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Environmental Impact Statement – Appendix O: Traffic and Transport Assessment

Warragamba Dam Raising

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1 Introduction

1.1 Project application

WaterNSW, a New South Wales (NSW) state-owned corporation, is seeking project approval for the Warragamba Dam Raising Project (the Project). The approval is sought under Part 5, Division 5.2 (section 5.12) (State Significant Infrastructure) of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act).

To support the project approval application, an environmental impact statement (EIS) is being prepared. This report is part of the EIS and has been prepared to assess the Project's impact on traffic and transport. The Secretary's Environmental Assessment Requirements (SEARs) that this report addresses are discussed in Section 1.4. The background to the Project is described in the following section. A more detailed description of the Project is contained in Section 2.

1.2 Project background

The Hawkesbury-Nepean Valley (the valley) in western Sydney has the highest flood risk in New South Wales, if not Australia. The potential for significant flooding of the Hawkesbury-Nepean Valley was known by the local Aboriginal community before the first European settlement of the area in the 1790s. In the early years of European settlement, the risk of flooding was recognised and a series of proclamations were issued that warned of the risk of flooding. This high flood risk arises from the river being confined by narrow sandstone gorges, creating rapid deep backwater flooding over extensive floodplains. The floodplains are home to a large existing population who would be impacted in a major flood.

During the 1980s and 1990s updated flood investigation techniques and new geological evidence predicted that floods significantly larger than any historically recorded could occur in the Hawkesbury-Nepean Valley. The dam was raised by five metres in the late 1980s to meet modern dam safety requirements. Further investigations into flooding and flood mitigation were undertaken and culminated in 1995 in a proposal to raise Warragamba Dam by 23 metres primarily for dam safety but also to provide for flood mitigation. The 1995 proposal did not proceed. In the late 1990s, major upgrades of Warragamba Dam were undertaken to prevent dam failure during extreme flooding events, to protect Sydney's water supply, and to prevent catastrophic downstream floods from dam failure. This resulted in the construction of the auxiliary spillway. However, these works only dealt with dam safety issues and did not address the major flood risks to the people and businesses in the Hawkesbury-Nepean Valley and the NSW economy.

In 2011, an approximately 1 in 100 chance in a year flood impacted Brisbane, resulting in significant damage, economic costs, and social disruption. The substantial impacts of the 2011 Brisbane flood led the NSW Government to recommence investigations into flood mitigation options for the Hawkesbury-Nepean Valley.

In 2013, the NSW Government in response to the State Infrastructure Strategy and community concerns, initiated the Hawkesbury-Nepean Valley Flood Management Review to consider flood planning, flood mitigation and flood response in the Hawkesbury-Nepean Valley. The review found that current flood management and planning arrangements could be improved, and no single mitigation option could address all the flood risks present in the Hawkesbury-Nepean Valley (Department of Primary Industries (DPI) 2014a). The review concluded that raising Warragamba Dam to capture inflows is the most effective infrastructure measure that could have a major influence on flood levels during those events, when most of the damages occur. Other complementary and non-infrastructure options were also identified to mitigate flood risks (DPI 2014a).

Under the direction of Infrastructure NSW (INSW), the Hawkesbury-Nepean Valley Flood Management Taskforce was established to investigate feasible flood options to reduce overall risk to the Hawkesbury-Nepean Valley. In June 2016, the former Premier and Minister for Western Sydney, Mike Baird MP, announced the NSW Government plan to raise Warragamba Dam to significantly reduce the risk of flooding in the Hawkesbury-Nepean Valley. The cost-benefit analysis demonstrated that the Warragamba Dam Raising would provide a 75 percent reduction in flood damages on average, and reduce current levels of flood damages from $5 billion to $2 billion (2016 dollars).

Raising Warragamba Dam would significantly reduce flood risk; however, it would not eliminate the risk completely. Regardless of the increase in the dam's height, flooding can be generated from catchments other than Warragamba Dam. The raising of Warragamba Dam would therefore be complemented with other non-infrastructure and policy actions. In May 2017, INSW released *Resilient Valley, Resilient Communities*, which outlines the Hawkesbury-Nepean Valley Flood Risk Management Strategy (the Flood Strategy) (INSW 2017). The Flood Strategy covers the geographic region between Bents Bridge and the Brooklyn Bridge, encompassing areas within the Local Government Areas (LGAs) of Liverpool City, Penrith City, Hawkesbury City, The Hills Shire Blacktown City, Central Coast, and Hornsby Shire.

The objective of the Flood Strategy is to reduce flood risk to life, property and social amenity from floods in the Hawkesbury-Nepean Valley. The strategy includes nine key outcomes; a combination of infrastructure and non-infrastructure initiatives to mitigate the flood risk to the Hawkesbury-Nepean Valley floodplain downstream of Warragamba Dam. Actions include:

- coordinated flood risk management across the Hawkesbury-Nepean Valley now and in the future
- strategic and integrated consideration of flood risk in land use and emergency planning
- engaging and providing flood risk information for an aware, prepared and responsive community.

The Flood Strategy provides the context and policy impetus to mitigate flood risk in the Hawkesbury-Nepean Valley.

The assessment areas for the Project have been described in the context of both the stage of the works (construction and operation) and geographic extent of possible effects and impacts (upstream and downstream).

The Operational Study Area includes the areas upstream and downstream of Warragamba Dam that could be affected by the future operation of the Project.

Upstream of Warragamba Dam includes Lake Burragorang (that is, the reservoir formed by Warragamba Dam) and its tributaries and areas of the Blue Mountains National Park, Burragorang State Conservation Area, Nattai National Park, Nattai State Conservation Area and Yerranderie State Conservation Area. Most of the Blue Mountains National Park is also in the Greater Blue Mountains World Heritage Area (GBMWHA) and areas of the GBMWHA would be inundated by increased temporary inundation.

Downstream of Warragamba Dam the Operational Study Area includes the freshwater and estuarine reaches of the river system and its tributaries between Warragamba Dam where it joins the Nepean River near Wallacia (not including the reach of the Nepean River upstream of Wallacia) and Wisemans Ferry as well as the adjacent riparian zone, floodplain and wetland/lagoon waterbodies. During flood events, there are backwater flooding impacts along South Creek which flows into the Hawkesbury River downstream of Windsor and consequently South Creek has been included in the Operational Study Area. A plan showing the Operational Study Area is shown in Figure 1-1.

The construction study area has been defined as shown in Figure 1-2. The construction study area includes the areas in and around the existing Warragamba Dam, including auxiliary access roads and site buildings. The township of Warragamba and areas immediately upstream and downstream of Warragamba Dam, as well as the immediate surrounding road network are also included, as they are likely to be impacted by construction works.

Figure 1-1. Operational study area

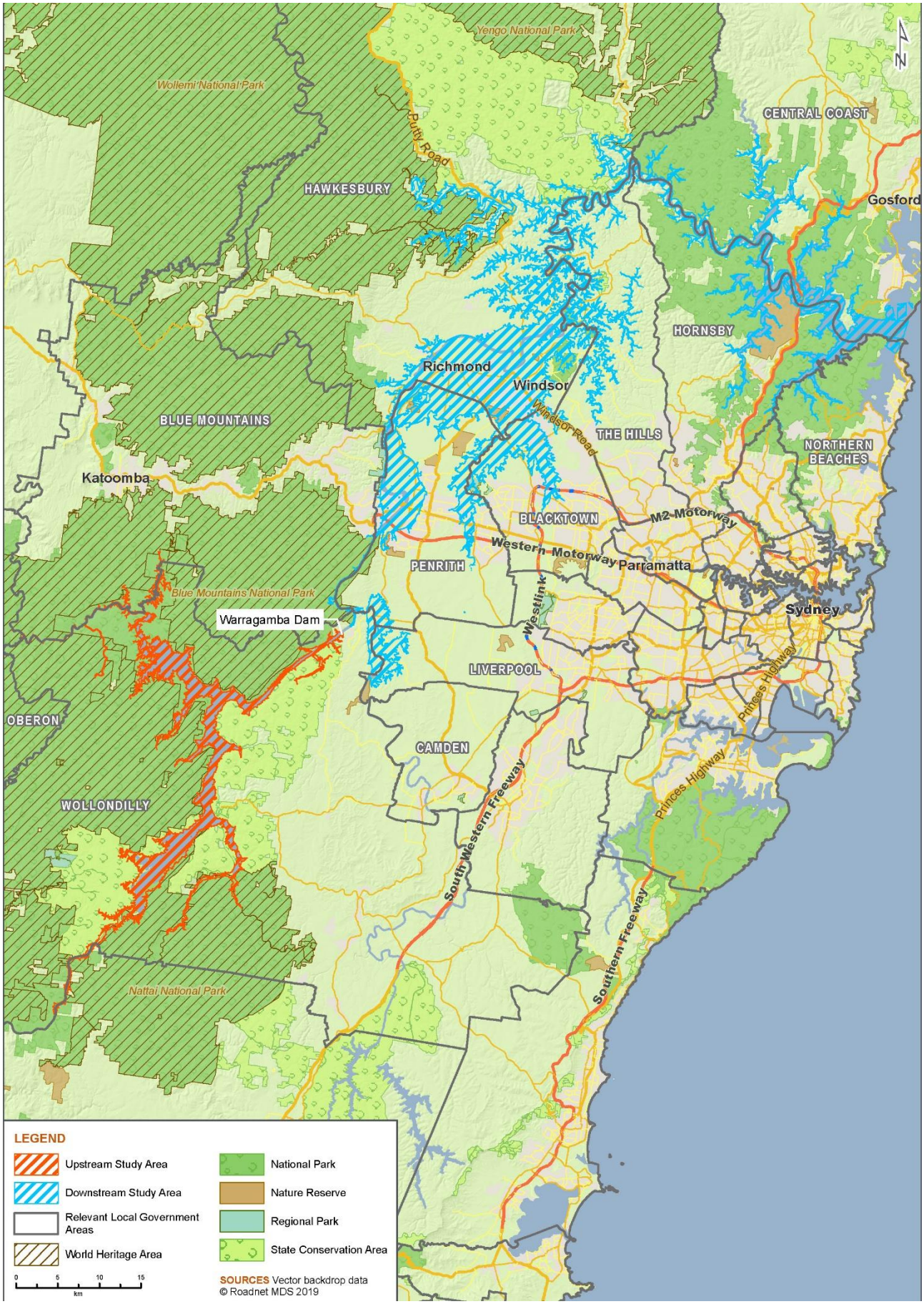
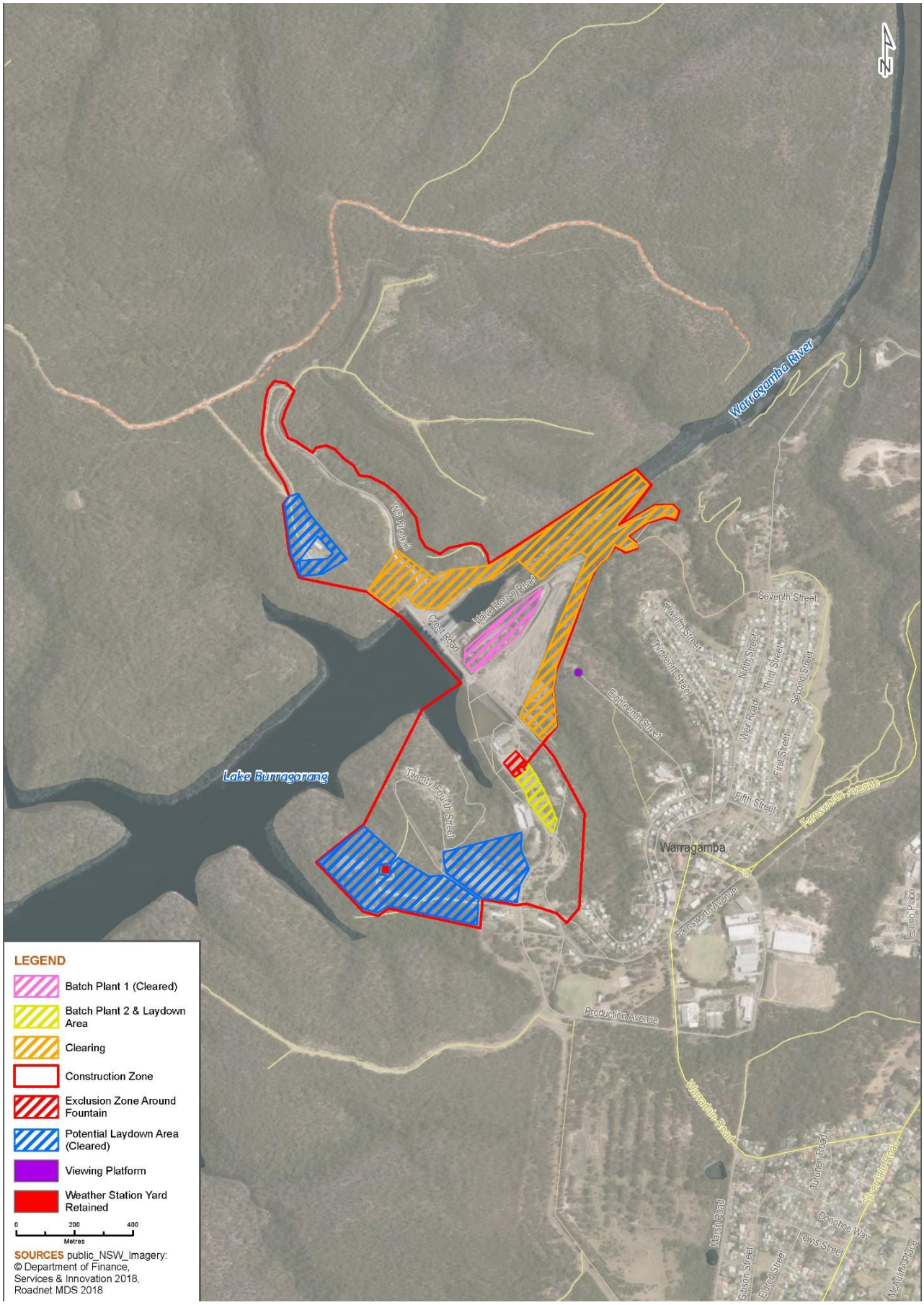


Figure 1-2. Construction study area



1.3 Secretary's Environmental Assessment Requirements (SEARs)

The Secretary's Environmental Assessment Requirements (SEARs) (13 March 2018) lists key tasks to be undertaken as part of the environmental impact assessment (EIA) approval process. Key Issue 17 of the SEARs details the transport and traffic assessment requirements for the Project. The desired performance outcomes of the traffic and transport assessment are as follows:

- network connectivity, safety, and efficiency of the transport system in the vicinity of the Project are managed to minimise impacts
- the safety of transport system customers is maintained
- impacts on network capacity and the level of service are effectively managed
- works are compatible with existing infrastructure and future transport corridors.

The SEARs relevant to the traffic and transport assessment, and where they are addressed in this report are presented in Table 1-1.

Table 1-1. Secretary's Environmental Assessment Requirement: Traffic and transport assessment

Desired performance outcome	Requirement	Where addressed
17. Transport and traffic Network connectivity, safety, and efficiency of the transport system in the vicinity of the project are managed to minimise impacts. The safety of transport system customers is maintained. Impacts on network capacity and the level of service are effectively managed. Works are compatible with existing infrastructure and future transport corridors.	1. The Proponent must assess construction transport and traffic (vehicle, pedestrian, and cyclists) impacts. The assessment should consider existing and planned developments, as well as upgrades around the Wollondilly Shire area. Consideration should be made to the structure and suitability of proposed access routes.	Section 4
	2. The Proponent must assess the operational transport impacts of the project.	Section 5.1
	3. The Proponent must provide consideration of the effects of extended inundation of downstream transport infrastructure, and of the effects on the road network of any alternate routes required where that transport infrastructure is inundated for prolonged periods. This should include assets such as Yarramundi, Richmond and Windsor road bridges and vehicular ferries at Lower Portland, Sackville, and Wisemans Ferry.	Section 5.2
	4. The Proponent must consider contingency plans for management of traffic during construction in the event of: (a) emergency closures due to flood, fire and road accidents; (b) significant pavement failures due to some roads needing repair within the Wollondilly Shire area; and (c) load limits of bridges in the area.	Section 7.2

1.4 Guidelines

Current guidelines applied in this assessment included those specified in the SEARS:

- Guide to Traffic Management – Part 3 Traffic Studies and Analysis (Austroads 2007)
- Guide to Traffic Generating Developments Version 2.2 (RTA 2002)
- Cycling Aspects of Austroads Guides (Austroads 2014)

- NSW Bicycle Guidelines v 1.2 (RTA 2005)
- Planning Guidelines for Walking and Cycling (DIPNR 2004).

The SEARS also identify the NSW *Sustainable Design Guidelines Version 3.0* (TfNSW 2013); these guidelines have since been superseded by the latest version, issued in March 2019.

2 Project description

2.1 The Project

Warragamba Dam Raising is a project to provide flood mitigation to reduce the significant existing risk to life and property in the Hawkesbury-Nepean Valley downstream of the dam. This would be achieved through raising the level of the central spillway crest by around 12 metres and the auxiliary spillway crest by around 14 metres above the existing full supply level (FSL) for temporary storage of inflows. The spillway crest levels and outlets control the extent and duration of the temporary upstream inundation. There would be no change to the existing maximum volume of water stored for water supply.

The NSW Government announcement in 2016 proposed that the dam wall be raised by 14 metres. Subsequently, the then NSW Department of Planning and Environment Secretary's Environmental Assessment Requirements (SEARs) required the Project to be designed, constructed and operated to be resilient to the future impacts of climate change and incorporate specific adaptation actions in the design.

Peer reviewed climate change research found that by 2090 it is likely an additional three metres of spillway height would be required to provide similar flood mitigation outcomes as the current flood mitigation proposal. Raising the dam side walls and roadway by an additional three metres may not be feasible in the future, both in terms of engineering constraints and cost. The current design includes raising the dam side walls and roadway by 17 metres now to enable adaptation to projected climate change. Any consideration of raising spillway heights is unlikely before the mid to late 21st century and would be subject to a separate planning approval process.

The 17-metre raising height of the dam abutments (side walls) and roadway have been considered and accounted for in the EIS and design. The potential maximum height and duration of upstream inundation remains consistent with what was originally proposed in 2016.

The Project also includes providing infrastructure to facilitate variable environmental flows to be released from Warragamba Dam.

The Project would include the following main activities and elements:

- demolition or removal of parts of the existing Warragamba Dam, including the existing drum and radial gates
- thickening and raising of the dam abutments
- thickening and raising of the central spillway
- new gates or slots to control discharge of water from the flood mitigation zone (FMZ)
- modifications to the auxiliary spillway
- operation of the dam for flood mitigation
- environmental flow infrastructure.

The Project would take the opportunity, during the construction period for the dam raising, to install the physical infrastructure to allow for management of environmental flows as outlined in the NSW Government's *2017 Metropolitan Water Plan*. However, the actual environmental flow releases themselves do not form part of the Project and are subject to separate administration under the *Water Management Act 2000*.

