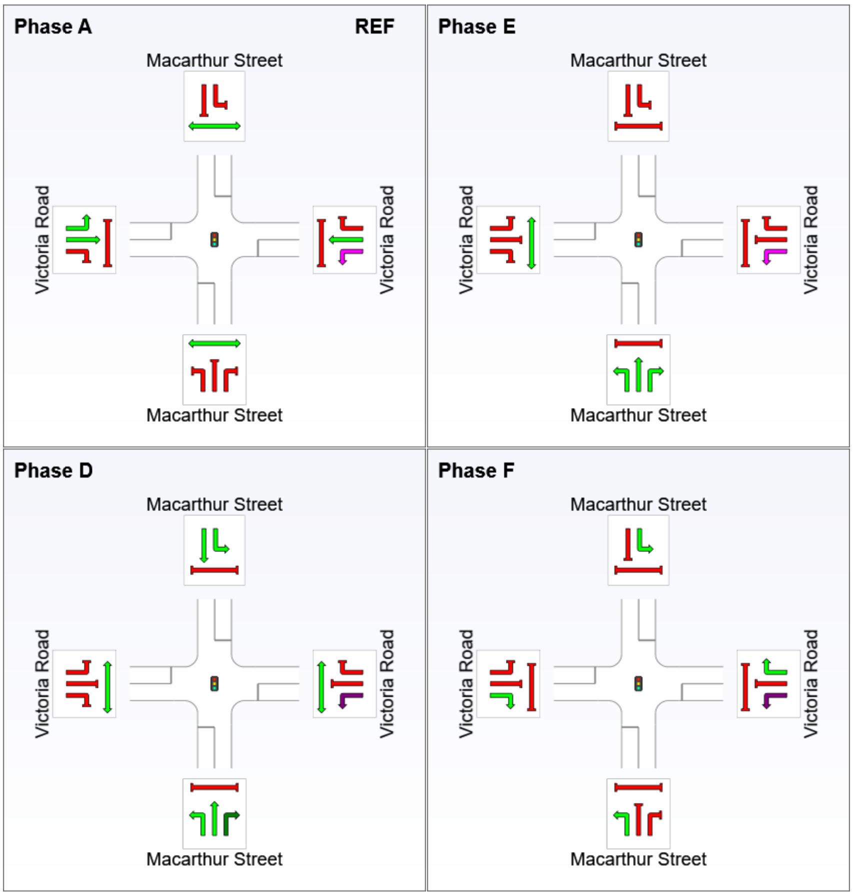
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Macarthur Street												
P1	Full	50	53	31.3	LOS D	0.1	0.1	0.92	0.92	200.2	219.5	1.10
East: Victoria Road												
P2	Full	50	53	31.3	LOS D	0.1	0.1	0.92	0.92	202.7	222.8	1.10
North: Macarthur Street												
P3	Full	50	53	31.3	LOS D	0.1	0.1	0.92	0.92	197.6	216.2	1.09
West: Victoria Road												
P4	Full	50	53	31.3	LOS D	0.1	0.1	0.92	0.92	203.5	223.8	1.10
All Pedestrians		200	211	31.3	LOS D	0.1	0.1	0.92	0.92	201.0	220.6	1.10

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 749 - Split plan 3
Reference Phase: Phase A
Input Phase Sequence: A, E, D, F



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	27	40	58
Green Time (sec)	21	7	12	10
Phase Time (sec)	27	13	18	16
Phase Split	36%	18%	24%	22%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Project: E:\Civlink\Gasworks Bridge Rehabilitation\00_2022 Update\Rev 3\Weekday PM - SB Closure.sip9

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Weekday PM - SB Closure

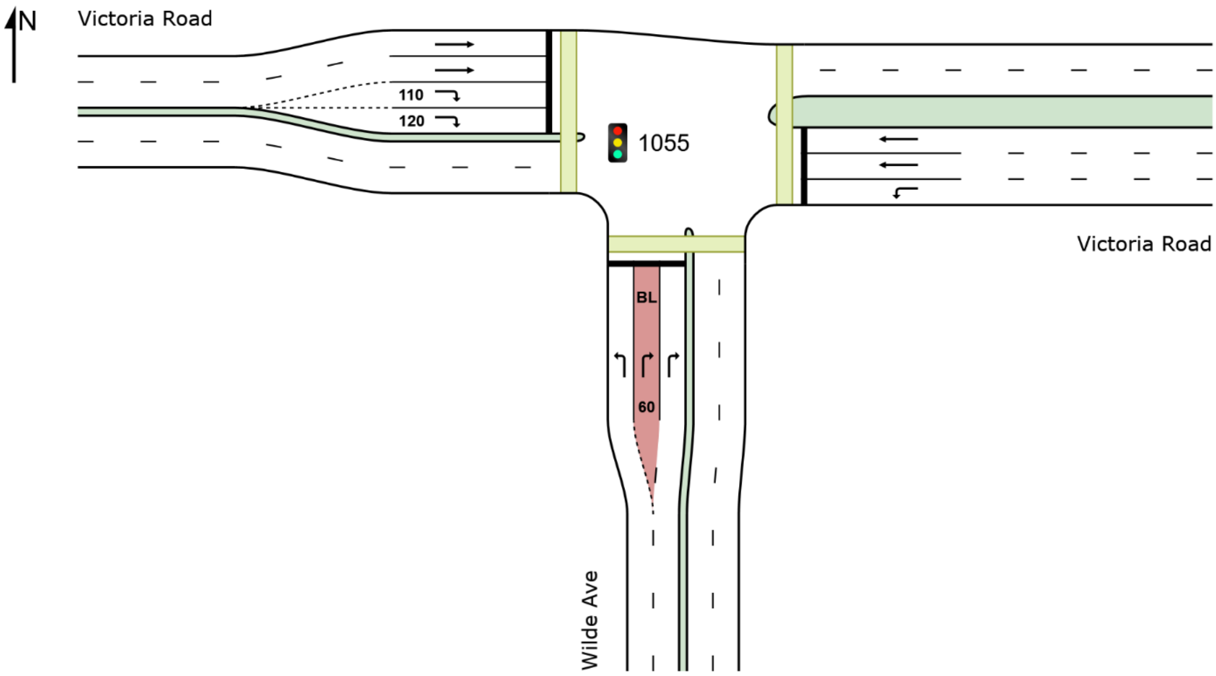
Site: 1055 [TCS 1055 Victoria Road Wilde Ave - Weekday PM Peak (Site Folder: 1055)]

Victoria Road / Wilde Ave Parramatta - Weekday PM Peak Existing 1700-1800 26 July - 26 Aug Average (estimated WB left turn LVs -missing detector 10)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 38 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS1055
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Wilde Ave														
1	L2	137	5.0	144	5.0	0.161	11.3	LOS A	1.5	10.9	0.57	0.71	0.57	49.3

3	R2	287	12.3	302	12.3	0.844 *	27.7	LOS B	6.3	46.3	0.99	1.02	1.51	40.6
Approach		424	9.9	446	9.9	0.844	22.4	LOS B	6.3	46.3	0.85	0.92	1.20	43.0
East: Victoria Road														
4	L2	213	11.7	224	11.7	0.249	11.1	LOS A	2.3	17.9	0.58	0.72	0.58	49.5
5	T1	603	5.0	635	5.0	0.912 *	27.9	LOS B	8.2	59.8	1.00	1.19	1.88	41.2
Approach		816	6.8	859	6.8	0.912	23.5	LOS B	8.2	59.8	0.89	1.07	1.54	43.1
West: Victoria Road														
11	T1	634	5.0	667	5.0	0.353	6.4	LOS A	3.9	28.2	0.65	0.55	0.65	54.3
12	R2	181	5.0	191	5.0	0.336 *	22.3	LOS B	1.7	12.5	0.93	0.76	0.93	43.1
Approach		815	5.0	858	5.0	0.353	9.9	LOS A	3.9	28.2	0.71	0.59	0.71	51.4
All Vehicles		2055	6.7	2163	6.7	0.912	17.9	LOS B	8.2	59.8	0.81	0.85	1.14	46.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

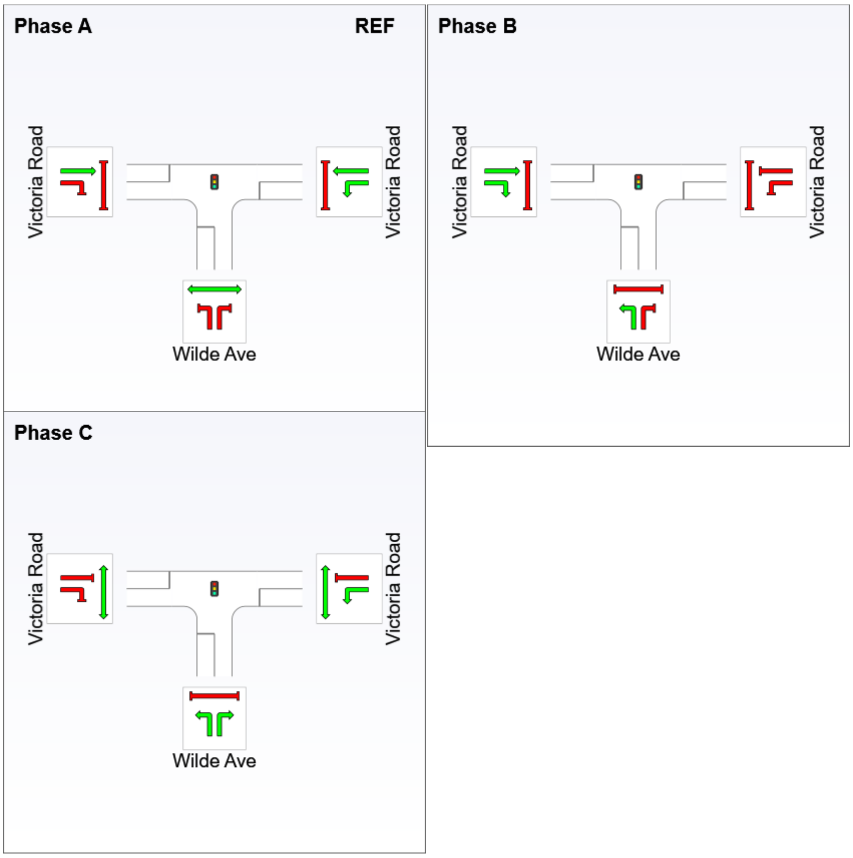
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Wilde Ave												
P1	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	182.3	219.5	1.20
East: Victoria Road												
P2	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	184.7	222.5	1.20
West: Victoria Road												
P4	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	184.9	222.8	1.21
All Pedestrians		150	158	13.5	LOS B	0.0	0.0	0.84	0.84	184.0	221.6	1.20

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Reference Phase: Sequence: Phase TCS1055 A
Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	13	25
Green Time (sec)	7	6	7
Phase Time (sec)	13	12	13
Phase Split	34%	32%	34%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

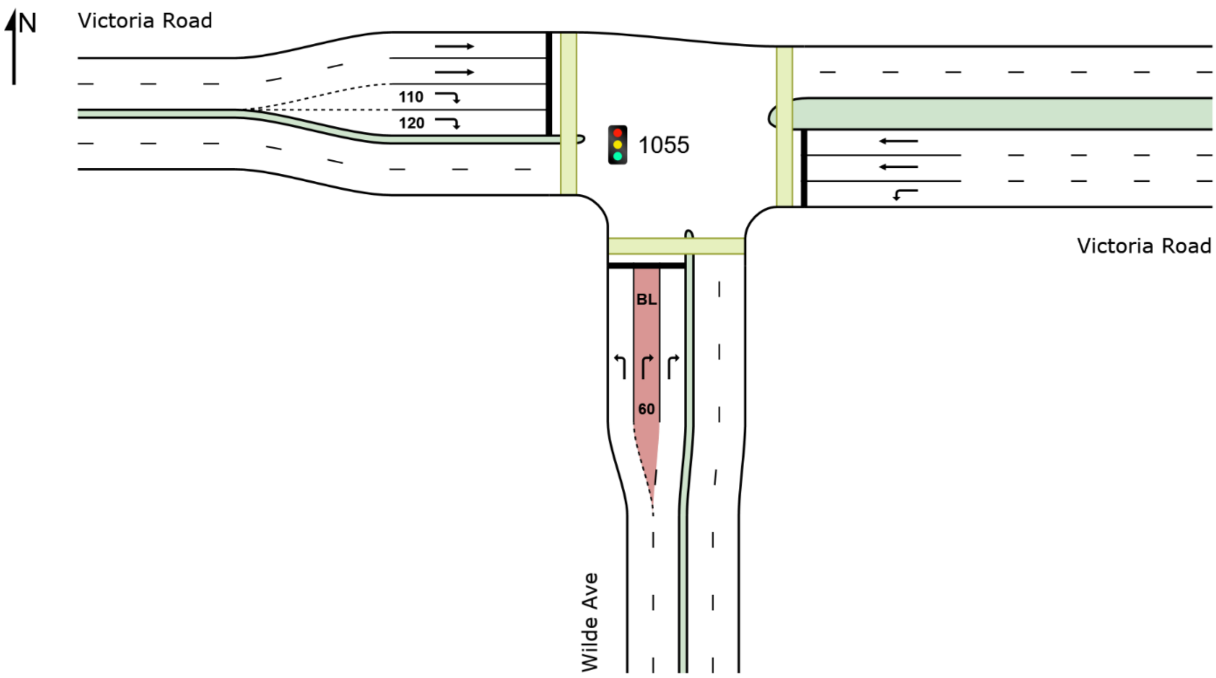
Site: 1055 [TCS 1055 Victoria Road Wilde Ave - Weekday PM Peak - SB Detour (Site Folder: 1055)]

Victoria Road / Wilde Ave Parramatta - Weekday PM Peak Existing 1700-1800 26 July - 26 Aug Average (estimated WB left turn LVs -missing detector 10)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 44 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS1055
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Wilde Ave														
1	L2	137	7	144	5.0	0.161	12.1	LOS A	1.7	12.5	0.57	0.71	0.57	48.8
3	R2	287	35	302	12.3	0.684	24.4	LOS B	6.1	44.5	0.96	0.87	1.08	42.1
Approach		424	42	446	9.9	0.684	20.4	LOS B	6.1	44.5	0.83	0.82	0.91	44.0
East: Victoria Road														
4	L2	886	59	933	6.7	* 0.890	26.4	LOS B	25.9	191.5	0.93	1.04	1.31	41.0
5	T1	603	30	635	5.0	0.739	20.0	LOS B	7.2	52.6	0.98	0.92	1.18	45.2
Approach		1489	89	1567	6.0	0.890	23.8	LOS B	25.9	191.5	0.95	0.99	1.26	42.6
West: Victoria Road														
11	T1	634	32	667	5.0	0.353	7.3	LOS A	4.4	32.4	0.65	0.55	0.65	53.6
12	R2	244	12	257	4.9	* 0.525	26.5	LOS B	2.8	20.5	0.97	0.79	1.00	41.1
Approach		878	44	924	5.0	0.525	12.7	LOS A	4.4	32.4	0.74	0.62	0.74	49.4

All Vehicles	2791	175	2938	6.3	0.890	19.8	LOS B	25.9	191.5	0.87	0.85	1.04	44.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

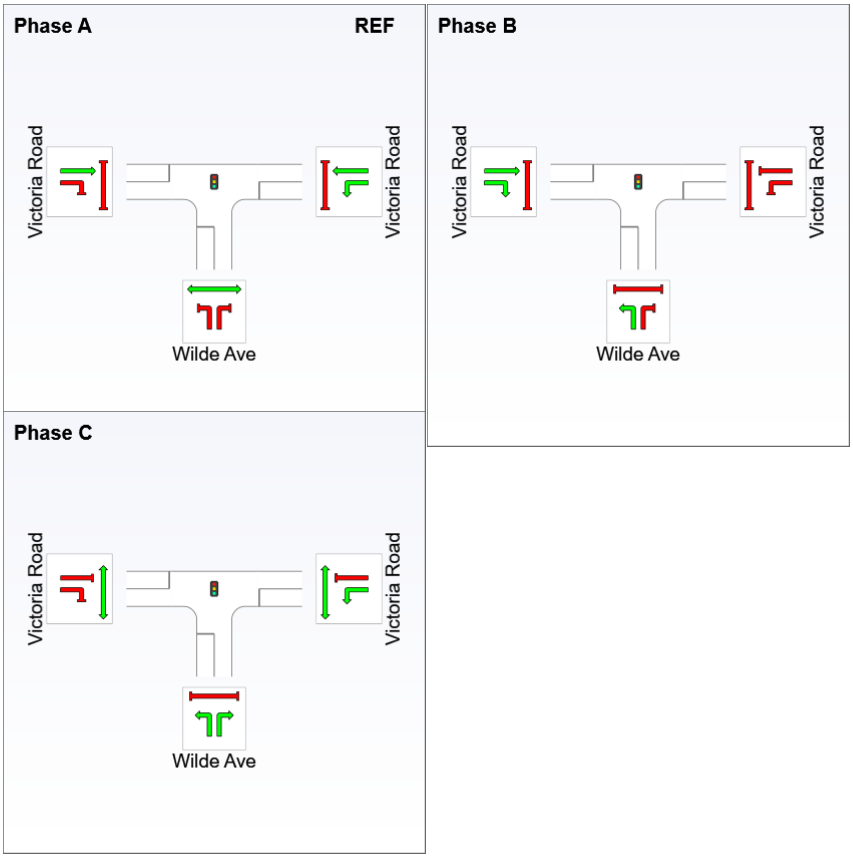
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Wilde Ave												
P1	Full	50	53	16.4	LOS B	0.1	0.1	0.87	0.87	185.3	219.5	1.18
East: Victoria Road												
P2	Full	50	53	16.4	LOS B	0.1	0.1	0.87	0.87	187.6	222.5	1.19
West: Victoria Road												
P4	Full	50	53	16.4	LOS B	0.1	0.1	0.87	0.87	187.8	222.8	1.19
All Pedestrians		150	158	16.4	LOS B	0.1	0.1	0.87	0.87	186.9	221.6	1.19

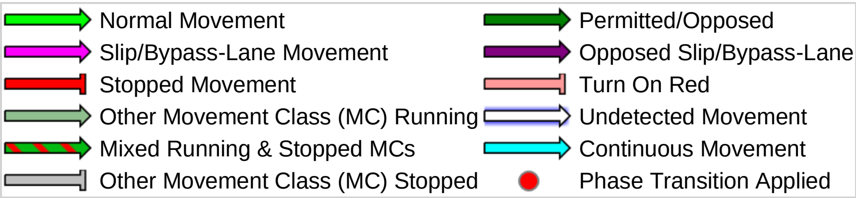
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Reference Phase: **Sequence: Phase** **TCS1055 A**
Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase



Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	16	28
Green Time (sec)	10	6	10
Phase Time (sec)	16	12	16
Phase Split	36%	27%	36%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Weekday PM - SB Closure

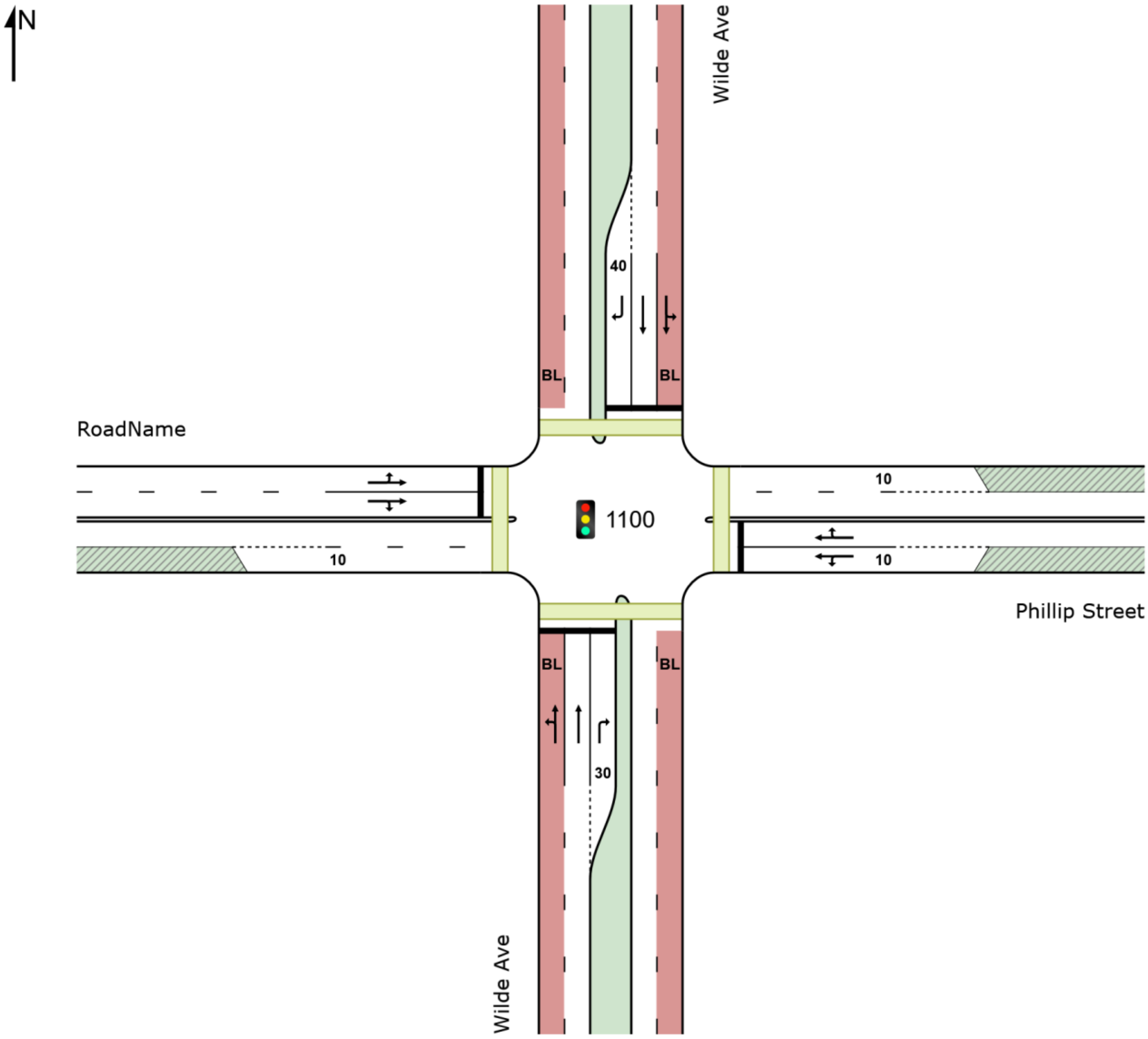
Site: 1100 [TCS 1100 - Wilde Ave Phillip St - Weekday PM Peak (Site Folder: 1100)]

Wilde Ave Phillip St Parramatta, Weekday PM Peak Existing 1700-1800 26 July - 26 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 56 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, D, E, F
Output Phase Sequence: A, D, E, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Wilde Ave														
1	L2	34	2	36	5.0	0.125	22.1	LOS B	1.1	9.3	0.81	0.68	0.81	32.7
2	T1	204	22	215	10.6	* 0.749	28.0	LOS B	6.0	43.7	0.99	0.94	1.21	30.6
3	R2	12	1	13	5.0	0.035	17.6	LOS B	0.2	1.7	0.83	0.64	0.83	33.6
Approach		250	24	263	9.6	0.749	26.7	LOS B	6.0	43.7	0.96	0.89	1.14	31.0
East: Phillip Street														
4	L2	23	1	24	5.0	0.139	24.2	LOS B	1.2	8.5	0.86	0.68	0.86	32.2
5	T1	143	7	151	5.0	* 0.693	25.5	LOS B	5.1	37.4	0.96	0.85	1.10	31.0
6	R2	54	3	57	5.0	0.693	29.7	LOS C	5.1	37.4	0.98	0.89	1.14	31.0
Approach		220	11	232	5.0	0.693	26.4	LOS B	5.1	37.4	0.95	0.84	1.08	31.1

North: Wilde Ave														
7	L2	108	5	114	5.0	0.263	12.6	LOS A	1.5	11.9	0.81	0.72	0.81	35.5
8	T1	132	18	139	13.6	0.468	23.8	LOS B	3.4	24.7	0.95	0.75	0.95	31.7
9	R2	154	8	162	5.0	* 0.511	19.9	LOS B	3.4	25.1	0.96	0.78	0.96	32.9
Approach		394	31	415	7.9	0.511	19.2	LOS B	3.4	25.1	0.92	0.75	0.92	33.1
West: RoadName														
10	L2	93	5	98	5.0	0.204	12.6	LOS A	1.2	8.4	0.81	0.71	0.81	35.3
11	T1	106	5	112	5.0	* 0.609	25.4	LOS B	5.0	36.2	0.98	0.83	1.03	31.0
12	R2	66	3	69	5.0	0.609	28.8	LOS C	5.0	36.2	0.98	0.83	1.03	31.2
Approach		265	13	279	5.0	0.609	21.8	LOS B	5.0	36.2	0.92	0.79	0.95	32.4
All Vehicles		1129	79	1188	7.0	0.749	22.9	LOS B	6.0	43.7	0.93	0.81	1.01	32.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

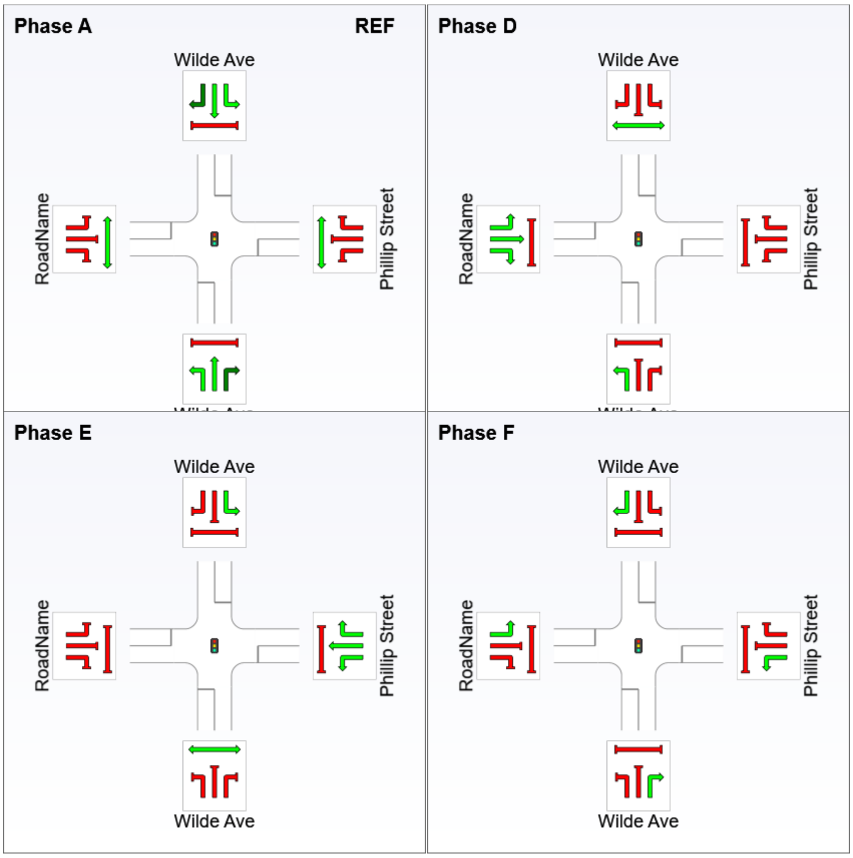
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Wilde Ave												
P1	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	192.0	220.5	1.15
East: Phillip Street												
P2	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	188.3	215.7	1.15
North: Wilde Ave												
P3	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	192.0	220.5	1.15
West: RoadName												
P4	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	188.3	215.7	1.15
All Pedestrians		200	211	22.4	LOS C	0.1	0.1	0.89	0.89	190.1	218.1	1.15

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Reference **Sequence: Phase:** **TCS Phase** **1100 A**
Input Phase Sequence: A, D, E, F



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	D	E	F
Phase Change Time (sec)	0	14	29	44
Green Time (sec)	8	9	9	6
Phase Time (sec)	14	15	15	12
Phase Split	25%	27%	27%	21%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

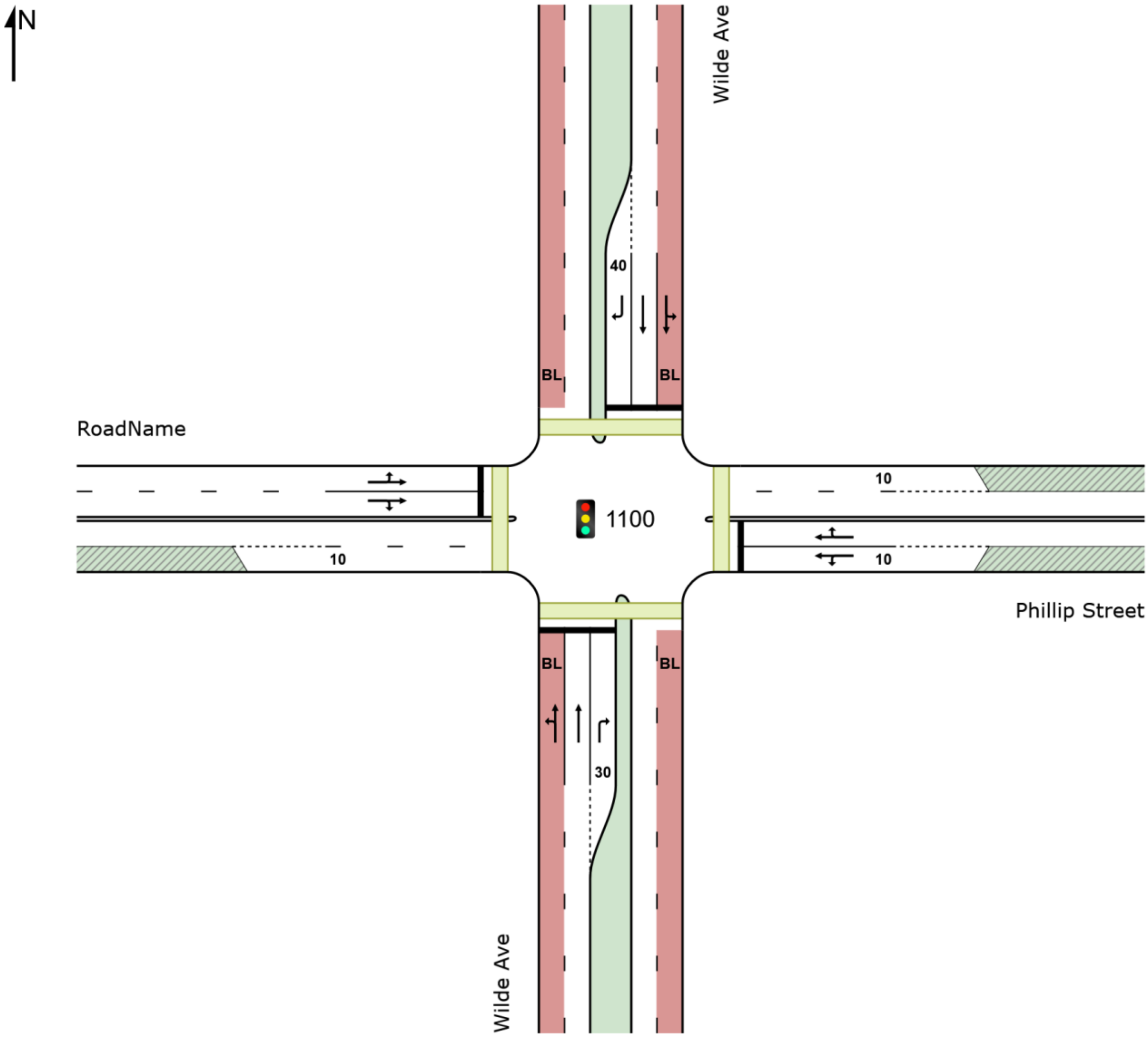
Site: 1100 [TCS 1100 - Wilde Ave Phillip St - Weekday PM Peak - SB Detour (Site Folder: 1100)]

Wilde Ave Phillip St Parramatta, Weekday PM Peak Existing 1700-1800 26 July - 26 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, D, E, F
Output Phase Sequence: A, D, E, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Wilde Ave														
1	L2	34	2	36	5.0	0.065	22.6	LOS B	1.5	13.5	0.58	0.59	0.58	32.6

2	T1	204	22	215	10.6	0.265	24.0	LOS B	7.6	55.7	0.69	0.58	0.69	31.7
3	R2	12	1	13	5.0	0.052	23.9	LOS B	0.4	2.6	0.79	0.65	0.79	31.8
Approach		250	24	263	9.6	0.265	23.8	LOS B	7.6	55.7	0.68	0.59	0.68	31.8
East: Phillip Street														
4	L2	23	1	24	5.0	0.137	46.1	LOS D	2.3	17.0	0.86	0.69	0.86	27.0
5	T1	143	7	151	5.0	0.683	49.4	LOS D	10.2	74.2	0.95	0.81	0.99	25.8
6	R2	54	3	57	5.0	0.683	53.9	LOS D	10.2	74.2	0.97	0.83	1.01	25.7
Approach		220	11	232	5.0	0.683	50.2	LOS D	10.2	74.2	0.94	0.80	0.98	25.9
North: Wilde Ave														
7	L2	844	42	888	5.0	0.863 *	25.5	LOS B	30.2	223.1	0.91	0.93	0.96	40.4
8	T1	132	18	139	13.6	0.863 *	22.9	LOS B	30.2	223.1	0.68	0.58	0.69	32.3
9	R2	154	8	162	5.0	0.303 *	20.4	LOS B	5.1	37.3	0.67	0.70	0.67	32.8
Approach		1130	68	1189	6.0	0.863	24.5	LOS B	30.2	223.1	0.85	0.86	0.89	38.1
West: RoadName														
10	L2	93	5	98	5.0	0.262	27.6	LOS B	3.2	23.5	0.88	0.74	0.88	30.8
11	T1	106	5	112	5.0	0.734 *	57.2	LOS E	10.8	78.7	1.00	0.89	1.10	24.4
12	R2	66	3	69	5.0	0.734	60.6	LOS E	10.8	78.7	1.00	0.89	1.10	24.5
Approach		265	13	279	5.0	0.734	47.7	LOS D	10.8	78.7	0.96	0.84	1.02	26.4
All Vehicles		1865	116	1963	6.2	0.863	30.7	LOS C	30.2	223.1	0.85	0.81	0.89	33.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

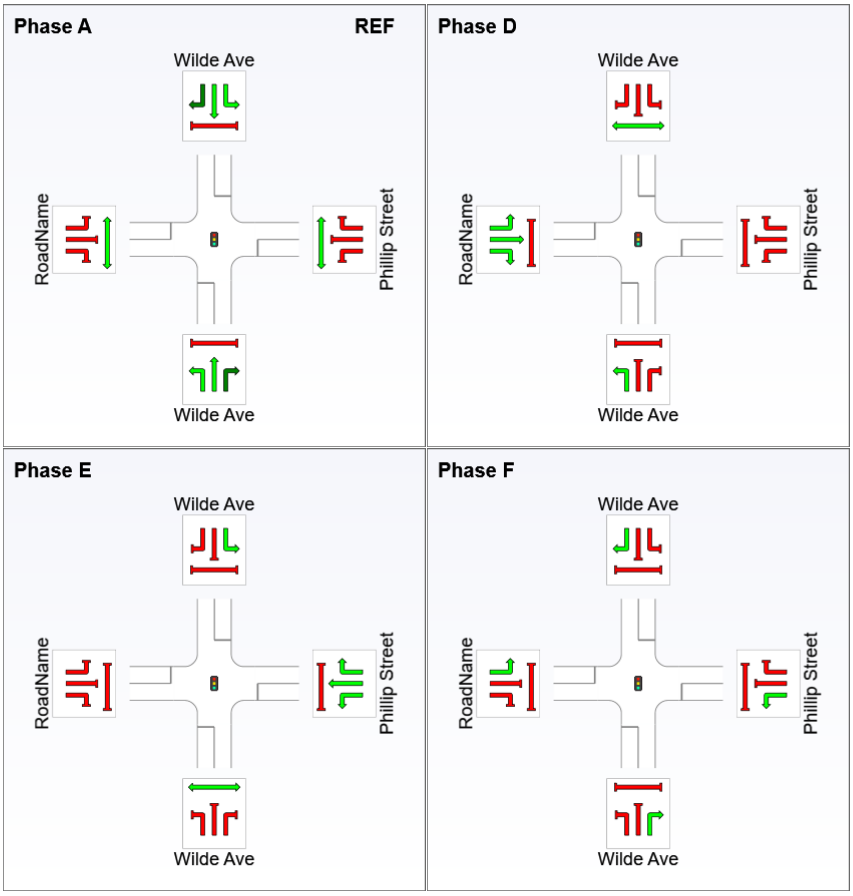
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Wilde Ave												
P1	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	223.9	220.5	0.98
East: Phillip Street												
P2	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	220.2	215.7	0.98
North: Wilde Ave												
P3	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	223.9	220.5	0.98
West: RoadName												
P4	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	220.2	215.7	0.98
All Pedestrians		200	211	54.3	LOS E	0.2	0.2	0.95	0.95	222.0	218.1	0.98

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, D, E, F



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	D	E	F
Phase Change Time (sec)	0	56	78	105
Green Time (sec)	50	16	21	9
Phase Time (sec)	56	22	27	15
Phase Split	47%	18%	23%	13%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

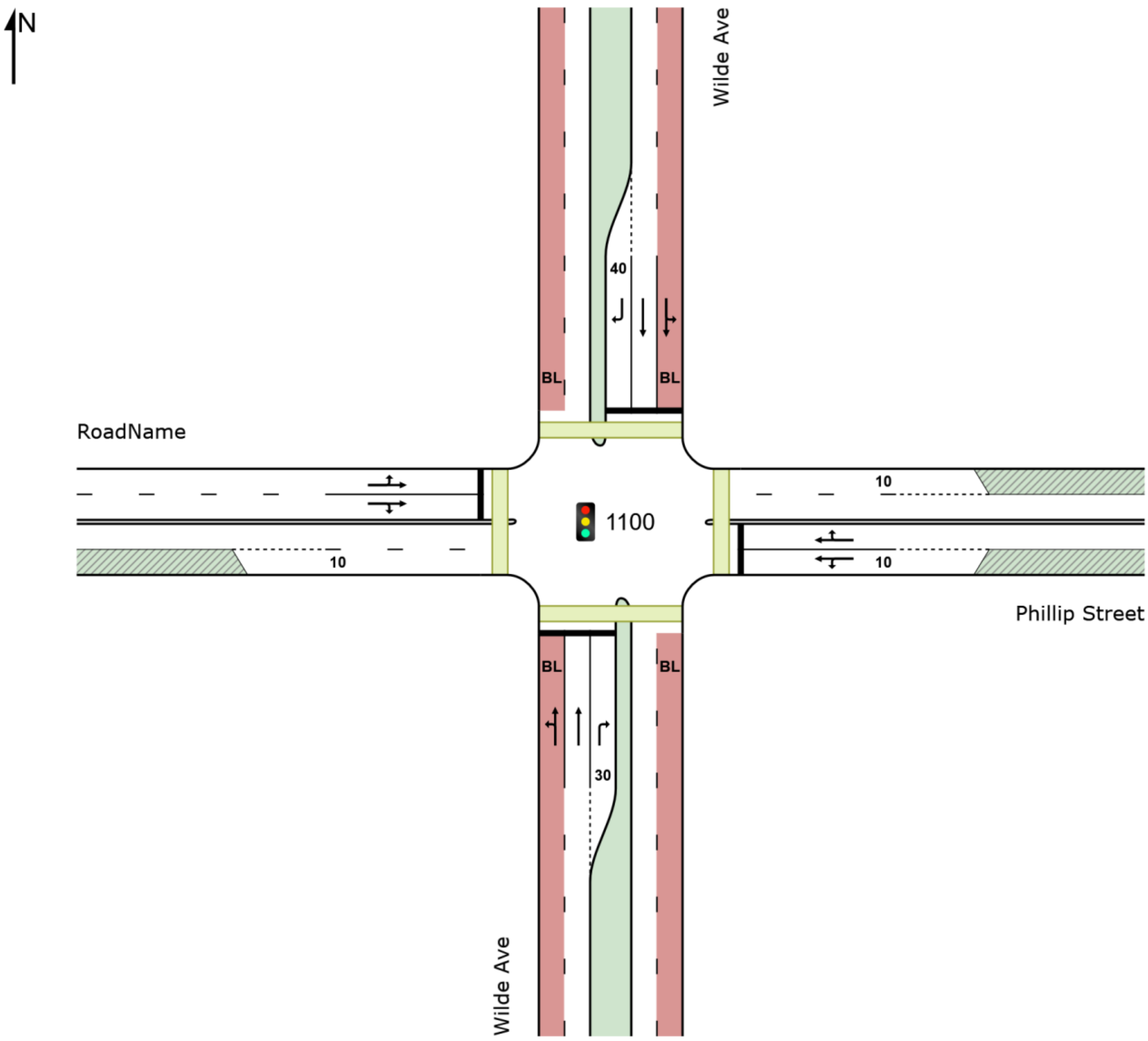
Site: 1100 [TCS 1100 - Wilde Ave Phillip St - Weekday PM Peak - SB Detour - 56s Cycle time (Site Folder: 1100)]

Wilde Ave Phillip St Parramatta, Weekday PM Peak Existing 1700-1800 26 July - 26 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 56 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, D, E, F
Output Phase Sequence: A, D, E, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Wilde Ave														
1	L2	34	2	36	5.0	0.125	22.1	LOS B	1.1	9.3	0.81	0.68	0.81	32.7
2	T1	204	22	215	10.6	0.749	28.0	LOS B	6.0	43.7	0.99	0.94	1.21	30.6
3	R2	12	1	13	5.0	0.038	18.0	LOS B	0.2	1.7	0.87	0.65	0.87	33.5
Approach		250	24	263	9.6	0.749	26.7	LOS B	6.0	43.7	0.96	0.89	1.14	31.0
East: Phillip Street														
4	L2	23	1	24	5.0	0.139	24.2	LOS B	1.2	8.5	0.86	0.68	0.86	32.2
5	T1	143	7	151	5.0	0.693	25.5	LOS B	5.1	37.4	0.96	0.85	1.10	31.0
6	R2	54	3	57	5.0	0.693	29.7	LOS C	5.1	37.4	0.98	0.89	1.14	31.0
Approach		220	11	232	5.0	0.693	26.4	LOS B	5.1	37.4	0.95	0.84	1.08	31.1
North: Wilde Ave														
7	L2	844	42	888	5.0	* 1.605	572.1	LOS F	158.4	1168.9	1.00	3.57	7.28	5.6
8	T1	132	18	139	13.6	* 1.605	74.5	LOS F	158.4	1168.9	0.97	1.01	1.54	29.0
9	R2	154	8	162	5.0	* 0.511	19.9	LOS B	3.4	25.1	0.96	0.78	0.96	32.9
Approach		1130	68	1189	6.0	1.605	438.7	LOS F	158.4	1168.9	0.99	2.89	5.75	7.0
West: RoadName														
10	L2	93	5	98	5.0	0.204	12.6	LOS A	1.2	8.4	0.81	0.71	0.81	35.3
11	T1	106	5	112	5.0	* 0.609	25.4	LOS B	5.0	36.2	0.98	0.83	1.03	31.0
12	R2	66	3	69	5.0	0.609	28.8	LOS C	5.0	36.2	0.98	0.83	1.03	31.2
Approach		265	13	279	5.0	0.609	21.8	LOS B	5.0	36.2	0.92	0.79	0.95	32.4
All Vehicles		1865	116	1963	6.2	1.605	275.6	LOS F	158.4	1168.9	0.97	2.08	3.90	10.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Pedestrian Movement Performance

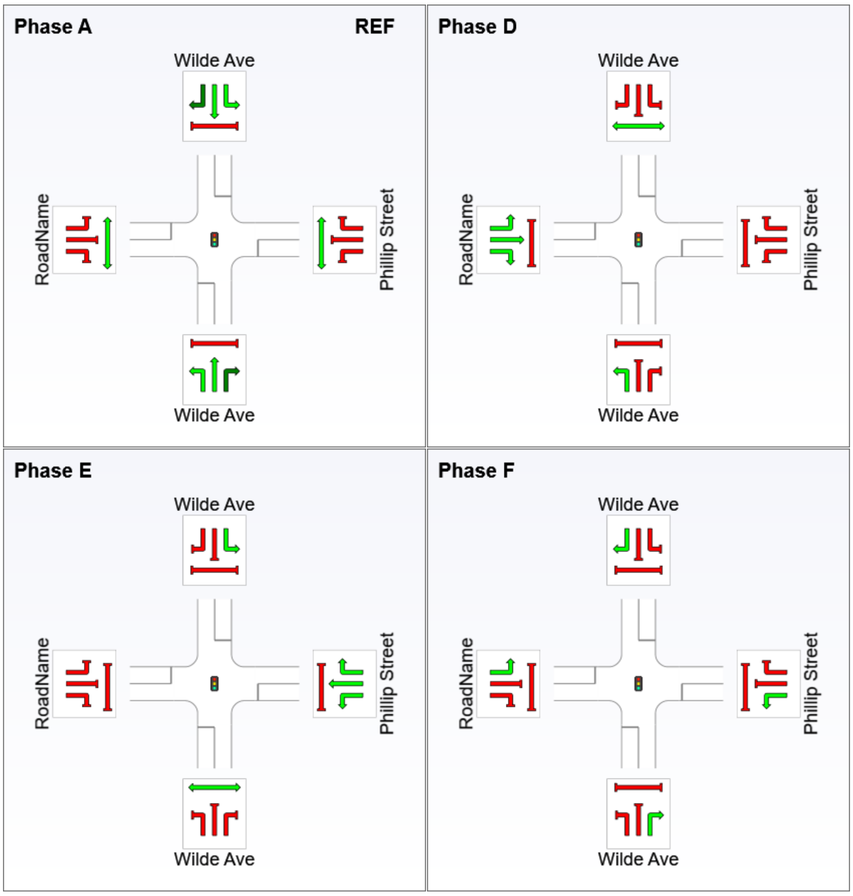
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Wilde Ave												
P1	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	192.0	220.5	1.15
East: Phillip Street												
P2	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	188.3	215.7	1.15
North: Wilde Ave												
P3	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	192.0	220.5	1.15
West: RoadName												
P4	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	188.3	215.7	1.15

All Pedestrians	200	211	22.4	LOS C	0.1	0.1	0.89	0.89	190.1	218.1	1.15

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Reference Sequence: TCS Phase: 1100 Phase: A
Input Phase Sequence: A, D, E, F



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	D	E	F
Phase Change Time (sec)	0	14	29	44
Green Time (sec)	8	9	9	6

Phase Time (sec)	14	15	15	12
Phase Split	25%	27%	27%	21%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Organisation: CIVLINK | Licence: NETWORK / 1PC | Created: Wednesday, 31 May 2023 6:25:42 PM
Project: E:\Civlink\Gasworks Bridge Rehabilitation\00_2022 Update\Rev 3\Weekday PM - SB Closure.sip9

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Weekday PM - SB Closure

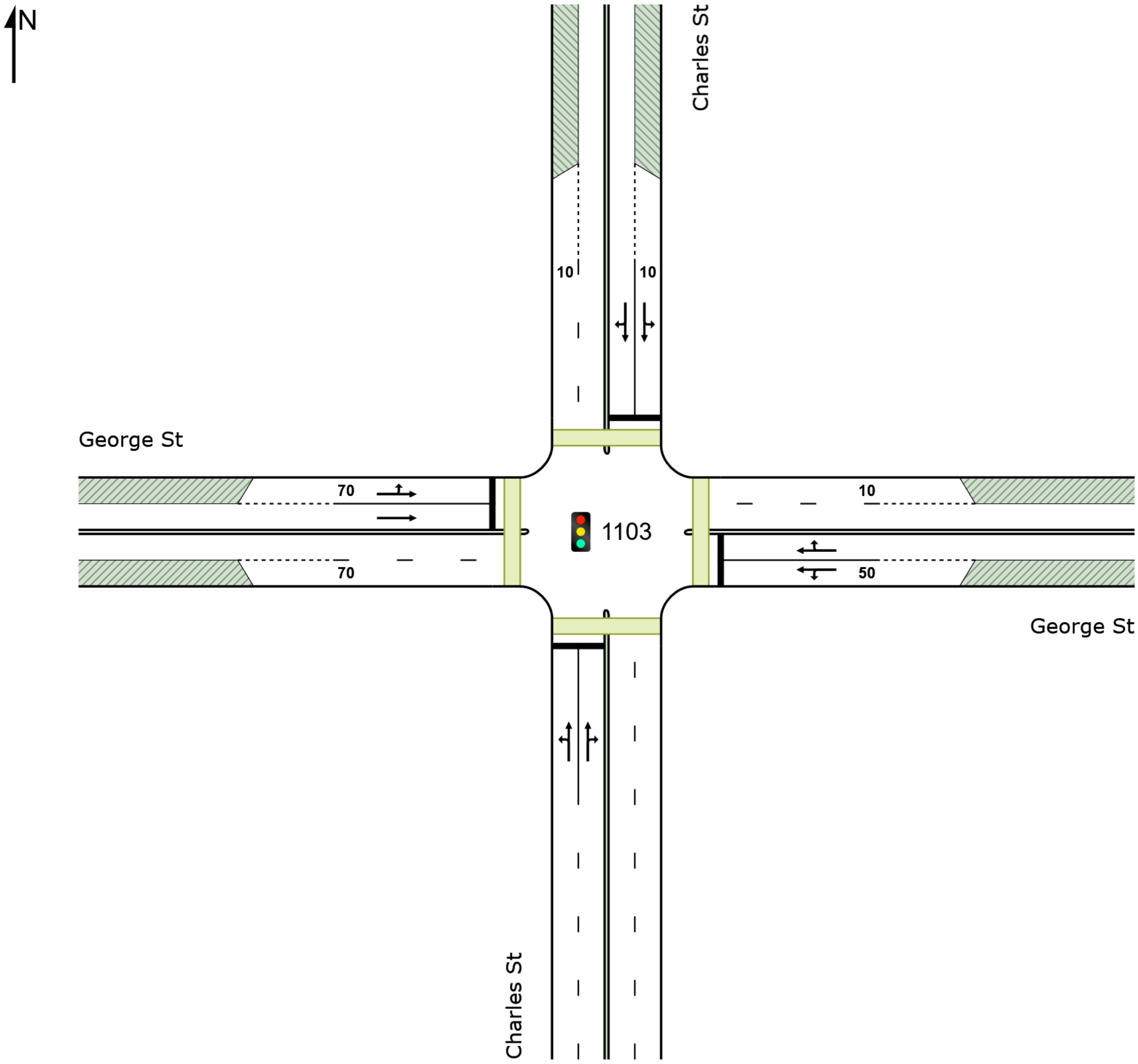
Site: 1103 [TCS 1103 - George St Charles St - PM Peak - Detour (Site Folder: 1103)]

George St Charles St Parramatta, Weekday PM Peak Existing 1700-1800 26 July - 26 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 84 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Charles St														
1	L2	30	2	32	5.0	0.116	13.4	LOS A	2.3	16.9	0.51	0.48	0.51	35.9
2	T1	144	7	152	5.0	0.579	17.6	LOS B	5.5	39.9	0.67	0.61	0.68	33.2
3	R2	80	4	84	5.0	0.579	31.3	LOS C	5.5	39.9	0.89	0.78	0.90	30.2
Approach		254	13	267	5.0	0.579	21.4	LOS B	5.5	39.9	0.72	0.65	0.73	32.5
East: George St														
4	L2	46	2	48	5.0	0.122	25.9	LOS B	2.0	14.8	0.75	0.67	0.75	31.5
5	T1	58	3	61	5.0	0.294	29.8	LOS C	3.1	22.3	0.87	0.70	0.87	29.7
6	R2	38	2	40	5.0	* 0.294	36.7	LOS C	3.1	22.3	0.92	0.71	0.92	29.0
Approach		142	7	149	5.0	0.294	30.4	LOS C	3.1	22.3	0.84	0.69	0.84	30.1

North: Charles St														
7	L2	796	40	838	5.0	0.900	33.8	LOS C	38.3	279.9	0.79	0.93	0.99	37.7
8	T1	119	6	125	5.0	0.900	33.2	LOS C	38.3	279.9	0.79	0.97	1.15	30.8
9	R2	60	3	63	5.0	* 0.900	59.1	LOS E	4.5	33.0	0.79	1.09	1.67	24.5
Approach		975	49	1026	5.0	0.900	35.3	LOS C	38.3	279.9	0.79	0.94	1.05	35.5
West: George St														
10	L2	38	2	40	5.0	0.171	36.8	LOS C	1.9	13.6	0.89	0.71	0.89	28.8
11	T1	267	13	281	5.0	* 0.856	44.6	LOS D	12.5	91.0	1.00	1.06	1.31	26.9
Approach		305	15	321	5.0	0.856	43.6	LOS D	12.5	91.0	0.98	1.02	1.26	27.1
All Vehicles		1676	84	1764	5.0	0.900	34.3	LOS C	38.3	279.9	0.82	0.89	1.02	32.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Pedestrian Movement Performance

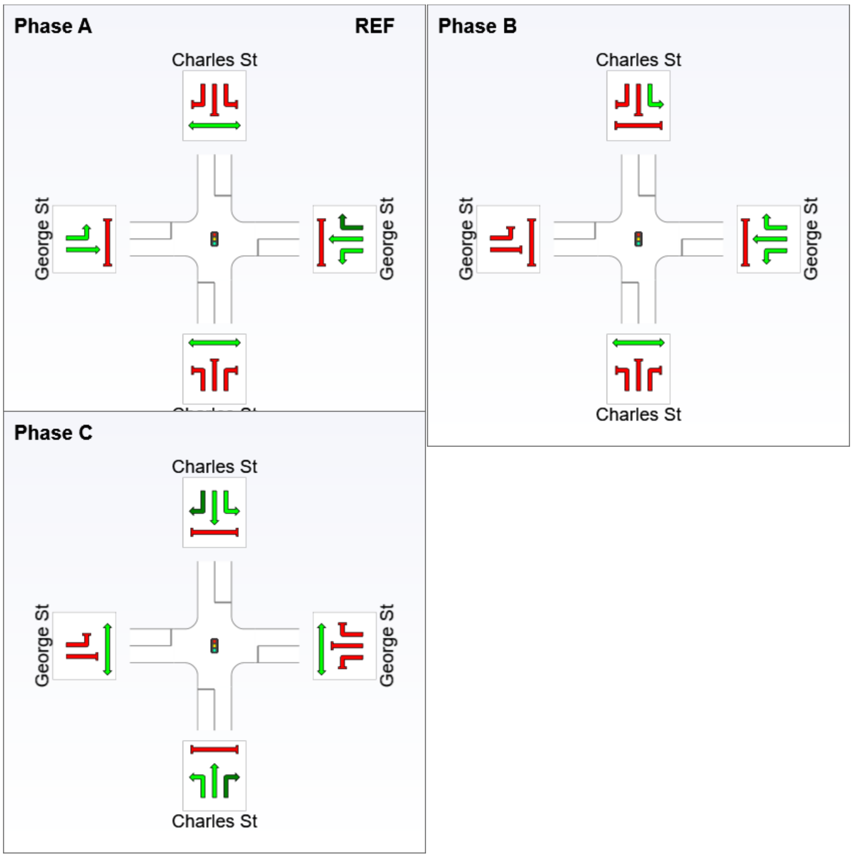
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Charles St												
P1	Full	50	53	36.3	LOS D	0.1	0.1	0.93	0.93	202.2	215.7	1.07
East: George St												
P2	Full	50	53	36.3	LOS D	0.1	0.1	0.93	0.93	202.2	215.7	1.07
North: Charles St												
P3	Full	50	53	36.3	LOS D	0.1	0.1	0.93	0.93	202.2	215.7	1.07
West: George St												
P4	Full	50	53	36.3	LOS D	0.1	0.1	0.93	0.93	202.2	215.7	1.07
All Pedestrians		200	211	36.3	LOS D	0.1	0.1	0.93	0.93	202.2	215.7	1.07

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

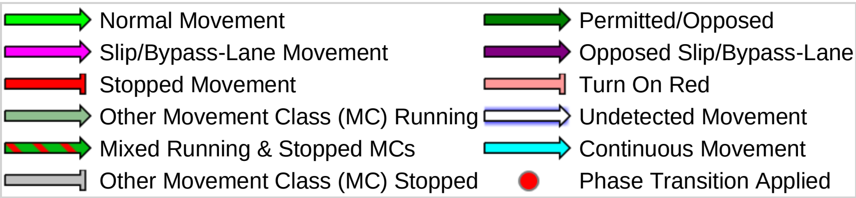
Input Phase Sequence

Phase Reference	**Sequence: Phase:**	**TCS Phase**	**1100 A**

Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase



Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	20	32
Green Time (sec)	14	6	46
Phase Time (sec)	20	12	52
Phase Split	24%	14%	62%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

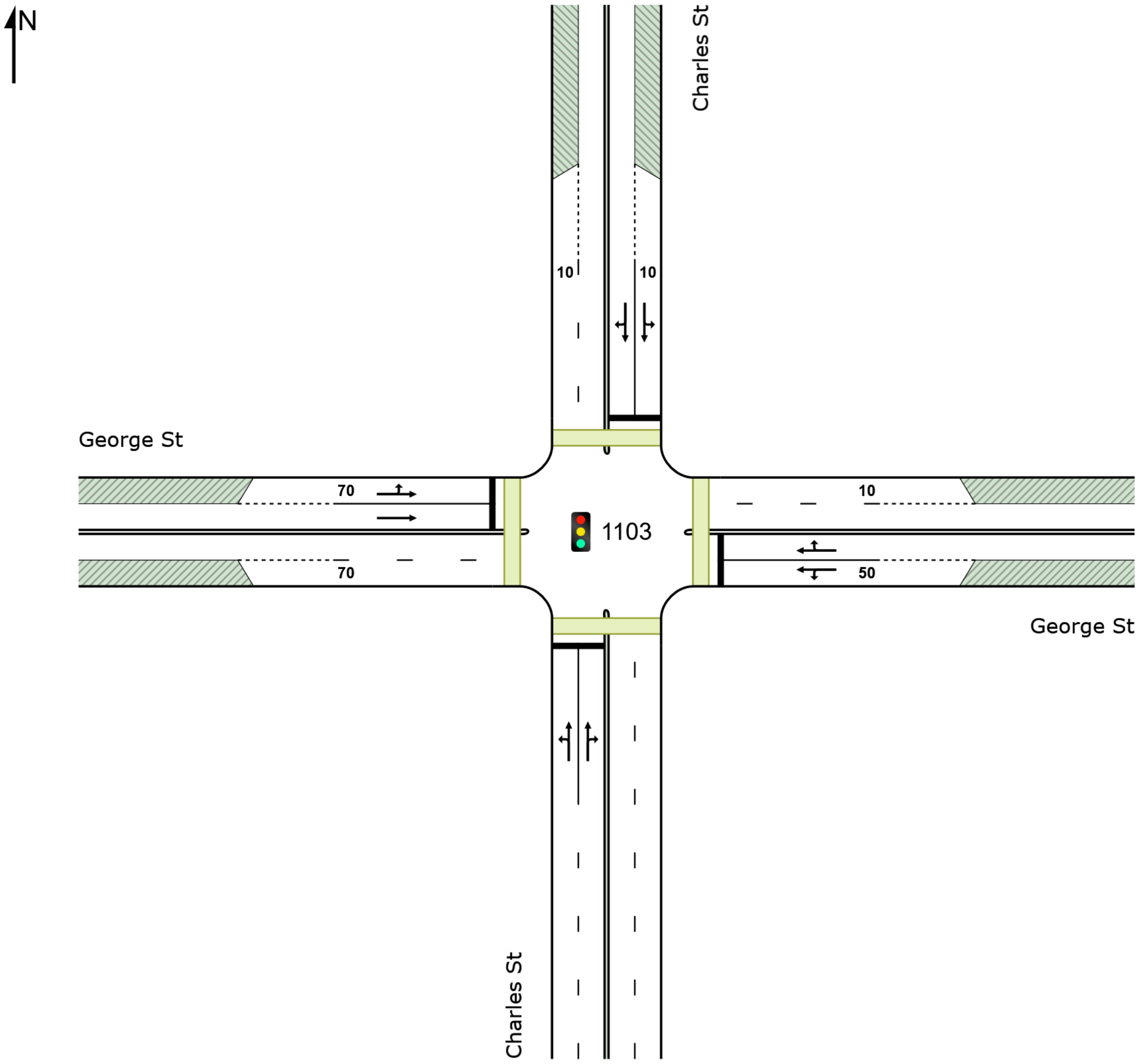
Site: 1103 [TCS 1103 - George St Charles St - PM Peak (Site Folder: 1103)]

George St Charles St Parramatta, Weekday PM Peak Existing 1700-1800 26 July - 26 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 38 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Charles St														

1	L2	30	5.0	32	5.0	0.150	18.5	LOS B	0.8	6.1	0.87	0.69	0.87	33.8
2	T1	144	5.0	152	5.0	* 0.751	19.1	LOS B	4.5	33.1	0.98	0.95	1.27	32.7
3	R2	80	5.0	84	5.0	0.751	23.1	LOS B	4.5	33.1	1.00	0.99	1.33	32.6
Approach		254	5.0	267	5.0	0.751	20.3	LOS B	4.5	33.1	0.97	0.93	1.24	32.8
East: George St														
4	L2	46	5.0	48	5.0	0.064	8.8	LOS A	0.6	4.1	0.54	0.59	0.54	36.8
5	T1	58	5.0	61	5.0	0.156	7.9	LOS A	1.2	8.4	0.72	0.60	0.72	36.2
6	R2	38	5.0	40	5.0	* 0.156	11.7	LOS A	1.2	8.4	0.75	0.60	0.75	36.1
Approach		142	5.0	149	5.0	0.156	9.2	LOS A	1.2	8.4	0.67	0.60	0.67	36.4
North: Charles St														
7	L2	60	5.0	63	5.0	0.381	18.1	LOS B	2.6	18.8	0.88	0.73	0.88	34.3
8	T1	119	5.0	125	5.0	0.381	14.8	LOS B	2.6	18.8	0.90	0.73	0.90	33.9
9	R2	60	5.0	63	5.0	0.381	20.4	LOS B	1.8	12.9	0.94	0.74	0.94	33.1
Approach		239	5.0	252	5.0	0.381	17.0	LOS B	2.6	18.8	0.90	0.74	0.90	33.8
West: George St														
10	L2	38	5.0	40	5.0	0.155	18.7	LOS B	0.9	6.3	0.87	0.70	0.87	33.6
11	T1	267	5.0	281	5.0	* 0.774	19.5	LOS B	5.6	41.1	0.99	1.00	1.32	32.9
Approach		305	5.0	321	5.0	0.774	19.4	LOS B	5.6	41.1	0.98	0.96	1.26	33.0
All Vehicles		940	5.0	989	5.0	0.774	17.5	LOS B	5.6	41.1	0.91	0.84	1.08	33.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

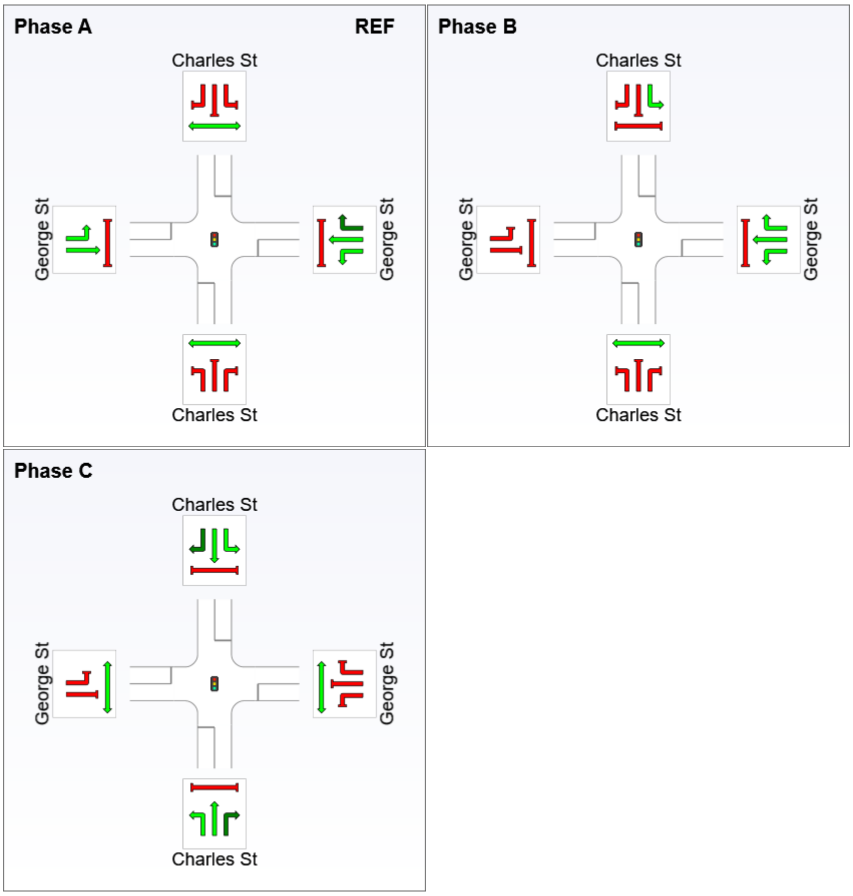
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Charles St												
P1	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20
East: George St												
P2	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20
North: Charles St												
P3	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20
West: George St												
P4	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20
All Pedestrians		200	211	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase

- Normal Movement
- Slip/Bypass-Lane Movement
- Stopped Movement
- Other Movement Class (MC) Running
- Mixed Running & Stopped MCs
- Other Movement Class (MC) Stopped
- Permitted/Opposed
- Opposed Slip/Bypass-Lane
- Turn On Red
- Undetected Movement
- Continuous Movement
- Phase Transition Applied

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	13	25
Green Time (sec)	7	6	7
Phase Time (sec)	13	12	13
Phase Split	34%	32%	34%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

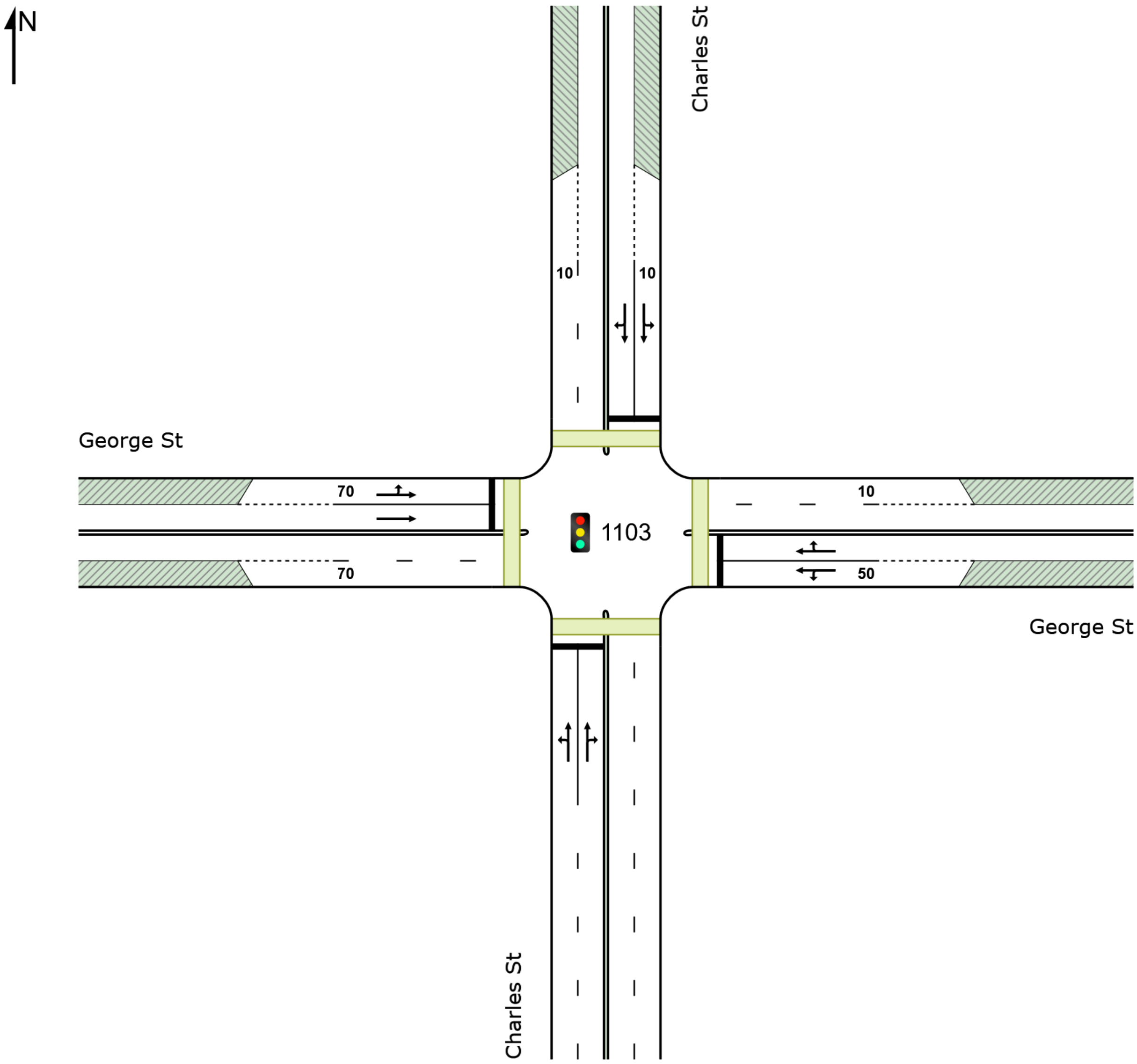
Site: 1103 [TCS 1103 - George St Charles St - PM Peak - Detour - 38s Cycle TIme (Site Folder: 1103)]

George St Charles St Parramatta, Weekday PM Peak Existing 1700-1800 26 July - 26 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 38 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Charles St														
1	L2	30	2	32	5.0	0.165	17.6	LOS B	1.0	7.5	0.85	0.68	0.85	34.2
2	T1	144	7	152	5.0	0.825	20.9	LOS B	4.6	33.6	0.97	1.00	1.42	32.2
3	R2	80	4	84	5.0	0.825	26.2	LOS B	4.6	33.6	1.00	1.09	1.58	31.7
Approach		254	13	267	5.0	0.825	22.2	LOS B	4.6	33.6	0.96	0.99	1.40	32.2
East: George St														
4	L2	46	2	48	5.0	0.064	9.4	LOS A	0.6	4.1	0.57	0.61	0.57	36.5
5	T1	58	3	61	5.0	0.155	7.5	LOS A	1.1	8.4	0.71	0.60	0.71	36.3
6	R2	38	2	40	5.0	0.155	11.1	LOS A	1.1	8.4	0.73	0.59	0.73	36.4
Approach		142	7	149	5.0	0.155	9.0	LOS A	1.1	8.4	0.67	0.60	0.67	36.4
North: Charles St														
7	L2	796	40	838	5.0	1.113 *	143.6	LOS F	63.1	461.0	1.00	2.21	4.12	17.6
8	T1	119	6	125	5.0	1.113	136.9	LOS F	63.1	461.0	1.00	2.26	4.60	15.9
9	R2	60	3	63	5.0	1.113	140.3	LOS F	12.3	90.0	1.00	2.26	4.65	15.8
Approach		975	49	1026	5.0	1.113	142.6	LOS F	63.1	461.0	1.00	2.22	4.21	17.3
West: George St														
10	L2	38	2	40	5.0	0.181	19.8	LOS B	0.9	6.5	0.90	0.70	0.90	33.3
11	T1	267	13	281	5.0	0.903 *	26.7	LOS B	6.7	49.2	1.00	1.26	1.83	31.0
Approach		305	15	321	5.0	0.903	25.8	LOS B	6.7	49.2	0.98	1.19	1.72	31.2
All Vehicles		1676	84	1764	5.0	1.113	91.8	LOS F	63.1	461.0	0.96	1.71	3.03	21.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: SIDRA Standard.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

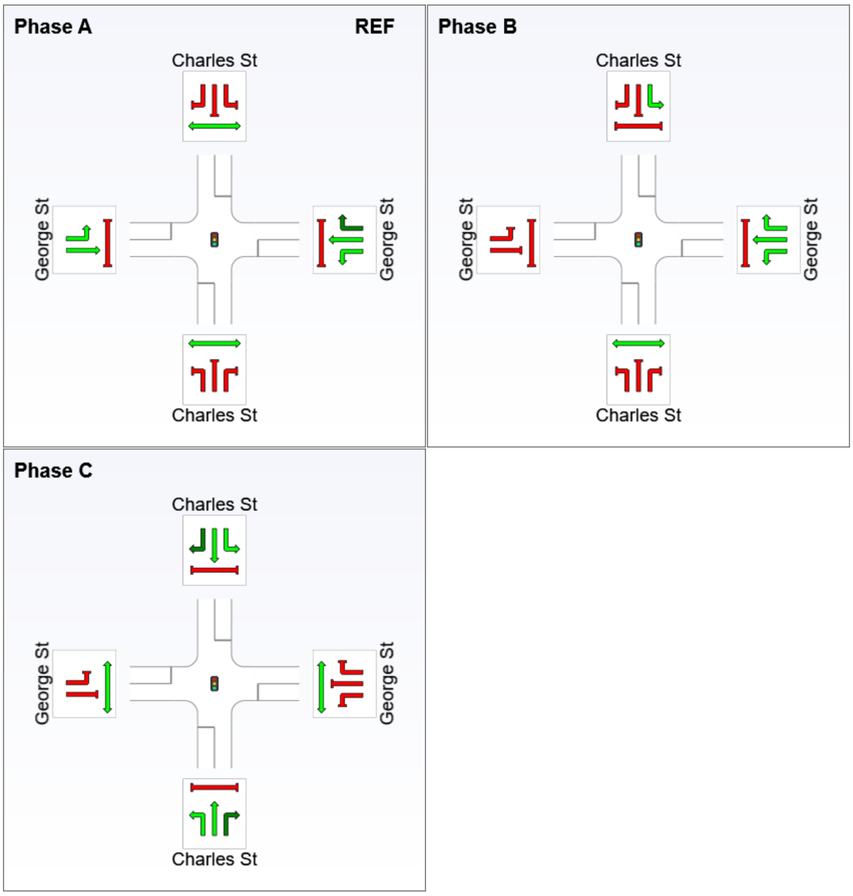
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Charles St												
P1	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20
East: George St												
P2	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20
North: Charles St												
P3	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20
West: George St												
P4	Full	50	53	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20
All Pedestrians		200	211	13.5	LOS B	0.0	0.0	0.84	0.84	179.4	215.7	1.20

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	12	24
Green Time (sec)	6	6	8
Phase Time (sec)	12	12	14
Phase Split	32%	32%	37%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Organisation: CIVLINK | Licence: NETWORK / 1PC | Created: Wednesday, 31 May 2023 6:27:39 PM
Project: E:\Civlink\Gasworks Bridge Rehabilitation\00_2022 Update\Rev 3\Weekday PM - SB Closure.sip9