Figure 2-1 shows the existing dam and Figure 2-2 shows the dam after construction works have been completed.

Figure 2-1. Schematic of existing dam

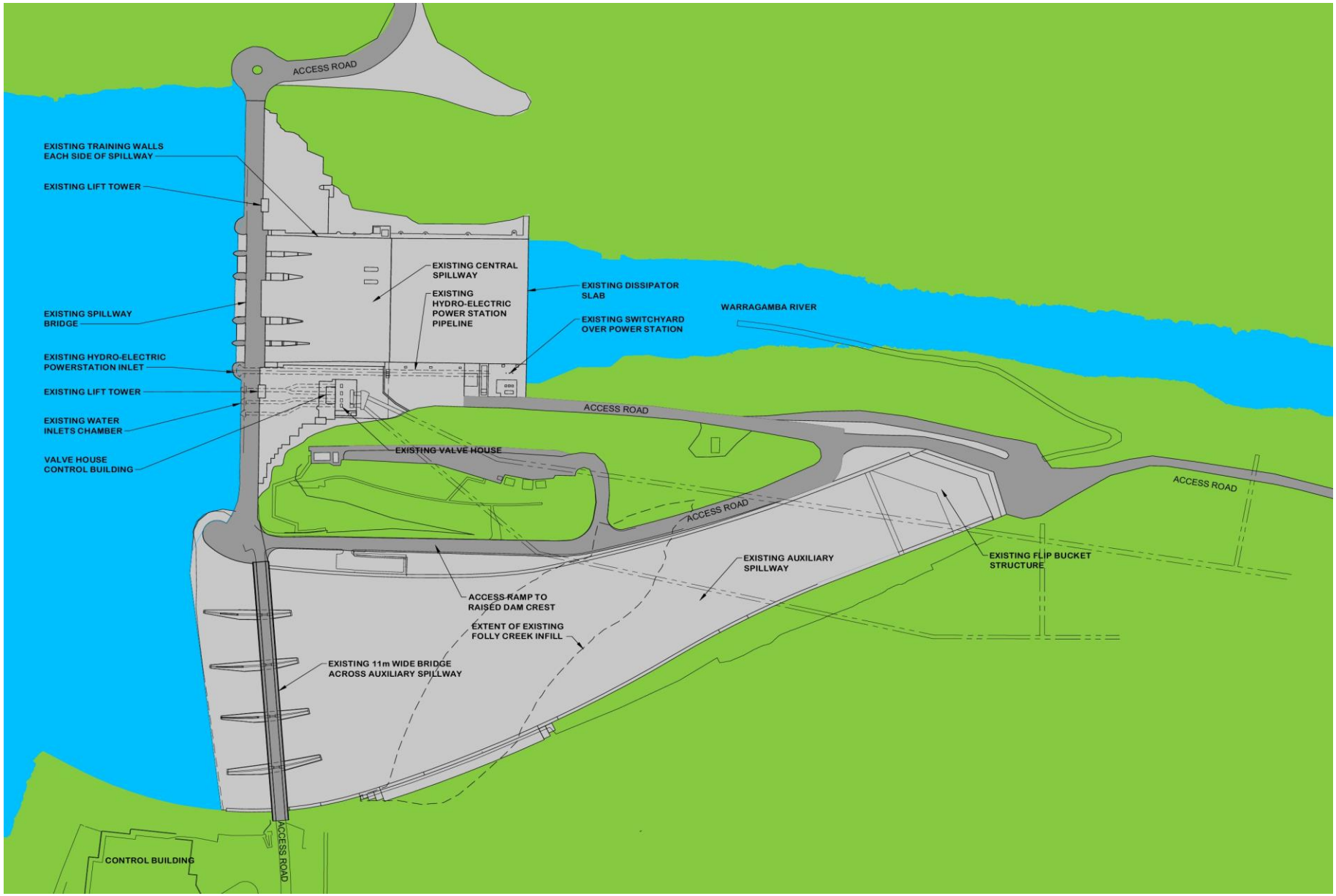
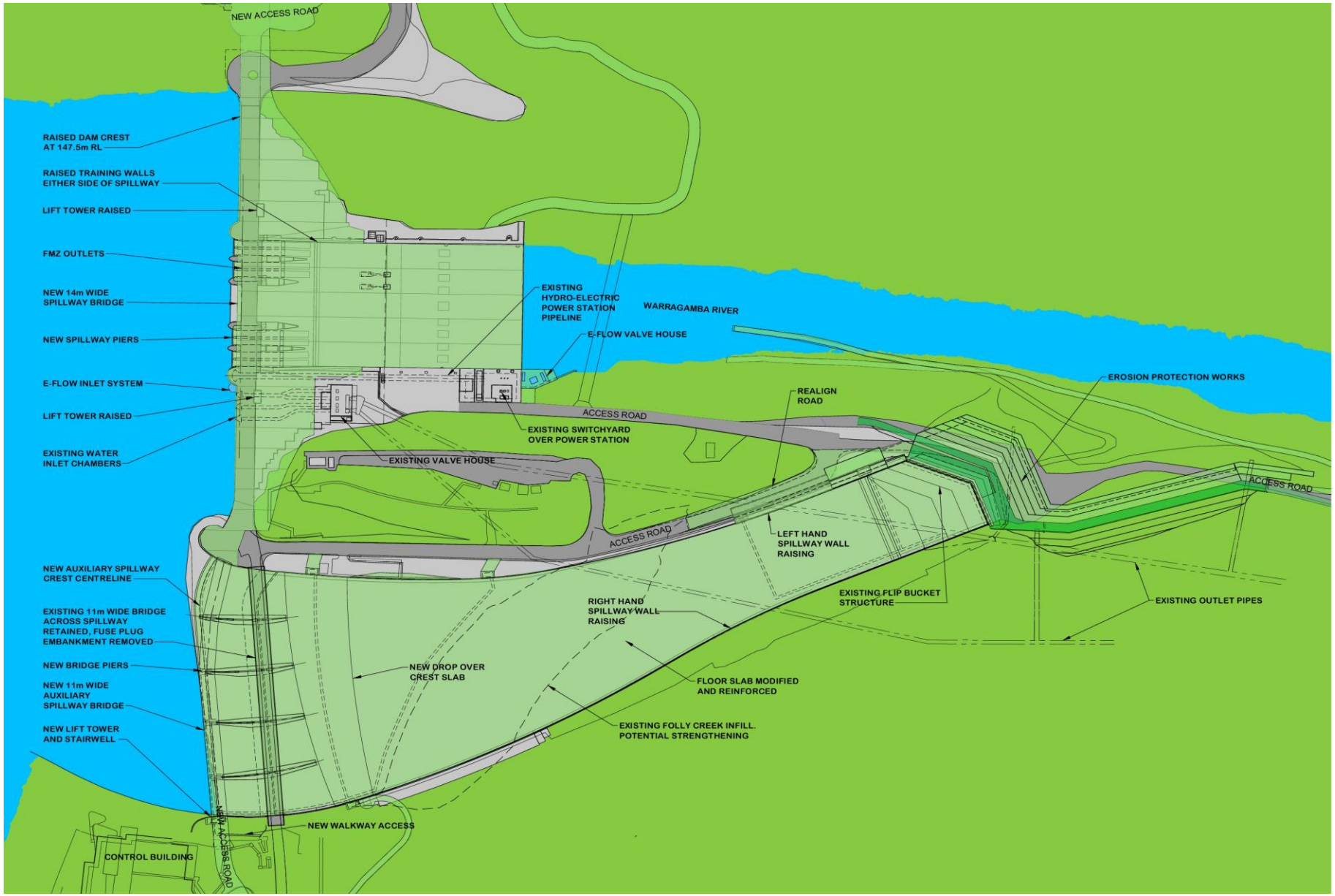


Figure 2-2. Modified dam including Project works



Operation of the dam for flood mitigation

Operational objectives in order of priority are to:

- maintain the structural integrity of the dam
- minimise risk to life
- maintain Sydney's water supply
- minimise downstream impact of flooding to properties
- minimise environmental impact
- minimise social impact.

There would be two different modes of operation for the Project: normal and flood operations. In both modes Warragamba Dam would continue to store and supply up to 80 percent of Sydney's drinking water. The storage capacity, which is the dam's FSL, would not change.

Operation of the proposed dam is discussed in Chapter 15 and shown on Figure 2-3 and Figure 2-4.

Normal operations

Normal operations would occur when the dam storage level is at or lower than FSL.

Normal operations mode for the modified dam would be essentially the same as current operations, apart from environmental flow releases. Inflows would be captured up to FSL, after which environmental flows releases would cease and flood operation procedures would be implemented.

Flood operations

During large rainfall events when the storage level rises above FSL, flood operations mode would commence. In this mode, inflows to Lake Burragorang would be captured and temporarily stored (increasing water levels in Lake Burragorang and upstream tributaries). The raised dam would provide capacity (i.e. the FMZ) to capture temporarily around 1,000 gigalitres of water during a flood event.

Water would be discharged in a controlled manner via the gated conduits or slots until the dam level returns to FSL. FMZ operating protocols would guide this process and be developed for approval by the relevant regulatory authorities.

The raised dam would not be able to fully capture inflows from all floods. For floods that exceed the capacity of the FMZ, water would spill firstly over the central spillway and then, depending on the size of the flood, the auxiliary spillway.

Figure 2-3. Existing dam operations

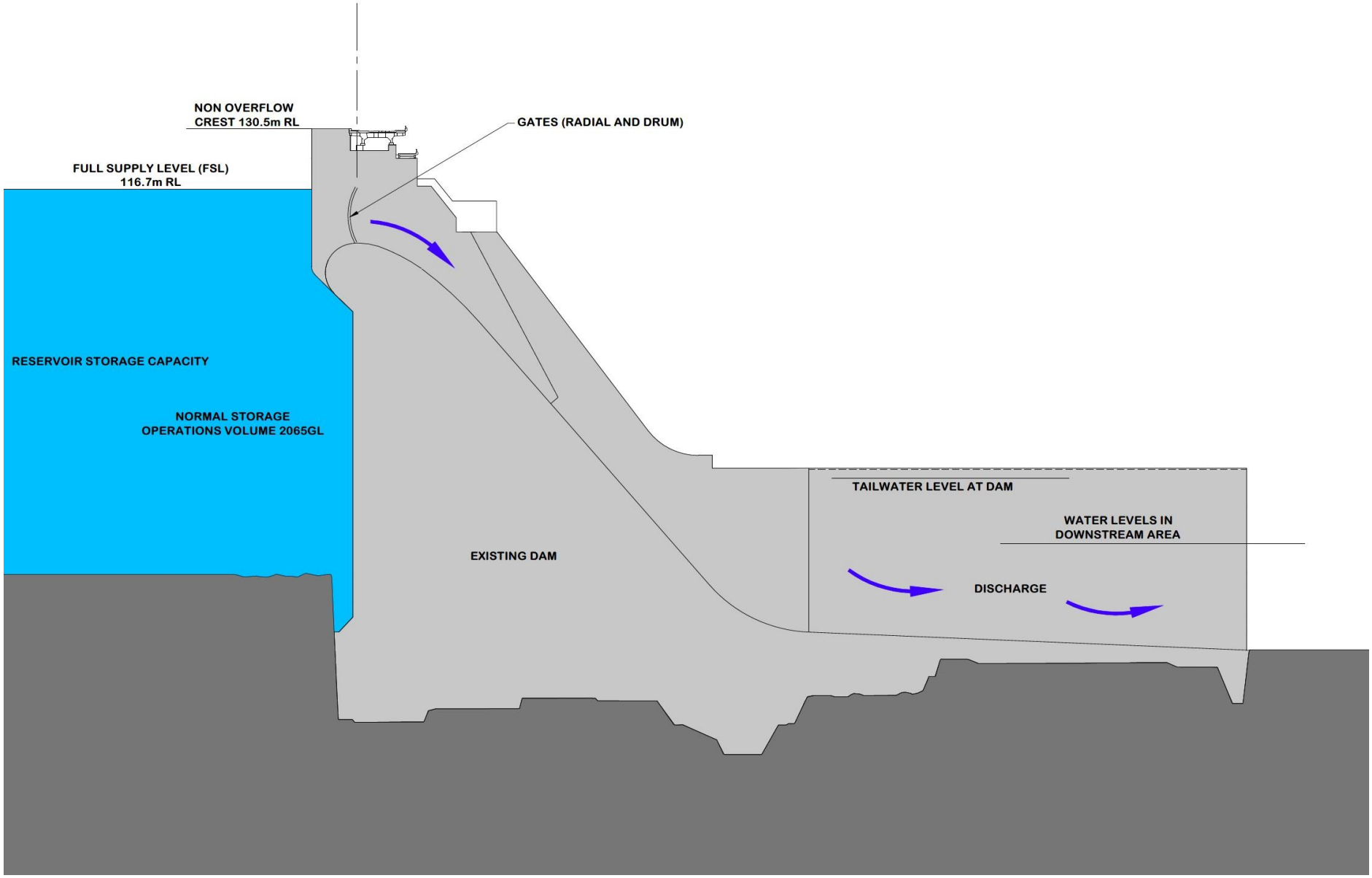
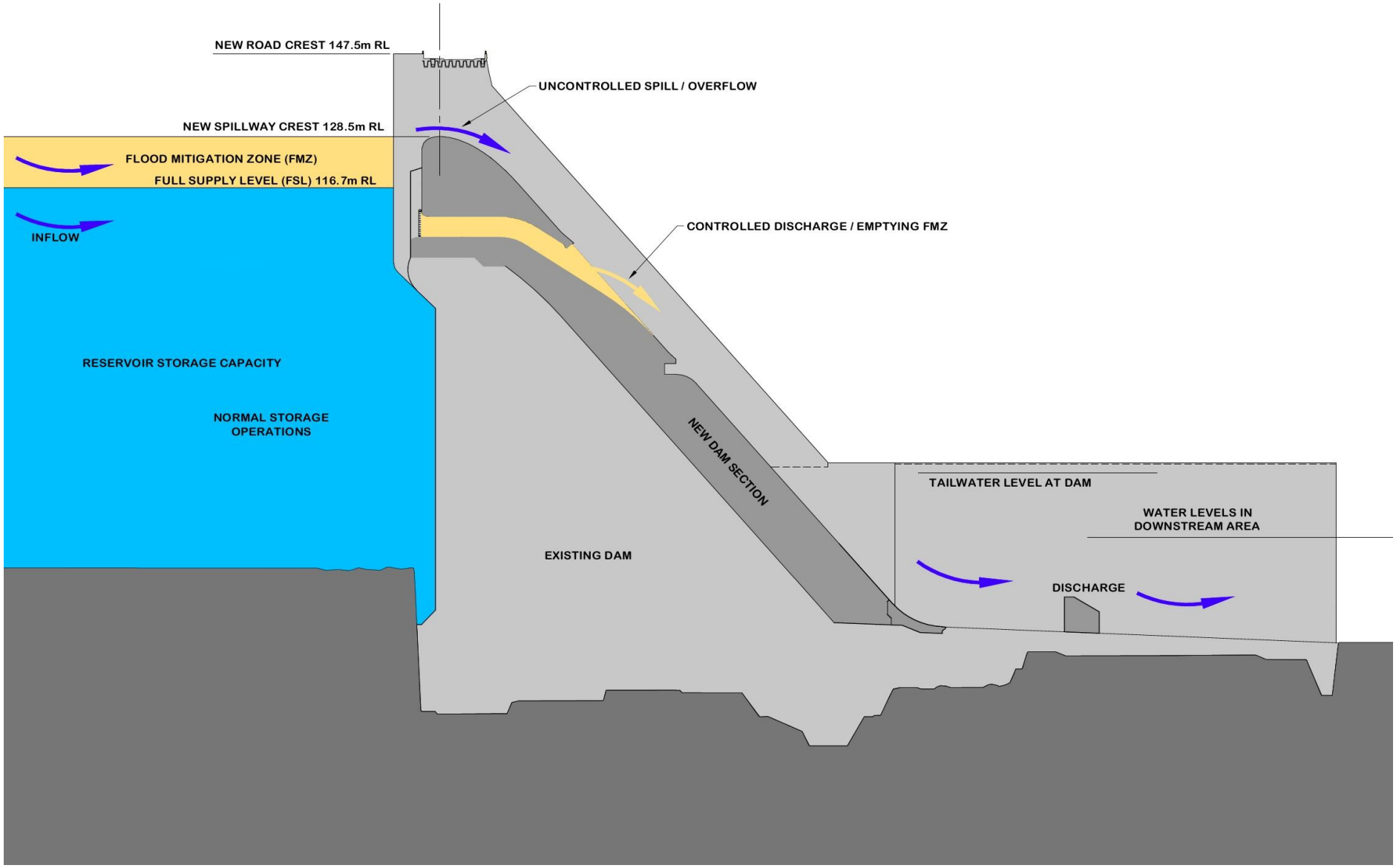


Figure 2-4. Future dam operations



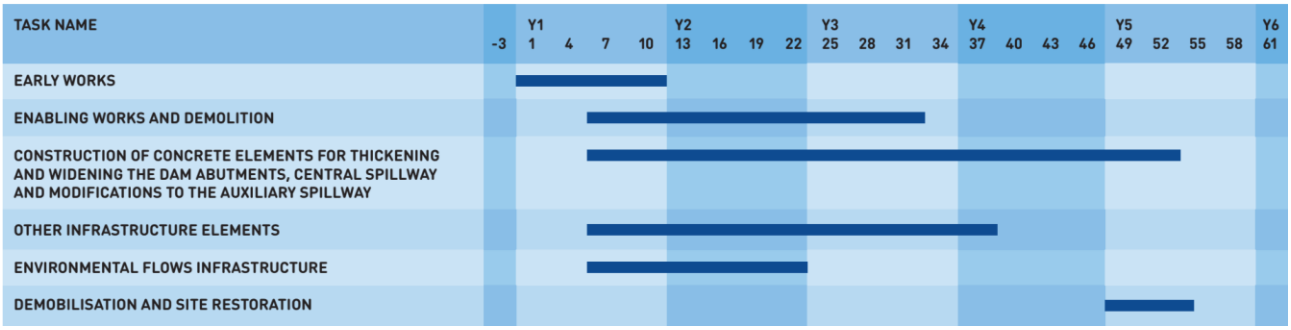
2.2 Project construction

This section describes the proposed approach to construction. If the project is approved, further detailed construction planning would take place prior to commencement to inform a construction environmental management plan (CEMP). This plan would consider methods and the scheduling of activities to minimise impacts on the community and the environment such as noise, access, and amenity, and would detail mitigation and management measures.

2.2.1 Construction program

A preliminary construction program is presented in Figure 2-5 with the Project anticipated to be completed between four to five years from commencement.

Figure 2-5 Preliminary construction program



2.2.2 Construction workforce

The number of workers would vary over the program. Up to 300 workers would undertake establishment activities including setting up offices and compounds, assembling the concrete batch plants and beginning early and enabling works. The number of workers on site would increase during construction to around 500 during peak construction periods.

2.2.3 Construction hours

The majority of works would take place during **standard construction hours** for NSW which are:

- 7am to 6pm – Monday to Friday
- 8am to 1pm – Saturday
- no work on Sundays and Public Holidays.

This includes the majority of high noise generating activities such as:

- deliveries of materials including concrete, sand, and aggregates for concrete production
- demolition work including hydro-blasting (a concrete removal technique that uses high pressure water)
- earthworks, excavations, drilling and blasting.

2.2.4 Construction materials

Raw materials (such as fly ash, sand, cement, and aggregates) to produce concrete would constitute the majority of materials required for the Project. The estimated volume and type of concrete for the main components of construction are presented in Table 2-1.

Table 2-1. Volumes and type of concrete required

Project element	Estimated concrete (m^3)
Abutment and central spillway	
Abutment and central spillway thickening and raising (mass concrete)	502,500
Crest kerbs and parapet (reinforced concrete)	300
Spillway (concrete)	5,900
Lift towers (reinforced concrete)	2,500
Spillway training walls (reinforced concrete)	5,800
Outlet conduits (reinforced concrete)	3,000
Bridges	
Bridge piers (reinforced concrete)	11,200
Bridge deck (precast elements)	500
Other bridge elements (concrete)	1,000
Auxiliary spillway	
Spillway overflow (mass concrete)	63,500
Spillway crest (mass concrete)	11,100
Other spillway works (reinforced concrete)	5,600
Spillway (concrete)	6,700
Erosion protection downstream (reinforced concrete)	1,600
TOTAL	**621,200**

Based upon the likely concrete mixes, the weight of different constituents of the concrete is presented in Table 2-2. There would be two main types of concrete produced:

1. Conventional structural concrete mix - typically used in most construction projects.
2. Mass concrete mix - for the dam thickening and auxiliary spillway crest structure. The mass concrete mix uses less cement but more fly ash and coarse aggregates than a conventional concrete mix.

An assessment of potential sources of aggregates, fly ash and cement was undertaken for the concept design.

Quarries in the Blue Mountains, Southern Highlands, Central Coast and South Coast were identified as capable of supplying coarse aggregates suitable for the Project. Fly ash would be sourced from coal fired power stations in the region or elsewhere if NSW supplies are running low. Cement would be sourced from suppliers in the Sydney region.

Further assessment during construction planning and detailed design would determine the preferred source locations.

Table 2-2. Typical weight of materials for concrete production

Materials	Standard concrete (kg/m^3)	Mass concrete (kg/m^3)	Total weight (tonnes)
Cement	240	100	75,123
Fly ash	80	135	89,580
Coarse aggregate	1,100	1,250	846,874
Fine Aggregate (Sand)	800	800	546,656

The amount of other materials required for construction of the Project is presented in Table 2-3.

Table 2-3. Other construction materials

Materials	Total amount (various units)
Steel for reinforcing	8,760 t
Steel for formwork	15,700 m^2
Other steel elements	2,120 t
Engineering fill	24,380 m^3
Timber for formwork	6,313 m^2

Earthworks volumes

Earthworks would be required during construction. The volume of earthworks for relevant activities is presented in Table 2-4.

Table 2-4. Earthworks volumes

Activity	Estimated earthworks volume (m^3)	Waste classification
Removal of the fuse plugs in the auxiliary spillway.	83,000	General solid waste (non-putrescible). Excavated natural material – consisting of basalt rocks and engineered clay core.
Excavation for the foundations and tie ins of the modified dam wall including the left abutment works	60,000	General solid waste (non-putrescible). Mostly virgin excavated natural material with some excavated natural material.
Coffer dams	21,000	General solid waste (non-putrescible). Virgin excavated natural material, excavated natural material, building and demolition waste, asphalt waste.
Access road works	40,000	General solid waste (non-putrescible). Virgin excavated natural material, excavated natural material, building and demolition waste, asphalt waste.
Excavation for the auxiliary spillway modifications	25,000	General solid waste (non-putrescible). Virgin excavated natural material, excavated natural material, building and demolition waste, asphalt waste.
Erosion protection works downstream of auxiliary spillway	30,000	General solid waste (non-putrescible). Mostly virgin excavated natural material with some excavated natural material.
Excavations for temporary works such as temporary site access roads and for site facilities such as batch plants	10,000	General solid waste (non-putrescible). Virgin excavated natural material, excavated natural material, building and demolition waste, asphalt waste.
TOTAL	**269,000**	

2.2.5 Spoil and waste management

The Project would generate spoil due to the earthworks detailed in Table 2-4. Some material may be able to be reused on Project for temporary or permanent works, or other off-site projects. Spoil may be temporarily stockpiled before

being permanently placed. Once spoil has been placed permanently placed, the area would be covered in topsoil and replanted with suitable native vegetation.

Waste materials would be generated from the demolition of existing dam elements such as the hydro blasting, dam road, radial and drum gates, other electrical and mechanical infrastructure, and concrete demolition. These materials would be disposed of off-site.

The estimated volume or weight of waste materials generated during construction and potential management options are presented in Table 2-5.

Table 2-5. Waste materials generated and potential management options

Material	Volume or weight generated during construction	Potential management options
Concrete slurry from hydro blasting	4,300 t	Suitable material would be reused with remainder emplaced on site or taken off-site for reuse or disposal
Other concrete waste	60,000 t	Taken off-site for reuse or disposal
Steel	2,500 t	Taken off-site for reuse or disposal
Timber formwork	11,000 m^2	Taken off-site for recycling
General construction waste	4,000 t	Reused on-site or taken off-site for disposal
Vegetation from clearing	10,000 t	Mulched and reused on site for landscaping

2.2.6 Traffic management and access

2.2.6.1 Construction vehicle movements

The majority of truck movements would be generated by the delivery of materials for concrete production. There would also be the delivery of other materials such as steel, plant and equipment, precast elements and new components for the dam. Approximately 500 workers would travel to site during the peak construction period. The numbers and types of vehicles accessing the Project site during the different construction stages are presented in Table 2-6. Each vehicle accessing the site would generate two traffic movements a day – one to access the site and one to leave the site. More information on daily and peak traffic movements is presented in Section 4.1.

Table 2-6. Construction vehicle movements

Material	Approximate number of vehicles per day travelling to project site
Site establishment	Light vehicles – 100 Heavy vehicles – 50
Main works	Light vehicles – 250 Heavy vehicles– 104
Demobilisation	Light vehicles – 50 Heavy vehicles – 25

Generally, vehicles accessing the site from either north, south, or east would travel along The Northern Road, Park Road, Silverdale Road, Farnsworth Avenue and Production Avenue. Vehicles from the south would access the site via Silverdale Road, Warradale Road, Farnsworth Avenue and Production Avenue.

There would also be on-site traffic movements. A construction traffic management plan would be prepared and implemented to minimise the impacts of both on-site and offsite traffic movements.

3 Existing environment

3.1 Study area

The study area for the operational traffic and transport assessment is shown in Figure 1-1. The operational study area is based on the flood footprint for a probable maximum flood (PMF) for upstream and downstream areas of Warragamba Dam. The construction study area also includes the roads and intersections around Warragamba and the region which would be used by light and heavy vehicles during the construction of the Project (refer Figure 3-1 and Figure 3-2). Operational impacts of the Project upstream of the dam on fire trails, walking tracks and private property access are assessed Chapter 20 (Protected and sensitive lands) of the EIS.

3.2 Warragamba Dam

3.2.1 Road networks

Warragamba Dam road network

There is a network of roads and parking areas near the dam which are directly related to the dam, catchment, or associated operations – and also provide access to recreational areas. Production Avenue and Farnsworth Avenue provide access to the existing Warragamba Dam and visitor centre and Haviland Park. Local roads, such as Twenty Third Street and Twenty Fourth Street connect with Production Avenue and Farnsworth Avenue within the proposed Project construction site. However, most of these roads have public access restrictions and are controlled with boom gates and other security measures.

Parking at Warragamba Dam

There are a number of designated parking areas located on Production Avenue and Farnsworth Avenue adjacent to Warragamba Dam as shown on Figure 3-1. The parking located on Farnsworth Avenue (as shown on Figure 3-1 is designated for Warragamba Dam staff only, however, the other parking areas are open to the visitors visiting Warragamba Dam and Haviland Park.

Surrounding road network

There are two proposed local heavy vehicle routes to access Warragamba Dam construction site namely:

- from the north – via The Northern Road, Park Road (through Wallacia), Silverdale Road, Farnsworth Avenue and Production Avenue
- from the south – via Silverdale Road, Warradale Road and Production Avenue.

While Marsh Road in the south would provide more direct access to the construction site than Warradale Road, its pavement condition is poor and there is a load limit on the road of eight tonnes.

The Warragamba local road network can be categorised into three basic types of roads:

- residential streets which make up the majority of the local roads
- local arterial roads such as Farnsworth Avenue and Silverdale Road which provide connections to the regional road network
- commercial or industrial roads which service light industry, recreational facilities and commercial facilities in the southern part of Warragamba.

The Blaxland Crossing Bridge is located on the east side of Warragamba area and connects Park Road and Mulgoa Road with Silverdale Road. Currently heavy trucks from Nortons Basin quarry and Warragamba chlorination plant use this bridge. It is anticipated that the heavy trucks coming from the north will use this bridge to access the proposed Project construction site.

Major road network adjacent to the Project are shown on Figure 3-2.

Figure 3-1. Existing parking areas in and around Warragamba Dam

Figure 3-2. Major road networks adjacent to the Project

Regional road network

Regional roads, namely the M4 Motorway, The Northern Road, and the Hume Motorway would provide regional access to the Project construction site for materials and workers.

The M4 Motorway is located to the north of Warragamba and connects the Warragamba Dam area to Western Sydney and other parts of Sydney via The Northern Road and Mulgoa Road.

The Northern Road and Mulgoa Road are located to the east of the Warragamba and connect with Park Road and Silverdale Road respectively. Currently construction work is being undertaken to upgrade The Northern Road which is anticipated to be completed before the commencement of the Project construction works. The Northern Road is a key corridor and would be used to transport construction materials to the site from both the north and south.

Hume Motorway is located to the south of Warragamba and connects to Warragamba via Menangle Street, Remembrance Drive, Narellan Road, The Northern Road and Silverdale Road.

3.2.2 Major intersections and traffic counts survey

As part of the study, seven key intersections were identified for intersection capacity analysis and to identify potential impacts of Project construction traffic on the performance of these intersections. Selection of these intersections was based on the anticipated trip distribution and routes of light and heavy construction vehicles. The seven intersections are:

1. Mulgoa Road/Park Road
2. Silverdale Road/Farnsworth Avenue
3. Warradale Road/Production Avenue
4. Warradale Road/Silverdale Road
5. Silverdale Road/Marsh Road
6. Farnsworth Avenue/Production Avenue
7. Park Road/Northern Road.

The Northern Road Upgrade project[1] includes recent traffic count data (carried out in 2017) of the Park Road/Northern Road intersection. This data was used for assessing the capacity of Park Road/Northern Road intersection. For the other six intersections, traffic count surveys were undertaken for both AM and PM peaks for two-hour periods (AM peak – from 7 am to 9 am and PM peak – 4 pm to 6 pm). The one-hour turning movement counts were then calculated by adding four sets of consecutive 15-minute traffic count data within the two-hour survey periods for both AM and PM peaks and identifying the maximum hourly traffic volume for each of the surveyed intersections. It should be noted that different intersections may have a different peak-hour. However, for intersection capacity analysis, the maximum hourly traffic volume was considered as a conservative approach.

Directional traffic counts surveys were also undertaken on three road segments, Silverdale Road, Park Road, and Farnsworth Avenue. Traffic counts survey location are shown on Figure 3-3.

Intersection traffic counts survey were conducted on 23 June 2018 (Saturday) and 26 June 2018 (Tuesday) to capture both AM and PM traffic for a weekend day and a weekday respectively. The dates were selected to avoid school holidays. Directional traffic counts surveys were undertaken from 23 June 2018 to 29 June 2018 for one week to capture weekly traffic variation.

The traffic survey was undertaken during the winter season and as such, no traffic volume data is available for the summer season. Any seasonal variations of traffic volume data were not captured in this study. Further research into other sources of traffic data were undertaken, however, there was no suitable long-term traffic data that could be used to assess seasonal variations in traffic volumes.

Figure 3-4, Figure 3-5, and Figure 3-6 show average daily traffic (ADT), the AM peak two-hour period (7 am to 9 am) and the PM peak two-hour period (4 pm to 6 pm) traffic over a one-week period for the three directional traffic count locations.

[1] The Northern Road Upgrade-Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park- Final Environmental Impact Statement, December 2017

Generally, weekend traffic volumes were lower than the weekday traffic volume at all three locations. Peak PM traffic volumes were higher than the AM peak period. Consequently, the traffic assessment and intersection capacity analysis were undertaken for a weekday only to assess the performance for the worst-case scenario.

The current intersection traffic count data (total and heavy vehicle) for both AM and PM peak-hours (one-hour traffic count) at seven intersections are shown on Figure 3-7 and Figure 3-8 respectively.

The turning patterns and volumes at the Park Road/Northern Road intersection were extracted from the Northern Road Upgrade Project report. An annual growth rate of 3.5 percent has been applied to the turning volume data to estimate the 2018 turning volume for the Park Road/Northern Road intersection. Details of the assumed annual growth rate are discussed in Section 3.2.4 below.

The turning volumes of future year 2022 with and without the developments for both AM and PM peak-hours are provided in Appendix A of this report.

3.2.3 Roads and intersection capacity

The existing performance of the road network in the vicinity of the Project was identified to provide a baseline to assess the impacts of additional construction traffic on the existing road network capacity. The performance of the road network is largely dependent on the operating performance of intersections that are the critical capacity control points. The level of service (LOS) is the standard measure used to assess the operational performance of the intersections. Level of service is ranked from LOS A to LOS F, with LOS A representing the best performance and LOS F the worst. SIDRA Intersection modelling software (version 7) has been used to model and assess the performance of the identified intersections.

The criteria used to determine intersection LOS based on average delay is outlined in Table 3-1 as defined by Roads and Maritime Services (RMS) in *Guide to Traffic Generating Development (2002)*.

Table 3-1. RMS delay-based level of service criteria for intersections

Level of service	Average delay per vehicle (sec)	Traffic signals/roundabouts	Give way and stop signs
A	<14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; incidents would cause excessive delays at signals Roundabouts require other control modes	At capacity; requires other control mode
F	>70	Over capacity; unstable operation	Over capacity; unstable operation

Intersection capacity analysis was carried out for all seven intersections for scenarios:

- intersection capacity analysis of Base Year 2018
- intersection capacity analysis of Future Year 2022 without Project Construction Traffic
- intersection capacity analysis of Future Year 2022 with Project Construction Traffic (Intersection capacity analysis of future year 2022 with Project Construction Traffic was carried out for two scenarios- Scenario 1 and Scenario 2 as illustrated in Section 4.1.2).