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Weekday PM - SB Closure

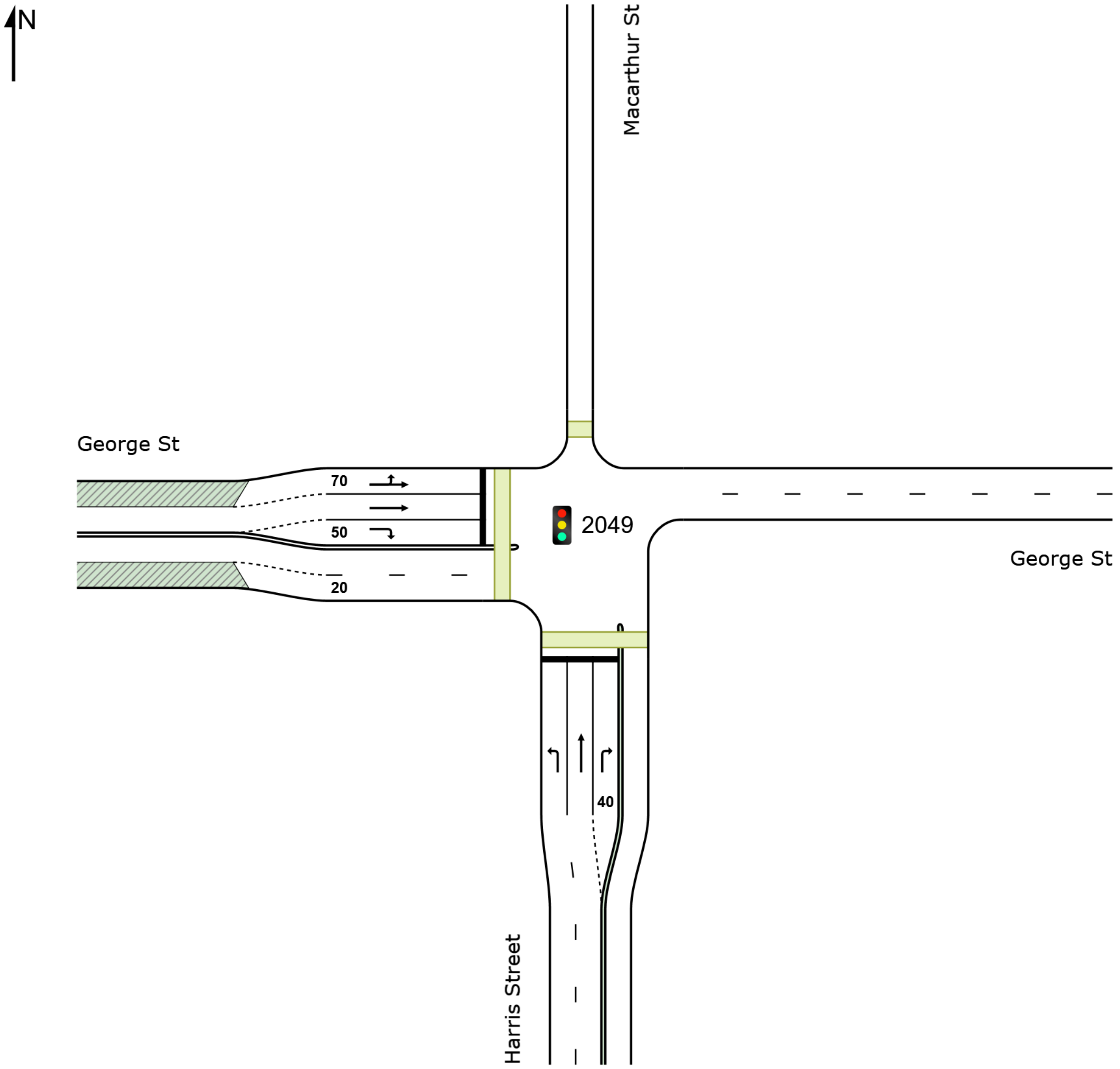
Site: 2049 [TCS 2049 - George St Harris St Macarthur St - PM - SB Detour - 20% Reduction (Site Folder: 2049)]

George St Charles St Parramatta, Weekday PM Peak Existing 1700-1800 26 July - 26 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Harris Street														
1	L2	146	7	154	5.0	0.278	37.1	LOS C	6.8	49.5	0.80	0.75	0.80	18.9
2	T1	478	24	503	5.0	* 0.904	56.9	LOS E	33.3	242.8	1.00	1.07	1.24	19.3
3	R2	31	2	33	5.0	0.073	40.6	LOS C	1.5	10.6	0.80	0.70	0.80	18.4
Approach		655	33	689	5.0	0.904	51.8	LOS D	33.3	242.8	0.95	0.98	1.12	19.2
West: George St														
10	L2	158	8	166	5.0	0.157	15.0	LOS B	4.3	31.3	0.48	0.64	0.48	32.7
11	T1	100	5	105	5.0	0.094	11.1	LOS A	2.6	19.0	0.46	0.37	0.46	32.6

12	R2	849	43	894	5.1	0.912 *	41.8	LOS C	52.8	385.3	0.89	0.95	1.03	19.7
Approach		1107	56	1165	5.0	0.912	35.2	LOS C	52.8	385.3	0.79	0.85	0.90	22.9
All Vehicles		1762	89	1855	5.0	0.912	41.3	LOS C	52.8	385.3	0.85	0.90	0.98	21.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Pedestrian Movement Performance

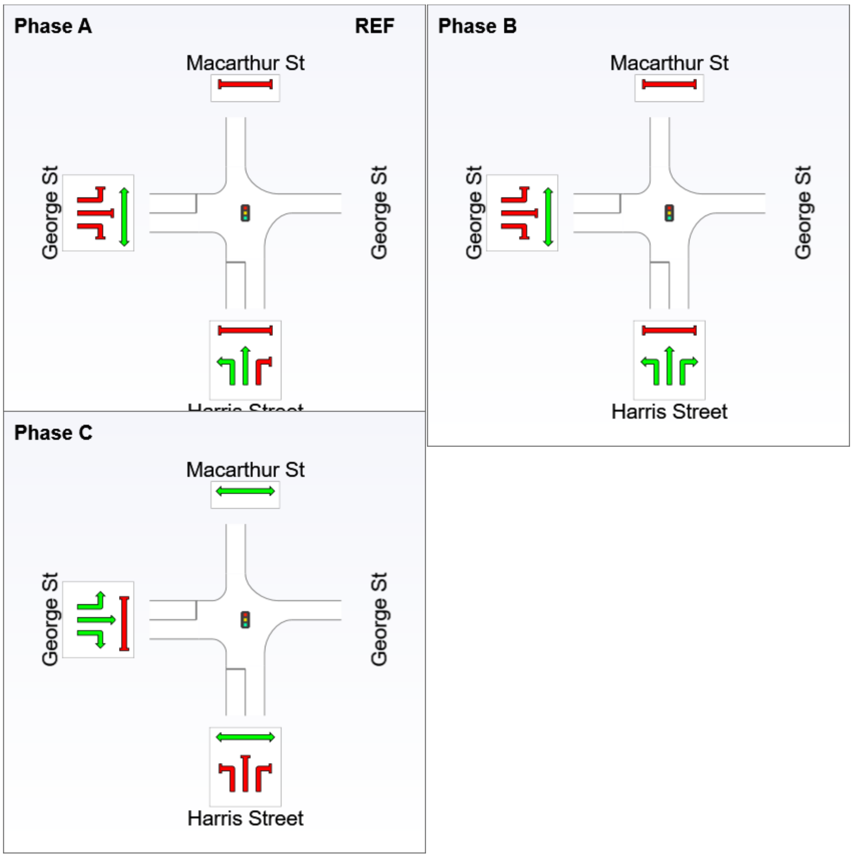
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Harris Street												
P1	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	220.2	215.7	0.98
North: Macarthur St												
P3	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	212.2	205.3	0.97
West: George St												
P4	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	222.7	219.0	0.98
All Pedestrians		150	158	54.3	LOS E	0.2	0.2	0.95	0.95	218.4	213.3	0.98

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Reference	**Sequence: Phase:**	**TCS Phase**	**1100 A**

Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	7	43
Green Time (sec)	1	30	71
Phase Time (sec)	7	36	77
Phase Split	6%	30%	64%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

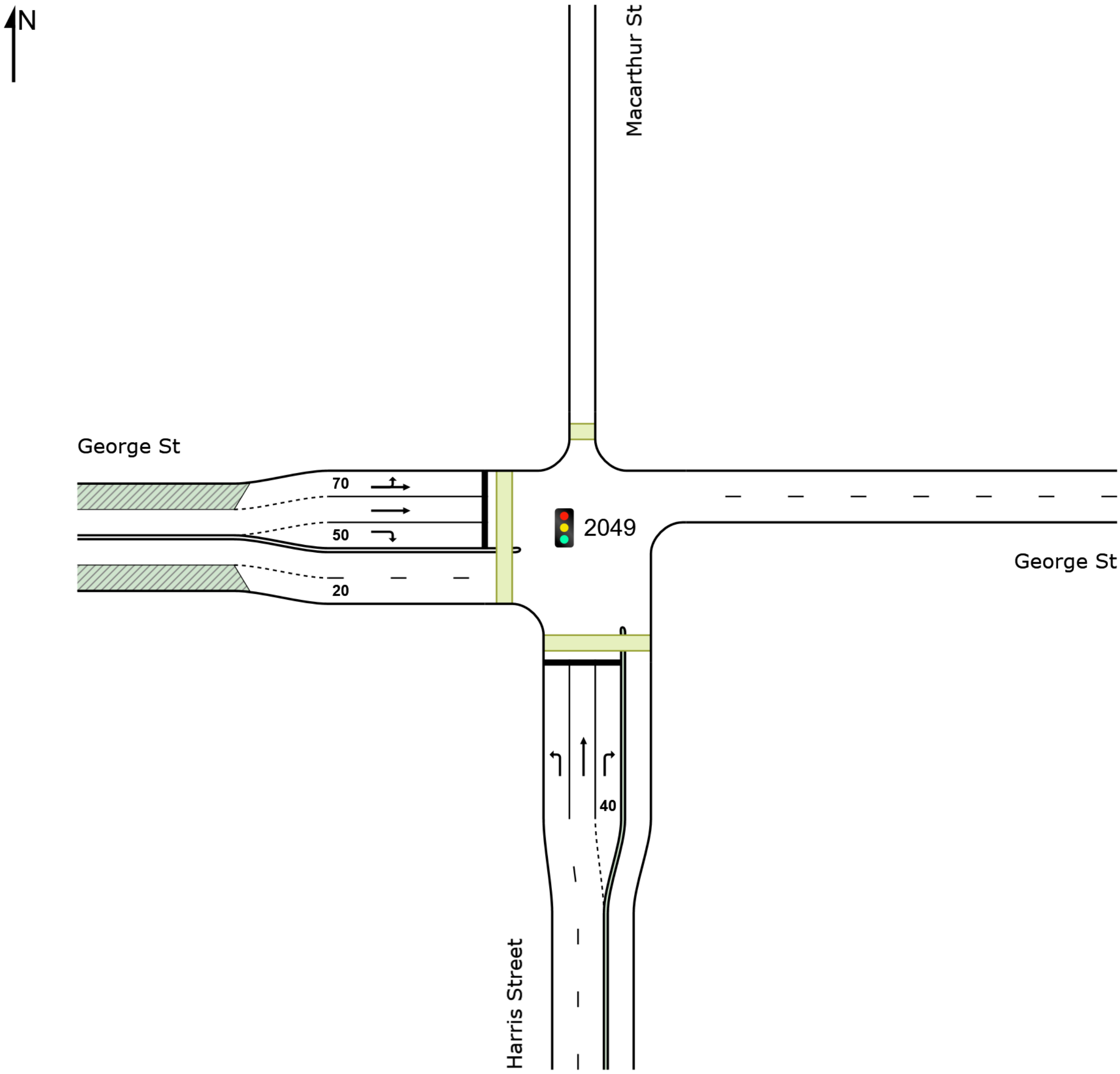
Site: 2049 [TCS 2049 - George St Harris St Macarthur St - PM - SB Detour - 66s cycle time (Site Folder: 2049)]

George St Charles St Parramatta,Weekday PM Peak Existing 1700-1800 26 July - 26 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 66 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total	HV]	[Total	HV]				[Veh.	Dist]				
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h

South: Harris Street														
1	L2	146	5.0	154	5.0	0.333	25.5	LOS B	4.1	30.2	0.86	0.76	0.86	22.7
2	T1	478	5.0	503	5.0	* 1.060	108.2	LOS F	36.1	263.9	1.00	2.04	2.48	13.0
3	R2	31	5.0	33	5.0	0.120	31.0	LOS C	0.9	6.9	0.90	0.71	0.90	21.0
Approach		655	5.0	689	5.0	1.060	86.1	LOS F	36.1	263.9	0.96	1.69	2.05	14.1
West: George St														
10	L2	158	5.0	166	5.0	0.165	11.0	LOS A	2.6	18.9	0.51	0.65	0.51	34.5
11	T1	100	5.0	105	5.0	0.099	7.2	LOS A	1.6	11.4	0.49	0.39	0.49	34.9
12	R2	996	5.0	1048	5.0	* 1.103	143.8	LOS F	93.1	679.5	1.00	1.72	2.72	7.8
Approach		1254	5.0	1320	5.0	1.103	116.2	LOS F	93.1	679.5	0.90	1.48	2.27	10.3
All Vehicles		1909	5.0	2009	5.0	1.103	105.9	LOS F	93.1	679.5	0.92	1.55	2.19	11.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Pedestrian Movement Performance

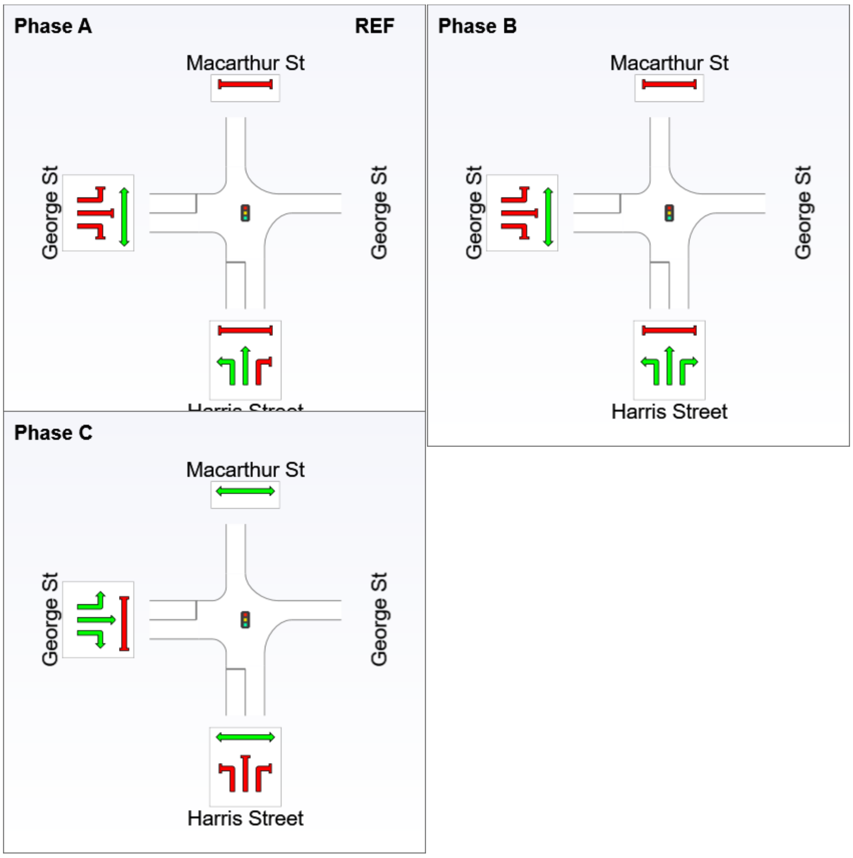
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Harris Street												
P1	Full	50	53	27.3	LOS C	0.1	0.1	0.91	0.91	193.3	215.7	1.12
North: Macarthur St												
P3	Full	50	53	27.3	LOS C	0.1	0.1	0.91	0.91	185.3	205.3	1.11
West: George St												
P4	Full	50	53	27.3	LOS C	0.1	0.1	0.91	0.91	195.8	219.0	1.12
All Pedestrians		150	158	27.3	LOS C	0.1	0.1	0.91	0.91	191.4	213.3	1.11

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Reference	**Sequence: Phase:**	**TCS Phase**	**1100 A**

Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	7	23
Green Time (sec)	1	10	37
Phase Time (sec)	7	16	43
Phase Split	11%	24%	65%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

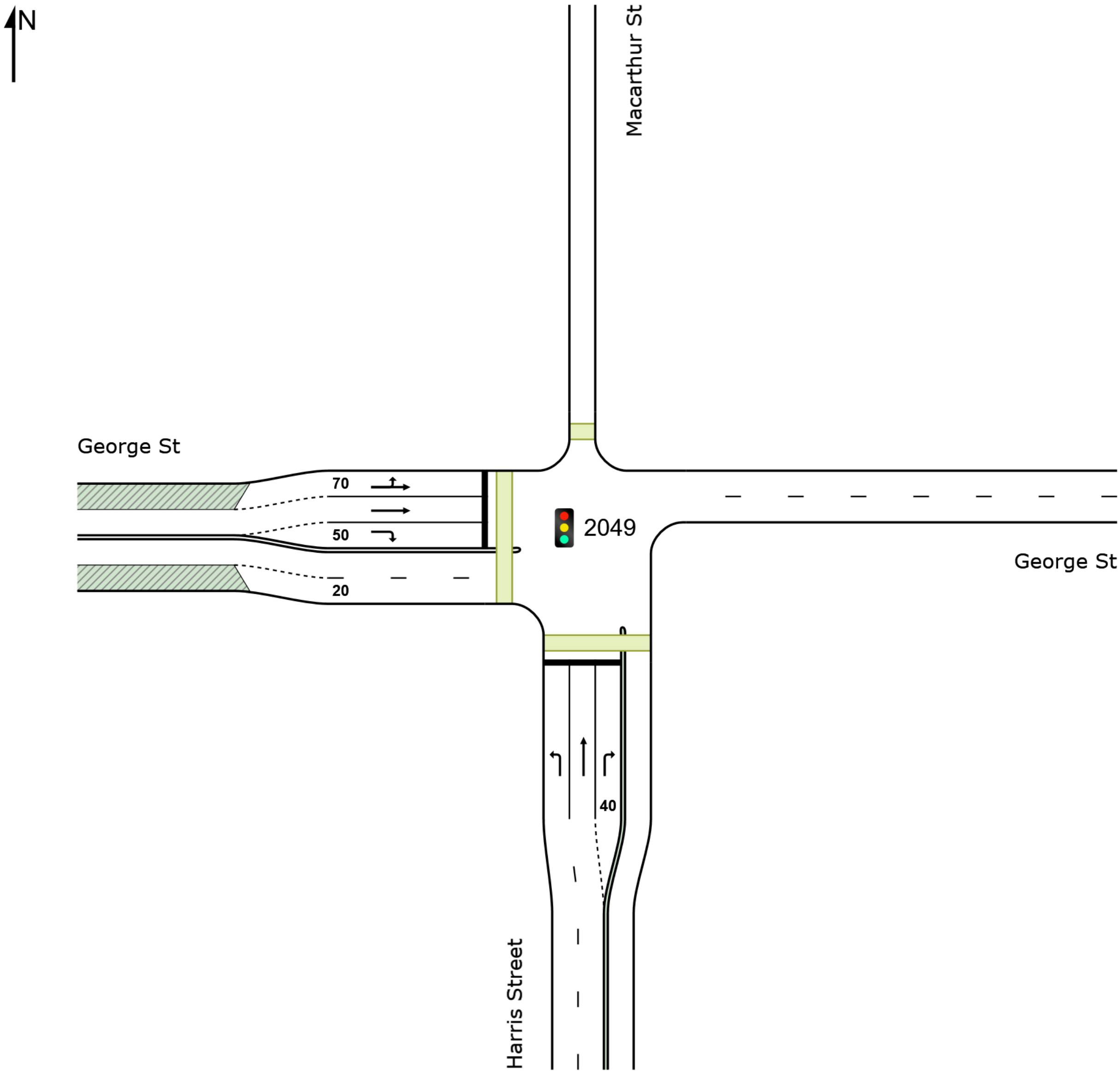
Site: 2049 [TCS 2049 - George St Harris St Macarthur St - PM - SB Detour (Site Folder: 2049)]

George St Charles St Parramatta, Weekday PM Peak Existing 1700-1800 26 July - 26 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h

South: Harris Street														
1	L2	146	5.0	154	5.0	0.312	40.6	LOS C	7.1	52.1	0.84	0.76	0.84	18.0
2	T1	478	5.0	503	5.0	* 1.013	103.3	LOS F	45.1	329.3	1.00	1.38	1.64	13.5
3	R2	31	5.0	33	5.0	0.084	44.2	LOS D	1.5	11.1	0.83	0.71	0.83	17.6
Approach		655	5.0	689	5.0	1.013	86.6	LOS F	45.1	329.3	0.96	1.21	1.42	14.2
West: George St														
10	L2	158	5.0	166	5.0	0.148	13.2	LOS A	3.9	28.7	0.44	0.62	0.44	33.5
11	T1	100	5.0	105	5.0	0.089	9.4	LOS A	2.4	17.4	0.42	0.34	0.42	33.6
12	R2	996	5.0	1048	5.0	* 1.007	86.8	LOS F	95.8	699.4	1.00	1.15	1.46	11.8
Approach		1254	5.0	1320	5.0	1.007	71.4	LOS F	95.8	699.4	0.88	1.02	1.25	14.9
All Vehicles		1909	5.0	2009	5.0	1.013	76.6	LOS F	95.8	699.4	0.91	1.08	1.31	14.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: SIDRA Standard.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Harris Street												
P1	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	220.2	215.7	0.98
North: Macarthur St												
P3	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	212.2	205.3	0.97
West: George St												
P4	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	222.7	219.0	0.98
All Pedestrians		150	158	54.3	LOS E	0.2	0.2	0.95	0.95	218.4	213.3	0.98

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

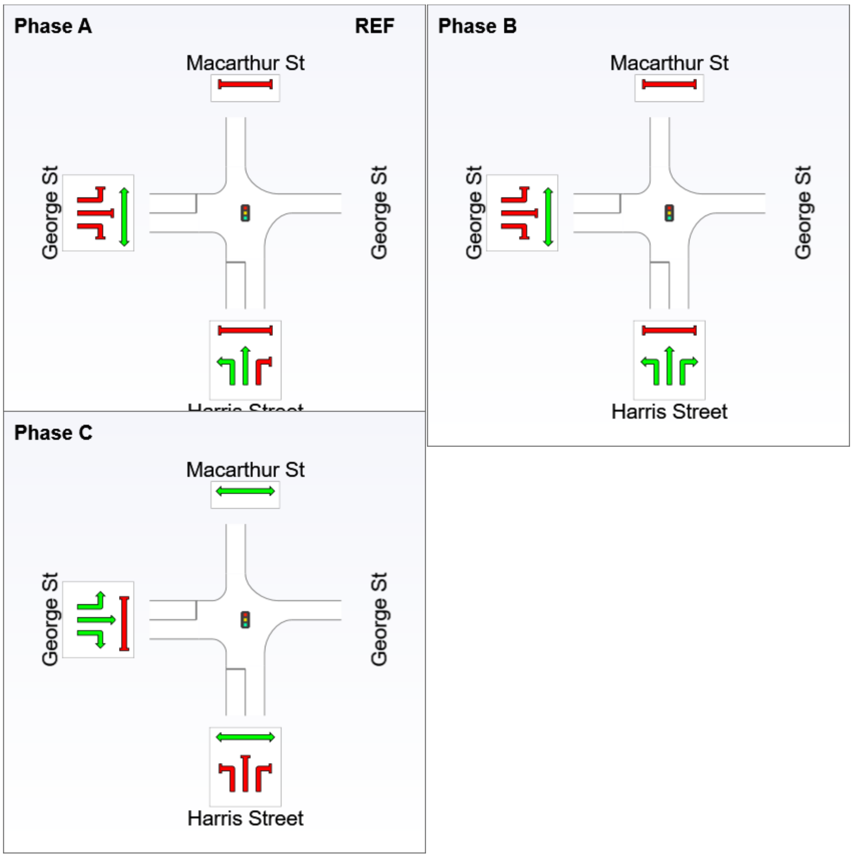
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 1100

Reference Phase: Phase A

Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	7	39
Green Time (sec)	1	26	75
Phase Time (sec)	7	32	81
Phase Split	6%	27%	68%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

USER REPORT FOR SITE

All Movement Classes **Template: Report**

Project: Weekday PM - SB Closure

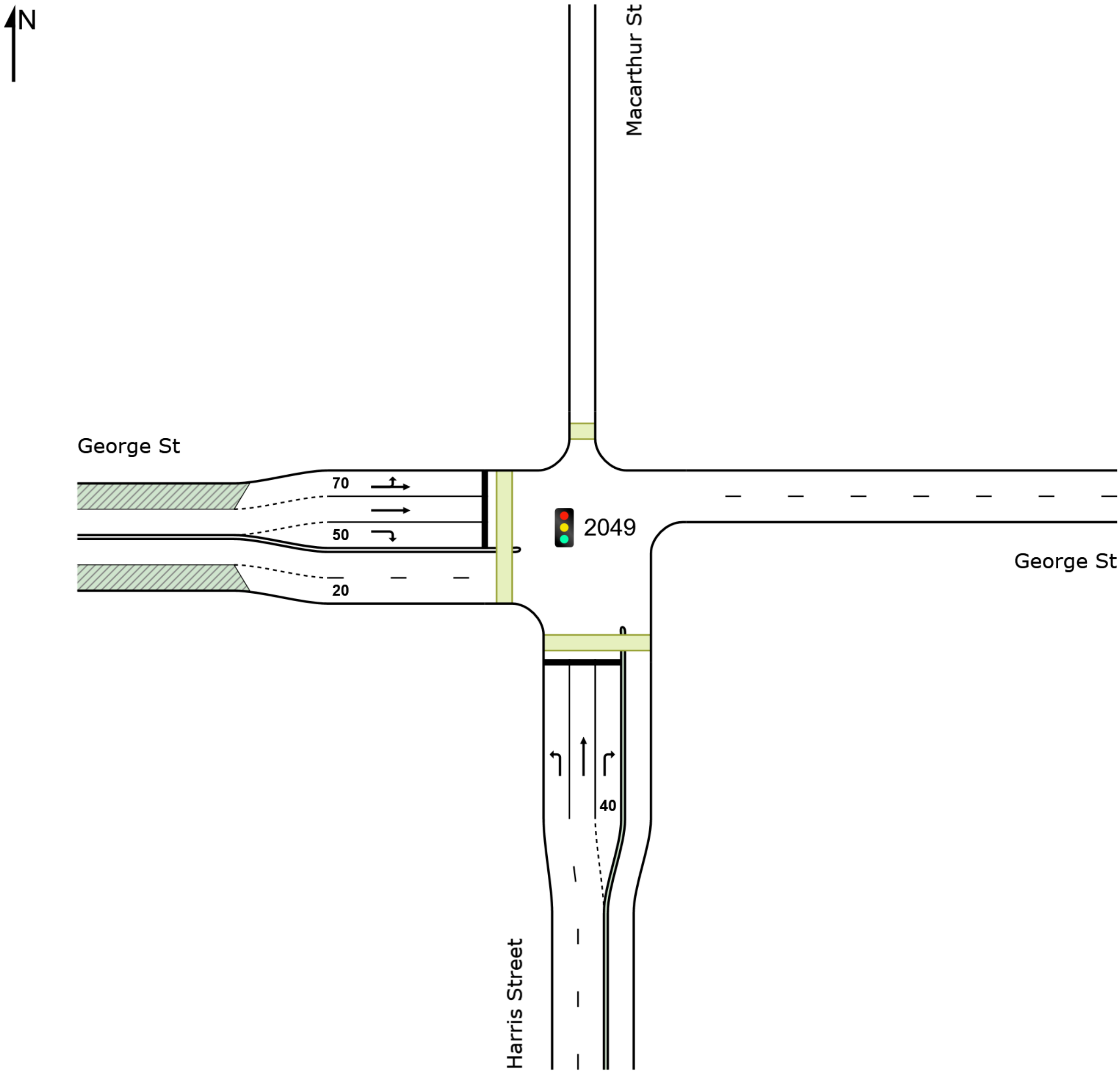
Site: 2049 [TCS 2049 - George St Harris St Macarthur St - PM - SB Detour - 20% Reduction (Site Folder: 2049)]

George St Charles St Parramatta, Weekday PM Peak Existing 1700-1800 26 July - 26 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Harris Street														
1	L2	146	7	154	5.0	0.278	37.1	LOS C	6.8	49.5	0.80	0.75	0.80	18.9
2	T1	478	24	503	5.0	* 0.904	56.9	LOS E	33.3	242.8	1.00	1.07	1.24	19.3
3	R2	31	2	33	5.0	0.073	40.6	LOS C	1.5	10.6	0.80	0.70	0.80	18.4
Approach		655	33	689	5.0	0.904	51.8	LOS D	33.3	242.8	0.95	0.98	1.12	19.2
West: George St														
10	L2	158	8	166	5.0	0.157	15.0	LOS B	4.3	31.3	0.48	0.64	0.48	32.7
11	T1	100	5	105	5.0	0.094	11.1	LOS A	2.6	19.0	0.46	0.37	0.46	32.6

12	R2	849	43	894	5.1	* 0.912	41.8	LOS C	52.8	385.3	0.89	0.95	1.03	19.7
Approach		1107	56	1165	5.0	0.912	35.2	LOS C	52.8	385.3	0.79	0.85	0.90	22.9
All Vehicles		1762	89	1855	5.0	0.912	41.3	LOS C	52.8	385.3	0.85	0.90	0.98	21.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

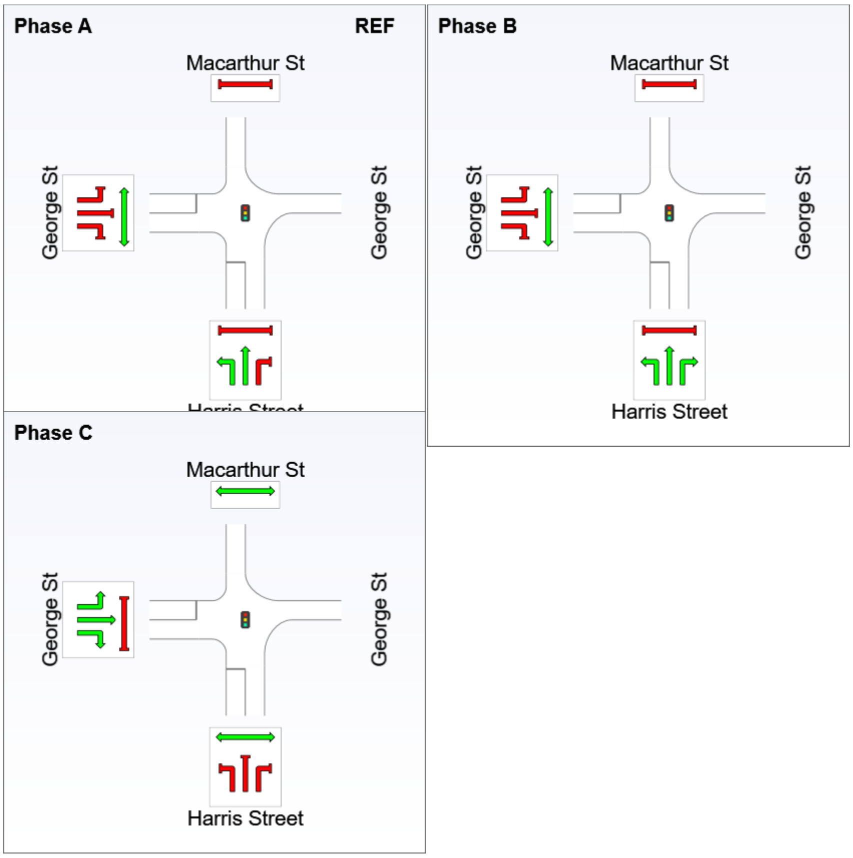
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Harris Street												
P1	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	220.2	215.7	0.98
North: Macarthur St												
P3	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	212.2	205.3	0.97
West: George St												
P4	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	222.7	219.0	0.98
All Pedestrians		150	158	54.3	LOS E	0.2	0.2	0.95	0.95	218.4	213.3	0.98

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Reference Sequence: TCS 1100
Phase: Phase A
Input Phase Sequence: A, B, C



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	B	C
Phase Change Time (sec)	0	7	43
Green Time (sec)	1	30	71
Phase Time (sec)	7	36	77
Phase Split	6%	30%	64%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

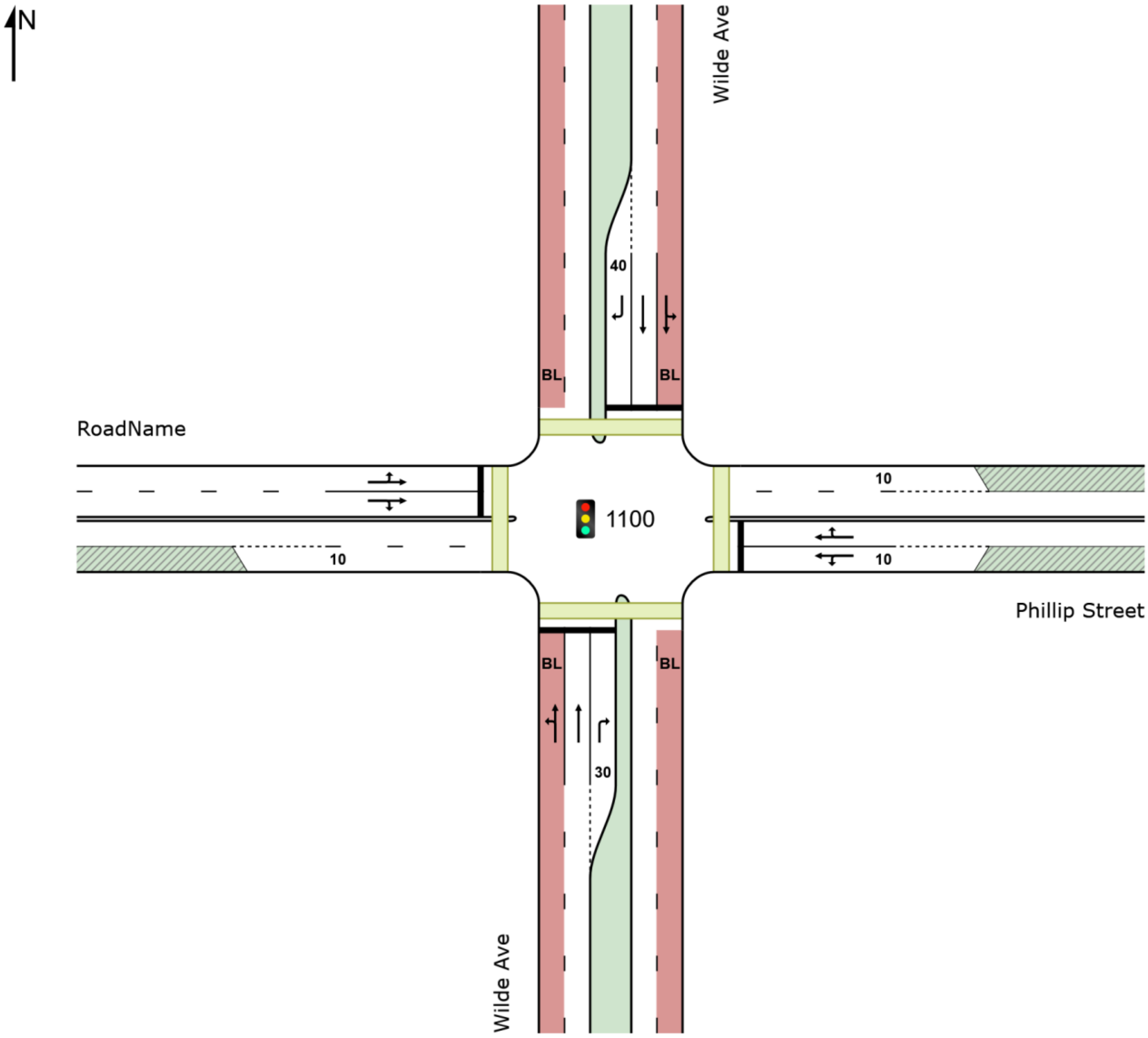
Site: 1100 [TCS 1100 - Wilde Ave Phillip St - Weekday AM Peak (Site Folder: 1100)]

Wilde Ave Phillip St Parramatta, SAT Peak Existing
1200-1300 30 July - 20 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 64 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, D, E, F
Output Phase Sequence: A, D, E, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Wilde Ave														
1	L2	41	2	43	5.0	0.108	21.1	LOS B	1.3	10.8	0.74	0.66	0.74	33.0

2	T1	131	18	138	13.7	0.303	22.7	LOS B	3.4	24.7	0.87	0.70	0.87	32.0
3	R2	22	1	23	5.0	0.069	18.1	LOS B	0.5	3.4	0.83	0.67	0.83	33.5
Approach		194	21	204	10.9	0.303	21.8	LOS B	3.4	24.7	0.84	0.69	0.84	32.4
East: Phillip Street														
4	L2	18	1	19	5.0	0.095	26.4	LOS B	0.9	6.4	0.84	0.66	0.84	31.5
5	T1	97	5	102	5.0	0.475	27.1	LOS B	3.8	27.4	0.93	0.74	0.93	30.6
6	R2	37	2	39	5.0	0.475	31.1	LOS C	3.8	27.4	0.95	0.76	0.95	30.6
Approach		152	8	160	5.0	0.475	28.0	LOS B	3.8	27.4	0.93	0.74	0.93	30.7
North: Wilde Ave														
7	L2	250	13	263	5.0	* 0.425	12.2	LOS A	3.8	28.6	0.79	0.75	0.79	35.5
8	T1	234	23	246	9.9	* 0.566	24.1	LOS B	6.8	49.4	0.93	0.78	0.93	31.6
9	R2	195	10	205	5.0	* 0.488	19.4	LOS B	4.7	34.6	0.88	0.77	0.88	33.1
Approach		679	45	715	6.7	0.566	18.4	LOS B	6.8	49.4	0.86	0.76	0.86	33.4
West: RoadName														
10	L2	53	3	56	5.0	0.124	14.1	LOS A	0.8	5.6	0.81	0.69	0.81	34.8
11	T1	78	4	82	5.0	* 0.489	28.0	LOS B	4.2	31.0	0.96	0.77	0.96	30.3
12	R2	56	3	59	5.0	0.489	31.4	LOS C	4.2	31.0	0.96	0.77	0.96	30.5
Approach		187	9	197	5.0	0.489	25.1	LOS B	4.2	31.0	0.92	0.75	0.92	31.5
All Vehicles		1212	83	1276	6.9	0.566	21.2	LOS B	6.8	49.4	0.87	0.75	0.87	32.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

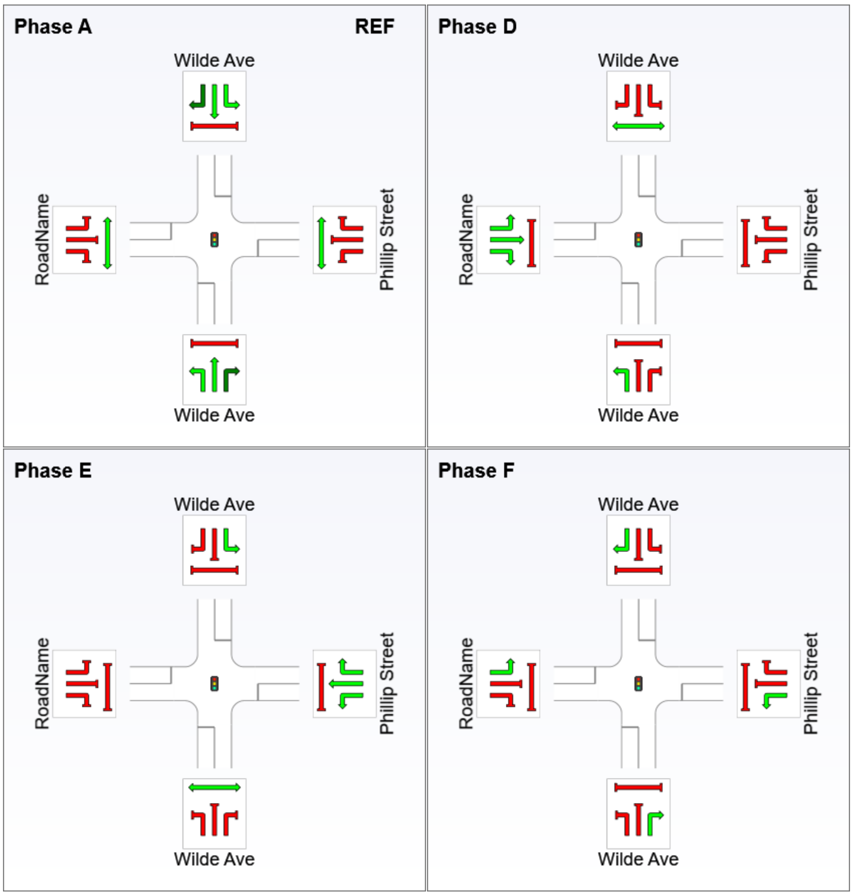
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Wilde Ave												
P1	Full	50	53	26.3	LOS C	0.1	0.1	0.91	0.91	196.0	220.5	1.13
East: Phillip Street												
P2	Full	50	53	26.3	LOS C	0.1	0.1	0.91	0.91	192.3	215.7	1.12
North: Wilde Ave												
P3	Full	50	53	26.3	LOS C	0.1	0.1	0.91	0.91	196.0	220.5	1.13
West: RoadName												
P4	Full	50	53	26.3	LOS C	0.1	0.1	0.91	0.91	192.3	215.7	1.12
All Pedestrians		200	211	26.3	LOS C	0.1	0.1	0.91	0.91	194.1	218.1	1.12

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Reference Sequence: TCS Phase 1100
Reference Phase: A
Input Phase Sequence: A, D, E, F



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

Phase Timing Summary

Phase	A	D	E	F
Phase Change Time (sec)	0	20	36	52
Green Time (sec)	14	10	10	6
Phase Time (sec)	20	16	16	12
Phase Split	31%	25%	25%	19%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

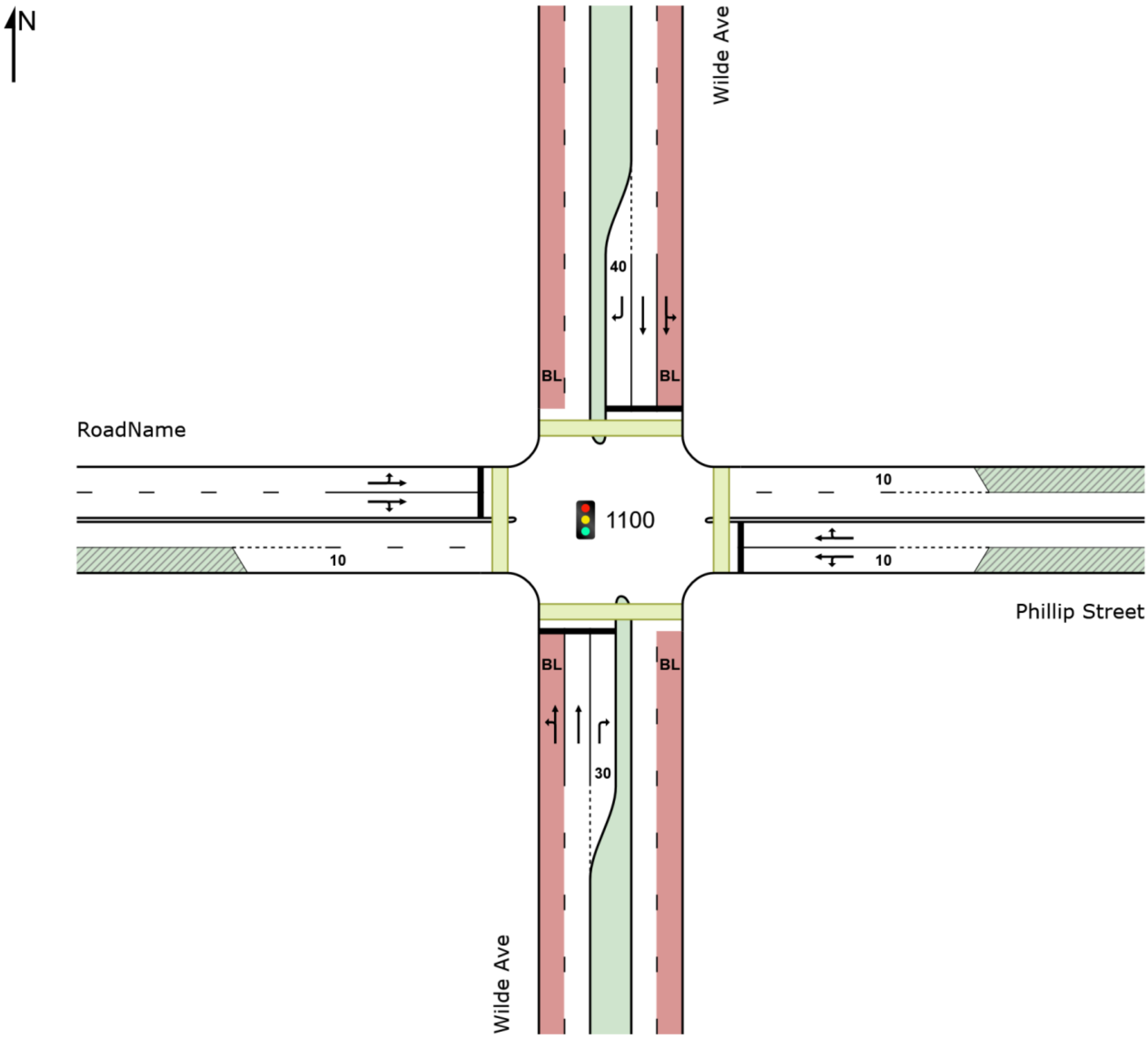
Site: 1100 [TCS 1100 - Wilde Ave Phillip St - Weekday AM Peak - SB Detour - 150s (Site Folder: 1100)]

Wilde Ave Phillip St Parramatta, SAT Peak Existing
1200-1300 30 July - 20 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, D, E, F
Output Phase Sequence: A, D, E, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Wilde Ave														
1	L2	41	2	43	5.0	0.063	20.2	LOS B	1.8	15.8	0.49	0.57	0.49	33.3
2	T1	131	18	138	13.7	0.131	20.1	LOS B	4.7	34.4	0.55	0.47	0.55	32.7
3	R2	22	1	23	5.0	0.106	38.8	LOS C	1.0	7.1	0.92	0.68	0.92	28.1
Approach		194	21	204	10.9	0.131	22.2	LOS B	4.7	34.4	0.58	0.51	0.58	32.2
East: Phillip Street														
4	L2	18	1	19	5.0	0.136	64.7	LOS E	2.2	16.0	0.91	0.70	0.91	23.7
5	T1	97	5	102	5.0	0.680	68.4	LOS E	9.0	65.8	0.98	0.81	1.03	22.8
6	R2	37	2	39	5.0	0.680	72.9	LOS F	9.0	65.8	0.99	0.83	1.05	22.7
Approach		152	8	160	5.0	0.680	69.1	LOS E	9.0	65.8	0.98	0.81	1.02	22.9
North: Wilde Ave														
7	L2	1058	53	1114	5.0	1.008 *	74.4	LOS F	91.5	673.8	1.00	1.08	1.34	23.2
8	T1	234	23	246	9.9	1.008 *	24.3	LOS B	91.5	673.8	0.62	0.54	0.64	31.7
9	R2	195	10	205	5.0	0.283 *	16.3	LOS B	6.4	46.5	0.52	0.65	0.52	34.1
Approach		1487	85	1565	5.7	1.008	58.9	LOS E	91.5	673.8	0.88	0.94	1.12	25.3
West: RoadName														
10	L2	53	3	56	5.0	0.146	36.0	LOS C	2.5	18.4	0.85	0.72	0.85	28.8
11	T1	78	4	82	5.0	0.636 *	69.4	LOS E	10.1	73.6	1.00	0.81	1.01	22.6
12	R2	56	3	59	5.0	0.636	72.8	LOS F	10.1	73.6	1.00	0.81	1.01	22.7
Approach		187	9	197	5.0	0.636	60.9	LOS E	10.1	73.6	0.96	0.78	0.96	24.1
All Vehicles		2020	123	2126	6.1	1.008	56.3	LOS D	91.5	673.8	0.86	0.88	1.05	25.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Pedestrian Movement Performance

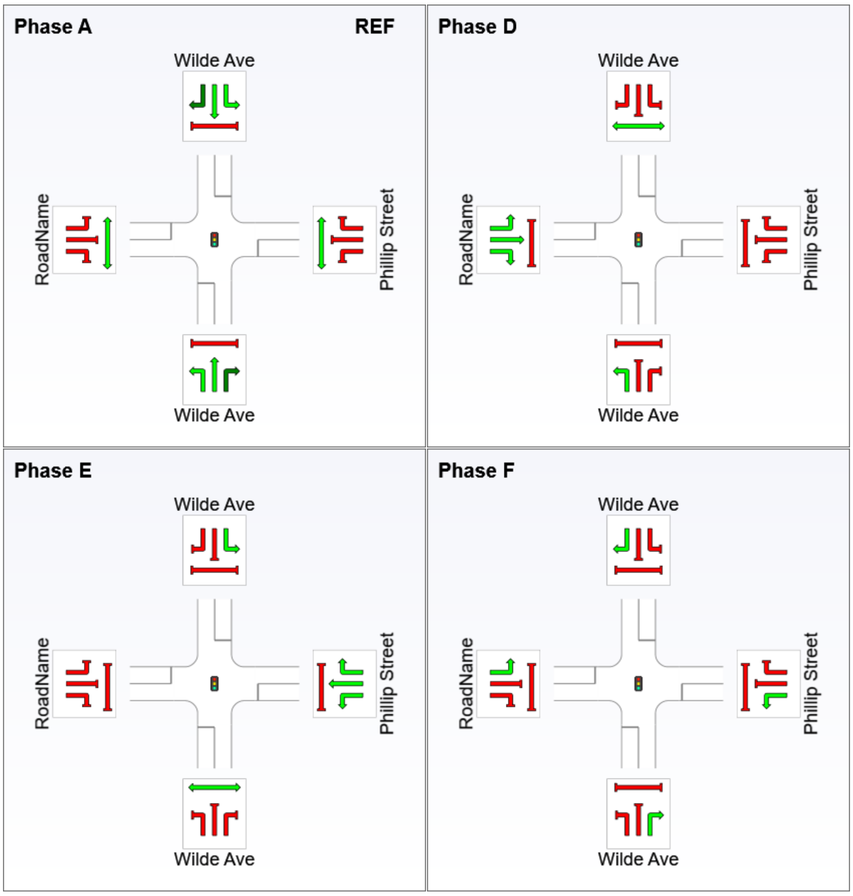
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Wilde Ave												
P1	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	238.9	220.5	0.92
East: Phillip Street												
P2	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	235.2	215.7	0.92
North: Wilde Ave												
P3	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	238.9	220.5	0.92
West: RoadName												

P4	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	235.2	215.7	0.92
All Pedestrians		200	211	69.3	LOS F	0.2	0.2	0.96	0.96	237.0	218.1	0.92

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, D, E, F



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	D	E	F
Phase Change Time (sec)	0	82	106	130

Green Time (sec)	76	18	18	14
Phase Time (sec)	82	24	24	20
Phase Split	55%	16%	16%	13%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

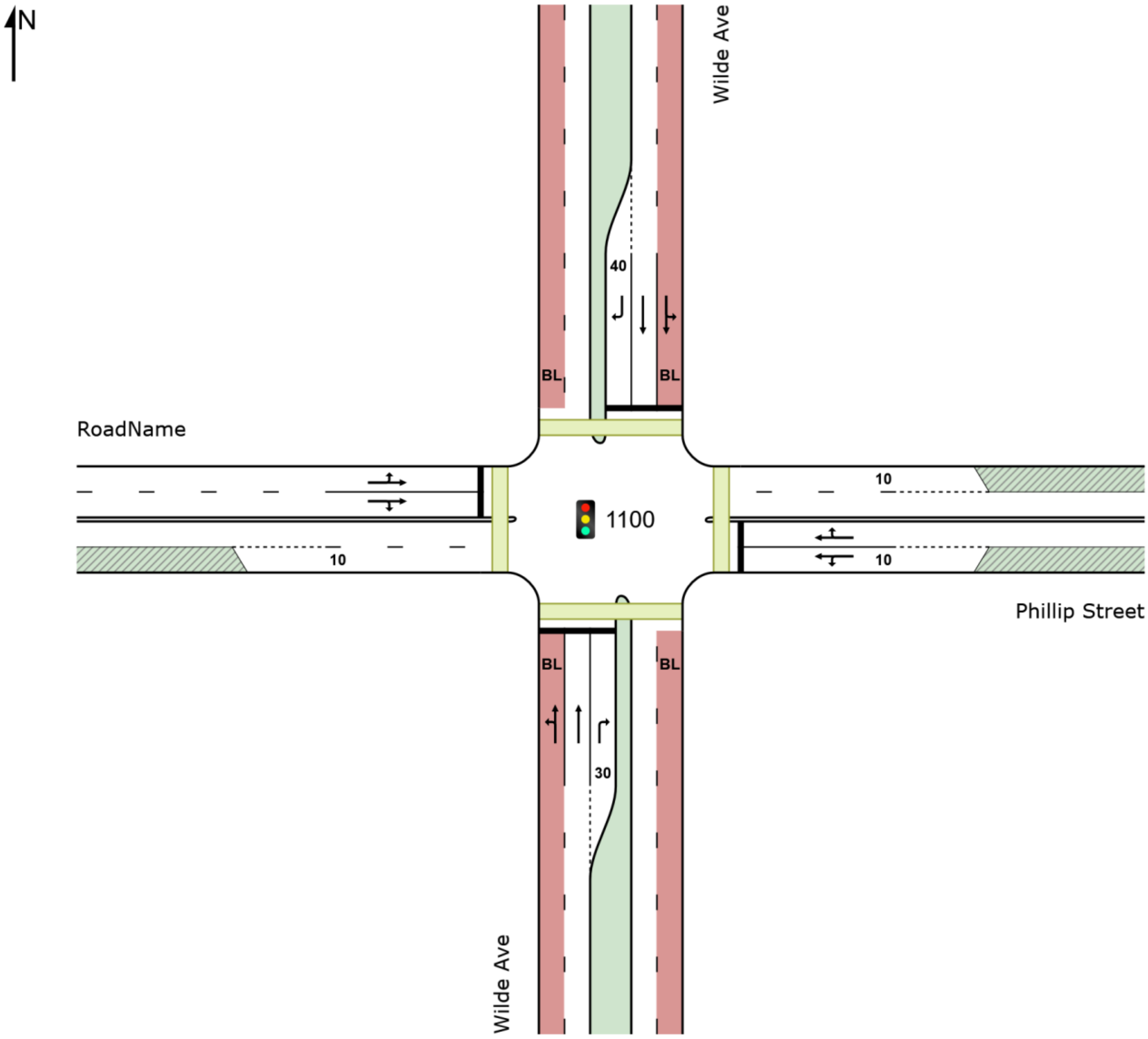
Site: 1100 [TCS 1100 - Wilde Ave Phillip St - Weekday AM Peak - SB Detour - 120s (Site Folder: 1100)]

Wilde Ave Phillip St Parramatta, SAT Peak Existing
1200-1300 30 July - 20 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site Practical Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, D, E, F
Output Phase Sequence: A, D, E, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total	HV]	DEMAND FLOWS [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE [Veh.	Dist]	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		veh/h	veh/h	veh/h	%	v/c	sec		veh	m				km/h
South: Wilde Ave														
1	L2	41	2	43	5.0	0.068	19.8	LOS B	1.6	14.0	0.53	0.58	0.53	33.4
2	T1	131	18	138	13.7	0.147	20.1	LOS B	4.2	31.0	0.61	0.52	0.61	32.7
3	R2	22	1	23	5.0	0.108	31.2	LOS C	0.7	5.2	0.93	0.68	0.93	29.9
Approach		194	21	204	10.9	0.147	21.3	LOS B	4.2	31.0	0.63	0.55	0.63	32.5
East: Phillip Street														
4	L2	18	1	19	5.0	0.120	50.6	LOS D	1.7	12.6	0.89	0.69	0.89	26.1
5	T1	97	5	102	5.0	0.602	52.7	LOS D	7.1	51.6	0.96	0.77	0.97	25.2
6	R2	37	2	39	5.0	0.602	56.9	LOS E	7.1	51.6	0.98	0.79	0.99	25.2
Approach		152	8	160	5.0	0.602	53.5	LOS D	7.1	51.6	0.96	0.77	0.97	25.3
North: Wilde Ave														

7	L2	1058	53	1114	5.0	* 1.079	126.3	LOS F	101.1	744.6	1.00	1.29	1.83	17.5
8	T1	234	23	246	9.9	* 1.079	27.0	LOS B	101.1	744.6	0.69	0.60	0.73	31.5
9	R2	195	10	205	5.0	* 0.317	17.4	LOS B	6.0	43.9	0.60	0.68	0.60	33.7
Approach		1487	85	1565	5.7	1.079	96.4	LOS F	101.1	744.6	0.90	1.10	1.49	20.1
West: RoadName														
10	L2	53	3	56	5.0	0.144	27.8	LOS B	1.9	13.8	0.84	0.71	0.84	30.7
11	T1	78	4	82	5.0	* 0.573	54.1	LOS D	8.0	58.2	0.99	0.80	0.99	24.9
12	R2	56	3	59	5.0	0.573	57.4	LOS E	8.0	58.2	0.99	0.80	0.99	25.0
Approach		187	9	197	5.0	0.573	47.6	LOS D	8.0	58.2	0.95	0.77	0.95	26.4
All Vehicles		2020	123	2126	6.1	1.079	81.5	LOS F	101.1	744.6	0.88	0.99	1.32	21.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

Pedestrian Movement Performance

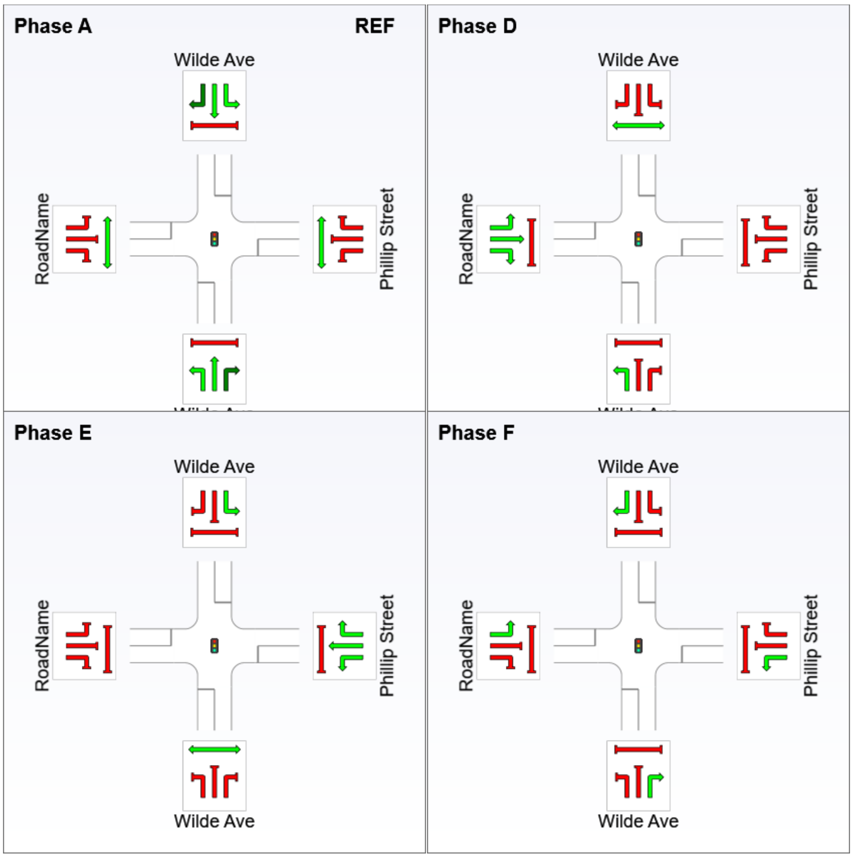
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Wilde Ave												
P1	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	223.9	220.5	0.98
East: Phillip Street												
P2	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	220.2	215.7	0.98
North: Wilde Ave												
P3	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	223.9	220.5	0.98
West: RoadName												
P4	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	220.2	215.7	0.98
All Pedestrians		200	211	54.3	LOS E	0.2	0.2	0.95	0.95	222.0	218.1	0.98

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Reference	**Sequence: Phase:**	**TCS Phase**	**1100 A**

Input Phase Sequence: A, D, E, F



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	D	E	F
Phase Change Time (sec)	0	60	82	104
Green Time (sec)	54	16	16	10
Phase Time (sec)	60	22	22	16
Phase Split	50%	18%	18%	13%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

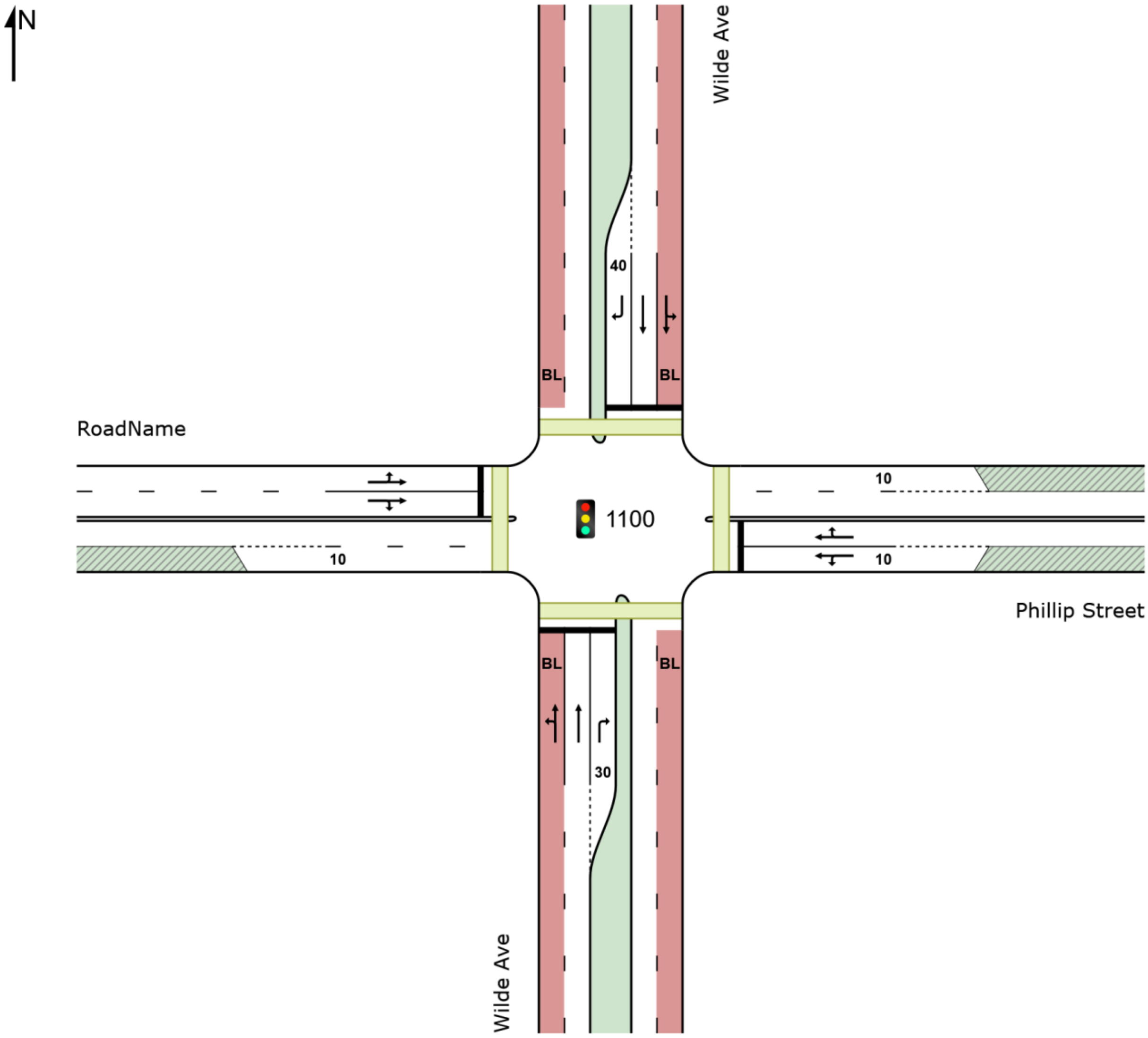
Site: 1100 [TCS 1100 - Wilde Ave Phillip St - Weekday AM Peak - SB Detour - 56s (Site Folder: 1100)]

Wilde Ave Phillip St Parramatta, SAT Peak Existing
1200-1300 30 July - 20 Aug Average
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 56 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: TCS 1100
Reference Phase: Phase A
Input Phase Sequence: A, D, E, F
Output Phase Sequence: A, D, E, F

Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Wilde Ave														
1	L2	41	2	43	5.0	0.134	22.1	LOS B	1.2	10.5	0.81	0.68	0.81	32.7

2	T1	131	18	138	13.7	0.464	24.7	LOS B	3.4	24.5	0.95	0.75	0.95	31.4
3	R2	22	1	23	5.0	0.070	18.2	LOS B	0.4	3.2	0.88	0.67	0.88	33.5
Approach		194	21	204	10.9	0.464	23.4	LOS B	3.4	24.5	0.91	0.73	0.91	31.9
East: Phillip Street														
4	L2	18	1	19	5.0	0.090	23.0	LOS B	0.8	5.6	0.83	0.66	0.83	32.5
5	T1	97	5	102	5.0	0.451	23.6	LOS B	3.3	24.1	0.93	0.74	0.93	31.5
6	R2	37	2	39	5.0	0.451	27.5	LOS B	3.3	24.1	0.94	0.75	0.94	31.6
Approach		152	8	160	5.0	0.451	24.5	LOS B	3.3	24.1	0.92	0.73	0.92	31.6
North: Wilde Ave														
7	L2	1058	53	1114	5.0	1.995 *	922.4	LOS F	253.0	1862.3	1.00	4.49	9.17	3.6
8	T1	234	23	246	9.9	1.995 *	78.8	LOS F	253.0	1862.3	1.00	1.30	1.92	28.0
9	R2	195	10	205	5.0	0.565 *	19.9	LOS B	4.5	32.8	0.95	0.79	0.95	32.9
Approach		1487	85	1565	5.7	1.995	671.3	LOS F	253.0	1862.3	0.99	3.50	6.95	4.8
West: RoadName														
10	L2	53	3	56	5.0	0.116	12.3	LOS A	0.6	4.7	0.79	0.69	0.79	35.4
11	T1	78	4	82	5.0	0.475 *	24.4	LOS B	3.7	27.2	0.95	0.77	0.95	31.2
12	R2	56	3	59	5.0	0.475	27.8	LOS B	3.7	27.2	0.95	0.77	0.95	31.4
Approach		187	9	197	5.0	0.475	22.0	LOS B	3.7	27.2	0.91	0.74	0.91	32.3
All Vehicles		2020	123	2126	6.1	1.995	500.3	LOS F	253.0	1862.3	0.97	2.77	5.36	6.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
* Critical Movement (Signal Timing)

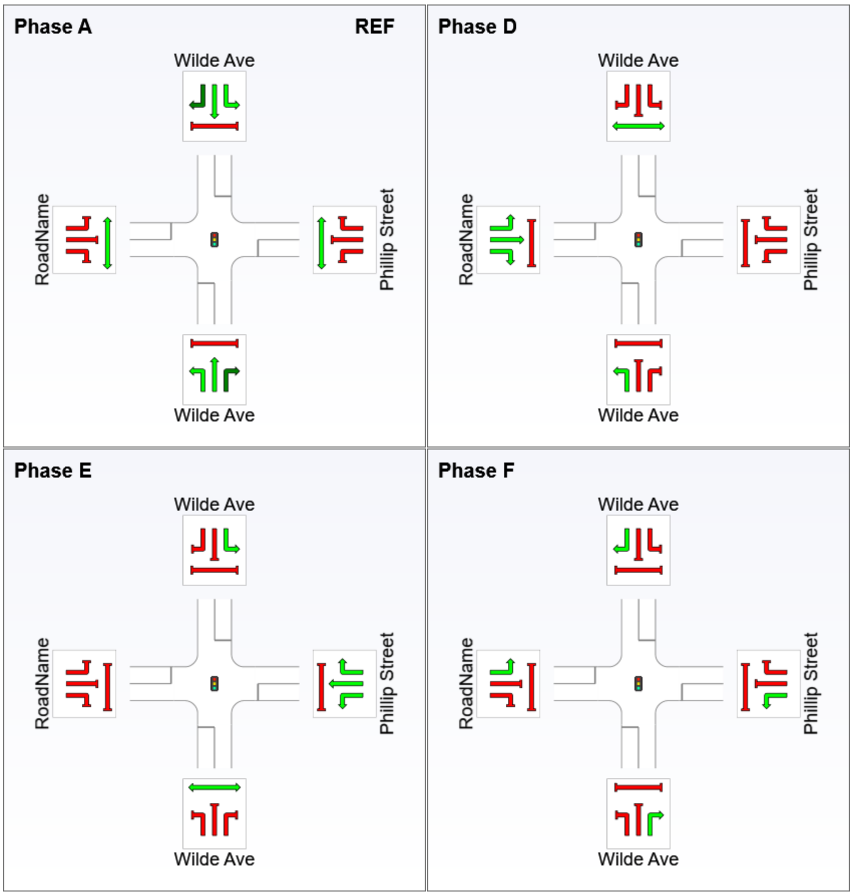
Pedestrian Movement Performance

Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [Ped	Dist]	Prop. Que	Effective Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Wilde Ave												
P1	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	192.0	220.5	1.15
East: Phillip Street												
P2	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	188.3	215.7	1.15
North: Wilde Ave												
P3	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	192.0	220.5	1.15
West: RoadName												
P4	Full	50	53	22.4	LOS C	0.1	0.1	0.89	0.89	188.3	215.7	1.15
All Pedestrians		200	211	22.4	LOS C	0.1	0.1	0.89	0.89	190.1	218.1	1.15

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Input Phase Sequence

Phase Reference Sequence: TCS Phase: Phase 1100 A
Input Phase Sequence: A, D, E, F



REF: Reference Phase
VAR: Variable Phase

Phase Timing Summary

Phase	A	D	E	F
Phase Change Time (sec)	0	14	29	44
Green Time (sec)	8	9	9	6
Phase Time (sec)	14	15	15	12
Phase Split	25%	27%	27%	21%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Organisation: CIVLINK | Licence: NETWORK / 1PC | Created: Wednesday, 31 May 2023 6:45:45 PM
Project: E:\Civlink\Gasworks Bridge Rehabilitation\00_2022 Update\Rev 3\Weekday PM - SB Closure.sip9

Appendix D – Noise and vibration impact assessment

Design
for a better
future /

GASWORKS BRIDGE REVIEW OF ENVIRONMENTAL FACTORS

CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

JUNE 2023

CONFIDENTIAL

Question today
Imagine tomorrow
Create for the future

Gasworks Bridge Review of Environmental Factors
Construction Noise and Vibration Assessment

Fulton Hogan

WSP
Level 27, 680 George Street
Sydney NSW 2000
GPO Box 5394
Sydney NSW 2001

Tel: +61 2 9272 5100
Fax: +61 2 9272 5101
wsp.com

REV	DATE	DETAILS
5	1 June 2023	Final

	NAME	DATE	SIGNATURE
Prepared by:	Ash Stevens	1 June 2023	
Reviewed by:	Rebecca Warren	1 June 2023	
Approved by:	Rebecca Warren	1 June 2023	

TABLE OF CONTENTS

1 INTRODUCTION

1.1 BACKGROUND

WSP Australia Pty has been engaged by Fulton Hogan on behalf of Transport for New South Wales (TfNSW) to undertake a Construction Noise and Vibration Impact Assessment (CNVIA) of proposed remedial works on the Gasworks Bridge in Parramatta, NSW (referred to as 'the proposal' hereafter). This assessment will support the Review of Environmental Factors (REF) for the proposal.

The proposal is located within the City of Parramatta Local Government Area, around 18 kilometres west of Sydney's Central Business District (CBD) and adjacent to the Parramatta CBD.

The construction works for the proposal generally comprise of the following:

- installation of a site compound and equipment laydown areas (Areas A, B and C)
- sealing of the concrete deck of the bridge structure (Spans 1-5)
- installation of temporary traffic management (steel barriers) and relocation of existing zebra crossing
- staged installation of an encapsulated (containment) scaffolding system on the bridge structure
- staged removal of the existing lead paint coating from all wrought iron and steel elements of the bridge and application of a new protective paint and coating (blasting, priming and coating works)
- bridge repair works (structural and non-structural) including:
  - remediation of structural steel elements of the bridge
  - repair/replacement of corroded rivets
  - treatment of flame cut holes
  - cleaning bridge scuppers (drainage)
  - removal and replacement of mesh screen on pedestrian walkway on western side of the bridge
  - removal and replacement of a 20m rail section on eastern side of the bridge, like-for-like
  - replacement of timber planks (like for like) on walkway on western side of bridge including re-fixing loose timbers and removing splintering sections
  - removal and replacement of existing W beams on roadside truss
  - Removal of redundant gas main on eastern side of bridge, which would include the removal of bolts and lifting of sections of the pipe for offsite removal (in accordance with waste disposal guidelines)
  - cleaning and removal of moss, vegetation and graffiti from bridge piers
  - rectification of concrete spalling and cracks.
- removal/disposal of waste materials staged removal (and cleaning) of the containment and scaffolding system
- demobilisation of site compound and equipment laydown areas, and removal of traffic management.

1.2 SCOPE AND PURPOSE

The objective of this assessment is to assess the potential construction noise and vibration impacts associated with the proposal with respect to surrounding sensitive receivers.

The scope of this assessment included:

- Identification of the nearest noise and vibration sensitive receivers
- Determination of existing background noise environment in the proposal area
- Derivation of relevant noise and vibration criteria
- Identification of noise and vibration generating activities
- Assessment of construction noise and vibration impacts associated with relevant construction activities, including construction related traffic
- Provision of high-level recommendations for further mitigation, where required.

The assessment has been conducted with consideration to the following guidelines:

- TfNSW's *Construction Noise and Vibration Strategy* (CNVS) (April 2020)
- NSW EPA *Interim Construction Noise Guideline* (ICNG) (July 2009)
- NSW EPA *Assessing Vibration: a technical guideline* (AVTG) (2006)
- NSW EPA *Noise Policy for Industry* (NPfI) (2017)
- NSW EPA *NSW Road Noise Policy* (RNP) (March 2011)
- German Standard DIN 4150: Part 3 – 1999: *Structural Vibration in Buildings: Effects on Structures*
- Australian Standard 1055:1997 and 2018 – *Acoustics – Description and Measurement of Environmental Noise* (AS 1055)

The operation of the proposal would not result in any material change to the noise environment. As such an assessment of operational impacts of the proposal has not been completed.