Figure 3-3. Traffic count survey locations

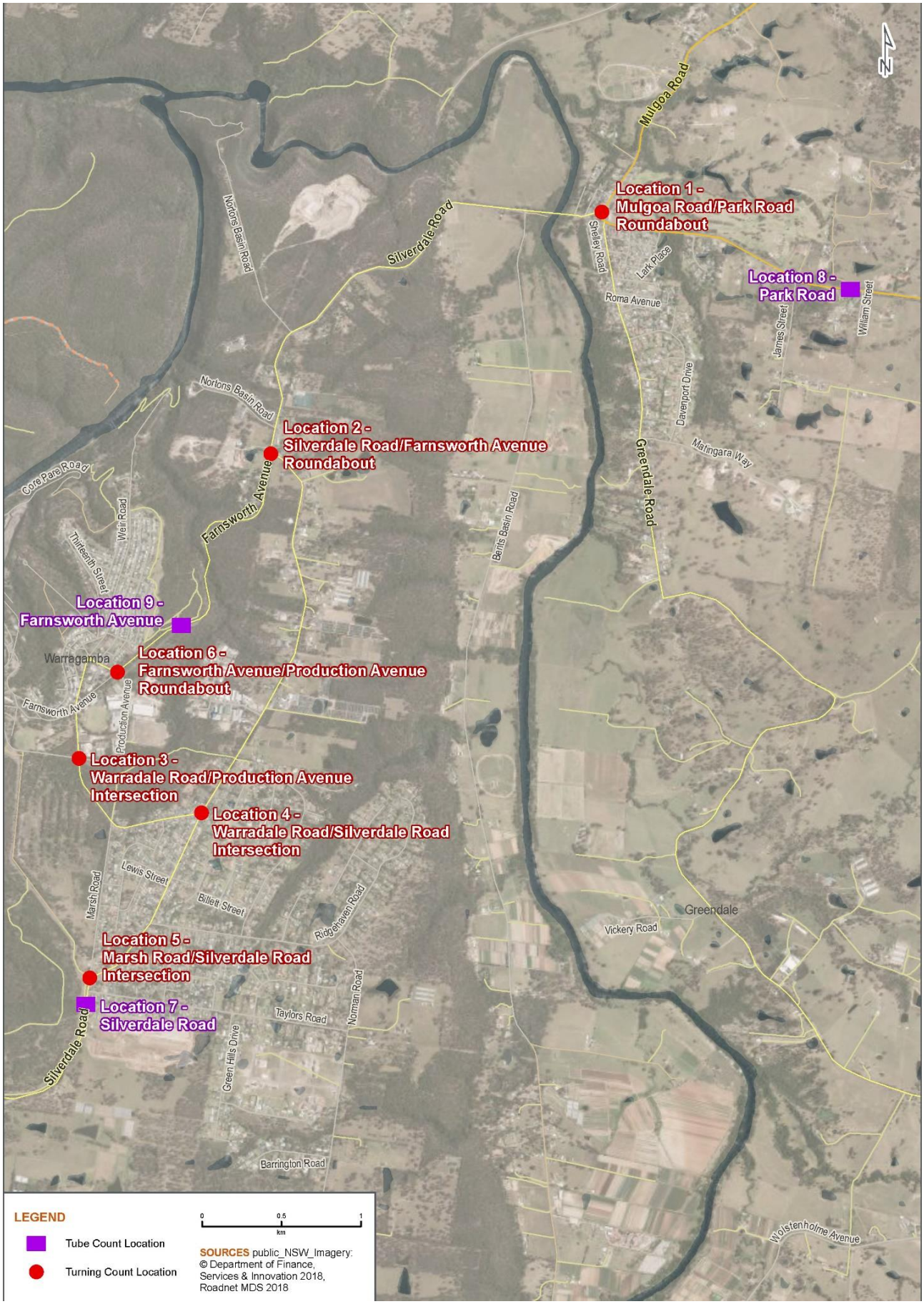


Figure 3-4. Weekly traffic variation of Silverdale Road, south of Taylors Road

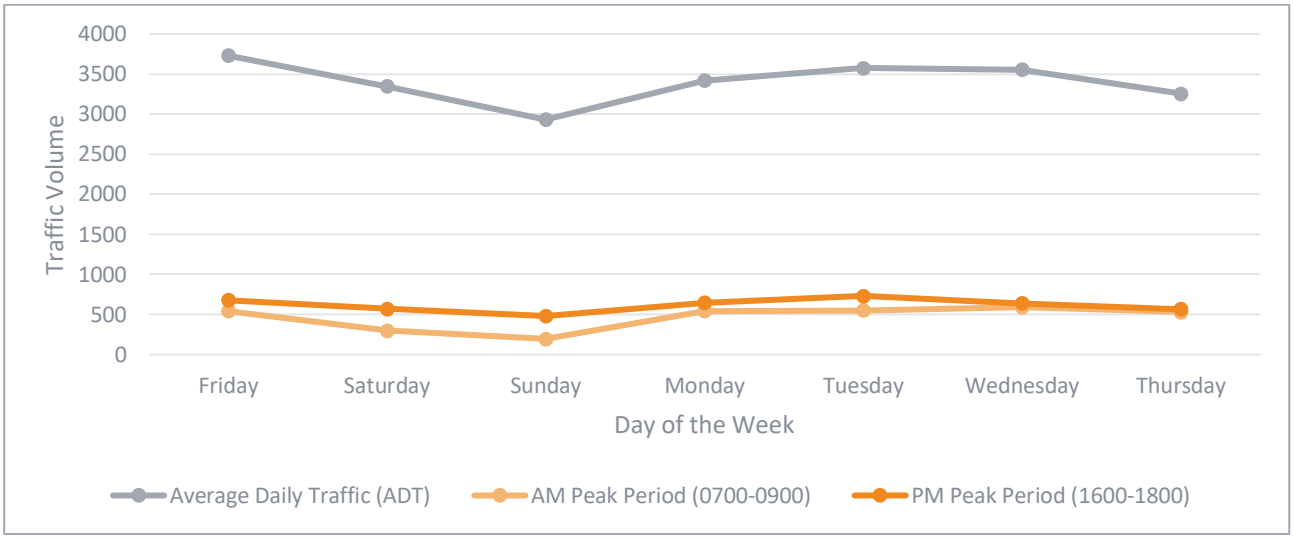


Figure 3-5. Weekly traffic variation of Park Road, east of James Street

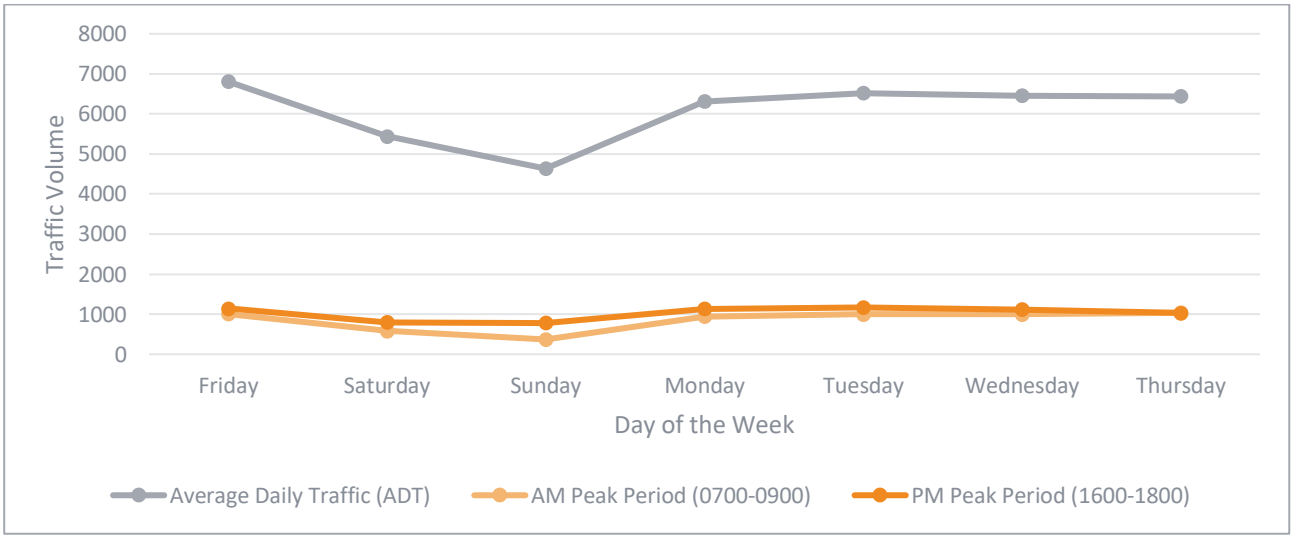


Figure 3-6. Weekly traffic variation of Farnsworth Avenue, north of Production Avenue

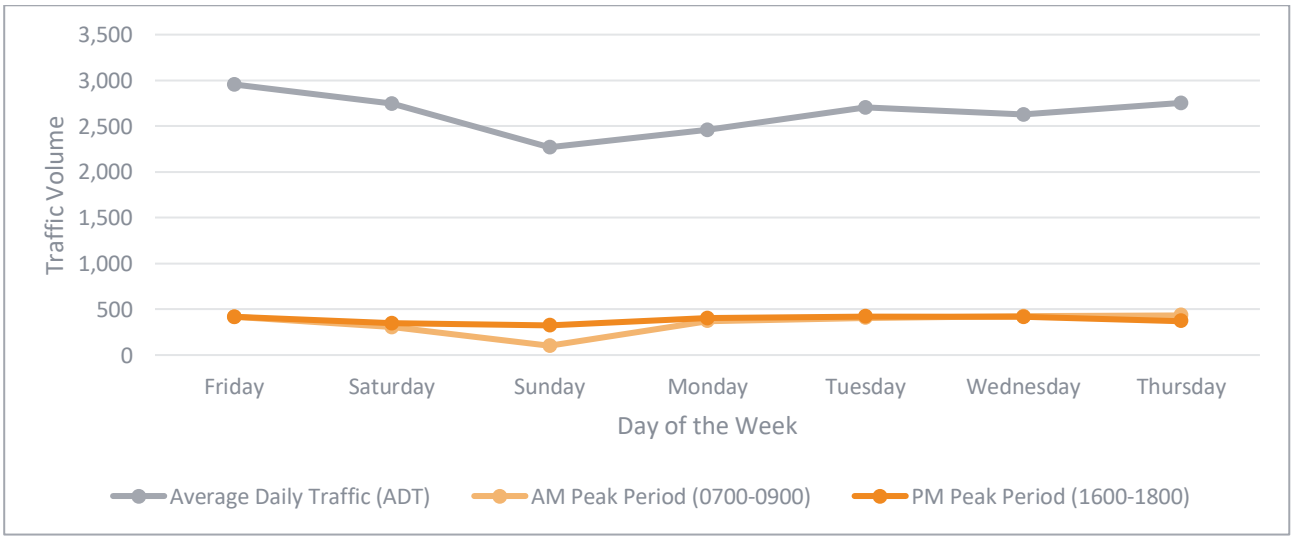


Figure 3-7. Existing intersection traffic count data in the AM peak-hour (1-hourperiod)

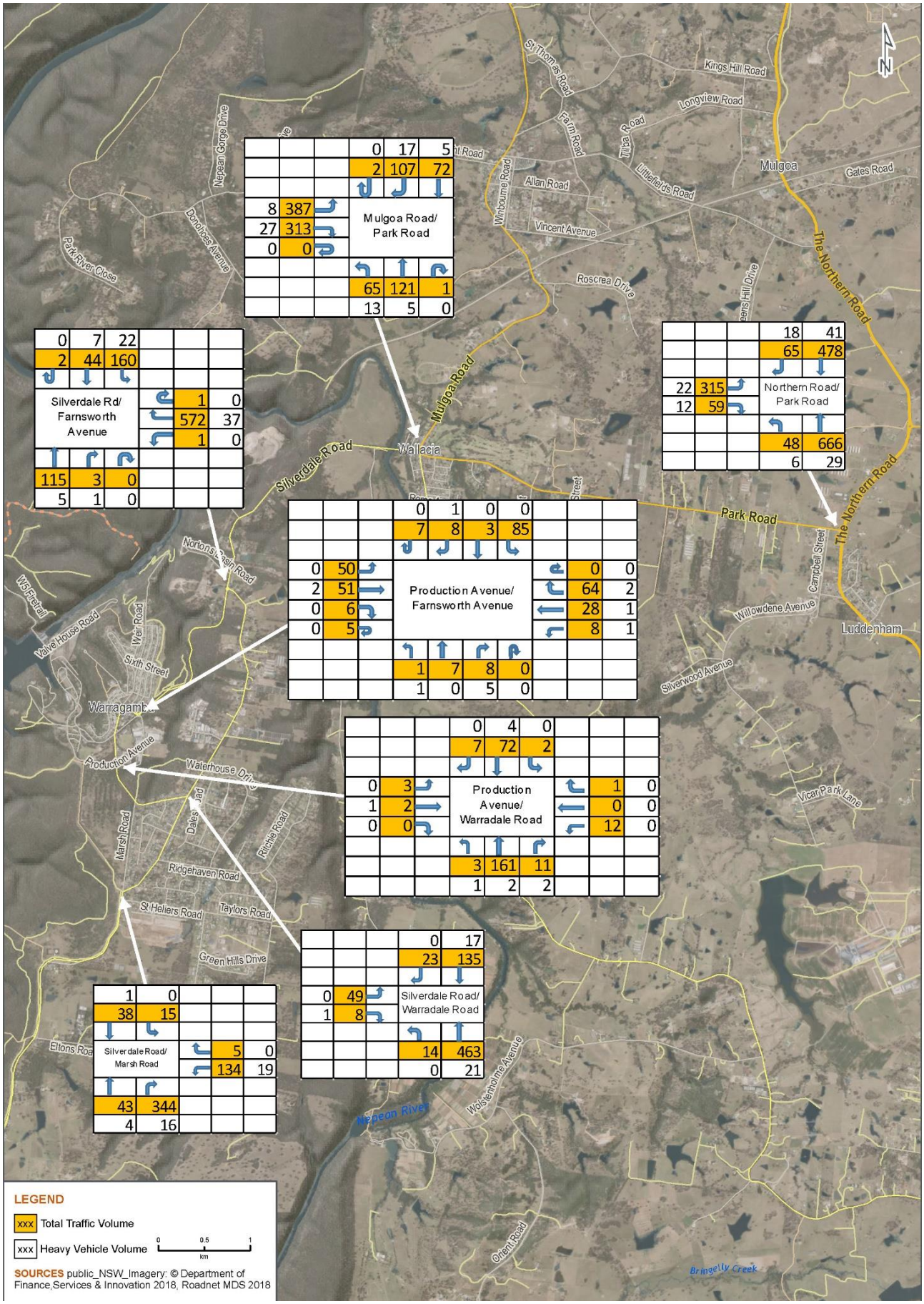
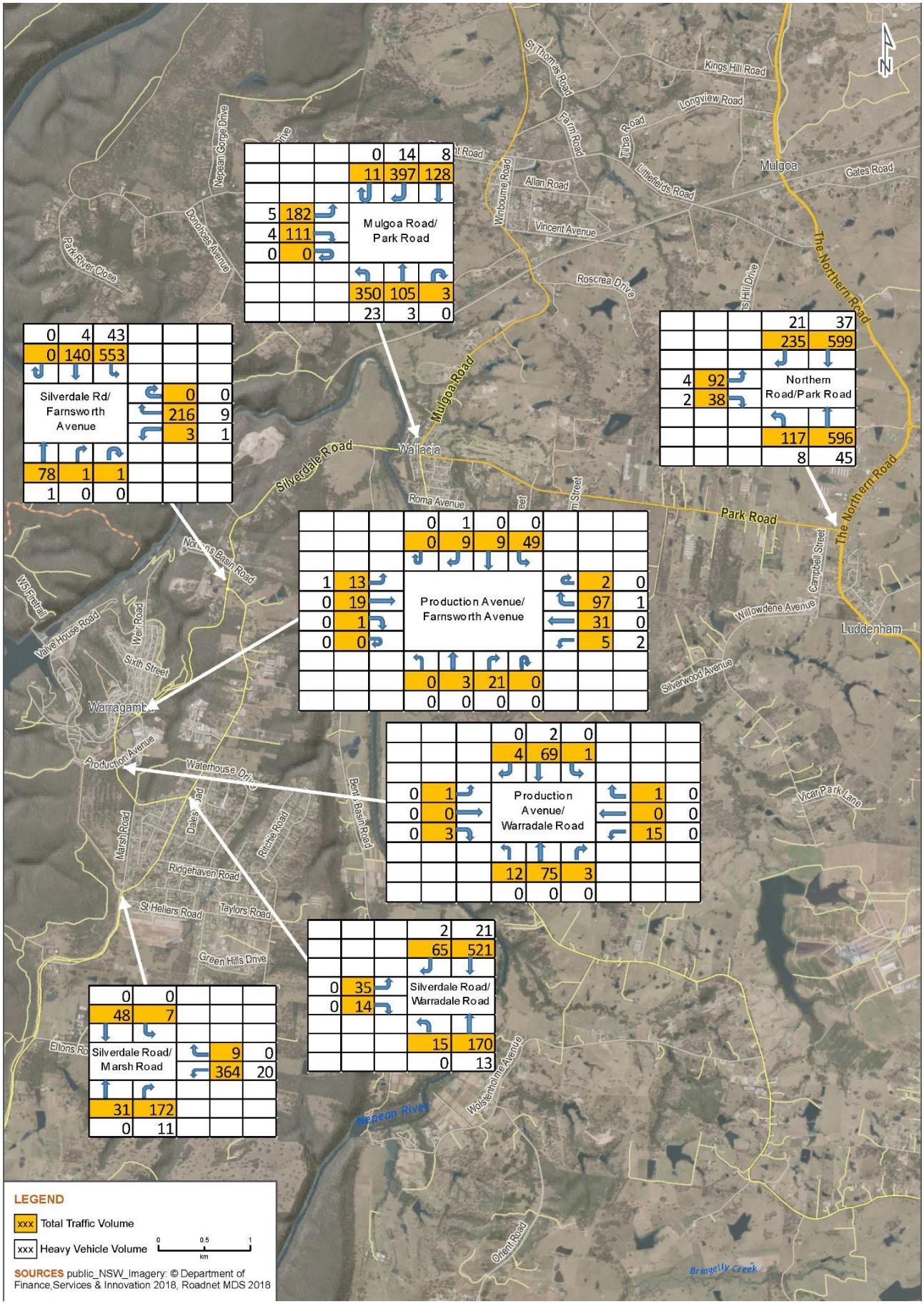


Figure 3-8. Existing intersection traffic count data in the PM peak-hour (1-hour period)



3.2.4 Planned developments, growth rate and future year traffic estimation

Regarding planned future development in and around the Wollondilly Shire Council, the Council was consulted to obtain relevant information relating to such development. Specifically, in relation to planned and committed development impacting on the road network, which may coincide with traffic associated with construction and operation of the Project. In this regard, it was agreed to use a 3.5 percent annual traffic growth rate to estimate the construction year 2022 traffic and to capture any additional traffic from future planned development. The assumed annual growth rate is high and conservative, given that the NSW average is 1.6 percent annual growth rate[2].

The agreed annual growth rate was applied for four years (from 2018 to 2022) on six intersections where traffic count surveys were undertaken to estimate the future year 2022 (Project construction starting year) background traffic. The traffic data for the Park Road/Northern Road intersection were increased by the agreed annual growth rate for five years (from 2017 to 2022) to estimate the background traffic for this intersection.

It is to be noted that future planned and committed developments outside the Council area, including large projects such as the Western Sydney Airport, have not been considered in the assessment of traffic impacts, given such traffic would likely impact on the State road network further afield, which is already subject to high volumes of heavy vehicular traffic. As such, any additional traffic from the Project would result in little additional impact.

3.2.5 Average travel speed

Travel speeds provide an additional means of assessing the functional performance of a road. The criteria for determining the Level of Service based on average travel speeds is outlined in Table 3-2 as defined by Austroads *Guide to Traffic Management, Part 3: Traffic Studies and Analysis (2013)*.

Table 3-2. Austroads speed-based level of service criteria for urban roads

Average travel speed as a percentage of posted speed limit	Level of service (volume to capacity<1)
>85%	A
67-85%	B
50-67%	C
40-50%	D
30-40%	E
<30%	F

Table 3-3 shows the average travel speed on Park Road, Silverdale Road and Farnsworth Avenue.

[2] Retrieved from http://www.abs.gov.au/ausstats/abs@.nsf/mf/3218.0 on 27 July 2018

Table 3-3. Current travel speed of various roads around the Project site

Location	Criterion	Posted speed limit (km/hr)	Average travel speed (km/hr)*	Speed ratio (travel speed/ posted speed)	LOS
Park Road					
Eastbound	24-hour average speed	80	82.4	103%	A
	AM peak average speed		82.8	104%	A
	PM peak average speed		81.4	102%	A
Westbound	24-hour average speed	80	83.5	104%	A
	AM peak average speed		82	103%	A
	PM peak average speed		83.1	104%	A
Silverdale Road					
Northbound	24-hour average speed	60	60.8	101%	A
	AM peak average speed		60.5	101%	A
	PM peak average speed		59.3	99%	A
Southbound	24-hour average speed	60	61.6	103%	A
	AM peak average speed		59.6	99%	A
	PM peak average speed		62	103%	A
Farnsworth Avenue					
Northbound	24-hour average speed	60	65.9	110%	A
	AM peak average speed		65.7	110%	A
	PM peak average speed		65.8	110%	A
Southbound	24-hour average speed	60	67.3	112%	A
	AM peak average speed		65.3	109%	A
	PM peak average speed		65.7	110%	A

* Directional Traffic Survey 2018

Currently all these roads are performing with LOS A. However, all investigated roads are single lane dual carriageway. It is anticipated that additional heavy trucks loaded with construction materials may drive at lower speeds which may result in reducing the average travel speed of the roads.

3.2.6 Property accesses

Existing accesses to properties in Warragamba, Wallacia and Silverdale area were assessed and qualitative assessment was carried out to investigate the potential future impacts of the Project traffic on the existing access locations.

Currently many properties have direct access from Silverdale Road, Park Road and Mulgoa Road in the Silverdale and Wallacia area. The properties shown on Figure 3-9 and Figure 3-10 respectively. It is anticipated that additional Project traffic especially heavy vehicles may have impacts on these access locations along Silverdale Road, Warradale Road, Mulgoa Road and Park Road.

The southern route also passes through the main activity centres (commercial, schools etc.) of Tahmoor, Picton, and The Oaks as shown in Figure 3-11 to Figure 3-13. There are schools and commercial centres located along the southern route in these areas. Additional heavy vehicle movements in these areas may impact access and result in a reduction in pedestrian safety.

Besides the abovementioned properties, many rural properties have direct access from Park Road, Silverdale Road, Montpelier Drive and Remembrance Drive along the Northern and Southern routes which may be impacted by the additional Project traffic.

Figure 3-9. Property access from Park Road (northern route)

Figure 3-10. Property access from Silverdale Road and Warradale Road (southern route)

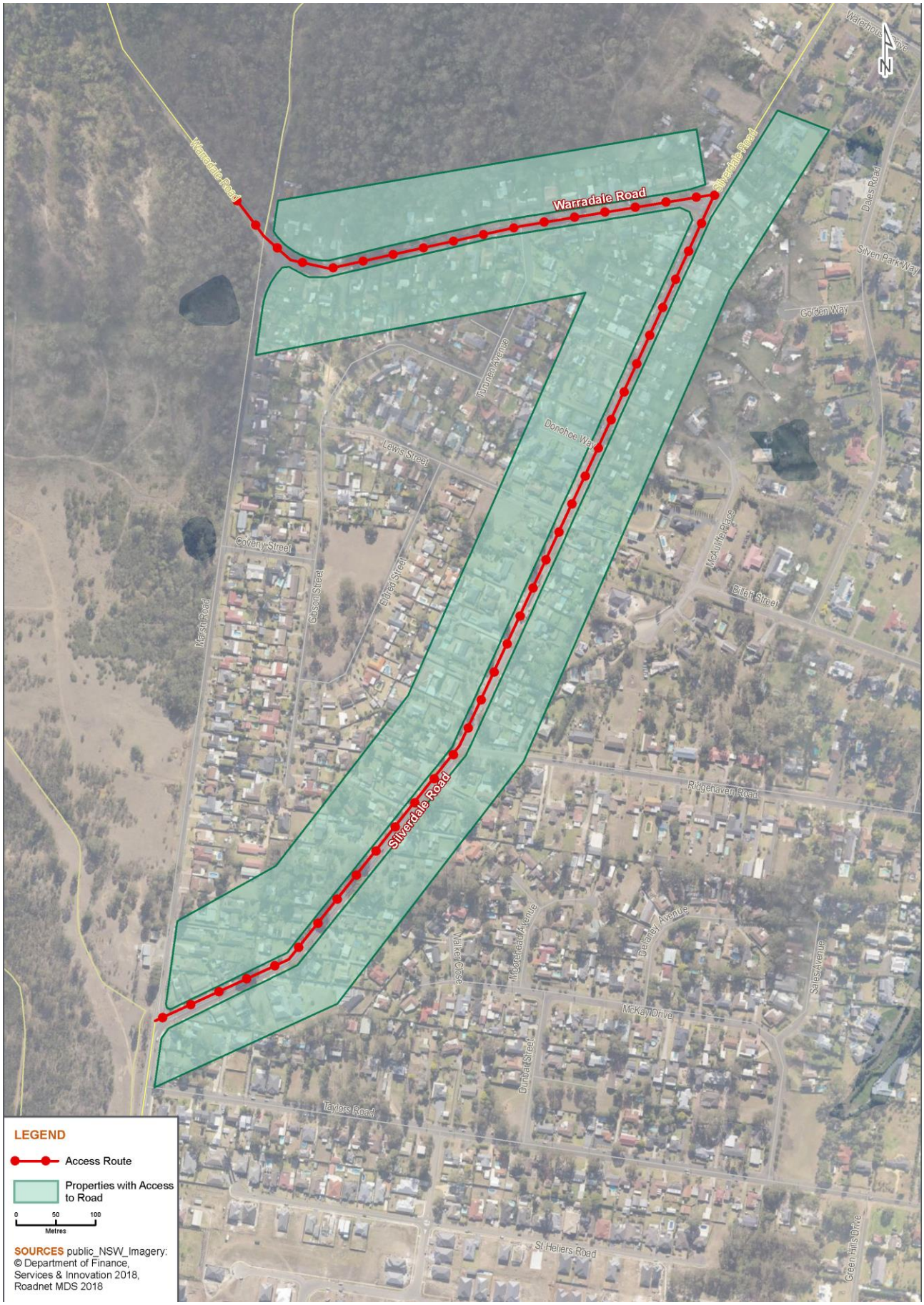


Figure 3-11. Property access from Montpelier Drive (southern route)

Figure 3-12. Property access from Argyle Street (southern route)

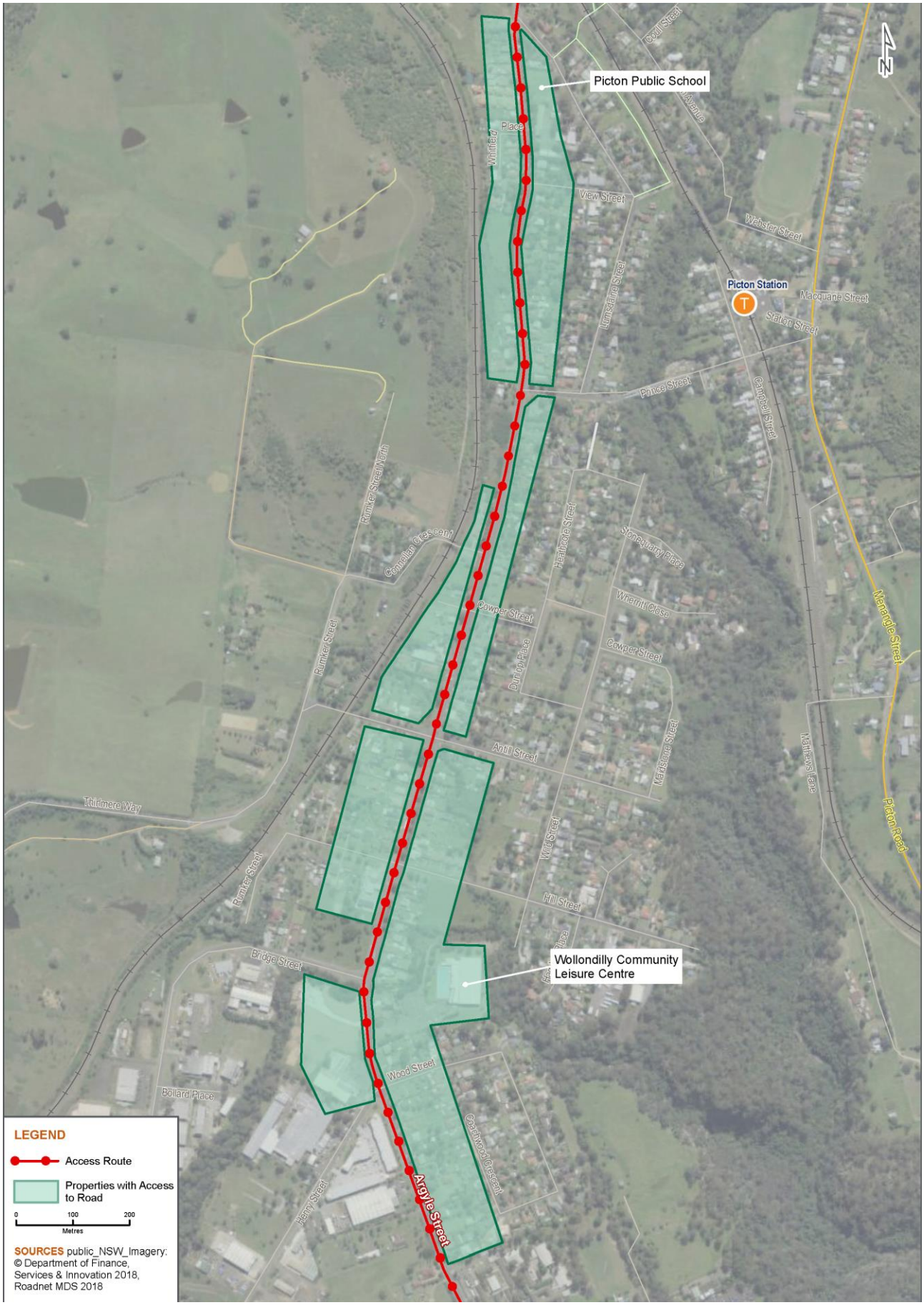
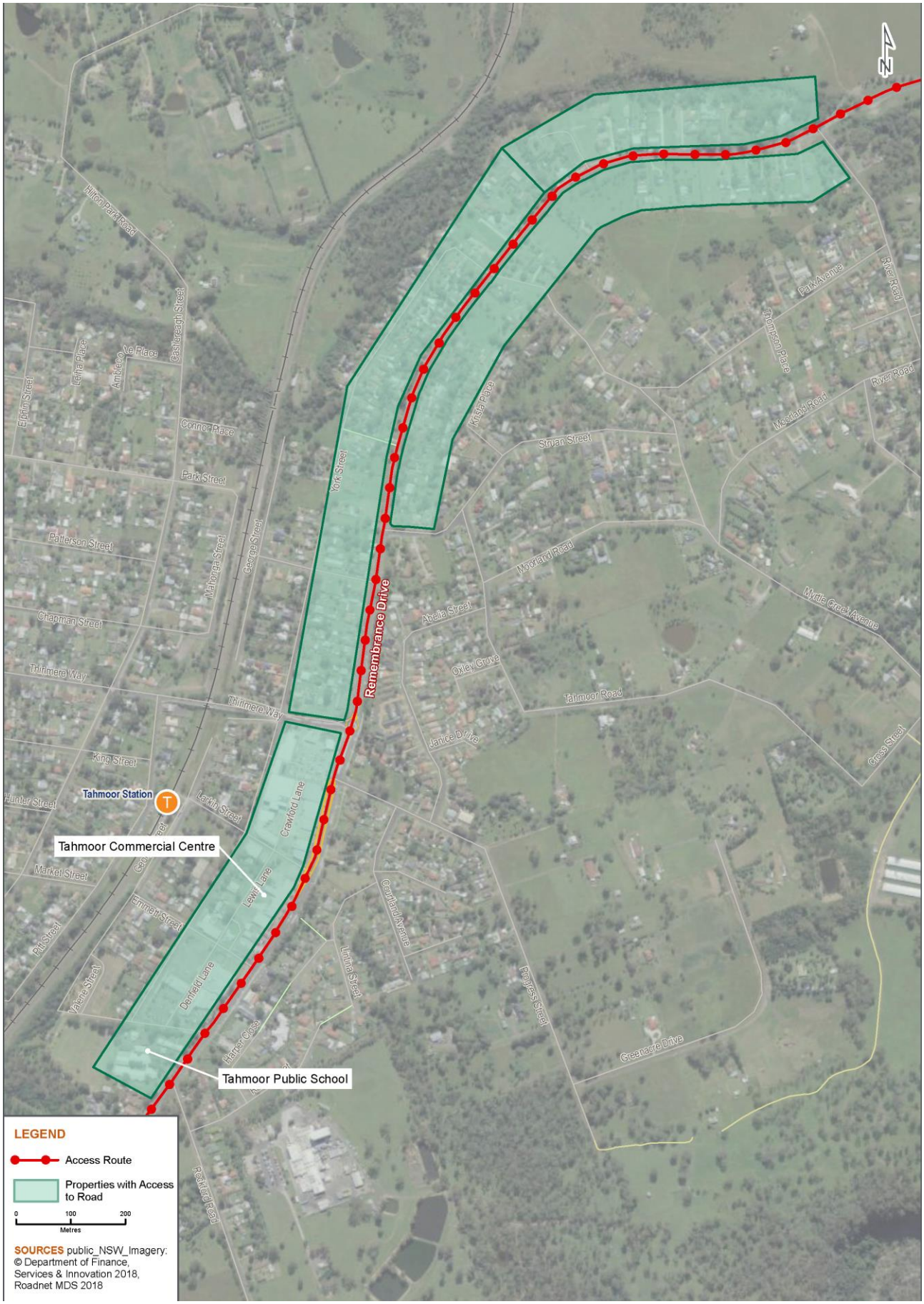


Figure 3-13. Property access from Remembrance Drive (southern route)



3.2.7 Pavement condition

Existing pavement condition of the road network was assessed based on the pavement condition index (PCI) data received from the Wollondilly Shire Council (undated received during the coordination meeting held 5 June 2018) (Table 3-4).

Table 3-4. Pavement condition index (PCI) level

Pavement condition index (PCI)	Road condition
10 to 8	Very good
5 to 8	Good
2.5 to 5	Fair
1 to 2.5	Poor
<1	Very poor

Source: Pavement Condition Index, Wollondilly Shire Council

The existing pavement condition of the surrounding road network is shown in Figure 3-14. Roads along the northern route (Silverdale Road, Farnsworth Avenue and Production Avenue) have good pavement condition. However, roads along the southern route (Silverdale Road, Warradale Road) have poor pavement condition.

3.2.8 Pedestrians and cyclists

There is no designated cycle path available within the Project study area. However, designated pedestrian walkways are available along some of the roads surrounding the Project site as shown with blue lines on Figure 3-15 to Figure 3-18. However, these walkways are not continuous and are concentrated around the main activity centres. Most of these walkways are narrow (1.25 metres) except for the walkways around Farnsworth Avenue and Weir Road (ranges from 2 metres to 2.8 metres).

Figure 3-19 shows the Strava heat map of active transport use (pedestrians and cyclists) in the vicinity of the study area. It indicates that the highest active transport activity occurs along Silverdale Road, Farnsworth Avenue, Warradale Road, Production Avenue, Weir Road and Marsh Road. It is to be noted that this map is indicative and is based on users that log their journeys through the exercise tracker Strava. Further information on how the heatmap was produced is available at: https://medium.com/strava-engineering/the-global-heatmap-now-6x-hotter-23fc01d301de.

3.2.9 Public transport and school bus service

NSW Sustainable Design Guidelines and Council policy both encourage the transition towards more sustainable modes of transport. The Project is located remote from major transport interchanges or public transport hubs and large population centres, so it is difficult to increase the potential mode split to active transport. For example, there is no obvious public transport hub or park-and-ride site for a Project construction workforce shuttle bus that would generate sufficient patronage to be worthwhile.

Currently there are two bus routes, 795 and 32, serving the Warragamba area. Bus route 795 goes from Penrith to Warragamba via Mulgoa Road-Silverdale Road-Marsh Road-Warradale Road-Fourteenth Street-Weir Road. Bus route 795 frequency is one to two trips per hour (30 min/60 min headway) during both AM and PM peak periods and three trips during off-peak period[3].

Bus route 32 goes from Camden to Warragamba via Macquarie Grove Road-Cobbitty Road-Werombi Road-Silverdale Road-Marsh Road-Warradale Road. Bus route 32 frequency is 1-2 trips per hour (34 min to 75 min headway) during both AM and PM peak periods[4].

[3] Derived from https://www.busways.com.au/travelling-with-us/route/795/route-795-penrith-warragamba- jamisontown-regentville/20180603-0 on 12 November 2018

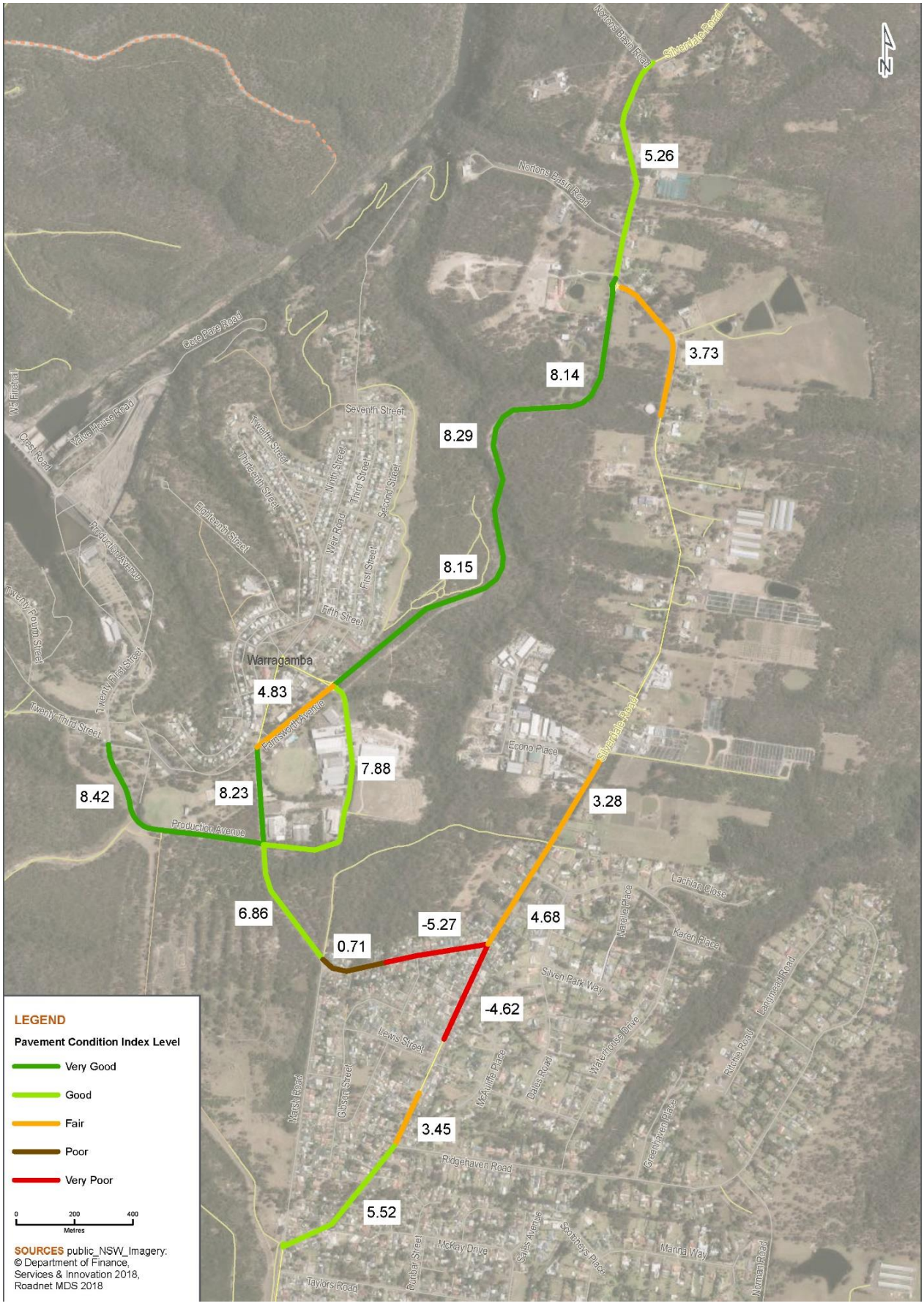
[4] Derived from https://busabout.com.au/pdf/timetables/31-32.pdf on 12 November 2018

The Warragamba Public School is located on Farnsworth Avenue and provides school bus access from Weir Road. Currently one school bus (Bus route 4106) operates in the morning and uses Silverdale Road, Farnsworth Avenue, Marsh Road, Warradale Road and other local roads to access the Weir Road (the School).

3.2.10 Loading capacity of Blaxland Crossing Bridge

Normal loading capacity of Blaxland Crossing Bridge is approximately 57.5 tonnes. Recently the bridge has undergone a major maintenance works to replace the bearings on both ends of the bridge during which time the loading capacity was reduced to 38 tonnes. However, the maintenance works of Blaxland Crossing Bridge has been completed recently and the normal loading capacity of the bridge has been retained.