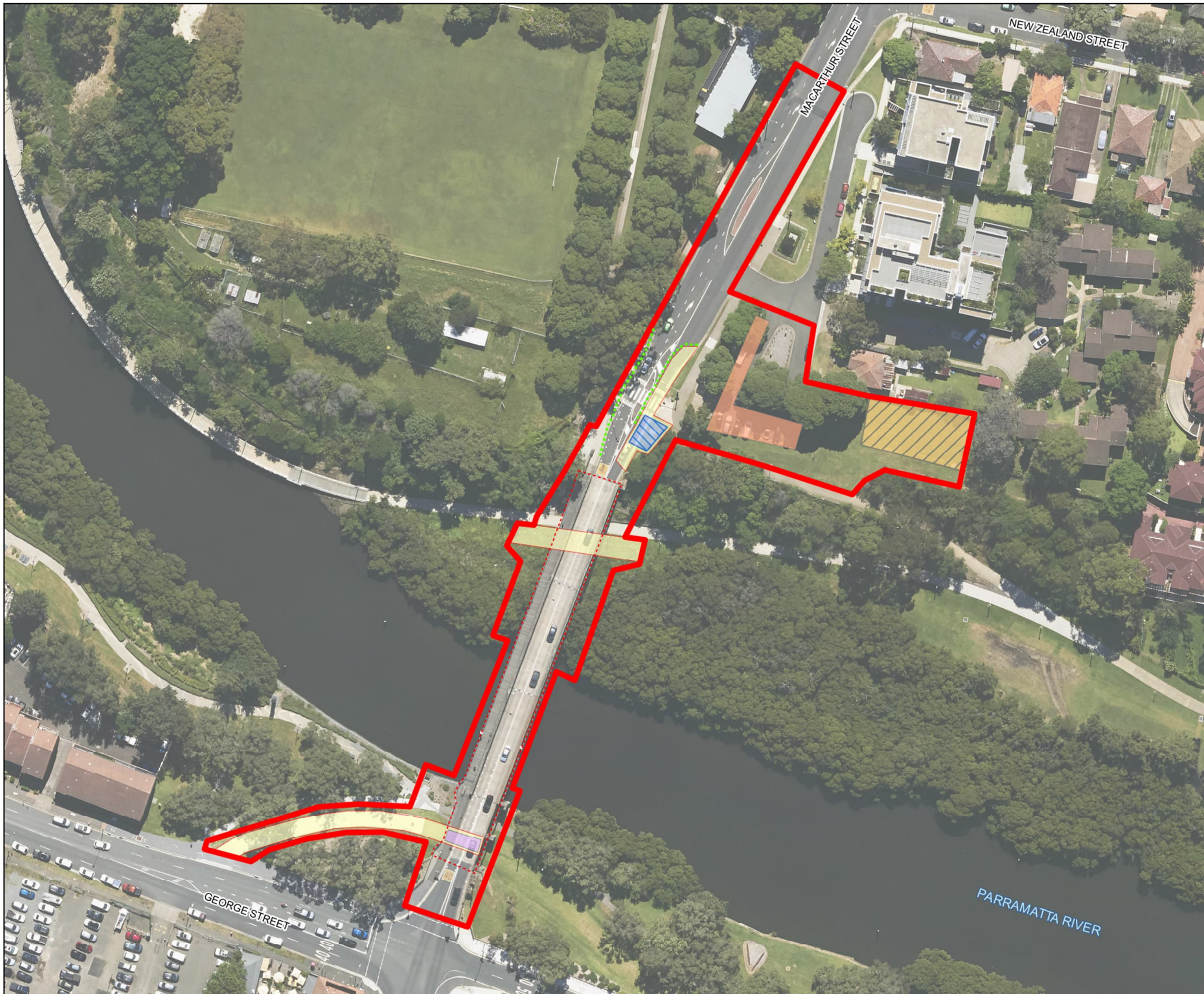
Vibration during construction activities is generally associated with the use of heavy machinery and vibratory equipment. Due to the nature of the construction activities, impacts from vibration are anticipated to be negligible and have not been assessed further as part of this assessment.

1.3 PROPOSAL LOCATION

The proposal is located on Macarthur Street, Parramatta, spanning the Parramatta River. The existing Gasworks Bridge (the bridge) is an iron lattice design with an overall length of 110 metres and a width of 10.3 metres wide. It was completed in 1885. A pedestrian walkway is located on the western side of the bridge. The bridge and the walkway are both major thoroughfares for the local community connecting the Parramatta CBD, located to the southeast with the residential area of Parramatta to the north.

The proposal site and key features are presented in Figure 1.1

.



Gasworks Bridge REF

Figure 1.1
Location of the proposal

Legend

- Roads
- Watercourses
- Traffic Management Barriers
- Proposal Site
- Bridge Structure

Construction Areas

- Sand blasting equipment
- Construction parking
- Decontamination unit
- Equipment laydown area
- Site compound

Coordinate system: GDA2020 MGA Zone 56

Scale ratio correct when printed at A3

1:1,000 Date: 1/06/2023

Data Sources: Imagery © Metromap 2020

C:\Users\AURC508271\WSP O365\AU-WKG - Geospatial - AIS - Documents\Projects\PS123629_GasworksBridge_REF_Parramatta\Mxd\01_REF\PS123629_REF_Fig1.1_LocationOfTheProposal_r1v8.mxd

2 EXISTING ENVIRONMENT

This section provides an overview of the existing noise environment surrounding the site.

WSP adopted publicly available existing noise measurement data from past developments near the proposal site. This method has previously been accepted by the NSW EPA and TfNSW where site-specific measurements were unable to be completed.

Noise monitoring data was adopted from the noise assessment previously undertaken by WSP for the *Sydney Wharf Upgrade Parramatta Construction Noise and Vibration Impact Statement (CNVIS)*, dated 24 April 2018 ('the Parramatta Ferry Wharf Report')[1].

2.1 SENSITIVE RECEIVERS

The proposal has the potential to adversely impact nearby properties that are considered sensitive to noise and vibration. Sensitive receiver locations have been identified from desktop review and previous investigations.

Receivers potentially sensitive to both noise and vibration have been identified in the surrounding area and are classified by land use types defined in the ICNG and CNVS. The proposal is in an urban area of residential and non-residential land uses, including commercial, active recreation, education and places of worship.

Receivers have been geographically categorised into Noise Catchment Areas (NCAs). These NCAs are based on areas with similar noise environments, which assist with assessment, consultation and notification requirements for the proposal. NCAs are listed in Table 2.1 and presented in Figure 2.1.

Table 2.1 NCAs

NCA	DESCRIPTION	RECEIVER TYPES
NCA01	Receivers north east of the site	Residential
NCA02	Receivers north west of the site	Residential receivers, educational, active recreation
NCA03	Receivers south west of the site	Residential. commercial, hotel
NCA04	Receivers south east of the site	Residential, Active recreation, passive recreation, place of worship, commercial areas

The noise sensitive receivers in each NCA nearest to the proposal site are listed in Table 2.2 and locations are presented in Figure 2.1.

Table 2.2 Noise sensitive receivers and distance to proposal site

NCA	MINIMUM DISTANCES FROM CONSTRUCTION FOOTPRINT (m)	
	RESIDENTIAL	NON-RESIDENTIAL RECEIVERS[1]
NCA01	70	5
NCA02	200	5
NCA03	5	5

1 Source: https://roads-waterways.transport.nsw.gov.au/documents/projects/sydney-west/parramatta-wharf/parramatta-wharf-upgrade-ref-2018-04.pdf (accessed 20 August 2021); pdf page 229 onward

NCA	MINIMUM DISTANCES FROM CONSTRUCTION FOOTPRINT (m)	
	RESIDENTIAL	NON-RESIDENTIAL RECEIVERS[1]
NCA04	230	100

(1) Sensitive non-residential receivers including hotel, commercial, educational institutions and place of worship

The noise sensitive receivers nearest to the proposal are listed in Table 2.3. It is noted the nearest sensitive receivers are associated with passive and active recreation areas, with the nearest residential receivers located adjacent to the works.

Table 2.3 Noise sensitive receivers

RECEIVER ID	ADDRESS	RECEIVER TYPE	DISTANCE TO PROPOSAL SITE (m)
R1	8 MacArthur Street	Residential	5
R2	10 MacArthur Street	Residential	15
R3	12 MacArthur Street	Residential	30
R4	1 Rangihou Crescent	Residential	50
R5	MacArthur Girls High School (sports field)	Active recreation	35
R6	3 Stewart Street	Residential	200
R7[1]	135 George Street	Hotel[1]	25
R8	190 Goerge Street	Commercial	65
R9	140 Angus Lane	Residential	170
R10	111 George Street	Mixed use	130
R11	2 Noller Parade	Residential	270
R12	1a Noller Parade	Residential	230
R13	163 George Street	Place of worship	140
R14	153 George Street	Commercial	140
R15[2]	103 Harris Street	Passive Recreation[2]	100
R16	42 Hassall Street	Residential	250

(1) This receiver would generally be considered commercial, however as the premises has accommodation facilities, it has been assessed as a residential land use.

(2) It is noted this receiver includes an amenities building which is currently not in operation due to Parramatta Light Rail construction works. Impacts have been assessed for completeness.

Project No: PS123629	Author: AS
Date: 31/05/2023	Approved by: RW

To be read in conjunction with WSP document: Gasworks Bridge REF

GASWORKS BRIDGE

Figure 2.1

Project location, sensitive receivers and monitoring locations

wsp

2.2 EXISTING NOISE ENVIRONMENT

Noise monitoring was not conducted for the purpose of this assessment due to ongoing minor construction activities associated with the Parramatta Light Rail. As such, prevailing background and ambient noise levels were adopted from the *Parramatta Ferry Wharf Report*. Monitoring was conducted at three monitoring locations in general accordance with the Australian Standard 1055:1997 – *Acoustics – Description and Measurement of Environmental Noise* (AS 1055) in February 2018.

It is noted that large scale work on PRL is complete with only commissioning trials remaining, it is considered that the adoption of these 2018 noise levels is considered suitable for the purpose of this assessment and are still representative of the current noise environment.

The adopted background noise levels (rating background levels) are summarised in Table 2.4.

Table 2.4 Summary of ambient noise levels

NCA	NOISE MONITORING (NM) LOCATION[4]	BACKGROUND NOISE LEVEL (dBA RBL[1])		
		DAY[2]	EVENING[2]	NIGHT[2]
NCA01	NM01 - MacArthur Street	46	46	39
NCA02	NM02 - 4-6 Queens Avenue	49	43	42
NCA03	NM03 - 34 Charles Street	48	44	44
NCA04[3]	NM03 - MacArthur Street	46	46	39

(1) RBL – rating background level. The overall single-figure background level representing each assessment period (daytime/evening/night-time) as defined in the NPfI.

(2) Time periods defined in the NPfI – Day: 7:00 am to 6:00 pm Monday to Saturday, 8:00 am to 6:00 pm Sunday; Evening: 6:00 pm to 10:00 pm; Night: the remaining periods.

(3) Noise levels adopted from NM01 for the purpose of this assessment.

(4) Noise monitoring locations identified in Figure 2.1.

3 ASSESSMENT CRITERIA

3.1 CONSTRUCTION NOISE

The CNVS establishes assessment methods for construction noise impacts at sensitive receivers from TfNSW projects. The strategy includes reference to objectives in the ICNG.As the proposal duration will be greater than six weeks, a detailed assessment method has been adopted per the CNVS.

3.1.1 CONSTRUCTION ASSESSMENT PERIODS

Table 3.1 outlines the CNVS assessment periods applicable to the proposal.

Table 3.1 CNVS assessment periods

NAME	RBL PERIOD	TIME PERIODS
Standard Hours (SH)	Day	Monday to Friday – 7:00 am to 6:00 pm Saturday – 8:00 am to 1:00 pm Sunday/Public Holiday - Nil
Out of Hours Works (OOHW) Period 1	Day	Saturday – 7:00 am to 8:00 am and 1:00 pm to 6:00 pm Sunday and public holidays – 8:00 am to 6:00 pm
	Evening	Monday to Saturday – 6:00 pm to 10:00 pm
Out of Hours Works (OOHW) Period 2	Day	Sunday and public holidays – 7:00 am to 8:00 am
	Evening	Sunday and public holidays – 6:00 pm to 10:00 pm
	Night	All days 10:00 pm to 7:00 am

Works outside SH should only be conducted when it is not feasible or reasonable to work within SH. Some activities will need to be completed outside SH to maintain a safe work environment and to minimise impacts to operational transport infrastructure and services. OOHW would include activities undertaken during weekend shutdowns. Approval from TfNSW would be required for any OOHW and the affected community would be notified as outlined in the CNVS.

3.1.2 CONSTRUCTION MANAGEMENT NOISE LEVELS

The CNVS provides the methodology by which noise and vibration from construction projects can be assessed and mitigation measures identified and applied. The strategy specifies that construction noise management levels (NMLs) are to be defined using the method specified in the ICNG. This requires the development of NMLs based on existing RBLs and a comparison of predicted construction noise levels with the NML for identified work periods.

Recommended SH represent the times of the day when receivers are likely to be less sensitive to noise impacts. Where work is proposed outside of SH, justification is required and more stringent NMLs apply. For non-residential receiver types, the NMLs only apply when the receiver is being used.

Table 3.2 sets out the application of the NMLs for noise at residential receivers.

Table 3.2 Application of the ICNG NMLs for residential receivers

TIME OF DAY	NML, dBA $L_{eq,15min}$	HOW TO APPLY
SH: Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{eq,15\ min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected (HNA) 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
OOHW	Noise affected RBL + 5 dB	A strong justification would typically be required for works outside the recommended SH. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should consult with the community.

Table 3.3 presents the NMLs for each assessment period for residential receivers in each NCA. The NMLs for SH and OOHW have been calculated from the measured and adopted RBLs in each NCA as shown in Table 2.4.

Table 3.3 NMLs for residential receivers

NCA	NM LOCATION	RBL dBA			NML dBA $L_{eq,15min}$[1]			
		DAY	EVENING	NIGHT	SH	OOHW 1	OOHW 2	HNA
NCA01	NM01	46	46	39	56	51	44	75
NCA02	NM02	49	43	42	59	54	47	75
NCA03	NM03	48	44	44	58	53	49	75
NCA04	NM01	46	46	39	56	51	44	75

(1) Time periods as defined in Table 3.1

Table 3.4 presents the NMLs that have been adopted for non-residential sensitive receivers. The NMLs apply when the premises are in use during any assessment period.

Table 3.4 NMLs for non-residential sensitive receivers

LAND USE	NML dBA $L_{eq,15min}$
Commercial	External noise level –70
Education institutions	Internal noise level – 45
Active recreation	External noise level – 65
Passive recreation	External noise level – 60
Place of worship	Internal noise level – 45

It is noted that some noise management levels are presented as internal noise levels. A 10 dB correction has been applied to the internal noise levels to reflect external noise levels as indicated in the ICNG.

3.1.3 Site specific construction NMLs

The specific NMLs for construction activities at surrounding receivers are presented in Table 3.5. These NMLs have been determined from the background noise levels provided in Table 3.3 for residential receivers.

Table 3.5 Site Specific NMLs

NCA	NML dBA $L_{eq,15\ min}$ [1]			
	SH	OOHW 1	OOHW 2	HNA
Residential receivers in NCA1	56	51	44	75
Residential receivers in NCA2	59	54	47	75
Residential receivers in NCA3	58	53	49	75
Residential receivers in NCA4	56	51	44	75
Commercial[2]	70	n/a	n/a	n/a
Education institutions[2,3]	55	n/a	n/a	n/a
Place of worship[2]	55	55	n/a	n/a
Passive recreation	60	60	n/a	n/a
Active recreation	65	65	n/a	n/a

(1) Time periods as defined in Section 3.1.1.

(2) Criteria apply when in use. It is assumed that commercial and educational premises are unlikely to be operational outside SH.

(3) A 10 dB correction has been applied to the internal noise levels to reflect external noise levels as indicated in the ICNG.

3.1.4 SLEEP DISTURBANCE

In the event that construction work would be required to take place during the night-time periods (10:00 pm to 7:00 am), this has the potential to lower sleep quality of the residents adjacent to the work due to maximum noise level events. Potential impacts include sleep disturbance and sleep awakening reactions.

Section 4.3 of the ICNG discusses the method for quantifying and assessing sleep disturbance (sleep awakening). This guidance references the NSW *Road Noise Policy* (RNP) (EPA, 2013) that discusses criteria for the assessment of sleep disturbance.

The RNP suggests a screening level of $L_{1,1min}$ dBA, equivalent to the RBL + 15 dB. Where this level is exceeded, further analysis should be carried out. Section 5.4 of the RNP also states that:

- Maximum internal noise levels below 50 to 55 dBA would be unlikely to result in people's sleep being disturbed
- If the noise exceeds 65 to 70 dBA once or twice each night the disturbance would be unlikely to have any notable health or wellbeing effects.

The guidance within the RNP indicates that internal noise levels of 50 to 55 dBA are unlikely to cause sleep awakening reactions. Therefore, at levels above 55 dBA, sleep disturbance would be considered likely. Assuming that receivers may have windows partially open for ventilation, a 10 dB outside to inside correction has been adopted as indicated in the ICNG.

Based on the above, the noise level 65 dBA L_{max} (external) has been adopted as sleep disturbance screening criterion for assessment purposes. Feasible and reasonable safeguards should be considered where there are night-time predicted exceedances above this limit.

It should be noted that this assessment method (sleep disturbance criteria based on guidance for sleep awakening) may not capture the full extent of impacts during the early and late stage of sleep (difficulty falling asleep and waking up early). However, this assessment method would provide an indication of the potential sleep disturbance when works occur in the night-time period. The night-time impacts due to construction works are quantified and managed through the $L_{eq,15\ min}$ assessment.

Based on this guidance, Table 3.6 presents the site-specific sleep disturbance noise goals used to assess the likelihood for sleep disturbance within residences due to night time construction activities.

Table 3.6 Sleep disturbance NMLs at residential receivers

NCA	NOISE MONITORING LOCATION	SLEEP DISTURBANCE CRITERIA, DBA $L_{1,1MIN}$	
		RNP SCREENING CRITERION	RNP AWAKENING GOAL
NCA01	NM01	54	65
NCA02	NM02	57	65
NCA03	NM03	59	65
NCA04	NM01	54	65

3.1.5 CONSTRUCTION TRAFFIC NOISE

The RNP provides guidance on the assessment of noise impacts from road traffic noise on sensitive receivers.

While the RNP specifically references criteria with reference to land use developments, the approach has been adopted to assess additional traffic generated on local roads by construction activities. The existing roads immediately surrounding the proposal are a mix of arterial, sub-arterial and local roads. Arterial and sub-arterial roads are assessed over day (7:00 am to 10:00 pm) and night (10:00 pm to 7:00 am) periods and local roads are assessed over a one-hour period (typically the peak hour) within the respective day and night periods.

Table 3.7 presents a summary of the applicable criteria for residential receivers.

Table 3.7 Road traffic noise criteria for residential receivers on existing roads affected by additional traffic from land use developments

ROAD TYPE	ROAD TRAFFIC NOISE CRITERIA	
	DAY (7:00 AM TO 10:00 PM)	NIGHT (10:00 PM TO 7:00 AM)
Arterial/Sub-arterial/Collector	60 dBA $L_{eq,15hr}$	55 dBA $L_{eq,9hr}$
Local Roads	55 dBA $L_{eq,1hr}$	50 dBA $L_{eq,1hr}$

The RNP application notes state that ‘for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion.’

Therefore, if the road traffic noise levels increase by more than 2 dB as a result of the proposed construction traffic, and the criteria in Table 3.7 are exceeded, investigation of mitigation options would be required.

3.2 CONSTRUCTION VIBRATION

Vibration during construction activities is generally associated with the use of heavy machinery and vibratory equipment. Where vibration intensive plant such as vibratory rollers, hydraulic hammers, impact piling rigs or jackhammers are used, vibration must be managed to minimise disturbance to building occupants and to avoid damage to buildings and other structures.

Due to the nature of the construction activities, impacts from vibration during construction activities are anticipated to be negligible and have not been assessed further as part of this assessment.

4 ASSESSMENT

4.1 CONSTRUCTION NOISE

To assess the potential noise impacts during construction, scenarios comprising typical plant and equipment have been developed based on indicative staging information.

4.1.1 CONSTRUCTION STAGES AND DURATION

The proposal would be constructed in stages with the stages occurring at different times depending on the activity. Table 4.1 presents the proposed construction activities as currently being investigated by the civil team and approximate associated durations.

Table 4.1 Proposed construction activities

STAGE	ACTIVITIES	APPROXIMATE DURATION
Site establishment	— pre-construction soil sampling — delivery and installation of temporary fencing for site compound and laydown areas — establishment of environmental controls — clearing of surface vegetation for laydown areas — trimming of mangroves adjacent to the bridge — installation of hardstand at site compound and laydown areas — delivery and installation of site sheds and amenities to site compound — connection of temporary utilities (power, water etc) to side compound — installation of works zone signs (including, pedestrian controls and navigation signage as required on the Parramatta River).	7 days
Bridge deck sealing works	— Sealing of existing cracks on bridge deck.	3 days
Set up traffic management	— closure and temporary detour of Macarthur Street and the bridge — installation of temporary steel barriers. — temporary relocation of the existing zebra crossing	3 days
Scaffolding/ containment system installation	— installation of scaffolding system — installation of encapsulation (containment) system — location and protection of existing services and utilities — installation of decontamination unit at site compound — installation of air monitoring equipment.	30 days
Blasting, priming and coating works	— cleaning and surface preparation — water washing of surfaces and storage of waste materials	55 days

	— removal of existing lead-based coating system using abrasive blasting, power tools and hand tools — transfer and safe storage of spent abrasive and hazardous materials — removal of hazardous coatings to licenced disposal facility — priming and painting.	
Bridge repair works	— repair of structural elements of the bridge — repair/replacement of corroded rivets — treatment of flame cut holes — cleaning of bridge scuppers (drainage) — replacement of mesh railing on bridge walkway — replacement of 20 metres of rail on east side of bridge like-for-like — remove splinters and sand timber planks — remove and reinstall W beams on truss — remove redundant gas pipe on eastern side of bridge — cleaning of graffiti, moss and vegetation (using high pressure wash) on bridge piers on southern embankment — repair concrete spall (concrete which has broken away from the subsurface) — removal/disposal of waste materials.	15 days
Removal of encapsulation and dismantling of scaffolding	— cleaning and dismantling of scaffold — removal and disposal of containment system including ground based and hanging scaffold.	15 day

Demobilisation	— removal of steel barriers and vehicle crash protections (crash cushions)
	— removal of environmental controls
	— removal of all site sheds and facilities from site compound
	— removal of all plant and equipment from site compound/laydown areas
	— reinstate site compound and laydown areas to pre-construction condition, including:
	    — removal of hardstand
	    — import and install turf underlay
	    — reinstate turf in affected areas
	— removal of site fencing from site compound and laydown areas
	— removal of temporary works signage and reinstate signage and line marking on the bridge
	— completion of site clean-up works
	— final inspection and handover.
		5 days

Construction work is expected to take place over a period of approximately three months, beginning in Quarter 3, 2023. Works are expected to occur during both SH and OOHW. This includes weekend shutdowns from approximately 8:00 pm Friday to 5:00 am Monday morning. A total of 7 weekend shutdowns are expected to be required.

Construction compounds will be established within the construction boundary to contain site sheds, construction amenities and materials laydown. Please refer to Figure 2.1 for the location of construction compounds. One site compound is proposed to be located adjacent to receiver R1.

Remediation works (S04) are to occur within a scaffolding and containment area constructed of impermeable heavy-duty plastic sheeting, which will provide a nominal amount of acoustic shielding.

Temporary fencing will be installed around the perimeter of the proposal (S01) (including all site compounds and equipment laydown areas) in addition to temporary hoarding (plywood) to separate the public from work areas. This would include on the Gasworks Bridge shared pathway on the western side of the bridge, and shared pathways on both sides of the Parramatta River. This hoarding would be installed against the bridge structure to separate the proposal site from the roadway.

These construction stages have been split into five different worst-case scenarios for the purpose of noise modelling. The scenarios under investigations in this noise assessment are presented in Table 4.2.

Table 4.2 Construction noise scenarios

SCENARIO ID	ACTIVITIES	LOCATION	PERIOD
S01a	Site establishment	Site compound and surroundings	SH
SO1b	Set up traffic management	Macarthur Street	OOHW
S02	Bridge deck sealing works	On bridge	OOHW
S03	Scaffolding/ containment system installation Removal of encapsulation and dismantling of scaffolding	On ground, below and around the bridge	SH OOHW
S04a	Remediation works: — Blasting, priming and coating works — Bridge repair works	On bridge Northern end of the bridge, spans 4 and 5	SH
S04b	Remediation works: — Blasting, priming and coating works — Bridge repair works	On bridge Southern end of bridge, spans 1, 2 and 3	SH
S05	Demobilisation	Site compound and surroundings	SH

4.1.2 NOISE SOURCE LEVELS

The proposed list of construction equipment has been provided by the civil team. The nominated equipment for the construction work scenarios and the sound power level (SWL) of each item are detailed in Table 4.3. SWLs have been sourced from the following documents:

- NSW Roads and Maritime Services, *Construction Noise and Vibration Guideline* (CNVG)
- Transport for NSW, *Construction Noise and Vibration Strategy* (CNVS)
- Department for Environment Food and Rural Affairs (United Kingdom), *Update of noise database for prediction of noise on construction and open sites – Phase 3: Noise measurement data for construction plant used on quarries* (DEFRA)
- British Standard BS 5228-1:2009+A1:2014, *Code of practice for noise and vibration control on construction and open sites – Noise* (BS5228)
- WSP noise monitoring database.

Table 4.3 Construction work scenarios and equipment SWLs

EQUIPMENT		EQUIPMENT PER SCENARIO					SOUND POWER LEVEL, dBA	SOURCE
	S01A	S01B	S02	S03	S04A/ S04B	S05		
Ablution facilities and decontamination					X		72	WSP
Air compressors					X	X	109	CNVG
Dust extraction unit					X		107	DEFRA
Delivery trucks	X	X	X	X	X	X	103	CNVG
Roller	X						109	CNVG
Excavator	X						110	CNVG
Elevated work platforms					X		98	CNVG
Floats			X				100	BS5228
Generators				X	X	X	103	CNVG
High volume air samplers					X		78	Literature
High pressure wash					X		97	DEFRA
HIAB/Franna crane	X	X		X		X	98	CNVG
Light vehicles	X	X			X	X	88	CNVG
Lighting towers		X	X	X		X	80	CNVS
Other power tools	X	X	X	X	X	X	102	CNVG
Oxy-acetylene torches					X		105	CNVG
Airless pumps and paint equipment					X		117	WSP
Telescopic handlers				X			107	DEFRA
Vacuum loading machines					X		109	CNVG
Water cart					X		107	CNVG
TOTAL SWL	113	106	107	111	119 [1] [109]	112	-	
Maximum SWL (sleep disturbance)	N/A	111	108	115	N/A	113		

(1) S04 works are to occur within a containment area constructed of impermeable heavy-duty plastic sheeting. This sheeting is anticipated to provide a minimum 10 dB noise reduction. This reduced level is presented in brackets.

(2) Maximum noise levels have been calculated for periods where OOHW has been proposed. These are based on a typical short term maximum noise level for operation of the proposed equipment.

4.1.3 NOISE MODELLING METHODOLOGY

Prediction of construction noise impacts from the proposal has been completed using SoundPLAN noise modelling software (version 8.2) using the Industrial Module and the ISO 9613-2 calculation method.

A three-dimensional model of the proposal was developed, including elevation contours, locations of sensitive receivers, noise-generating equipment and intervening buildings. The model considered noise sources, receivers and the effect of distance, ground topography, atmospheric attenuation and obstacles such as barriers and buildings. Further, several measures have been identified which would provide noise mitigation benefit to the proposal, including temporary hoarding installation and location of construction compounds, which have been included in the modelling.

The parameters used and values adopted in the noise modelling are presented in Table 4.4.

Table 4.4 Modelling parameters

PARAMETER	INPUT
Buildings	Building footprints and number of floors taken from aerial photography. Building heights and number of floors were estimated from Google Street as follows: per floor 3 metres, pitched roof 2.5 metres.
Topography	Sourced from SIXMaps NSW (1 metre contour intervals).
Façade calculation	Impacts calculated at the most affected façade of nearby receivers.
Prediction algorithm	ISO9613-2 1996.
Meteorological conditions	Default meteorological conditions were used for all assessment periods, representative of downwind propagation conditions between 1 and 5 m/s, and equivalent to a moderate temperature inversion.
Ground surface / absorption	Vegetated areas modelled assuming ground absorption coefficient of 0.5.
Sources	Most of the equipment has been modelled as an area source with all equipment in each work stage modelled as operating simultaneously. Delivery trucks have been modelled as line sources in the vicinity of the compound. Works during S04 have been modelled to reflect the containment of spray painting works to the bridge structure only, with concurrent laydown activities.
Source heights	Construction plant and equipment noise source heights are modelled to be 2 metres above ground.
Temporary fencing	Temporary fencing around the perimeter of the proposal in addition to temporary hoarding (plywood) to separate the public from work areas (2-metre-high fences). This would include on the walkway on the western side of the bridge, and shared pathways which are present on both sides of the Parramatta River. The same hoarding would be installed against the bridge structure to separate the proposal site from the roadway.

PARAMETER	INPUT
NCA impacts	NCA noise impacts assessed at the most affected representative receiver.

The noise modelling is considered to be conservative as it assumes all equipment operating simultaneously at their closest point within the area of construction activities to the receivers. Actual measured noise levels would be expected to be lower.

4.1.4 PREDICTED NOISE LEVELS

The predicted noise levels for each scenario are presented in Table 4.5, outlining the noise level within each NCA for each representative receiver type. Predicted noise levels at buildings within each NCA were assessed and the results presented graphically in the form of exceedances of NMLs during SH in Appendix A.

Noise predictions outlined in this report include the mitigation effects of temporary hoarding to be constructed as part of S01 activities as well as the presence of the containment unit for S04a and S04b.

The noise levels presented are conservative as predictions assume all plant operating at the closest point within the construction footprint to the receiver. Works are expected to take place intermittently, particularly during sensitive OOHW periods, and when considering the spatial distribution of noise sources, so these exceedances would not be expected to occur continuously over the duration of the proposal.

Results presented consider noise mitigation strategies to be implemented to demonstrate their effectiveness on resultant noise levels at receivers. These measures include:

- Temporary fencing around the perimeter of the proposal in addition to temporary hoarding (plywood) to separate the public from work areas (2-metre-high fences).
- Construction compound location adjacent receiver R1 which would act as a noise barrier for high noise generating works during S04a and S04b.
- Noise attenuation of the encapsulation area (such as plywood hoarding and acoustic screening) on acoustically significant plant items for S04a and S04b.

The formatting of the construction noise assessment results (Table 4.5) indicates the following:

- The orange shaded cells show exceedances of the SH day period.
- The yellow shaded cells show exceedances of the OOH 1 period.
- The blue shaded cells exceedances of the OOH 2 period.
- The **cells with red text** show exceedances of highly noise affected NMLs.

Where a predicted noise level exceeds a less stringent NML (SH), it follows that the more stringent NMLs (OOHW) are also exceeded.

Table 4.5 Maximum predicted construction noise levels and indicative exceedances per scenario

NCA	RECEIVER ID	RECEIVER TYPE	NML, dBA $L_{eq,15min}$ [1,2,3] / , L_{max} [3]					MODELLED NOISE LEVEL PER SCENARIO AT CLOSEST POINT TO RECEIVER, dBA $L_{eq,15min}$ [2,3] (SLEEP DISTURBANCE L_{max} [3])						
			SH	OOHW 1	OOHW 2	HNA	Sleep disturbance	S01A SH	S01B OOHW	S02 OOHW	S03 SH and OOHW	S04a[4] SH	S04b[4] SH	S05 SH
1	R1	Residential	56	51	44	75	65	78	56 (61)	56 (57)	57 (61)	59	56	75
	R2	Residential	56	51	44	75	65	74	54 (59)	55 (56)	57 (61)	57	58	71
	R3	Residential	56	51	44	75	65	71	57 (62)	51 (52)	53 (57)	55	50	67
	R4	Residential	56	51	44	75	65	66	48 (53)	54 (55)	56 (60)	56	55	64
2	R5	Active Recreation	65	65	65	65	-	60	63 (-)	57 (-)	58 (-)	61	56	61
	R6	Residential	59	54	47	75	65	46	46 (51)	47 (48)	48 (52)	50	49	46
3	R7	Hotel	58	53	49	75	-	58	50 (-)	60 (-)	65 (-)	59	64	57
	R8	Commercial	70	-	-	-	-	56	50 (-)	- (-)	60 (-)	58	61	56
	R9	Residential	58	53	49	75	65	52	45 (50)	49 (50)	53 (57)	51	52	51
	R10	Mixed Use	58	53	49	75	-	51	45 (50)	50 (51)	55 (59)	48	54	51
4	R11	Residential	56	51	44	75	65	54	43 (48)	46 (47)	50 (54)	48	48	52
	R12	Residential	56	51	44	75	65	54	44 (49)	47 (48)	50 (54)	49	49	53
	R13	Place of worship	55	55	55	55	-	54	45 (-)	46 (-)	48 (-)	50	47	53
	R14	Commercial	70	-	-	-	-	57	47 (-)	- (-)	55 (-)	53	55	56
	R15	Passive Recreation	60	60	60	60	-	52	44 (-)	50 (-)	53 (-)	50	53	51
	R16	Residential	56	51	44	75	65	53	43 (48)	47 (48)	49 (53)	48	50	51

(1) Time periods as defined in Table 3.1, HNA – Highly noise affected.
(2) Predicted noise levels are represented by a single point for nearest receivers per noise catchment area for this assessment.
(3) Where a predicted noise level exceeds a less stringent NML (SH), it follows that the more stringent NMLs (OOHW) would also be exceeded.
Results include 10 dB attenuation from containment unit.

4.1.5 NOISE IMPACTS - SH

The assessment of construction noise impacts at the nearest sensitive receivers indicates that noise levels are predicted to exceed relevant NMLs at the nearest sensitive receivers in NCA01 and at the hotel in NCA03, with site establishment and demobilisation presenting the greatest impact in NCA01 and scaffolding installation / removal and remediation works in NCA03. No other exceedances are predicted in NCA02 and NC04 during SH.

Noise levels are predicted to result in exceedances of relevant criteria by up to 22 dBA during S01a, up to 1 dBA during S01b, up to 2 dBA during S02, up to 7 dBA during S03, up to 1 dBA during S04a, up to up to 6 dBA during S04b and up to 19 dBA during S05.

The most significant noise generating plant is the spray pump and paint equipment (S04). Noise predictions include the noise reduction of the containment unit, which is assumed to result in a 10 dB reduction in noise levels. These activities are not expected to operate over the full construction period, however, are expected to last for 55 days and would require noise management and mitigation measures to effectively manage impacts at receivers.

The closest residences to the construction work in NCA01 (R1) is predicted to be highly noise affected when works are at their closest during the establishment of the site compound (S01a).

The noise levels presented are conservative as predictions assume all plant operating at the closest point within the construction footprint to the receiver. In reality noise impacts are likely to be lower as plant items may not be operating simultaneously at all times and may be operating at further distance from some receivers. Works are expected to take place intermittently over any construction period and considering the spatial distribution of noise sources, so these exceedances would not be expected to occur continuously over the duration of the proposal. Noise levels are expected to be considerably lower than the above predictions for most of the works when mitigation measures are in place.

As a result of the predicted exceedances, noise mitigation and management measures have been outlined in Section 5 to reduce the potential noise impacts during SH.

4.1.6 NOISE IMPACTS - OOHW

OOHW is expected to occur during S01b, S02 and S03 only. OOHW construction noise impacts are predicted to exceed relevant NMLs at the nearest sensitive receivers in during all OOHW activities. During OOHW period 2, exceedances of up to 13 dBA are predicted during S01b, up to 12 dBA during S02 and up to 16 dBA during S03.

The closest residences to the construction work in NCA01 (R1 and R2) are predicted to be the most impacted when works are at their closest during S03. Receiver R3 is predicted to be the most impacted during S01b.

Based on the current available information regarding the proposed construction activities, noise impacts may be intrusive outside SH at the nearest receivers to the works areas. As a result of the predicted exceedances during OOHW, noise mitigation and management measures (such as respite periods) would be required to for OOHW as outlined in Section 5.

4.1.7 SLEEP DISTURBANCE

OOHW (and as such potential sleep disturbance impacts) are expected to occur during S01b, S02 and S03 only.

The loudest equipment proposed during these night-time work stages generally includes lighting towers, generators and other equipment which tend to generate relatively a steady noise signal and have a minor impact on maximum levels. These maximum noise levels are expected to be controlled by the use of quieter equipment such as franna / telescopic handlers and smaller hand tools. As such, maximum noise levels are not expected to be substantially louder than predicted L_{Aeq} levels.

No exceedances of sleep awakening criteria are predicted to occur during any of the work stages (S01b, S02 or S03), however exceedances of the sleep disturbance screening criteria may occur during each work stage. As such mitigation measures and respite periods will be implemented during these work stages.

4.2 CONSTRUCTION TRAFFIC NOISE

4.2.1 INTRODUCTION

Construction vehicle movements have the potential to generate temporary noise impacts to receivers adjacent to the haul routes. A *Traffic Management Plan* and a *Traffic Impact Assessment* (Civlink Consulting Pty Ltd, 2022) provided an assessment the existing environment and impacts of the proposal on traffic. The latest versions of these documents do not include an assessment of proposed weekend traffic diversions on the road network. As such, the previous version (Civlink Consulting Pty Ltd, 2021) is considered for the weekend diversion impacts.

A high-level assessment of construction traffic noise impact has been completed based on available traffic information, in consideration of typical weekday conditions and weekend diversion impacts.

4.2.2 TRAFFIC NOISE ASSESSMENT

Construction vehicles would be required to access the site via a number of access routes to complete the proposal, which would temporarily increase the number of traffic movements along the traffic network. It is understood that construction traffic would access the proposal site compound and laydown areas from Victoria Road via MacArthur Street to the north, and Hassall Street via Harris Street to the south.

Table 4.6 provides a summary of the measured 2022 traffic volumes for the Gasworks Bridge. No detailed weekday data was provided, but figures show hourly traffic volumes in excess of 1,400 were measured during the afternoon peak hour.

Table 4.6 Gasworks Bridge displaced traffic volumes (Saturday peak)

PERIOD	TIME	VOLUME (VEHICLE PER HOUR)
Northbound	12:00 pm - 1:00 pm	384
Southbound	12:00 pm - 1:00 pm	601
Total	**12:00 pm - 1:00 pm**	**985**

Typical traffic conditions

Construction works would require up to 15 heavy vehicle movements per day to deliver equipment and remove material during site preparation, site establishment, installation and decommissioning of scaffolding and containment system, and during rehabilitation works on compounds and laydown areas. These works would be undertaken during commencement and completion of the proposal works.

For the remainder of the proposal, it is expected that 12 light vehicles would access the site daily, with periodic heavy vehicles movements to remove waste from the proposal site.

Weekend traffic diversions

Construction of the proposal would require the temporary closure of the Gasworks Bridge (Macarthur Street) and the closure of the carpark on the northern side of the Gasworks Bridge.

The closure of the Gasworks Bridge would require the temporary diversion of both the northbound and southbound lanes during weekend periods (refer to Figure 4.1). Detours are expected to be in place from 8 pm Friday to 5am Monday. A total of seven weekend shutdowns are expected to be required (four at the commencement, and an additional three towards the completion of the Proposal).

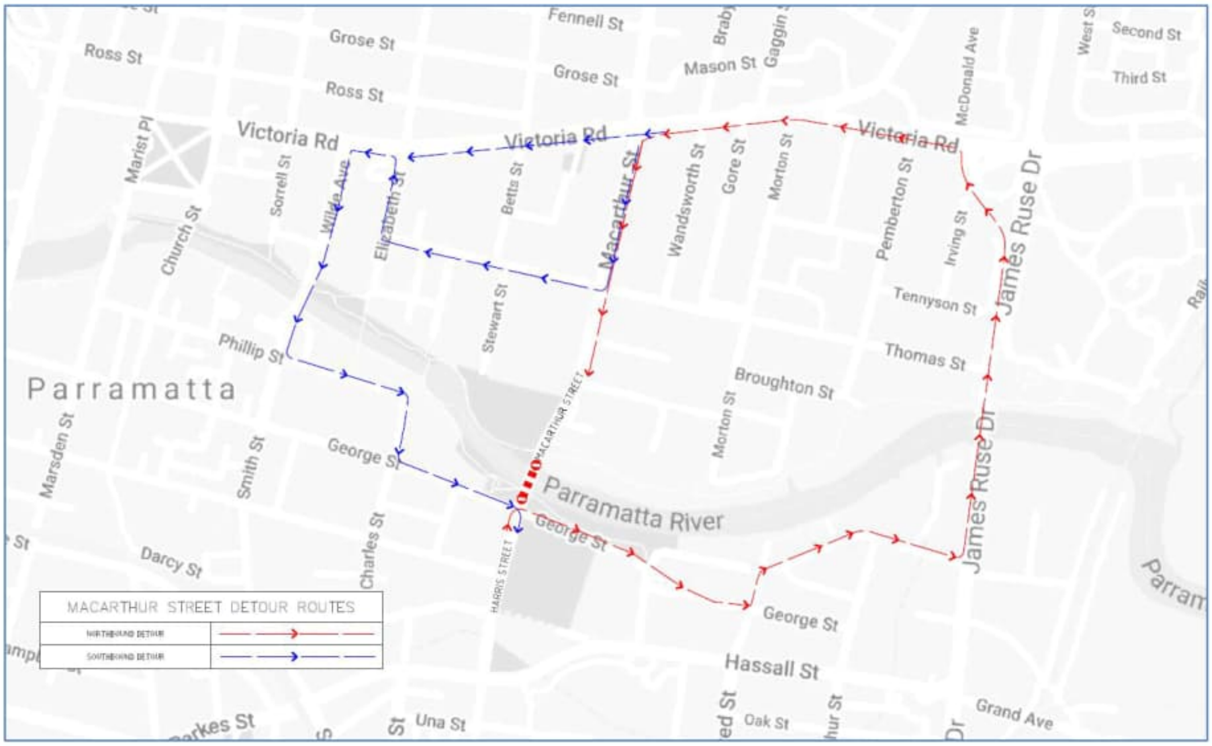


Figure 4.1 Detour routes – Full bridge closure (Source: Civlink Consulting Pty Ltd, 2022)

A summary of traffic volumes presented in the 2021 version of the *Traffic Impact Assessment* was completed, and changes in traffic flows on the surrounding road network are presented in Table 4.7.

These traffic volumes do not include construction-related traffic from the proposal, nor do they consider the typical daily variation in traffic volumes, and present a worst-case scenario for traffic volumes.

Table 4.7 Summary of peak hour volumes on surrounding road network as a result of diversion

INTERSECTION	ROAD	EXISTING PEAK HOUR VOLUMES[1]			FUTURE PEAK HOUR VOLUMES (WITH DIVERSION)[1]			CHANGE IN VOLUMES	
		EB/NB	WB/SB	KMH	EB/NB	WB/SB	KMH	EB/NB	WB/SB
Victoria Street / Macarthur Street	Victoria Street	964	658	42	1567	658	42	603	0
	Macarthur Street	319	241	35	319	241	34	0	0
Victoria Street / Wilde Avenue	Victoria Street	707	732	45	1365	732	45	658	0
	Wilde Avenue	305	n/a	37	305	n/a	40	0	n/a
Wilde Avenue/ Phillip Street	Wilde Avenue	330	246	29	246	988	31	-84	742
	Phillip Street	196	222	28	196	222	27	0	0
Charles Street / George Street	Charles Street	335	384	33	796	384	27	461	0
	George Street	162	173	28	162	173	37	0	0

(1) Source: Civlink Consulting, 2021

4.2.3 TRAFFIC NOISE IMPACTS

Typical traffic conditions

An approximate 60 per cent increase in traffic is required to increase traffic noise levels by more than 2 dB.

Traffic generated by the proposal's construction activities are negligible compared with the existing traffic volumes. Therefore, impacts due to the proposal are expected to comply with the RNP criteria.

Nevertheless, it is recommended that heavy vehicle movements to and from the site be restricted to SH where feasible. Nonetheless, traffic noise mitigation measures are outlined in Section 5.

Weekend traffic diversions

Based on the traffic volumes presented in the *Traffic Impact Assessment* and summarised in Table 4.7, it is noted that the diversion during weekends is anticipated to result in notable traffic impacts on the surrounding traffic network. Particularly on Victoria Road, Wilde Avenue and Charles Street, where diverted traffic is likely to result in a doubling or tripling in peak hour volumes.

Traffic management would be required on local roads to manage the impacts of traffic diversions during construction. Management of these impacts would be determined by the nominated construction contractor during the detailed design.

In consideration of diversion traffic volumes, proposal construction traffic volumes are likely to be negligible.

5 CONSTRUCTION NOISE AND VIBRATION MITIGATION AND MANAGEMENT

5.1 STANDARD CONSTRUCTION NOISE AND VIBRATION MITIGATION

The CNVS outlines standard measures for mitigating and managing construction noise and vibration to be implemented across all TfNSW construction projects where reasonable and feasible. These standard measures are outlined in Appendix B.

Prior to commencement of works, a Construction Noise and Vibration Management Plan (CNVMP) would be prepared and implemented in accordance with the requirements of the ICNG and CNVS. The CNVMP would take into consideration measures for reducing the source noise levels of construction equipment by construction planning and equipment selection.

The CNVMP would outline measures to reduce the noise impact from construction activities. Reasonable and feasible noise mitigation measures which would be considered include:

- Regularly training workers and contractors (such as at the site induction and toolbox talks) on the importance of minimising noise emissions and how to use equipment in ways to minimise noise
- Avoiding any unnecessary noise when carrying out manual operations and when operating plant
- Avoiding/limiting simultaneous operation of noisy plant in discernible range of a sensitive receiver
- Switching off any equipment not in use for extended periods e.g. heavy vehicles engines would be switched off whilst being unloaded.
- Using the most suitable equipment necessary for the construction works at any one time
- Restriction of heavy vehicle movements to and from the site to SH where feasible and avoiding deliveries at night/evenings wherever practicable.
- No idling of delivery trucks.
- Keeping truck drivers informed of designated routes, parking locations and acceptable delivery hours for the site.
- Minimising talking loudly; no swearing or unnecessary shouting, or loud stereos/radios onsite; no dropping of materials from height, no throwing of metal items and slamming of doors.
- Maximising the offset distance between noisy plant and adjacent sensitive receivers
- Directing noise-emitting plant away from sensitive receivers
- Regularly inspecting and maintaining plant to avoid increased noise levels from rattling hatches, loose fittings etc.
- Most works would be carried out during SH (i.e. 7:00 am to 6:00 pm Monday to Friday; 8:00 am to 1:00 pm Saturdays), with the exception of stage S01b, S02 and S03 which would require OOHW. Any works outside these hours may be undertaken if approved by TfNSW and the community is notified prior to these works commencing. An OOHW application form would need to be prepared by the Contractor and submitted to the TfNSW Environment and Planning Manager for approval prior to any works outside normal hours.

- Work would be conducted behind temporary hoardings/screens wherever practicable. The installation of construction hoarding would take into consideration the location of residential receivers to ensure that 'line of sight' is broken, where feasible.
- Where the $L_{Aeq\ ,15min}$ construction noise levels are predicted to exceed 75 dBA and/or 30 dB above the Rating Background Level at nearby affected sensitive receivers, respite periods would be observed, and in accordance with the CNVS. This would include restricting the hours that very noisy activities can occur. These are anticipated during S01a - Site Establishment due to the close proximity of works to set up the site compound to Receiver R1.

Proposed construction equipment was not identified to be a significant vibration generating risk.

Table 5.1 provides indicative benefits of typical engineering control mitigation measures for construction activities, based on guidance in AS 2436 and experience on similar construction projects.

Table 5.1 Indicative noise reduction from construction controls

ENGINEERING CONTROLS	POSSIBLE NOISE REDUCTION, dB
Screen or enclosure for stationary equipment	10-15
Maximising the offset distance between noisy plant items and sensitive receivers.	3-6
Avoiding using noisy plant simultaneously and/or close together, adjacent to sensitive receivers.	2-5
Orienting equipment away from sensitive receivers.	3-5
Carrying out loading and unloading away from sensitive receivers.	3-5
Using noise source controls, such as the use of residential class mufflers, to reduce noise from all plant and equipment including bulldozers, cranes, graders, excavators and trucks	5-10
Selecting site access points and roads as far as possible away from sensitive receivers	3-6

5.2 SITE SPECIFIC CONSTRUCTION NOISE MITIGATION

Further to the measures already implemented on the proposal, the following site-specific construction noise mitigation measures should be implemented:

- All work should be undertaken during standard construction hours other than those identified as OOHW in Table 4.2.
- During Scenario S01 (site establishment), the installation of construction hoarding should take into consideration the location of sensitive receivers to ensure that 'line of sight' is broken. This has the potential to reduce noise levels between 5 and 10 dB.
- During Scenario S04, use of the spray pump and paint equipment is the main contributor to construction noise. t is understood that these works would only take place during SH.
- When the spray pump and paint equipment is to be used near sensitive receivers, it is recommended that the noise reduction properties of the containment system be confirmed to achieve the mitigation reductions as outlined in this report. Alternatively, they could be fitted with temporary noise screens or enclosures (10-15 dB reduction) placed around the containment area.
- It is recommended that consultation be undertaken with residents to effectively communicate likely impacts, potential periods of high intensity works, and to develop a schedule of consultation to program intensive works. Respite periods

should be negotiated, and a community consultation strategy developed to ensure a complaints hotline and feedback pathway is established.

- Use of the vacuum loading machine and the compressor is a significant contributor to construction noise. It is recommended that the use of these plant items is limited where possible, and to avoid sensitive time periods. It is recommended that a temporary noise screen or enclosure (10-15 dB reduction) is placed around the works in conjunction with temporary barriers.
- The positioning of plant and equipment in Laydown Area A (north of the bridge) should be considered so that noisiest items are located furthest away from noise sensitive receivers. Positioning these items at the southern end of the laydown area will provide increased separation from source to receiver and also offers the potential for other equipment to provide shielding.
- Activities at the nearest sensitive non-residential receivers are likely to fluctuate over the course of the day, therefore, it is recommended that consultation be undertaken with operators to determine feasible construction staging to manage impacts, effectively communicate likely impacts, potential periods of high intensity works, and to develop a schedule of consultation to program intensive works outside the most active periods. Respite periods should be negotiated, and a community consultation strategy developed to ensure a complaints hotline and feedback pathway is established.
- Appropriate respite periods should be adopted in accordance with Table 5.2 during work stages where exceedances of criteria are predicted.

5.3 ADDITIONAL CONSTRUCTION NOISE MITIGATION

Where all reasonable and feasible standard mitigation measures have been applied and exceedances are still predicted to occur, the CNVS provides guidance on additional mitigation measures to be implemented for each receiver depending on level of exceedance for the predicted noise level above the NML. Additional mitigation measures and their associated acronyms are outlined in Table B.4. Table 5.2 outlines when to implement the additional noise management measures.

Table 5.2 Implementation of additional management measures

CONSTRUCTION HOURS	RECEIVER PERCEPTION	dBA ABOVE RBL	dBA ABOVE NML	ADDITIONAL MANAGEMENT MEASURES[1]
SH Monday-Friday (7:00 am-6:00 pm)	Noticeable Clearly audible	5 to 10 > 10 to 20	0 < 10	- -
Saturday (8:00 am - 1:00 pm)	Moderately intrusive	> 20 to 30	> 10 to 20	PN, V
	Highly intrusive	> 30	> 30	PN, V
	75dBA or greater	N/A	N/A	PN, V, SN
OOHW Period 1	Noticeable	5 to 10	< 5	-
Monday-Friday (6:00 pm - 10:00 pm)	Clearly audible	> 10 to 20	5 to 15	PN
Saturday (7:00 am - 8:00 am, 1:00 pm - 10:00 pm)	Moderately intrusive	> 20 to 30	> 15 to 25	PN, V, SN, RO

CONSTRUCTION HOURS	RECEIVER PERCEPTION	dBA ABOVE RBL	dBA ABOVE NML	ADDITIONAL MANAGEMENT MEASURES[1]
Sunday/PH (8:00 am - 6:00 pm)	Highly intrusive	> 30	> 25	PN, V, SN, RO, RP[2], DR[2]
OOHW Period 2	Noticeable	0 to 10	< 5	PN
Monday-Saturday (12:00 am - 7:00 am, 10:00 pm - 12:00 am)	Clearly audible	> 10 to 20	5 to 15	PN, V
Sunday/PH (12:00 am - 8:00 am, 6:00 pm - 12:00 am)	Moderately intrusive	> 20 to 30	> 15 to 25	PN, V, SN, RP, DR
	Highly intrusive	> 30	> 25	PN, V, SN, AA, RP, DR

(1) AA = alternative accommodation, V = verification, IB = individual briefing, PN = periodic notification, R2 = respite period, DR = duration reduction, R0 = respite offer, PC = phone calls, SN = specific notification

(2) Respite periods and duration reductions are not applicable when works are carried out during OOHW Period 1 Day only

5.4 TRAFFIC MANAGEMENT

This assessment has demonstrated that the proposal would generate a minor increase in traffic noise on affected roads associated with the construction activities, and levels are expected to remain within RNP criteria.

The construction traffic noise impacts are not expected to be significant compared with the existing traffic noise impacts under typical weekday conditions, nor with consideration to traffic volumes on local roads during weekend traffic diversions.

Traffic management would be required on local roads to manage the impacts of traffic diversions during construction. Management of these impacts would be determined by the nominated construction contractor during the detailed design.

As best practice, it is recommended that the findings of the Traffic Management Plan be used to inform the CNVMP.

6 CONCLUSION

WSP has completed a Construction Noise and Vibration Impact Assessment for a proposed maintenance works at Gasworks Bridge in Parramatta, NSW. The assessment was conducted with reference to the CNVS.

Sensitive receivers surrounding the proposal included residences, commercial, active recreation, education, mixed-use developments and places of worship; these receivers have been categorised into noise catchment areas for the purpose of this assessment.

Background noise levels surrounding the proposal were adopted from a noise assessment previously undertaken by WSP for TfNSW. These background noise levels were used to derive the project specific noise criteria for residential and non-residential receivers to assess potential noise and vibration impacts during construction and operations.

Precise construction methodology would need to be confirmed by the construction contractor, however potential noise impacts associated with an indicative construction staging has been conservatively assessed to facilitate community consultation and effective noise management and mitigation prioritisation.

Noise predictions have included a series of noise reducing measures to be incorporated during the site establishment phase, including temporary hoarding. The noise reduction of the containment unit has also been considered in this assessment.

The assessment of construction noise impacts at the nearest sensitive receivers indicates that noise levels are predicted to exceed relevant NMLs at the nearest sensitive receivers in NCA01 and at the hotel in NCA03 during SH.

OOHW construction noise impacts are predicted to exceed relevant NMLs at the nearest sensitive receivers in during all OOHW activities. Scenario S02 (Bridge deck sealing works) and S03 (scaffolding installation and demobilisation) generates the greatest impact to sensitive receivers during the night period.

As a result of the predicted exceedances, noise mitigation and management measures are recommended to reduce the potential noise impacts during SH and OOHW.

A high-level investigation into proposal-related construction traffic has indicated that the proposal would generate a minor increase in traffic noise on affected roads associated with the construction activities, and levels are expected to remain within RNP criteria. The construction traffic noise impacts are not expected to be significant compared with the existing traffic noise impacts under typical weekday conditions, nor with consideration to traffic volumes on local roads during weekend traffic diversions. Traffic management would be required on local roads to manage the impacts of traffic diversions during construction. Mitigation and management measures are presented in this report.

APPENDIX A

FAÇADE NOISE MAPS

Project No: PS123629	Author: AS
Date: 31/05/2023	Approved by: RW

To be read in conjunction with WSP document: Gasworks Bridge REF

0 50 100 150 m

GASWORKS BRIDGE

Facade Noise Map - Scenario 01

wsp

www.wsp.com

Project No: PS123629	Author: AS
Date: 31/05/2023	Approved by: RW

To be read in conjunction with WSP document: Gasworks Bridge REF

0 50 100 150 m

GASWORKS BRIDGE

Facade Noise Map - Scenario 1b

wsp

www.wsp.com

Project No: PS123629	Author: AS	
Date: 31/05/2023	Approved by: RW	

To be read in conjunction with WSP document: Gasworks Bridge REF

0 50 100 150 m

GASWORKS BRIDGE

Facade Noise Map - Scenario 02

wsp

Project No: PS123629	Author: AS	
Date: 31/05/2023	Approved by: RW	

To be read in conjunction with WSP document: Gasworks Bridge REF

0 50 100 150 m

GASWORKS BRIDGE

Facade Noise Map - Scenario 03

wsp

www.wsp.com

Project No: PS123629	Author: AS	
Date: 31/05/2023	Approved by: RW	

To be read in conjunction with WSP document: Gasworks Bridge REF

0 50 100 150 m

GASWORKS BRIDGE

Facade Noise Map - Scenario 4a

wsp

www.wsp.com

Project No: PS123629	Author: AS
Date: 31/05/2023	Approved by: RW

To be read in conjunction with WSP document: Gasworks Bridge REF

0 50 100 150 m

GASWORKS BRIDGE

Facade Noise Map - Scenario 4b

wsp

www.wsp.com

Project No: PS123629	Author: AS
Date: 31/05/2023	Approved by: RW

To be read in conjunction with WSP document: Gasworks Bridge REF

0 50 100 150 m

GASWORKS BRIDGE

Facade Noise Map - Scenario 05

wsp

www.wsp.com

APPENDIX B

MITIGATION MEASURES

B1 STANDARD MITIGATION MEASURES

Table B.1 Standard management measures to reduce construction noise and vibration

ACTION REQUIRED	APPLIES TO	DETAILS
Implementation of any proposal specific mitigation measures required	Airborne noise Ground-borne noise & vibration	In addition to the measures set out in this table, any specific mitigation measures identified in the EIA documentation (e.g.REF, submissions or representations report) or approval or licence conditions must be implemented.
Implement stakeholder consultation measures (refer to Sections 8.2.1 and 8.3 for further details of community consultation measures)	Airborne noise Ground-borne noise & vibration	Periodic notification (monthly letterbox drop and website notification) detailing all upcoming construction activities delivered to sensitive receivers at least 7 days prior to commencement of relevant works. In addition to Periodic Notification, the following strategies may be adopted on a case-by-case basis: • Proposal Specific Website • Proposal Infoline • Construction Response Line • Email Distribution List • Web-based Surveys • Social Media • Community and Stakeholder Meetings and • Community Based Forums (if required by approval conditions).
Register of noise and vibration sensitive receivers	Airborne noise Ground-borne noise & vibration	A register of most affected noise and vibration sensitive receivers (NVSRs) would be kept on site. The register would include the following details for each NVSR: • Address of receiver • Category of receiver (e.g. Residential, Commercial etc.) • Contact name and phone number. The register may be included as part of the proposals Community Liaison Plan or similar document and maintained in accordance with the requirements of this plan.
Construction hours and scheduling	Airborne noise Ground-borne noise & vibration	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating noise with special audible characteristics and/or vibration levels should be scheduled during less sensitive time periods.
Construction respite period	Ground-borne noise & vibration Airborne noise	Noise with special audible characteristics and vibration generating activities (including jack and rock hammering, sheet and pile driving, rock breaking and vibratory rolling) may only be carried out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of one hour between each block. 'Continuous' includes any period during which there is less than a 1 hour respite between ceasing and recommencing any of the work. No more than two consecutive nights of noise with special audible characteristics and/or vibration generating work may be undertaken in the same NCA over any 7-day period, unless otherwise approved by the relevant authority.
Site inductions	Airborne noise Ground-borne noise & vibration	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • All relevant proposal specific and standard noise and vibration mitigation measures • Relevant licence and approval conditions • Permissible hours of work • Any limitations on noise generating activities with special audible characteristics

ACTION REQUIRED	APPLIES TO	DETAILS
Site inductions		• Location of nearest sensitive receivers • Construction employee parking areas • Designated loading/unloading areas and procedures • Site opening/closing times (including deliveries) • Environmental incident procedures.
Behavioural practices	Airborne noise	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors. No excessive revving of plant and vehicle engines. Controlled release of compressed air.
Monitoring	Airborne noise Ground-borne noise & vibration	A noise monitoring program should be carried out for the duration of works in accordance with the Construction Noise and Vibration Management Plan and any approval and licence conditions.
Attended vibration measurements	Ground-borne vibration	Attended vibration measurements shall be undertaken at all buildings within 25 metres of vibration generating activities when these activities commence to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.
Update Construction Environmental Management Plans	Airborne noise Ground-borne noise & vibration	The CEMP must be regularly updated to account for changes in noise and vibration management issues and strategies.
Building condition surveys	Vibration Blasting	Undertake building dilapidation surveys on all buildings located within the buffer zone prior to major project construction activities with the potential to cause property damage.

Table B.2 Standard source measures to reduce construction noise and vibration

ACTION REQUIRED	APPLIES TO	DETAILS
Plan worksites and activities to minimise noise and vibration	Airborne noise Ground-borne vibration	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.
Equipment selection	Airborne noise Ground-borne noise & vibration	Use quieter and less vibration emitting construction methods where feasible and reasonable, see APPENDIX C. For example, when piling is required, bored piles rather than impact-driven piles will minimise noise and vibration impacts. Similarly, diaphragm wall construction techniques, in lieu of sheet piling, will have significant noise and vibration benefits.
Maximum noise levels	Airborne-noise	The noise levels of plant and equipment must have operating Sound Power or Sound Pressure Levels compliant with the allowable noise levels in APPENDIX C.
Rental plant and equipment	Airborne-noise	The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used on site unless compliant with the allowable noise levels in APPENDIX C.
Use and siting of plant	Airborne-noise	Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be avoided. The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.
Non-tonal reversing alarms	Airborne noise	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out-of-hours work, including delivery vehicles.

ACTION REQUIRED	APPLIES TO	DETAILS
Minimise disturbance arising from delivery of goods to construction sites	Airborne noise	Loading and unloading of materials/deliveries is to occur *as far as possible* from sensitive receivers.
Minimise disturbance arising from delivery of goods to construction sites *continued*		Select site access points and roads as far as possible away from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.
Construction Related Traffic	Airborne noise	Schedule and route vehicle movements away from sensitive receivers and during less sensitive times. Limit the speed of vehicles and avoid the use of engine compression brakes. Maximise on-site storage capacity to reduce the need for truck movements during sensitive times.
Silencers on Mobile Plant	Airborne noise	Where possible reduce noise from mobile plant through additional fittings including: Residential grade mufflers Damped hammers such as "City" Model Rammer Hammers Air Parking brake engagement is silenced.
Prefabrication of materials off-site	Airborne noise	Where practicable, pre-fabricate and/or prepare materials off-site to reduce noise with special audible characteristics occurring on site. Materials can then be delivered to site for installation.
Engine compression brakes	Airborne noise	Limit the use of engine compression brakes at night and in residential areas. Ensure vehicles are fitted with a maintained original equipment manufacturer exhaust silencer or a silencer that complies with the National Transport Commission's 'In-service test procedure' and standard.

Table B.3 Standard path measures to reduce construction noise and vibration

ACTION REQUIRED	APPLIES TO	DETAILS
Shield stationary noise sources such as pumps, compressors, fans etc	Airborne noise	Stationary noise sources should be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained. Appendix F of AS 2436: 1981 lists materials suitable for shielding.
Shield sensitive receivers from noisy activities	Airborne noise	Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant.

B2 ADDITIONAL MITIGATION MEASURES

Table B.4 Additional mitigation measures

MEASURE	DESCRIPTION	ABBREVIATION
Periodic Notification	For each I&P project, a notification entitled 'Project Update' or 'Construction Update' is produced and distributed to stakeholders via letterbox drop and distributed to the project postal and/or email mailing lists. The same information will be published on the TfNSW website (www.transport.nsw.gov.au). Periodic notifications provide an overview of current and upcoming works across the project and other topics of interest. The objective is to engage, inform and provide project-specific messages. Advanced warning of potential disruptions (e.g. traffic changes or noisy works) can assist in reducing the impact on stakeholders . The approval conditions for projects specify requirements for notification to sensitive receivers where works may impact on them. Content and length is determined on a project-by-project basis and must be approved by TfNSW prior to distribution. Most projects distribute notifications on a monthly basis. Each notification is graphically designed within a branded template. In certain circumstances media advertising may also be used to supplement Periodic Notifications, where considered effective. Periodic Notification may be advised by the I&P Community Engagement Team in cases where AMMM are not triggered as shown in Tables 9 to 11, for example where community impacts extend beyond noise and vibration (traffic, light spill, parking etc). In these circumstances the I&S Community Engagement Team will determine the community engagement strategy on a case-by-case basis.	PN
Verification Monitoring	Verification monitoring of noise and/or vibration during construction may be conducted at the affected receiver(s) or a nominated representative location (typically the nearest receiver where more than one receiver has been identified). Monitoring can be in the form of either unattended logging (i.e. for vibration provided there is an immediate feedback mechanism such as SMS capabilities) or operator attended surveys (i.e. for specific periods of construction noise). The purpose of monitoring is to confirm that: • construction noise and vibration from the project are consistent with the predictions in the noise assessment • mitigation and management of construction noise and vibration is appropriate for receivers affected by the works Where noise monitoring finds that the actual noise levels exceed those predicted in the noise assessment then immediate refinement of mitigation measures may be required and the CNVIS amended. Refer to Section 8.4 for more details.	V
Specific Notification	Specific notifications are in the form of a personalised letter or phone call to identified stakeholders no later than seven calendar days ahead of construction activities that are likely to exceed the noise objectives. Alternatively (or in addition to), communications representatives from the contractor would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities and provide an individual briefing. • Letters may be letterbox dropped or hand distributed • Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and their specific needs • Individual briefings are used to inform stakeholders about the impacts of noisy activities and mitigation measures that will be implemented. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project Specific notifications are used to support periodic notifications, or to advertise unscheduled works and must be approved by TfNSW prior to implementation/distribution.	SN

MEASURE	DESCRIPTION	ABBREVIATION
Respite Offer	The purpose of a project specific respite offer is to provide residents subjected to lengthy periods of noise or vibration respite from an ongoing impact. The offer could comprise pre- purchased movie tickets, bowling activities, meal vouchers or similar offer. This measure is determined on a case-by-case basis, and may not be applicable to all I&P projects.	RO
Alternative Accommodation	Alternative accommodation options may be provided for residents living in close proximity to construction works that are likely to incur unreasonably high impacts. Alternative accommodation will be determined on a case-by-case basis and should provide a like-for-like replacement for permanent residents, including provisions for pets, where reasonable and feasible.	AA
Alternative construction methodology	Where the vibration assessment identifies that the proposed construction method has a high risk of causing structural damage to buildings near the works, the proponent will need to consider alternative construction options that achieve compliance with the VMLs for building damage. For example, replace large rock breaker with smaller rock breakers or rock saws.	AC
Respite Period	OOHW during evening and night periods will be restricted so that receivers are impacted for no more than 3 consecutive evenings and no more than 2 consecutive nights in the same NCA in any one week. A minimum respite period of 4 evenings/5 nights shall be implemented between periods of consecutive evening and/or night works. Strong justification must be provided where it is not reasonable and feasible to implement these period restrictions (e.g. to minimise impacts to rail operations), and approval must be given by TfNSW through the OOHW Approval Protocol (Section 6). Note; this management measure does not apply to OOHW Period 1 – Days (See Table 1).	RP
Duration Reduction	Where Respite Periods (see management measure above) are considered to be counterproductive to reducing noise and vibration impacts to the community it may be beneficial to increase the number of consecutive evenings and/or nights through Duration Reduction to minimise the duration of the activity. This measure is determined on a project-by-project basis, and may not be applicable to all I&S projects. Impacted receivers must be consulted and evidence of community support for the Duration Reduction must be provided as justification for the Duration Reduction. A community engagement strategy must be agreed with and implemented in consultation with I&P Community Engagement Representatives.	DR

ABOUT US

WSP is one of the world's leading professional services consulting firms. We are dedicated to our local communities and propelled by international brainpower. We are technical experts and strategic advisors including engineers, technicians, scientists, planners, surveyors and environmental specialists, as well as other design, program and construction management professionals. We design lasting solutions in the Transport & Water, Property & Buildings, Earth & Environment, and Mining & Power sector as well as offering strategic Advisory, Engagement & Digital services. With approximately 6,100 talented people in more than 50 offices in Australia and New Zealand, we engineer future ready projects that will help societies grow for lifetimes to come. www.wsp.com/en-au/.

Appendix E – Air quality impact assessment

Fulton Hogan

Gasworks Bridge - Review of Environmental Factors

Air Quality Impact Assessment

JUNE 2023

Question today
Imagine tomorrow
Create for the future

Gasworks Bridge - Review of Environmental Factors
Air Quality Impact Assessment

Fulton Hogan

WSP
Level 15, 28 Freshwater Place
Southbank VIC 3006

Tel: +61 3 9861 1111
Fax: +61 3 9861 1144
wsp.com

REV	DATE	DETAILS
A	5 October 2021	Rev A
B	3 March 2023	Rev B
C	1 June 2023	Rev C

	NAME	DATE	SIGNATURE
Prepared by:	John Conway	6 June 2023	
Reviewed by:	Mark Tulau	6 June 2023	
Approved by:	Morgan Cardiff	6 June 2023	

WSP acknowledges that every project we work on takes place on First Peoples lands.
We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers and pay our respects to Elders past and present.

Table of contents

Abbreviations

AAQMS	Ambient Air Quality Monitoring Station
AHD	Australian height datum
Air NEPM	National Environment Protection (Ambient Air Quality) Measure
AWS	Automatic Weather Station
AQIA	Air Quality Impact Assessment
BoM	Bureau of Meteorology
CO	Carbon monoxide
EPA	Environment Protection Authority
LGA	Local Government Area
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NSW	New South Wales
PAHs	Polycyclic Aromatic Hydrocarbons
PM	Particulate Matter
$PM_{2.5}$	Particles with an aerodynamic diameter of 2.5 micrometres or less
PM_{10}	Particles with an aerodynamic diameter of 10 micrometres or less
REF	Review of Environmental Factors
SO_2	Sulphur dioxide
TfNSW	Transport for New South Wales
TSP	Total suspended particulates
WSP	WSP Australia Pty Limited
Units	
ºC	Degree Celsius
km	kilometre
km/h	kilometre per hour
m	Metre
m^2	Square metres
mm	Millimetres
$\mu g/m^3$	Microgram per cubic meter

Executive summary

Transport for New South Wales (TfNSW) is proposing remediation works of the Gasworks Bridge in Parramatta to remove the existing hazardous lead paint from the bridge structure, the repainting using a polyurethane paint system and the repair of both structural and non-structural elements of the bridge (the proposal). This qualitative Air Quality Impact Assessment (AQIA) report was prepared in support of a Review of Environmental Factors (REF) for the proposal.

The proposal is located on Macarthur Street, Parramatta, spanning the Parramatta River. On the western side of the bridge is a pedestrian walkway. The bridge and the walkway are both major thoroughfares for the local community connecting Parramatta Central Business District (CBD) located to the south-east with the residential area of Parramatta to the north.

The existing environment was characterised in respect of existing land uses, the nearest sensitive receptors, local meteorology and air quality conditions.

The proposal is in an urban area comprising a mix of residential and non-residential land uses. The land use immediately surrounding the Gasworks Bridge comprise predominantly recreational areas on the banks of the Parramatta River.

The existing local air quality was analysed and reviewed. The National Pollutant Inventory (NPI) provides information on the type and magnitude of pollutants for industrial premises that exceed specific thresholds. For the 2020/2021 reporting period, twelve facilities emitting 36 substances in the Parramatta local government area (LGA) were reported to the NPI. The nearest industrial premise to the proposal is a metal manufacturing plant located approximately 1.5 kilometres (km) to the east. There are no other significant industrial sources of air emissions in the vicinity of the proposal. Vehicular traffic emissions on the local road network are also a major source of local air emissions.

The nearest ambient air quality monitoring station (AAQMS) to the proposal is located at Parramatta North (Cumberland Hospital on Fleer Street) approximately 2.2 km to the north-west of the proposal. Ambient air monitoring data collected at the Parramatta North AAQMS for the past five years (2018 to 2022 inclusive) were analysed and are presented in this report as broadly representative of the proposal area. The results indicate that, except for 2019, the annual average PM_{10} concentrations were compliant with the relevant *National Environment Protection (Ambient Air Quality) Measure 2021* (Air NEPM) standard, while there were multiple exceedances of the 24-hour average PM_{10} Air NEPM standard for 2018 to 2020 with a maximum of 22 daily exceedances in 2019 due primarily to bushfire smoke. There were exceedances of the annual and 24-hour $PM_{2.5}$ Air NEPM standard for the years 2018 to 2020, with a maximum of 21 daily exceedances in 2019 due to bushfire smoke. There were no exceedances of the 24-hour and annual PM_{10} and $PM_{2.5}$ Air NEPM standards in 2021 and 2022. Despite the exceedances, the majority of which were due to exceptional events, the overall air quality at the Parramatta North AAQMS is broadly representative of that experienced at the proposal site.

Meteorological data collected at the EPA Parramatta North AAQMS for the years 2018 to 2022 was analysed to evaluate the local wind speed and wind direction. The data indicates predominantly north-west and south-east winds with an annual average wind speed of 1.1 m/s and calm conditions of 26.5% over the five years.

Sensitive receptors in the vicinity of the proposal were identified including residences, recreational areas, a school and a commercial premise. Several residential receptors are situated adjacent to the remediation impact zone of the proposal.

The main types of emissions likely to be generated during proposal works include dust, lead, VOCs, odour and combustion emissions from the following sources:

- site establishment (dust of varying size fractions)
- vehicle, plant and machinery movements to/from the proposal site to the compound and laydown areas
- combustion emissions of engine fuel associated with on-site plant, equipment and vehicles
- combustion emissions from diesel powered generators

- emissions from abrasive blasting of the existing lead-based paint on the Gasworks Bridge and removal via the dust extraction system emission point (dust of varying size fractions, lead, and VOCs)
- emissions during repainting of the entire Gasworks Bridge (VOCs and odour)
- spent abrasive and hazardous material waste contaminated with lead-based paint (dust of varying size fractions and lead).

A risk-based approach was used for assessing the potential impacts of air emissions during proposal works based on the assessment methodology presented in section 4. Initial risk ratings were assigned to each potential air emission source without proposed mitigation measures.

With the implementation of source-specific mitigation measures in place for the proposal works to minimise potential air quality impacts, residual risks were assigned to each source. All activities were assigned a low residual risk with proposed mitigation measures in place.

An Air Quality Management Plan (AQMP) would be prepared and implemented as part of the Construction Environment Management Plan (CEMP). The AQMP would outline the type and nature of emissions sources, the potential impact on nearby sensitive receptors and recommended management measures to reduce and minimise air emissions. This would include both emission monitoring of the dust extraction unit and ambient air monitoring for dust and lead.

1 Introduction

1.1 Proposal overview

WSP Australia Pty Ltd (WSP) was engaged by Fulton Hogan Australia Pty Ltd (Fulton Hogan) on behalf of Transport for New South Wales (TfNSW) to prepare a qualitative air quality impact assessment (AQIA) report for the proposed remedial works on the Gasworks Bridge in Parramatta, NSW (the proposal).

The proposal is located on Macarthur Street, Parramatta, spanning the Parramatta River in the City of Parramatta Local Government Area (LGA). The proposal is situated approximately 18 kilometres (km) west of Sydney's central business district (CBD) and adjacent to Parramatta CBD.

This AQIA report was prepared in support of the Review of Environmental Factors (REF) for the proposal.

1.2 Proposal description

The proposal comprises remediation works of the Gasworks Bridge to remove the existing bridge coating (containing hazardous lead paint), repainting with a polyurethane paint system, and the repair of both structural and non-structural elements of the bridge.

This proposal would include the following activities:

- installation of a site compound and equipment laydown areas (Areas A, B and C)
- sealing of the concrete deck of the bridge structure (Spans 1-5)
- installation of temporary traffic management (steel barriers) and relocation of existing zebra crossing
- staged installation of an encapsulated (containment) scaffolding system on the bridge structure
- staged removal of the existing lead paint coating from all wrought iron and steel elements of the bridge and application of a new protective paint and coating (blasting, priming and coating works)
- bridge repair works (structural and non-structural) including:
  - remediation of structural steel elements of the bridge
  - repair/replacement of corroded rivets
  - treatment of flame cut holes
  - cleaning bridge scuppers (drainage)
  - removal and replacement of mesh screen on pedestrian walkway on western side of the bridge
  - removal and replacement of a 20m rail section on eastern side of the bridge, like-for-like
  - replacement of timber planks (like for like) on walkway on western side of bridge including re-fixing loose timbers and removing splintering sections
  - removal and replacement of existing W beams on roadside truss
  - Removal of redundant gas main on eastern side of bridge, which would include the removal of bolts and lifting of sections of the pipe for offsite removal (in accordance with waste disposal guidelines)
  - cleaning and removal of moss, vegetation and graffiti from bridge piers
  - rectification of concrete spalling and cracks.
- removal/disposal of waste materials staged removal (and cleaning) of the containment and scaffolding system
- demobilisation of site compound and equipment laydown areas, and removal of traffic management.

1.3 Proposal location

The proposal is located on Macarthur Street, Parramatta, spanning the Parramatta River. The existing Gasworks Bridge, completed in 1885, is an iron lattice design with an overall length of 110 m and a width of 10.3 m. On the western side of the bridge is a pedestrian walkway. The bridge and the walkway are both major thoroughfares for the local community connecting Parramatta CBD located to the south-east with the residential area of Parramatta to the north.

The location of the proposal and key features is shown on Figure 1-1.

1.4 Objective

The purpose of the AQIA is to characterise the existing environment, assess qualitatively the likely impacts of the proposal, and to recommend mitigation and management measures to minimise or reduce potential air quality impacts on the receiving environment.

1.5 Scope of work

The scope of work for this AQIA is as follows:

- review all relevant information provided by the client and request further information where gaps existC
- describe and characterise the existing environment (air quality, meteorology, topography, and sensitive receptors) for the proposal area using publicly available information (e.g., Environment Protection Authority and Google Earth Aerial Image)
- identify the main sources of air emissions during proposal activities and characterise the type, location, frequency and duration of emission sources
- undertake a qualitative assessment of the potential air quality impacts during the proposal works
- propose management measures to minimise the potential impacts during the maintenance works.

Operation of the proposal would not result in any material change that would impact the existing air quality. As such, potential operational impacts were not considered further.

1.6 Pollutants of interest

The key pollutants associated with the proposal comprise particulate matter (dust[1]) of varying size fractions and lead. These dust fractions include:

- Total suspended particulates (TSP)
- Particulate matter with an aerodynamic diameter of less than or equal to 10 micrometres (PM_{10})
- Particulate matter with an aerodynamic diameter of less than or equal to 2.5 micrometres ($PM_{2.5}$)
- Deposited dust[2]

---

1 Particulate matter and dust are often used interchangeably. For the purposes of this AQIA the term 'dust' has been used to include particles that can affect human health and give rise to dust soiling.

2 Dust that is suspended longer in the air and has settled onto a surface.

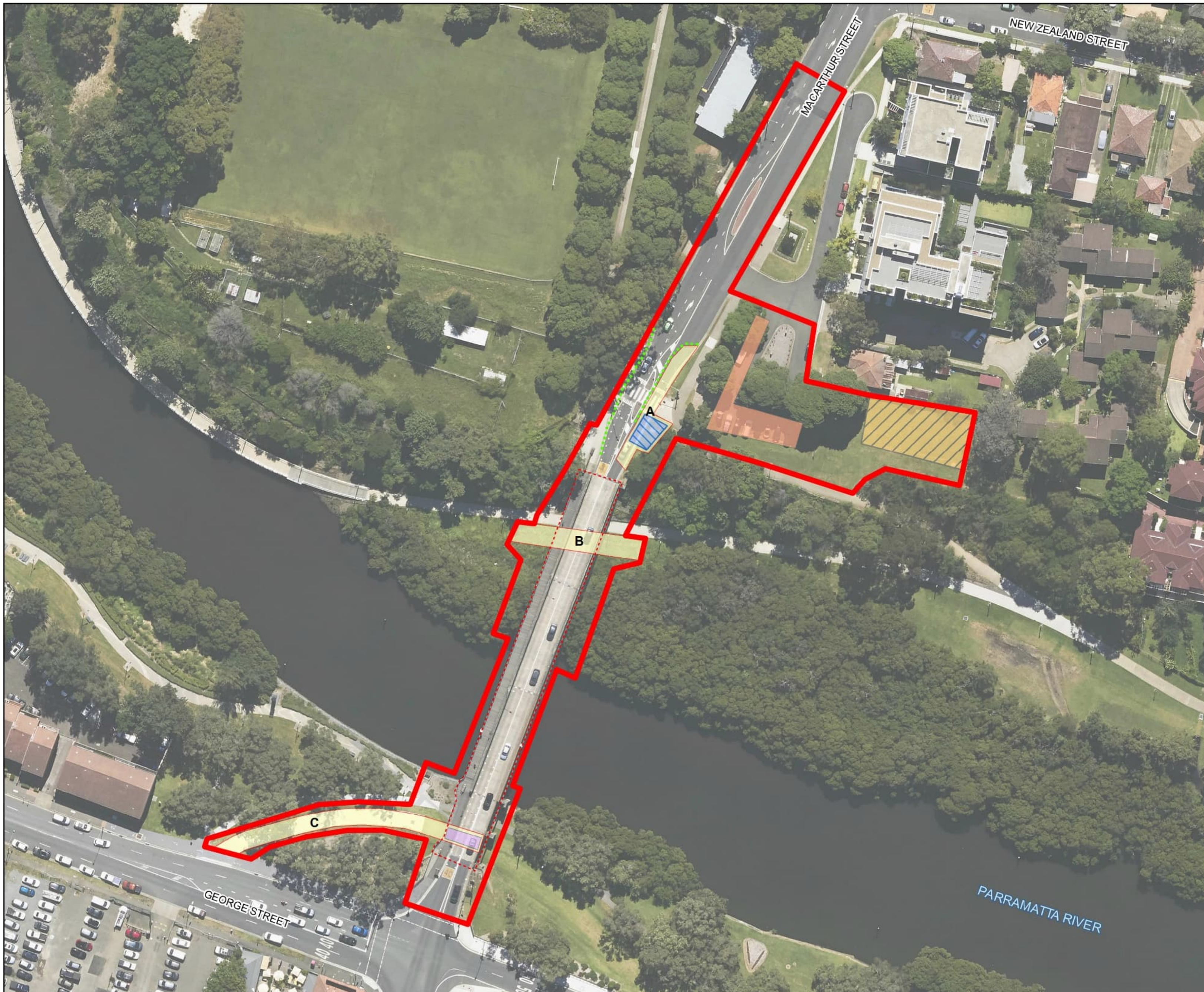
Combustion emissions would also be generated from vehicles and on-site plant machinery during proposal works. These include:

- oxides of nitrogen (NO_x) comprising of nitrogen dioxide (NO) and nitrogen dioxide (NO_2)
- carbon monoxide (CO)
- sulphur dioxide (SO_2)
- volatile organic compounds (VOCs),
- semi-volatile organic compounds (SVOCs) e.g., polycyclic hydrocarbons,
- dust of varying size fractions

Lead, and dust of varying size fractions would be generated from the remediation (paint stripping) activities, whilst the repainting of the bridge may release VOC and odour emissions.

Gasworks Bridge REF

Figure 1.1
Location and key areas of the Proposal



Legend

- Roads
- Watercourses
- Traffic Management Barriers
- Proposal Site
- Bridge Structure

Construction Areas

- Sand blasting equipment
- Construction parking
- Decontamination unit
- Equipment laydown area
- Site compound

0 10 20 m

Coordinate system: GDA2020 MGA Zone 56

Scale ratio correct when printed at A3

1:1,000 Date: 1/06/2023

Data Sources: Imagery © Metromap 2020

C:\Users\AURC508271\WSP O365\AU-WKG - Geospatial - AIS - Documents\Projects\PS123629_GasworksBridge_REF_Parramatta\Mxd\01_REF\PS123629_REF_Fig1.1_LocationOfTheProposal_r1v8.mxd

2 Legislative context

2.1 Commonwealth

2.1.1 National Environment Protection Council Act 1994

The National Environment Protection Council (NEPC) was established under the National Environment Protection Council Act 1994 (NEPC Act). The primary functions of the NEPC are to:

- to prepare National Environment Protection Measures (NEPMs)
- to assess and report on the implementation and effectiveness of the NEPMs in each state and territory.

NEPMs are a special set of national objectives designed to assist in protecting or managing aspects of the environment e.g., air quality.

The NEPM relevant to air quality for this proposal is the:

- National Environment Protection (Ambient Air Quality) Measure 2021 (Air NEPM).

2.1.1.1 National Environment Protection (Ambient Air Quality) Measure 2021

Key pollutants commonly found in ambient air are nationally regulated under the National Environment Protection (Ambient Air Quality) Measure (Air NEPM).

The Air NEPM outlines standards and goals for key pollutants that are required to be achieved nationwide, with due regard to population exposure. The national environment protection standards of this measure are presented Table 2.1.

Commonwealth, State and Territory Environment Ministers have flagged an objective to move to a $PM_{2.5}$ standard of 20µg/m^3 (1-day average) and 7µg/m^3 (1-year average) by 2025 as prescribed in the Air NEPM 2021 amendment.

These standards are not relevant to air emissions from individual sources, specific industries or roadside locations. Air NEPM standards are intended to be applied at performance monitoring locations that represent air quality for a region or sub-region of 25,000 people or more. These performance monitoring stations are operated by the relevant environmental regulatory authority in each State and Territory.

Table 2.1 Air NEPM standards

POLLUTANT	AVERAGING PERIOD	AIR QUALITY STANDARD[1, 2]
PM_{10}	24 hours	50 µg/m^3
	Annual	25 µg/m^3
$PM_{2.5}$	24 hours	25 µg/m^3
		20 µg/m^3 [3]
	Annual	8 µg/m^3
		7 µg/m^3 [3]
Lead	Annual	0.5 µg/m^3

(1) Defined as a standard that consists of quantifiable characteristics of the environment against which environmental quality can be assessed

(2) µg/m^3 – unit of measurement for particulate matter expressed as micrograms per cubic metre

(3) To be adopted from 2025

2.2 State

2.2.1 Protection of the Environment Operations Act 1997

The Protection of the Environment Operations Act 1997 (POEO Act) provides the legislative framework for the protection and enhancement of air quality in NSW. Its primary objectives are to reduce risks to harmless levels through pollution prevention, cleaner production, application of waste management hierarchy, continual environmental improvement and environmental monitoring.

2.2.2 Protection of the Environment Operations (Clean Air) Regulation 2010

The Protection of Environment Operations (Clean Air) Regulation 2010 ([POEO (Clean Air) Regulation] provides measures for the control of air emissions from sources including industry, motor vehicles, fuels, wood heaters and open burning. Under Schedule 4, concentration standards for specific pollutants are prescribed for scheduled activities (licensable) for specific industries and general activities and plant.

The POEO Act together with the POEO (Clean Air) Regulation provides a comprehensive framework for regulating activities to minimise their impact on air quality.

The proposal activities are not considered a prescribed scheduled activity and therefore not required to apply for an Environment Protection Licence. For non-scheduled premises, Schedule 6 of the POEO (Clean Air) Regulations prescribes a standard of 100 mg/m^3 for solid particles. There are no concentrations for lead.

2.2.3 Approved Methods for the Modelling and Assessment of Air Quality in NSW 2022

The NSW EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales 2022* (Approved Methods) prescribes the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in the state. The Approved Methods lists impact assessment criteria for a number of pollutants and the relevant criteria to this proposal are presented in Table 2.2.

Table 2.2 Impact assessment criteria

POLLUTANT	AVERAGING PERIOD	STANDARDS
TSP	Annual	90 µg/m^3
PM_{10}	24 hours	50 µg/m^3
	Annual	20 µg/m^3
$PM_{2.5}$	24 hours	25 µg/m^3
	Annual	8 µg/m^3
Deposited dust	Annual	2 g/m^2/month (increase) 4 g/m^2/month (cumulative)
Lead	Annual	0.5

3 Existing environment

3.1 Topography and land use

The proposal is in an urban area comprising a mix of residential and non-residential land uses. Which commercial, recreational, educational, and places of worship. The area immediately surrounding the Gasworks Bridge is predominantly recreational along the banks of the Parramatta River.

In general, the proposal area is generally flat with an elevation of around 10 to 15 m Australian Height Datum. (AHD) To the south side of the Gasworks Bridge, the local topography is low lying and relatively flat ranging from 6 m to 8 m and dropping to 3 m at Parramatta River. To the north, the topography rises to a main ridge at 22 m which extends from Beecroft in the east to Seven Hills in the west.

3.2 Sensitive receptors

The *Approved Methods* (NSW EPA 2016) describes a sensitive receptor as:

'A location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area. An air quality impact assessment should also consider the location of any known or likely future sensitive receptor.'

The area surrounding the proposal comprises of residences, the Macarthur Girls High School, reserves (Stewart Street Reserve, Rangihour Reserve and Queens Wharf Reserve) and commercial premises. Table 3.1 presents the nearest sensitive receptors to the site boundary and to the location of the proposal works. The nearest residential sensitive receptors are located between 5 m and 50 m from the proposal area to the north of Gasworks Bridge.

Additionally, potentially sensitive receptors near the proposal may include users of adjacent recreational / open space areas, pedestrians and commuters using the Gasworks Bridge to cross the Parramatta River. Figure 3-1 presents the location of the nearest sensitive receptors to the proposal.

Table 3.1 Sensitive receptors identified in the vicinity of the proposal

RECEPTOR ID	ADDRESS	RECEPTOR TYPE	DISTANCE TO PROPOSAL (M)	DIRECTION FROM PROPOSAL SITE BOUNDARY
R1	135 George Street	Albion Hotel	20	South
R2	190 George Street	Commercial	15	West
R3	Stewart Street reserve	Recreational	5	North-east
R4	MacArthur Girls High School (sports field)	School	35	North-west
R5	8 MacArthur Street	Residential	5	North-east
R6	10 MacArthur Street	Residential	5	East
R7	Rangihou Reserve	Recreational	5	East
R8	Queen's Wharf Reserve	Recreational	5	East
R9	1a Noller Parade	Residential	230	East

RECEPTOR ID	ADDRESS	RECEPTOR TYPE	DISTANCE TO PROPOSAL (M)	DIRECTION FROM PROPOSAL SITE BOUNDARY
R10	2 Noller Parade	Residential	270	East
R11	153 George Street	Commercial	70	South-east
R12	163 George Street east	Guardian childcare/education centre	140	South-east
R13	103 Harris Street	Robin Thomas Reserve	100	South

Gasworks Bridge REF
Figure 3.1
Air quality - sensitive receiver
Legend
Sensitive Receptor Locations
Proposed high volume air sampler
Roads
Watercourses
Access Entry Area
Traffic Management Barriers
Proposal Site
Bridge Span
Bridge Structure
Construction Areas
Sand blasting equipment
Construction parking
Decontamination unit
Equipment laydown area
Site compound
NEW ZEALAND STREET
MACARTHUR STREET
RANGIHOU CRESCENT
PARRAMATTA
PARRAMATTA RIVER
GEORGE STREET
HARRIS STREET
MACQUARIE STREET
NOLLER PARADE
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
A
B
C
1
2
3
4
5
BLACKTOWN
BURWOOD
SYDNEY
0
25
50
m
Coordinate system: GDA2020 MGA Zone 56
Scale ratio correct when printed at A3
1:1,500
Date: 7/06/2023
Data Sources: Imagery © Metromap 2020
© WSP Australia Pty Ltd ("WSP") Copyright in the drawings, information and data recorded ("the information") is the property of WSP. This document and the information are solely for the use of the authorised recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by WSP. WSP makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information. NCSI Certified Quality System to ISO 9001. © APPROVED FOR AND ON BEHALF OF WSP Australia Pty Ltd.
C:\Users\AURC508271\WSP O365\AU-WKG - Geospatial - AIS - Documents\Projects\PS123629_GasworksBridge_REF_Parramatta\Mxd\01_REF\PS123629_REF_Fig6.15_AirQualitySensitiveReceptors_r1v8.mxd

3.3 Local meteorology

The wind direction and wind speed during proposal activities, can influence the extent and magnitude of air quality impacts. Adverse impacts can occur in any direction from a site. They are, however, more likely to occur downwind of the prevailing wind direction and in proximity to the proposal site.

The closest monitoring station to the proposal site is located at Parramatta North approximately 2.2 km to the north-west. The ambient air quality monitoring station (AAQMS) is operated and managed by the Environment Protection Authority (EPA) and monitors for the following parameters:

- PM_{10} and $PM_{2.5}$
- ozone
- wind speed and wind direction.

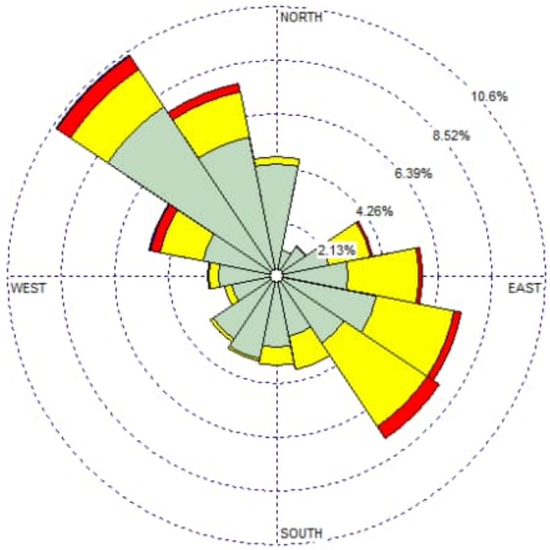
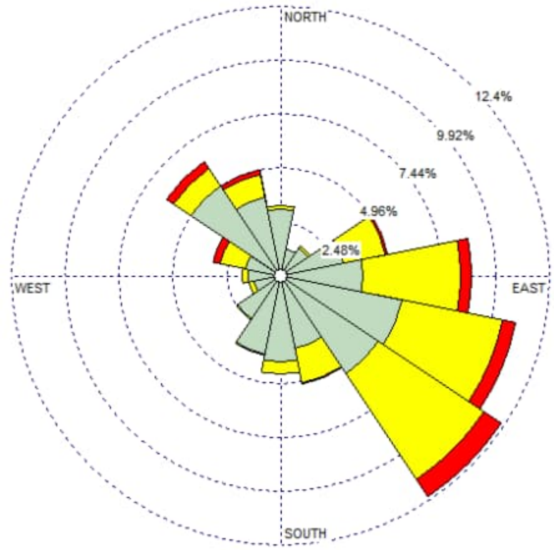
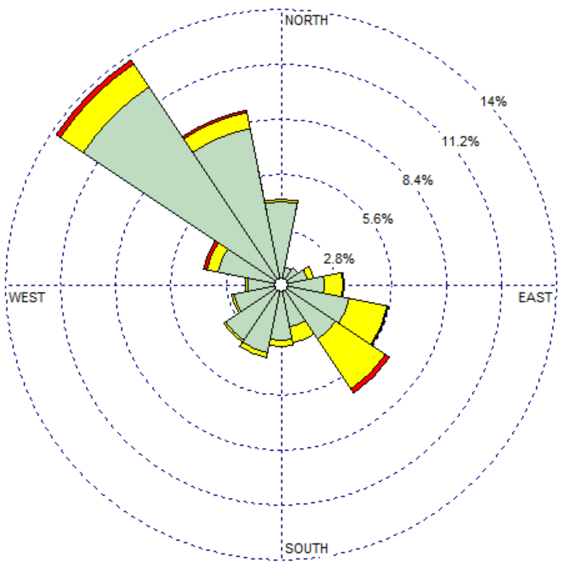
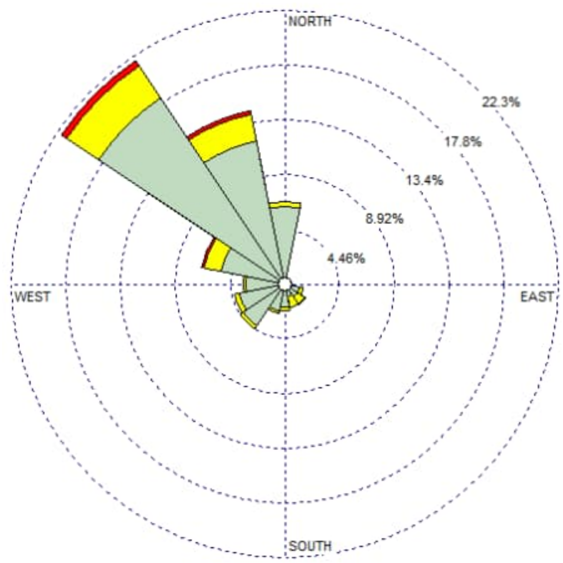
The Parramatta North AAQMS is located at the Cumberland Hospital on Fleer Street at an elevation of 16 m and commenced operation in December 2017. It is a performance monitoring station and reports for compliance. Meteorological and ambient air quality data is available for 2018 to 2022.

Wind speed and wind direction collected at the Parramatta North AAQMS were analysed for the years 2018 to 2022. Figure 3-2 presents the annual and seasonal wind roses for the Parramatta North AAQMS illustrating the frequency of strength and direction of winds.

The wind roses indicate the typical wind fields at Parramatta North AAQMS are:

- predominantly from the south-east and east south-east during summer with an average wind speed of 1.4 m/s and calm conditions (wind speeds of less than 0.5 m/s) of 21.9%
- most frequently from the north-west during autumn with an average wind speed of 0.9 m/s and calm conditions of 31.8%
- most frequently from the north-west during winter with an average wind speed of 0.96 m/s and calm conditions of 25.4%
- predominantly from the north-west during spring followed by the south-east with an average wind speed of 1.2 m/s and calm conditions of 25.8%
- over the 5-year period (2018 to 2022) most frequently from the north-west and south-east with an annual average wind speed of 1.1 m/s and calm conditions of 26.5%.

In summary, the Parramatta North AAQMS experiences on average light winds and high calm conditions across all seasons. Similar meteorological conditions are likely to be experienced at the proposal site with likely variances due to distance and topography. Sensitive receptors located downwind of the prevailing wind directions (i.e., south-east and north-west) may potentially be most affected from air emissions during proposal works.

<table>
<tr><th>Spring</th><th>Summer</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><th>Autumn</th><th>Winter</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><th>Annual</th><th>Legend</th></tr>
</table>

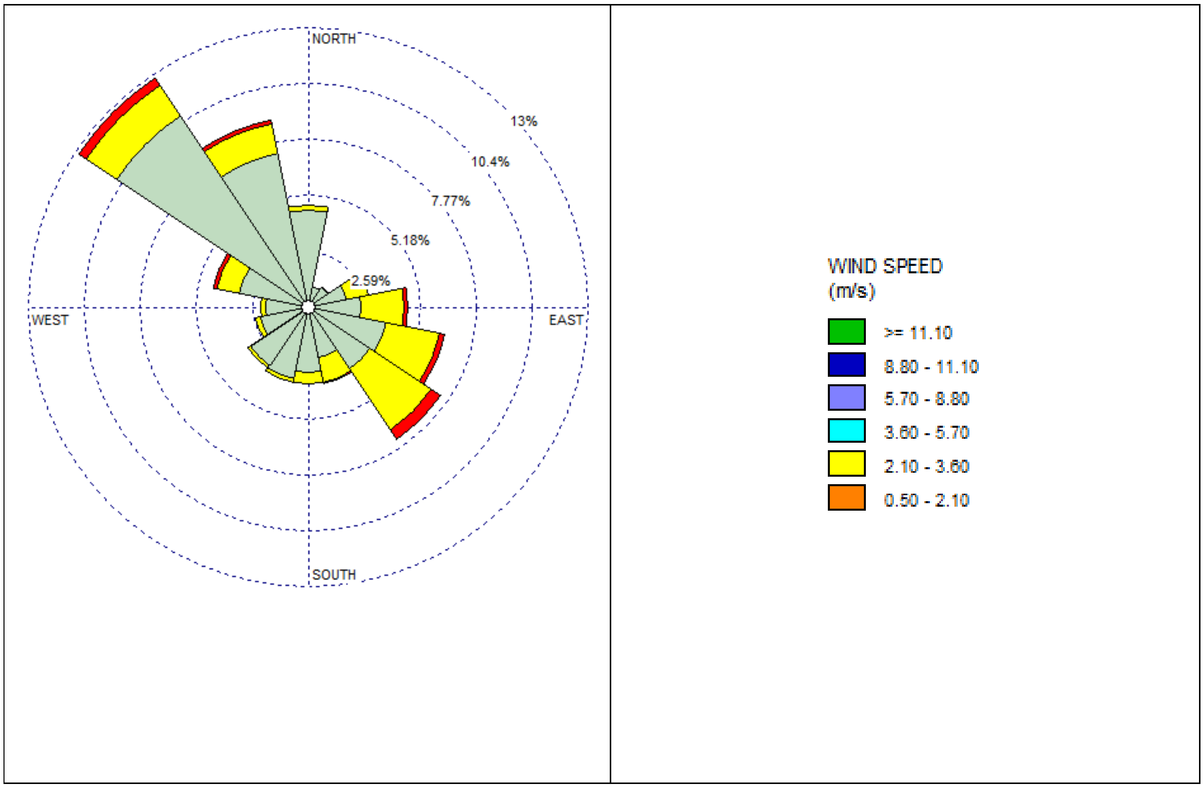


Figure 3-2 Annual and seasonal wind roses at Parramatta North AAQMS (2018 to 2022)

3.4 Local ambient air quality

3.4.1 Existing air emission sources

The main industrial and non-industrial (diffuse) air emission sources contributing to the local airshed include:

- vehicular traffic using the local road networks
- wind-blown dust
- burning (fuel reduction, regeneration and agricultural) and wildfires
- domestic and commercial solvents/aerosols
- domestic solid and liquid fuel burning
- residential activities (e.g., lawnmowers and barbecues)
- commercial shipping/boating
- recreational boating
- railway operations
- service station
- dry cleaning
- industrial activities.

These sources give rise to pollutant emissions relevant to the proposal including:

- total suspended particulates (TSP), deposited dust, PM_{10}, and $PM_{2.5}$
- lead
- NO_x, CO and SO_2
- volatile organic compounds (VOCs)
- semi-volatile organic compounds (SVOCs) e.g., polycyclic aromatic hydrocarbons (PAHs)
- odour.

3.4.2 Industrial facilities

A National Pollutant Inventory (NPI) database review was conducted to identify existing industrial emission sources in the Parramatta local government area (LGA). Twelve facilities emitting 36 substances were reported to the NPI for the 2020/2021 reporting year. These facilities included:

- beverage manufacturing
- petroleum and coal product manufacturing
- waste treatment and disposal services
- bakery product manufacturing
- food product manufacturing
- cement, lime, plaster, and concrete product manufacturing
- metal product manufacturing
- mineral, metal and chemical wholesaling.

3.4.3 All air emission sources

Air emissions from all sources (industrial and diffuse) listed in sections 3.4.1 and 3.4.2 within the Parramatta LGA for the reporting period 2020/2021 are summarised in Table 3.2. Except for $PM_{2.5}$, for the pollutants listed in Table 3.2, emissions from vehicular traffic contribute to a large proportion of the overall emissions in the Parramatta LGA.

Table 3.2 NPI reported air emissions in the Parramatta LGA for 2020/2021

POLLUTANT	EMISSIONS TO AIR (KG)		
	INDUSTRIAL	VEHICULAR TRAFFIC[2]	TOTAL[3]
PM_{10}	38,164	111,105	343,906
$PM_{2.5}$	6,783	NA	6,783
NO_x	42,445	2,880,572	3,081,112
CO	125,179	1,880,000	2,160,000
SO_2	2,770	53,119	97,832
Total VOCs	NA	2,210,626	4,958,387
PAHs	NA	7,749	14,272
Lead & compounds	86	474	567

(1) NA: Data not available (2) Reported motor vehicles emissions for 1999 (3) All other emissions sources listed in section 3.4.1

3.4.4 Background air quality

PM_{10} and $PM_{2.5}$ data collected at the Parramatta North AAQMS for the years 2018 to 2022 is summarised as follows:

- except for 2019, there were no exceedances of the annual PM_{10} Air NEPM standard for all years analysed
- the annual $PM_{2.5}$ Air NEPM standard was exceeded for 2018 to 2020
- there were multiple exceedances of the 24-hour PM_{10} Air NEPM standard for 2018 to 2020, with a maximum of 22 daily exceedances in 2019 due to bushfire smoke
- there were multiple exceedances of the 24-hour $PM_{2.5}$ Air NEPM standard for 2018 to 2020, with a maximum of 21 daily exceedances in 2019 due to bushfire smoke.
- there were no exceedances of the 24-hour and annual PM_{10} and $PM_{2.5}$ Air NEPM standards in 2021 and 2022.

Given the nearby location of the Parramatta North AAQMS, the air quality at the proposal site is expected to be of similar magnitude. As such, the air quality at the Parramatta North AAQMS is considered to be broadly representative of the proposal site.

Table 3.3 Ambient air quality data at Parramatta North AAQMS (2018 to 2022)

YEAR	ANNUAL AVERAGE (µG/M³)		MAXIMUM 24-HOUR AVERAGE (µG/M³)		
	PM_{10}	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**	**Number and date of maximum exceedances**
2018	21.6	**9.2**	**107.4**	**42.1**	PM_{10}: 8 (maximum on 22 November) $PM_{2.5}$: 4 (maximum on 29 May)
2019	**25.5**	**10.5**	**195.3**	**130.1**	PM_{10}: 22 (maximum on 10 December) $PM_{2.5}$: 21 (maximum on 10 December)
2020	19.3	**8.2**	188.9	72.9	PM_{10}: 9 (maximum on 23 January) $PM_{2.5}$: 10 (maximum on 8 January)
2021	17.1	6.6	42.5	17.1	0
2022	14.1	5.2	42.7	16.9	0
Air NEPM standard	***25***	***8***	***50***	***25***	

4 Impact assessment

4.1 Assessment methodology

The main air emissions generated during proposal works is expected to be dust, combustion products, VOCs and odour. Given the small-scale nature of the works, with emissions likely to be intermittent and short-term, a risk-based approach was considered appropriate to evaluate the potential risk of adverse air quality impacts for the proposal.

The risk based qualitative assessment was carried out as follows:

- identify potential emission sources based on proposed activities (section 4.2.5)
- analyse the likelihood and consequence of air emissions being generated (section 4.3.1)
- based on the likelihood and consequence criteria, assign an initial risk rating (prior to mitigation measures) for the emission sources as presented in the Risk Rating Matrix (section 4.4)
- following the implementation of mitigation measures, assign a residual risk rating for each emission source.

Table 4.1, Table 4.2 and Table 4.3 present the likelihood categories, consequence descriptors and risk rating matrix for each emission source.

Table 4.1 Likelihood categories

LIKELIHOOD	DESCRIPTION
Certain	Expected to occur in most circumstances, or 100% chance of recurrence during the course of an activity or the activity lasts years.
Likely	Expected to occur at some time, or 50% chance of recurrence during the course of an activity, or the activity lasts months.
Possible	May happen at some time, or 30% chance of recurrence during the course of an activity, or the activity lasts days to weeks.
Unlikely	May occur within the life of the proposal or 10% chance of recurrence during the course of an activity, or the activity lasts hours.
Rare	Highly unlikely to occur but theoretically possible, 5% chance of recurrence during the course of an activity.

Table 4.2 Consequence descriptor

CONSEQUENCE	DESCRIPTION
Severe	Permanent or long-term serious environmental harm/life threatening or long-term harm to health and wellbeing. Amenity of the regional area permanently negatively altered – functional recovery in greater than 10 years if at all.
Major	Serious environment harm/high-level harm to health and wellbeing. Impacts on amenity to the localised area or regional area that significantly negatively alter perceptions of the area – functional recovery within 5 to 10 years.

CONSEQUENCE	DESCRIPTION
Moderate	Medium level of harm to health and wellbeing or the environment over an extended period of time. Impacts on amenity to the localised area or regional area that negatively alter perceptions of the area – functional recovery within 1 to 5 years.
Minor	Low to medium environmental impact/low potential for health and wellbeing impacts over a short period of time (months) Short term impacts on amenity to the localised area or regional area – functional recovery within less than 1 year.
Insignificant	No or minimal environmental impact, or no health and wellbeing impacts. Temporary localised impacts on amenity – no lasting effects.

Table 4.3 Risk rating matrix

LIKELIHOOD	CONSEQUENCE LEVEL				
	Insignificant	Minor	Moderate	Major	Severe
Certain	Low	Medium	High	Extreme	Extreme
Likely	Low	Medium	High	High	Extreme
Possible	Negligible	Low	Medium	High	High
Unlikely	Negligible	Low	Medium	Medium	High
Rare	Negligible	Negligible	Low	Medium	Medium

4.2 Proposal impacts

4.2.1 Proposal stages and duration

Subject to approval, the proposal is expected to commence in Quarter 3 of 2023 and take approximately four months to complete. Works are expected to take place during standard working hours and outside standard hours. The works during standard hours would likely be conducted 7 am – 6 pm Monday to Friday, 8 am – 1 pm Saturday, with no work on Sundays or public holidays.

Certain out of hours works would be required to minimise disruptions to customers, pedestrians, motorists, and nearby sensitive receivers; and to ensure the safety of the workers and operational assets. A total of 12weekend shutdowns are expected to be required. The associated out of hours work would occur to provide working access to the inner face of the bridge, to avoid traffic congestion and reduce traffic disruption

A construction compound will be established within the site boundary to contain site sheds, amenities, storage area and materials laydown. Figure 1-1 presents the location of the construction compound and laydown area.

The construction compound is proposed to be located at the northern end of the bridge, east of Macarthur Street on cleared land covering an area of 300 to 500 square metres (m^2).

Given the nature of proposal works, the proposal would not require excavation or earthworks. Minor turf clearing would be required at the site compound and laydown areas and would be reinstated on completion of the proposal. Table 4.4 presents the indicative proposed stages and activities. It is noted there is likely to be some overlap in the proposal stages identified.

Table 4.4 Proposal stages and activities

STAGE	ACTIVITIES	Approximate duration
Site establishment	— pre-construction soil & water sampling — delivery and installation of temporary fencing for site compound and laydown areas — establishment of environmental controls — clearing of surface vegetation for laydown areas — trimming of mangroves adjacent to the bridge — installation of hardstand at site compound and laydown areas (where required) — delivery and installation of site sheds and amenities to site compound — connection of temporary utilities (power, water etc) to side compound — installation of works zone signs (including, pedestrian controls and navigation signage as required on the Parramatta River).	7 days
Bridge deck sealing works	— sealing of existing cracks on the concrete bridge deck	3 days
Traffic management set-up	— closure and temporary detour of Macarthur Street and the bridge — installation of temporary steel barriers. — temporary relocation of the existing zebra crossing	3 days
Installation of scaffolding and containment system	— installation of scaffolding system — installation of containment system — location and protection of existing services and utilities — installation of decontamination unit at site compound — installation of high-volume air samplers (Air monitoring equipment)	30 days
Blasting, priming and coating works	— cleaning and surface preparation — water washing of surfaces (if required) and storage of waste materials — removal of existing lead-based coating system using abrasive blasting, power tools and hand tools (if required) — transfer and safe storage of spent abrasive and hazardous materials — removal of hazardous coatings to licenced disposal facility — priming and painting.	55 days

STAGE	ACTIVITIES	Approximate duration
Bridge repair works	— repair of structural elements of the bridge — repair/replacement of corroded rivets — treatment of flame cut holes — cleaning of bridge scuppers — replacement of mesh railing on bridge walkway — replacement of 20 metres of rail on east side of bridge — remove splinters and sand timber planks — remove and reinstall W beams on truss — remove redundant gas pipe on eastern side of bridge — cleaning of graffiti, moss and vegetation (using high pressure wash) on bridge piers on southern embankment — repair concrete spall (concrete which has broken away from the subsurface) — removal/disposal of waste materials.	15 days
Removal of encapsulation and dismantling of scaffolding	— cleaning and dismantling of scaffold — removal and disposal of containment system including ground based and hanging scaffold.	15 days

Demobilisation	— removal of steel barriers and vehicle crash protections
	— removal of environmental controls
	— removal of all site sheds and facilities from site compound
	— removal of all plant and equipment from site compound/laydown areas
	— reinstate site compound and laydown areas to pre-construction condition, including:
	    — removal of hardstand
	    — import and install turf underlay
	    — reinstate turf in affected areas
	— removal of site fencing from site compound and laydown areas
	— removal of temporary works signage and reinstate signage and line marking on the bridge
	— completion of site clean-up works
	— final inspection and handover.
		5 days

4.2.2 Equipment

The following equipment likely to be used during the proposal works would include, but not limited to:

- air compressors (large or small)
- scissor lift
- dust extraction unit and dust collector
- decontamination unit

- diesel generators
- ablution facilities
- crib sheds
- elevated work platforms
- floats
- high pressure wash
- hand tools
- spray pumps and paint equipment
- high volume air samplers
- telescopic handlers
- toilet blocks
- vacuum loading machines
- other power tools (vacuum shrouded).
- delivery trucks, light vehicles (including traffic control vehicles)
- water cart
- water blaster
- excavator
- roller
- HIAB/franna crane
- lighting towers
- oxy-acetylene torches
- airless pumps and paint equipment.

4.2.3 Vehicular traffic

Vehicles would be required to access the site via haulage and access routes, which would temporarily increase the number of traffic movements along the road network. It is understood that proposal traffic would access the proposal site compound and laydown areas from Hassall Street and Harris Street (via a small section of George Street) from the south and exit the proposal site from via Macarthur Street and Victoria Road to the north.

Due to the narrow width of the traffic lanes, works on sections of the bridge that can only be accessed from the roadway would need to be undertaken under modified traffic arrangements to ensure compliance with applicable safety requirements. Accordingly, the proposal would require partial and full closures of Macarthur Street and the Gasworks bridge at various times during proposal works, in addition to the closure of parking spaces at the northern area of the proposal site.

An extended partial closure of the Gasworks bridge would be required to facilitate access. This would require reducing traffic to a single lane in a southbound direction only, for the full duration of the Proposal. All northbound traffic movements would be directed via a local detour.

The Gasworks Bridge methodology indicates that 10 to 15 full time employees would be required to conduct the proposal works depending on activities, with up to 15 heavy vehicle movements required per day to deliver equipment and remove material during site establishment, installation and decommissioning of scaffolding and the encapsulation system and site demobilisation. During the installation and removal of scaffolding, due to access constraints from Macarthur Road, heavy vehicle access to the northern laydown area (beneath the bridge) would be required from Rangihou Crescent to the east of the proposal site, via the existing shared pathway. This access would require temporary pedestrian/cyclist management.

For the remainder of the proposal works, it is expected 12 light vehicles would access the proposal site daily, with periodic heavy vehicle movements for the removal of waste materials.

4.2.4 Ancillary activities

Temporary site compound and laydown areas would be required to accommodate a site office, amenities, equipment laydown, on-site fabrication workshops and storage areas for materials (see Figure 3-1. These areas would comprise:

- one main site compound at the northern side of the bridge, east of Macarthur Street on cleared land, covering an area of around 420 square metres. The area is considered part of the Rangihou Reserve. Access to this site compound would be via the existing car parking area to the immediate north of the bridge. The site compound would contain crib sheds, site office and amenities.

- an equipment laydown area (Area A) to be installed within the existing south bound lane of Macarthur Street and adjacent to the northern approach of the bridge. This area covers around 315 square metres and would be used to locate equipment required for blasting including the dust hopper, interceptor bin, blast hopper, compressor, generator and skip bin.
- an equipment laydown area (Area C) on the northern side of the Parramatta River, adjacent to the active pathway which extends beneath the bridge. This area covers around 200 square metres.
- an equipment laydown area (Area CD) at the southern side of (and extending beneath) the bridge, to the west of Macarthur Street. This laydown area (covering around 335 square metres) is located on a cleared and partially sealed section of the Queens Wharf Reserve, with access via George Street, and has most recently been utilised by the Parramatta Light Rail project (refer to Section **Error! Reference source not found.**) as a materials laydown area.

Hazardous and non-hazardous waste generated on site would be separated. The laydown area occupying the existing southern lane of MacArthur street would be used to store hazardous waste, which would be collected and stored in a bunded, locked area in the compound prior to collection, transport and disposal at a licensed waste facility.

4.2.5 Emission sources

The main air emissions sources during proposal works include:

- site establishment (dust of varying size fractions)
- vehicle, plant and machinery movements to/from the proposal site to the compound and laydown area (dust of varying size fractions)
- combustion emissions of engine fuel associated with on-site plant, equipment and vehicles
- combustion emissions from the diesel-powered generators
- emissions from abrasive blasting of the existing lead-based paint on the Gasworks Bridge and removal via the dust extraction system emission point (dust of varying size fractions, lead, and VOCs)
- emissions during repainting of the entire Gasworks Bridge (VOCs and odour)
- spent abrasive and hazardous material waste contaminated with lead-based paint (dust of varying size fractions and lead).

4.3 Risk assessment

4.3.1 Likelihood and consequence of emission occurrence

Occurrence, likelihood and potential impact consequence of each emission source during proposal works were assessed based on the definitions presented in Table 4.1, Table 4.2, Table 4.3 and presented in Table 4.5.

It is noted that the impact consequence was assessed in consideration of nearby sensitive receptors. There are 13 sensitive receptors identified in the vicinity of the proposal.

Table 4.5 Likelihood and consequence analysis of each emission source

RISK NO.	EMISSION SOURCE	LIKELIHOOD AND CONSEQUENCE
1	Dust emissions from site establishment	The works would be short-lived (7 days), and the dust impacts localised. The likelihood of dust being generated is ‘possible’ with the consequence ‘minor’ given the distance to the nearest sensitive receptors.

RISK NO.	EMISSION SOURCE	LIKELIHOOD AND CONSEQUENCE
2	Vehicle, plant and machinery movements to/from the proposal site to the compound and laydown areas	There is the potential for dust generation from vehicles moving to/from the proposal site to the compound and laydown areas.. Given the low number of vehicles on-site per day (15 truck movements), and plant and machinery in use, the short duration of proposal works and the small works footprint, the likelihood of occurrence is 'possible' with a 'minor' consequence.
3	Combustion emissions associated with vehicles, plant, and machinery	Diesel fuel combustion from vehicle movements and on-site plant and machinery operations would generate dust, CO, NO_x, SO_2 and trace amounts of non-combustible hydrocarbons (i.e., VOCs and PAHs). The likelihood of combustion emissions occurring would be 'likely' with the consequence 'minor', given the small number of trucks, plant and machinery that would be used on a daily basis.
4	Combustion emissions from the diesel generators	Diesel fuel combustion from vehicle movements and on-site plant, machinery operation and generator would generate dust, CO, NO_x, SO_2 and trace amounts of non-combustible hydrocarbons (i.e., VOCs and PAHs). The likelihood of combustion emissions occurring would be 'likely' with the consequence 'minor'.
5	Dust and lead emissions from the extraction system emission point of the containment system.	Abrasive blasting to remove the existing paint on the Gasworks Bridge will give rise to dust, lead and possibly low levels of VOCs. The likelihood of emissions occurring would be 'certain' during blasting activities with the consequence 'minor' given these works will occur over a period of less than 2 months.
6	VOC emissions during repainting of the Gasworks Bridge	VOCs and odour may be emitted during repainting of the Gasworks Bridge. The primer, stripe and final coats would be water based with low levels of VOCs present in the paints. The likelihood of emissions occurring would be 'possible' with the consequence 'minor'.
7	Spent abrasive and hazardous material waste contaminated with lead-based paint in the construction compound/laydown areas	Blast media waste contaminated would be stored in the construction compound and may give rise to dust and lead emissions. The likelihood of emissions occurring would be 'possible' with the consequence 'minor'. Large amounts of blast media waste are not expected to be generated and then stored on-site at any given time.

4.4 Risk ratings

Initial risk ratings and residual risk ratings post-mitigation of each potential emission source is presented in Table 4.5.

In summary, all activities are assigned a low residual risk with proposed mitigation measures in place (section 5). Management and monitoring measures detailed in Table 5.1 are recommended to minimise dust, lead, VOCs, odour and combustion emissions from the proposal activities.

Table 4.6 Risk register for activities associated with construction of the proposal

RISK NO.	ACTIVITY	INITIAL RISK RATING			MITIGATION MEASURES	RESIDUAL RISK RATING		
		Likelihood	**Consequence**	**Risk rating**		**Likelihood**	**Consequence**	**Risk rating**
1	Dust emissions from site establishment	Possible	Minor	Low	See section 5	Unlikely	Minor	Low
2	Vehicle and plant and machinery movements from the proposal site to/from the compound and laydown areas	Possible	Minor	Low		Unlikely	Minor	Low
3	Combustion emissions associated with vehicles, plant, and equipment	Likely	Minor	Medium		Possible	Minor	Low
4	Combustion emissions associated with the diesel generator	Likely	Minor	Medium		Possible	Minor	Low
5	Dust and lead emissions from abrasive blasting of lead-based paint on the Gasworks Bridge and removal of emissions via the dust extraction system	Certain	Minor	Medium		Possible	Minor	Low
6	VOC and odour emissions during repainting of the Gasworks Bridge	Possible	Minor	Low		Unlikely	Minor	Low
7	Emissions from spent abrasive and hazardous material waste contaminated with lead paint	Possible	Minor	Low		Unlikely	Minor	Low

5 Mitigation measures

The main types of air emissions likely to be emitted during proposal activities as listed in section 1.6 are dust, lead, combustion emissions, VOCs and odour. The sources of these air emissions are discussed in section 4.2.5. Table 5.1 presents recommended mitigation measures to minimise potential air quality impacts from these emission sources during proposal works.

Table 5.1 Proposed mitigation measures

RISK NO.	ACTIVITY	MITIGATION MEASURES
All	All	An Air Quality Management Plan (AQMP) would be prepared and implemented as part of the Construction Environment Management Plan (CEMP). The AQMP would outline the type and nature of emissions sources, the potential impact on nearby sensitive receptors and management measure to reduce and minimise air emissions.
1 & 2	Dust emissions associated with site establishment, vehicle , plant and machinery movements to/from the proposal site to the compound and laydown areas	Restrict/cease activities with high dust generating potential during periods of high winds (> 10 m/s)
		Cover or stabilise potentially dust-generating materials during transport to/from the proposal site to the compound and laydown areas
3	Combustion emissions from vehicles, plant and machinery	Maintain vehicles and plant and machinery to facilitate efficient operation
		Minimise diesel engine idle times and locate away from the ambient air quality monitoring equipment and sensitive receptors.
		Minimise idling time of all plant and machinery and switch off when noy in use for more than 15 minutes. Where possible locate away from the ambient air quality monitoring equipment and sensitive receptors.
4	Combustion emissions from the generator	Site the generators away from (at least 50 m) and upwind of sensitive receptor locations as well as ambient air quality monitoring equipment and the dust extraction system. Switch off the generators when not in use.
5	Abrasive blasting of paint on the Gasworks Bridge and removal of emissions via the dust extraction system	The containment system would operate under negative pressure with airlock doors. Airlocks would be installed at the access stair entrances to the containment system to ensure controlled entry and exit during the coating removal process to prevent the escape of the hazardous coating material to air. The ventilation system for the removal and extraction of dust, lead and potentially VOCs would comply with the requirements prescribed in the *AS/NZS 4361.1: Guide to hazardous paint management, Part 1: Lead and other hazardous metallic pigments in industrial applications.* .

RISK NO.	ACTIVITY	MITIGATION MEASURES
		The containment system and emission point would be sited at a location to ensure adequate dispersion of air. The height of the ventilation emission point would be at least 3 m above the height of the containment system. Where feasible vacuum shrouded abrasive blasting equipment or vacuum shrouded power tools would be used. An air quality monitoring plan would be prepared and implemented for the proposal to include as a minimum: — The requirements detailed in AS 4361.1:2017 (Appendix F) — The requirements of TfNSW Specification B220 — Emission monitoring for dust fractions (PM_{10} and $PM_{2.5}$) and lead to demonstrate the removal efficiency of the dust extraction system as per the manufacturer's specification requirements — Ambient air quality monitoring of dust fractions and lead prior to and for the duration of the abrasive blasting activity at specific locations as per the Contractors requirements. — Visual dust monitoring would be undertaken on a daily basis, the frequency and locations as per the Contractors requirements
6	Emissions from the waste liquid paint stored in the construction compound	— Use water-based paints or paints with low levels of VOCs — Use of the paints sparingly.
7	Spent abrasive and hazard material waste contaminated with lead paint	A vacuum loader's hopper would collect the waste and transfer it to bulk bags on pallets which would then be wrapped, labelled and stored in the hazardous storage area prior to being transported to a licensed waste disposal facility. All hazardous removal would be conducted in accordance with TfNSW Specification B233 and AS 4361.1: 2017.

6 Conclusion

Transport for New South Wales is proposing to carry out remediation works of the Gasworks Bridge in Parramatta, NSW to remove the existing hazardous lead paint from the bridge structure and repaint with a polyurethane-based paint system. This qualitative air quality impact assessment was prepared in support of a REF for the proposal.

This report qualitatively assessed potential air quality impacts for the proposal.

The main types of emissions likely to be generated during proposal works include dust, lead, VOCs, odour, and combustion emissions from the following sources:

- site establishment (dust of varying size fractions)
- vehicle, plant and machinery movements to/from the proposal site to the compound and laydown areas
- combustion emissions of engine fuel associated with on-site plant, equipment and vehicles
- combustion emissions from the diesel-powered generators
- emissions from abrasive blasting of the existing lead-based paint on the Gasworks Bridge and removal via the dust extraction system emission point (dust of varying size fractions, lead, and VOCs)
- emissions during repainting of the entire Gasworks Bridge (VOCs and odour)
- spent abrasive and hazardous material waste contaminated with lead-based paint (dust of varying size fractions and lead).

A risk-based approach was used for assessing the potential impacts of air emissions during proposal works based on the assessment methodology presented in section 4. Initial risk ratings were assigned to each potential air emission source without proposed mitigation measures.

With the implementation of source-specific mitigation measures in place for the proposal works to minimise potential air quality impacts, residual risks were assigned for each source. All activities potentially generating air emissions were assigned a low residual risk with proposed mitigation measures in place.

An Air Quality Management Plan (AQMP) would be prepared and implemented as part of the Construction Environment Management Plan (CEMP). The AQMP would outline the type and nature of emissions sources, the potential impact on nearby sensitive receptors and management measures to reduce and minimise air emissions. This would include both emission monitoring of the dust extraction unit and ambient air monitoring for dust and lead.

7 Limitations

This Report is provided by WSP Australia Pty Limited (*WSP*) for Allied Pinnacle Pty Ltd (*Client*) in response to specific instructions from the Client and in accordance with WSP's proposal dated May 2021 and agreement with the Client dated July 2021 (*Agreement*).

7.1 permitted purpose

This Report is provided by WSP for the purpose described in the Agreement and no responsibility is accepted by WSP for the use of the Report in whole or in part, for any other purpose (*Permitted Purpose*).

7.2 qualifications and assumptions

The services undertaken by WSP in preparing this Report were limited to those specifically detailed in the Report and are subject to the scope, qualifications, assumptions and limitations set out in the Report or otherwise communicated to the Client.

Except as otherwise stated in the Report and to the extent that statements, opinions, facts, conclusion and / or recommendations in the Report (*Conclusions*) are based in whole or in part on information provided by the Client and other parties identified in the report (*Information)*, those Conclusions are based on assumptions by WSP of the reliability, adequacy, accuracy and completeness of the Information and have not been verified. WSP accepts no responsibility for the Information.

WSP has prepared the Report without regard to any special interest of any person other than the Client when undertaking the services described in the Agreement or in preparing the Report.

7.3 use and reliance

This Report should be read in its entirety and must not be copied, distributed or referred to in part only. The Report must not be reproduced without the written approval of WSP. WSP will not be responsible for interpretations or conclusions drawn by the reader. This Report (or sections of the Report) should not be used as part of a specification for a project or for incorporation into any other document without the prior agreement of WSP.

WSP is not (and will not be) obliged to provide an update of this Report to include any event, circumstance, revised Information or any matter coming to WSP's attention after the date of this Report. Data reported and Conclusions drawn are based solely on information made available to WSP at the time of preparing the Report. The passage of time; unexpected variations in ground conditions; manifestations of latent conditions; or the impact of future events (including (without limitation) changes in policy, legislation, guidelines, scientific knowledge; and changes in interpretation of policy by statutory authorities); may require further investigation or subsequent re-evaluation of the Conclusions.

This Report can only be relied upon for the Permitted Purpose and may not be relied upon for any other purpose. The Report does not purport to recommend or induce a decision to make (or not make) any purchase, disposal, investment, divestment, financial commitment or otherwise. It is the responsibility of the Client to accept (if the Client so chooses) any Conclusions contained within the Report and implement them in an appropriate, suitable and timely manner.

In the absence of express written consent of WSP, no responsibility is accepted by WSP for the use of the Report in whole or in part by any party other than the Client for any purpose whatsoever. Without the express written consent of WSP, any use which a third party makes of this Report or any reliance on (or decisions to be made) based on this Report is at the sole risk of those third parties without recourse to WSP. Third parties should make their own enquiries and obtain independent advice in relation to any matter dealt with or Conclusions expressed in the Report.

7.4 disclaimer

No warranty, undertaking or guarantee whether expressed or implied, is made with respect to the data reported or the Conclusions drawn. To the fullest extent permitted at law, WSP, its related bodies corporate and its officers, employees and agents assumes no responsibility and will not be liable to any third party for, or in relation to any losses, damages or expenses (including any indirect, consequential or punitive losses or damages or any amounts for loss of profit, loss of revenue, loss of opportunity to earn profit, loss of production, loss of contract, increased operational costs, loss of business opportunity, site depredation costs, business interruption or economic loss) of any kind whatsoever, suffered on incurred by a third party.

Bibliography

Commonwealth Government, National Environment Protection Council Act 1994

Commonwealth Government, National Environment Protection (Ambient Air Quality) Measure (Air NEPM) [February 2021]

Institute of Air Quality Management, Guidance on the assessment of dust from demolition and construction, 2014

National Pollutant Inventory (2008). Emission Estimation Technique Manual for Combustion Engines V3.0

NSW Government, Protection of the Environment Operations Act 1997

NSW Government, Protection of the Environment (Clean Air) Regulations 2010

NSW Environment Protection Authority (2022) Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, August 2022

Transport for NSW, B223 (Management of Lead Chromium and Asbestos in Bridge Maintenance Painting)

Transport for NSW, B220 (Protective treatment of Bridge Steel Work)

Australian Standard 4361.1: 2017, Guide to hazardous paint management, Part 1: Lead and other hazardous metallic pigments in industrial applications

Appendix F – Biodiversity assessment report

Transport for NSW

Biodiversity assessment report for REF

Gasworks Bridge Remediation Macarthur Street Parramatta

March 2023

NSW GOVERNMENT

transport.nsw.gov.au

Table of contents

List of tables

List of figures

Executive summary

TfNSW is to conduct remediation works on the Gasworks Bridge which is located over the Parramatta River on Macarthur Street in the suburb of Paramatta. The Proposal would involve the removal of existing hazardous lead paint from the bridge structure and repainting with a polyurethane paint system in areas nominated by the principal.

The key impacts of the proposal include the removal of up to 0.02 hectares of native vegetation (consisting of the trimming 13 individual mangroves) and associated habitat.

The summary of native vegetation removal is presented in the table below:

Plant community type (PCT)	Condition class	BC Act	EPBC Act	FM Act	Percent cleared in IBRA region[1]	Proposal area[2] (Ha)
PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Intact	-	-	Marine Vegetation	86%	0.02
Total native vegetation impacted						0.02

No threatened ecological communities listed under the BC Act and/or the EPBC Act were recorded within the study area.

No threatened flora species listed under the BC Act and/or the EPBC Act were recorded or have habitat within the study area.

No threatened fauna were recorded within the study area however, likelihood of occurrence assessments identified an 2 threatened fauna species as having a moderate or higher likelihood of occurrence within the study area, being:

- *Micronomus norfolkensis* (Eastern Freetail-bat)
- *Myotis macropus* (Southern Myotis)

Assessments of impact significance were conducted for the two threatened fauna species with habitat that is considered likely to be affected by the proposal. These impact assessments determined that the proposal is unlikely to lead to a significant impact on these two threatened fauna species, or their habitats.

The study area occurs within land mapped under the SEPP (Coastal Management) 2018 as areas of Coastal Wetlands and Proximity to Coastal Wetlands. As advised by TfNSW *the installation of the scaffolding would not result in any impacts that would permanently modify the value of the Coastal Wetland area nor are any ground disturbance works beyond the construction of the scaffolding be required, the proposed works would not affect land or development regulated by the Coastal Management SEPP.*

The study area is mapped as key fish habitat by the Department of Primary Industries (DPI). and occurs within coastal wetlands under SEPP Coastal Management 2018. Any area that may be impacted upon that occurs within coastal wetlands or proximity to coastal wetlands is classified as Type 1 – highly sensitive key fish habitat. Any impact to Type 1 key fish habitat is generally not approved by the DPI. However, as the impact is minor (branch trimming) and temporary it is recommended that consultations occur with the DPI and approval may be given.

Mangroves are classified as Marine Vegetation under the FM Act. Any cutting, removing, destroying, transplanting, shading or damaging in any way requires a Part 7 Fisheries Management Act Permit.

Given the proposal unlikely to have a significant impact on threatened species, populations, ecological communities or their habitats, a Species Impact Statement (SIS) is not required under the BC Act to support this proposal. In respect to Matters of National Environmental Significance (MNES) matters including threatened flora, fauna and communities, a referral of this proposal for consideration as a controlled action under the EPBC Act is not required. The Transport for NSW No Net Loss Guidelines (July 2022) indicates that offsets are not required for this proposal as the impacts do not exceed biodiversity offset thresholds.

1. Introduction

1.1 Proposal background

Gasworks bridge is an iron lattice design and was completed in 1885 with an overall length of 110m at 10.3m wide. On the western side of the bridge there is a pedestrian walkway. The bridge and the walkway are both major thoroughfares for the local community. Historic works on the bridge included use of hazardous lead paint.

Fulton Hogan on behalf of Transport for NSW (TfNSW) propose to complete remediation works on the Gasworks Bridge which is located over the Parramatta River on Macarthur Street in the suburb of Parramatta.

1.2 The proposal

The proposal involves remediation works on the Gasworks Bridge which is located over the Parramatta River on Macarthur Street in the suburb of Paramatta. The Proposal would involve the removal of existing hazardous lead paint from the bridge structure and repainting with a polyurethane paint system in areas nominated by the principal.

The Proposal would include:

- installation of a site compound and equipment laydown areas (Areas A, B and C)
- sealing of the concrete deck of the bridge structure (Spans 1-5)
- installation of temporary traffic management (steel barriers) and relocation of existing zebra crossing
- staged installation of an encapsulated (containment) scaffolding system on the bridge structure
- staged removal of the existing lead paint coating from all wrought iron and steel elements of the bridge and application of a new protective paint and coating (blasting, priming and coating works)
- bridge repair works (structural and non-structural) including:
  - remediation of structural steel elements of the bridge
  - repair/replacement of corroded rivets
  - treatment of flame cut holes
  - cleaning bridge scuppers (drainage)
  - removal and replacement of mesh screen on pedestrian walkway on western side of the bridge
  - removal and replacement of a 20m rail section on eastern side of the bridge, like-for-like
  - replacement of timber planks (like for like) on walkway on western side of bridge including re-fixing loose timbers and removing splintering sections
  - removal and replacement of existing W beams on roadside truss
  - Removal of redundant gas main on eastern side of bridge, which would include the removal of bolts and lifting of sections of the pipe for offsite removal (in accordance with waste disposal guidelines)
  - cleaning and removal of moss, vegetation and graffiti from bridge piers
  - rectification of concrete spalling and cracks.
- removal/disposal of waste materials staged removal (and cleaning) of the containment and scaffolding system
- demobilisation of site compound and equipment laydown areas, and removal of traffic management.

1.2.1 Assessment areas

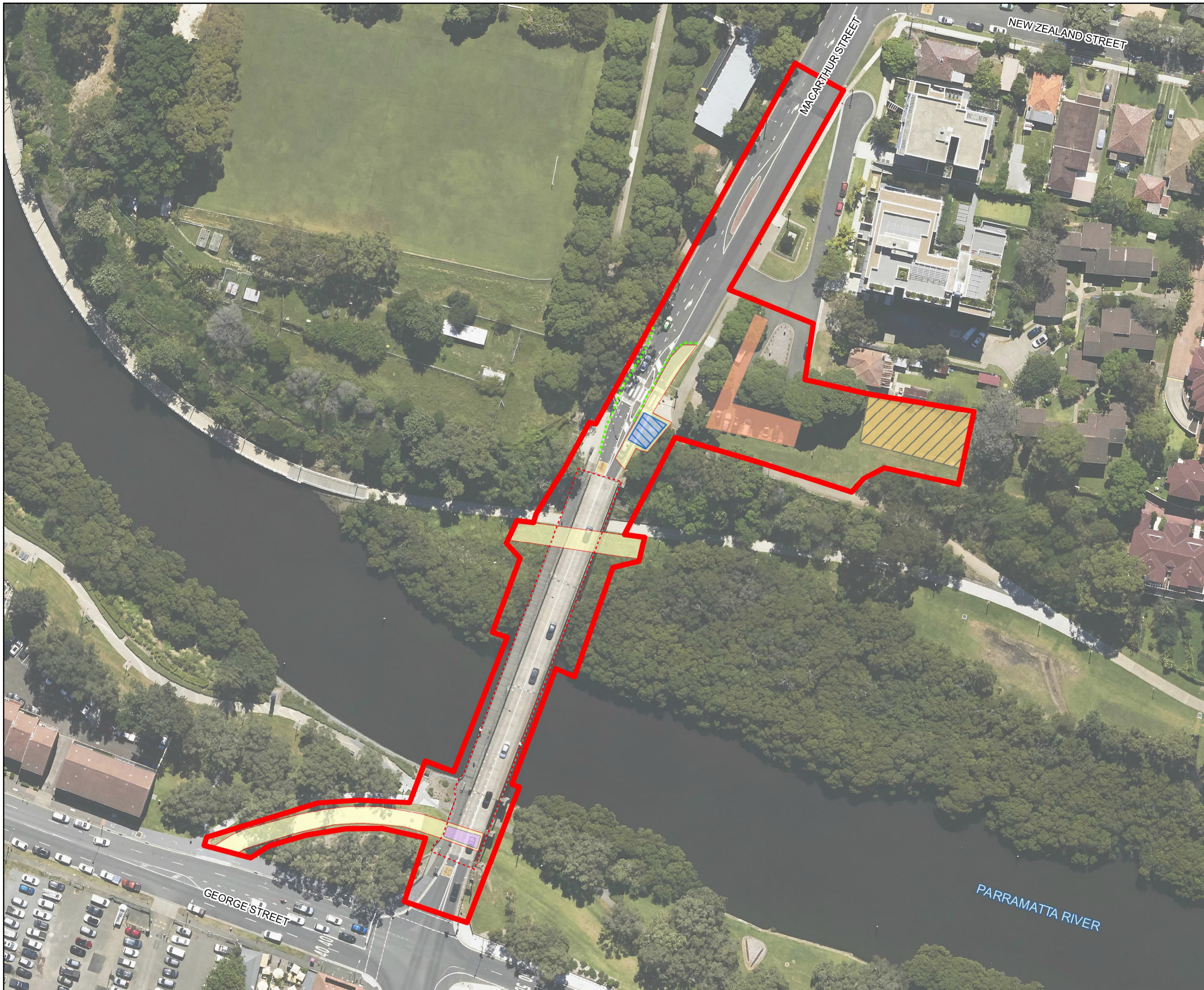
The Proposal is located on Macarthur Street, Parramatta, spanning the Parramatta River in the City of Parramatta Local Government Area (LGA). The Proposal is located approximately 18 kilometres west of Sydney's central business district (CBD) and adjacent the Parramatta CBD (Figure 1.1 and Figure 1.2).

The following areas are discussed throughout the Biodiversity Assessment Report (BAR) and are defined as:

- Proposed Remediation Impact Zone (proposal site): the proposal is the environmental assessment construction footprint which includes impacts as a result of equipment laydown area, proposed site compound, temporary access for installation of scaffolding system defined by Transport for NSW (TfNSW) for the proposal (refer to Figure 1.1).
- Study area: is shown in Figure 3.1 and is generally a 20 buffer around the Remediation impact zone, except for the northern component adjacent to Macarthur Street where the study area is consistent with the proposed remediation impact zone.
- Locality: This is taken to be a 10 kilometre radius surrounding the proposal footprint.
- The study area is located in the Sydney Basin bioregion (Cumberland subregion) (Thackway and Cresswell, 1995).

Gasworks Bridge

Figure 1.1
Location of the proposal

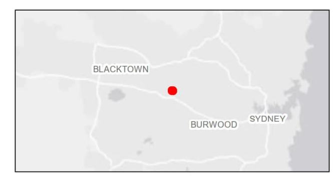


Legend

- Roads
- Watercourses
- Traffic Management Barriers
- Proposal Site
- Bridge Structure

Construction Areas

- Sand blasting equipment
- Construction parking
- Decontamination unit
- Equipment laydown area
- Site compound



0 10 20 m

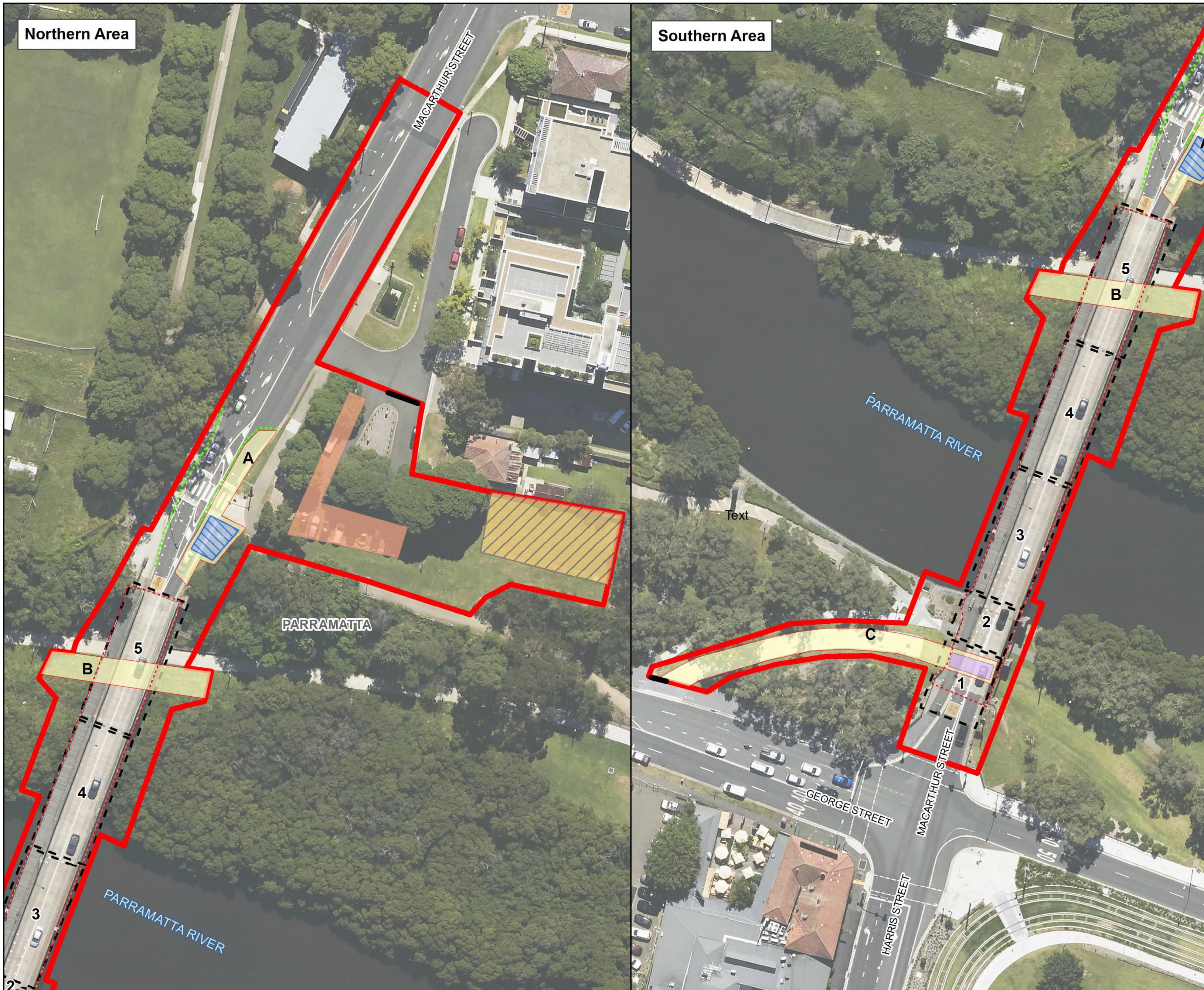
Coordinate system: GDA2020 MGA Zone 56

Scale ratio correct when printed at A3

1:1,000 Date: 1/06/2023

Data Sources: Imagery © Metromap 2020

C:\Users\AURC508271\WSP O365\AU-WKG - Geospatial - AIS - Documents\Projects\PS123629_GasworksBridge_REF_Parramatta\Mxd\01_REF\PS123629_REF_Fig1.1_LocationOfTheProposal_r1v8.mxd



Gasworks Bridge

Figure 1.2
Key features of the proposal

Legend

- Roads
- Watercourses
- Traffic Management Barriers
- Access Entry Area
- Proposal Site
- Bridge Span
- Bridge Structure

Construction Areas

- Sand blasting equipment
- Construction parking
- Decontamination unit
- Equipment laydown area
- Site compound

Coordinate system: GDA2020 MGA Zone 56

Scale ratio correct when printed at A3

1:800 Date: 1/06/2023

Data Sources: Imagery © Metromap 2020

C:\Users\AURC508271\WSP O365\AU-WKG - Geospatial - AIS - Documents\Projects\PS123629_GasworksBridge_REF_Parramatta\Mxd\01_REF\PS123629_REF_Fig3.1_KeyFeaturesOfTheProposal_r1v9.mxd

1.3 Legislative context

A Review of Environmental Factors (REF) is prepared to satisfy Transport for NSW (TfNSW) duties under s.5.5 of the EP&A Act to "examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity" and s.5.5 in making decisions on the likely significance of any environmental impacts. This biodiversity impact assessment forms part of the REF being prepared for the Gasworks Bridge Remediation Macarthur Street Parramatta and assesses the biodiversity impacts of the proposal to meet the requirements of the EP&A Act.

The BC Act requires that the significance of the impact on threatened species, populations and threatened ecological communities is assessed using the test listed in Section 7.3 of the BC Act. Similarly, Part 7A of the FM Act requires that significance assessments are undertaken in accordance with Division 12 of the FM Act. Where a significant impact is likely to occur, a species impact statement (SIS) must be prepared in accordance with the Environment Agency Head's requirements, or a biodiversity development assessment report (BDAR) must be prepared by an accredited assessor in accordance with the biodiversity assessment method (BAM) (DPIE 2020a).

In September 2015, a 'strategic assessment' approval was granted by the Federal Minister in accordance with the EPBC Act. The approval applies to TfNSW road activities being assessed under Division 5.1 (formerly Part 5) of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species.

As a result, TfNSW road proposals assessed via an REF:

- Must address and consider potential impacts on EPBC Act listed threatened species, populations, ecological communities and migratory species, including application of the "avoid, minimise, mitigate and offset" hierarchy
- Do not require referral to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for these matters, even if the activity is likely to have a significant impact
- Must use the Biodiversity Assessment Method (BAM) to calculate credits that would offset significant impacts on EPBC Act listed threatened species, populations, ecological communities and migratory species.

Assessments of impact significance are required for all relevant biodiversity values in accordance with the *Matters of National Environmental Significance: Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999* (DoE 2013).

2. Methods

2.1 Personnel

This BAR has been prepared by a team of qualified and experienced ecologists and accredited BAM assessors (see Table 2.1).

Table 2.1: Personnel

Name	Role	Qualifications
Toby Lambert	Bachelor of Science Accredited BAM Assessor (BAAS17046)	Principal Ecologist – Technical review
Lukas Clews	Bachelor of Science (Hons) Masters of Scientific Studies Diploma of Conservation and Land Management Accredited BAM Assessor (BAAS17060)	Principal Ecologist –Report preparation
Deborah Landenberger	Bachelor of Science (Hons) Accredited BAM Assessor (BAAS18187)	Principal Ecologist – Report preparation
Sebastian Miller	Bachelor of Marine Science	Ecologist – Field survey and report preparation
David Naiken	Bachelor of Environmental Science (Major GIS) Master of Climate Change	GIS consultant – map preparation and data management

2.2 Background research

A background review of existing information was carried out to identify:

- Threatened terrestrial and aquatic species and their habitat
- Threatened ecological communities
- Important habitat for migratory species
- Areas of outstanding biodiversity value.

The desk-based assessment of the existing environment within a nominal search area of 10 kilometres surrounding the study area included analysis of the following information sources:

- BioNet - the website for the Atlas of NSW Wildlife and Threatened Biodiversity Data Collection (TBDC) – searched 22 September 2022. (Environment Energy and Science, 2021d)
- BioNet Vegetation Classification database – reviewed 19 August 2022.
- BAM calculator (BAM-C)
- Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool – searched 19 August 2022.
- NSW DPI Fisheries Spatial Data Portal. – accessed 22 September 2022.
- Regional vegetation mapping e.g., 'State Vegetation Type Map: Western Region Version 1.0. VIS_ID 4492 (Office of Environment and Heritage, 2019)'.

- Commonwealth Atlas of Groundwater Dependent Ecosystems (GDE): GDE Atlas Map: Water Information: Bureau of Meteorology (bom.gov.au) – accessed 22 September 2022.
- Topographic map and arial photographs
- Priority weed listings for the Greater Sydney region (Department of Primary Industries 2021)
- NSW Flora Online (PlantNET) – accessed 19 August 2022.
- NSW Mitchell Landscapes (Department of Planning Industry and Environment, 2021b)
- Interim Biogeographic Regionalisation of Australia (IBRA version 7.0)
- Coastal management areas identified by the Resilience and Hazards SEPP 2022.
- Register of Declared Areas of Outstanding Biodiversity Value (AOBV) – Critical habitat declarations in NSW (Department of Planning Industry and Environment, 2021a)
- Register of Critical Habitat (Department of Agriculture Water and the Energy, 2021d)
- BioNet Vegetation Classification Database (Environment Energy and Science, 2021c)
- Species Profiles and Threats Database (Department of Agriculture Water and the Energy, 2021e)
- Other relevant documents and data that were reviewed as part of this study are referenced throughout this report where appropriate.

2.3 Vegetation assessment

Vegetation assessment of the study area was carried out on a one day site inspection on by WSP on 3 September 2021. The field survey aimed to ground-truth the results of the background research including State Vegetation Type Map and to assess any areas not previously mapped.

2.3.1 Vegetation mapping

Preliminary mapping of vegetation community boundaries was undertaken through analysis of existing vegetation mapping and aerial photograph interpretation.

Analysis of the aerial photographs was used to identify areas of disturbance (e.g. buildings, vehicle tracks, footpaths and power lines), vegetation structure and likely native versus exotic species composition throughout the study area. This provided an initial definition of vegetation communities into simple structural and disturbance classifications for verification during field surveys.

Vegetation within the study area and locality has been previously mapped at the regional scale by the following:

- NSW State Vegetation Type Map, State Government of NSW and Department of Planning and Environment 2022
- The Native Vegetation of the Sydney Metropolitan Area - Version 3.1 (OEH, 2016) VIS_ID 4489.