Figure 3-14. Existing pavement condition of roads surrounding the Project site



Source: Pavement Condition Index, Wollondilly Shire Council (undated received on 5 June 2018)

Figure 3-15. Walkways along Park Road and Silverdale Road

Figure 3-16. Walkways along Farnsworth Avenue and Weir Road

Figure 3-17. Walkways along Production Avenue

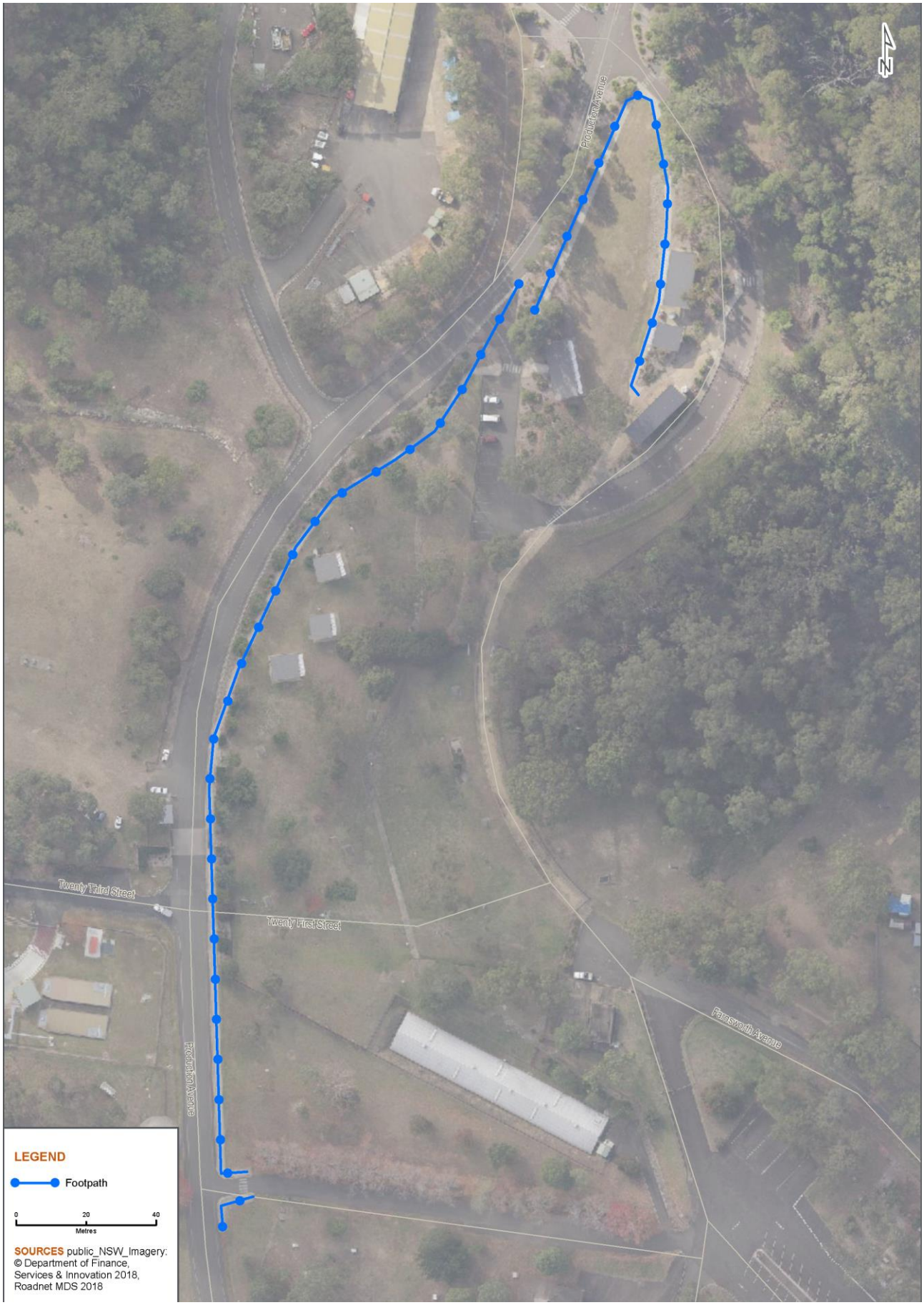


Figure 3-18. Walkways along Warradale Road

Figure 3-19 Active transport (pedestrian and cyclists) Strava heat map in Warragamba area

Source: https://www.strava.com/heatmap#12.81/151.01269/-33.88418/hot/all

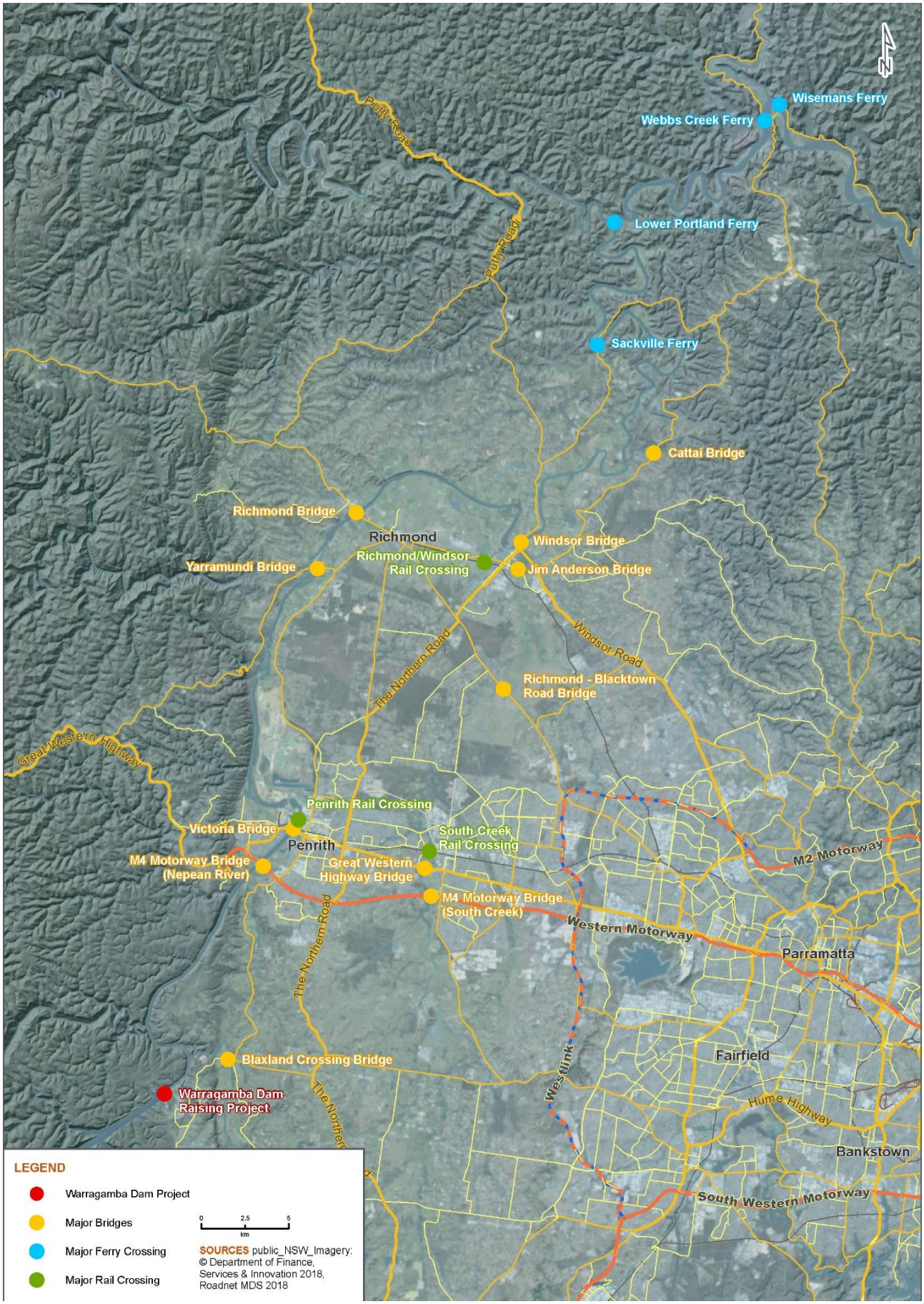
3.3 Existing downstream transport infrastructure and river crossings

The Hawkesbury-Nepean River, its floodplain and its flooding potential presents a major constraint to transport corridors, however many of these are key corridors enabling the movement of vehicles and trains across the river. Many of the crossings due to their location, low capacity and historical development are flood prone and below the 1 in 100 chance in a year (1% AEP) flood level. There are also a number of important transport corridors which cross tributaries of the Hawkesbury-Nepean River which are also evacuation routes. Key transport crossings are presented on Figure 3-20 and in Table 3-5.

Table 3-5. Key waterway crossings in the study area

Crossing	Maximum flood closure level (metres AHD)	Features
Road		
Cattai Creek Bridge at Cattai	1.99	Cattai Road/Wisemans Ferry Road crossing of Cattai Creek
Yarramundi Bridge	5.61	Crossing of the Hawkesbury-Nepean River north of Penrith and provides access to Yarramundi and Winmalee
Windsor Bridge (new)	9.8	New bridge crossing of the Hawkesbury River at Windsor
Richmond Bridge	7.82	Crossing of Hawkesbury River - provides access to Bells Line of Road and North Richmond
Richmond- Blacktown Road Bridge	12.57	Crossing of Rickaby Creek – important evacuation route
Jim Anderson Bridge	14.16	Hawkesbury Valley Way crossing of South Creek – important evacuation route from Windsor
Victoria Road Bridge	28	Great Western Highway crossing of Nepean River at Penrith. Approaches to bridge are lower than bridge
M4 Motorway Bridge - Nepean River	30.4	Westbound M4 Motorway crossing of Nepean River
M4 Motorway Bridge - Nepean River	32.6	Eastbound M4 Motorway crossing of Nepean River
M4 Motorway Bridge - South Creek	26.1	M4 Motorway crossing of South Creek at St Marys
Great Western Highway Bridge - South Creek	24.56	Great Western Highway crossing of South Creek at St Marys
Blaxland Bridge (Wallacia)	33.8	Silverdale Road crossing of the Nepean River at Wallacia
Car ferry		
Sackville Ferry crossing	3 to 3.5	Car ferry crossing Hawkesbury River
Lower Portland Ferry crossing	3 to 3.5	Car ferry crossing Hawkesbury River
Webbs Creek Ferry crossing	3 to 3.5	Car ferry crossing Hawkesbury River
Wisemans Ferry crossing	3 to 3.5	Car ferry crossing Hawkesbury River
River crossing (rail)		
Penrith rail crossing (28 m height)	28	Main western line crossing of Nepean River. Approaches are lower than bridge
South Creek rail crossing (24.8 m height)	24.8	Main western line crossing of South Creek at St Marys
Richmond/Windsor rail crossing (12.65 m height)	12.65	Richmond line crossing of South Creek

Figure 3-20. Major bridges and ferry crossings downstream of Warragamba Dam



4 Construction impacts

The impacts of construction vehicles on local roads and traffic have been assessed for the road network surrounding the Project as shown in Figure 3-2. The methodology and outcomes for the assessment are discussed in the following sections. Assessment of Project impacts on the surrounding road network were undertaken against the following criteria:

- roads and intersection capacity
- pavement condition
- average travel speed
- property access
- pedestrian and cyclist
- public transport
- local parking.

4.1 Construction program, traffic generation and travel routes

To enable the Project to be built, a large quantity of concrete would be required. Concrete would be produced at the dam site at one or two concrete batch plants. Materials for the concrete production would comprise:

- cement
- fly ash
- fine aggregates
- coarse aggregates.

These would be sourced from off-site and delivered to batch plants at the Project construction site. The majority of heavy vehicles movements to and from the Project construction site would be trucks delivering materials for concrete production, with transport of fine and coarse aggregates generating the highest proportion of heavy vehicle movements. The exact locations for the sources of the materials has not yet been determined and would be the responsibility of the construction contractor for the Project. However, quarries on the South Coast, or in the Southern Highlands, Blue Mountains and immediately north of Sydney have been identified as producing aggregates suitable for the Project. Fly ash would most likely be sourced from a power station in the eastern states and cement from suppliers in the Sydney region. An allowance of 15 percent additional heavy vehicle movements has been made to account for deliveries of other materials and equipment to the construction site.

The number of heavy vehicles travelling to the Project site would be relatively low in comparison to the capacity of the major highways and arterial roads that would be most likely routes. Therefore, the traffic assessment has focussed on the local road network and local traffic routes to the Project site.

The construction program and required materials for the Project are shown in the following Table 4-1.

Table 4-1. Project construction program

Aspect	Amount	Unit
Construction period – year	2022-2025	
Total number of peak delivery weeks	150	weeks
Construction working days per week	6	days
Construction working hours per weekday	10	hours
Construction working hours per Saturday	5	hours
Materials for concrete production	1,558,233	tonnes

Source: WaterNSW 2018

Table 4-2 shows the assumptions that have been made to estimate the total heavy vehicle movements per day accessing the construction site.

Table 4-2. Assumptions for heavy vehicle trip generation

Assumption	Criterion
Total allowable weight of each truck, *x*	42,500 kg
Weight of each truck, *y*	16,000 kg
Net weight, *(x-y)*	26,500 kg
Short loads factor	15%
Other truck movements factor	15%

Source: WaterNSW 2018

Based on the construction program and the assumptions, the total number of daily heavy vehicle movements would be about 208 movements as outlined below in Table 4-3.

Table 4-3. Heavy vehicle movements during construction

Material	Total Tonnes	Total heavy vehicles - construction period	Daily heavy vehicles accessing site	Daily heavy vehicle movements
Cement	75,123	2,835	3.8	7.6
Fly ash	89,580	3,380	4.5	9.0
Fine aggregate (Sand)	846,874	31,957	42.6	85.2
Coarse Aggregate	546,656	20,629	27.5	55.0
Steel	10,880	1,232	1.6	3.3
Short loads (Note)		9,005	12.0	24.0
Other truck movements		8,820	11.8	23.5
Total		**77,858**	**103.8**	**207.6**

Note: Short loads assume that trucks are only loaded to 85% of total capacity which is a conservative assessment

These 208 truck movements would generally be spread evenly through the ten-effective-hour day and as such, an average of about 21 heavy vehicle movements would occur in every hour (10.5 IN and 10.5 OUT).

It is estimated that up to 500 workers would be on site daily during the peak construction period. Using a conservative approach, it has been assumed heavy vehicle and worker trips would occur in the same hour and that all workers would travel to the site by car with an average car occupancy of two people per car. It has been assumed that all workers (250 cars) would travel to the site during the morning peak-hour (AM peak) and would leave the construction site during the PM peak.

Based on this estimation, the Project will generate **250 car trips/hour** (250 vehicles IN at AM peak-hour and 250 vehicles/hour OUT at PM peak-hour) and **21 heavy vehicle trips/hour** (10.5 trucks/hour IN and OUT in every hour) during the construction period.

4.1.1 Heavy vehicle routes

Heavy vehicles would use pre-defined fixed routes, namely a northern route and a southern route to deliver construction materials to the dam site. The routes are shown in Figure 4-1 and Figure 4-2 below.

The northern route includes the following roads:

- The Northern Road
- Park Road from The Northern Road to Wallacia
- Silverdale Road from Wallacia to Farnsworth Avenue
- Farnsworth Avenue between the intersections of Silverdale Road and Production Avenue
- Production Avenue between the intersections of Silverdale Road and the construction access.

The southern route includes the following roads:

- Silverdale Road from the Oaks to Warradale Road
- Warradale Road to Production Avenue
- Production Avenue between intersection of Warradale Road and the construction access.

It is to be noted that a combination of the above two routes may also be used by trucks travelling to the site. Section 4.1.2 details trip distribution assumptions considered in this assessment. Further, it should be noted that trucks approaching from the south may also use the northern route.

4.1.2 Traffic distribution and assignment

For the purpose of assessing the impacts of Project construction traffic, estimated worker journeys were distributed and assigned to different roads and intersections. It is assumed that majority of workers (75 percent) would travel to the site from the Greater Western Sydney region (Penrith, Liverpool, Campbelltown etc.) using Mulgoa Road and The Northern Road during the AM peak-hour. These two roads are the only convenient options to access the site from the Greater Western Sydney Region. Twenty percent (20 percent) of worker journeys was assumed to originate from the south using Silverdale Road, whereas five percent (5 percent) was assumed from the adjacent local Wallacia area, as shown in Figure 4-3. In the PM peak, the same proportion of worker journeys would be in the opposite direction as shown in Figure 4-4.

Heavy vehicles would use the northern and southern routes to access the site. However, the southern route would only potentially be used by heavy vehicles if aggregates for concrete production were sourced from the Southern Highlands. If aggregates are sourced from other locations, all heavy vehicles would use the northern route to access the construction site. Other materials would generally be sourced from the Sydney region and therefore a proportion of heavy vehicles would always use the northern route. Considering this, two scenarios were assessed for assessing the impact on the road networks namely:

- Scenario 1 - 100% heavy vehicles using the northern route.
- Scenario 2 - 50% heavy vehicles using the northern route and 50% using the southern route.

Figure 4-1. Northern truck route

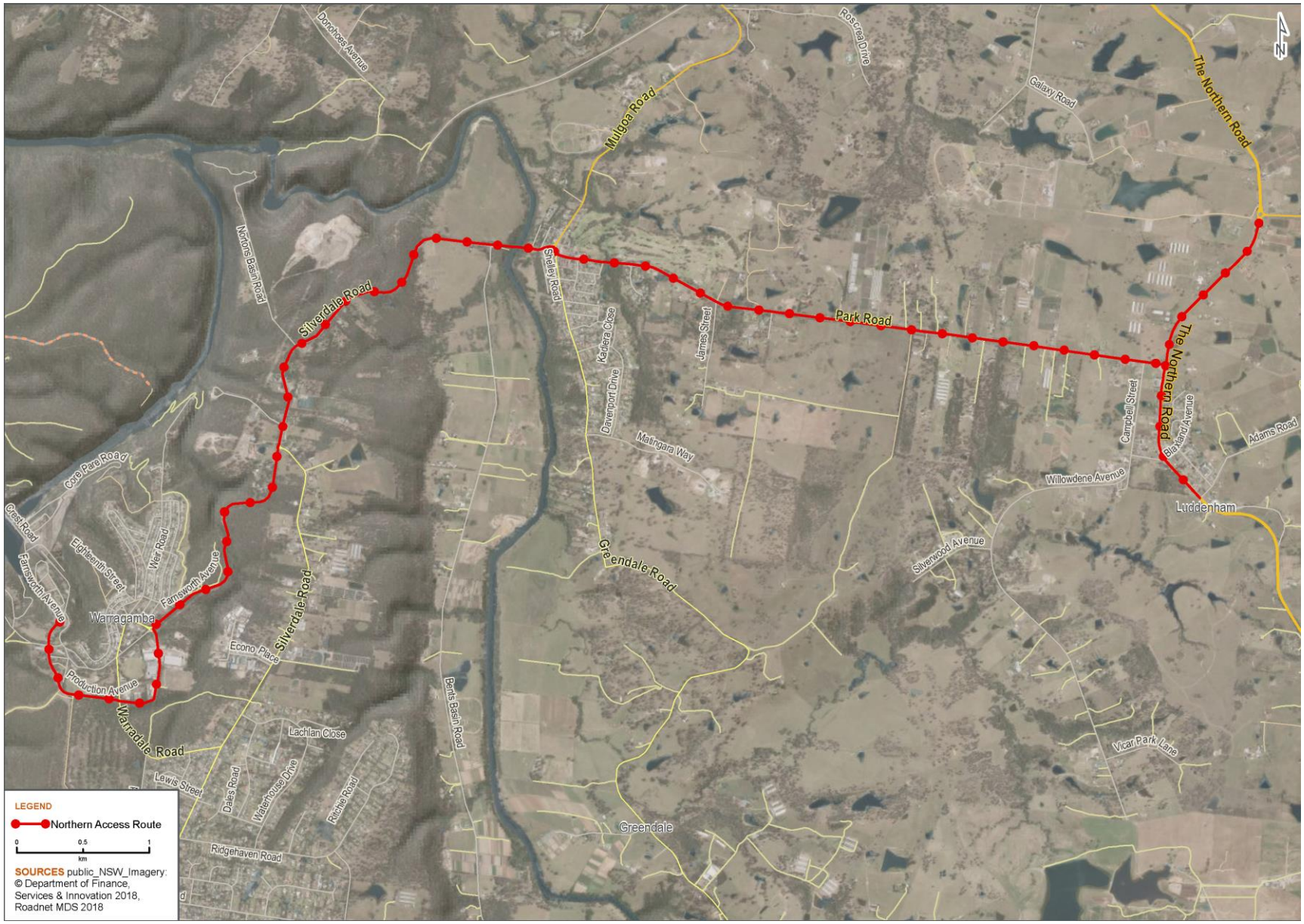


Figure 4-2. Southern truck route

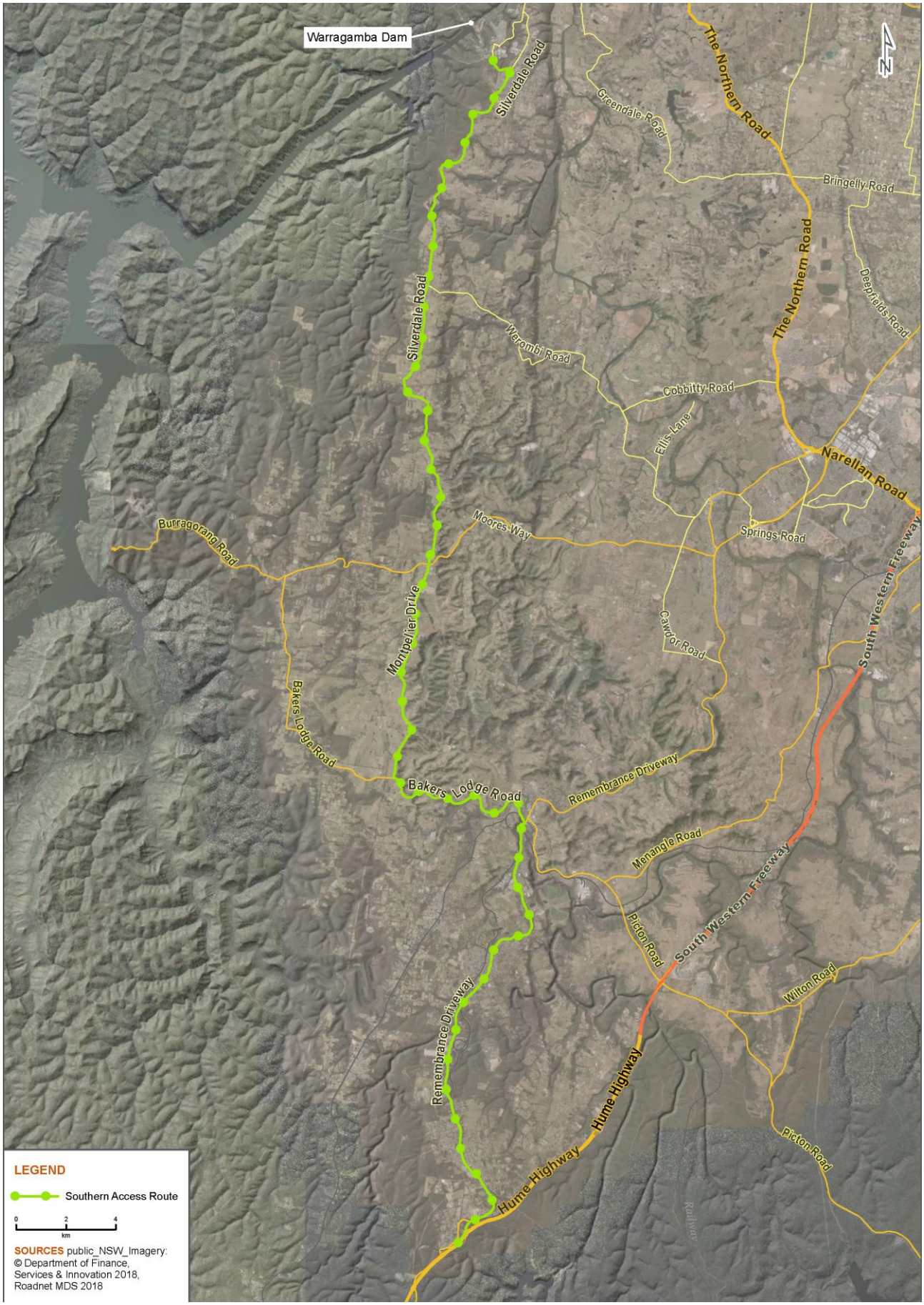


Figure 4-3. Trip distribution and assignment of worker journeys - AM peak

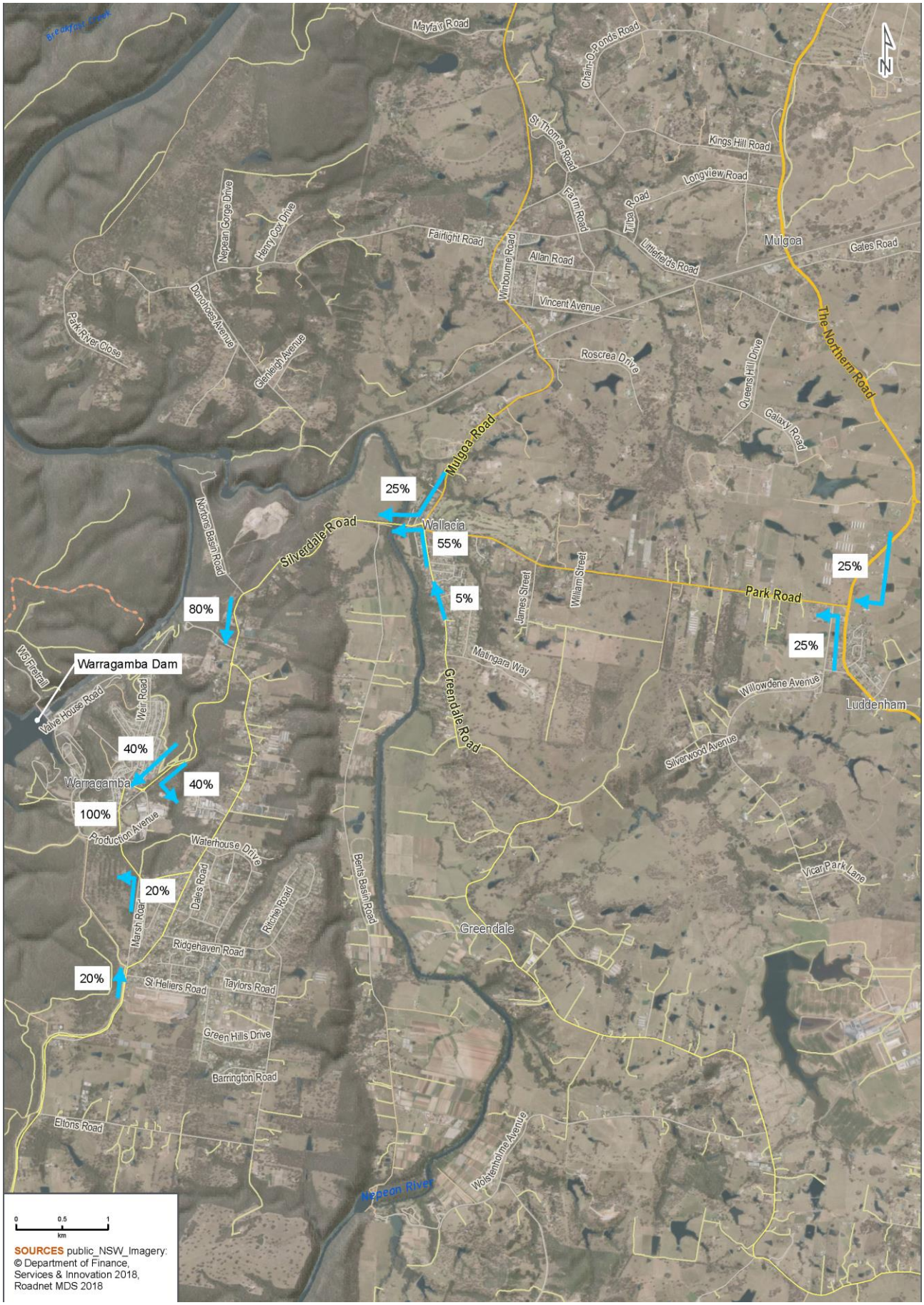
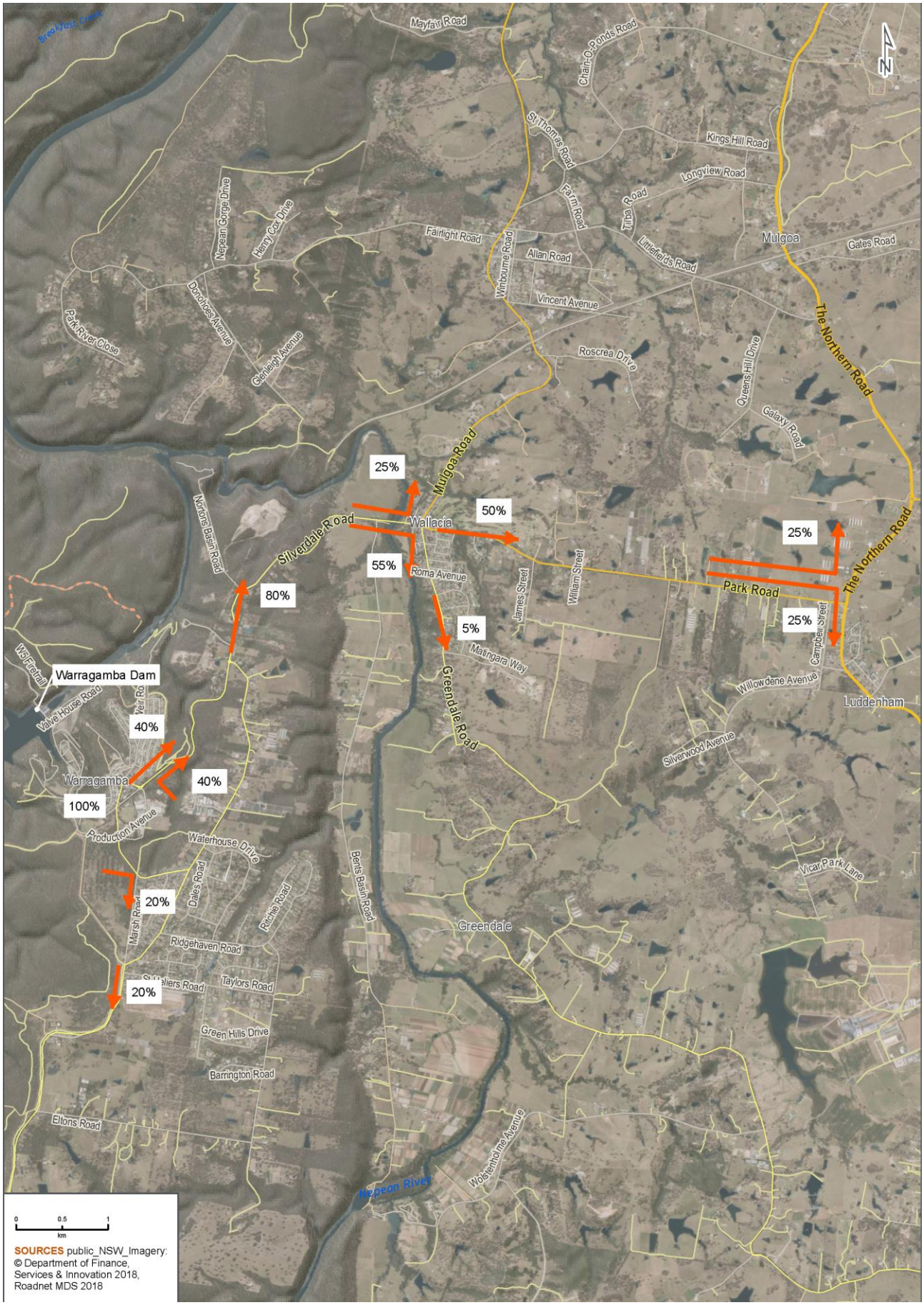


Figure 4-4. Trip distribution and assignment of worker journeys - PM peak



4.2 Road modifications

Due to Project construction works, the following road network modification will occur during the construction period:

- removal of non-construction related accesses (construction site only)
- access restriction at Production Avenue (northern part near the construction site) and Twenty-Third Street/Twenty-Fourth Street for construction vehicles only
- closure of Farnsworth Avenue (northern part near the construction site) for all vehicles
- closure of visitors' parking area at the Warragamba Dam Visitor Centre
- installation of temporary traffic signals at Production Avenue/Warradale Road intersection to enhance the safety of vehicles/heavy trucks movements.

4.3 Impacts on intersections

It is anticipated that the majority of future northbound and southbound through-traffic at the Park Road/Northern Road intersection would use the new link between the Elizabeth Drive/Existing Northern Road intersection and New Northern Road/Existing Northern intersection to reach their destination, as shown in Figure 4-5 below. The exact percentage of demand shift to the new link is unknown and would require undertaking strategic/micro-simulation model analysis to determine the number of shifting traffic. For the purpose of this study, the northbound and southbound traffic of the Park Road/Northern Road intersection was reduced to 50 percent for future year 2022 analysis, assuming 50 percent of the existing Northern Road traffic would shift to the new link in future years. It should be noted that the majority of the north-south traffic at Park Road/Northern Road intersection is through traffic and the new link would provide a better and faster option to reach the destination. It is anticipated that more traffic would use the new link in future for north-south movements. As such, adoption of a 50% shift of future traffic to the new link is considered to be conservative for assessing the Park Road/Northern Road intersection.

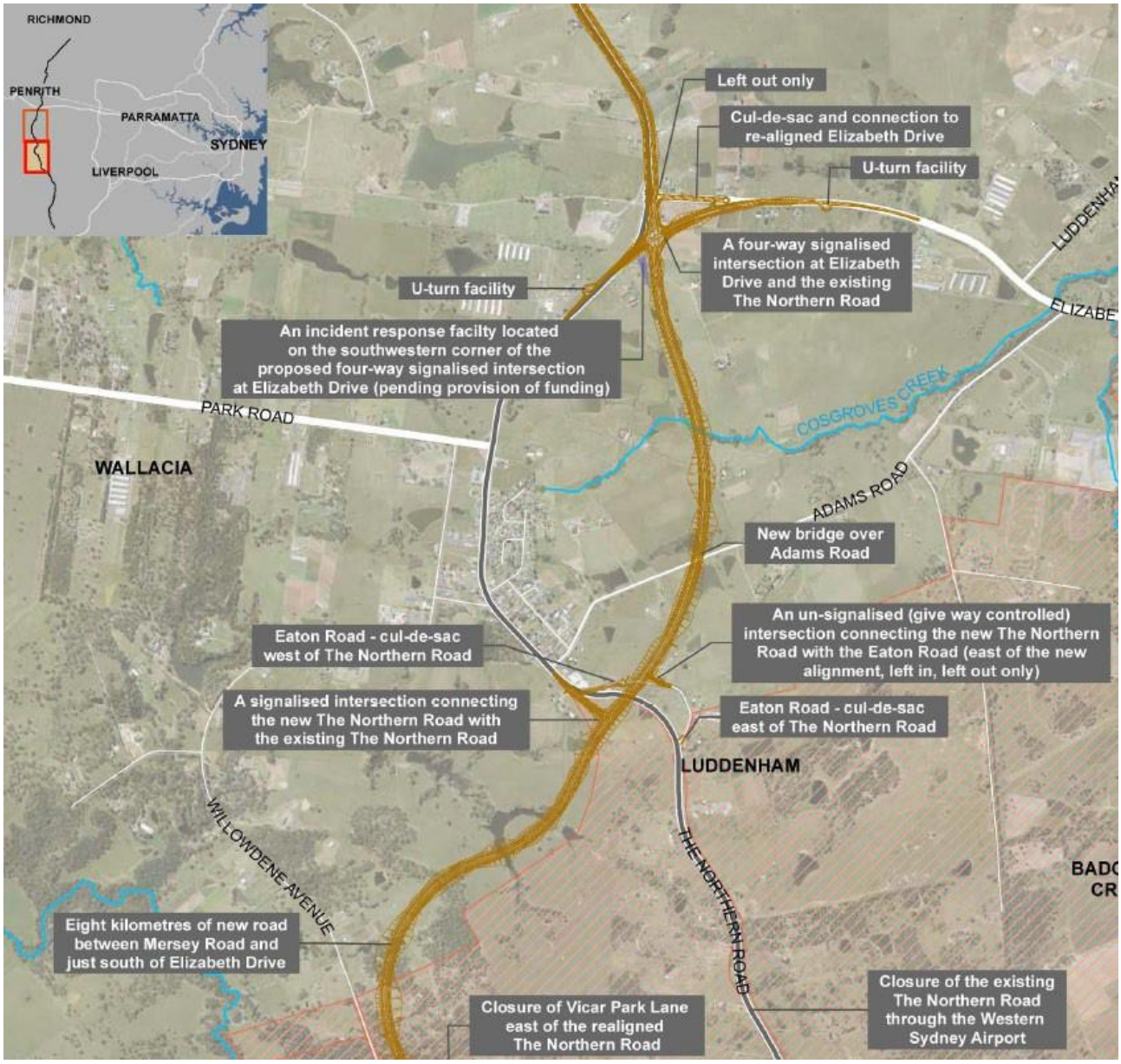
Table 4-4 shows the intersection capacity analysis of the seven intersections for the Project. All intersections except the Park Road/Northern Road intersection are predicted to perform at LOS A in future year scenarios in both AM and PM peaks, and with and without Project traffic. A queue length survey was carried out for the six intersections during the traffic count surveys and no queue was observed during the survey period. As such, the SIDRA model was not calibrated for the capacity analysis of these intersections and default SIDRA Intersection parameter values were used.