For the purposes of this report, native vegetation is defined in section 1.6 of the BC Act which states that native vegetation and clearing native vegetation have the same meanings as in Part 5A of the *Local Land Services Act 2013*. Part 5A 60B of the *Local Land Services Act 2013* defines the meaning of native vegetation as any of the following types of plants native to New South Wales.

- Trees (including any sapling or shrub or any scrub)
- Understorey plants
- Groundcover (being any type of herbaceous vegetation)
- Plants occurring in a wetland.

A plant is native to New South Wales if it was established in New South Wales before European settlement.

2.3.2 Vegetation survey and classification

The field surveys aimed to ground-truth the results of the background research including desktop analysis of vegetation and habitat assessment. The floristic diversity and possible presence of threatened species was assessed using a combination of survey techniques including; plot-based (quadrat/transect) and rapid point assessments in accordance with the relevant guidelines.

Field validation (ground-truthing) of the existing mapping within the proposal area was completed to confirm the vegetation structure, dominant canopy species, native diversity, underlying geology, condition and presence of threatened ecological communities. This was based on the completion of random meanders, rapid data points and drive by assessments.

One vegetation integrity plot, as described in the Biodiversity Assessment Methodology (BAM) (Department of Planning Industry and Environment, 2020), was completed within the one PCT recorded. Six rapid data points were also completed throughout the study area (see Figure 3.1).

The information collected during the survey was used to determine the Plant Community Type (PCT) for each vegetation type recorded as detailed in the BioNet Vegetation Classification System (Office of Environment Energy and Science, 2021) and whether vegetation within the study area aligned to any state or commonwealth listed ecological communities.

Vegetation zones

The vegetation within the study area was firstly assessed to a PCT and then aligned to a vegetation zone which is defined in the BAM as 'an area of native vegetation on the subject land that is the same PCT and has a similar broad condition state' (Department of Planning Industry and Environment, 2020). A broad condition state infers that the vegetation has a similar tree cover, shrub cover, ground cover, weediness or combinations of these attributes which determine vegetation condition.

The broad condition states that were applied to vegetation within the study area are summarised in Table 2.2. These factors were defined by using factors such as levels of disturbance, weed invasion and resilience.

Vegetation integrity scores were not calculated for the vegetation. The Mangroves are considered typical for the PCT and are considered to be intact.

Table 2.2: Vegetation board conditions states

Broad Condition State	Description
Intact	Native vegetation where all tree, shrub, grass and/or forb structural growth form groups expected for a plant community type are present. Exotic weed cover is generally <30%.
Modified	Native vegetation where one or more structural understorey components of the vegetation is entirely removed or severely reduced. Exotic weed cover is generally >30%.
Regrowth	Native vegetation where a proportion of over-storey and mid-storey species characteristic of the PCT are naturally regenerating. Most over-storey species present have a diameter at breast height <5cm, and there are no trees at the large tree benchmark present. This native vegetation may also include native plantings. Groundcover component is generally >50% native however may be co-dominated by exotic species in highly modified landscapes.
Derived	PCTs that have changed to an alternative stable state because of land management practices since European settlement. Over-storey structural components of derived communities have either entirely been removed or are severely reduced (i.e. derived native grasslands with or without scatted paddock trees). Exotic weed cover is <50%.
Native plantings	Areas where native plant species (both indigenous and non-indigenous to the region) have been planted. Groundcover component may be either be dominated or co-dominated by native and exotic species depending on current or historic land management practices.

Plot and transect-based vegetation survey

Vegetation surveys were carried out in accordance with the BAM (Department of Planning Industry and Environment, 2020). A plot based full floristic survey was carried out based on a 20 x 20 m quadrat, with function data collected using and 20m x 50m plot (henceforth referred to as a vegetation integrity plot (VI plot)).

Native vegetation recorded within the study area was aligned to Plant Community Types (PCTs) as contained in the BioNet Vegetation Classification Database (Environment Energy and Science Group, 2021). This was achieved by identifying native vegetation to formation, class and type and its corresponding Threatened Ecological Community (where applicable). Furthermore, other characteristics such as florist composition, underlying geology, soil type, landform and other description attributes were collected where available and assessed against BioNet Vegetation Classification Database PCT profiles.

Areas of non-native vegetation were also identified and mapped. Data was collected in these areas through rapid point assessments to show the composition and abundance of non-native vegetation within the study area.

One vegetation zone consisting of one PCT was recorded the number of plots completed for this PCT is provided in Table 2.4. As both remaining vegetation zones could not be assigned to a PCT, vegetation integrity plots were not done.

Table 2.3: Minimum number of plots required and completed per vegetation zone

Veg zone	PCT	Condition	Area (ha)	No. plots required	No. plots completed (plot IDs)
Zone 1	PCT 920: Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Intact	0.18	1	1 (Q1)
Zone 2	Miscellaneous ecosystem – Planted Native Vegetation	n/a	0.38	none	0
Zone 3	Miscellaneous ecosystem – Exotic Grassland	n/a	0.66	none	0

Random Meander

Random meander surveys are a variation of the transect type survey and were completed in accordance with the technique described by Cropper (1993), whereby the recorder walks in a random meander throughout the study area recording dominant and key plant species (eg threatened species, priority weeds), boundaries between various vegetation communities and condition of vegetation. The time spent in each vegetation community was generally proportional to the size of the community and its species richness.

2.3.3 Patch size

According to Section 4.3.2 of the BAM a patch is an area of native vegetation that occurs on the subject land and includes native vegetation that has a gap of less than 100m from the next area of native vegetation (or ≤3m for non-woody ecosystems). A patch may extend onto adjoining land.

The vegetation zones within the study area are within 100m of continuous strips of mangroves along Parramatta River, Duck River and other tributaries. Due to this close proximity all vegetation is considered to be part of a greater patch of 25-100 ha in size.

2.3.4 Native vegetation cover

All vegetation within the study area was mapped and categorised into native vegetation PCTs and their condition, or as miscellaneous ecosystem and type where a PCT could not be assigned to the vegetation present. Using GIS software the total areas of each category within the subject land were calculated and totalled. Table 2.5 summarises the native vegetation cover in the landscape assessment area.

Table 2.4: Native vegetation cover in the assessment area

Assessment area (ha)	1.22 ha
Total area of native vegetation cover (ha)	0.56 ha
Percentage of native vegetation cover (%)	46%
Class (0-10, >10-30, >30-70 or >70%)	>30-70%

2.4 Threatened species assessment

The list of candidate threatened species for assessment was developed using the database searches. Some species were removed from the assessment due to the absence of suitable habitat in the development study area. A threatened species was excluded from needing further assessment if:

- Ecological information about a species provided in Threatened Biodiversity Data Collection (EES Group, 2021) or published, peer reviewed literature, suggests that the species is unlikely to occur, or habitat is unlikely to be suitable.
- Habitat constraints (defined in Threatened Biodiversity Data Collection (EES Group, 2021) are not present within the subject land.
- Habitat is not suitable because it is substantially degraded.
- If the species is a vagrant in the IBRA subregion, the species is considered unlikely to occur and no further assessment is required.

2.4.1 Habitat suitability assessment

Opportunistic sightings of animals were recorded during field surveys. Evidence of animal activity, such as scats, diggings, scratch marks, nests/dreys, burrows etc., was also noted. This provided indirect information on animal presence and activity.

Fauna habitat assessments were undertaken to assess the likelihood of threatened fauna species (those species known or predicted to occur within the locality from the literature and database review) occurring within the study area. Fauna habitat assessments were the primary assessment tool in assessing whether threatened species are likely to occur within the study area, if they are not observed during field surveys. Fauna habitat characteristics assessed included:

- structure and floristics of the canopy, understorey and ground cover, including the presence of flowering and fruiting trees representing potential foraging resources;
- presence of hollow-bearing trees offering potential roosting and breeding habitat for arboreal mammals, birds and herptiles;
- presence of ground cover vegetation, leaf litter, rock outcrops and fallen timber increasing niche opportunity for ground-dwelling mammals, birds and herptiles;
- presence of waterways (ephemeral or permanent) and water bodies.

Condition of Habitat

The following criteria were used to evaluate the condition of habitat values:

- Good: A full range of fauna habitat components are usually present (for example, old growth trees, fallen timber, feeding and roosting resources) and habitat linkages to other remnant ecosystems in the landscape are intact.
- Moderate: Some fauna habitat components are missing or greatly reduced (for example, old-growth trees and fallen timber), although linkages with other remnant habitats in the landscape are usually intact, but sometimes degraded.
- Poor: Many fauna habitat elements in low quality remnants have been lost, including old growth trees (for example, due to past timber harvesting or land clearing) and fallen timber, and tree canopies are often highly fragmented. Habitat linkages with other remnant ecosystems in the landscape have usually been severely compromised by extensive clearing in the past.

2.4.2 Targeted flora surveys

Due to the vegetation types present within the study area, there are no threatened flora species considered likely to occur in the study area and therefore no targeted surveys were undertaken (see Appendix B for Likelihood of Occurrence tables).

2.4.3 Targeted fauna surveys

The site survey included inspections for threatened microbat roosting potential inside infrastructure associated with Gasworks Bridge. The OEH (2018) 'Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method was adhered to however no suitable roosting habitat was observed.

No other targeted fauna surveys were undertaken.

2.5 Aquatic surveys

The habitat value of waterways (i.e. habitat sensitivity and classification of waterways for fish passage) is characterised in accordance with NSW DPI (Fisheries) document Policy and Guidelines for fish habitat conservation and management (Department of Primary Industries, 2013).

No formal aquatic surveys were conducted during the field surveys.

The Gasworks Bridge crosses the Parramatta River. No threatened aquatic species habitat was mapped within the study area. However, the Parramatta River has been mapped as Key Fish Habitat (Department of Primary Industries, 2021).

2.6 Limitations

No sampling technique can eliminate the possibility that a species is present within a study area. For example, some species of plant may be present in the soil seed bank and some fauna species use habitats on a sporadic or seasonal basis and may not be present within the study area during surveys. The conclusions in this report are based upon data acquired for the proposal and the environmental field surveys, therefore, they are merely indicative of the environmental condition of the study area at the time of preparing the report, including the presence or otherwise of species. It should be recognised that study area conditions, including the presence of threatened species, can change with time.

Targeted surveys have been conducted to detect target sedentary animal species and threatened flora species that are considered likely to occur within the study area based on habitat characteristics and previous records. As the actual distribution and the range of habitat utilised by some species is not fully understood, there is always a small possibility that other species could occur on the site despite being considered to have a low likelihood of occurrence based on their known range and known habitats.

2.6.1 Other limitations

Other limitations relating to the conclusions contained in this report are detailed in the following sections.

Reliance on externally supplied information

In preparing this study, WSP has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations. Except as otherwise stated in the study, WSP has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this study (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. WSP will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

Study for benefit of client

This document has been prepared for the exclusive benefit of the client and no other party. WSP assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with in this study, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in this study (including without limitation matters arising from any negligent act or omission of WSP or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in this study).

Other parties should not rely upon the study or the accuracy or completeness of any conclusions and should make their own inquiries and obtain independent advice in relation to such matters.

2.6.2 Changing circumstances

To the best of WSP's knowledge, the proposal presented and the facts and matters described in this study reasonably represent the client's intentions at the time of preparation of the study. However, the passage of time, the manifestation of latent conditions or the impact of future events (including a change in applicable law) may have resulted in a variation of the proposal and of its possible environmental impact.

WSP will not be liable to update or revise this assessment to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the document.

3. Existing environment

This section describes the environmental context of the study area including abiotic and biotic features of the landscape area. The context of the study area assists in assessing likelihood of occurrence for threatened species and determining PCTs.

A summary of landscape features providing landscape context for the subject land, including IBRA bioregions and subregions, Mitchell landscapes, catchment areas and land uses is provided in Table 3.1.

Table 3.1: Landscape features

Landscape feature	Subject land
IBRA bioregions and subregions	Sydney Basin Bioregion/Cumberland subregion
NSW landscape regions (Mitchell landscapes)	Ashfield Plains
Local Government Area (LGA)	City of Parramatta Council
Native vegetation extent in the buffer area	Within the study area buffer, as defined in the BAM, native vegetation cover has been identified as 30 – 70%
Cleared areas	Cleared areas are associated with residential housing, parks, and sporting field.
Rivers and watercourses	One first order river occur within the study area being the Parramatta River (Figure 3.3).
Wetlands	A SEPP Coastal Management 2018 Coastal Wetland and associated proximity buffers occurs within the study area
Connectivity features	Native vegetation within the study area is part of the riparian vegetation that occurs along the Parramatta River. The riparian vegetation on both banks extends to a weir to the west. Connectivity of the native vegetation to the east is part of the riparian vegetation occurs along the banks of the Parramatta River to Sydney Harbour.
Areas of Geological Significance and Soil Hazard Features	There are no areas identified to have geological significance. Potential high risk acid sulphate soils, associated with low lying alluvial flats along the northern bank of the Parramatta River have been identified within the study area.
Areas of outstanding biodiversity value	None present.
Key Fish Habitat	The Parramatta River is mapped as Key Fish Habitat (Department of Primary Industries, 2021c)

3.1 Plant community types and vegetation zones

This report describes Plant Community Types (PCTs) in terms of their floristic composition, geological substrate and soils, landscape position, location, and relevant regional vegetation classification. The distribution of PCTs within the subject land is outlined in Table 3.2. Descriptions of the vegetation that occurs in the subject land are provided below and the vegetation is matched to the most likely PCT as described in the BioNet Vegetation Classification database.

One PCT was recorded in the study area:

- PCT 920: Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion

In addition, two non-native vegetation types were assigned to a miscellaneous ecosystem class, being:

- Miscellaneous ecosystem – Planted Native Vegetation
- Miscellaneous ecosystem – Exotic grassland

Table of 3.1 outlines the vegetation zones within the study area.

Table 3.2: Plant community types and area of impact

Veg. zone	Plant community type (PCT)	Condition Class	Threatened ecological community	Area (ha)		Patch size class	VI score
				Study area	Impacted area		
Zone 1	PCT 920: Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Intact	No	0.18	0.02 of trimming of Mangroves	25-100 ha	Not calculated
			Total extent of native vegetation	0.18	0.02		
Zone 2	Miscellaneous ecosystem – Planted Native vegetation	n/a	No	0.38	0.04	NA	NA
Zone 3	Miscellaneous ecosystem – Exotic Grassland	n/a	No	0.66	0.62	NA	NA
			Total extent of non-native vegetation	1.03	0.66		
			Total native and non-native vegetation	1.22	0.68		


Gasworks Bridge
Figure 3.1
Plant community types
Legend
Vegetation Integrity Plot
Rapid Data Points
Roads
Watercourses
Access Entry Area
Proposal Site
Study Area
Bridge Structure
Bridge Span
Construction Areas
Sand blasting equipment
Construction parking
Decontamination unit
Equipment laydown area
Site compound
Plant Community Types
1 - PCT 920 - Mangrove forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion
2 - Miscellaneous ecosystem - exotic grassland
3 - Miscellaneous ecosystem - planted native vegetation
BLACKTOWN
BURWOOD
SYDNEY
Coordinate system: GDA2020 MGA Zone 56
Scale ratio correct when printed at A3
1:1,000
Date: 1/06/2023
Data Sources: Imagery © Metromap 2020
MACARTHUR STREET
GEORGE STREET
PARRAMATTA RIVER
A
B
C
C:\Users\AURC508271\WSP O365\AU-WKG - Geospatial - AIS - Documents\Projects\PS123629_GasworksBridge_REF_Parramatta\Mxd\01_REF\PS123629_REF_Fig6.16_PlantCommunityTypes_r1v7.mxd

3.1.1 PCT 920: Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion

Description

The occurrence of this vegetation type within the study area is illustrated in Figure 3.1 with photographic representation provided in Photo 3.1 and Photo 3.2. An overview of floristic and structural composition is presented in Table 3.3 and a general description provided below.

PCT ID	920
PCT name	Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion
Vegetation class	Mangrove Swamps
Vegetation formation	Saline Wetlands
Estimate of per cent cleared	86 %
Area in study area	0.18 ha
Conservation status	Does not form part of any listed threatened ecological community under either the BC Act or EPBC Act. This PCT is mapped as key fish habitat as identified under the FM Act.
Vegetation zones (condition) and plots	Zone 1 (intact), plot Q1

Justification for PCT selection:

In selecting the most representative PCT for this vegetation type, the following candidate PCTs were considered;

- PCT 916 – Mangrove – Grey Mangrove low closed forest of the NSW Coastal Bioregion
- PCT 918 – Mangrove – River Mangrove low closed forest of the NSW Coastal Bioregion
- PCT 920 – Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion.

Based on the dominance of both *Aegiceras corniculatum* (River Mangrove), *Avicennia marina* subsp. *australasica* (Grey Mangrove) and the landscape position fringing a tidal portion of the Parramatta River PCT 920 was considered the closest representative PCT.

All vegetation in PCT 920 was considered to be intact condition.

Floristic and structural summary of PCT 920 within the study area

Growth form	Average % foliage Cover	Typical species (native and exotic)
Trees	62	*Avicennia marina* subsp. *australasica* (Grey Mangrove)
Shrubs	45	*Aegiceras corniculatum* (River Mangrove)
Grass and grass-like	0	None recorded
Forb	0.8	*Tetragonia tetragonoides* (New Zealand Spinach) and *Samolus repens* (Creeping Brookweed)
Fern	0	None recorded

Other	0	None recorded
Exotic	0	None recorded
High Threat Exotic	0	None recorded

3.1.2 Miscellaneous ecosystem – Planted Native Vegetation

This vegetation type does not align to any recognised plant community type in NSW and is the result of planted native vegetation by City of Parramatta Council. This vegetation assemblage is the dominant vegetation on the southern side of the Parramatta River. Small areas of planted vegetation occur to the north of the Parramatta River adjoining the shared pathways.

The planted vegetation included shrubs, trees, groundlayer species and planted sedges.

This vegetation assemblage is dominated by *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Corymbia maculata* (Spotted Gum), *Westringia fruticosa* (Coastal Rosemary), *Leptospermum polygalifolium* subsp. *polygalifolium* (Lemon Scented Tea-tree), *Kunzea ambigua* (Tick Bush), *Themeda trianda* (Kangaroo Grass), *Carex appressa* (Tall Sedge), *Cenchrus clandestinus* (Kikuyu) and *Imperata cylindrica* subsp. *major* (Blady Grass).

Photo 3.1 Miscellaneous ecosystem – Planted Native Vegetation to the north of George Street

Photo 3.2 Planted sedges adjoining Mangroves on the northern side of the Parramatta River

3.1.3 Miscellaneous ecosystem – Exotic Grassland

This vegetation type does not align to any recognised plant community type in NSW due to its limited native vegetation and degraded condition. This vegetation assemblage is occurs within parklands and adjoins the shared pathways (Photo 3.3). Within the study area this vegetation type was mostly dominated by exotic perennial grass species such as *Axonopus fissifolius** (Narrow-leaf Carpet Grass), *Cenchrus clandestinus** (Kikuyu), *Ehrharta erecta** (Panic Veldtgrass), *Bromus catharticus** (Prairie Grass) *Plantago lanceolata** (Lambs Tongue) and *Hypochaeris radicata**

Photo 3.3 Miscellaneous ecosystem – Exotic Grassland

3.2 Threatened ecological communities

No threatened ecological communities listed under the BC Act or the EPBC Act was recorded within the study area.

3.3 Groundwater dependent ecosystems

Groundwater dependant ecosystems (GDEs) are communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater (Department of Land and Water Conservation, 2002). When considering GDEs, groundwater is generally defined as the saturated zone of the regolith (the layer of loose rock resting on bedrock, constituting the surface of most land) and its associated capillary fringe, however it excludes soil water held under tension in soil pore spaces (the unsaturated zone or vadose zone) (Eamus et al., 2006).

GDEs include a diverse range of ecosystems from those entirely dependent on groundwater to those that may use groundwater while not having a dependency on it for survival (i.e. ecosystems or organisms that use groundwater opportunistically or as a supplementary source of water) (Hatton and Evans, 1998). Eamus et al. (2006) considers the following broad classes of these ecosystems:

- Aquifer and cave ecosystems, where stygofauna (groundwater-inhabiting organisms) may reside within the groundwater resource. The hyporheic zones (Figure 3.2) of rivers and floodplains are also included in this category because these ecotones often support stygobites (obligate groundwater inhabitants).
- All ecosystems dependent on the surface expression of groundwater. This category includes base-flow rivers and streams, wetlands (Figure 3.2), some floodplains and mound springs and estuarine seagrass beds. While it is acknowledged that plant roots are generally below ground, this class of groundwater dependant ecosystems requires a surface expression of groundwater, which may, in many cases, then soak below the soil surface and thereby become available to plant roots.
- All ecosystems dependent on the subsurface presence of groundwater, often accessed via the capillary fringe (non-saturated zone above the saturated zone of the water table) when roots penetrate this zone. This class includes terrestrial ecosystems such as River Red Gum (Eucalyptus camaldulensis) forests on the Murray–Darling basin (Figure 3.2). No surface expression of groundwater is required in this class of groundwater dependant ecosystems.

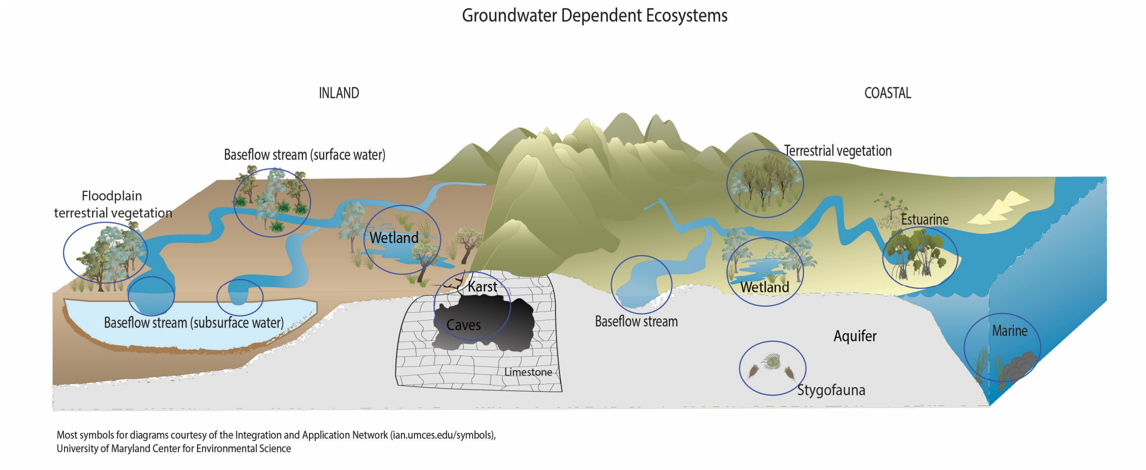


Figure 3.2: Conceptual biophysical model of groundwater dependent ecosystems

GDEs possess a range of values, including being important and sometimes rare ecosystems in themselves, as well as providing important ecosystem services such as water purification (Department of Land and Water Conservation, 2002).

The dependence (or interaction) of the vegetation communities identified within the proposal footprint, on groundwater was determined by aligning them with the groundwater dependant ecosystem types as shown in Figure 3.2.

The Bureau of meteorology has not mapped any groundwater dependant ecosystems within the study area (Bureau of Meteorology 2021). However, estuarine and near-shore marine systems depend on groundwater discharges to provide habitat for flora and fauna. Mangroves rely on seawater, tidal influences and groundwater discharge for their water requirements. The groundwater can be in the form of off-shore discharge zones, diffuse discharge through sandbeds or baseflow into streams that discharge into the ocean (Department of Planning Industry and Environment, 2021).

Taking the precautionary measure, it is assumed that the Mangroves within the study area have the potential to be groundwater dependant. No water uptake and the proposal involves the trimming of Mangroves and is unlikely to have a significant impact upon this groundwater dependant ecosystem.

3.4 Threatened species

Based on the results of the desktop searches 54 threatened flora species were known or predicted to occur in the locality. None of these threatened flora species have a moderate or higher likelihood of occurring within the study area (Appendix B). In terms of threatened fauna species, the results of the desktop searches identified 53 species as known or predicted to occur in the locality of which 2 have been identified as having a moderate or higher likelihood of occurring within the study area (Appendix B).

An overview of threatened fauna species results are presented in Table 3.3. All potentially occurring threatened biodiversity are discussed further below.

Table 3.3: Threatened species

Species name	Common name	Status		Potential Occurrence	SAII	Affected Species?
		BC Act[1]	EPBC Act[2]			
Micronomus norfolkensis	Eastern Coastal Freetail-bat	V	-	Moderate	No	Yes
Myotis macropus	Southern Myotis	V	-	Moderate	No	Yes

1. Vulnerable (V), Endangered (E), Endangered Population (EP)Critically Endangered (CE) as listed on the BC Act
2. Vulnerable (V), Endangered (E), Critically Endangered (CE), Migratory (M) as listed on the EPBC Act

3.4.1 Threatened fauna

Hollow-dwelling Microchiropteran Bats

The Mangroves that occur along the Parramatta River have the potential to contain hollows which provide roosting and breeding habitat for hollow-dwelling microchiropteran bats. No hollow-bearing tree surveys or nocturnal microchiropteran bat surveys were undertaken as part of the field surveys. Therefore, the presence of hollow-dwelling microchiropteran bats cannot be discounted. The most likely species to occur are *Myotis macropus* (Southern Myotis) and *Micronomus norfolkensis* (Eastern Coastal Freetail-bat). The Parramatta River provides foraging opportunities for hollow-dwelling microchiropteran bat species, in the form of insect populations and fish within the Parramatta River. Foraging habitat for both of these microbat species in the form of insects occur within the Mangroves and on the surface of the Parramatta River. *Micronomus norfolkensis* (Eastern Coastal Freetail-bat) also forages on fish that would occur within the Parramatta River.

The proposal is likely to be limited to trimming of Mangrove trees for the installation of the scaffolding for painting of the bridge. It is unlikely that removal of any Mangrove trees will occur. However, the removal of any vegetation within the study area, would represent a reduction in potential foraging habitat for Hollow-dwelling microchiropteran bats.

Endangered Populations

Based on the results of the desktop searches one endangered fauna population and four endangered flora populations were known or predicted to occur in the locality. None of the endangered populations were recorded within the study area or have habitat.

3.5 Aquatic results and FM Act

3.5.1 Aquatic habitat

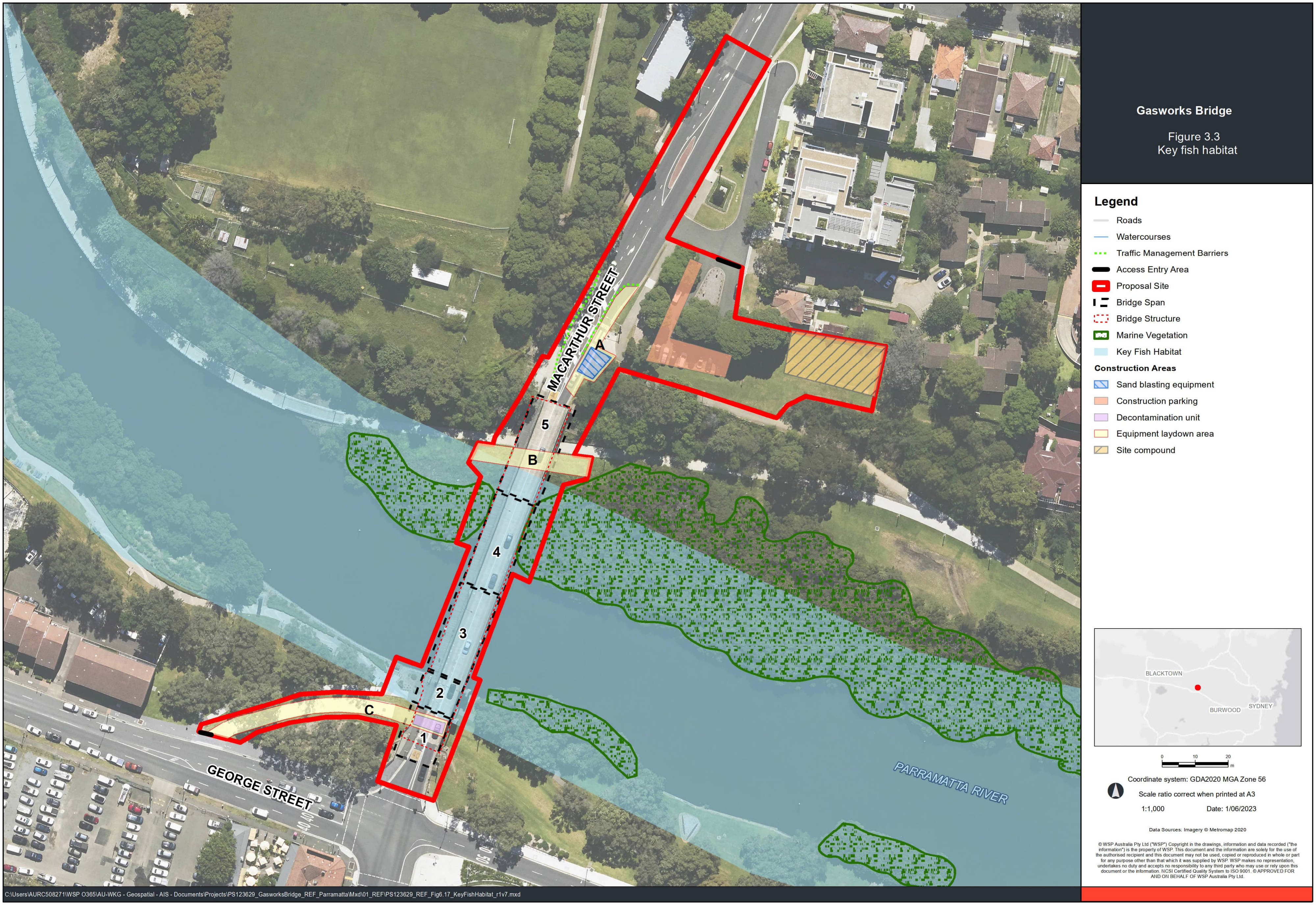
The study area occurs within the Parramatta catchment, adjoining the Parramatta River. Aquatic habitat includes the Mangroves and associated mudflats and the Parramatta River. The Parramatta River is tidal and hence is considered estuarine. The Parramatta River provides habitat for a range of terrestrial species, aquatic fauna and flora which includes but is not limited to macrophytes (West & Williams et al.2004), water birds, fish, insects, crabs and snails.

3.5.2 FM Act

No threatened aquatic species or threatened communities listed under the FM Act was identified by the data base searches or was recorded within the study area.

The Parramatta River and part of riparian vegetation along the banks of the river is mapped as Key Fish Habitat (Department of Primary Industries, 2021c) (Figure 3.3). The study area occurs within land identified as ‘proximity area for coastal wetlands’ under the Chapter 2 (Coastal Management) of the Resilience and Hazards SEPP (2021). Any area that occurs within this Coastal SEPP is classified as Type 1 – highly sensitive key fish habitat as outlined in the Department of Primary Industries Policy and guidelines for habitat and conservation management (2013). Impact to any areas of Type 1 fish habitat is generally prohibited by the DPI. Consultation with the DPI is recommended as the impact is minor (branch trimming) and temporary and approval may be given.

Mangroves are classified as Marine Vegetation (Figure 3.3) under the FM Act. Any cutting, removing, destroying, transplanting, shading or damaging in any way requires a Part 7 Fisheries Management Act Permit.


Gasworks Bridge
Figure 3.3
Key fish habitat
Legend
Roads
Watercourses
Traffic Management Barriers
Access Entry Area
Proposal Site
Bridge Span
Bridge Structure
Marine Vegetation
Key Fish Habitat
Construction Areas
Sand blasting equipment
Construction parking
Decontamination unit
Equipment laydown area
Site compound
MACARTHUR STREET
GEORGE STREET
PARRAMATTA RIVER
A
B
C
1
2
3
4
5
BLACKTOWN
BURWOOD
SYDNEY
0
10
20
m
Coordinate system: GDA2020 MGA Zone 56
Scale ratio correct when printed at A3
1:1,000
Date: 1/06/2023
Data Sources: Imagery © Metromap 2020
© WSP Australia Pty Ltd ("WSP") Copyright in the drawings, information and data recorded ("the information") is the property of WSP. This document and the information are solely for the use of the authorised recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by WSP. WSP makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information. NCSI Certified Quality System to ISO 9001. © APPROVED FOR AND ON BEHALF OF WSP Australia Pty Ltd.
C:\Users\AURC508271\WSP O365\AU-WKG - Geospatial - AIS - Documents\Projects\PS123629_GasworksBridge_REF_Parramatta\Mxd\01_REF\PS123629_REF_Fig6.17_KeyFishHabitat_r1v7.mxd

3.6 Areas of outstanding biodiversity value

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

3.7 Wildlife connectivity corridors

Wildlife corridors are generally links of native vegetation that join two or more areas of similar habitat and are critical for sustaining ecological processes, such as provision for animal movement and the maintenance of viable populations (Department of Environment, 2016).

Native vegetation within the study area is part of a larger contiguous area that occurs along both banks of the Parramatta River. The riparian vegetation extends to the east is mostly intact native vegetation which includes other areas of Mangroves and wetlands at Sydney Olympic Park and Newington Nature Reserve. Parts of the foreshore is intersected with parklands that contains planted vegetation. The vegetation continues east downstream to Sydney Harbour. Connectivity on the northern bank that extends to the west consists of generally intact Mangroves, with the southern bank consisting of parklands and the ends at the Parramatta Ferry Terminal.

The proposal is likely to require a small area of trimming (up to 0.02ha) for the installation of the scaffolding and would not result in loss of wildlife connectivity. Therefore, movement of individuals and exchange of genetic material from the vegetation with the study area to the vegetation along the Parramatta River would occur.

3.8 SEPPs

There are two NSW State Environmental Planning Policy's (SEPPs) that relate to biodiversity that are considered for the study area. These are:

- Coastal management areas identified by the Resilience and Hazards SEPP 2021.
- Core koala habitat identified by the Biodiversity and Conservation SEPP 2021.

An overview of each SEPP and the relevance to the study area is provided below.

3.8.1 Resilience and Hazards SEPP (2021)

The State Environmental Planning Policy Resilience and Hazards 2021 was introduced to further simplify the total 45 planning policies into one of 11 themed based policies including chapter 2 (Coastal Management) to further simplify policy for coastal assets. Under the Resilience and Hazards SEPP, areas of 'Coastal Wetlands' and 'Proximity Coastal Wetlands (100 metre buffer)' have been mapped across the state.

The Proposal is located within land identified as 'proximity area for coastal wetlands' and immediately adjacent to/partially in areas identified as 'coastal wetlands' per clause 2.8 of the Resilience and Hazards SEPP

As advised by TfNSW the installation of the scaffolding would not result in any impacts that would permanently modify the value of the Coastal Wetland area nor are any ground disturbance works beyond the construction of the scaffolding be required, the proposed works would not affect land or development regulated by the Resilience and Hazards SEPP.

3.8.2 SEPP (Koala Habitat Protection)

The Koala Habitat Protection SEPP came into effect on 1 March 2020. The SEPP is not relevant to Part 5.1 developments although the intentions of the SEPP are considered for this BAR.

3.9 Matters of national environmental significance

Matters of National Environmental Significance (MNES), listed under the EPBC Act, are addressed in this section. The following biodiversity MNES protected under the EPBC Act were considered for their relevance to the Proposal:

- wetlands of international importance (Ramsar) (EPBC Act sections 16 and 17B)
- listed threatened species and communities (EPBC Act sections 18 and 18A)
- listed migratory species (EPBC Act sections 20 and 20A).

3.9.1 Threatened communities listed under the EPBC Act

The results of the protected matters database search identified 11 TECs listed under the EPBC Act as being likely to occur within the locality as follows:

- Blue Gum High Forest of the Sydney Basin Bioregion
- Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion
- Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community
- Coastal Upland Swamps in the Sydney Basin Bioregion
- Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion
- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest
- River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria
- Shale Sandstone Transition Forest of the Sydney Basin Bioregion
- Subtropical and Temperate Coastal Saltmarsh
- Turpentine-Ironbark Forest of the Sydney Basin Bioregion
- Western Sydney Dry Rainforest and Moist Woodland on Shale.

No vegetation types recorded within the study area corresponded to any threatened ecological community listed under the EPBC Act.

3.9.2 Threatened flora listed under the EPBC Act

Based on the results of the desktop searches 32 threatened flora species were known or predicted to occur in the locality (see Appendix B). No threatened flora species were considered to have a moderate or higher likelihood of occurrence within the study area.

3.9.3 Threatened fauna listed under the EPBC Act

Based on the results of the desktop searches 30 threatened fauna species were known or predicted to occur in the locality. Of these No threatened fauna listed on the EPBC Act has been assessed as having a moderate or high likelihood of occurrence. The detailed likelihood of occurrence assessment for species considered during the desktop study is presented in Appendix B.

3.9.4 Migratory Species

The desktop database search identified 18 terrestrial and wetland migratory species that are known or predicted to occur within the locality. None of these migratory species have habitat within the study area (Appendix B).

3.9.5 Oceanic Species

In addition to the return of many migratory estuarine fauna, listed as migratory or threatened, within Commonwealth, and State legislations, another group of fauna, oceanic species, were strongly influenced by the study area's relative proximity to the Tasman Sea. Such species as Sea Turtles, Whales, Albatross, Shearwaters and Petrels were returned from database searches. Due to their lack of suitable habitat within the study area or estuarine habitats within the vicinity of the study area, these species were not considered for impact assessment within Table C1 of Appendix B.

3.9.6 Wetlands of international and national importance

No wetlands of international importance occur within or adjoining the study area.

Two nationally important wetlands being, Bicentennial Park and Newington Wetlands occur within 10km of the study area.

Newington Wetlands occur 1.5 km to the east of the study area, and Bicentennial Park occurs 6.4km to the east. The proposal is unlikely to impact upon these two nationally important wetlands due to the distance from study area and low impact involved

3.9.7 World or national heritage

One world heritage property of Australian Convict sites (Old Government House and Domain) was identified within 10km of the study area. This world heritage property occurs approximately 2 km to the west of the study area. The proposal would not impact upon Old Government House and domain.

Two national heritage properties being Old Government House and Government Domain and Parramatta Female Factory and Institutions precinct occur within 10km of the study area.

The Parramatta Female Factory and institutions precinct occurs approximately 2km to the north west of the study area. The proposal is unlikely to impact upon this national heritage property

4. Avoidance and minimisation

In managing biodiversity, Transport aims to achieve a balanced outcome, taking account of environmental considerations together with economic and community objectives. This includes a balanced approach to examining the environmental consequences of an activity, recognising that achieving an optimal outcome often requires compromise and decisions regarding environmental values. A key part of Transport's management of biodiversity for this Proposal is the application of the 'avoid, minimise, mitigate and offset' hierarchy as follows:

1. Avoid and minimise impacts as the highest priority
2. Mitigate impacts where avoidance is not feasible or practicable in the circumstance
3. Offset where residual, significant unavoidable impacts would occur.

Avoiding environmental impacts as the first step is consistent with the application of the precautionary principle. Transport priority is to avoid impacts to the environment. This can be achieved by early consideration of environmental issues from identification of constraints at project inception through to options analysis and selection of a preferred option, design investigation and assessment of the preferred option, detailed design, and implementation of on-ground safeguards during construction and operation and maintenance of the activity.

The primary method to avoid impacts is to locate activities away from areas of known or potential high biodiversity value. In identifying suitable work sites, the first preference is to locate existing cleared and disturbed areas that have good access, are not within immediate proximity to waterways, and that support good site management practices (for example, management of material stockpiles). The proposed compound site will be placed in the areas of exotic grassland to avoid impacts to biodiversity. The proposed location of the scaffolding has been placed to minimise the impact to the Mangroves, thus requiring only trimming and no removal of any Mangrove trees. During the installation further refinements would be made to reduce the amount of trimming where possible.

5. Impact assessment

The proposal's likely direct and indirect impacts on biodiversity during construction and operational phases are summarised in this chapter. There are a range of potential biodiversity impacts that may occur due to the proposal including:

- Removal of native vegetation
- Removal of threatened fauna species habitat
- Aquatic impacts
- Injury and mortality of fauna
- Edge effects on adjacent native vegetation and habitat
- Invasion and spread of weeds.

5.1 Construction direct impacts

5.1.1 Removal of native vegetation

Under the current proposal, the estimated clearing of native vegetation is approximately up to 0.02 ha of trimming of Mangroves which are part of the following PCT:

- PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion

The proposal would also result in the removal of about 0.38 ha of miscellaneous ecosystem – Native vegetation plantings and about 0.66 ha of miscellaneous ecosystem – exotic grassland.

Table 5.1: Summary of direct impacts on native vegetation

Veg. zone	Plant community type (PCT)	Broad condition class	TEC	FM Act	Percent cleared in IBRA region[1]	Area to be impacted (ha)[2]
Zone 1	PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Intact	No	Marine Vegetation	86%	0.02
					Total native vegetation impacted	0.02
Zone 2	Miscellaneous ecosystem – Planted Native vegetation	N/A	-	-	-	0.38
Zone 3	Miscellaneous ecosystem – Exotic Grassland	N/A	-	-	-	0.66
					TOTAL vegetation impacted	1.04

NOTE 1:Based on the VIS classification database

NOTE 2: Area to be cleared based on ground-truthed vegetation mapping within the study area and includes only trimming of mangrove trees

5.1.2 Removal of threatened fauna habitat

The extent of vegetation clearing estimated to result from the proposal is outlined above in Section 4.1.1. This vegetation, including planted trees, provides suitable habitat for a two threatened fauna species listed under the BC Act. As such, direct impacts to habitat for threatened fauna species (although it is only moderate to poor quality) would occur during construction.

The direct impacts of the proposal to habitats for threatened fauna has been estimated based on the current design and are based on a worst-case scenario. A breakdown of the direct impacts to habitat for threatened fauna species is provided in Table 5.2

Table 5.2: Summary of direct impacts on threatened fauna and habitat

Species name	EPBC Act	BC Act	Credit type[1]	Potential occurrence (Moderate, High, Recorded)	Impacted by the proposal	Impact (ha)
Micronomus norfolkensis (Eastern Coastal Freetail-bat)	-	V	Ecosystem	Moderate	Yes	0.02
Myotis macropus (Southern Myotis)	-	V	Species	Moderate	Yes	0.02

5.1.3 Removal of threatened flora

There are no direct impacts to threatened flora predicted from the proposal.

5.1.4 Aquatic impacts

The aquatic impacts are limited to trimming of Mangroves on the northern side of Parramatta River for the installation of the scaffolding. The trimming is likely to be less than or equal to 0.02ha.

Mangroves are classified as Marine Vegetation (Figure 3.3) under the FM Act. Any cutting, removing, destroying, transplanting, shading or damaging in any way requires a Part 7 Fisheries Management Act Permit.

Impacts to aquatic habitat would be of low magnitude and standard mitigation measures would be implemented to limit impacts (see Section 5).

5.1.5 Injury and mortality

Fauna injury or death is unlikely to occur as the transport of materials along the access roads will occur on existing roads and the shared pathways (see Figure 1-2), which is likely to be limited to commonly occurring birds and reptiles. Whilst there is potential for vehicles to cause fauna death or injury this would not increase significantly than already occurring.

Mitigation measures designed to reduce an injury and mortality of fauna are provided in Section 6.

5.1.6 Groundwater dependent ecosystems

GDEs include a diverse range of ecosystems from those entirely dependent on groundwater to those that may use groundwater while not having a dependency on it for survival (i.e. ecosystems or organisms that use groundwater opportunistically or as a supplementary source of water (Hatton and Evans, 1998).

Taking the precautionary measure, it is assumed that the Mangroves within the study area have the potential to be groundwater dependant. No water uptake and the proposal involves the trimming of Mangroves and is unlikely to have a significant impact upon this groundwater dependant ecosystem.

Potential impacts to groundwater quality would be minimised by administrative controls such as management plans (CEMP) and emergency response protocols during construction and operation, as well as engineering controls such as flooding and drainage design. Stormwater management is in place for the existing infrastructure on the subject land to mitigate erosion and discharge of sediment or pollutants into drainage or waterways (except clean water).

5.2 Indirect and operational impacts

The Proposal will have minor indirect impacts to surrounding biodiversity including increased edge effects from trimming and invasion of weeds, pests and diseases.

5.2.1 Edge effects on adjacent native vegetation and habitat

Edge effects are likely to be minor PCT 920 Mangrove Forests on the northern bank of the Parramatta River currently adjoins exotic grassland and the shared pathways. The installation of the scaffolding will be temporary and unlikely to result in introducing new edge effects than is already occurring.

5.2.2 Wildlife connectivity and habitat fragmentation

Impacts to wildlife connectivity are expected to be minor. Habitat fragmentation will not increase as a result of the proposal. The minor trimming of mangrove trees (up to 0.02 ha) will not create a noticeable difference in distance between vegetation patches currently occurring and will likely regrow overtime. The proposal is expected to use pre-existing clearings and paths for access and minor impacts on planted native vegetation will not exacerbate the fragmentation of existing vegetation.

5.2.3 Injury and mortality

The proposal involves remediation works of Gasworks Bridge and the operational stage of the project is unlikely to create a significant difference of habitat for biodiversity. As a result, the proposal is not considered likely to cause an increased risk of injury or mortality to biodiversity after construction is completed. Whilst there is potential for vehicles to cause fauna death or injury this would not increase significantly than already occurring.

Mitigation measures designed to reduce an injury and mortality of fauna are provided in Section 5.

5.2.4 Invasion and spread of weeds

Proliferation of weed species is an indirect impact (i.e. not a direct result of proposal activities). The most likely causes of weed dispersal and importation associated with the proposal include attachment of seed (and other propagules) to vehicles and machinery during the construction works. The study area contains mown lawn areas with exotic pasture weeds. Any introduction of weeds would be minor and is unlikely to introduce weeds into the Mangrove vegetation. The Mangroves is currently in good condition and the estuarine mud environment is unlikely to allow weed species to establish.

Exotic pasture weeds maybe introduced and have the potential to impact upon the planted sedges and native gardens that occur within the study area. However, if the Mitigation measures outlined in Section 5 are designed to limit the spread and germination of weeds.

5.2.5 Invasion and spread of pests

The study area is likely habitat for a range of commonly occurring pest species including brown rat and European rabbit. Proposal activities have the potential to disperse pest species out of the subject land across the surrounding landscape due to disturbance, causing an increased impact to adjacent habitats. This will particularly be associated with the construction phase due to the increased vehicle and machinery noise and movement. However, the magnitude of this impact would be low and mitigation measures are not deemed necessary. During operation these disturbances are likely to be at similar impact to prior construction and so unlikely to cause an increased impact of pests.

5.2.6 Invasion and spread of pathogens and disease

Plant and animal pathogens can affect threatened biodiversity through direct mortality and modification to vegetation structure and composition. The following pathogens are considered to have potential to affect the biodiversity within the study area and are the subject of Key Threatening Process listings:

- Amphibian Chytrid Fungus (*Batrachochytrium dendrobatidis*)
- Exotic Rust Fungi (order Pucciniales, e.g. Myrtle rust fungus *Uredo rangelii*)
- Phytophthora Root Rot Fungus (*Phytophthora cinnamomi*).

These three pathogens have all been recorded in the Sydney Basin bioregion and have potential to occur on within the subject land at present or in the future. The main way in which Exotic Rust Fungi and Phytophthora Root Rot Fungus may be spread is through the movement of infected plant material and/or soil. The construction and operation of the Proposal may increase the risk of disturbing and spreading these pathogens. With the implementation of hygiene procedures for the use of vehicles and the importation of materials to the subject land, the risk of introducing these pathogens would, however, be low. Preferential use of plant materials sourced on-site (e.g. mulch, seeds) used for vegetation restoration would also help to minimise this risk.

Amphibian Chytrid Fungus can be spread through the movement of infected animals or water (including mud or moist soil) from infected areas. With the implementation of hygiene procedures for the use of vehicles and the importation of materials to the subject land, the risk of introducing this pathogen to uninfected areas is low.

Pathogens would be managed within the subject land according to the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (NSW Roads and Traffic Authority, 2011) (see Chapter 5).

5.2.7 Changes to hydrology

The study area includes marine vegetation and adjacent aquatic ecosystems that need to be considered during the construction and operational phases of the project. However, the existing hydrological conditions of the proposal are already affected by altered landform and altered stormwater runoff and velocity because of surrounding land uses and existing roads. The proposal may result in further alteration to the hydrology of the study area due to an increase in surface runoff in both construction and operation. However, these changes would be relatively minor. As such, the increased runoff is not expected to create a significant impact. Provided mitigation measures outlined within Table 6.1 are implemented appropriately, the alterations are not expected to result in serious adverse impacts to local surface water quality. The proposed activity would not result in the exacerbation of any key threatening processes, including the alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.

It is recommended that the stormwater design for the Proposal project be done in accordance with 'Managing urban stormwater: Soils and construction, Volume 2D: Main Road Construction, Sydney' (Blue Book) (Department of Environment & Climate Change, 2008) to avoid potential impacts to surrounding native vegetation communities include marine vegetation and aquatic ecosystems.

5.2.8 Noise, light, dust and vibration

Noise, dust and vibration during the installation of the scaffolding, painting works and vehicle movement would be minor. Considering the existing levels of noise and vibration from the surrounding urban development and the high levels of use of the existing Gasworks Bridge, George Street, Harris Street and Macarthur Street by vehicles, it is unlikely there would be a significant increase in within the study area. Light would also unlikely be impacted except for minor light regimes in the from trimmed vegetation on the edges of PCT 920. The magnitude of this impact would be low and mitigation measures are not deemed necessary.

5.3 Cumulative impacts

The study area is surrounded by urban development, parklands and road infrastructure. Parramatta has been developed from the late 1788 (City of Parramatta, 2021) and currently there is little native vegetation that is available for development. The majority of existing intact native vegetation occurs along the banks of the Parramatta River and in nature reserves (Newington, Sydney Olympic Park and Baludarri Wetlands). In addition, the impacts from the proposal will be minor and is unlikely increase cumulative impacts within the locality.

5.4 Assessments of significance

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

The proposed works would be assessed under Part 5, Division 5.1 of the EP&A Act. Section 7.3 of the BC Act outlines the 'test of significance' that is to be undertaken to assess the likelihood of significant impact upon threatened species or ecological communities listed under the BC Act. Assessments were undertaken in accordance with the guidelines provided in the Threatened Species Test of Significance Guidelines: The Assessment of Significance (Office of Environment & Heritage, 2018) which outlines a set of guidelines to help applicants/proponents of a development or activity with interpreting and applying the factors of assessment in the former 'seven-part test'. The guidance provided by the Department of Environment and

Climate Change (2007) has been used here in preparing these tests of significance and in determining whether there is likely to be a significant effect to a threatened species, population or ecological community listed under the BC Act.

Full details of assessment of significance under the BC Act are presented in Appendix C. The conclusions of the EP&A Act assessment are provided in Table 4.5, which indicates that a significant effect is considered unlikely on any threatened species or ecological communities listed under the BC Act.

No threatened ecological communities, flora or fauna species were recorded or are considered to have a moderate or high likelihood of occurring in the study area (Appendix B)

Table 5.3: Summary of BC Act significance assessments findings

Significance assessment question *(per Section 7.2 of the BC Act and Threatened Species Test of Significance Guidelines (OEH 2018))*						
Threatened species, or communities	a	b	c	d	e	Likely significant impact?
Micronomus norfolkensis (Eastern Coastal Freetail-bat)	N	x	N	N	Y	Unlikely
Myotis macropus (Southern Myotis)	N	x	N	N	Y	Unlikely
Y = Yes (negative impact), N = No (no or positive impact), X = Yes/No answer not applicable, ? = unknown impact.						

6. Mitigation

Once all practicable steps to avoid or minimise impacts have been implemented at the detailed design phase, mitigation measures would be implemented to lessen the potential ecological impacts of the proposal. Mitigation measures are to be undertaken during the construction and operational phases. The Roads and Maritime (now Transport) guidelines and procedures identify a range of mitigation techniques to be applied, including managing the vegetation clearing process, re-establishment of native vegetation at the end of a project, weed management, provision of supplementary fauna habitat (such as nest boxes for appropriate species), and installation of erosion and sediment controls as appropriate.

The following mitigation measures as outlined in the Biodiversity Guidelines: Protecting and managing biodiversity of RTA projects (NSW Roads and Traffic Authority, 2011) are recommended for implementation (see Table 6.1). The NSW DPI (Fisheries) document Policy and Guidelines for fish habitat conservation and management (2013 update) (Department of Primary Industries, 2013) has also been used.

Table 6.1: Mitigation measures

ID	Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated?	Responsibility
B01	Removal of native vegetation	Native vegetation removal will be minimised through detailed design.	Detailed design	Effective	The predicted residual impact to native vegetation species habitat is estimated of up to 0.02 ha of trimming.	Contractor
B03		Vegetation removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective		Contractor
B05		The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven		Contractor
B06	Removal of threatened fauna habitat	Habitat removal will be minimised during the construction of the scaffolding.	Detailed design	Effective	The predicted residual impact to native vegetation species habitat is estimated of up to 0.02 ha of trimming.	Contractor
B08		Habitat removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective		
B10		The unexpected species find procedure is to be followed under *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven		Contractor
B16	Aquatic impacts	Aquatic habitat will be protected in accordance with *Guide 10: Aquatic habitats and riparian zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) and Section 3.3.2 *Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013* (DPI (Fisheries NSW) 2013).	During construction	Effective	Minor, localised, modification intact Mangrove Vegetation	Contractor
B17	Groundwater dependent ecosystems	Interruptions to water flows associated with groundwater dependent ecosystems will be minimised through detailed design.	Detailed design	Effective	Minor, localised, modification intact Mangrove Vegetation	Contractor
B18	Changes to hydrology	Changes to existing surface water flows will be minimised through detailed design.	Detailed design	Effective	Minor, localised modification expected during construction phase.	Contractor

					No residual impact anticipated during operation phase	
B21	Edge effects on adjacent native vegetation and habitat	Exclusion zones will be set up at the limit of clearing in accordance *with Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	No residual impact is anticipated	Contractor
B23	Invasion and spread of weeds	Weed species will be managed in accordance *with Guide 6: Weed management* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	None as the proposed control measures are known to be effective	Contractor
B24	Invasion and spread of pests	Pest species will be managed within the proposal site.	During construction	Effective	No residual impact is anticipated	Contractor
B25	Invasion and spread of pathogens and disease	Pathogens will be managed in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	None as the proposed control measures are known to be effective	Contractor
B26	Noise, light, dust and vibration	Shading and artificial light impacts will be minimised through detailed design.	Detailed design	Effective	Impacts from noise and light spill would remain	Contractor

7. Offsets and other measures

The proposal will impact up to 0.02ha of native vegetation and 0.66 ha of planted native vegetation and exotic grassland.

7.1 Thresholds

This biodiversity assessment identifies that the proposal is not likely to have a significant impact on any threatened biodiversity listed under the BC Act or EPBC Act (see Section 4.4 and Appendix C). In this instance, and due to the Strategic Assessment, the EPBC Act environmental offsets policy does not apply.

Transport would provide biodiversity offsets or where offsets are not reasonable or feasible, supplementary measures for impacts that exceed the thresholds in Table 7.1.

Implementation of the Transport for NSW No Net Loss Guidelines (July 2022) indicates that offsets are not required for this proposal as the impacts do not exceed biodiversity offset thresholds.

The proposal will impact up to 0.02ha of native vegetation and 0.66 ha of planted native vegetation and exotic grassland. As such in consideration of the Transport No Net Loss Guidelines (2022), works conducted on plantations and exotic vegetation are exempt and as the native vegetation being cleared is less than 1 ha, no offset is required. Table 7.1 outlines the threshold conditions required by the No Net Loss Guidelines.

Table 7.1: Offset thresholds (TfNSW No Net Loss Guidelines)

Impact	Threshold
Works involving clearing of a CEEC	Where there is any clearing of an CEEC in 'moderate to good' condition - Not triggered
Works involving clearing of an EEC	Where clearing of a EEC ≥ 2 ha in 'moderate to good' condition - Not triggered
Works involving clearing of VEC	Where clearing of VEC ≥ 5 ha in 'moderate to good' condition - Not triggered
Works involving clearing of any habitat for a known species credit fauna species or clearing of breeding habitat (as defined by the TBDC) for dual-credit fauna species (excluding exotic and planted vegetation that cannot be assigned to a plant community type)	Where clearing ≥ 1 ha in 'moderate to good' condition - Not triggered
Works involving removal of known threatened flora species and their habitat	Where loss of individuals is ≥10 or where clearing of habitat is ≥ 1 ha - Not triggered
Type 1 or Type 2 key fish habitats	Where there is a net loss of habitat - Not triggered
Any residual biodiversity impact that doesn't require offsets in accordance with the No Net Loss Guideline is to be assessed against the requirements of the Tree and Hollow Replacement Guideline.	Any clearing of hollows and/or trees ≥5cm DBH - Not triggered

7.2 Biodiversity offset strategy/tree and hollow replacement plan

This proposal will impact up to 0.02 ha of native vegetation limited to trimming of mangrove branches and utilise previously cleared or modified landscapes for construction purposes. Offset calculations are therefore not required. No impacts to hollow bearing trees are expected so a tree and hollow replacement plan is not required.

8. Conclusion

One PCT identified in the study area based on floristic composition, geological substrate, and landscape position being PCT 920: Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion

In addition, two non-native vegetation types were assigned to a miscellaneous ecosystem class, being:

- Miscellaneous ecosystem – Planted Native Vegetation
- Miscellaneous ecosystem – Exotic grassland

No threatened ecological communities listed on the BC Act or the EPBC Act were recorded within the study area.

No threatened fauna species listed under the BC Act and/or the EPBC Act were recorded during the field surveys. However two fauna species were assessed as have a moderate or higher likelihood of occurrence being:

- *Micronomus norfolkensis* (Eastern Freetail-bat)
- *Myotis macropus* (Southern Myotis)

The key impacts of the proposal will involve the trimming of up to 0.02 ha of PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion (consisting of 13 individual mangroves).

It is recommended that the trimming of the Mangrove trees do not contain hollows as they provide habitat for threatened and commonly occurring microbats.

The overall outcome of the tests of significance (see Appendix C) indicate that there it is unlikely that to be significant impact upon the threatened species as a result of the proposal.

The study area is located within both land identified as 'proximity area for coastal wetlands' per clause 11 of the Coastal Management SEPP and immediately adjacent to/partially in areas identified as 'coastal wetlands' under clause 10 of the Coastal Management SEPP. As advised by TfNSW the installation of the scaffolding would not result in any impacts that would permanently modify the value of the Coastal Wetland area nor are any ground disturbance works beyond the construction of the scaffolding be required, the proposed works would not affect land or development regulated by the Coastal Management SEPP.

The Parramatta River and part of riparian vegetation along the banks of the river is mapped as Key Fish Habitat (Department of Primary Industries, 2021) (Figure 3.3). The study area occurs within land identified as 'proximity area for coastal wetlands' in the SEPP Coastal Management (2018). Any area that occurs within this Coastal SEPP is classified as Type 1 – highly sensitive key fish habitat as outlined in the Department of Primary Industries Policy and guidelines for habitat and conservation management (2013). Any impact Type 1 key fish habitat is generally prohibited by the DPI. It is recommended that consultation with the Department of Primary Industries occur before any construction begins.

Mangroves are classified as Marine Vegetation under the FM Act. Any cutting, removing, destroying, transplanting, shading or damaging in any way. A Part 7 Fisheries Management Act Permit is required for damage to marine vegetation.

Minimisation of biodiversity impacts would occur during the installation of the scaffolding to reduce impacts where practicable. However, mitigation measures would need to be implemented as a result of the proposal to further lessen the potential ecological impacts of the proposal. The Roads and Maritime Biodiversity Guidelines: Protecting and managing biodiversity of RTA projects (NSW Roads and Traffic Authority, 2011) identify a range of mitigation techniques to be applied and these techniques must be implemented during construction.

Although efforts have been made to avoid, minimise and mitigate potential ecological impacts from the proposal, some residual impacts would occur. This biodiversity assessment identifies that the proposal is not likely to have a significant impact on any threatened biodiversity listed under the BC Act or EPBC Act (see Section 4.4 and Appendix C). In this instance, and due to the Strategic Assessment, the EPBC Act environmental offsets policy does not apply. It is however Transport for NSW policy that biodiversity offsets (or where offsets are not reasonable or feasible, supplementary measures) would be provided for impacts that exceed predetermined thresholds. The Transport No Net Loss Guidelines (2022) indicates that offsets are not required for this proposal as the impacts do not exceed biodiversity offset thresholds.

9. Glossary

Term	Definition
Accredited person or assessor	Means as person accredited under section 6.10 (of the BC Act) to prepare reports in accordance with the BAM.
Biodiversity Assessment Method	The Biodiversity Assessment Method is established under section 6.7 of the BC Act. The BAM is established for the purpose of assessing certain impacts on threatened species and threatened ecological communities (TECs), and their habitats, and the impact on biodiversity values.
Biodiversity Assessment Method Calculator	Biodiversity Assessment Method Calculator (BAM-C) – the online computer program that provides decision support to assessors and proponents by applying the BAM and referred to as the BAM-C. The BAM-C contains biodiversity data from the BioNet Vegetation Classification and the Threatened Biodiversity Data Collection that the assessor is required to use in a BAM assessment. The BAM-C applies the equations used in the BAM, including those to determine the number and class of biodiversity credits required to offset the impacts of a development, or created at a biodiversity stewardship site. It is published by the Department (DPIE 2020a).
Biodiversity credit report	The report produced by the BAM-C that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site (DPIE 2020a).
Biodiversity offsets	The gain in biodiversity values achieved from the implementation of management actions on areas of land, to compensate for losses to biodiversity values from the impacts of development (DPIE 2020a).
Biodiversity Offsets and Agreement Management System	The online system used to administer the Biodiversity Offsets Scheme. The BOAMS is used by accredited assessors (to carry out specific BAM-related tasks involving access to the BAM-C to perform assessments, submit data, generate credits and calculate a credit price), by landholders (to apply for a Biodiversity Stewardship Agreement and manage ongoing reporting obligations for their agreement) and by proponents of developments (to view their credit obligation or the payment required to the Biodiversity Conservation Fund).
Biodiversity risk weighting	A factor of the formulas used by the BAM to calculate credits. The biodiversity risk weighting (BRW) is a score given to each vegetation zone and species based on the 'sensitivity to loss' versus the 'sensitivity to gain'. The value is set for threatened species and listed in the TBDC. The BRW for vegetation is calculated for each vegetation zone by the BAM-C using a factor of the 'sensitivity to loss' of the PCT or TEC (located in the BioNet vegetation classification) and the 'sensitivity to gain' of the ecosystem credit species (in the TBDC) that are predicted to occur.
Biodiversity Stewardship site	Refers to land which is the subject to a Biodiversity Stewardship Agreement under the BC Act.
BioNet Atlas	The DPIE database of flora and fauna records (formerly known as the NSW Wildlife Atlas). The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails listed under the BC Act) and some fish (DPIE 2020a).
BioNet Vegetation classification	Refers to the vegetation community-level classification for use in vegetation mapping programs and regulatory biodiversity impact assessment frameworks in NSW. Refer About BioNet Vegetation Classification | NSW Environment and Heritage (DPE 2020a).
Construction footprint	The area to be directly impacted by the proposal during construction activities. See also definition for subject land.

Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to Clause 228(2) of the EP&A Regulation 2000 for cumulative impact assessment requirements.
Direct impact	Direct impacts on biodiversity values include those related to clearing native vegetation and threatened species habitat and impacts on biodiversity values prescribed by the Biodiversity Conservation Regulation 2017 (the BC Regulation) (DPIE 2020a).
Ecosystem credit species	Threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for ecosystem credits. This is analogous with the definition of 'predicted species'.
Ecosystem credits	A measurement of the value of threatened ecological communities, threatened species habitat for species that can be reliably predicted to occur with a PCT, and PCTs generally. Ecosystem credits measure the loss in biodiversity values at a development, activity, clearing or biodiversity certification site and the gain in biodiversity values at a biodiversity stewardship site (DPIE 2020a).
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (DPIE 2020a).
Indirect impact	Impacts that occur when the proposal affects native vegetation and threatened species habitat beyond the development footprint or within retained areas (e.g. transporting weeds or pathogens, dumping rubbish). This includes impacts from activities related to the construction or operational phase of the proposal and prescribed impacts (DPIE 2020a).
Landscape assessment area	The area which includes the subject land and a 1500 m buffer surrounding the outside edge of the boundary of the subject land or 500 m along each side of the centre line of a linear-shaped proposal
Local population	The population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions: • *The local population of a threatened plant species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.* • *The local population of resident fauna species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.* • *The local population of migratory or nomadic fauna species comprises those individuals that are likely to occur in the study area from time to time or return year to year (OEH 2018).*
Matter of national environmental significance	A matter of national environmental significance (MNES) is any of the nine defined components protected by a provision of Part 3 of the EPBC Act (Commonwealth).
Mitigation	Action to reduce the severity of an impact.
Native vegetation	Has the same meaning as in section 1.6 of the BC Act and section 60B of the LLS Act. In summary, a) trees (including any sapling or shrub or any scrub) b) understorey plants c) groundcover (being any type of herbaceous vegetation)

	d) plants occurring in a wetland. A plant is native to New South Wales if it was established in New South Wales before European settlement (BC Act). Native vegetation does not extend to marine vegetation (being mangroves, seagrasses or any other species of plant that at any time in its life cycle must inhabit water other than fresh water). Marine vegetation is covered by the provisions of the FM Act.
NSW (Mitchell) landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (DPIE 2020a).
Operational footprint	The area that will be subject to ongoing operational impacts from the proposal. This includes the road, surrounding safety verges and infrastructure, fauna connectivity structures and maintenance access tracks and compounds.
Patch size	An area of native vegetation that: • *occurs on the development site or biodiversity stewardship site* • *includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or ≤30 m for non-woody ecosystems).* Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site (DPIE 2020a).
PlantNET	An online database of the flora of New South Wales which contains currently accepted taxonomy for plants found in the State, both native and exotic.
Population	A group of organisms, all of the same species, occupying a particular area (DPIE 2020a).
Spatial datasets	Spatial databases required to prepare a BAR • *BioNet NSW (Mitchell) Landscapes – Version 3.1* • *NSW Interim Biogeographic Regions of Australia (IBRA region and sub-regions) – Version 7* • *NSW soil profiles* • *hydrogeological landscapes* • *acid sulfate soils risk* • *digital cadastral database* • *Vegetation Information Systems maps* • *Geological sites of NSW.*
Species credit species	Threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for species credits (DPIE 2020a). This is analogous with the definition of 'candidate species'.
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection (DPIE 2020a).
Species polygon	An area of land identified in Chapter 5 (of the BAM) that contains habitat or is occupied by a threatened species (DPIE 2020a).
Study area	The area directly affected by the proposal (subject land or construction footprint) and any additional areas likely to be affected by the proposal, either directly or indirectly.
Subject land	Land subject to a development, activity, clearing, biodiversity certification or a biodiversity stewardship proposal. It excludes the landscape assessment area which surrounds the subject land (i.e., the area of land in the 1500 m buffer zone around the subject land or 500m buffer zone for linear proposals). In the case of a biodiversity certification proposal, subject land includes the biodiversity certification assessment area (DPIE 2020a). See also definition for construction footprint.

Threatened Biodiversity Data Collection	A publicly assessable online database (registration required) which contains information for listed threatened species, populations and ecological communities (DPIE 2020a). Part of the BioNet database, published by the EHG and accessible from the BioNet website at www.bionet.nsw.gov.au.
Vegetation integrity (score)	The condition of native vegetation assessed for each vegetation zone against the benchmark for the PCT. The vegetation integrity score is the quantitative measure of vegetation condition calculated by the BAM-C (DPIE 2020a).
Vegetation zone	A relatively homogeneous area of native vegetation on a development site, clearing site, land to be biodiversity certified or biodiversity stewardship site that is the same PCT and has the same broad condition state (DPIE 2020a).

10. Abbreviations

Term	Definition
AOBV	Area of Outstanding Biodiversity Value
BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method calculator
BC Act	Biodiversity Conservation Act 2016 (NSW)
BC Regulation	Biodiversity Conservation Regulation 2017 (NSW)
BDAR	Biodiversity Development Assessment Report
BOAMS	Biodiversity Offsets and Agreement Management System
BOS	Biodiversity Offset Scheme
BRW	Biodiversity risk weighting
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DIWA	Directory of Important Wetlands in Australia
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
EEC	Endangered ecological community
EHG	NSW Environment and Heritage Group within the Department of Planning and Environment
EIS	Environmental Impact Statement
EP&A Act	*Environment Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
Fisheries NSW Policy and guidelines	Fisheries NSW Policy and guidelines for fish habitat conservation and management (Update 2013)
FM Act	Fisheries Management Act 1994 (NSW)
GDE	Groundwater dependent ecosystems
IBRA	Interim Biogeographically Regionalisation of Australia
MNES	Matters of national environmental significance
PCT	Plant community type
PMST	Protected Matters Search Tool
REF	Review of Environmental Factors
SAII	Serious and Irreversible Impacts
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SSD	State Significant Development
SSI	State Significant Infrastructure
TBDC	Threatened Biodiversity Data Collection
TECs	Threatened ecological communities (VECs, EECs and CEECs)
TfNSW	Transport for NSW
VEC	Vulnerable Ecological Community

11. References

Bureau of Meteorology (2021a) Weather observations for Parramatta North (Masons Drive) Weather Station

Bureau of Meteorology (2021b) Groundwater Dependant Ecosystems Atlas Viewer http://www.bom.gov.au/water/groundwater/gde/map.shtml

City of Parramatta (2021) Parramatta History and Heritage (Accessed 01/10/2021)

https://historyandheritage.cityofparramatta.nsw.gov.au/blog/2015/05/26/parramatta-timeline-1788-present

Cropper, S. C. (1993) Management of Endangered Plants, Melbourne, CSIRO Australia.

Debus, S. J. S. (1995). Surveys of large forest owls in Northern New South Wales: methodology, calling behaviour and owls responses. Corella, 19, 38-50.

Department of Agriculture, Water and the Environment (2021a) Directory of Important wetlands of Australia.

Department of Agriculture, Water and the Environment (2021b) Species Profiles and Threats Database

Department of Agriculture, Water and the Environment (2021c) (online) National Flying-fox monitoring viewer https://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf

Department of Agriculture, Water and the Environment (2021d) Register of Critical Habitat

Department of Agriculture, Water and the Environment (2021e) "EPBC Protected Matters Search Tool." 2021, from http://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf.

Department of Environment. (2016). National Wildlife Corridors Plan [Online]. Department of Environment. Available: http://www.environment.gov.au/topics/biodiversity/biodiversity-conservation/wildlife-corridors/what-are-wildlife-corridors

Department of Environment and Conservation (2004). Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft). Hurstville, Department of Environment and Conservation.

Department of Environment and Climate Change (2008). Managing urban stormwater : soils and construction. Vol. 2D Main Road Construction. Sydney Metropolitan Catchment Management Authority.

Department of the Environment (2013). Significant Impact Guidelines 1.1 - Matters of National Environmental Significance Canberra: Department of the Environment.

Department of Land and Water Conservation (2002). The NSW State Groundwater Dependent Ecosystem Policy. Sydney: Department of Land and Water Conservation.

Department of Planning Industry and Environment (2020) Biodiversity Assessment Method. Sydney: Environment, Energy and Science Group.

Department of Planning Industry and Environment (2021a), Register of Declared Areas of Outstanding Biodiversity Vale (AOBV) – critical habitat declarations in NSW

Department of Planning Industry and Environment (2021b), NSW Mitchell Landscapes

Department of Planning Industry and Environment (2021c) Groundwater Dependant Ecosystems web page. Water in NSW Group https://www.industry.nsw.gov.au/water/science/groundwater/ecosystems

Department of Primary Industries (2013). Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management (2013 update). Wollongbar: NSW Department of Primary Industries.

Department of Primary Industries (2021a). Register of critical habitat [Online]. Available: https://www.dpi.nsw.gov.au/fishing/species-protection/conservation/what/register [Accessed 2019].

Department of Primary Industries (2021b) Priority Weed listing for Greater Sydney Region.

Department of Primary Industries (2021c). Fisheries NSW Spatial Data Portal [Online]. Available: https://webmap.industry.nsw.gov.au/Html5Viewer/index.html?viewer=Fisheries_Data_Portal [Accessed 2021].

Eamus, D., Froend, R., Loomes, R., Hose, G. & Murray, B. (2006). A functional methodology for determining the groundwater regime needed to maintain the health of groundwater-dependent vegetation. Australian Journal of Botany, 24, 97–114.

Environment, Energy and Science (EES) Group (2021a) Threatened Biodiversity Data Collection. Available from: https://www.environment.nsw.gov.au/asmslightprofileapp/account/login?ReturnUrl=%2fAtlasApp%2fDefault.asp

Environment, Energy and Science (EES) Group (2021b) BioNet Atlas of NSW Wildlife

https://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/atlasreport.aspx

Environment, Energy and Science (EES) Group (2021c) BioNet Vegetation Classification Database. Available from: https://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx?ReturnUrl=%2fNSWVCA20PRapp%2fdefault.aspx

Hatton, T. & Evans, R. (1998). Dependence of ecosystems on groundwater and its significance to Australia. Canberra: Land and Water Resources Research and Development Corporation.

Office of Environment and Heritage (2013) The Native Vegetation of the Sydney Metropolitan Area. Version 2.0

Office of Environment & Heritage (2016). NSW Guide to Surveying Threatened Plants. Sydney: Office of Environment and Heritage.

Roads & Maritime Services (2016). Guideline for Biodiversity Offsets. Roads & Maritime Services.

Roads and Traffic Authority (2011). Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects. Sydney: RTA.

Royal Botanic Gardens (2021). "Plantnet - The Plant Information Network System of Botanic Gardens Trust Version 2.0." 2021, from http://plantnet.rbgsyd.nsw.gov.au/.

TfNSW (2022), No Net Loss Guidelines

Thackway, R. & Cresswell, I. D. (1995). An Interim Biogeographic Regionalisation of Australia. Canberra: Australian Nature Conservation Agency.

West G, Williams, R.J., and Laird, R. (2004) Distribution of Estuarine Vegetation in the Parramatta River and Sydney Harbour, 2000. A report for the NSW Maritime and Australian Maritime Safety Authority

Appendix A: Species recorded

Recorded flora

Family	Scientific name	Common name	BC Act	EPBC Act	Q1	RD1	RD2	RD3	RD4	RD5	RD6	RM
Acanthaceae	*Avicennia marina*	Grey Mangrove			x							x
Asteraceae	*Bidens pilosa**	Cobbler's Pegs				x		x				x
Asteraceae	*Cirsium vulgare**	Spear Thistle				X						x
Asteraceae	*Conyza bonariensis* *	Tall fleabane				x	x					x
Asteraceae	*Hypochaeris radicata**	Catsear				x						x
Asteraceae	*Senecio madagascarensis**	Fireweed						x				x
Asteraceae	*Sonchus oleraceus**	Common Sowthistle				x				x	x	x
Asteraceae	*Taraxacum officinale**	Dandelion										x
Aizoaceae	*Tetragonia tetragonoides*	New Zealand Spinach			x			x				x
Brassicaceae	*Capsella bursa-pastoris**	Shepherd's Purse				x						x
Brassicaceae	*Cardamine hirsuta**	Common bittercress				x						x
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak					x					x
Convolvulaceae	*Dichondra repens*	Kidney Weed										x
Convolvulaceae	*Ipomoea indica**	Blue Morning Glory						x				x
Cyperaceae	*Carex appressa*	Tall Sedge						x	x	x		x
Cyperaceae	*Ficinia nodosa*	Knobby Club-rush						x		x	x	x
Cyperaceae	*Gahnia aspera*	Rough Saw-sedge					x					x
Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush					x					x
Fabaceae (Faboideae)	*Indigofera australis*	Australian Indigo					x					x
Fabaceae (Faboideae)	*Medicago arabica**	Spotted Burr Medic				x	x				x	x
Fabaceae (Faboideae)	*Trifolium repens**	White Clover										x
Fabaceae (Mimosoideae)	*Acacia myrtifolia*	Myrtle Wattle					x					x
Lamiaceae	*Plectranthus parviflorus*	Cockspur Flower					x					x
Lamiaceae	*Westringia fruticosa*	Coastal Rosemary							x	x		x
Myrsinaceae	*Anagallis arvensis**	Scarlet/Blue Pimpernel				x						x

Myrtaceae	*Corymbia maculata*	Spotted Gum								x		x
Myrtaceae	*Kunzea ambigua*	Tick Bush					x					x
Myrtaceae	*Leptospermum polygalifolium subsp. polygalifolium*	Lemon-scented Tea-tree					x					x
Myrtaceae	*Lophostemon confertus*	Brush Box										x
Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark							x	x		x
Phormiaceae	*Dianella caerulea var. producta*	Blue Flax lily					x					x
Pittosporaceae	*Bursaria spinosa*	Blackthorn					x					x
Plantaginaceae	*Plantago lanceolata**	Lamb's Tongues										x
Poaceae	*Axonopus fissifolius**	Narrow-leaved Carpet Grass								x		x
Poaceae	*Bromus catharticus**	Prairie Grass				x	x					x
Poaceae	*Cenchrus clandestinus**	Kikuyu Grass							x			x
Poaceae	*Cenchrus setaceus**	Fountain Grass					x		x		x	x
Poaceae	*Cynodon dactylon*	Common Couch										x
Poaceae	*Ehrharta erecta**	Panic Veldtgrass				x						x
Poaceae	*Holcus lanatus**	Yorkshire Fox									x	x
Poaceae	*Imperata cylindrica* var. *major*	Blady Grass					x				x	x
Poaceae	*Lolium perenne**	Perennial Ryegrass									x	x
Poaceae	*Poa annua**	Winter Grass				x						x
Poaceae	*Stenotaphrum secundatum**	Buffalo Grass										x
Poaceae	*Themeda triandra*	Kangaroo Grass					x					x
Papaveraceae	*Fumaria indica**	Fumitory						x				x
Polygonaceae	*Rumex crispus**	Curled Dock				x						x
Primulaceae	*Aegiceras corniculatum*	River Mangrove			x							x
Primulaceae	*Samolus repens*	Creeping Brookweed			x							x
Proteaceae	*Hakea sericea*	Needlebush					x					x
Rubiaceae	*Galium spp.*							x				x
Rubiaceae	*Richardia humistrata**	South American Mexican Clover				x						x
Solanaceae	*Solanum nigrum**	Black-berry Nightshade						x				x
Solanaceae	*Solanum mauritianum**	Wild Tobacco Bush							x			x

Appendix B: Habitat suitability assessment

Use the below criteria to determine the likelihood that a threatened species could occur in the study area. The criteria are designed for use in a BAR only and is not applicable for use in a BDAR (i.e., where the BAM-C is being used). Only recorded sightings from BioNet are valid for these criteria.

Likelihood	Criteria
Recorded	The species was observed in the study area during the current survey or has been recorded within the past five years (known from a reputable source).
High	A species is considered highly likely to occur in the study area if: • *There are previous credible records on BioNet within the study area from the last 10 years and suitable habitat is present.* OR • *The species is highly mobile, is dependent on identified suitable habitat within the study area (i.e., for breeding or important life cycle periods such as winter flowering resources) and has been recorded recently (within five years) on BioNet in the locality. This also includes species known or likely to visit the study area during regular seasonal movements or migration.*
Moderate	A species is considered moderately likely to occur in the study area if: • *Any suitable habitat (e.g., foraging) is present in the study area, the species is highly mobile and has been recorded in the locality in the last 10 years on BioNet. The species may be unlikely to maintain sedentary populations, however, may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area.* OR • *The species is not highly mobile, is dependent on identified suitable habitat features (e.g., hollows, rocky outcrops) within the study area and has been recorded in the locality in the last 10 years on BioNet.* OR • *For flora species that are associated with PCTs in the study area (see TBDC) or have been recorded in the locality in the last 10 years on BioNet – the associated PCT/habitat present in the study area is not degraded and the species was not targeted by surveys in accordance with the BAM and relevant survey guidelines. In addition, for flora species known to occur in disturbed areas (e.g., orchids), records from any time within the locality may warrant inclusion in this category.*
Low	A species is considered to have a low likelihood of occurring in the study area if: • *For highly mobile species, the species may be an occasional visitor, but habitat similar to the study area is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitats in the study area and the species has not been recorded in the locality in the last 10 years on BioNet.* OR • *The species is not highly mobile, is dependent on identified suitable habitat features (e.g., hollows, rocky outcrops) within the study area and has not been recorded in the locality in the last 10 years on BioNet.* OR • *For flora species that are associated with PCTs in the study area (see TBDC) and the species was not identified following targeted surveys in accordance with the BAM and relevant survey guidelines. Flora species that have been recorded in the locality on BioNet at any time, associated suitable habitat (see the TBDC) is not present in the study area, though similar habitats of the same vegetation formation is present in the study area.*

Unlikely	Suitable habitat for the species is absent from the study area.

Habitat suitability assessment table

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Plants						
Bynoe's Wattle *(Acacia bynoeana)*	E1	V	Preferred specific habitat types not present within the study area.	Occurs south of Dora Creek-Morisset area to Berrima and the Illawarra region and west to the Blue Mountains. It grows mainly in heath and dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes disturbed sites such as trail margins and recently burnt areas. Typically occurs in association with *Corymbia gummifera, Eucalyptus haemastoma, E. gummifera, E. parramattensis, E. sclerophylla, Banksia serrata* and *Angophora bakeri.*	PMST	Low – No habitat for this species is present in the study area.
Downy Wattle (*Acacia pubescens*)	V	V	Preferred specific habitat types not present within the study area.	Restricted to the Sydney Region from Bilpin to the Georges River and also at Woodford where it usually grows in open sclerophyll forest and woodland on clay soils. Typically, it occurs at the intergrade between shales and sandstones in gravely soils often with ironstones.	Bionet (13 records) PMST PlantNet	Low – No habitat for this species is present in the study area.
Sunshine Wattle (*Acacia terminalis subsp. terminalis*)	E1	E	Preferred specific habitat types not present within the study area.	Grows in scrub and dry sclerophyll woodland between Botany Bay and the northern foreshore of Port Jackson. The locations from which several of the early collections were made no longer provide habitat, having been cleared for development of the eastern suburbs. Recent collections have been made only from Clifton Gardens, Dover Heights, Parsley Bay, Nielsen Park, Cooper Park, Chifley and Watsons Bay.	PMST	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.
Allocasuarina glareicola	E1	E	Preferred specific habitat types not present within the study area.	Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool. Grows in Castlereagh woodland on lateritic soil.	PMST	Low – No habitat for this species is present in the study area.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Asterolasia elegans	E1	E	Preferred specific habitat types not present within the study area.	Occurs on Hawkesbury sandstone. Can be found in sheltered forests on mid to low slopes and valleys and in areas of sheltered forest.	PMST	Low – No habitat for this species is present in the study area.
Thick Lip Spider Orchid (*Caladenia tessellata*)	E1	V	Preferred specific habitat types not present within the study area.	Occurs south of Swansea where it grows on clay loam or sandy soils. Prefers low open forest with a heathy or sometimes grassy understorey. Within NSW, currently known from two disjunct areas; one population near Braidwood on the Southern Tablelands and three populations in the Wyong area on the Central Coast. Previously known also from Sydney and South Coast areas.	PMST	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.
Netted Bottlebrush (*Callistemon linearifolius*)	V	-	Preferred specific habitat types not present within the study area.	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Was more widespread across its distribution in the past. Some populations are reserved in Ku-ring-gai Chase National Park, Lion Island Nature Reserve, and Spectacle Island Nature Reserve. Further north it has been recorded from Yengo National Park and Werakata National Park. Grows in dry sclerophyll forest on the coast and adjacent ranges.	Bionet (3 records) PlantNet	Low – There is no habitat in the study area suitable for this species.
Leafless Tongue Orchid (*Cryptostylis hunteriana*)	V	V	Preferred specific habitat types not present within the study area.	Occurs south from the Gibraltar Range, chiefly in coastal districts but also extends on to tablelands. Grows in swamp-heath and drier forest on sandy soils on granite & sandstone. Occurs in small, localised colonies most often on the flat plains close to the coast but also known from some mountainous areas growing in moist depressions and swampy habitats.	PMST	Low – No habitat for this species is present in the study area.
White-flowered Wax Plant (*Cynanchum elegans*)	E1	E	Preferred specific habitat types not present within the study area.	Occurs from the Gloucester district to the Wollongong area and inland to Mt Dangar where it grows in rainforest gullies, scrub, and scree slopes. This species typically occurs at the ecotone between dry subtropical forest/woodland communities.	PMST	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Darwinia biflora	V	V	Preferred specific habitat types not present within the study area.	Recorded in Ku-ring-gai, Hornsby, Baulkham Hills and Ryde local government areas. The northern, southern, eastern and western limits of the range are at Maroota, North Ryde, Cowan and Kellyville, respectively.	PMST	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.
Dillwynia tenuifolia	V	-	Preferred specific habitat types not present within the study area.	In western Sydney, Dillwynia tenuifolia is found on alluvial soils or on residual soil landscapes near the alluvial boundary. In this region this species is strongly associated with the alluvial Hawkesbury – Nepean Terrace Gravels (ferruginised clay and consolidated sand of the Londonderry Clay, the conglomerate of the Rickabys Creek Gravels, laterised sand and clay of the St Mary's Formation). *Dillwynia tenuifolia* also occurs to a lesser extent on the residual Cumberland Plain landscape on the Bringelly Shale and Ashfield Shale where there is influence from the quaternary alluvium of the Hawkesbury – Nepean Channels and Floodplains (eg South Creek, Kemps Creek, Ropes Creek, and Eastern Creek) and where the gravelly Berkshire Park soil landscape is present (i.e. Kemps Creek, Scheyville).	Bionet (1 record)	Low – There is no habitat in the study area suitable for this species.
Dillwynia tenuifolia Sieber ex D.C. in the Baulkham Hills local government area	E2	-	Preferred specific habitat types not present within the study area.	The endangered population includes all locations for the species within the Baulkham Hills local government area. Only two confirmed locations are known, both near the junction of Wisemans Ferry and Sackville Roads.	Bionet (1 record)	Low – There is no habitat in the study area suitable for this species.
Epacris purpurascens var. purpurascens	V	-	Preferred specific habitat types not present within the study area.	Recorded from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South. Found in a range of habitat types, most of which have a strong shale soil influence.	Bionet (66 records)	Low – There is no habitat in the study area suitable for this species.
Camfield's Stringybark (*Eucalyptus camfieldii*)	V	V	Preferred specific habitat types not present within the study area.	Restricted distribution in a narrow band with the most northerly records in the Raymond Terrace area south to Waterfall. Localised and scattered distribution includes sites at Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park.	PMST	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Eucalyptus sp. cattai	E4	CE	Preferred specific habitat types not present within the study area.	A small, often mallee-form tree to 4.5m, occurs in The Hills Local Government Area, with known populations occurring within the area bounded by Kellyville - Maraylya - Glenorie. Occurs as a rare emergent tree in scrub, heath and low woodland on sandy soils, usually as isolated individuals or occasionally in small clustered groups. The sites at which it occurs are generally flat and on ridge tops.	PMST	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.
Narrow-leaved Black Peppermint (*Eucalyptus nicholii*)	V	V	Preferred specific habitat types not present within the study area.	Occurs from Niangala to Glenn Innes where it grows in grassy sclerophyll woodland on shallow relatively infertile soils on shales and slates, mainly on granite. Endemic on the NSW Northern Tablelands, of limited occurrence, particularly in the area from Walcha to Glen Innes; often on porphyry or granite.	Bionet (1 record)	Low – No habitat for this species is present in the study area. This species is often planted in the Sydney region. However no individuals were recorded within the study area.
Bauer's Midge Orchid (*Genoplesium baueri*)	E1	E	Preferred specific habitat types not present within the study area.	The species has been recorded from locations between Ulladulla and Port Stephens. About half the records were made before 1960 with most of the older records being from Sydney suburbs including Asquith, Cowan, Gladesville, Longueville and Wahroonga. No collections have been made from those sites in recent years. Currently the species is known from just over 200 plants across 13 sites. The species has been recorded at locations now likely to be within the following conservation reserves: Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments.	PMST	Low – The habitat in the study area is considered unlikely to be suitable for this species.
Narrow-leaf Finger Fern (*Grammitis stenophylla*)	E1		Preferred specific habitat types not present within the study area.	The Narrow-leaf Finger Fern is a little fern, growing in small colonies, with hanging or erect fronds. Occurs in eastern Queensland and eastern NSW. In NSW it has been found on the south, central and north coasts and as far west as Mount Kaputar National Park near Narrabri. Moist places, usually near streams, on rocks or in trees, in rainforest and moist eucalypt forest.	Bionet (1 record)	Low – The habitat in the study area is considered unlikely to be suitable for this species.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Haloragodendron lucasii	E1	E	Preferred specific habitat types not present within the study area.	The known locations of this species are confined to a very narrow distribution on the north shore of Sydney. Associated with dry sclerophyll forest. Reported to grow in moist sandy loam soils in sheltered aspects, and on gentle slopes below cliff-lines near creeks in low open woodland. Associated with high soil moisture and relatively high soil-phosphorus levels. Flowering occurs from August to November with fruits appearing from October to December.	PMST	Low – The habitat in the study area is considered unlikely to be suitable for this species.
Hibbertia superans	E1	-	Preferred specific habitat types not present within the study area.	Distributed from Baulkham Hills to South Maroota in the northern outskirts of Sydney. Occurs in both open woodland and heathland, and appears to prefer open disturbed areas, such as tracksides.	Bionet (43 records)	Low – The habitat in the study area is considered unlikely to be suitable for this species
Lasiopetalum joyceae	V	V	Preferred specific habitat types not present within the study area.	Has a restricted range occurring on lateritic to shaley ridgetops on the Hornsby Plateau south of the Hawkesbury River. It is currently known from 34 sites between Berrilee and Duffys Forest. Seventeen of these are reserved. Grows in heath on sandstone.	PMST	Low – The habitat in the study area is considered unlikely to be suitable for this species.
Leptospermum deanei	V	V	Preferred specific habitat types not present within the study area.	Occurs in Hornsby, Warringah, Ku-ring-gai and Ryde LGAs. Woodland on lower hill slopes or near creeks. Sandy alluvial soil or sand over sandstone. Occurs in Riparian Scrub, Woodland - e.g. *Eucalyptus haemstoma*; and Open Forest - e.g. *Angophora costata*	PMST	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.
Macadamia integrifolia	-	V	Preferred specific habitat types not present within the study area.	Found in remnant forest in northern NSW and south-east QLD, preferring partially open areas such as rainforest edges.	Bionet (2 records)	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.
Marsdenia viridiflora R. Br. subsp. *viridiflora* population in the Bankstown, Blacktown, Camden,	E2	-	Preferred specific habitat types not present within the study area.	Endangered population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool, and Penrith local government areas. Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Grows in vine thickets and open shale woodland.	Bionet (1 record)	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas						
Biconvex Paperbark (*Melaleuca biconvexa*)	V	V	Preferred specific habitat types not present within the study area.	Occurs as disjunct populations in coastal New South Wales from Jervis Bay to Port Macquarie, with the main concentration of records is in the Gosford/Wyong area. Grows in damp places, often near streams, or low-lying areas on alluvial soils of low slopes or sheltered aspects.	PMST	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.
Deane's Paperbark (*Melaleuca deanei*)	V	V	Preferred specific habitat types not present within the study area.	Occurs in coastal districts, including western Sydney (e.g. Baulkham Hills, Liverpool shires) from Berowra to Nowra where it grows in wet heath on sandstone and shallow/skeletal soils near streams or perched swamps.	PMST	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.
Tall Knotweed (*Persicaria elatior*)	V	V	Preferred specific habitat types not present within the study area.	Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). The species also occurs in Queensland. This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	PMST	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.
Hairy Geebung (*Persoonia hirsuta*)	E1	E	Preferred specific habitat types not present within the study area.	Occurs in central coast and central tableland districts where it grows in woodland to dry sclerophyll forest on sandstone and rarely shale. Often occurs in areas with clay influence, in the ecotone between shale and sandstone.	PMST	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.
Persoonia mollis subsp. maxima	E1	E	Preferred specific habitat types not present within the study area.	Highly restricted, known from the Hornsby Heights-Mt Colah area north of Sydney in the Sydney Basin Bioregion. Occurs in three populations (described on a catchment basis) located over an approximate north-south range of	PMST	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
				5.75 km and east-west distance of 7.5 km. Additional locations may exist outside the current distribution. Occurs in sheltered aspects of deep gullies or on the steep upper hillsides of narrow gullies on Hawkesbury Sandstone. These habitats support relatively moist, tall forest vegetation communities, often with warm temperate rainforest influences.		
Nodding Geebung (*Persoonia nutans*)	E1	E	Preferred specific habitat types not present within the study area.	Persoonia nutans is restricted to the Cumberland Plain. It is known from an area between Richmond and Macquarie Fields, particularly near the Nepean and Georges Rivers. The range of the species is fragmented, with about 99 per cent of the known populations occurring in the north of the distribution at Agnes Banks, Londonderry, Castlereagh, Berkshire Park and Windsor Downs. This species is also known from Kemps Creek on the sandy lateritic soils. Persoonia nutans is strongly associated with the Hawkesbury – Nepean Terrace Gravels and the presence of the Londonderry Clay geological formation (clay with sand – top layer hard, semi-indurated zone of cemented ironstone pisolites) with the Berkshire Park and Agnes Banks soil landscapes (laterite and sand).	PMST	Low – This species has been recorded in Wenthworthville to the west. However, within the study area, soils and habitat are considered unsuitable for this species.
Pimelea curviflora var. curviflora	V	V	Preferred specific habitat types not present within the study area.	Confined to coastal areas around Sydney where it grows on sandstone and laterite soils. It is found between South Maroota, Cowan, Narrabeen, Allambie Heights, Northmead and Kellyville, but its former range extended south to the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly. Usually occurs in woodland in the transition between shale and sandstone, often on Lucas Heights soil landscape.	Bionet (6 records) PMST PlantNet	Low – This species has been recorded in North Parramatta, however habitat in the study area is considered unlikely to be suitable for this species.
Spiked Rice-flower (*Pimelea spicata*)	E1	E	Preferred specific habitat types not present within the study area.	This species occurs in two disjunct areas: in coastal districts from Lansdowne to Shellharbour, and in Cumberland Plain Woodland inland to Penrith. In western Sydney it grows on Wianamatta Shales in Greybox - Ironbark Woodland with Bursaria spinosa and Themeda	Bionet (2 records) PMST	Low – This species has been recorded in North Parramatta, however habitat in the study area is considered unlikely to be suitable for this species.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
				australis. In the Illawarra, it occurs on well-structured clay soils in grassland or open woodland.		
Brown Pomaderris (*Pomaderris brunnea*)	E1	V	Preferred specific habitat types not present within the study area.	Within the Hawkesbury–Nepean region, Pomaderris brunnea is known from a small area around the Colo, Nepean, and Hawkesbury Rivers, including the Bargo area and near Camden. It is restricted to the Picton – Razorback Hills and Nattai Plateau. It is also found near Camden on the Cumberland Plain, Hawkesbury – Nepean Channels and Floodplains, and Hawkesbury – Nepean Terrace Gravels. This species shows a strong preference for alluvial soils and the shale/sandstone transitional zone of the residual Lucas Heights soil landscape around Bargo. Suitable habitat is the Sydney Hinterland Transitional Woodland around Bargo and the Alluvial Woodland and Riparian Forest along the Nepean River at Camden.	PMST	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.
P. prunifolia in the Parramatta, Auburn, Strathfield and Bankstown Local Government Areas	E2	-	Preferred specific habitat types not present within the study area.	An isolated population of *Pomaderris prunifolia* occurred in the Parramatta, Auburn, Strathfield and Bankstown Local Government Areas, disjunct from other populations. There are early collections from the late 1800s and early 1900s from Flemington (Auburn, Strathfield LGAs), Bankstown and Parramatta. The only recent collection from this area is from Rydalmere, where only 3 plants occur within Rookwood Cemetery and at The Crest of Bankstown.	Bionet (7 records)	Low – This species has been historically recorded adjacent to the study area along the banks of Parramatta River and at several locations within Parramatta and Rydalmere. However this species is rare in the region and unlikely to occur in the small area (0.5ha) of the study area.
Illawarra Greenhood (*Pterostylis gibbosa*)	E1	E	Preferred specific habitat types not present within the study area.	Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). It is apparently extinct in western Sydney which is the area where it was first collected (1803). All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage.	PMST	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.
Sydney Plains Greenhood (*Pterostylis saxicola*)	E1	E	Preferred specific habitat types not	Restricted to western Sydney between Freemans Reach in the north and Picton in the south. There are very few known populations and they are all very small and	Bionet (2 records) PMST	Low –

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
			present within the study area.	isolated. Two populations occur within a conservation reserve (Georges River National Park; Scheyville NP).		There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.
Eastern Underground Orchid (*Rhizanthella slateri*)	V	E	Preferred specific habitat types not present within the study area.	Occurs from south-east Queensland to south-east NSW. In NSW, currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. There has been a recent discovery of this species in the Lane Cove catchment in the Ku-ring-gai LGA. Habitat requirements are poorly understood, and no particular vegetation type has been associated with the species.	PMST	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.
Scrub Turpentine *(Rhodamnia rubescens*)	E4	CE	Preferred specific habitat types not present within the study area.	Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of R. rubescens typically occur in coastal regions Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	Bionet (3 records) PMST	Low – There is no habitat in the study area considered suitable for this species
Native Guava (*Rhodomyrtus psidioides*)	E4	CE	Preferred specific habitat types not present within the study area.	Occurs from Broken Bay, approximately 90 km north of Sydney, New South Wales, to Maryborough in Queensland. Populations are typically restricted to coastal and sub-coastal areas of low elevation however the species does occur up to c. 120 km inland in the Hunter and Clarence River catchments and along the Border Ranges in NSW. Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines. This species is characterised being extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.	PMST	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.
Magenta Lilly Pilly (*Syzygium paniculatum*)	E1	V	Preferred specific habitat types not	Occurs between Buladelah and St Georges Basin where it grows in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea. On the south coast the	Bionet (7 records) PMST	Low – There are many records of *Syzygium paniculatum* around urbanised areas of

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
			present within the study area.	Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.		Sydney as this species is commonly planted as street tree and as a hedge plant in gardens. However, the study area is not considered to be suitable habitat for this species and and no plantings of this species occurred within the study area..
Glandular-pink Bell (*Tetratheca glandulosa*)	V	-	Preferred specific habitat types not present within the study area.	Endemic to NSW, with around about 150 populations from Yengo National Park to Lane Cove National Park. Associates in areas with shale cappings over sandstone. Occurs in heath, scrublands to woodlands and open forest. Common woodland tree species include: *Corymbia gummifera, C. eximia, Eucalyptus haemastoma, E. punctata, E. racemosa*, and/or *E. sparsifolia*, with an understorey dominated by species from the families Proteaceae, Fabaceae, and Ericaceae.	Bionet (1 record)	Low – This species has been recorded in North Parramatta, however habitat in the study area is considered unlikely to be suitable for this species.
Austral Toadflax (*Thesium australe*)	V	V	Preferred specific habitat types not present within the study area.	Grows in grassland or woodland often in damp sites. It is a semi-parasitic herb and hosts are likely to be *Themeda australis* and *Poa* spp.	PMST	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.
Creek Triplarina (*Triplarina imbricata*)	E1	E	Preferred specific habitat types not present within the study area.	Found only in a few locations in the ranges south-west of Glenreagh and near Tabulam in north-east NSW. The species was previously recorded in Parramatta, near Sydney, however, the species is no longer thought to occur in this area. Occurs along watercourses in low open forest with Water Gum (Tristaniopsis laurina) or in montane bogs, often with *Baekea amissa*.	Bionet (4 records) PlantNet	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.
Narrow-leafed Wilsonia (*Wilsonia backhousei*)	V	-	Preferred specific habitat types not present within the study area.	In NSW Narrow-leaf Wilsonia is found on the coast between Mimosa Rocks National Park and Wamberal north of Sydney (Nelson's Lake, Potato Point, Sussex Inlet, Wowly Gully, Parramatta River at Ermington, Clovelly, Voyager Point, Wollongong and Royal National Park). It grows in all southern states. his is a species of the margins of salt marshes and lakes.	Bionet (26 records) PlantNet	Low – No habitat for this species is present in the study area.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Zannichellia palustris	E1	-	Preferred specific habitat types not present within the study area.	Known in NSW from the lower Hunter and in Sydney Olympic Park. Grows in fresh or slightly saline stationary or slow moving waters and flower during the warmer months. NSW populations behave as annuals, dying back completely every summer.	PlantNet	Low – Although known to occur at Sydney Olympic Park and recorded at Newington Nature Reserve, the species has not been recorded further inland.
Zieria involucrata	E1	V	Preferred specific habitat types not present within the study area.	Has a disjunct distribution north and west of Sydney, in the Baulkham Hills, Hawkesbury, Hornsby and Blue Mountains local government areas. Recent records for the species come from 22 populations in the catchments of the Macdonald, Colo and Hawkesbury Rivers between Melon Creek and Mogo Creek in the north to Little Cattai Creek (Hillside) and Wheeny Creek (Colo) in the south and Katoomba. Occurs primarily on Hawkesbury sandstone. Also occurs on Narrabeen Group sandstone and on Quaternary alluvium.	PMST	Low – There is no habitat in the study area suitable for this species and this species has never been recorded or collected in the locality.
Birds						
Regent Honeyeater (*Anthochaera phrygia*)	E4	CE	Preferred specific habitat types not present within the study area.	Occurs mostly in box-ironbark forests and woodland and prefers the wet, fertile sites such as along creek flats, broad river valleys and foothills. Riparian forests with Casuarina cunninghamiana and Amyema cambagei are important for feeding and breeding. Important food trees include Eucalyptus sideroxylon (Mugga Ironbark), E. albens (White Box), E. melliodora (Yellow Box) and E. leucoxylon (Yellow Gum).	Bionet (2 records) PMST	Low – There is a historical record from 1968 within central Parramatta however as there is minimal foraging habitat this was likely a vagrant bird. There is no habitat considered suitable for this species within the study area.
Dusky Woodswallow (*Artamus cyanopterus*)	V	-	Preferred specific habitat types not present within the study area.	The Dusky Woodswallow has two separate populations. The eastern population is found from Atherton Tableland, Queensland south to Tasmania and west to Eyre Peninsula, South Australia. The other population is found in south-west Western Australia. The Dusky Woodswallow is found in open forests and woodlands and may be seen along roadsides and on golf courses.	Bionet (3 records)	Low – This species is known from the Sydney Region, but the study area does not provide any suitable open forest or woodland habitat for this species. It is considered to have a low likelihood of occurrence.
Australian Bittern	E1	E	Preferred specific habitat types not	Occurs from south-east Queensland to south-east South Australia, Tasmania and the south-west of Western	Bionet (1 record)	Low –

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
(*Botaurus poiciloptilus*)			present within the study area.	Australia. The Australasian Bittern's preferred habitat is comprised of wetlands with tall dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. It favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and reeds (e.g. Phragmites, Cyperus, Eleocharis, Juncus, Typha, Baumea, Bolboschoenus) or cutting grass (Gahnia) growing over a muddy or peaty substrate	PMST	Although recorded in the locality at George Kendall Riverside Park and Sydney Olympic Park, further east along Parramatta River. Habitat within the study area does not contain such suitable mudflats of the reserve and therefore unlikely this species would occur within the study area.
Red Knot (*Calidris canutus*)	-	E	Preferred specific habitat types not present within the study area.	Common in all the main suitable habitats around the coast of Australia. Mainly inhabit intertidal mudflats, sand flats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs.	PMST	Low – Although recorded in the locality at Sydney Olympic Park, further east along Parramatta River. Habitat within the study area does not contain such suitable mudflats of the reserve and therefore unlikely this species would occur within the study area.
Curlew Sandpiper (*Calidris ferruginea*)	E1	CE	Preferred specific habitat types not present within the study area.	In Australia, Curlew Sandpipers occur around the coasts of all states and are also quite widespread inland, though in smaller numbers. They occur in Australia mainly during the non-breeding period but also during the breeding season when many non-breeding one year old birds remain. Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh and in Mangroves.	Bionet (1 record) PMST	Low – Although recorded in the locality at Sydney Olympic Park, further east along Parramatta River. Habitat within the study area does not contain such suitable mudflats of the reserve and therefore unlikely this species would occur within the study area.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Great Knot (*Calidris tenuirostris*)	V	CE,M	Preferred specific habitat types not present within the study area.	"In NSW, the species has been recorded at scattered sites along the coast down to about Narooma. It has also been observed inland at Tullakool, Armidale, Gilgandra and Griffith. Occurs within sheltered, coastal habitats containing large, intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons. Often recorded on sandy beaches with mudflats nearby, sandy spits and islets and sometimes on exposed reefs or rock platforms. Migrates to Australia from late August to early September, although juveniles may not arrive until October-November. Most birds return north in March and April, however some individuals may stay over winter in Australia.	PMST	Low – Although recorded in the locality at Sydney Olympic Park, further east along Parramatta River. Habitat within the study area does not contain such suitable mudflats of the reserve and therefore unlikely this species would occur within the study area.
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	V	-	Preferred specific habitat types not present within the study area.	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests with an acacia understorey. Also occur in subalpine Snow Gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box ironbark assemblages, or in dry forest in coastal areas, occasionally feeding on exotic plant species on urban fringe areas. Favours old growth forest and woodland attributes for nesting and roosting. Nesting occurs in Spring and Summer with nests located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.	Bionet (1 record)	Low – There is no habitat considered suitable for this species in the study area.
Lesser Sand Plover, Mongolian Plover (*Charadrius mongolus*)	V	E	Preferred specific habitat types not present within the study area.	The Lesser Sand-plover breeds in central and north eastern Asia, migrating further south for winter. In Australia the species is found around the entire coast but is most common in the Gulf of Carpentaria, and along the east coast of Queensland and northern NSW. Individuals are rarely recorded south of the Shoalhaven estuary, and there are few inland records. Almost entirely coastal in NSW, favouring the beaches of sheltered bays, harbours and estuaries with large intertidal sand flats or mudflats; occasionally occurs on sandy beaches, coral reefs and	PMST	Low - This species has not been recorded along the Parramatta River mudflats or inlet. The habitat within the study area is considered to not be suitable for this species.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
				rock platforms. Highly gregarious, frequently seen in flocks exceeding 100 individuals; also often seen foraging and roosting with other wader species. Roosts during high tide on sandy beaches, spits and rocky shores; forage individually or in scattered flocks on wet ground at low tide, usually away from the water's edge.		
Varied Sittella (*Daphoenositta chrysoptera*)	V	-	Preferred specific habitat types not present within the study area.	The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Nests in an upright tree fork high in the living tree canopy.	Bionet (2 records)	Low - Although this species has been recorded previously in the general Parramatta locality, these are likely vagrant birds. Furthermore, there is no habitat considered suitable for this species in the study area.
White-fronted Chat (population of Sydney Metropolitan Catchment Management area) (*Epthianura albifrons*)	V, E2	-	Preferred specific habitat types not present within the study area.	The White-fronted Chat is found across the southern half of Australia, from southernmost Queensland to southern Tasmania, and across to Western Australia as far north as Carnarvon. Found mostly in temperate to arid climates and very rarely sub-tropical areas, it occupies foothills and lowlands up to 1000 m above sea level. In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas. Gregarious species, usually found foraging on bare or grassy ground in wetland areas, singly or in pairs. Have been observed breeding from late July through to early March, with 'open-cup' nests built in low vegetation. Nests in the Sydney region have also been seen in low isolated Mangroves. Nests are usually built about 23 cm above the ground (but have been found up to 2.5 m above the ground).	Bionet (1 record)	Low – This species has been recorded in the nearby area at Newington Nature Reserve and Sydney Olympic Park, further east along Parramatta River as well as within Parramatta 500m from the study area. However, this close recording was most likely a vagrant bird. Habitat within the study area may provide some habitat for such vagrants but is of marginal size (0.5ha) for this species use and more likely to be attracted to more suitable habitat at Newington Nature Reserve.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Grey Falcon (*Falco hypoleucos*)	E1	-	Preferred specific habitat types not present within the study area.	Sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. The breeding range has contracted since the 1950s with most breeding now confined to arid parts of the range. There are possibly less than 5000 individuals left. Population trends are unclear, though it is believed to be extinct in areas with more than 500mm rainfall in NSW. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey.	PMST	Low – There is no habitat considered suitable for this species in the study area.
Little Lorikeet (*Glossopsitta pusilla*)	V	-	Preferred specific habitat types not present within the study area.	The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year and 'locally nomadic' movements are suspected of breeding pairs.	Bionet (1 record)	Low – There is no habitat considered suitable for this species in the study area.
Painted Honeyeater (*Grantiella picta*)	V	V	Preferred specific habitat types not present within the study area.	Lives in dry forests and woodlands. Primary food is the mistletoes in the genus Amyema, though it would take some nectar and insects. Its breeding distribution is dictated by presence of mistletoes which are largely restricted to older trees. Less likely to be found in in strips of remnant box-ironbark woodlands, such as occur along roadsides and in windbreaks, than in wider blocks.	PMST	Low – This species has not been recorded in the locality and the Sydney city area is not known as a location for this species. The habitat in the study area is not considered suitable for this species
White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	V	-	Preferred specific habitat types not present within the study area.	The White-bellied Sea-eagle is distributed around the Australian coastline, including Tasmania, and well inland along rivers and wetlands of the Murray Darling Basin. In New South Wales it is widespread along the east coast, and along all major inland rivers and waterways.	Bionet (3 records)	Low – The habitat in the study area is not considered suitable for this species.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Little Eagle (*Hieraaetus morphnoides*)	V	-	Preferred specific habitat types not present within the study area.	The Little Eagle is distributed throughout the Australian mainland occupying habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. Prey includes birds, reptiles and mammals, with the occasional large insect and carrion. Most of its former native mammalian prey species in inland NSW are extinct and rabbits now form a major part of the diet.	Bionet (1 record)	Low – The habitat in the study area is not considered suitable for this species.
White-throated Needletail (*Hirundapus caudacutus*)	-	V, M	Preferred specific habitat types not present within the study area.	Occurs in airspace over forests, woodlands, farmlands, plains, lakes, coasts and towns. Breeds in the northern hemisphere and migrates to Australia in October-April.	Bionet (3 records) PMST	Low – Although this species has been recorded along Parramatta River near to the study area, it is considered likely to fly over the study area on occasion but is unlikely to utilise the habitat in the study area. This species is commonly recorded in the Sydney region seasonally.
Swift Parrot (*Lathamus discolor*)	E1	CE	Preferred specific habitat types not present within the study area.	Breeding occurs in Tasmania, majority migrates to mainland Australia in autumn, over-wintering, particularly in Victoria and central and eastern NSW, but also south-eastern Queensland as far north as Duaringa. In mainland Australia is semi-nomadic, foraging in flowering eucalypts in eucalypt associations, particularly box-ironbark forests and woodlands.	Bionet (5 records) PMST	Low – The habitat in the study area is not considered suitable for this species.
Bar-tailed Godwit (Western Alaskan) (*Limosa lapponica baueri*)	-	V	Preferred specific habitat types not present within the study area.	The bar-tailed godwit (both subspecies combined) has been recorded in the coastal areas of all Australian states. During the non-breeding period, the distribution of bar-tailed godwit (western Alaskan) is predominately New Zealand, northern and eastern Australia. The migratory bar-tailed godwit (western Alaskan) does not breed in Australia. The bar-tailed godwit (western Alaskan) occurs mainly in coastal habitats such as large intertidal	PMST	Low – This species has been recorded in North Parramatta but is most likely a vagrant bird. Habitat within the study area may provide some habitat for vagrants but is of marginal size (0.5ha) for this species use and more likely to be attracted to more suitable habitat at Newington Nature Reserve.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
				sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays.		
Barking Owl (*Ninox connivens*)	V	-	Preferred specific habitat types not present within the study area.	Found throughout continental Australia except for the central arid regions. Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas.	Bionet (2 records)	Low – The habitat in the study area is not considered suitable for foraging or breeding for this species.
Powerful Owl (*Ninox strenua*)	V	-	Preferred specific habitat types not present within the study area.	A sedentary species with a home range of approximately 1000 hectares it occurs within open eucalypt, casuarina or callitris pine forest and woodland. It often roosts in denser vegetation including rainforest of exotic pine plantations. Generally, feeds on medium-sized mammals such as possums and gliders but would also eat birds, flying-foxes, rats and insects. Prey are generally hollow dwelling and require a shrub layer and owls are more often found in areas with more old trees and hollows than average stands.	Bionet (119 records)	Low – The habitat in the study area is not considered suitable for foraging or breeding for this species.
Eastern Curlew (*Numenius madagascariensis*)	-	CE	Preferred specific habitat types not present within the study area.	Within Australia, the Eastern Curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sand flats, often with beds of seagrass.	PMST	Low – Although recorded in the locality at George Kendall Riverside Park and Sydney Olympic Park, further east along Parramatta River. Habitat within the study area may provide some habitat for vagrants but is of marginal size (0.5ha) for this species use and more likely to be attracted to more suitable habitat at Newington Nature Reserve
Southern Fairy Prion (*Pachyptila turtur subantarctica*)	-	V	Preferred specific habitat types not present within the study area.	Fairy Prions (including other subspecies) are often beachcast on the south-eastern coast of Australia, and are commonly seen offshore over the continental shelf and over pelagic waters. The southern subspecies of the Fairy Prion is a marine bird, found mostly in temperate and subantarctic seas. On Macquarie Island and adjacent islets, the burrows of Fairy Prions are usually in crevices, in hollows beneath cushions of Colobanthus muscoides	PMST	Low – This species is a marine bird, it is unlikely to be found as far inland as the study area.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
				or in burrows in peaty soil held together by a thick cover of Cotula plumosa.		
Eastern Osprey (*Pandion haliaetus*)	V	M	Preferred specific habitat types not present within the study area.	Eastern Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging.	Bionet (1 record)	Low – Marginal foraging habitat is present within the study area, however it is of marginal size (0.5ha) for this species use and therefore may only attract a vagrant bird on occasion.
Scarlet Robin (*Petroica boodang*)	V	-	Preferred specific habitat types not present within the study area.	The Scarlet Robin is found from south east Queensland to south east South Australia and also in Tasmania and south west Western Australia. In NSW, it occurs from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes. Some birds may appear as far west as the eastern edges of the inland plains in autumn and winter.	Bionet (1 record)	Low – The habitat in the study area is not considered suitable for this species. As this species has been recorded in the locality, if observed within the study area they would be likely be a vagrant bird.
Superb Parrot (*Polytelis swainsonii*)	V	V	Preferred specific habitat types not present within the study area.	The Superb Parrot mainly inhabits forests and woodlands dominated by eucalypts, especially River Red Gums (Eucalyptus camaldulensis) and box eucalypts such as Yellow Box (Eucalyptus melliodora) or Grey Box (E. microcarpa). The species also seasonally occurs in box-pine (Callitris) and Boree (Acacia pendula) woodlands (Webster 1998).	Bionet (1 record)	Low – The habitat in the study area is not considered suitable for this species
Australian Painted Snipe (*Rostratula australis*)	E1	E	Preferred specific habitat types not present within the study area.	The Australian Painted Snipe is restricted to Australia. Most records are from the south east, particularly the Murray Darling Basin, with scattered records across northern Australia and historical records from around the Perth region in Western Australia. In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Prefers fringes of	PMST	Low – Habitat within the study area may provide some habitat for vagrant birds but is of marginal size (0.5ha) for this species use and more likely to be attracted to more suitable habitat at Newington Nature Reserve.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
				swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.		
Australian Fairy Tern (*Sternula nereis nereis*)	-	V	Preferred specific habitat types not present within the study area.	Within Australia, the Fairy Tern occurs along the coasts of Victoria, Tasmania, South Australia and Western Australia; occurring as far north as the Dampier Archipelago near Karratha. The subspecies has been known from New South Wales (NSW) in the past, but it is unknown if it persists there. The Fairy Tern (Australian) nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The subspecies has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline. The bird roosts on beaches at night.	PMST	Low – The habitat in the study area is not considered suitable for this species
Hooded Plover (*Thinornis rubricollis cucullatus*)	-	V	Preferred specific habitat types not present within the study area.	The Hooded Plover is endemic to southern Australia and is nowadays found mainly along the coast from south of Jervis Bay, NSW, south through Victoria and Tasmania to the western side of the Eyre Peninsula (South Australia). In south-eastern Australia Hooded Plovers prefer sandy ocean beaches, especially those that are broad and flat, with a wide wave-wash zone for feeding, much beach cast seaweed, and backed by sparsely vegetated sand-dunes for shelter and nesting. Occasionally Hooded Plovers are found on tidal bays and estuaries, rock platforms and rocky or sand-covered reefs near sandy beaches, and small beaches in lines of cliffs. They regularly use near-coastal saline and freshwater lakes and lagoons, often with saltmarsh.	PMST	Low – This species is not known to occur in regions as far inland as the study area, and although habitat within the study area may provide some marginal habitat, individuals would more likely occur at nearby higher quality habitat such as Newington Nature Reserve.
Masked Owl (*Tyto novaehollandiae)*	V	-	Preferred specific habitat types not present within the study area.	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution.	Bionet (2 records)	Low – The habitat in the study area is considered unlikely to be suitable for this species.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Sooty Owl (*Tyto tenebricosa*)	V	-	Preferred specific habitat types not present within the study area.	Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. Territories are occupied permanently. Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests.	Bionet (1 record)	Low – The habitat in the study area is considered unlikely to be suitable for this species.
Mammals						
Large-eared Pied Bat (*Chalinolobus dwyeri*)	V	V	Preferred specific habitat types not present within the study area.	Forages over a broad range of open forest and woodland habitats, this species is a cave roosting bat which favours sandstone escarpment habitats for roosting, in the form of shallow overhangs, crevices and caves.	PMST	Low – This species has not been recorded in the study area in the past and no suitable roosting habitat (i.e. sandstone caves, suitable crevices in Gasworks Bridge) or foraging habitat is present.
Spotted-tail Quoll (*Dasyurus maculatus*)	V	E	Preferred specific habitat types not present within the study area.	Wet and dry sclerophyll forests and rainforests, and adjacent open agricultural areas. Generally associated with large expansive areas of habitat to sustain territory size. Requires hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	Bionet (2 records) PMST	Low – This species has not been recorded in the locality and the study area does not provide any suitable habitat for this species.
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	V	-	Preferred specific habitat types not present within the study area.	Found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	Bionet (6 records)	Low – This species has not been recorded in the study area in the past and no suitable roosting habitat (i.e. sandstone caves, suitable crevices in Gasworks Bridge) or foraging habitat is present.
Southern Brown Bandicoot (*Isoodon obesulus obesulus*)	E1	E	Preferred specific habitat types not present within the study area.	This species prefers sandy soils with scrubby vegetation and/or areas with low ground cover that are burn from time to time. A mosaic of post fire vegetation is important for this species.	PMST	Low – This species has not been recorded in the locality and the study area does not provide any suitable habitat for this species.
Eastern Coastal Freetailed-bat (*Micronomus norfolkensis*)	V	-	Potentially suitable habitat for this species	The Eastern Freetail-bat is found along the east coast from south QLD to southern NSW. Occurs in dry sclerophyll forest, woodland, swamp forests and	Bionet (8 records)	Moderate – The Mangroves provide roosting and breeding habitat for this species and the

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
			associated with the study area	Mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark.		Parramatta River and the exotic grassland provides foraging habitat for this species.
Little Bentwing-bat (*Miniopterus australis*)	V	-	Preferred specific habitat types not present within the study area.	East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	Bionet (1 record)	Low – This species has not been recorded in the study area in the past and no suitable roosting habitat (i.e. sandstone caves, suitable crevices in Gasworks Bridge) or foraging habitat is present.
Large Bent-winged Bat (*Miniopterus orianae oceanensis*)	V	-	Preferred specific habitat types not present within the study area.	Occurs on east and north west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other manmade structures.	Bionet (21 records)	Low – This species is known to occur in the suburbs of Sydney, including a record further west at Lennox Bridge along Parramatta River. However, no suitable roosting habitat (i.e. sandstone caves or suitable crevices in Gasworks Bridge) are present in the study area.
Southern Myotis (*Myotis Macropus*)	V	-	Suitable habitat for this species associated with the study area.	Roosts in groups close to water in caves, mine shafts, hollow-bearing trees, and storm water channels, buildings, under bridges and in dense foliage. Forages over streams and pools catching insects and small fish.	Bionet (11 records)	Moderate – The Mangroves provide roosting and breeding habitat for this species and the Parramatta River and the exotic grassland provides foraging habitat for this species
Greater Glider (*Petauroides volans)*	-	V	Preferred specific habitat types not present within the study area.	The Greater Glider occurs in eucalypt forests and woodlands along the east coast of Australia from north east Queensland to the Central Highlands of Victoria. This species feeds exclusively on eucalypt leaves, buds, flowers and mistletoe. Shelter during the day in tree hollows and would use up to 18 hollows in their home range. Occupy a relatively small home range with an average size of 1 to 3 ha.	Bionet (1 record) PMST	Low – There is no suitable habitat for this species is present in the study area.
Brush-tailed Rock Wallaby (*Petrogale penicillate*)	E1	V	Preferred specific habitat types not	The range of the brush-tailed rock-wallaby extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing	PMST	Low – There is no suitable habitat for this species is present in the study area.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
			present within the study area.	Range. However, the distribution of the species across its original range has declined significantly in the west and south and has become more fragmented. In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night. Highly territorial and have strong site fidelity with an average home range size of about 15 ha.		
Koala (*Phascolarctos cinereus*)	V	V	Preferred specific habitat types not present within the study area.	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area would select preferred browse species.	Bionet (3 records) PMST	Low – There is no suitable habitat for this species is present in the study area.
New Holland Mouse (*Pseudomys novaehollandiae*)	-	V	Preferred specific habitat types not present within the study area.	Distribution is fragmented across all eastern states of Australia, where it inhabits open heath lands, open woodlands with heath understorey and vegetated sand dunes.	PMST	Low – There is no suitable habitat for this species is present in the study area.
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	Preferred specific habitat types not present within the study area.	Generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may	Bionet (604 records) PMST	Low - A nationally important Grey-headed Flying-fox camp is located at Parramatta Park to the north west of the study area. This species may fly over the study area to areas of suitable foraging habitat. However the vegetation within the study area does not provide foraging habitat for the Grey-headed Flying Fox.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
				have tens of thousands of animals and are used for mating, and for giving birth and rearing young.		
Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	V	-	Preferred specific habitat types not present within the study area.	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes.	Bionet (8 records)	Low – This species has not been recorded in the study area in the past and no suitable roosting habitat or foraging habitat is present.
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	V	-	Preferred specific habitat types not present within the study area.	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. This species usually roosts in tree hollows.	Bionet (6 records)	Low – This species has not been recorded in the study area in the past and no suitable roosting habitat or foraging habitat is present.
Amphibians						
Giant Burrowing Frog (*Heleioporus australiacus*)	V	V	Preferred specific habitat types not present within the study area.	In the northern population there is a marked preference for sandstone ridgetop habitat and broader upland valleys. In these locations the frog is associated with small headwater creeklines and along slow flowing to intermittent creeklines. The vegetation is typically woodland, open woodland and heath and may be associated with 'hanging swamp' seepage lines and where small pools form from the collected water. They have also been observed occupying artificial ponded structures such as fire dams, gravel 'borrows', detention basins and box drains that have naturalised over time and are still surrounded by other undisturbed habitat.	PMST	Low. There is no suitable habitat for this species is present in the study area.
Green and Golden Bell Frog (*Litoria aurea*)	E1	V	Preferred specific habitat types not present within the study area.	Various types of habitat utilised has been documented. For breeding utilises a wide range of waterbodies, including both natural and man-made structures, such as marshes, dams and stream sides, and ephemeral locations that are more often dry than wet. Is found in various small pockets of habitat in otherwise developed	Bionet (165 records) PMST	Low – Although recorded in wetland areas to the east at Rydalmere and Newington Nature Reserve, there is no habitat considered suitable for this species in the study area.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
				areas and has the tendency of often turning up in highly disturbed sites.		
Growling Grass Frog, Southern Bell Frog (*Litoria raniformis*)	E	V	Preferred specific habitat types not present within the study area.	This species is found mostly amongst emergent vegetation, including Typha sp. (bullrush), Phragmites sp. (reeds) and Eleocharis sp. (sedges), in or at the edges of still or slow-flowing water bodies such as lagoons, swamps, lakes, ponds and farm dams. Additionally, this species can occur in open grassland, open forest, ephemeral and permanent non-saline marshes and swamps and steep-banked water edges (like ditches and drains) and gently graded edges containing fringing plants.	PMST	Low – There is no habitat considered suitable for this species in the study area.
Stuttering Frog (*Mixophyes balbus*)	E1	V	Preferred specific habitat types not present within the study area.	Stuttering Frogs occur along the east coast of Australia from southern Queensland to north-eastern Victoria. Considered to have disappeared from Victoria and to have undergone considerable range contraction in NSW, particularly in south-east NSW. It is the only Mixophyes species that occurs in south-east NSW and in recent surveys it has only been recorded at three locations south of Sydney. The Dorrigo region, in north-east NSW, appears to be a stronghold for this species. Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range.	PMST	Low – There is no habitat considered suitable for this species in the study area.
Red-crowned Toadlet (*Pseudophryne australis*)	V	-	Preferred specific habitat types not present within the study area.	A brown to black frog with a bright red orange triangle on the head. Length is appox 30mm. The toadlet has restricted distribution, it is confined to the Sydney basin form Polkolbin in the north. Inhabits wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks amongst masses of dune vegetation or thick piles of leaf litter.	Bionet (3 records)	Low – There is no habitat considered suitable for this species in the study area.
Reptiles						

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Broad-headed Snake (*Hoplocephalus bungaroides*)	E1	V	Preferred specific habitat types not present within the study area.	The Broad-headed Snake is largely confined to Triassic and Permian sandstones. Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges. Moves from the sandstone rocks to shelters in hollows in large trees within 200m of escarpments in summer.	PMST	Low – There is no habitat considered suitable for this species in the study area.
Invertebrates						
Cumberland Plain Land Snail (*Meridolum corneovirens*)	E1	E	Preferred specific habitat types not present within the study area.	Lives in small areas on the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains. Primarily inhabits Cumberland Plain Woodland (a critically endangered ecological community). Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.	Bionet (1 record)	Low – There is no habitat considered suitable for this species in the study area.
Dural Land Snail (*Pommerhelix duralensis*)	-	E	Preferred specific habitat types not present within the study area.	Occurs in low densities along the western and northwest fringes of the Cumberland IBRA. Known to occur far north of St Albans, along the footslopes of the Blue mountains as far south as The Oaks. Habitats include shale-derived and sandstone derived soils with forested habitats that have good native cover and woody debris. Favours sheltering under rocks or inside bark, does not burrow or climb. Rests in exposed areas such as rocks or leaf litter.	Bionet (31 records) PMST	Low – There is no habitat considered suitable for this species in the study area.
Fish						
Black Rockcod, Black Cod, Saddled Rockcod (*Epinephelus daemelii*)	-	V	Preferred specific habitat types not present within the study area.	Adult Black Rockcod are known to occur in caves, gutters and on rocky reefs from near shore environments to depths of at least 50 m. Recently settled small juveniles are occasionally found in intertidal rock pools along the NSW coastline and larger juveniles are generally captured by anglers on rocky reefs in estuary systems.	PMST	Low – There is no habitat considered suitable for this species in the study area.
Macquarie Perch (*Macquaria australasica*)	-	E	Preferred specific habitat types not	Adult Black Rockcod are known to occur in caves, gutters and on rocky reefs from near shore environments to depths of at least 50 m. Recently settled small juveniles	PMST	Low – There is no habitat considered suitable for this species in the study area.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
			present within the study area.	are occasionally found in intertidal rock pools along the NSW coastline and larger juveniles are generally captured by anglers on rocky reefs in estuary systems.		
Australian Grayling *(Prototroctes maraena*)	-	V	Preferred specific habitat types not present within the study area.	Primarily freshwater fish found in coastal rivers in south-eastern mainland Australia and Tasmania. Larvae migrate out to see for the first 4 – 6 months before migrating back to freshwater. In their freshwater phase they are found in moderate to fast flowing waters, such as glides or runs, during the day and slow-flowing waters at night.	PMST	Low – There is no habitat considered suitable for this species in the study area.
Migratory species						
Common Sandpiper (*Actitis hypoleucos)*	-	M	Preferred specific habitat types not present within the study area.	The Common Sandpiper frequents a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity. It is mostly encountered along muddy margins or rocky shores and rarely on mudflats. It has been recorded in estuaries and deltas of streams, banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow, and may be steep. The species is often associated with Mangroves, and sometimes found in areas of mud littered with rocks or snags. Roost sites are typically on rocks or in roots or branches of vegetation, especially Mangroves. The species is known to perch on posts, jetties, moored boats and other artificial structures, and to sometimes rest on mud or 'loaf' on rocks.	Bionet (9 records)	Low – Although recorded in the nearby area at Newington Nature Reserve, further east along Parramatta River. Habitat within the study area does not contain such suitable mudflats of the reserve and therefore unlikely this species would occur within the study area.
Fork-tailed Swift (*Apus pacificus*)	-	M	A seasonal aerial species for which there is no habitat in study area.	The Fork-tailed Swift is a vagrant species to all states and territories of Australia. In NSW, it is recorded in a variety of habitats between October-April each year, with most occurrences east of the Great Divide. However, there are some populations that have been found west of the Great Divide. This species typically occupy habitats along the coastal regions, but have been commonly observed	PMST	Low – marginally suitable habitat identified within the subject land with limited records within the subject land or vicinity.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
				within urban areas, heathland, saltmarsh, riparian woodland, grassland and sometimes open farmland.		
Sharp-tailed Sandpiper (*Calidris acuminata*)	-	M	Preferred specific habitat types not present within the study area.	The Sharp-tailed Sandpiper spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage. They are widespread in most regions of New South Wales (NSW) and Victoria, especially in coastal areas, but they are sparse in the south-central Western Plain and east Lower Western Regions of NSW.	Bionet (16 records)	Low – Although recorded in the locality at Sydney Olympic Park, further east along Parramatta River. Habitat within the study area does not contain such suitable mudflats of the reserve and therefore unlikely this species would occur within the study area.
Great Knot (*Calidris tenuirostris*)	V	CE,M	Preferred specific habitat types not present within the study area.	"In NSW, the species has been recorded at scattered sites along the coast down to about Narooma. It has also been observed inland at Tullakool, Armidale, Gilgandra and Griffith. Occurs within sheltered, coastal habitats containing large, intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons. Often recorded on sandy beaches with mudflats nearby, sandy spits and islets and sometimes on exposed reefs or rock platforms. Migrates to Australia from late August to early September, although juveniles may not arrive until October-November. Most birds return north in March and April, however some individuals may stay over winter in Australia.	PMST	Low – Although recorded in the locality at Sydney Olympic Park, further east along Parramatta River. Habitat within the study area does not contain such suitable mudflats of the reserve and therefore unlikely this species would occur within the study area.
Oriental Cuckoo, Horsfield's Cuckoo (*Cuculus optatus*)	-	M	Preferred specific habitat types not present within the study area.	Breeds in northern Eurasia and sometimes forages over winter in northern and eastern Australia. Mainly inhabits forests, occurring in coniferous, deciduous and mixed forest. It feeds mainly on insects and their larvae, foraging for them in trees and bushes as well as on the ground. It is usually secretive and hard to see.	PMST	Low – There is no habitat considered suitable for this species in the study area.
Latham's Snipe, Japanese Snipe	-	M	Preferred specific habitat types not	Latham's Snipe is a non-breeding visitor to south-eastern Australia. This species occurs in permanent and	Bionet (13 records)	Low –

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
(*Gallinago hardwickii*)			present within the study area.	ephemeral wetlands up to 2000m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation.		This species has been recorded in the nearby area at Newington Nature Reserve and Sydney Olympic Park, further east along Parramatta River.. Habitat within the study area may provide some habitat for such vagrants but is of marginal size (0.5ha) for this species use and more likely to be attracted to more suitable habitat at Newington Nature Reserve.
White-throated Needletail (*Hirundapus caudacutus)*	-	M, V	A seasonal aerial species for which there is no habitat in subject land.	The White-throated Needletail is widespread in eastern and south-eastern Australia, being recorded in all coastal regions in Queensland and NSW between September-April each year during the non-breeding migration period. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. They also commonly occur over heathland but less often over treeless areas, such as grassland or swamps	PMST	Low – marginally suitable habitat identified within the subject land with limited records within the subject land or vicinity.
Caspian Tern (*Hydroprogne caspia*)	-	M	Preferred specific habitat types not present within the study area.	The Caspian Tern is found in sheltered coastal embayments preferring sandy or muddy margins. Also found in near-coastal or inland terrestrial wetlands. It forages in open wetlands, preferring sheltered shallow water near the margins. It usually breeds in low islands, cays, spits, banks, ridges, beaches of sand or shell, terrestrial wetlands and stony or rocky islets or banks and occasionally among beach-cast debris above the high-water mark or at artificial sites, including islands in reservoirs, or on dredge-spoil. Generally roosting occurs on bare exposed sand or shell spits, banks or shores.	Bionet (3 records)	Low – Although recorded in the locality at George Kendall Riverside Park and Sydney Olympic Park, further east along Parramatta River. Habitat within the study area may provide some habitat for vagrants but is of marginal size (0.5ha) for this species use and more likely to be attracted to more suitable habitat at Newington Nature Reserve
Bar-tailed Godwit (*Limosa lapponica)*	-	M	Preferred specific habitat types not	The bar-tailed godwit (both subspecies combined) has been recorded in the coastal areas of all Australian states. During the non-breeding period, the distribution of bar-	Bionet (1 record)	Low – Although recorded in the locality at George Kendall Riverside Park and Sydney Olympic

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
			present within the study area.	tailed godwit (western Alaskan) is predominately New Zealand, northern and eastern Australia. The migratory bar-tailed godwit (western Alaskan) does not breed in Australia. The bar-tailed godwit (western Alaskan) occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays.		Park, further east along Parramatta River. Habitat within the study area may provide some habitat for vagrants but is of marginal size (0.5ha) for this species use and more likely to be attracted to more suitable habitat at Newington Nature Reserve
Black-faced Monarch (*Monarcha melanopsis*)	-	M	Preferred specific habitat types not present within the study area.	Widespread in eastern Australia and vagrant to Western Australia. Mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest.	PMST	Low – There is no habitat considered suitable for this species in the study area.
Spectacled Monarch (*Monarcha trivirgatus*)	-	M	Preferred specific habitat types not present within the study area.	Found in Australia, Indonesia, and Papua New Guinea. Its natural habitats are subtropical or tropical moist lowland forests, subtropical or tropical Mangrove forests, and subtropical or tropical moist montane forests.	PMST	Low – suitable habitat present within the study area but no known records occur within the locality
Yellow Wagtail (*Motacilla flava*)	-	M	Preferred specific habitat types not present within the study area.	This species occurs in a range of habitats including estuarine habitats such as sand dunes, Mangrove forests and coastal saltmarshes. This species also occurs in open grassy areas including disturbed sites such as sports grounds and has been recorded on the edges of wetlands, swamps, lakes and farm dams. This species migrates from Asia to Australia in spring-summer. It has been recorded in the estuarine areas of the Hunter River in Newcastle NSW and in QLD and the north of NT and WA.	PMST	Low – suitable habitat present within the study area but no known records occur within the locality
Satin Flycatcher (*Myiagra cyanoleuca*)	-	M	Preferred specific habitat types not present within the study area.	Widespread in eastern Australia. In NSW, they are widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller	PMST	Low – There is no habitat considered suitable for this species in the study area.

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
				woodlands, and on migration, occur in coastal forests, woodlands, Mangroves and drier woodlands and open forests. Satin Flycatchers mainly inhabit eucalypt forests, often near wetlands or watercourses. They generally occur in moister, taller forests, often occurring in gullies. They also occur in eucalypt woodlands with open understorey and grass ground cover, and are generally absent from rainforest. In south-eastern Australia, they occur at elevations of up to 1400 m above sea level.		
Rufous Fantail (*Rhipidura rufifrons*)	-	M	Preferred specific habitat types not present within the study area.	Occurs in a range of habitats including the undergrowth of rainforests/wetter eucalypt forests/gullies, monsoon forests paperbarks, sub-inland and coastal scrubs, Mangroves, watercourses, parks and gardens. When migrating they may also be recorded on farms, streets and buildings. Migrates to SE Australia in October-April to breed, mostly in or on the coastal side of the Great Dividing Range.	PMST	Low – suitable habitat present within the study area but no known records occur within the locality
Eastern Osprey (*Pandion haliaetus*)	V	M	Preferred specific habitat types not present within the study area.	Eastern Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging.	Bionet (1 record)	Low – Marginal foraging habitat is present within the study area, however it is of marginal size (0.5ha) for this species use and therefore may only attract a vagrant bird on occasion.
Pacific Golden Plover (*Pluvialis fulva*)	-	M	Preferred specific habitat types not present within the study area.	Prefers sandy, muddy or rocky shores, estuaries and lagoons, reefs, saltmarsh, and or short grass in paddocks and crops. The species is usually coastal, including offshore islands; rarely far inland. Often observed on beaches and mudflats, sandflats and occasionally rock shelves, or where these substrates intermingle; harbours, estuaries and lagoons.	Bionet (1 record)	Low – Although recorded in the locality at George Kendall Riverside Park and Sydney Olympic Park, further east along Parramatta River. Habitat within the study area may provide some habitat for vagrants but is of marginal size (0.5ha) for this species use and more likely to be attracted to more suitable habitat at Newington Nature Reserve
Grey Plover (*Pluvialis squatarola*)	-	M	Preferred specific habitat types not	Grey plovers search for food by running short distances, pausing constantly as they track down small prey. They	Bionet (1 record)	Low –

Scientific name	Status		Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
			present within the study area.	then continue their short sprint to pick up what they find. Their habitats are mudflats, saltmarshes, tidal reefs and estuaries, and rarely inland.		This species has been recorded further east in the Sydney Olympic Park wetlands, however none known to occur further west. As more suitable habitat exists to the east of the study area it is unlikely that the study area would be considered suitable.
Greater Crested Tern (*Thalasseus bergii*)	-	M	Preferred specific habitat types not present within the study area.	Greater Crested Terns are medium sized, slender terns that are widely distributed. They are commonly found in near-coastal environments and estuaries, but also inhabit lakes and rivers inland.	Bionet (1 record)	Low – Although recorded in the locality at George Kendall Riverside Park and Sydney Olympic Park, further east along Parramatta River. Habitat within the study area may provide some habitat for vagrants but is of marginal size (0.5ha) for this species use and more likely to be attracted to more suitable habitat at Newington Nature Reserve
Common Greenshank (*Tringa nebularia*)	-	M	Preferred specific habitat types not present within the study area.	Occurs in a range of inland and coastal environments. Inland, it occurs in both permanent and temporary wetlands, billabongs, swamps, lakes floodplains, sewage farms, saltworks ponds, flooded irrigated crops. On the coast, it occurs in sheltered estuaries and bays with extensive mudflats, Mangrove swamps, muddy shallows of harbours and lagoons, occasionally rocky tidal ledges. It generally prefers wet and flooded mud and clay rather than sand.	Bionet (1 record)	Low – Although recorded in the locality at George Kendall Riverside Park and Sydney Olympic Park, further east along Parramatta River. Habitat within the study area may provide some habitat for vagrants but is of marginal size (0.5ha) for this species use and more likely to be attracted to more suitable habitat at Newington Nature Reserve

Distribution and habitat requirement information adapted from Australian Government Department of the Agriculture, Water and the Environment SPRAT http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl and NSW Department of Planning & Environment Threatened Species Data Collection https://www.environment.nsw.gov.au/threatenedspeciesapp/

Key: Listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 – X = Extinct, CE = Critically Endangered, E = Endangered, V = Vulnerable. Listed under the NSW Biodiversity Conservation Act 2016 – E3 = Critically Endangered, E1 = Endangered Species, E2 = Endangered Population, V = Vulnerable.

BioNet = OEH Bionet Atlas of NSW Wildlife, PMST = Department of Environment and Energy's EPBC Protected Matters Search Tool and PlantNet = Royal Botanic Gardens PlantNet Spatial Search.

Appendix C: Plot-based field data sheets

BAM 1			Covers	Native	Trees	Shrubs	Grass	Forb	Fern	Other	Exotic	HighThreat
PCT 920 Estuarine Mangrove forest			# spp	Count	Count	Count	Count	Count	Count	Count	Count	Count
Date: 03/09/2021			4	4	1	1	0	2	0	0	0	0
Species	Cover	Abundance	Sum cover	Cover	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum
			95	95	80	10	0	5	0	0	0	0
Avicennia marina subsp. australasica	80	300	TG	1	80							
Aegiceras corniculatum	10	40	SG	1		10						
Samolus repens	4	500	FG	1				4				
Tetragonia tetragonioides	1	10	FG	1				1				

Easting	316081
Northing	6256580
Orientation	115

BAM Attributes 20x50m plot	
Stem classes	
80+	0
50-79	0
30-49	0
20-29	Yes
10-19	Yes
5-9	0
<5	0

Hollows	0
Length logs (m)	58 m

Appendix D: Tests of Significance (BC Act)

The Project will be assessed under Part 5 Division 5.1 of the EP&A Act. Under this assessment, Section 7.3 of the BC Act requires that a test of significance is undertaken to assess the likelihood of significant impact upon threatened species, populations or ecological communities listed under the BC Act.

Assessment of habitat to be impacted upon by the Proposal found that there is potential within the study area for threatened biodiversity to occur. The following species have been assessed as part of this Proposal:

- Eastern Coastal Freetail-bat
- Southern Myotis

No threatened flora or fauna listed under the under the EPBC Act was recorded or have habitat within the study area.

The following assessments were undertaken to consider impacts of works associated with the Proposal upon threatened species, populations or communities with a moderate or greater likelihood of occurring within the proposal footprint.

Eastern Coastal Freetail Bat

Status

The Eastern Coastal Freetail-bat (*Micronomus norfolkensis*) is listed as Vulnerable under the BC Act.

Specific Impacts

The Eastern Coastal Freetail-bat has been recorded to the north of study area at Lake Parramatta, and further west at Northmead. Mangroves within the study area likely to contain hollows (no hollow-bearing tree surveys were completed as part of the field surveys). Therefore the hollows (if present) contain potential roosting and breeding habitat for this species. The Parramatta River and the exotic grassland provide foraging habitat for this species. Impacts to this species will involve the trimming of up to 0.02 ha of Mangrove trees and 1.04 ha removal of exotic grassland

In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The proposal involves minor trimming of Mangroves and removal of exotic grassland habitat. The scaffolding is temporary (in place for approximately four months). Once the scaffolding is removed the Mangroves are likely to regenerate due to propagules flowing downstream and from adjoining mangroves. Therefore, the proposed impact is consequently unlikely to be significant or place a population at risk of extinction.

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable.

- is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

- the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

Trimming of up to 0.02 ha of Mangrove trees and 1.04 ha of exotic grassland.

- whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

The proposal will result in minor modification of up to 0.02 ha foraging habitat for this species. The scaffolding which impacts upon the Mangroves is temporary (in place approximately four months). The extent of potential habitat to be removed represents a very small proportion of foraging habitat available within the surrounding landscape. Owing to the relatively small extent of potential habitat removal and the mobility of these species, the proposal is unlikely to fragment or isolated areas of habitat.

- the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The proposal is likely to modify habitat within the study area through Mangrove trimming required to install scaffolding. This clearing will occur at the edge of existing habitat and will not result in increased fragmentation or isolation. Given the mobile nature of the species, this impact is unlikely to affect the importance of the habitat within the locality.

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The study area did not represent a declared area of outstanding biodiversity value and is not in the immediate vicinity of such areas.

Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

Under the BC Act a key threatening process (KTP) is ‘a process that threatens, or that may threaten, the survival or evolutionary development of species or ecological communities.’ Currently 38 key threatening processes (KTPs) are listed for NSW (Office of Environment & Heritage 2018).

Of relevance to the Eastern Coastal Freetailed-bat, the proposed development will involve the KTP ‘Clearing of native vegetation,’ however, this impact is likely to be very minor and will not result in direct removal of plants.

Mitigation measures would be implemented for the proposal to address any additional impacts to biodiversity including rehabilitation, prevention and management of weeds. KTPS will be limited through the implementation of industry accepted construction mitigation measures.

Conclusion

The proposal is likely to impact this species through the minor modification of a small amount of riparian vegetation (trimming of (up to 0.02 ha) Mangroves and removal of grassland habitat. The trimming is required for installation of scaffolding for proposed remediation works of the Gasworks Bridge. The scaffolding is temporary to complete the works which is estimated to be approximately four months. Large tracts of habitat for this species occurs to the east of the study area which provides foraging, roosting and breeding habitat for this species. Given minor and temporary impacts as a result of the proposal, it is unlikely to be significant for the species.

Southern Myotis

Status

The Southern Myotis (*Myotis macropus*) is listed as Vulnerable under the BC Act.

Specific Impacts

No crevices underneath the Gasworks Bridge was observed during the field survey. However, the Mangroves within the study area likely to contain hollows (no hollow-bearing tree surveys were completed as part of the field surveys). Therefore the hollows (if present) contain potential roosting and breeding habitat for this species. The Southern Myotis forages on fish and insects with the Parramatta River and grassland areas providing foraging habitat. Impacts to this specie will involve the trimming of up to 0.02 ha of Mangrove trees and 0.66 ha removal of exotic grassland.

In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The proposal involves minor trimming of Mangroves and removal of exotic grassland habitat. The scaffolding is temporary (in place for approximately four months). Once the scaffolding is removed the Mangroves are likely to regenerate due to propagules flowing downstream and from adjoining mangroves. Therefore, the proposed impact is consequently unlikely to be significant or place a population at risk of extinction.

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable.

- is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

- the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

Trimming of up to 0.02 ha of Mangrove trees and 0.66 ha of exotic grassland.

- whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

The proposal will result in minor modification of approximately 0.02 ha foraging habitat for this species. The scaffolding which impacts upon the Mangroves is temporary (in place approximately four months). The extent of potential habitat to be removed represents a very small proportion of foraging habitat available within the surrounding landscape. Owing to the relatively small extent of potential habitat removal and the mobility of these species, the proposal is unlikely to fragment or isolated areas of habitat.

- the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The proposal is likely to modify habitat within the study area through Mangrove trimming required to install scaffolding. This clearing will occur at the edge of existing habitat and will not result in increased fragmentation or isolation. Given the mobile nature of the species, this impact is unlikely to affect the importance of the habitat within the locality.

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The study area did not represent a declared area of outstanding biodiversity value and is not in the immediate vicinity of such areas.

Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

Under the BC Act a key threatening process (KTP) is ‘a process that threatens, or that may threaten, the survival or evolutionary development of species or ecological communities.’ Currently 38 key threatening processes (KTPs) are listed for NSW (Office of Environment & Heritage 2018).

Of relevance to the Southern Myotis, the proposed development will involve the KTP ‘Clearing of native vegetation,’ however, this impact is likely to be very minor and will not result in direct removal of plants.

Mitigation measures would be implemented for the proposal to address any additional impacts to biodiversity including rehabilitation, prevention and management of weeds and pathogens, containment of sedimentation and runoff. KTPS will be limited through the implementation of industry accepted construction mitigation measures.

Conclusion

The proposal is likely to impact this species through the minor modification of a small amount of riparian vegetation (trimming of (up to 0.02 ha) Mangroves) and removal of grassland habitat. The trimming is required for installation of scaffolding for proposed remediation works of the Gasworks Bridge. The scaffolding is temporary to complete the works which is estimated to be approximately four months. Large tracts of habitat for this species occurs to the east of the study area which provides foraging, roosting and breeding habitat for this species. Given minor and temporary impacts as a result of the proposal, it is unlikely to be significant for the species.

Appendix G – Heritage impact assessment

AUSTRAL ARCHAEOLOGY PTY LTD
ABN: 55 629 860 975
Info@australarch.com.au
www.australarchaeology.com.au

GASWORKS BRIDGE PARRAMATTA NEW SOUTH WALES

HISTORICAL HERITAGE ASSESSMENT

FINAL REPORT

WSP AUSTRALIA PTY LTD

20 February 2023

DOCUMENT INFORMATION

Project:	Gasworks Bridge
Services required:	Historic Heritage Assessment
Client:	WSP Australia Pty Ltd
Prepared by:	Stephanie Moore, Dominique Bezzina, David Marcus
Project number:	21088

DOCUMENT HISTORY AND APPROVAL STATUS

Version No.	Version Type	Issue Date	Authored by	Approved by	Date Approved
1	Interim Draft	22/09/2021	SM, DB, DM	DM	22/09/2021
2	Draft	24/09/2021	SM, DB, DM	DM	24/09/2021
3	Final	20/02/2023	DB, DM	DM	20/02/2023
4	Final	31/03/2023	DM	DM	31/03/2023

DISTRIBUTION OF COPIES

Version No.	Quantity	Issue date	Issued to
1	1	22/09/2021	WSP Australia Pty Ltd
2	1	24/09/2021	WSP Australia Pty Ltd
3	1	20/02/2023	WSP Australia Pty Ltd
4	1	31/03/2023	WSP Australia Pty Ltd

EXECUTIVE SUMMARY

Austral Archaeology Pty Ltd (Austral) has been commissioned by WSP Australia Pty Ltd (WSP), on behalf of Fulton Hogan [the Proponent] to undertake a Historical Heritage Assessment (HHA) for the proposed maintenance works at Gasworks Bridge, Parramatta, New South Wales (NSW). The works consist of removal of existing lead paint from all wrought iron and steel components of the bridge and re-painting with a polyurethane paint system [the Proposal] (see Section 7). The repair of structural and non-structural components of the bridge will also be carried out. This report will form part of a Review of Environmental Factors (REF) being prepared by WSP under Part 5 of the *Environmental Planning and Assessment Act 1979* (EPA Act).

The study area consists of Gasworks Bridge itself, which carries Macarthur Street over the Parramatta River at Parramatta, and a construction compound and access track on part of Lot 1 DP587055, and laydown areas across Lots 1 and 2, DP1151643, Lots 34 and 56 DP1107897, Lot 1 DP69432 and Lot B DP433896 The study area is located within the City of Parramatta Local Government Area (LGA).

The location of the study area is shown in Figure 1.1 and Figure 1.2.

The purpose of this HHA is to assess the potential impact from the Proposal on the significance of any built heritage or archaeological values that may be present within or in the vicinity of the study area. The report will provide suitable management recommendations should impacts to either built heritage or archaeological values be anticipated.

IDENTIFIED ARCHAEOLOGICAL AND HERITAGE VALUES

The study area contains varying degrees of historical heritage values and archaeological potential owing to its historical use as an early wharf, the development of a water powered mill, and construction of a gasworks. Archaeological remains of interest relate to:

- Queens Wharf, the earliest landing site along the Parramatta River;
- Howells Water Mill, evidence of early industry in Parramatta; and,
- The former AGL Gasworks.

These remains are likely to be associated with the development of Parramatta through the late 18th and early 19th centuries.

The Gasworks Bridge is locally significant for its historical, technical, aesthetic, and associational values while the land immediately to the east of the bridge along the northern bank is listed for its heritage values as a wetland.

CONCLUSIONS

Based on the known history of the study area, the following conclusions have been made:

- The proposed construction compound and equipment laydown areas (north of Parramatta River) contains no archaeological potential;
- The proposed laydown areas (south of Parramatta River) are within an area assessed as having high archaeological potential for State and Locally significant remains. However, this area has undergone high levels of modern disturbance which has affected its archaeological potential; and
- Gasworks Bridge is locally significant as a representative example of iron lattice bridges.

The proposed works will have a minimal impact on the heritage significance associated with Gasworks Bridge, as while the proposed works will visually detract from the item while repairs are being carried out. Ancillary works will be removed upon completion and the subsequent condition of the bridge will be considerably improved.

While the southern side of the river is identified as containing an archaeological resource associated with Queens Wharf, the subsequent construction of the gasworks and later road corridor has caused significant degrees of disturbance in this area. There are no similar heritage constraints identified in association with the compound or laydown areas north of the river. Thus, there is little potential for archaeological material to be present within the laydown area and the proposed use of the northern compound as well as both the northern and southern laydown areas will not impact on any archaeological material. Trimming of the mangrove trees which exist within the boundaries of land designated as heritage protected wetlands is also required for the installation of scaffolding, the nature of these works are nominal and will only result in a temporary impact to the affected trees, which will be able to regenerate over time. Similarly, the use of either the northern or southern banks will affect views to and from various heritage items, any such impacts will be temporary in nature and will be resolved upon completion of the project.

As such, the proposed works will not overly detract from heritage values of nearby items and the proposed works are **acceptable** from a heritage standpoint.

RECOMMENDATIONS

This assessment has determined that while the proposed works would adversely affect heritage values associated with the bridge and surrounds while repair works are being undertaken, the proposed works are unlikely to encounter historical archaeological relics of heritage significance. Furthermore, due to the temporary nature of the proposed work, upon completion of the project, heritage values would be returned to their prior levels, if not improved

Based on the results of the assessment and the nature of the proposed works, it is recommended that:

1) Further assessments and approvals under the NSW Heritage Act 1977 are not required for these areas.
2) The *Standard Management Procedure - Unexpected Heritage Items* (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.
3) Should the proposed works be altered significantly from those outlined in Section 7 or APPENDIX A: SCOPE OF WORKS of this report, then a reassessment of the heritage/archaeological impact may be required.
4) A copy of this assessment should be lodged by the Proponent in the local history section of the local library, and in the library maintained by Heritage NSW.

CONTENTS

FIGURES

TABLES

1. INTRODUCTION

Austral Archaeology Pty Ltd (Austral) has been commissioned by WSP Australia Pty Ltd (WSP), on behalf of Fulton Hogan [the Proponent] to undertake a Historical Heritage Assessment (HHA) for the proposed maintenance works at Gasworks Bridge, Parramatta, New South Wales (NSW). The maintenance works consist of removal of existing lead paint from all wrought iron and steel components of the bridge and re-painting with a polyurethane paint system [the Proposal] (see Section 7). The repair of structural and non-structural components of the bridge will also be carried out. This report will form part of a Review of Environmental Factors (REF) being prepared by WSP under Part 5 of the *Environmental Planning and Assessment Act 1979* (EPA Act).

The study area consists of Gasworks Bridge itself, which carries Macarthur Street over the Parramatta River at Parramatta, and a construction compound and access track on part of Lot 1 DP587055, and laydown areas across Lots 1 and 2, DP1151643, Lots 34 and 56 DP1107897, Lot 1 DP69432 and Lot B DP433896 The study area is located within the City of Parramatta Local Government Area (LGA).

The location of the study area is shown in Figure 1.1 and Figure 1.2.

1.1 METHODOLOGY

The methodology supporting this report involved a period of research to locate additional background material and to prepare a synthesis of the historical research to reflect better and understand the historical context of the study area. The Study Area was also subject to a physical inspection, to identify ground disturbance, areas of archaeological potential, or other features of interest.

The report is underpinned by the philosophy of the International Council on Monuments and Sites (ICOMOS) and the *Burra Charter: Australia ICOMOS Charter for Places of Cultural Significance, 2013* (Burra Charter), the practices and guidelines of Heritage NSW and the requirements of the *Parramatta Local Environmental Plan 2011* (Parramatta LEP) and *Parramatta Development Control Plan 2011* (Parramatta DCP).

1.2 ASSESSMENT OBJECTIVES

The purpose of this historical heritage assessment is to assess the potential impact from the Proposal on the significance of any heritage values that may be present within or in the vicinity of the study area. The report will provide suitable management recommendations should impacts to heritage values be anticipated.

The objectives of this report are to:

- Identify any potential historical heritage and/or archaeological values within or in the vicinity of the study area;
- Produce an archaeological predictive model and sensitivity map to guide any management decisions regarding the study area;
- Make a statement of significance regarding any historical heritage values that may be impacted by the Proposal;
- Assess the impact of the proposed works on any identified heritage values; and
- Make appropriate management and mitigation recommendations.

1.3 PROJECT TEAM AND ACKNOWLEDGEMENTS

The project team has been led by Stephanie Moore (Senior Archaeologist, Austral) who has managed the project and was primary author of the assessment. The background research was prepared by Dominique Bezzina (Entry-Level Archaeologist, Austral). David Marcus (Director, Austral) undertook and documented the site inspection and reviewed the draft report for quality assurance and technical adequacy. David has also updated the report in light of slight amendments to the proposed project impacts.

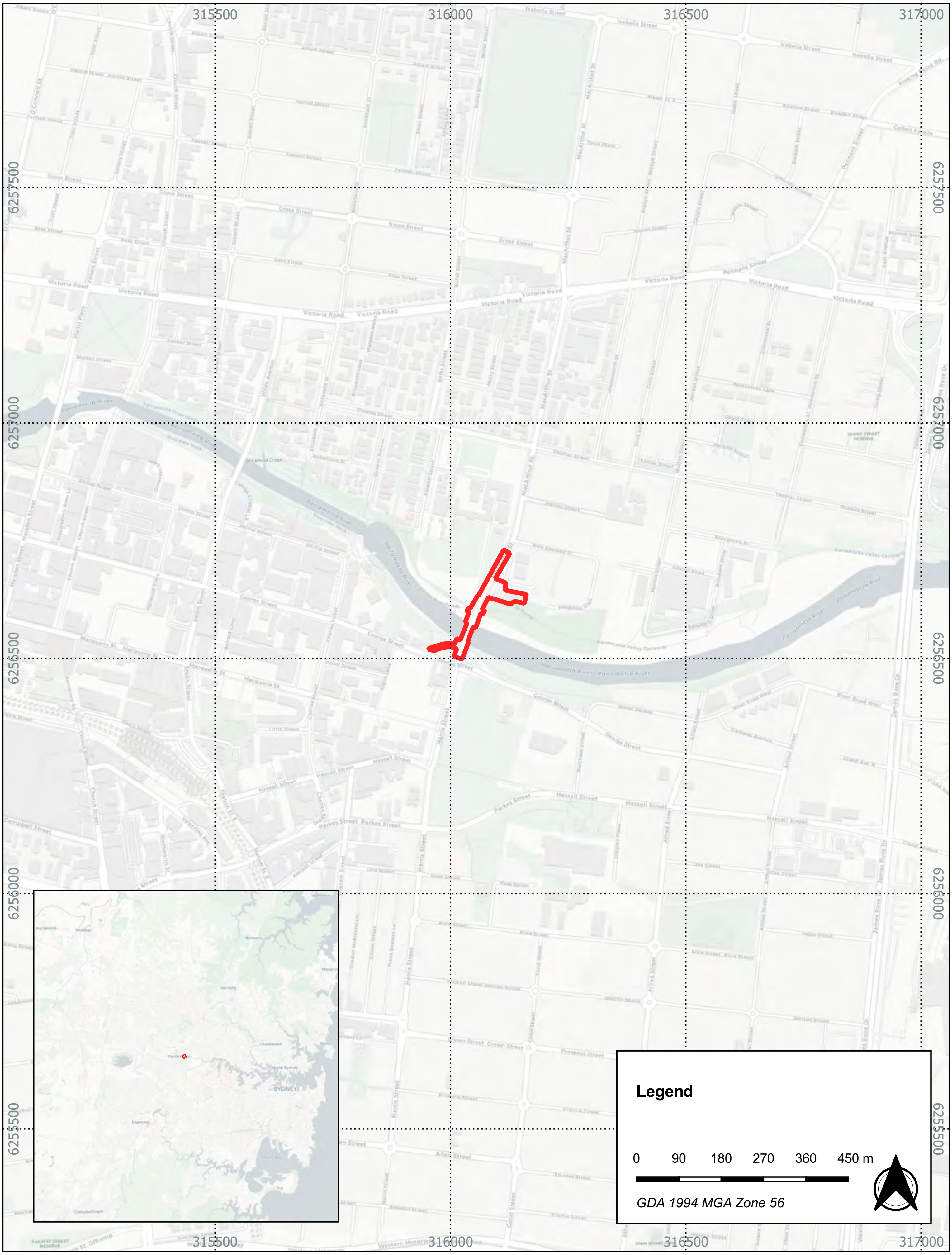


Figure 1.1 Location of the study area

21088 Gasworks Bridge, Parramatta

Source: CartoDB *Drawn by: DRM Date: 2023-03-31*

AUSTRAL ARCHAEOLOGY

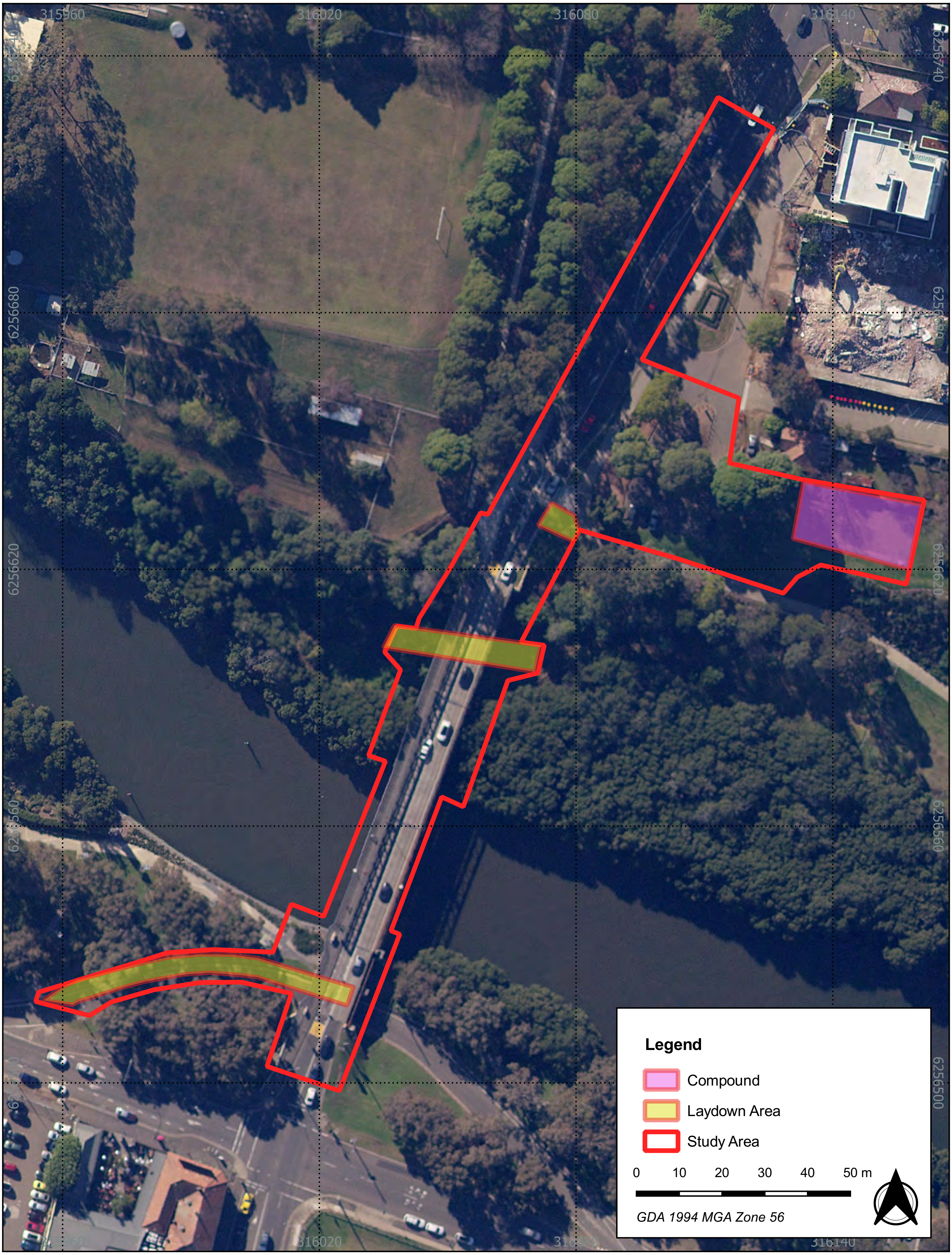


Figure 1.2 Detailed aerial of the study area

21088 Gasworks Bridge, Parramatta

Source: NSW Aerial *Drawn by: DRM Date: 2023-03-31*

AUSTRAL ARCHAEOLOGY

1.4 LIMITATIONS OF THE REPORT

This assessment includes an assessment of heritage values to support the REF being prepared by the Proponent. The report must be read in conjunction with the REF as it refers to supporting documentation not included within this report. It does not include an assessment of Aboriginal cultural heritage that may be present within the Study Area.

The results, assessments and judgements contained in this report are constrained by the standard limitations of historical research and by the unpredictability inherent in archaeological zoning from the desktop. Whilst every effort has been made to gain insight to the historical values of the Study Area, Austral cannot be held accountable for errors or omissions arising from such constraining factors.

1.5 ABBREVIATIONS

The following are common abbreviations that are used within this report:

Burra Charter	Burra Charter: Australia ICOMOS Charter for Places of Cultural Significance 2013
CBD	Central Business District
CEMP	Construction Environmental Management Plan
CHL	Commonwealth Heritage List
DCP	Development Control Plan
DPC	Department of Premier and Cabinet
EPA Act	*Environment Planning and Assessment Act* 1979
EPBC Act	*Environment Protection and Biodiversity Conservation Act* 1999
EPI	Environmental Planning Instrument
Heritage Act	*Heritage Act 1977 No 136 - NSW Legislation* n.d.
HHA	Historical Heritage Assessment
ICOMOS	International Council on Monuments and Sites
IHO	Interim Heritage Order
LEP	Local Environmental Plan
LGA	Local Government Area
NHL	National Heritage List
NPW Act	*National Parks and Wildlife Act 1974* (Minister of Energy and Environment 1974)
PHALMS	Parramatta Historical Archaeological Landscape Management Study
The Proponent	Fulton Hogan
The Proposal	The proposed works, as described in Section 1.
Parramatta DCP	Parramatta Development Control Plan 2011
Parramatta LEP	Parramatta Local Environmental Plan 2011
REF	Review of Environmental Factors
RNE	Register of the National Estate
SHI	State Heritage Inventory
SHR	State Heritage Register
Study Area	Gasworks Bridge, Parramatta
WSP	WSP Pty Ltd

2. STATUTORY CONTEXT

The following section summaries the relevant statutory context, including heritage listings, acts, and environmental planning instruments which are relevant to the Study Area and its cultural heritage.

2.1 ENVIRONMENTAL PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) established the Australian Heritage Council (formerly the Australian Heritage Commission) and provides for the protection of cultural heritage at a national level and items owned or managed by the Commonwealth. The EPBC Act has established two heritage registers:

- Commonwealth Heritage List (CHL): for significant items owned or managed by Commonwealth Government agencies;
- National Heritage List (NHL): for items assessed as being of national cultural significance.

A referral under the EPBC Act that is approved by the Australian Heritage Council is required for works to an item registered on either of these lists to ensure that the item's significance is not impacted upon.

No part of the study area appears on either the CHL or the NHL.

The Australian Heritage Council is also responsible for keeping the Register of the National Estate (RNE). In 2007 the RNE was frozen, and no further sites were added to it. For Commonwealth properties, the RNE was superseded by the CHL and NHL lists. The RNE is now retained as an archive of information about more than 13,000 places throughout Australia.

No part of the study area appears on the RNE.

2.2 NSW HERITAGE ACT 1977

The Heritage Council is the approval authority under the Heritage Act for works to an item on the State Heritage Register (SHR). Section 57(1) of the Heritage Act identifies the need for Heritage Council approval if the work involves the following tasks:

- Demolishing the building or work;
- Damaging or despoiling the place, precinct or land, or any part of the place, precinct or land;
- Moving, damaging or destroying the relic or moveable object;
- Excavating any land for the purpose of exposing or moving the relic;
- Carrying out any development in relation to the land on which the building, work or relic is situated, the land that comprises the place, or land within the precinct;
- Altering the building, work, relic or moveable object;
- Displaying any notice or advertisement on the place, building, work, relic, moveable object or land, or in the precinct; and
- Damaging or destroy any tree or other vegetation on or remove any tree or other vegetation from the place, precinct or land.

Demolition of an SHR item (in whole) is prohibited under the Heritage Act, unless the item constitutes a danger to its occupants or the public. A component of an SHR item may only be demolished if it does not contribute to the significance of the item.

Section 57(1) of the Heritage Act also applies to archaeological remains (such as relics) within an SHR site, and excavation can only proceed subject to approval of a Section 60 application by Heritage NSW.

No part of the study area appears on the SHR.

HERITAGE AND CONSERVATION REGISTER (SECTION 170 REGISTER)

Under Section 170 of the Heritage Act, government instrumentalities must keep a Heritage and Conservation Register (a Section 170 Register) which contains items under the control or ownership of the agency, and which are, or could, be listed as heritage items (of State or local significance).

The Study Area is listed on the former Roads and Maritime Services, now Transport for NSW, Section 170 Heritage register as 'Gasworks Bridge over Parramatta River' (also known as RTA Bridge No. 592).

2.3 ENVIRONMENTAL PLANNING INSTRUMENTS

An Environmental Planning Instrument (EPI) is made under the EPA Act. An EPI can be a Development Control Plan (DCP), Local Environmental Plan (LEP) or a State Environmental Planning Policy.

PARRAMATTA LOCAL ENVIRONMENTAL PLAN 2011

The current LEP for the Study Area is the Parramatta LEP. Part 5.10 of the Parramatta LEP deals with heritage conservation, and subsections (2) and (3) determine whether development consent needs to be granted by Parramatta Council before any activities occurring which may impact cultural heritage. Heritage items are listed under Schedule 5, Part 1 of the Parramatta LEP.

The Study Area is listed on Schedule 5 of the Parramatta LEP as 'Gasworks Bridge' (Item No. I487).

The Study Area is also adjacent to the following heritage items listed on Schedule 5 of the Parramatta LEP:

- **'Wetlands' (Item No. I735)**
- **'Queens Wharf Reserve and stone wall and potential archaeological site' (Item No. I489)**
- **'Newlands gates and trees' (Item No. I544)**
- **'Newlands archaeological site' (Item No. A3)**

PARRAMATTA DEVELOPMENT CONTROL PLAN 2011

The applicable DCP for the Study Area is the Parramatta DCP. Part 2 of the Parramatta DCP (Site Planning) outlines general controls to be implemented for all developments, which includes some discussion of impacts to heritage items. Part 3.5 of the Parramatta DCP related to development principles for heritage, and includes the following controls;

- C.4 Retain all buildings and structures that explain the history of the area and contribute to its significance.
- C.34 Regular maintenance of heritage buildings is essential for their conservation and protection. Buildings should be kept structurally sound, habitable and weather proofed.

PARRAMATTA HISTORICAL ARCHAEOLOGICAL LANDSCAPE MANAGEMENT STUDY 2000

The Parramatta Historical Archaeological Landscape Management Study (PHALMS) was prepared for the NSW Heritage Office by Godden Mackay Logan (GML) in 2000. The PHALMS is a comprehensive archaeological study which covers the Parramatta LGA, utilising historical maps and documentation to create archaeological predictive modelling for the region. The PHALMS divided the Parramatta LGA into Parramatta Archaeological Management Units (PAMUs) which characterise the potential archaeological resources which may be found. The PAMUs are listed on the SHI and cross referenced to the LEP listed heritage items to which they relate. The Study Area covers two PAMUs, identified as 2895 and 3029.

PAMU 2895 encompasses Queens Wharf Reserve, the former AGL Gasworks, Howell's Water Mill and Military Barracks. PAMU 2895 is considered to have exceptional archaeological research potential, relating to the early river landing established in 1790, and the later development of the AGL Gasworks. Archaeological evidence within this area may include built landforms, structural features, intact subfloor deposits, open deposits and scatters, ecological samples and individual artefacts which have potential to yield information relating to major historic themes. The PHALMS identified that archaeological evidence within this PAMU is likely to be subject to minor disturbance, with some areas of major disturbance. PAMU 2895 is of State Significance.

PAMU 3029 covers the northern bank of the Parramatta River, where the proposed construction compound area is situated. The area was part of a number of small farms granted by Governor Phillip to settlers and emancipists and was later acquired by Samuel Marsden. The area was subdivided in the 1840s, and little is known of the development within the area until it was made a foreshore reserve in 1951. It is identified that this PAMU has been subject to major disturbance and have no archaeological significance or research potential.

2.4 SUMMARY OF HERITAGE LISTINGS

Table 2.1 lists the relevant statutory and non-statutory registers, listings and orders, and identifies those in which any part of the site is listed. The location of heritage items in relation to the Study Area are outlined in Figure 2.1.

Table 2.1 Summary of heritage register listings for the subject Study Area

Register/Listing	Inclusion	Statutory implications
NHL	No	No
CHL	No	No
RNE	No	No
SHR	No	No
Roads and Maritime S170 Register	Yes	Impact Statement to be prepared before works commence.
Parramatta LEP	Yes	Site Analysis and Impact Statement to be prepared before works commence.
Parramatta DCP	Yes	Regular Maintenance to be undertaken.

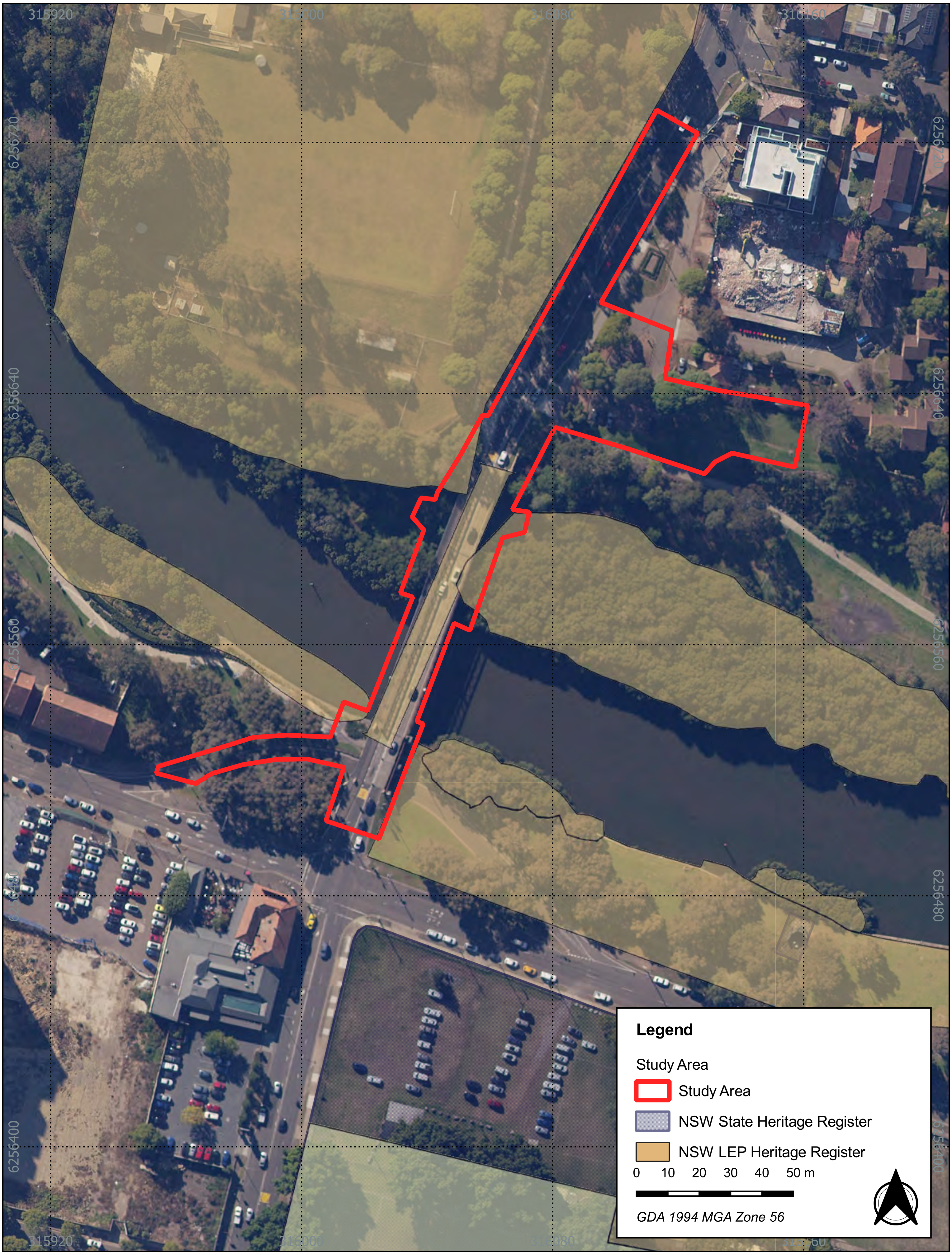


Figure 2.1 Heritage items in relation to the study area

21088 Gasworks Bridge, Parramatta

Source: NSW Topo *Drawn by: DRM Date: 2023-03-31*

AUSTRAL ARCHAEOLOGY

3. HISTORICAL CONTEXT

The following historical background is designed to contextualise a site-specific history which will aid in the understanding of the heritage values of the study area. This work will provide a useful and concise summary of the history of the study area.

3.1 HISTORY OF THE PARRAMATTA AREA

3.1.1 PRE-CONTACT ETHNOHISTORY

Until the arrival of Europeans in 1788, the land surrounding the Parramatta River was occupied by people of 4 Aboriginal tribes, the Wangal, Wallemudegal, Gammeraygal, and Burramattagal (Hoskins 2015). The river provided them with a variety of dietary resources such as ducks, fish, crabs, and shellfish and, along with this, acted as a territorial boundary and means of travel. Being a major water resource, permanent settlements would have been created within close proximity to its banks.

3.1.2 EARLY DEVELOPMENT – 1788 TO 1810

Governor Arthur Phillip arrived in the area that would eventually become known as Parramatta in 1788. The land was explored after it was determined that the original landing site in Sydney Cove was considered to be inappropriate for agricultural purposes and Phillip led a party following the river further upstream. Once the area about the new landing site was deemed to have greater potential for agriculture than Sydney Cove, actions were taken to develop the site for habitation. The initial European settlement at Parramatta was established on what is now named The Crescent, atop the traditional aboriginal hunting grounds of the Burramattagal people (Figure 3.1).

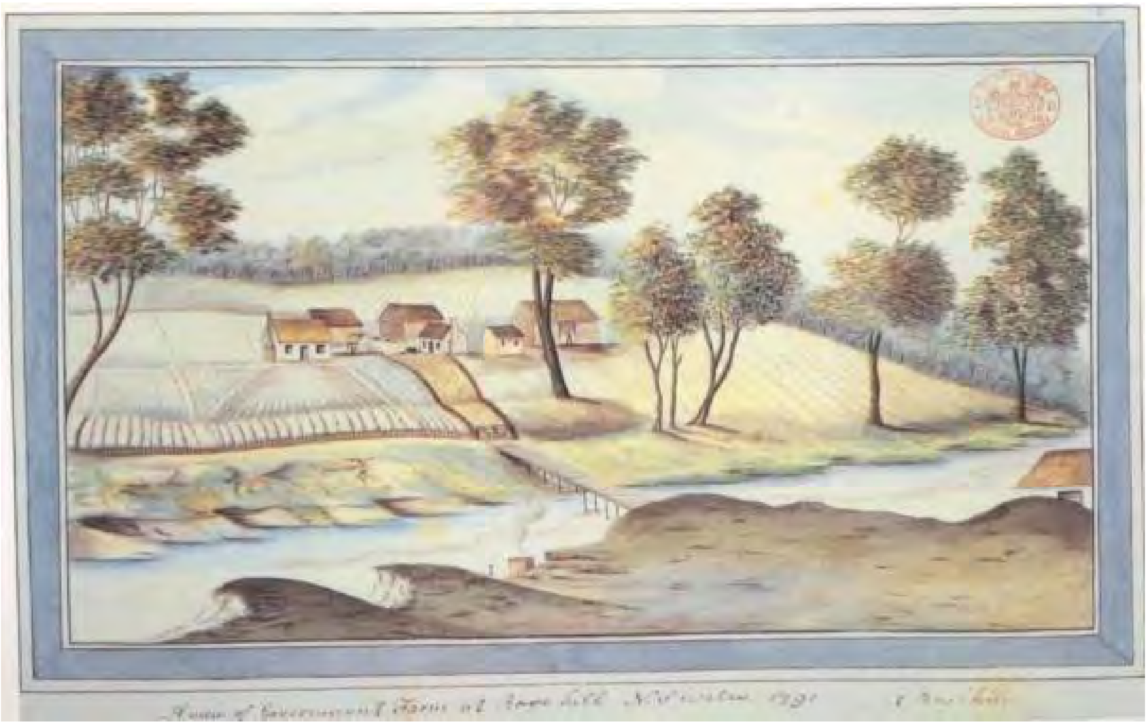


Figure 3.1 Government Farm in 1791 (Watling and Lambert Collection, Natural History Museum, British Museum)

Twenty marines and 20 convicts were brought upstream to begin land clearing for the eventual establishment of the Government Farm (Archaeological Heritage and Management Solutions Pty Ltd 2013). The farm was used for growing crops of wheat, barley, corn and oats which were to feed the Colony. The crops were established successfully, though the Colony still had to rely on imported foods (Archaeological Heritage and Management Solutions Pty Ltd 2013, Kass 2008). As the settlement was first established, Parramatta River acted as the only route for entering the area until an overland road was created between 1789 and 1791 (Artefact Heritage Pty Ltd 2017).

In 1790, Governor Phillip began planning the layout of the town under the name 'Rose Hill', with 2 east-west running roads and 2 north-south running roads being the focus of development (Archaeological Heritage and Management Solutions Pty Ltd 2013). By July 1790, the main road bisecting the settlement and leading towards the original Government House had been constructed. It was given the name High Street but has since been renamed to George Street (Michaela Anne Cameron 2015). The area surrounding Government House, the Governor's Domain, was used for grazing and growing of produce. The size of the Domain was reduced over time into the area of what is now Parramatta Park (Artefact Heritage Pty Ltd 2017).

In November 1790, Captain Watkin Tench reported that 32, 10-person houses had been completed for the men of the Colony, another 9 for "unmarried women" and "several small huts" for convict families (Archaeological Heritage and Management Solutions Pty Ltd 2013). Granaries, stores and military barracks were also constructed fronting the main streets along with farms and homesteads (Archaeological Heritage and Management Solutions Pty Ltd 2013). The name of the settlement was changed to "Parramatta" in June 1791, making it the first colonial settlement in Australia to be given the name used by the local Aboriginal people (Kass 2008).

3.1.3 EARLY DEVELOPMENT – 1810 TO 1900

As Parramatta grew, an increasing number of Government buildings and institutions were established, such as a local hospital, military barracks, Government brewery, goal, churches, stores and pubs (Curio Projects 2020). As a means of introducing and enforcing colonial ideologies and behaviours onto the local Aboriginal population, the "Native Institution" was established in 1814, with "The Annual Feast" introduced as an event adjacent to the grounds of the institution in order to encourage Aboriginal families to hand over their children to the institution. The event drew families and groups from as far as Jervis Bay and the Blue Mountains, with its purpose eventually shifting away from recruiting children for the institution and in later years becoming more focused on the feast itself (Curio Projects 2020).

Leasing of lots to individuals began in the early 1800s, which allowed for the construction of private residences and commercial buildings along George, Church and Macquarie streets (Archaeological Heritage and Management Solutions Pty Ltd 2013). By the 1840s, convicts were no longer brought into Australia and, by extension, Parramatta. As a result, the town suffered economically. Many of the buildings that were constructed for the purposes of the convict settlement were converted into public institutions, such as asylums and the goal. Other smaller buildings were incorporated into larger institutions, such as the Female Factory, which was converted into a mental health facility and is now incorporated into the Cumberland Hospital, and the Female Orphan School, which is now a part of Western Sydney University's Campus.

In the 1860s, the railway arrived in Parramatta, with the station being constructed at Church Street, veering the commercial focal point away from George Street (Artefact Heritage Pty Ltd 2017). At this stage, the main productions outlets in Parramatta included blacksmiths, tanneries, millers, brick kilns and tweed mills (Figure 3.2). The 1860s also saw the formation of a local council for the town, with the first election being held in December 1861 and the first council meeting held soon after in January 1862. Parramatta expanded further with the addition of satellite towns which accommodated an increase in population. Manufacturers began working from these areas to avoid "developmental pressures." Despite the increasing rate of urban development at this time, Parramatta maintained a pleasant landscape of farms, orchards, the river, and surrounding hills, and became something of a holiday destination for residents of the busier Sydney districts (Kass 2008).

Figure 3.2 'Parramatta' Lithograph by FC Terry, c. 1860 (Source: NLA http://nla.gov.au/nla.obj-135862408)

3.1.4 MODERN DEVELOPMENT – 1900 TO PRESENT

Entering the 1900s, the Central Business District (CBD) of Parramatta continued its commercial growth based around the junction of Church and Macquarie Street, while residential development increased around the main streets including Macquarie Street, Argyle Lane, Charles Street, George Street and Harris Street. The Parramatta Hospital also continued its evolution as buildings were added to it (Artefact Heritage Pty Ltd 2017). Major retailers opened and pushed local businesses out of the town centre.

In 1948, a municipal amalgamation occurred which included the absorption of Granville, Dundas, Ermington, Rydalmere and some sections of Blacktown. Further commercial development occurred and regional offices for companies operating within Western Sydney were established within the Parramatta CBD (Kass 2008).

The second half of the 20th century saw Parramatta and its CBD transform into the shape it takes today, with older buildings largely being amalgamated into, upgraded or replaced, by larger construction projects. Currently a major urban renewal project is being undertaken with the creation of Parramatta Square. This project area, bounded by Church Street Mall, Macquarie Street, Smith Street and Darcy Street, is intended to facilitate office spaces, multi-level retail buildings and civic facilities (Walker Corporation 2017).

3.2 HISTORICAL SKETCH OF THE STUDY AREA

The following section seeks to document the known development history of the site.

3.2.1 PHASE 0 – PRE-1820

The location of Gasworks Bridge is situated in proximity to the first landing site of Governor Phillip in Parramatta during his search for more fertile land. The location of the landing site was partially dictated by the presence of a natural stone formation present at the future site of the Gasworks Bridge. A basic wooden wharf, known as King's Wharf, was constructed to allow for cargo to brought into the settlement. As river traffic increased, leading to increasing amounts of goods being brought in, a more durable wharf, reinforced with stone, was later constructed east of the landing area in 1808 (Geoff Barker 2014, Hoskins 2015). The wharf walls are still present on the banks of the river in the vicinity of the modern Queen's Wharf Reserve. The area of the landing site also contained a flagstaff, storehouse and other military and government constructions (Casey & Lowe Pty Ltd 2013).

3.2.2 PHASE 1 – 1820 TO 1868

Samuel Marsden, a chaplain, missionary and farmer, acquired over 400 acres (4047 square metre) of land by 1802 which he named the Newlands Estate (Casey & Lowe Pty Ltd 2013). In the 1820s, Marsden constructed a seminary on his land near the northern river banks, approximately 300 metres west of the study area, and named it as 'Rangihou', after Marsden's New Zealand mission, with the purpose of teaching European farming practices to Māori men (Figure 3.3). This seminary was not active for long, however, as death rates were high amongst the attendants - largely due to the prevalence of European diseases to which the Māori men had no natural immunity. Marsden constructed another 2 houses within the Newlands Estate in 1835; Newland's house, which was intended for his wife, has now been incorporated into Macarthur Girls High School, and Broughton House, built for his daughter and her husband, and which remains standing within the grounds of Parramatta Nursing Home. Marsden's land was subdivided and sold off after his death in 1838. Residential properties began to be constructed on the land not too long after in 1844.

Meanwhile, George Howell, an ex-convict who initially had settled at Richmond, saw the advantage of the river and sought to utilize its power by constructing a wind and water mill with his son George Howell Jr in 1828 (Barker 2014). The mill was comprised of 6 stories and was positioned on the southern bank of Parramatta River within 100 metres from the southern end of the bridge within the Study Area (State Library of New South Wales 2018, Barker 2014). In order to redirect the flow of the river towards the mill, Howell constructed a dam which spanned the width of the river. The dam doubled as a means of passage over the river for the towns-people and was therefore often used by members of the community (Casey & Lowe Pty Ltd 2013). John Raine, a competitor of Howell and a resident leasing Marsden's property across from the mill, took issue with the dam's construction, claiming that people were using it to cross the river and steal from his home, and had his men take down the dam. The dam was reconstructed soon after by Howell, as Raine was not believed to have grounds to his claim.

Rangihu : the Rev. Samuel Marsden's cottage at Parramatta.
Sketched by the Rev. Richard Taylor in 1838.

Figure 3.3 'Rangihu: The Rev. Samuel Marsden's cottage at Parramatta' Sketched by the Rev. Richard Taylor in 1838 (Source: https://rangihou.wordpress.com/the-history-of-rangihou/)

3.2.3 PHASE 2 – 1868-1960

The mill was abandoned in 1868 after both Howell and his son had passed away, and the dam was once again dismantled to allow the passage of boats further upstream (Casey & Lowe Pty Ltd 2013). The mill was demolished to make way for the construction of a gasworks in 1872 (Varmin 1996). The gasworks provided the most important utility to the people of Parramatta, marked by the first lighting of a gas street lamp in 1873. The gasworks complex contained a brick factory that included a furnace, convertor and iron gasometer. The factory was bought by Australian Gas Lighting in 1890, who carried on operating the gasworks up until the turn of the century (Artefact Heritage Pty Ltd 2017). The use of electrical lighting overtook and fully replaced gas lighting 1919 and the out-of-use factory was eventually demolished after World War II (The Cumberland Argus 1961).

In order to facilitate travel to and from the gasworks, along with communications between communities across the Parramatta River, a new bridge, then known as the “Newlands Bridge”, was constructed. The building of the bridge took place between 1878 and 1885 at a total cost of £16,800. The bridge spans 110 metres long and 6.85 metres wide (Heritage NSW 2021). Soon after its construction, it became known as ‘Gasworks Bridge’ after the nearby gasworks. John A MacDonald was responsible for the design of both this and all other iron lattice bridges constructed in Australia between 1881 and 1893. It is one of 32 lattice girder bridges in the state of NSW and at the time was considered to be of a technically sophisticated design and engineering. Two memorial stones were placed at the eastern side of the bridge but have since been removed and are held in the Parramatta Heritage Centre (Parramatta City Council 2012).

The northern bank of the river, east of the bridge, also contained a number of terrace houses, which appear on town plans as early as 1895 and remained until the early 1980s.

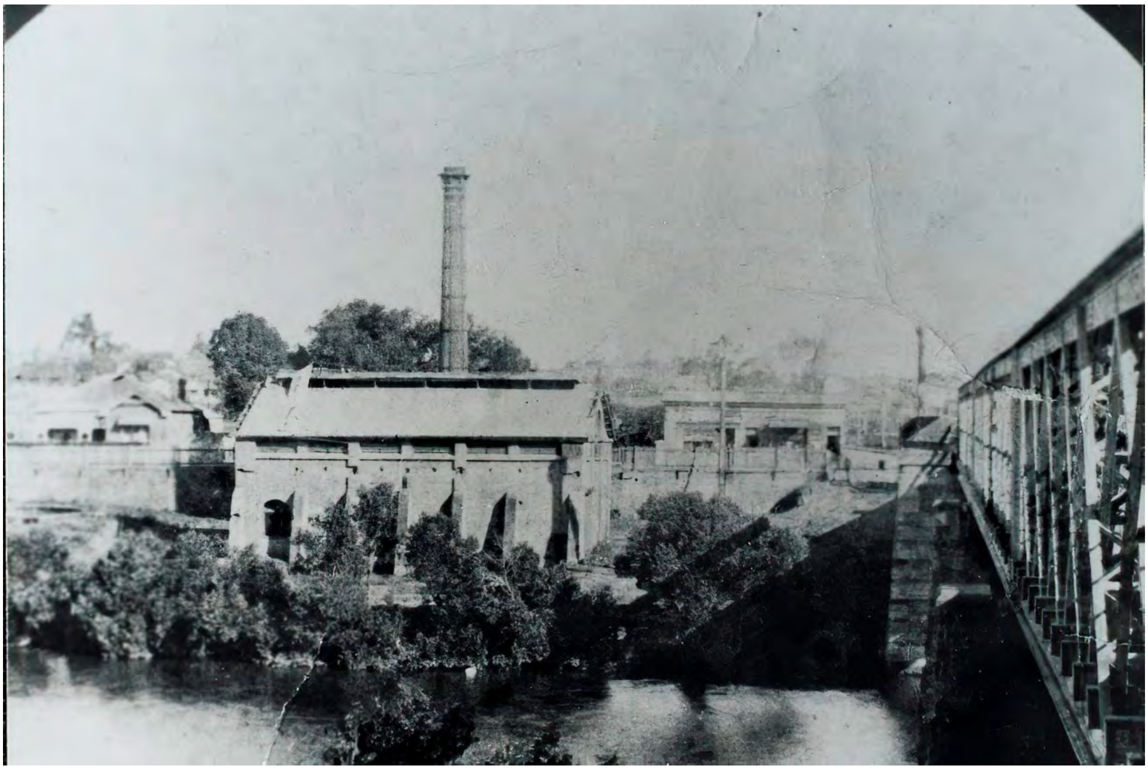


Figure 3.4 **South facing image of Parramatta Gasworks, with Gasworks Bridge to the right of the image, n.d. (Source: https://www.travel-news-photos-stories.com/2020/04/sydney-harbour-bridges-gasworks-bridge.html)**

Figure 3.5 Gasworks Bridge 1926 (Source: Parramatta Local Studies Library)

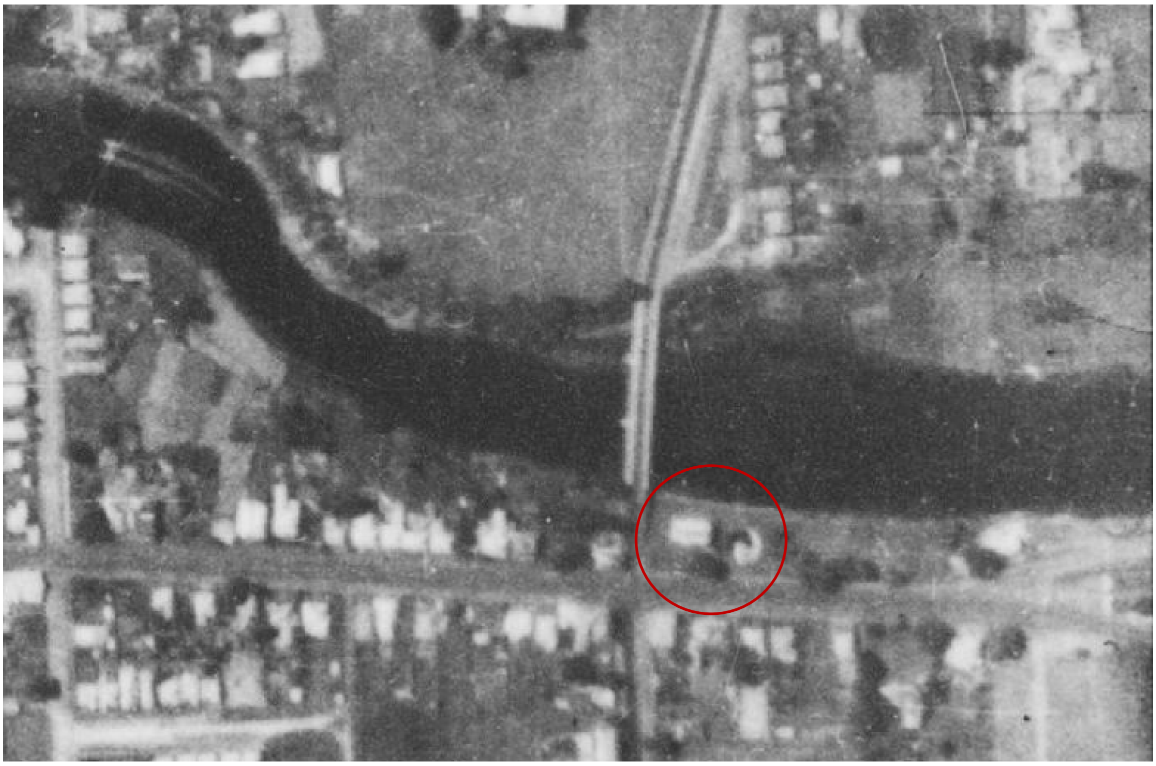


Figure 3.6 Detail of 1930 aerial image showing Gasworks Bridge, with the gasworks situated immediately to the east on the southern bank of Parramatta River (marked in red) (Source: NSW Spatial Services Historic Imagery Viewer)

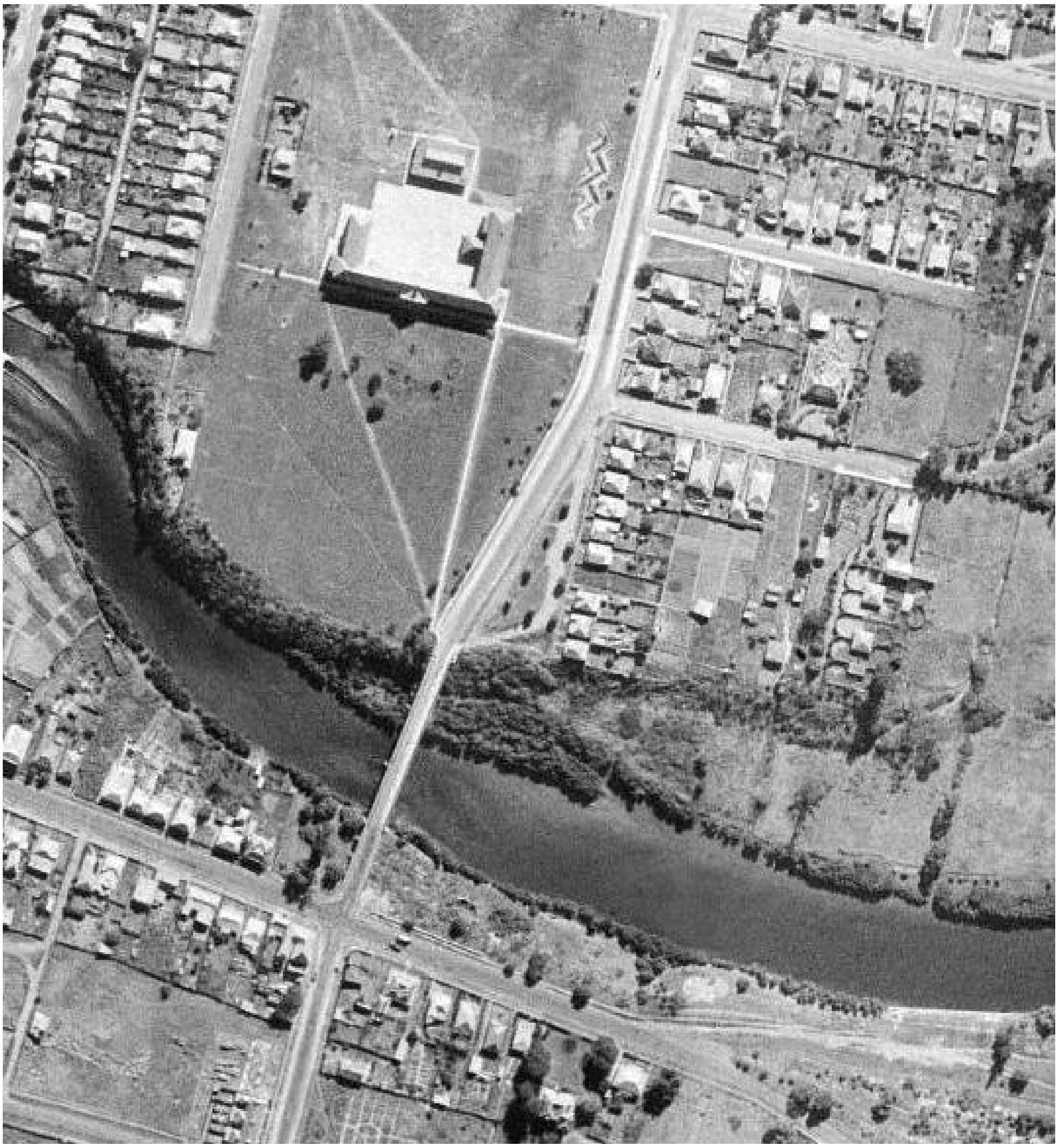


Figure 3.7 1943 Aerial Image of Parramatta, showing houses within the construction compound area and remnants of the Gasworks along the southern bank of the river (Source: NSW LPI SIX Maps)

3.2.4 PHASE 3 - 1960 - PRESENT

Since its construction, the bridge has undergone maintenance at different points in time to ensure the safety of residents and to maintain the bridge's integrity. The most recent records of maintenance and modification include noting the raising of the bridge by 18 inches (457 milimetres) in 1960 and a $1 million upgrade which included "replacing and repairing sandstone blocks, painting, structural assessment and general cleaning" over 9 months beginning in March 2016 (Parramatta City Council 2012, Heritage NSW 2021, Transport for NSW 2016). It is likely that the bridge was raised in the 1960s in order to accommodate for the construction of the traffic underpass which appears in aerial images as early as 1965. As part of the bicentennial celebrations of Australia in 1988, the NRMA and Department of Main Roads recognised the bridge as one of NSW's 50 most historic bridges, and a commemorative plaque was placed at the southern end of the bridge (Anne Bickford 1990).

Transport for New South Wales is currently constructing the Parramatta Light Rail Network which travelled from Westmead to Carlingford via Parramatta CBD and Camellia. According to the

Parramatta Light Rail Built Heritage Assessment, development of the light rail will run along George Street adjacent to the Gasworks Bridge and as such it has been predicted that there will not be any visual impact or physical impact to the bridge (Artefact Heritage Pty Ltd 2017).

3.3 CHRONOLOGY OF THE STUDY AREA

Based on the historical background presented, it is possible to summarise the chronology of the Study Area. This is presented in Table 3.1.

Table 3.1 Summary of chronological events relating to the Study Area

Phase	Summary	Date range
Phase 0	• Arrival of Gov. Phillip and establishment of Colonial settlement in Parramatta • Construction of King's Wharf and later replacement by Queen's Wharf • Construction of buildings and land clearing to make way for agricultural practice	Pre - 1820
Phase 1	• Rev. Samuel Marsden acquires ~400 acres of land, naming it the Newlands Estate • Construction of Marsden's Rangihou Seminary, Newlands House and Boughton House within the estate • Establishment of George Howell's wind and water mill on the southern banks of Parramatta River, and associated dam spanning the length of the river	1820 - 1868
Phase 2	• Howell's mill is abandoned and demolished after the death of him and his son and the land was subsequently taken over by the Parramatta gasworks • The Newlands Bridge, later named 'Gasworks Bridge', is constructed to facilitate communications and travel across the river	1868 - 1960
Phase 3	• Continuous maintenance occurs on Gasworks Bridge • Gasworks Bridge is raised 18 inches in 1960 • The bridge is recognised by NRMA and the Department of Main Roads as one of the 50 most historic bridge in NSW for bicentennial celebrations • $1 million dedicated to the bridge for cleaning, maintenance, structural assessments, and repairs in March 2016	1960 - Present

4. PREDICTIVE STATEMENTS

An assessment of archaeological potential usually considers the historic sequence of occupation in comparison to the structures that are currently extant, as well as the impact that the more recent constructions and works would have had on the earlier occupation phases and, as such, the likely intactness of the archaeological resource. This, in turn, is tied in with the extent to which a site may contribute knowledge not available from other sources to current themes in historical archaeology and related disciplines.

Regarding the assessment of the Study Area, the archaeological potential depends upon the anticipated likelihood for the survival of buried structural fabric and cultural deposits as well as an estimation of archaeological integrity. Structural fabric refers to what is generally regarded as building or civil engineering remnants. Cultural deposits refer to archaeological deposits, i.e. deposited sediments containing artefacts *et cetera*.

Having analysed the historical evidence in the previous chapters, the following section presents a summary of the potential for a physical archaeological resource to be present in the Study Area, that is, its archaeological sensitivity/potential.

The following predictive model draws on the areas of known archaeological sensitivity. As a general rule of archaeology, sites first redeveloped in either the 19th or early 20th century can also retain evidence of occupation from previous periods. It is also widespread that such evidence can be recovered even when sites have been redeveloped or disturbed by modern construction activity. Based on the detailed background history, the following general predictive statements can be made:

- The building of Gasworks Bridge is likely to have removed all evidence of archaeological material from within the footprint of its construction.
- Apart from the 20th century buildings constructed within the northern part of the study area, there is no documentary evidence relating to the use of the proposed construction compound area. Furthermore, a majority of the construction compound area is located on the lower part of the slope, which was not suitable for occupation. As such, construction of the 20th century buildings are presumed to have impacted heavily on the only part of the construction compound area which may have contained archaeological potential, and the construction compound area is unlikely to contain any archaeological material.
- Historical archaeological remains are not anticipated within the proposed laydown areas, as to the south, significant ground disturbance has previously occurred in the form of construction of the road underpass which is likely to have disturbed all archaeological remains which may have been present while to the north of the river, no heritage items have been identified.

As such, no parts of the study area are considered likely to contain archaeological potential.

5. SITE INSPECTION

The site inspection was conducted by David Marcus (Director, Austral) on 8 September 2021. The aims of the inspection were to confirm the nature of any heritage values associated with the Study Area, and the relationship between it and other recorded or previously unidentified heritage items in the surrounding area. Furthermore, the inspection sought to determine whether the use of the proposed construction compound and laydown areas along the northern bank of the river, and proposed laydown areas along the southern bank of the river would impact on heritage values or items.

For the purposes of this assessment, a heritage item is a “place, building, work, relic, moveable object or precinct” (as per the definition in Part 1 (4) of the Heritage Act).

NORTHERN CONSTRUCTION COMPOUND

The survey commenced by examining the proposed construction compound to the east of the bridge on the northern side of the river. The construction compound consisted of two discrete landscape elements: a concrete path and a grassed area to the east of the existing carpark. The grassed area formed a flat area level with the height of the carpark (Figure 5.1 & Figure 5.2), presumably having been levelled at the time of construction of the 2 houses which were formerly located in this part of the site in this part of the site (Figure 3.7). However, no evidence relating to the former buildings were identified during the survey. To the south of the terrace, the ground dropped sharply southwards towards the river, stopping where bisected by the shared pathway (Figure 5.3). Looking at the shared pathway itself, it ran eastwards from Macarthur Street on an artificial gradient cut into the existing landform on the northern side, with the fill dumped downslope to form the southern side (Figure 5.4). It continued dropping eastwards through a deep cutting on the northern side before joining the main riverside path (Figure 5.5), with the western running on a slightly raised berm leading towards and under the bridge (Figure 5.6). The survey did not identify any heritage items or values within the proposed construction compound which would be affected by the proposed works.

Views of the setting of the bridge from the riverside walkway are shown in Figure 5.7 to Figure 5.10, and it is noted that the setting of the bridge has been modified through the construction of a stormwater drain and modern retaining works to the east (Figure 5.7) and through the construction of a staircase on the west (Figure 5.10).

Figure 5.1 **West facing view of grassed terrace, looking towards carpark.**

Figure 5.2 **West facing view showing grassed terrace. Note start of slope to south (right).**

Figure 5.3 North-east facing view showing grade of slope from terrace to footpath.

Figure 5.4 East facing view showing pathway in vicinity of carpark.

Figure 5.5 **West facing view showing junction between upper path and riverside path.**

Figure 5.6 **West facing view along path looking towards the bridge.**

Figure 5.7 North-east facing view showing modern retaining wall and storm drain below bridge.

Figure 5.8 North facing view showing northern abutment of bridge.

Figure 5.9 **South facing view showing underneath of bridge and northern-most pier.**

Figure 5.10 **East facing view showing the bridge and pedestrian addition, as well as new staircase.**

SOUTHERN LAYDOWN AREAS

The proposed laydown areas on the southern side of the bridge incorporate the road corridor associated with the 1960s underpass, which ran below the bridge; although, the road corridor has since been closed and forms part of the general landscaping works associated with the Parramatta Light Rail. As part of this assessment, the former road alignment to both the east and the west of the bridge was examined for use as a laydown area.

To the west of the bridge, enabling works for the new light rail has resulted in significant ground disturbance culminating in the construction of a concrete road and adjacent path (Figure 5.11), with a large manhole cover in the road suggesting the presence of significant below-ground services (Figure 5.12). As the concrete road stops short of the bridge and does not continue along the original road alignment., All the grass within the laydown area consists of fresh turf, which is further indicative of recent disturbance in this area.

Where the underpass previously continued to the eastern side of the bridge, the road alignment in this part of the Study Area had also formed part of the light rail enabling works, although the only actual works undertaken here have been the remediation of the former road alignment and laying of new turf (Figure 5.13 and Figure 5.14). The survey noted that while this part of the site was within the curtilage of the Queens Wharf reserve, the excavation of the 1960s underpass had likely severely impacted any heritage values which may had been present.

As such, the survey did not identify any heritage items or values within either proposed laydown area on the southern side of the river which would be affected by the proposed works.

Figure 5.11 **West facing view showing proposed laydown area to the west of the bridge.**

Figure 5.12 **South-west facing view showing new road surface and pavement. Note the manhole cover to west (left).**

Figure 5.13 North-west facing view showing re-turfed road alignment.

Figure 5.14 West facing view along former road alignment.

GASWORKS BRIDGE

Views of the setting of the bridge from the riverside walkway on the southern side are shown in Figure 5.15 to Figure 5.18. The most significant heritage values in this area relate to the stonework of the various piers and abutments and, as long as no impact occurs to these items, then no additional heritage values were identified.

The bridge itself is structurally intact, consisting of the main part of the bridge which carries the road traffic and a secondary attachment on the western side for foot traffic. The survey noted all key elements which are to be affected by the proposed works, and general condition photos of the bridge are included in Figure 5.19 to Figure 5.23 below.

Figure 5.15 West facing view showing approach to southern end of bridge.

Figure 5.16 **South-east view showing southern abutment and piers of bridge.**

Figure 5.17 **South-east view showing southern abutment of bridge and former underpass alignment.**

Figure 5.18 East facing view showing pier at the southern end of the bridge.

Figure 5.19 South facing view showing northern end of the bridge.

Figure 5.20 South facing view showing examples of graffiti present along bridge.

Figure 5.21 North facing view showing southern terminus of bridge.

Figure 5.22 East facing view showing western profile of the bridge.

Figure 5.23 North facing view showing pedestrian walkway.

6. ASSESSMENT OF SIGNIFICANCE

An assessment of cultural significance seeks to establish the importance that a place has to the community. The concept of cultural significance is intrinsically tied to the fabric of the place, its history, setting and its relationship to other items in its surrounds and the response it evokes from the community.

The assessment of cultural significance with respect to archaeological sites can present difficulties because the nature and extent of the "relics" are often indeterminate and value judgements therefore need to be made based on potential attributes. The element of judgement can be greatly reduced by historical or other research, as has been completed for the current study. Archaeological deposits and features provide important evidence of the history and settlement of New South Wales. These heritage items may include deposits containing material culture (artefacts) that can be analysed to yield information regarding early urban development that is unavailable from other sources. Archaeological investigations can reveal much about technology, industry, past economic and social conditions and people's lives.

Sites that contain these elements therefore have scientific value that may be of considerable significance when analysed in association with documentary evidence. It is through this potential to reveal information about the past use of a place that archaeological sites have heritage significance.

6.1 BASIS FOR ASSESSMENT

The Burra Charter of Australia ICOMOS was formulated in 1979 (revised 1999 and 2013) [Australia ICOMOS 2013], based largely on the Venice Charter (for International Heritage) of 1966. The Burra Charter is the standard adopted by most heritage practitioners in Australia. The Charter divides significance into four categories for the purpose of assessment. They are: Aesthetic, Historical, Scientific/Technical, and Social significance.

The Heritage Council of NSW has established a set of seven criteria to be used in assessing cultural heritage significance in NSW, and specific guidelines have been produced to assist archaeologists in assessing significance for subsurface deposits (Heritage Council of New South Wales 2009; NSW Heritage Office 2001). The Heritage Council's criteria incorporate those of the Burra Charter, but are expanded to include rarity, representative value, and associative value.

In order to determine the significance of a historical site, the Heritage Council have determined that the following seven criteria are to be considered (NSW Heritage Office 2001):

- **Criterion (a):** an item is important in the course, or pattern, of NSW's cultural or natural history (or the local area);
- **Criterion (b):** an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the local area);
- **Criterion (c):** an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area);
- **Criterion (d):** an item has strong or special association with a particular community or cultural group in NSW for social, cultural or spiritual reasons (or the local area);
- **Criterion (e):** an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the local area);
- **Criterion (f):** an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the local area); and
- **Criterion (g):** an item is important in demonstrating the principal characteristics of a class of NSW's cultural or natural places or cultural or natural environments (or the local area).

These criteria were designed for use on known or built heritage items, where above ground heritage is both tangible and easily identified. Due to the nature of archaeology being that it is invisible until disturbed, the presence and attributes of archaeological material must be assumed based on the recorded levels of disturbance, known site history and the creation of predictive statements. Ultimately, the actual presence of archaeological material can only ever be framed in terms of the potential for it to be present. The following assessment therefore deals with the built and archaeological potential within the Study Area in a consolidated manner.

6.2 LEVELS OF SIGNIFICANCE

The Heritage Act allows for the protection of heritage items of State or local significance. The levels of significance can be defined as:

- Items of State significance are of special interest in a State context. They form an irreplaceable part of the environmental heritage of NSW and must have some connection of association to the State.
- Items of local significance are of special interest to the LGA. They important to the local community and often form an important part of the local identity. Collectively, such items reflect the cultural or natural history of the given area.

6.3 SIGNIFICANCE ASSESSMENT

This report provides a significance assessment of the potential archaeological resource associated with the 'Queens Wharf Reserve and stone wall and potential archaeological site' (Parramatta LEP Item No. I489), situated within PAMU 2895, and the 'Gasworks Bridge' (Parramatta LEP Item No. I487). It has been determined that no other heritage items or potential archaeological remains will be impacted by the works.

The significance assessment has been drawn from the SHI listings for the sites and is provided in Table 6.1.

Table 6.1 Assessment of Significance

Criterion	Assessment of Queens Wharf Reserve/PAMU 2895	Assessment of Gasworks Bridge
(a) an item is important in the course, or pattern, of NSW's cultural or natural history (or the local area);	This AMU/Queens Wharf Reserve provides evidence of a range of historical processes and activities relating to the history of Parramatta, including its early maritime history and the development of public utilities.	The Bridge has a high historical significance as it is on a main road. It is a large bridge with long spans over a major river, indicative of the then burgeoning road network. It has historic associative value based on its ability to represent the endeavours of local settlers, with their need for safe and reliable access across the Parramatta River. It is associated with bridge designer John A McDonald. It significantly helped open up western Sydney.
(b) an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the local area);	Does not meet the threshold for listing under this criterion.	Does not meet the threshold for listing under this criterion.
(c) an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area);	The archaeological resources of this AMU have no known aesthetic significance although it is recognised that exposed in situ archaeological remains may have distinctive/attractive visual qualities.	Aesthetically, the Bridge with its long lattice trusses and tall sandstone piers presents an imposing yet attractive reminder of the past. It has strong aesthetic lines that enhance the aesthetics of its environment. As such, the bridge has aesthetic significance.

Criterion	Assessment of Queens Wharf Reserve/PAMU 2895	Assessment of Gasworks Bridge
(d) an item has strong or special association with a particular community or cultural group in NSW for social, cultural or spiritual reasons (or the local area);	The potential social values of this AMU have not been assessed. However, some places take on high social values as a result of community interest in archaeological investigations.	Because of their numbers, the complete set of lattice truss bridges gain high social significance. The Bridge also has significance to the local community. The Bridge has contributed significantly to the social and commercial development of western Sydney.
(e) an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the local area);	The subject area has potential to contribute to our understanding of Parramatta's early maritime history and the development of utilities and services in the region	The Bridge has high technical significance because of its integrity and good condition, which contribute to its ability to demonstrate aspects of technology, design and style in bridge construction. The Bridge is a good example of British bridge technology.
(f) an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the local area); and	This AMU is likely to include scarce physical evidence relating to the early maritime history of Parramatta.	Does not meet the threshold for listing under this criterion.
(g) an item is important in demonstrating the principal characteristics of a class of NSW's cultural or natural places or cultural or natural environments (or the local area).	This AMU includes archaeological resources which, as a set, provide a physical chronicle of the history of Parramatta.	A good representative example of an iron lattice truss bridge.
Integrity/Intactness	Archaeological evidence at this site is likely to be subject to minor disturbance, with some areas of major disturbance.	The Bridge retains a high level of integrity and intactness.

The relevant historical themes which may be applied to the historical and archaeological values within the study area are listed below in Table 6.2.

Table 6.2 Historical Themes

Australian Theme	NSW Theme	Local Themes
3 Developing local, regional and national economies	Industry	Development of local industry (milling, gas generation)
3 Developing local, regional and national economies	Transport	Development of terrestrial and aquatic transportation routes.
4 Building towns and settlements	Town, suburbs and villages	Development the township of Parramatta
4 Building towns and settlements	Utilities	Generation of power

6.4 STATEMENT OF SIGNIFICANCE

The following statements of significance have been drawn from the SHI listings for the relevant heritage items and areas of archaeological potential within the Study Area.

QUEENS WHARF RESERVE

This item is of historical significance because it provides evidence of the history of amenities and services in the local area. The item is rare in local terms.

PAMU 2895

This AMU has exceptional archaeological research potential.

This area was the site of an early river landing established in 1790, later to be known as Queens Wharf. This area was developed by the Australian Gas Light Company in the 1870s, providing a gas supply to the town of Parramatta.

The physical archaeological evidence within this area may include built landforms, structural features, intact subfloor deposits, open deposits and scatters, ecological samples and individual artefacts which have potential to yield information relating to major historic themes including Environment, Utilities, Transport, Technology and Industry.

Archaeological evidence at this site is likely to be subject to minor disturbance, with some areas of major disturbance. However, it is noted that the description of impacts within the AMU does not include the road alignment constructed under Gasworks Bridge in the 1960s.

The overall AMU is of State significance.

GASWORKS BRIDGE

This item is of historical significance because it provides evidence of the history of amenities and services in the local area. The barrier formed by the river was a major factor in development as late as 1880, at which time it was only bridged at Church Street, Parramatta. In the 1880's both the Newlands (Gasworks) and Gladesville Bridges were opened.

The Study Area therefore contains historical and archaeological significance at a State and local level.

7. STATEMENT OF HERITAGE IMPACT

The purpose of this section is to present a comprehensive assessment of the impacts to the identified historic heritage and archaeological values associated with the study area from the proposed works.

7.1 PROPOSED WORKS

The scope of works proposed can be broadly described as 'the removal of existing lead paint from the Gasworks Bridge steel supporting structure and repainting with polyurethane paint system in areas nominated by the principal consultant'. Repairs to structural and non-structural components of the bridge will also be carried out. This scope of works will include:

- Supply of access scaffold systems, encapsulated to an A1 standard as per AS/NZS 4361.1:2017 Guide to hazardous paint management.
- Removal of surface corrosion in nominated locations.
- Rehabilitation of structural steel in nominated locations.
- Removal of existing lead paint from all wrought iron and steel components of the bridge.
- Application of protective coating where surface preparation has been carried out.
- Rectification of concrete spalling and cracks in nominated locations.
- Remedial works to prevent future crack propagation in nominated locations.
- Removal of debris and rubbish from bottom chords of bridge.
- Clearing and cleaning of bridge drainage scuppers.
- Rectification of timber planks in nominated locations.
- Replacement of damaged railing on the southeastern bridge approach.
- Removal of redundant utilities.
- Removal of graffiti from pier.

Scaffolding systems will consist of a combination of conventional scaffolding systems and a hanging 'drop deck' system, which will allow unobstructed travel of the river ferry. The scaffolding and containment system will not be permanently affixed to the Gasworks Bridge at any location. Surface preparation and removal of lead paint and corrosion will be undertaken with abrasive blasting, using a nominated blast medium. Application of the new coating system will be undertaken using a combination of air-assisted spraying and airless spray-painting equipment.

The proposed construction laydown areas will require installation of ground preparation works, and installation of temporary fencing. Additionally, storage containers to hold equipment may be placed on the site for the duration of works.

The proposed works also require the trimming of around 0.02 hectares of branches from mangrove trees in the adjacent wetlands to allow for the installation of the scaffolding and containment system in the general vicinity of the bridge and bridge piers on the northern side of the Parramatta River.

The full scope of works has been provided as Appendix A. The proposed scaffolding drawings are provided in Appendix B.

7.2 ASSESSED IMPACTS

CONSTRUCTION COMPOUND AREA

Works within the proposed construction compound area would be limited to minimal ground preparation works and installation of temporary above ground structures, including fencing. The proposed construction compound is in an area assessed as having no historical archaeological potential, and no heritage items have been identified within the proposal area. Any visual impacts to surrounding heritage items caused by construction of the compound or laydown area would be temporary in nature and removed following the completion of the project.

The proposed works have **no potential** to impact known historic heritage or archaeological values within this area.

SOUTHERN LAYDOWN AREAS

Works within the proposed laydown areas would be limited to minimal ground preparation works and installation of temporary above ground structures, including fencing. The proposed laydown areas are partially within PAMU 2895 and the LEP listed site ‘Queens Wharf Reserve and stone wall and potential archaeological site’, which are known to have potential to contain archaeological remains of State significance. In addition to potential archaeological remains associated with the Queens Wharf, the site retains potential to contain archaeological remains relating to Howell’s Water Mill and the former AGL Gasworks, which are of local significance. However, it is noted that the proposed laydown areas are within the corridor of a mid-20th century road alignment which was constructed to serve as an underpass below Gasworks Bridge. Construction of this road would have significantly impacted on any archaeological remains present within this part of the PAMU.

Although the wider area retains high archaeological potential, this is not the case in the location of the potential laydown areas, and therefore the works would not result in significant ground disturbance. Any visual impacts to surrounding heritage items caused by construction of the laydown area would be temporary in nature and removed following the completion of the project.

The proposed works have **low potential** to impact known historic heritage or archaeological values within this area.

GASWORKS BRIDGE

The proposed remediation and maintenance works would involve removal of lead-based paints, and replacement with suitable polyurethane alternatives. Suitable alternative paints would be applied in a colour similar to that being removed, in accordance with best practice principles. The works would be minor in nature and would not result in impacts to significant fabric of the Gasworks Bridge. The proposed works would ensure the continued use of the Gasworks Bridge, through preventative maintenance and removal of hazardous contaminants. Any visual impacts to surrounding heritage items caused by construction of scaffolding on the bridge would be temporary in nature and removed following the completion of the project.

The proposed works have **no potential** to impact known historic heritage values associated with the Gasworks Bridge.

WETLANDS

These impacts are unlikely to be significant as the impact is minor and temporary, and the mangroves are likely to regenerate following the removal of the scaffolding and containment system.

The proposed works have **low potential** to impact on the heritage values associated with the wetlands area, and the subsequent regrowth of vegetation will mitigate any short-term impact.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 CONCLUSIONS

Based on the known history of the study area, the following conclusions have been made:

- The proposed construction compound and equipment laydown areas (north of Parramatta River) contains no archaeological potential;The proposed laydown areas are within an area assessed as having high archaeological potential for State and Locally significant remains. However, this area has undergone high levels of modern disturbance which has affected its archaeological potential; and
- Gasworks Bridge is locally significant as a representative example of iron lattice bridges.

The proposed works would have a minimal impact on the heritage significance associated with Gasworks Bridge, as while the proposed works would visually detract from the item while repairs are being carried out, ancillary works such as scaffolding would be removed upon completion and the subsequent condition of the bridge would be considerably improved.

While the southern side of the river is identified as containing an archaeological resource associated with Queens Wharf, the subsequent construction of the gasworks and later road corridor has caused significant degrees of disturbance in this area. Thus, there is little potential for archaeological material to be present within the laydown area and the proposed use of both the northern and southern laydown areas would impact on any archaeological material. While the use of either the northern or southern banks would affect views to and from various heritage items, any such impacts would be temporary in nature and would be resolved upon completion of the project.

As such, the proposed works would not overly detract from heritage values of nearby items and the proposed works are **acceptable** from a heritage standpoint.

8.2 RECOMMENDATIONS

This assessment has determined that while the proposed works would adversely affect heritage values associated with the bridge and surrounds while repair works are being undertaken, the proposed works are unlikely to encounter historical archaeological relics of heritage significance. Furthermore, due to the temporary nature of the proposed work, upon completion of the project, heritage values would be returned to their prior levels, if not improved

Based on the results of the assessment and the nature of the proposed works, it is recommended that:

1) Further assessments and approvals under the NSW Heritage Act 1977 are not required for these areas.
2) The *Standard Management Procedure - Unexpected Heritage Items* (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.
3) Should the proposed works be altered significantly from those outlined in Section 7 or APPENDIX A: SCOPE OF WORKS of this report, then a reassessment of the heritage/archaeological impact may be required.
4) A copy of this assessment should be lodged by the Proponent in the local history section of the local library, and in the library maintained by Heritage NSW.

9. REFERENCES

Anne Bickford 1990, 'Parramatta River Environmental Impact Statement Report on European Heritage Sites'.

Archaeological Heritage and Management Solutions Pty Ltd 2013, 'Historical Archaeological Assessment and Research Design : 64-66 Phillip Street, Parramatta'.

Artefact Heritage Pty Ltd 2017, *'Parramatta Light Rail; Non-Aboriginal Archaeological Assessment', Report to WSP/Jacobs on behalf of Transport for NSW*.

Australia ICOMOS 2013, *The Burra Charter: the Australia ICOMOS Charter for Places of Cultural Significance*, Australia ICOMOS, Burwood, VIC.

Barker, G 2014, *Howell's Wind and Water Mill*, *Parramatta History and Heritage*, viewed 17 August 2021, <https://historyandheritage.cityofparramatta.nsw.gov.au/blog/2014/10/07/howells-wind-and-water-mill-parramatta>.

Casey & Lowe Pty Ltd 2013, 'Non-Aboriginal Heritage Assessment - Parramatta Valley Cycleway Escarpment Link'.

Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

Curio Projects 2020, 'Interpretation Plan for Charles Street Square'.

Environment Planning and Assessment Act 1979.

Geoff Barker 2014, *Governor Phillip and the 'Kings Wharf', 1788*, *Parramatta History and Heritage*, viewed 6 September 2021, <https://historyandheritage.cityofparramatta.nsw.gov.au/blog/2014/10/10/parramatta-landing-site-of-governor-phillip-1788>.

Heritage Act 1977 No 136 - NSW Legislation n.d., viewed 3 February 2021, <https://www.legislation.nsw.gov.au/view/html/inforce/current/act-1977-136>.

Heritage Council of New South Wales 2009, *Assessing significances for historical archaeological sites and 'relics'*, Heritage Branch, NSW Dept. of Planning, Parramatta, N.S.W., viewed 30 January 2019, <http://www.heritage.nsw.gov.au/03_index.htm>.

Heritage NSW 2021, *Gasworks Bridge*, *Hertiage Management System*, viewed 6 August 2021, <https://www.hms.heritage.nsw.gov.au/App/Item/ViewItem?itemId=2240221>.

Hoskins, I 2015, *River Cycles - A History of the Parramatta River*, *The Dictionary of Sydney*, viewed 16 August 2021, <https://dictionaryofsydney.org/entry/river_cycles_a_history_of_the_parramatta_river>.

Kass, T 2008, *Parramatta*, *The Dictionary of Sydney*, viewed 6 September 2021, <https://dictionaryofsydney.org/entry/parramatta>.

Michaela Anne Cameron 2015, *The Crescent*, *The Dictionary of Sydney*, viewed 8 September 2021, <https://dictionaryofsydney.org/entry/the_crescent#ref-uuid=5c8cb735-a1ce-65da-c514-233cbd5576d6>.

Minister of Energy and Environment 1974, 'National Parks and Wildlife Act'.

NSW Heritage Office 2001, ‘Assessing heritage significance’, viewed 1 May 2016, <http://www.environment.nsw.gov.au/resources/heritagebranch/heritage/listings/assessingheritagesignificance.pdf>.

Parramatta City Council 2012, ‘Assessment of Heritage Significance - Sandstone Blocks’.

State Library of New South Wales 2018, *Howells’ Mill Parramatta*, *State Library of NSW*, viewed 6 September 2021, <https://www.sl.nsw.gov.au/collection-items/howells-mill-parramatta>.

The Cumberland Argus 1961, ‘Flashback’, *Cumberland Argus*, viewed 17 August 2021, <http://nla.gov.au/nla.news-article131328858>.

Transport for NSW 2015, ‘Standard Management Procedure - Unexpected Heritage Items’.

Transport for NSW 2016, *Gasworks Bridge million dollar upgrade*, *Transport for NSW*, viewed 8 September 2021, <https://roads-waterways.transport.nsw.gov.au/about/news-events/news/members-of-parliament/2016/160308-gasworks-bridge-million-dollar-upgrade.html>.

Varmin, RVJ 1996, ‘Queens wharf Preserve Parramatta Archaeological Assessment for Parramatta City Council’.

Walker Corporation 2017, *Parramatta Square*, viewed 6 September 2021, <https://www.walkercorp.com.au/commercial/parramatta-square/>.

10. APPENDICES

APPENDIX A: SCOPE OF WORKS

Provided by WSP Pty Ltd

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

As described in Section 1.1, the proposal involves remediation works on the Gasworks bridge (the bridge) which is located over the Parramatta River on Macarthur Street in the suburb of Parramatta. The proposal would involve remedial works to remove the existing bridge coating (containing hazardous lead paint), repainting with a polyurethane paint system, and the repair of both structural and non-structural elements of the bridge.

The proposal would include the following key elements:

- installation of an encapsulated (containment) scaffolding system
- sealing of the bridge deck to prevent future corrosion
- removal of the existing lead paint coating and application of a new protective paint and coating. This would be undertaken across all wrought iron and steel elements of the bridge.
- remediation of structural steel elements where required
- remedial works to prevent future crack propagation in applicable locations
- removal of surface corrosion in applicable locations
- rectification of concrete spalling and cracks in applicable locations
- clearing and cleaning of bridge drainage infrastructure
- rectification of timber planks where required
- replacement of damaged railing on the south eastern bridge approach
- removal of redundant utilities, and
- cleaning and removal of graffiti from bridge piers.

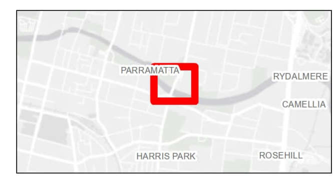
Figure 3-1 shows the general layout of key elements of the proposal.

Gasworks Bridge REF

Figure 3.1
Key Features of the proposal

Legend

- Roads
- Watercourses
- Proposal site access
- Proposal site
- Bridge span
- Equipment laydown area
- Site compound



0 10 20 m

Coordinate system: GDA2020 MGA Zone 56

Scale ratio correct when printed at A3

1:1,000 Date: 23-Mar-23

Data Sources: Imagery © Metromap 2020

G:\Projects\PS123629_GasworksBridge_REF_Parramatta\Mxd\01_REF\PS123629_REF_Fig3.1_KeyFeaturesOfTheProposal_r1v8.mxd

3.1.1 Materials and finishes

Materials and finishes for the proposal have been selected based on safety, to minimise environmental impacts and to be aesthetically pleasing.

Materials used for removal of the surface corrosion and existing lead paint

Abrasive material would be used as the nominated blast medium, producing a sharp angular profile in excess of 50µm. All nominated areas of the bridge would be blasted to a minimum blast class of SA 2½, which is a surface preparation grade resulting in thorough blast cleaning. This would remove all traces of lead-based paint, and other foreign matter from the steel surface, where accessible.

Materials used for application of paint

Application of prime coat would be carried out on all surfaces. Application of the prime coat would be carried out using a combination of air-assisted spray-painting equipment and airless spray-painting equipment.

The application and testing of the prime coat would be in accordance with TfNSW *Specification B220 - Protective Treatment of Bridge Steelwork* and the paint manufacturer's recommendations.

Stripe coating would be carried out for each additional coat after the prime coat has been applied. All welds, nuts, bolts, rivets, sharp edges, and hard-to-reach areas would have a stripe coat applied prior to final spray coats. Application of stripe coats would be carried out using a combination of brushes and rollers to ensure all surfaces have sufficient coverage.

The application of the final coats would be carried out using a combination of brushes, rollers, air-assisted spray equipment and airless spray equipment.

The application and testing of the new coating system would be carried out in accordance with TfNSW *Specification B220* and the paint manufacturer's recommendations.

3.2 Design

3.2.1 Design criteria

The proposal involves removing the paint layers on the steel trusses of the bridge, repairing corroded and damaged steel elements, and repainting.

The work involves the removal of lead-based paint. A containment system would be installed in accordance with *AS4361.1 Guide to Lead Paint Management – Industrial Applications.* The required method for paint removal is dry grit blasting. According to Table EI in Appendix E of the AS4361.1, the Emission Category is I. The containment system would be designed in accordance with the requirements of Table EI of the standard for this emissions category. Final paint coat would closely match the existing colour scheme (RMS Bridge Grey as per TfNSW Specification B220).

Key design criteria for the Proposal are:

- to maintain the heritage value
- to install a paint system that provides protection and longevity to the steel elements of the bridge
- to undertake activities using containment systems and other controls so as to not cause environmental contamination or impacts to human health
- to undertake activities using protective measures to protect road users, pedestrians, and cyclists.
- to reinstate disturbed areas of the site to their previous use.

3.2.2 Engineering constraints

Engineering constraints of the proposal primarily relate to the location of the bridge over a large water body and the requirement to completely contain the work due to the presence of lead-based paint. The Proposal requires both partial and full closure of the bridge and portions of Macarthur Street, on a number of occasions during construction, with the use of alternative detour routes.

Access under the bridge by boats and other vessels would generally be maintained with some restrictions. The exception to this is during the installation and dismantling of scaffolding and the containment system on bridge span number 3 (refer to

Figure 3-2), which would require the shutdown of ferry services. Pedestrian access would also be maintained under restrictions. There may be periodic requirements to divert pedestrian and cycle traffic to alternative crossings of the Parramatta River (refer to Section 6.1).

Other engineering constraints or considerations relate to the proximity of the proposal to residential, active recreational and educational land uses and the need to ensure that potential impacts on these land uses are minimised. In addition, minimising impacts to vegetation which is present along the Parramatta River.

3.2.3 Major design features

No major design features have been identified. The proposal would facilitate the continued safe use of the existing bridge structure.

3.3 Construction activities

3.3.1 Work methodology

Subject to approval, the proposal is expected to commence in Quarter 3 2023 and take around four months to complete. The indicative proposed construction activities for the proposal are identified in Table 3-1 and further discussed in this section, noting there is likely to be some overlap in the construction stages identified.

Table 3-1: Proposed construction activities

Stage	Activities
Site establishment	• pre-construction soil & water sampling (where required) • delivery and installation of temporary fencing for site compound and laydown areas • establishment of environmental controls • clearing of vegetation for laydown areas (where required) • trimming of mangroves adjacent to the bridge • installation of hardstand at site compound and laydown areas (where required) • delivery and installation of site sheds and amenities to site compound • connection of temporary utilities (power, water etc) to side compound • installation of works zone signs (including, pedestrian controls and navigation signage as required on the Parramatta River).
Bridge Deck sealing works	• sealing of existing cracks on bridge deck.
Set up traffic management	• closure and temporary detour of Macarthur Street and the bridge • installation of temporary steel barriers. • temporary relocation of the existing zebra crossing
Scaffolding/ containment system installation	• installation of scaffolding system • installation of encapsulation (containment) system • location and protection of existing services and utilities • installation of decontamination unit at site compound • installation of air monitoring equipment.
Blasting, priming and coating works	• cleaning and surface preparation • water washing of surfaces (if required) and storage of waste materials • removal of existing lead-based coating system using abrasive blasting, power tools and hand tools (if required) • transfer and safe storage of spent abrasive and hazardous materials • removal of hazardous coatings to licenced disposal facility • priming and painting.

Stage	Activities
Bridge repair works	• repair of girders and buckle plates including the Installation of new strengthening plates where the structural integrity of the beige is impaired • repair/replacement of corroded rivets • treatment of flame cut holes • cleaning of bridge scuppers • cleaning of graffiti, moss and vegetation (using high pressure wash) on bridge piers on southern embankment • replacement of mesh railing on bridge walkway • replacement of 20 metres of rail on east side of bridge • remove splinters and sand timber planks • remove and reinstall beams on truss • remove redundant gas pipe on eastern side of bridge • repair concrete spall • removal/disposal of waste materials.
Removal of Encapsulation and dismantling of scaffolding	• dismantling of scaffold and removal/disposal of containment system including ground based and hanging scaffold.

Demobilisation	• removal of steel barriers and vehicle crash protections
	• removal of environmental controls
	• removal of all site sheds and facilities from site compound
	• removal of all plant and equipment from site compound/laydown areas
	• reinstate site compound and laydown areas to pre-construction condition, including:
	  ▪ removal of hardstand
	  ▪ import and install turf underlay
	  ▪ reinstate turf in affected areas
	• removal of site fencing from site compound and laydown areas
	• removal of temporary works signage and reinstate signage and line marking on the bridge
	• completion of site clean-up works
	• final inspection and handover.

Site establishment

Site establishment works would include:

- a pre-construction survey of the proposal site, including a detailed photographic record of the existing site conditions, ground surfaces, vegetation, and infrastructure within the proposal site (refer to Figure 3-1)
- baseline soil testing for contaminants of concern within surface soils within the proposal site compound (at the location of the proposed hazardous materials storage area)
- installation of temporary fencing around the perimeter of the proposal site (including the site compound and equipment laydown areas) in addition to temporary hoarding (plywood) to separate the public from work areas
- establishment of environmental controls
- clearing of surface vegetation for equipment laydown areas,
- trimming of mangroves on the northern bank of the Parramatta River, to allow in installation of the scaffolding and containment system.
- installation of a hardstand at the site compound and equipment laydown areas (where required)

- establishment of a site office and amenities (including a decontamination unit) within the site compound area to the north of the bridge. The site compound would be the primary location provision of services such as electricity, wastewater and potable water, as well as the storage of hazardous materials and construction vehicle parking
- establishment of all equipment laydown areas (refer to Figure 3-1)
- connection of temporary utilities (power, water etc) to the site compound
- installation of work zone signs and navigation signage on the Parramatta River, as required, and based on consultation with Transdev (the operator of Sydney Ferries).

Bridge deck sealing works

Prior to the installation of the temporary barriers on the bridge, and to prevent water from percolating though the bridge deck, all existing cracks on the concrete bridge deck would be sealed. These works would be undertaken during a weekend shutdown of portions of Macarthur Street and closure of the bridge, with detours in place (refer to Section 3.3.3 and 3.3.7).

Traffic management set up

The installation of temporary steel barriers would be required to allow for the assembly of scaffolding on spans three, four and five of the bridge. This would require:

- closure and temporary detour of Macarthur Street and the bridge
- delivery and installation of end treatments
- temporary relocation of the existing zebra crossing
- adjustments to signage and line marking.

All traffic management would be undertaken in accordance with the Traffic Management Plan (Civlink, 2022b) developed for the proposal.

Scaffolding/containment system Installation

The scaffolding would be designed to provide safe access suitable for the installation of the containment system and minimise disruption to traffic on the bridge, shared pathways beneath, and boat/ferry traffic on the Parramatta River.

For spans of the bridge accessible from the ground, a traditional scaffolding system would be installed from the ground up. For spans over the waterway, a drop deck system (or similar) would be installed which would hang below the bridge structure. Access stairs would be installed at both bridge piers, and pedestrian access would be maintained on pedestrian and shared pathways on both the northern and southern banks of the river.

The scaffolding and containment system would be installed (and then dismantled) in stages, by qualified personnel and would be inspected on a regular basis throughout the duration of the Proposal.

Indicative details of the scaffolding system are shown in Figure 3-2.

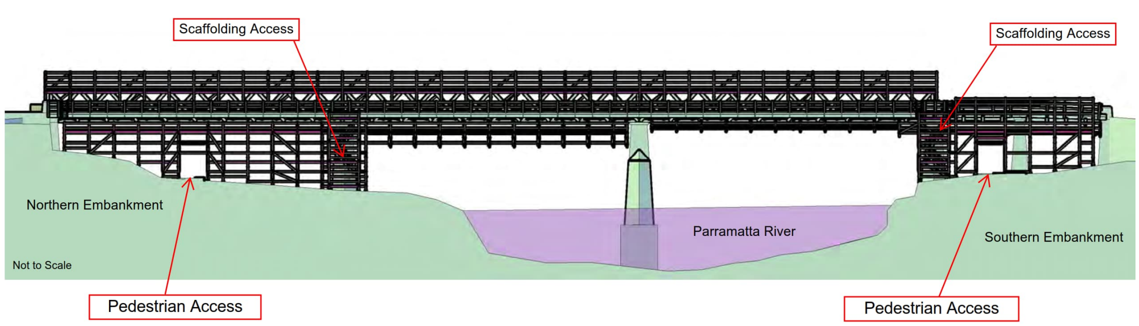


Figure 3-2: Indicative details of the scaffolding system

To ensure the protection of the public, environment and Parramatta River, a containment system would be installed around the bridge structure. The purpose of the containment system is to ensure all hazardous materials generated (mainly as a result of the removal of existing lead-based paint) are confined within the system, and act as a secondary defence to prevent the release of lead to the environment.

The side walls will be an impermeable heavy-duty plastic sheeting. The transition of the side walls to the bridge deck and over the trusses will be pitched to prevent water ponding on the containment system.

Airlocks will be installed at the access stair entrances to the containment, to ensure controlled entry and exit to prevent the escape of the hazardous coating material into the atmosphere. A dust extraction unit will be set up to create a negative pressure environment within the containment system.

Indicative details of the scaffolding and containment system are shown in Figure 3-3.

Figure 3-3: Indicative details of the scaffolding and containment system

All bridge drainage would be cleaned of foreign material and then diverted through the containment system, preventing the pooling of water and preventing any water escaping the system that would contaminate waterways or result in exposure to the public.

All existing services located within the containment area of the bridge would be protected during the blasting, priming and painting activities.

Remediation works (blasting, priming, and coating)

The existing lead-based coating system would be removed from all wrought iron and steel elements of the bridge, using a dry abrasive blast cleaning method. This method involves use of a sand blasting unit (which would be located in the equipment laydown areas) and an associated extraction system. The system is contained, with hoses transporting sand materials for blasting, and a vacuum system to extract the waste sand, as well as a dust extraction system. To carry out repairs on the steel trusses from the bridge roadway and where the abrasive blasting method is not suitable, a range of vacuum shrouded abrasive blasting equipment or vacuum shrouded power tools would be used.

The removal of hazardous material would be undertaken daily using a vacuum loader to ensure the volume does not exceed load limits of the containment system. The hazardous material would be transferred to a designated hazardous material storage area within the equipment laydown areas (refer to Section 3.4), where it would be stored in labelled bags prior to disposal at a licensed waste disposal facility.

The removal and disposal of the lead-based paint would be completed in in accordance with NSW waste guidelines and regulations.

On completion of the removal of the existing coating system, a prime coat would be applied. A prime cost is preparatory coating applied to the surface before painting, to provide a better paint finishing. The application of the prime coat would be undertaken using spray painting equipment. Stripe painting would be carried out after the prime coat has been applied using a combination of brushes and rollers. All welds, nuts, bolts, rivets, sharp edges, and hard-to-reach areas will have a stripe coat applied prior to the final spray coats.

The application of the final coat would be carried out using a combination of brushes, rollers, spray painting equipment. After the final coat has been applied, the new coating system would be inspected, and additional spot painting would be completed as required.

Bridge repair works

Following the removal of the existing coating system, miscellaneous bridge repairs would be undertaken concurrently with the priming and coating of the bridge structure. This stage of works would generally involve the repair of structural elements of the bridge, treatments to prevent future bridge damage, cleaning and graffiti removal, replacement of smaller bridge elements, and the removal of redundant utilities.

Removal of encapsulation and dismantling of scaffolding

On completion of remediation and bridge repair works on each bridge span, the scaffolding and containment system would be dismantled and removed from the proposal site.

Demobilisation

Once works are completed, inspected, and approved, the proposal site would be demobilised. This would include:

- the removal of the scaffolding and containment system from the bridge
- the transfer of all remaining general waste and hazardous waste materials to an appropriately licensed disposal facility in accordance with all relevant waste classification and waste transportation guidelines
- removal of the site compound, laydown areas and all environmental, traffic and pedestrian controls
- testing of soil for contaminants of concern at the location of the hazardous material storage area in the site compound to confirm no soil contamination has occurred during the proposal
- restoration of disturbed areas including the site compound areas, and any soil remedial works, if required
- completion of a final inspection and handover.

3.3.2 Construction workforce

The proposal would require a construction workforce of 10-15 people depending on the stage of work and activities being undertaken.

3.3.3 Construction hours and duration

The proposal would be undertaken during standard (NSW) Environment Protection Authority (EPA) standard construction hours (SH), which are:

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

Out of hours works (OOHW) would be required to minimise disruptions to pedestrians, motorists, and nearby sensitive receivers; and to ensure the safety of the construction workers and operational assets.

The OOHW would include the installation and subsequent removal of scaffolding and the containment system, as well as bridge sealing works. These activities would be undertaken during weekend shutdowns (where the bridge and a portion of Macarthur Street is closed to vehicle traffic in both directions), extending from around 8pm Friday to 5am Monday.

A total of seven weekend shutdowns are expected to be required (four at the commencement, and an additional three towards the completion of the proposal). Additional details on the weekend shutdowns are included in Section 3.3.7.

3.3.4 Plant and equipment

The plant and equipment likely to be used during construction would include, but not be limited to:

- Ablution facilities
- Air compressors (large or small)
- Dust extraction unit(s)
- Decontamination unit
- Dust Collector
- Delivery trucks
- Roller
- Crib sheds
- Excavator
- Elevated work platforms
- Floats
- Generators
- High volume air samplers (Air Monitors)
- High pressure wash
- HIAB/Franna crane
- Light vehicles (including traffic control vehicles)
- Lighting towers
- Other power tools (vacuum shrouded).
- Oxy-acetylene torches
- Airless pumps and paint equipment.
- Telescopic handlers
- Toilet blocks
- Trucks
- Vacuum
- Vacuum loading machines
- Water cart
- Water blaster.

3.3.5 Earthworks

The proposal would not require any excavations or earthworks. Minor turf clearing would be required at site compound and laydown areas (refer to Figure 3-1). These areas would be reinstated at the completion of the proposal.

3.3.6 Source and quantity of materials

The indicative materials to be used for the proposal would include, but not be limited to those shown in Table 3-2.

Table 3-2: Proposed materials required

Materials	Approximate Quantity
Blast material	70 tonnes
Paint	6,000 litres
Thinners	1,000 litres
Diesel	28,000 litres
Timber lengths	100 lineal metres
Marine ply board	96 square metres
Galvanised steel sheeting	240 square metres
Geotextile fabric	400 square metres
Plastic sheeting	500 square metres
Containment sheeting	5,280 square metres
Silicone/sealant	20 litres
Fasteners/screws	3000 units

3.3.7 Traffic management and access

Due to the narrow width of the traffic lanes, works on sections of the bridge that can only be accessed from the roadway would need to be undertaken under modified traffic arrangements to ensure compliance with applicable safety requirements. Accordingly, the proposal would require partial and full closures of Macarthur Street and the bridge at various times during construction, in addition to the closure of a number of parking spaces at the northern area of the proposal site.

An extended partial closure of the bridge would be required to facilitate construction access. This would require reducing traffic to a single lane in a southbound direction only, for the full duration of the proposal. All northbound traffic movements would be directed via a local detour. No private property access would be impacted during this extended partial closure.

Detours during weekend shutdowns would include:

- a northbound traffic detour which would travel down George Street, Alfred Street, River Road, James Ruse Drive, Victoria Road and back to Macarthur Street
- a southbound which would travel via Victoria Road / or Thomas and Elizabeth Street to Wilde Avenue and back onto George Street.

During the extended partial closure, northbound traffic would follow the same route described above, with southbound movements unaffected.

Figure 3-4: Traffic detour routes during weekend shutdown of the Gasworks bridge

The proposal would require up to 15 heavy vehicle movements per day to deliver equipment and remove material during site establishment, installation and decommissioning of scaffolding and the encapsulation system, and site demobilisation. These works are expected to take around 47 days to complete and would generally be undertaken on commencement of the proposal and at the end of the proposed works. Heavy vehicle haulage routes are shown on Figure 3-5.

During the installation and removal of scaffolding, due to access constraints from Macarthur Road, heavy vehicle access to the northern laydown area (beneath the bridge) would be required from Rangihou Crescent to the east of the proposal site, via the existing shared pathway. This access would require temporary pedestrian/cyclist management (refer to Figure 3-6).

During the remainder of the proposal, it is expected that 12 light vehicles would access the proposal site daily, with periodic heavy vehicle movements to remove waste materials.

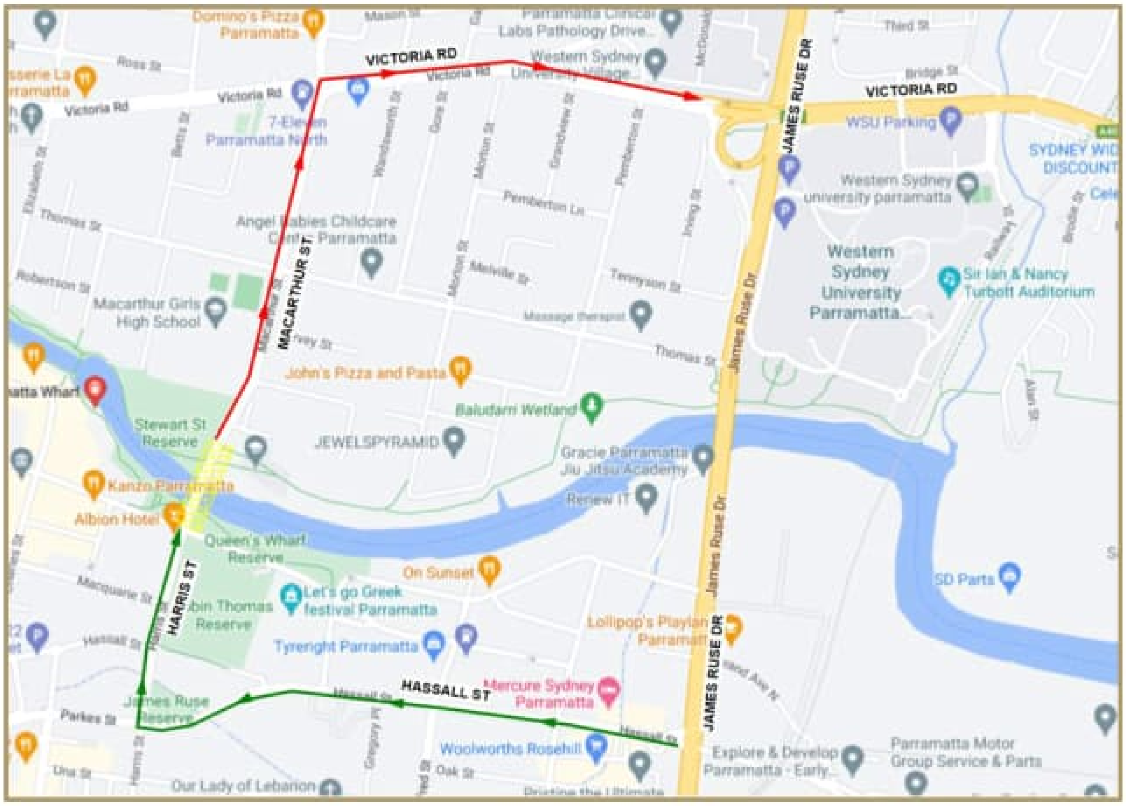


Figure 3-5: Heavy vehicle haulage routes

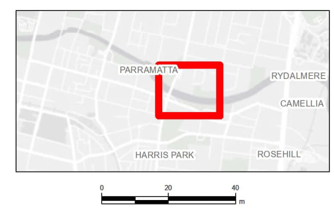
Further discussion of potential transport, traffic and access impacts is provided in Section 6.1.

Gasworks Bridge REF

Figure 3.6
Access for scaffolding installation and removal

Legend

- Roads
- Watercourses
- Proposal site access
- Temporary access for scaffolding installation and removal
- Proposal site



Coordinate system: GDA2020 MGA Zone 56

Scale ratio correct when printed at A3

1:1,500 Date: 23-Mar-23

Data Sources: Imagery © Metromap 2020

G:\Projects\PS123629_GasworksBridge_REF_Parramatta\Mxd\01_REF\PS123629_REF_Fig3.6_AccessForScaffolidingInstallationAndRemoval_r1v6.mxd

Author: David.Naiken

www.wsp.com

3.4 Ancillary facilities

Temporary construction site compound and laydown areas would be required to accommodate a site office, amenities, equipment laydown, on-site fabrication workshops and storage areas for materials. These areas comprise:

- one main site compound at the northern side of the bridge, east of Macarthur Street on cleared land, covering an area of around 420 square metres. The area is considered part of the Rangihou Reserve. Access to this site compound would be via the existing car parking area to the immediate north of the bridge (refer to Figure 3-6)
- one equipment laydown area adjacent to the northern approach of the bridge, directly to the east of Macarthur Street, covering around 45 square metres
- one equipment laydown area on the northern side of the Parramatta River, adjacent to the active pathway which extends beneath the bridge. This area covers around 200 square metres
- one laydown area at the southern side of (and extending beneath) the bridge, to the west of Macarthur Street. This laydown area (covering around 335 square metres) is located on a cleared and partially sealed section of the Queens Wharf Reserve, with access via George Street (refer to Figure 3-1, and has most recently been utilised by the Parramatta Light Rail project (refer to Section 6.13) as a materials laydown area.

The use of the site compound and equipment laydown areas would be interchangeable, depending on the location of the work activities. However, the site office, all amenities (toilets, change rooms, meal rooms, first aid), and onsite fabrication workshops would be confined to the site compound.

The equipment laydown areas would be used for materials handling and storage areas, as well as the siting the air extraction unit, ventilation system and other machinery required for containment and dry abrasive blasting. The blasting equipment would be stored in the equipment laydown areas with the hazardous waste storage bins being adjacent. The equipment laydown locations have been selected due to their proximity to the bridge. This would also eliminate the need to move hazardous waste between the equipment laydown areas and the site compound, thus eliminating any potential contact with the public. Decontamination facilities would also be located in the equipment laydown areas, to eliminate the potential for exposure of contaminants to the public.

Hazardous and non-hazardous waste generated on site would be separated. Hazardous waste would be collected and stored in a bunded, locked area prior to collection, transport and disposal at a licensed waste facility.

The site compound would have acoustic screening/walls installed around the perimeter and/or noisy plant to mitigate noise impacts. Temporary fencing would be erected around the perimeter of the site compound and equipment laydown area. The temporary fencing would be manually erected and dismantled using hand tools.

Impacts associated with the utilisation of this area have been considered in the environmental impact assessment of this Review of Environmental Factors (Chapter 6).

As the laydown areas to the south of the Parramatta River are located on flood liable land, these areas would be vacated when floods are forecast. A flood contingency plan detailing how materials would be removed in the event of a flood would be included in the Construction Environmental Management Plan (CEMP).

An overview of the proposed site compound and equipment laydown areas are shown in Figure 3-1. These locations have been identified in consultation with the City of Parramatta and placed to avoid steep slopes which are present towards the Parramatta River as well as adjacent to George Street. The location has also considered nearby sensitive residential receivers to minimise the noise and vibration impacts of the proposal (refer to Section 6.2).

3.5 Public utility adjustment

The proposal has been designed to avoid relocation of services where feasible. Some services will likely require protection prior to remediation works, such as the water main which is located on the eastern side of the Bridge (refer to Photo 3-1 and Photo 3-2). A redundant gas line would be removed as part of the proposal as described in Table 3-1.

Photo 3-1: Water main facing north

Photo 3-2: Water main facing south

3.6 Property acquisition

The proposal would not require the acquisition of any property, however would require the temporary use of existing public open space (currently owned by the NSW Government/City of Parramatta) for the installation of the site compounds and ancillary facilities, as described in Section 3.4.

3.7 Operation and maintenance

On completion of the remediation works the proposal site would return to its pre-proposal operations.

APPENDIX B: PROPOSED SCAFFOLDING LAYOUT

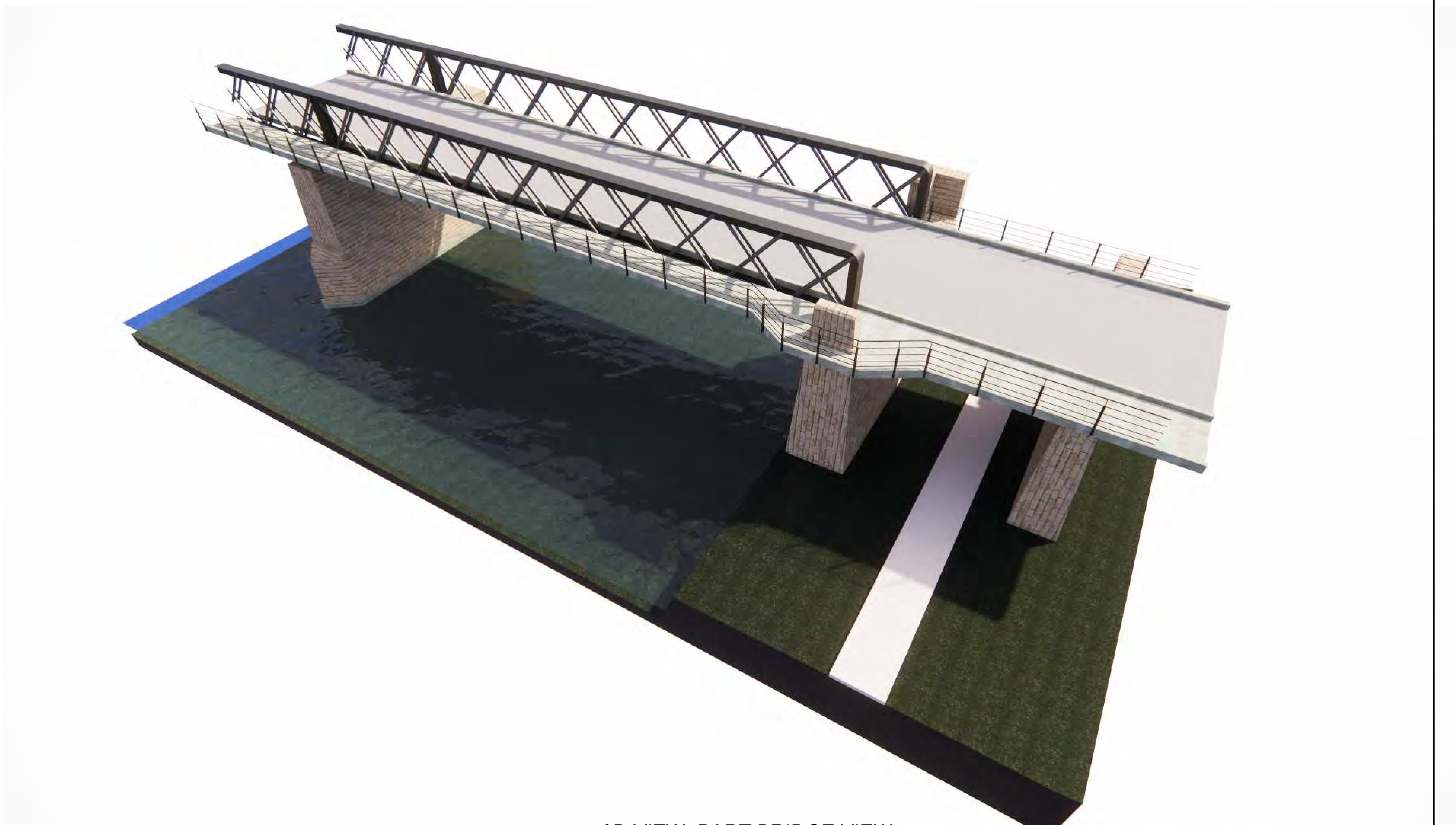
Prepared by Freyssinet.

GASWORKS BRIDGE REMEDIATION
BRIDGE OVER PARRAMATTA RIVER
AT HARRIS STREET PARRAMATTA, NSW 2150

LOCALITY PLAN
N.T.S.

DRAWINGS LIST

S001	COVER SHEET
S002	PART ACCESS LAYOUT ELEVATION AND SECTION
S003	ARTISTS IMPRESSIONS



3D VIEW: PART BRIDGE VIEW

ISSUED FOR TENDER PURPOSES ONLY

Issue	Date	Drawn	Description
1	30-04-21	J.L.W.	ISSUED FOR TENDER PURPOSES ONLY.

FREYSSINET AUSTRALIA PTY. LIMITED
A.B.N. 15 002 617 736
6 CHAPMAN PLACE
EAGLE FARM 4009 QLD AUSTRALIA
TELEPHONE: (07) 3862 0100
FACSIMILE: (07) 3862 0111
EMAIL: brisbane@freyssinet.com.au
WEB PAGE: www.freyssinet.com.au
AUCKLAND BRISBANE MELBOURNE PERTH SYDNEY

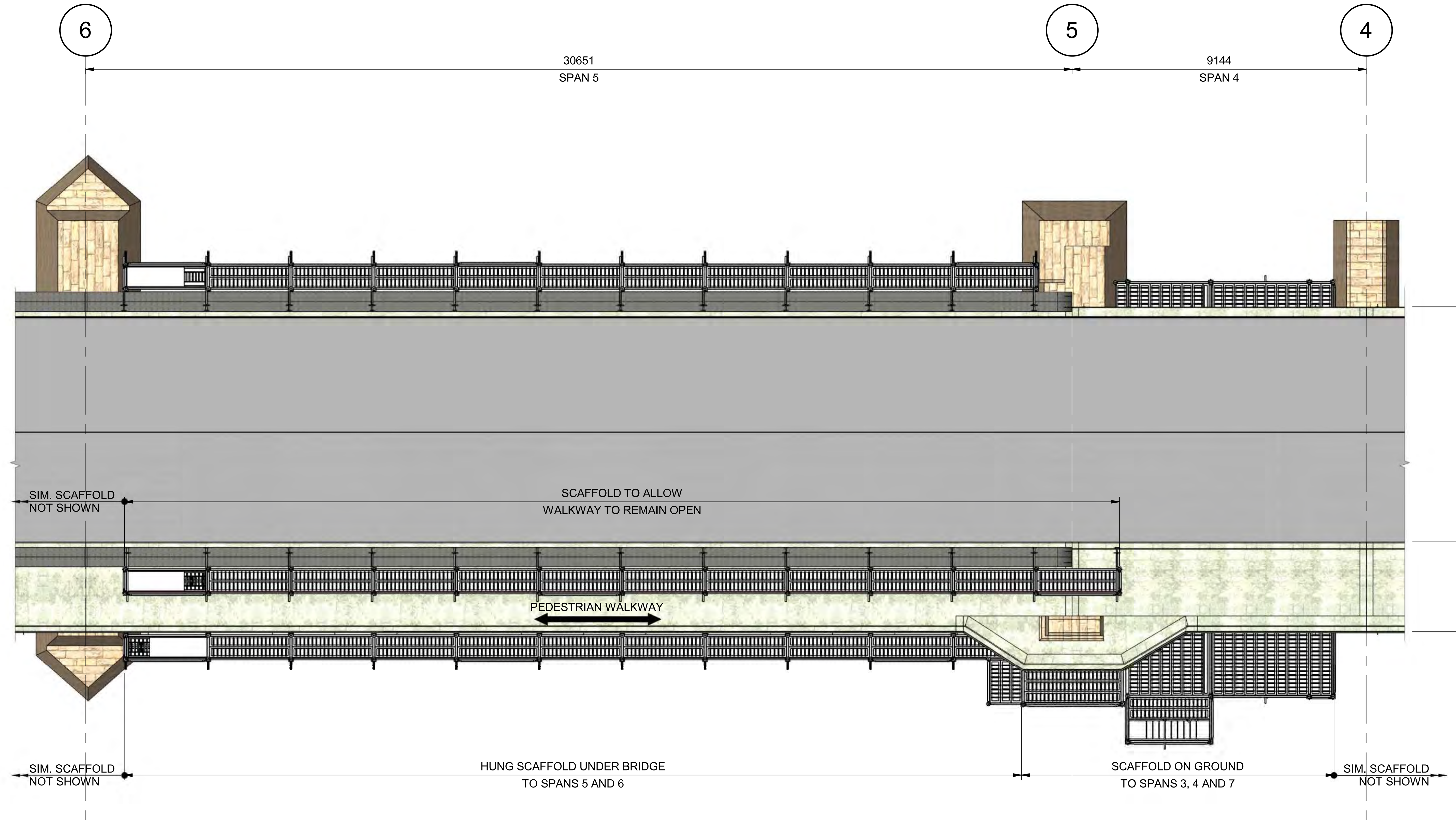
Project: GASWORKS BRIDGE REMEDIATION OVER PARRAMATTA RIVER

Title: COVER SHEET

A1

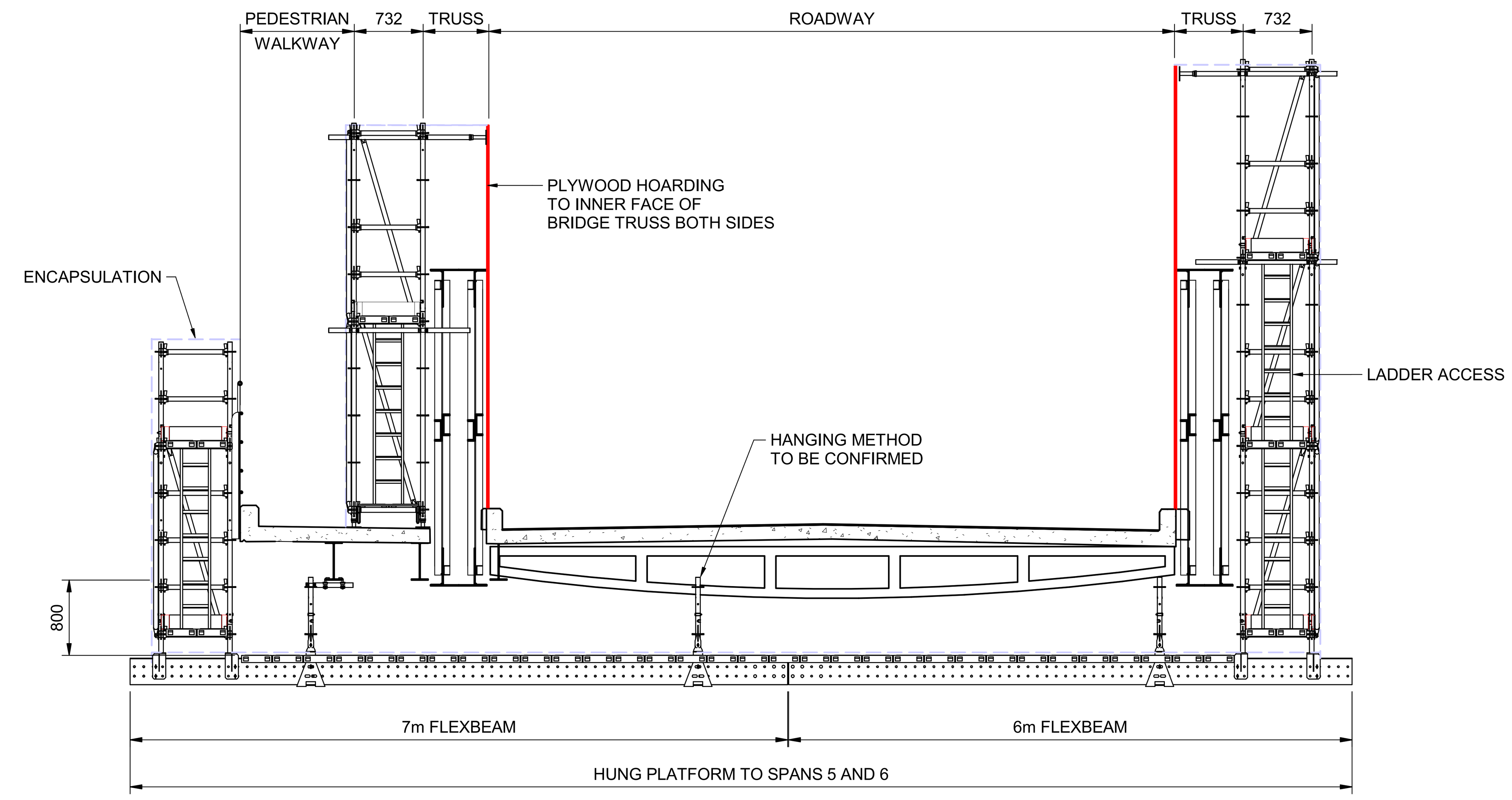
Date:	29/04/2021	Scale:	1 : 1
Designed:	-	Authorised:	
Drawn:	J.L.W.	Date:	
Project No.		Drawing No. S001	Issue 1
PLOT DATE :	29/04/2021 9:39:33 AM		

C:\Users\jamie.wilton\OneDrive - VINCI Construction\Remedial Tender\NSW\Gasworks Bridge\Gasworks Bridge Access.rvt



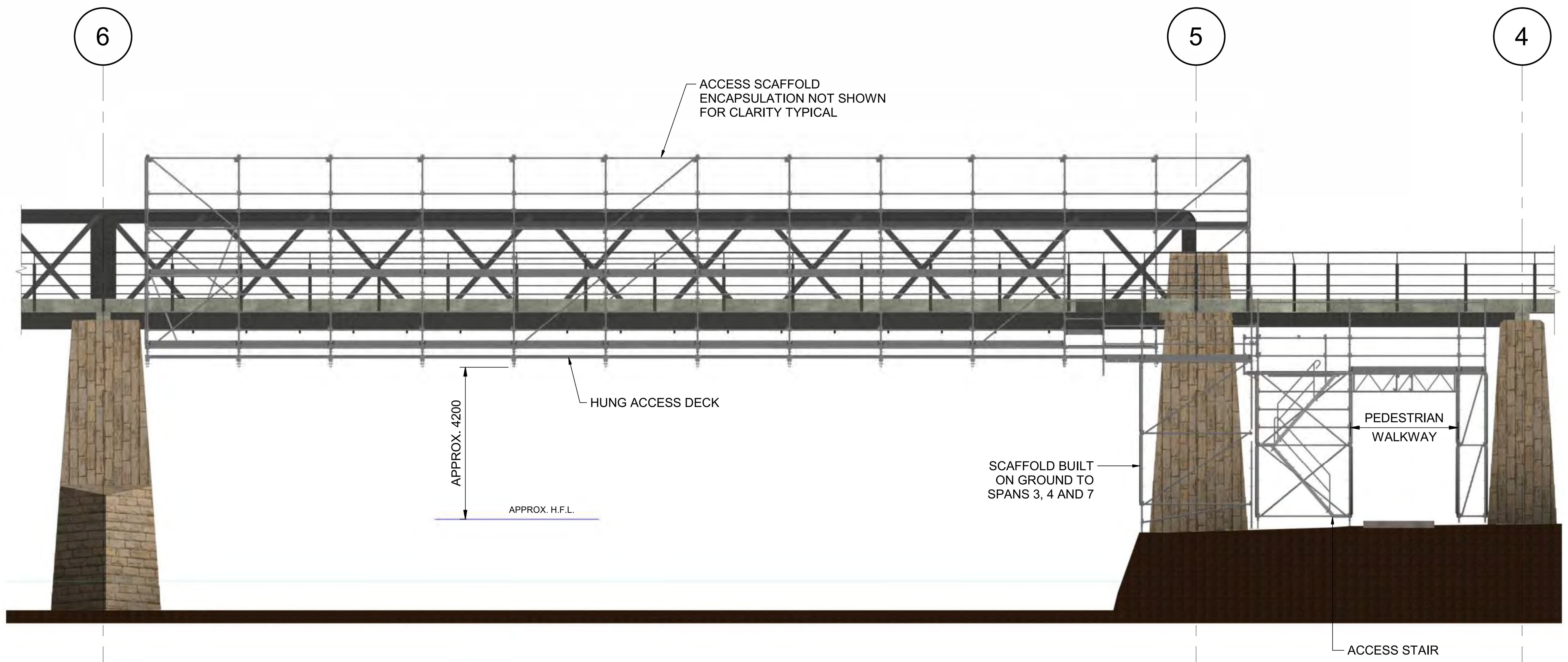
PART PLAN: ACCESS PLATFORM LAYOUT

SCALE - 1 : 100



TYPICAL HANING PLATFORM SECTION

SCALE - 1 : 50



PART PLAN: ACCESS PLATFORM ELEVATION

SCALE - 1 : 100

3D VIEW: PART SCAFFOLD ARRANGEMENT

ISSUED FOR TENDER PURPOSES ONLY

Issue	Date	Drawn	Description
1	30-04-21	J.L.W.	ISSUED FOR TENDER PURPOSES ONLY.

FREYSSINET AUSTRALIA PTY. LIMITED
A.B.N. 15 002 617 736
LEVEL 3, 13-15 LYON PARK ROAD
MACQUARIE PARK 2113 NSW AUSTRALIA
TELEPHONE: (61) 2 9491 7177
FACSIMILE: (61) 2 9491 7199
EMAIL: freyssinet@freyssinet.com.au
WEB PAGE: www.freyssinet.com.au
AUCKLAND BRISBANE MELBOURNE PERTH SYDNEY

Project:
GASWORKS BRIDGE REMEDIATION OVER PARRAMATTA RIVER

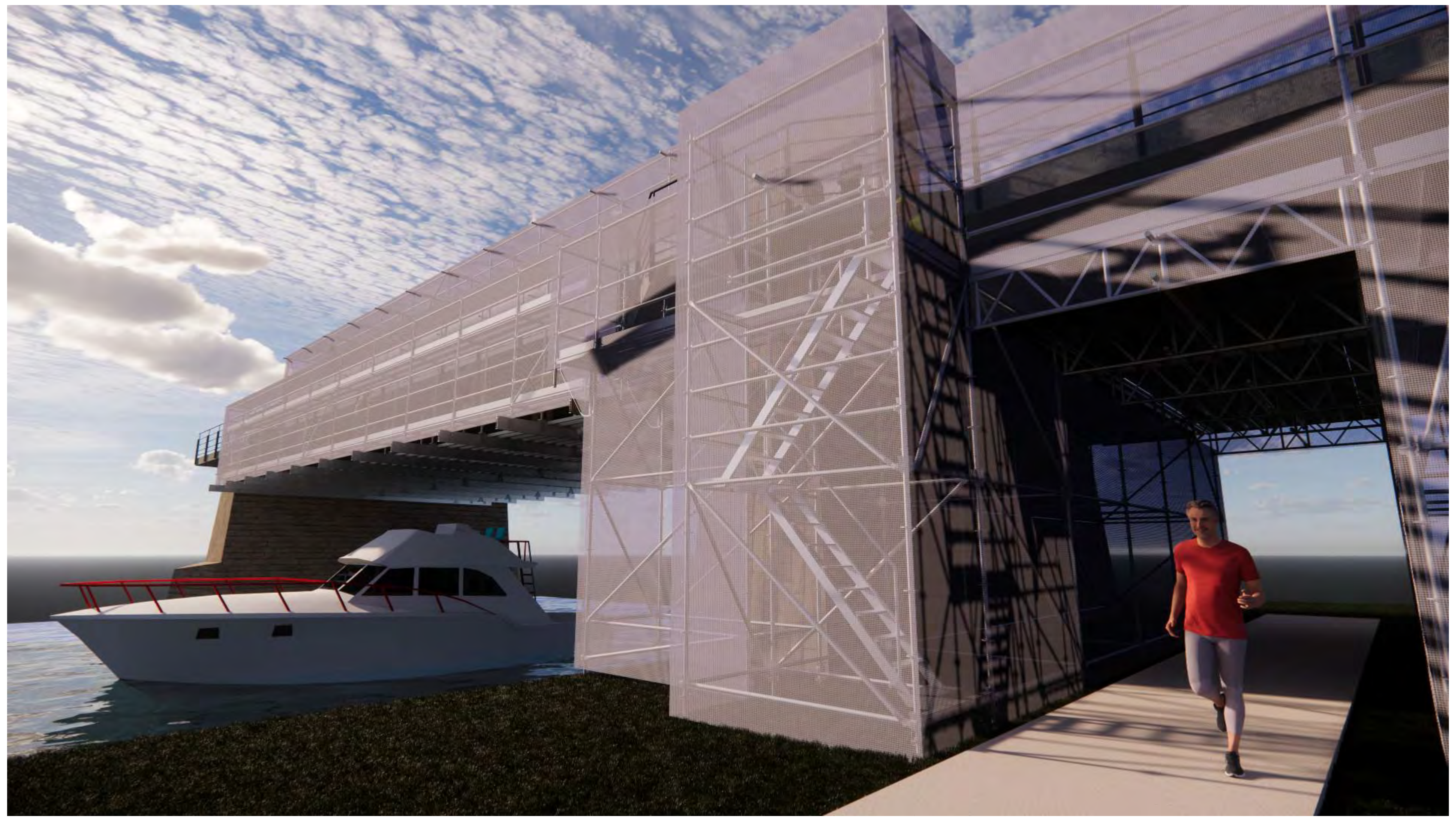
Title:
PART ACCESS LAYOUT ELEVATION AND SECTION

A1

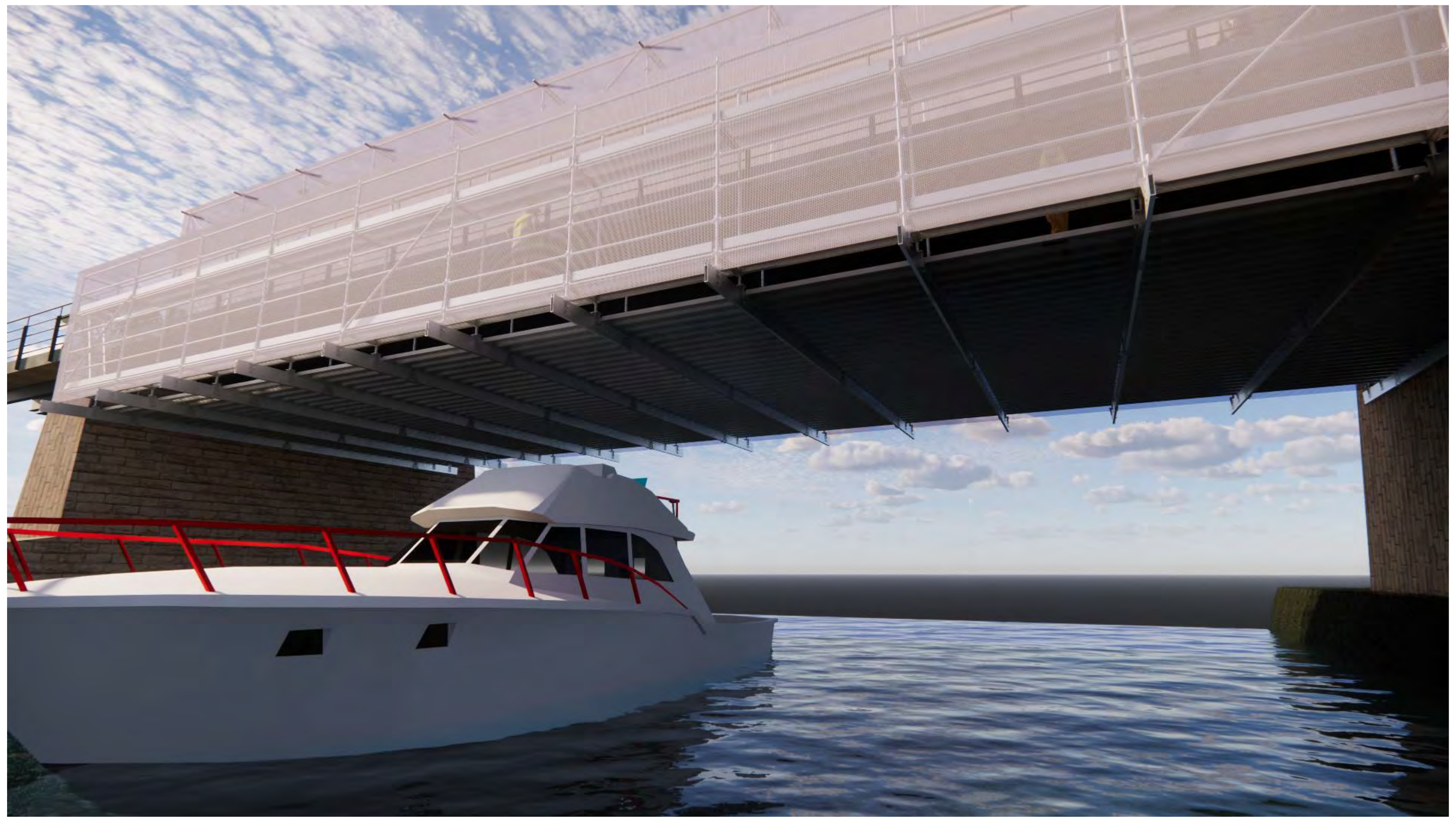
Date: 29/04/2021	Scale: As indicated		
Designed:	Authorised:		
Drawn: J.L.W.	Date:		
Project No.	Drawing No. S002	Issue 1	
PLOT DATE : 29/04/2021 9:40:02 AM			

C:\Users\jamie.wilton\OneDrive - VINCI Construction\Remedial Tender\NSW\Gasworks Bridge\Gasworks Bridge Access.rvt

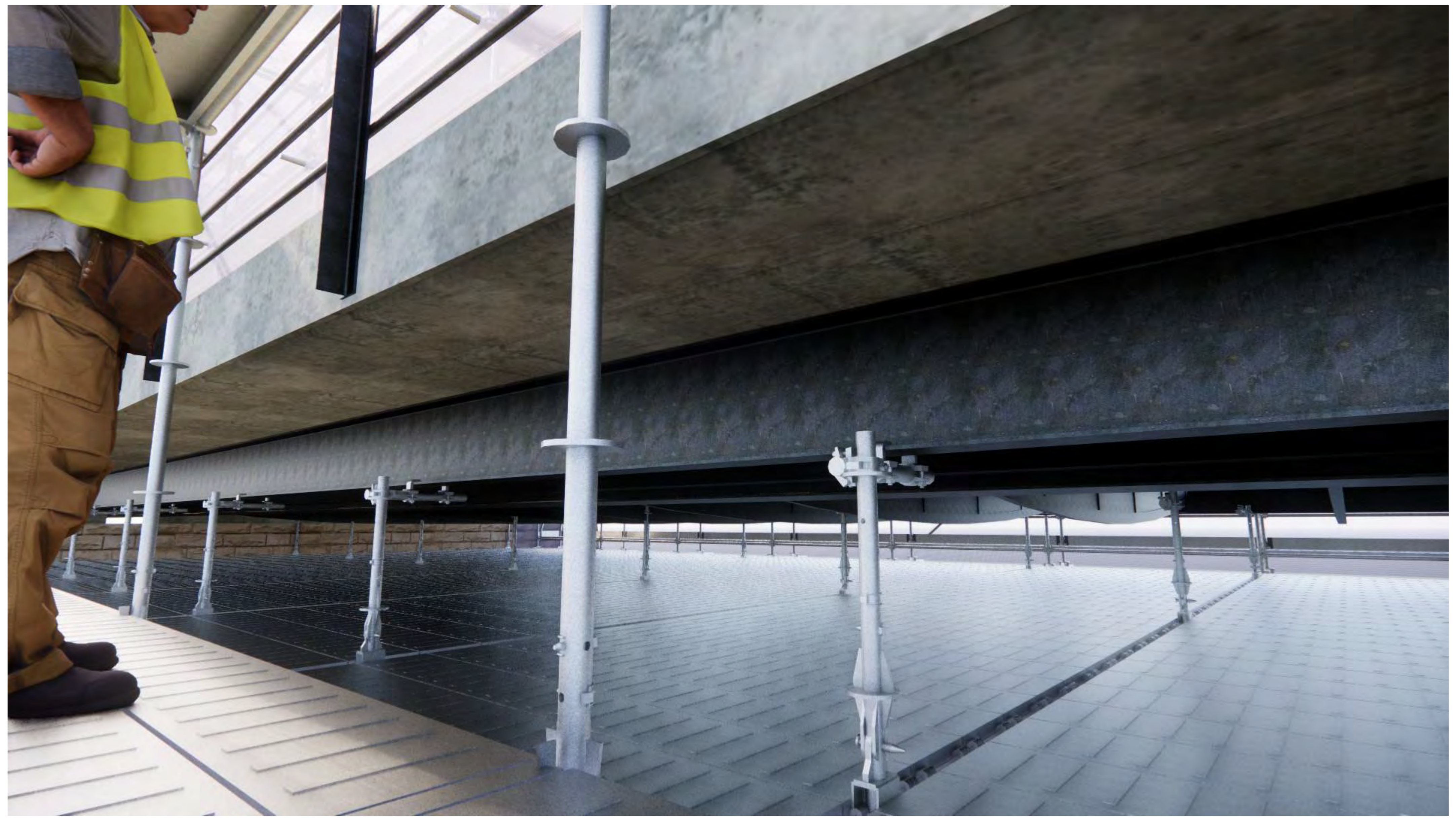
PEDESTRIAN WALKWAY



PEDESTRIAN WALKWAY THROUGH SCAFFOLD



HUNG SCAFFOLD ABOVE WATERWAY



ACCESS PLATFORM UNDER BRIDGE

ISSUED FOR TENDER PURPOSES ONLY

Issue	Date	Drawn	Description
1	30-04-21	J.L.W.	ISSUED FOR TENDER PURPOSES ONLY.

FREYSSINET

FREYSSINET AUSTRALIA PTY. LIMITED
A.B.N. 15 002 617 736
LEVEL 3, 13-15 LYON PARK ROAD
MACQUARIE PARK 2113 NSW AUSTRALIA
TELEPHONE: (61) 2 9491 7177
FACSIMILE: (61) 2 9491 7199
EMAIL: freyssinet@freyssinet.com.au
WEB PAGE: www.freyssinet.com.au

AUCKLAND BRISBANE MELBOURNE PERTH SYDNEY

Project:

GASWORKS BRIDGE REMEDIATION OVER PARRAMATTA RIVER

Title:

ARTISTS IMPRESSIONS

A1

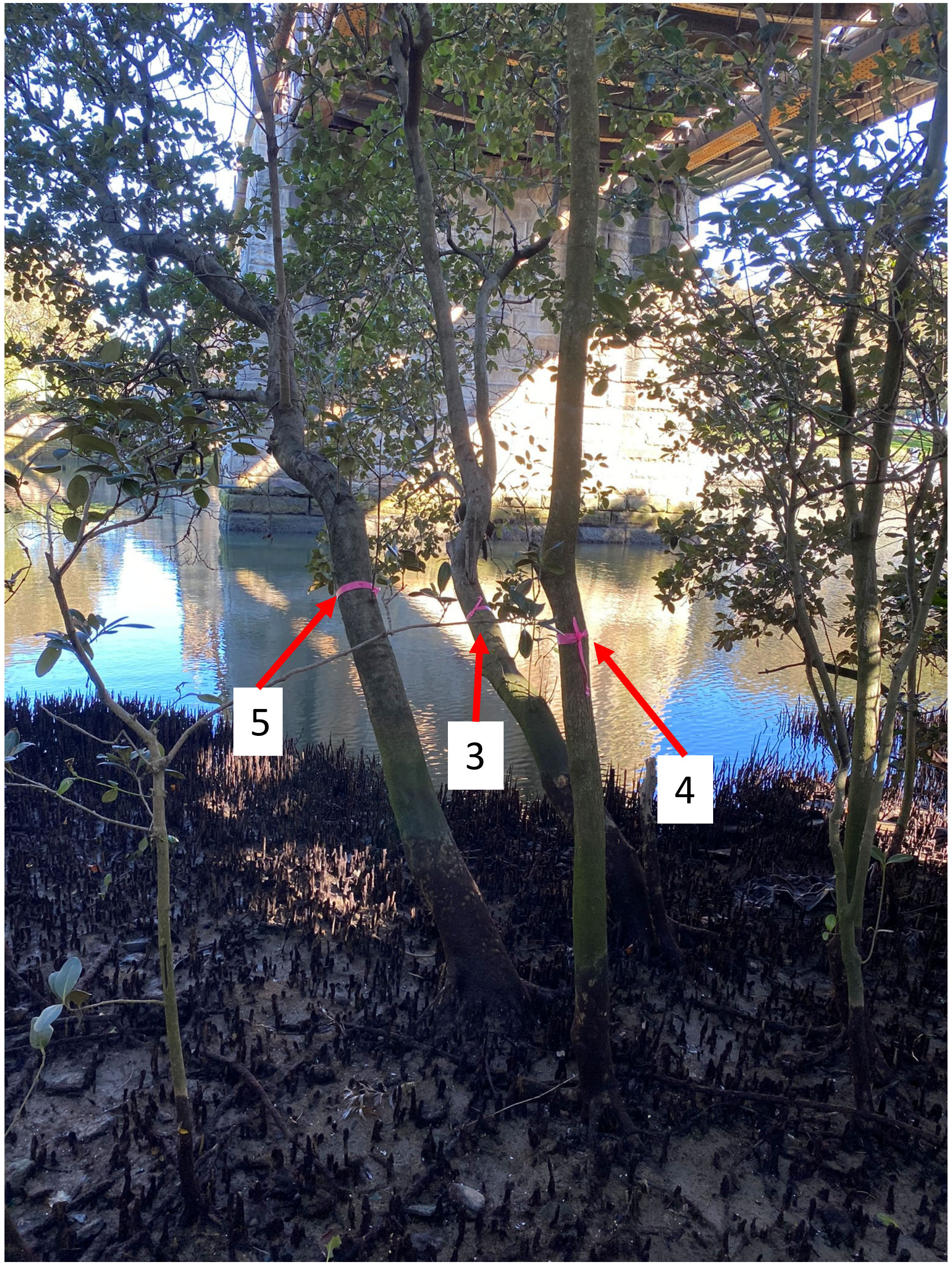
Date: 29/04/2021		Scale: 1 : 1	
Designed:		Authorised:	
Drawn: J.L.W.		Date:	
Project No.		Drawing No. S003	Issue 1
PLOT DATE : 29/04/2021 10:08:21 PM			

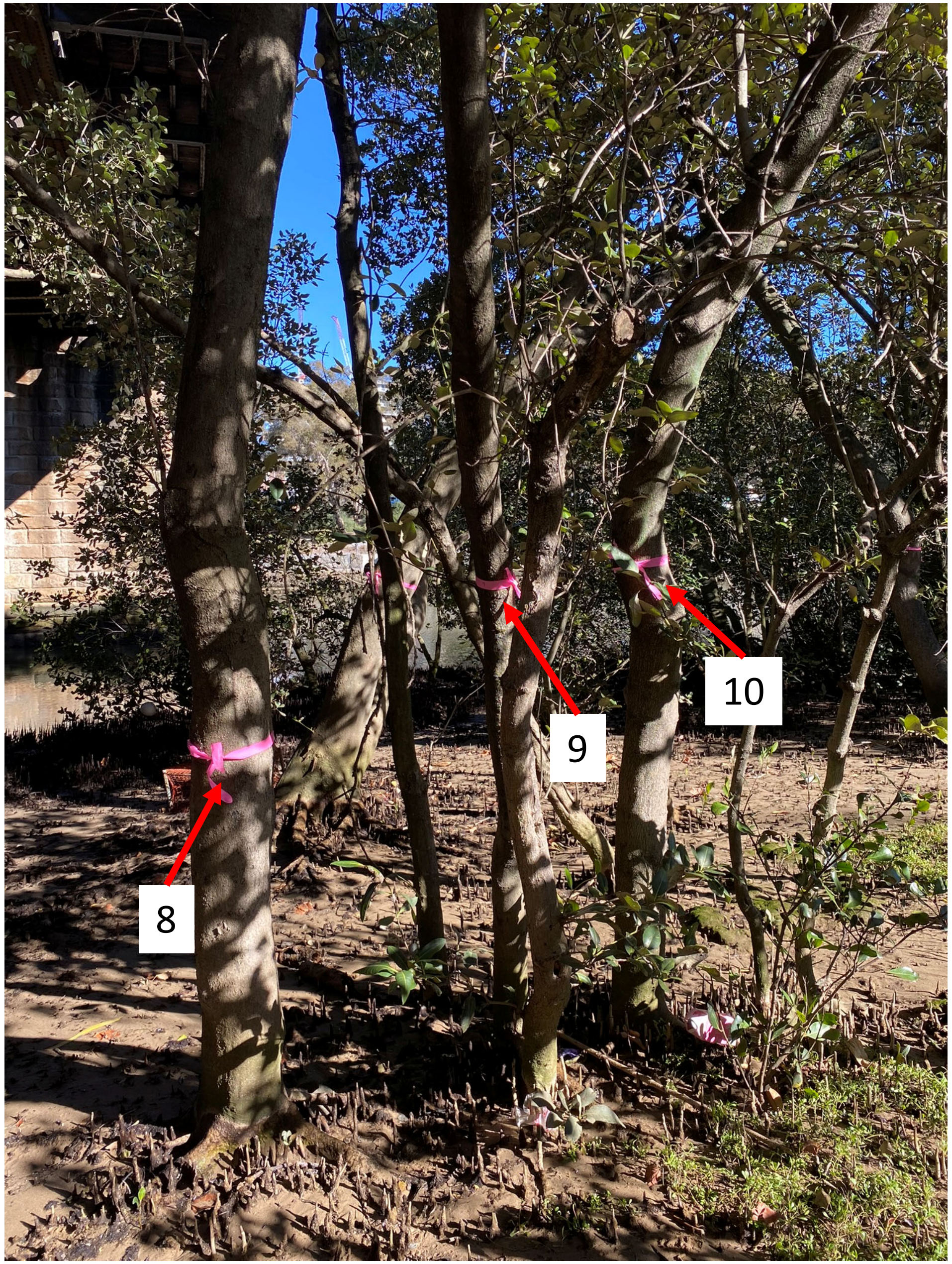
C:\Users\jamie.wilton\OneDrive - VINCI Construction\Remedial Tender\NSW\Gasworks Bridge\Gasworks Bridge Access_Adjusted.rvt

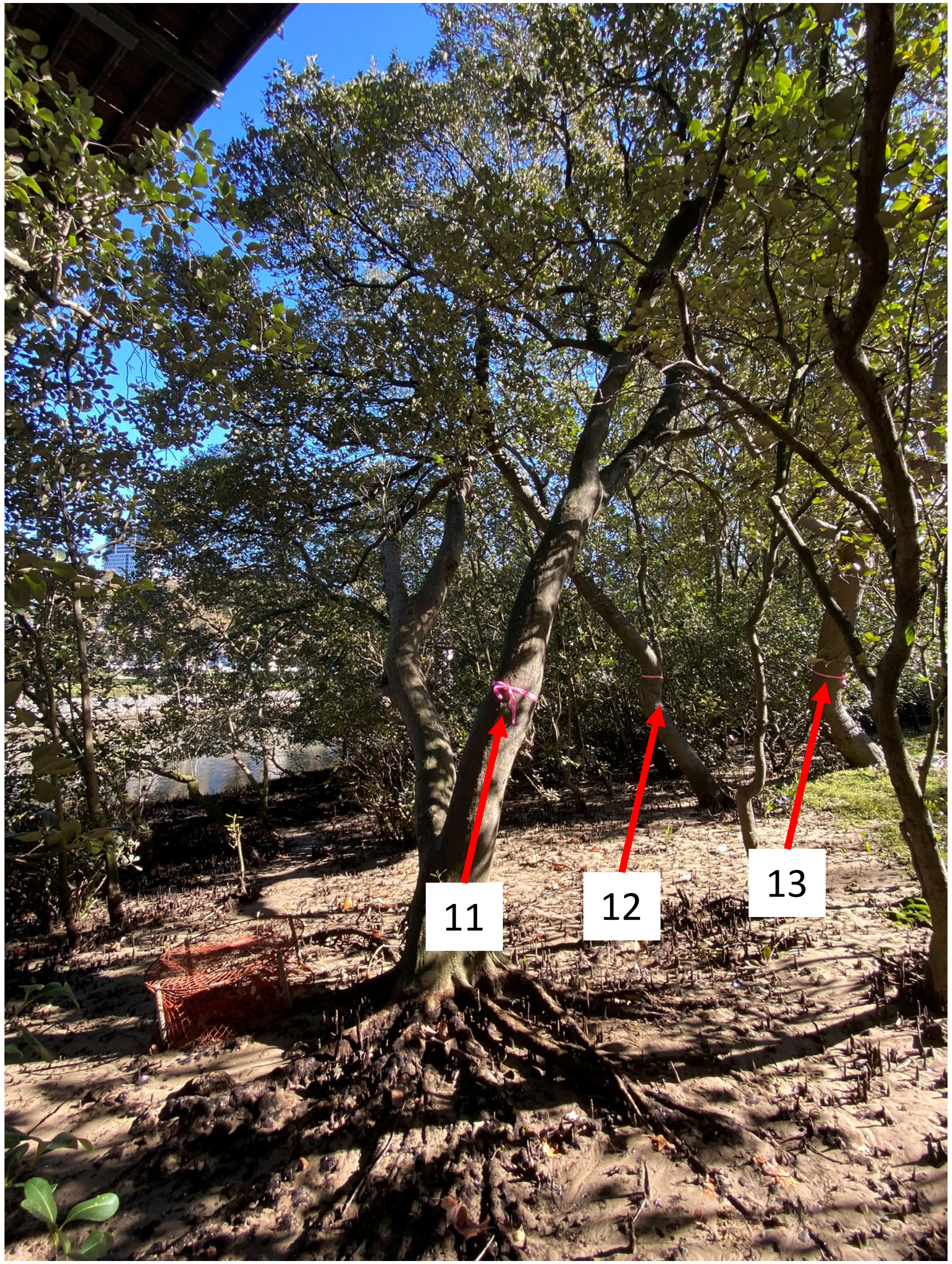
Appendix H Mangrove tree identification and trimming extent


#11
#10
#9
#8
#13
#12
#7
#6
#1
#3
#2
#4
#5
4

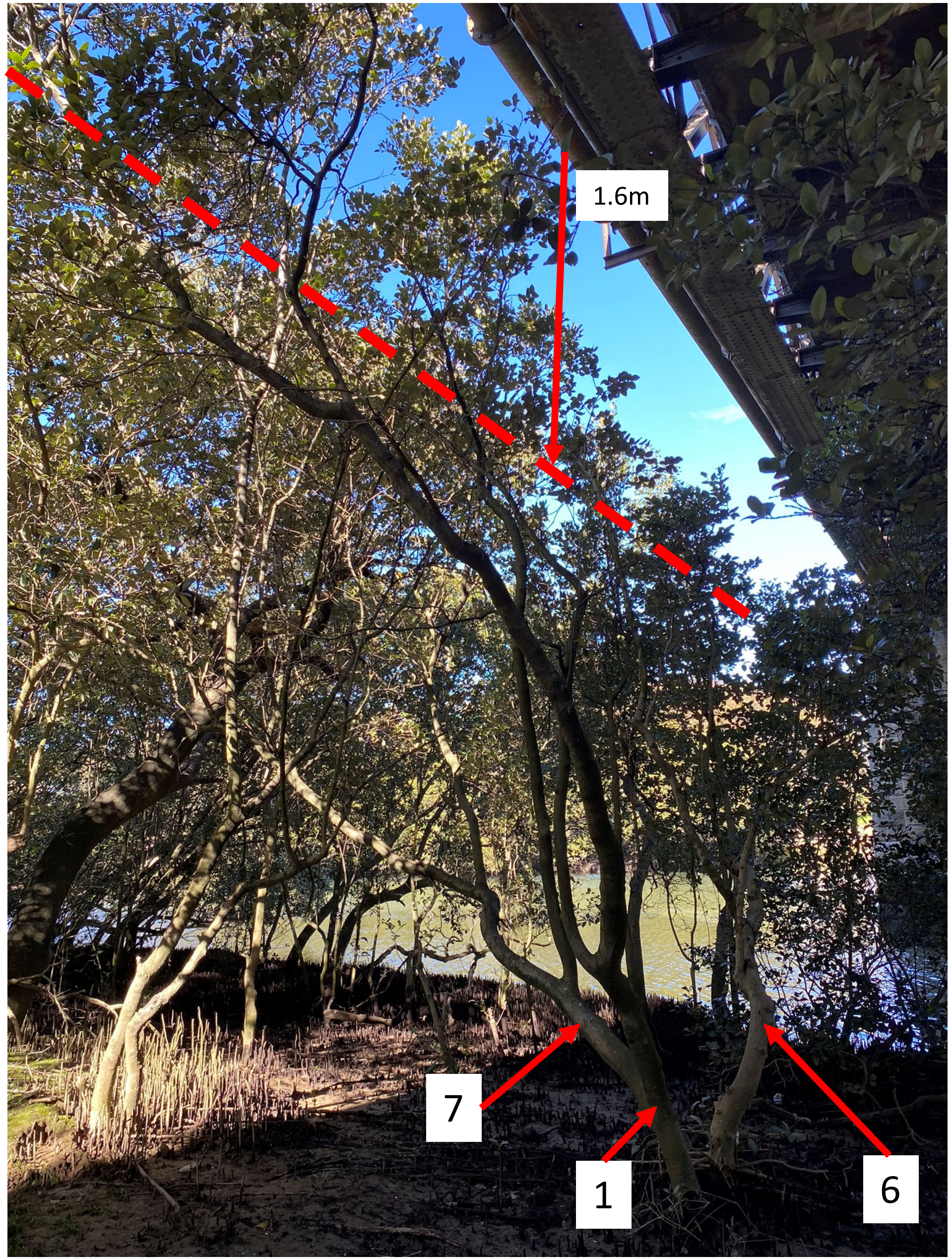

7
1
6


5
3
4


8
9
10


11
12
13

0.5m
1.6m



1.6m
7
1
6


0.5m
1.6m