It is also noted that traffic count surveys were undertaken during the winter season (Section 3.2.2) and that no traffic volume data is available for other seasons to understand the seasonal traffic variation in the study area. As such, the impacts of seasonal variations in traffic volume on intersection performance have not been assessed in this study. However, it is anticipated that seasonal variations in traffic volumes are likely to have minimal impact on road network capacity, as the road network currently operates with acceptable level of service and has sufficient levels of reserve capacity to accommodate seasonal variation in traffic volume as shown in Table 4-4.

A sensitivity analysis was carried out in SIDRA Intersection using the reduced traffic for Park Road/Northern Road intersection to investigate the intersection performance for future baseline year 2022. With the Northern Road Upgrade project which would attract a significant amount of northbound and southbound traffic from the Park Road/Northern Road intersection, this intersection would also perform at LOS B in the future year for both AM and PM peaks and with and without Project traffic.

Detailed SIDRA Intersection analysis results are provided in Appendix B of this report.

Figure 4-5. Northern Road upgrade project near Park Road/Northern Road intersection



Source: The Northern Road Upgrade-Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park- Final Environmental Impact Statement, December 2017

Table 4-4. Performance analysis of intersections around Project

Intersection	Assessment scenario	Peak-hour	Delay (sec)	LOS	Degree of saturation
Northern Road/Park Road intersection without Northern Road Upgrade-No reduction of traffic (stop controlled intersection)	2018	AM	37.8*	C*	0.75
		PM	30.6*	C*	0.43
	2022 Without Project	AM	174.6	F	1.12
		PM	48.3	D	0.56
	2022 Scenario 1	AM	373.9	F	1.35
		PM	899.1	F	1.96
	2022 Scenario 2	AM	321.4	F	1.29
		PM	840.8	F	1.9
Northern Road/Park Road intersection with Northern Road Upgrade-50% traffic reduction on northbound and southbound approach (stop controlled intersection)	2022 Without Project	AM	18.1	B	0.49
		PM	16.5	B	0.30
	2022 Scenario 1	AM	21.9	B	0.55
		PM	23.9	B	0.69
	2022 Scenario 2	AM	21.1	B	0.53
		PM	23.2	B	0.68
Park Road/Silverdale Road/Mulgoa Road intersection (roundabout)	2018	AM	7.2	A	0.58
		PM	8.1	A	0.56
	2022 Without Project	AM	7.5	A	0.67
		PM	9.3	A	0.69
	2022 Scenario 1	AM	7.6	A	0.69
		PM	10.6	A	0.73
	2022 Scenario 2	AM	7.6	A	0.68
		PM	10.4	A	0.72
Silverdale Road/Farnsworth Avenue intersection (roundabout)	2018	AM	7.5	A	0.41
		PM	5.3	A	0.44
	2022 Without Project	AM	7.6	A	0.47
		PM	5.3	A	0.51
	2022 Scenario 1	AM	7.8	A	0.58
		PM	5.3	A	0.51
	2022 Scenario 2	AM	7.7	A	0.58
		PM	5.3	A	0.51
Farnsworth Avenue/Production Avenue intersection (roundabout)	2018	AM	4.7	A	0.09
		PM	5.7	A	0.01
	2022 Without Project	AM	4.7	A	0.11
		PM	5.8	A	0.11
	2022 Scenario 1	AM	4.7	A	0.24
		PM	6.1	A	0.13
	2022 Scenario 2	AM	4.7	A	0.23
		PM	6.1	A	0.13

Intersection	Assessment scenario	Peak-hour	Delay (sec)	LOS	Degree of saturation
Production Avenue/Warradale Road intersection (stop controlled intersection)	2018	AM	10.2*	A*	0.1
		PM	7.6*	A*	0.05
	2022 Without Project	AM	10.4*	A*	0.11
		PM	7.7*	A*	0.06
	2022 Scenario 1	AM	13.6*	A*	0.14
		PM	10.3*	A*	0.21
	2022 Scenario 2	AM	14.2*	A*	0.15
		PM	10.3*	A*	0.22
Silverdale Road/Warradale Road intersection (stop controlled intersection)	2018	AM	10.0*	A*	0.26
		PM	9.9*	A*	0.32
	2022 Without Project	AM	10.5*	A*	0.3
		PM	10.6*	A*	0.37
	2022 Scenario 1	AM	10.5*	A*	0.3
		PM	10.6*	A*	0.37
	2022 Scenario 2	AM	12.8*	A*	0.31
		PM	12.7*	A*	0.37
Silverdale Road/Marsh Road intersection (stop controlled intersection)	2018	AM	9.6*	A*	0.13
		PM	9.6*	A*	0.23
	2022 Without Project	AM	10.0*	A*	0.15
		PM	10.3*	A*	0.27
	2022 Scenario 1	AM	10.2*	A*	0.17
		PM	10.5*	A*	0.27
	2022 Scenario 2	AM	10.3*	A*	0.18
		PM	10.6*	A*	0.27

* Worst movement delays and LOS

4.3.1 Temporary traffic signals at Warradale Road/Production Avenue intersection

As requested by the Wollondilly Shire Council during the coordination meeting held on 5th of June 2018, a temporary signalised intersection was considered at the Warradale Road/Production Avenue intersection to improve the safety of heavy vehicle movements. Capacity analysis of the proposed temporary signalised intersection was carried out to assess the performance during construction starting year 2022 for both scenario 1 and 2 and for AM and PM peaks. Table 4-5 shows the results of the analysis.

Table 4-5. Capacity analysis of Warradale Road/Production Avenue traffic signals

Intersection	Analysis scenario	Peak-hour	Average delay (sec.)	LOS	Degree of saturation
Warradale Road/Production Avenue intersection (signalized)	Scenario 1	AM	28.3	B	0.68
		PM	26.0	B	0.51
	Scenario 2	AM	28.4	B	0.68
		PM	26.2	B	0.54

The proposed temporary signalised intersection would perform at acceptable LOS for both scenarios and for both peak-hours in year 2022.

Temporary traffic signals were installed at this intersection during the auxiliary spillway project and were operational during the construction phase. The traffic signals were removed upon completion of the auxiliary spillway construction works. It is recommended that the temporary traffic signals at Warradale Road/Production Avenue intersection be deployed with an operational strategy similar to that used by the auxiliary spillway project during the construction period of the Project.

Currently vehicles more than six metres long are not permitted to perform the eastbound left turn due to kerb alignment and sight distances. However, Wollondilly Shire Council has requested that the intersection be modified to allow for this movement, and it was considered in the capacity analysis. A review of this intersection should be carried out pre-construction in accordance with the latest Austroads guidelines to ensure this turning movement can be accommodated and traffic signals safely implemented.

Project construction-related heavy vehicles would not use the eastbound left-turn movement of the temporary traffic signal at the Warradale Road/Production Avenue intersection to access the site during the construction phase. As such, the geometric constraint of this movement will not affect construction vehicles and heavy truck access to the Project construction site using the proposed temporary traffic signals.

4.4 Impacts on road capacity

Low traffic volumes were observed on Park Road, Farnsworth Avenue and Silverdale Road during the traffic count surveys as shown in Figure 3-4 to Figure 3-6. Moreover, the generated construction traffic would also be low (250 vehicles an hour) and would be distributed on these roads. As such, the existing road networks have enough spare capacity to accommodate additional construction traffic during the construction period. Therefore, it is anticipated that there would be negligible impacts from the Project on the road capacity in the study area.

4.5 Impacts on pavement condition

Additional heavy vehicle movements from construction traffic on the two access routes would result in some deterioration in the pavement condition. It is likely that the pavement condition of the southern route would be more affected than the northern route which has a better existing pavement condition.

4.6 Impacts on pedestrians and cyclists

The impacts of the Project traffic on the existing pedestrian and cyclist movements were assessed to identify any potential locations that would be potentially impacted by construction.

The proposed heavy vehicle routes for the Project would avoid possible pedestrian and cyclist activity areas within the local Warragamba area except for part of Silverdale Road and Production Avenue as shown in Figure 3-19. It is anticipated that construction vehicle movements would occur outside the peak active transport activities in the area and thus would have minimal impacts on active transport. However, the Northern and southern routes would pass through The Oaks, Wallacia, and Silverdale. The southern route may also pass through Tahmoor, Picton, and Bargo.

While there would be no direct impact on pedestrian or cyclist movements or paths, there may be an increased safety risk due to the increase in heavy vehicle movements. This is particularly the case where the heavy vehicle routes pass by schools or commercial areas.

The Project workforce would mostly involve workers living across the Sydney region, but site establishment should include limited secure bike parking to encourage cycling, particularly from the local area.

4.7 Impacts on access

The increased construction traffic would not result in any loss of access or any substantial delays in accessing roads from properties, businesses, or other facilities. However, there is the potential for increased safety risks for vehicles accessing heavy vehicle routes, particularly in residential areas and commercial areas where existing heavy vehicles numbers are low.

4.8 Impacts on public transport and school bus service

The existing bus routes and operations in Warragamba area would not be affected by the additional construction traffic as there is sufficient capacity on the existing local roads. It is also to be noted that due to the additional construction heavy truck movements in the Warragamba area, the bus travel time between the stops may increase. However, the bus routes (795 and 32) serving the Warragamba area have very low frequencies. Considering the low heavy truck movements (18 truck movements an hour), it is anticipated that such impacts on the overall bus travel

time will be very low. Similarly, the impacts on the school bus service would be minimal provided that the school drop off continues to take place on Weir Road.

4.9 Impacts on parking

All Project vehicles including worker/staff cars would be parked inside the construction area. It is also to be noted that WaterNSW staff would have access to the construction site and staff parking area for the purpose of operating the Dam. As such, no additional external or on-street parking spaces will be required.

The Warragamba Dam visitors' parking area, parking around Havilland Park and the parking area near the corner of Farnsworth Avenue and Production Avenue would be closed during the construction period.

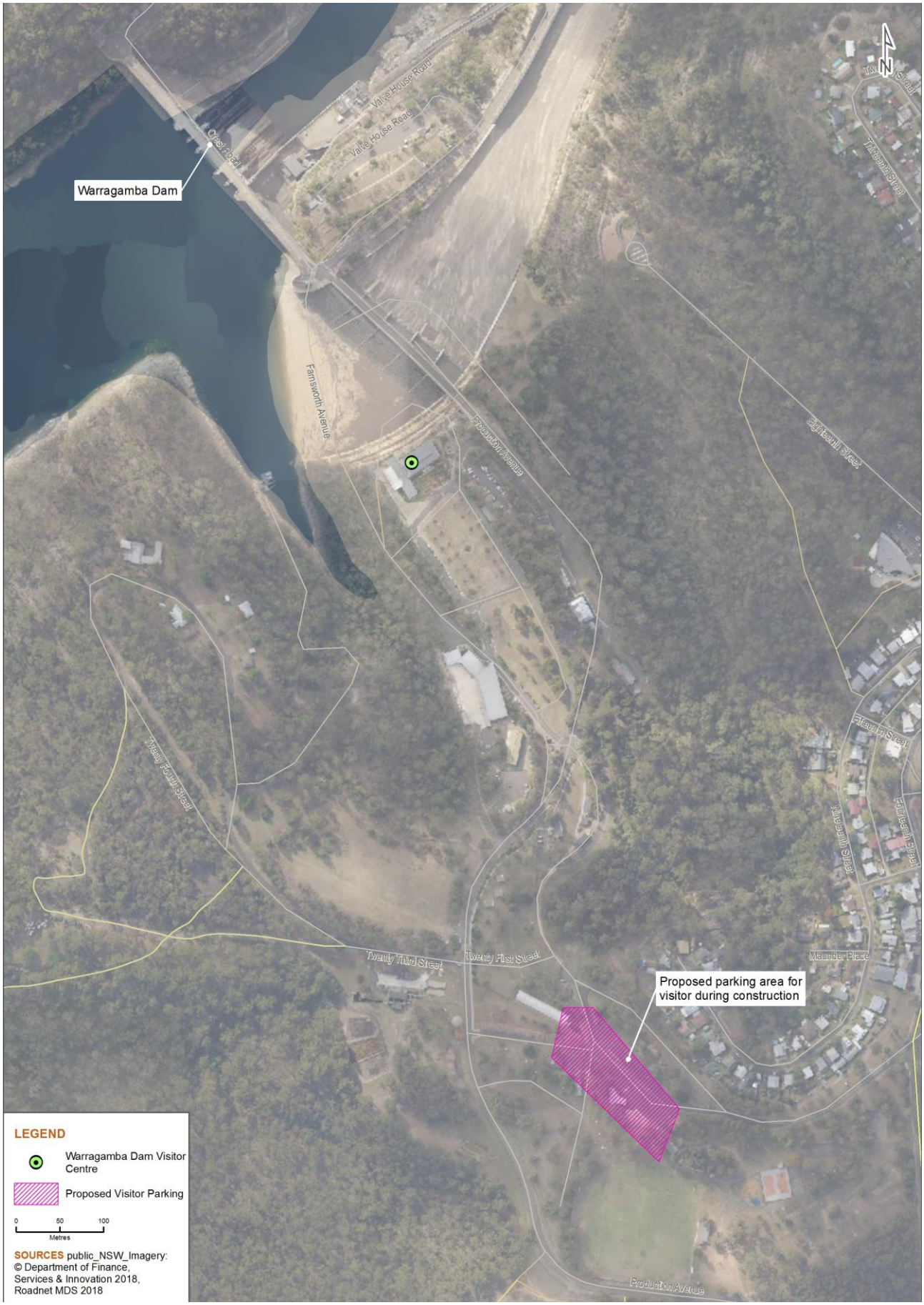
Warragamba Dam Visitor Centre may remain open during the construction period. However, if the visitor centre was to remain open, this would only be for bus tours and there would be no car or pedestrian access to the visitor centre. The existing parking area located on Farnsworth Avenue (Figure 4-6) would be available for parking and access to the adjacent recreational area, subject to agreement with Council. The potential impacts on the local parking is anticipated to be moderate as there would be a loss of parking and access to recreational areas. A detailed parking study would be prepared as part of the construction traffic management plan to understand and cater for potential impacts during the construction period.

Potential impacts on visitors during construction and management measures are discussed further in Chapter 25 (Visual amenity).

4.10 Impacts on Blaxland Crossing bridge

As per the proposed construction program as outlined in Table 4-1, the allowable weight of each truck including the construction materials will be 42.5 tonnes which is below the normal loading capacity (57.5 tonnes) of the bridge. As such, it is anticipated that there will be no adverse impacts on the Blaxland Crossing bridge due to the movements of construction trucks to access the Project construction site. However, during construction it is recommended that the posted speed limit on the bridge be reduced for heavy vehicles, and that bridge performance be continuously monitored.

Figure 4-6. Proposed visitor parking area



5 Operational impacts

The potential operational impacts of the Project on traffic and transport include:

- impacts in and around Warragamba Dam due to the operation of the Project
- impacts and benefits of the Project on the closure of downstream key river crossings due to flooding
- impacts and benefits of the Project on time to closure of downstream key river crossings (that is, period for evacuation)
- impacts of the Project on upstream traffic and transport routes.

A key objective of the Project is to delay peak flooding downstream to allow evacuation routes to remain open for longer and to provide increased opportunity and additional time for a greater number of people to self-evacuate via road. The following flood scenarios were considered:

- 1 in 5 chance in a year event
- 1 in 10 chance in a year event
- 1 in 20 chance in a year event
- 1 in 50 chance in a year event
- 1 in 100 chance in a year event
- 1 in 200 chance in a year event
- 1 in 500 chance in a year event
- 1 in 1000 chance in a year event
- probable maximum flood (PMF).

Evacuation planning is discussed in Chapter 15 (Flooding and hydrology). In summary:

- reducing risk to life is the key objective of the Project. The Project reduces the risk to life by reducing the flood peak level and the frequency of mass evacuations
- due to the populated flood islands and rapid, extensive and deep flooding of the valley, and the inclement weather associated with major flood events, shelter in place or rescue is not feasible and mass self-evacuation ahead of the flood event is the primary method of reducing risk to life from major flood events
- areas of the valley are modelled to take 20 hours to evacuate (SES Flood Plan 2015), but the BoM target forecast time is 15 hours in Richmond/Windsor and 8 hours at Penrith (BoM NSW Service Level Specification). The Hawkesbury-Nepean Valley Flood Risk Management Directorate (the Directorate), is working with BoM to extend this forecast time, but as forecasting the flood peak beyond 9 hours relies on rain yet to fall there are limits to the ability to extend the forecasts with accuracy.
- for those flood events that still trigger mass evacuation after the dam is raised, the dam raising delays the peak compared to the current dam. This means that the peak is later in the rainfall event causing the flood, so that more of the rain is on the ground and hence the accuracy of the forecast is improved.
- projected climate change is modelled to increase the intensity of rainfall during flood events, which then increase both the frequency and speed of flood events.

5.1 Impacts at Warragamba Dam

The operation of the Project would not generate any additional deliveries, workers or other traffic generating activities. As such, after construction is completed, traffic flows in the surrounding road network would return to their existing levels and there would be no additional traffic impacts on the road network surrounding Warragamba Dam from the operation of the Project.

Parking and the dam road network would be returned to their pre-construction configurations.

5.2 Traffic and transport impacts - downstream

5.2.1 Potential impacts on transport and road corridors

The Project would result in a change to the flow patterns (that is, hydrographs) and flood extents downstream of Warragamba Dam including:

- a delay in the peak of the flooding event compared to the existing conditions

- a reduction in peak flood levels, extents, and durations
- an increase in duration of low-level flooding during the discharge of water temporarily captured in the flood mitigation zone
- a reduction in the velocity of flood flows. The reduction in velocity at some locations is significant whereas at other locations negligible.

Depending upon the location and relative height of the road or transport corridor, the changes in downstream flooding due to the Project would have different impacts. A key objective of the Project is to delay peak flooding downstream to allow evacuation routes to remain open for longer and to provide increased opportunity and additional time for a greater number of people to self-evacuate via road. Changes in the period crossings are open is assessed in Section 5.3.

Once the peak of the flood event has passed and emptying of the flood mitigation zone has commenced, low level flooding would occur until the flood mitigation zone has been emptied. The majority of the flood mitigation zone would be emptied at a constant rate of about 100 gigalitres a day for up to 12 days, which may result in the ongoing closure of crossings, particularly those crossings which have low level relative to a waterway. The impacts on the major river crossings, including roads, rail, and ferry crossings, during various flood scenarios with and without the Project are assessed using the flood modelling. The following flood scenarios were considered:

- 1 in 5 chance in a year event
- 1 in 10 chance in a year event
- 1 in 20 chance in a year event
- 1 in 50 chance in a year event
- 1 in 100 chance in a year event
- 1 in 200 chance in a year event
- 1 in 500 chance in a year event
- 1 in 1000 chance in a year event
- probable maximum flood (PMF).

The assessment includes impacts on crossing closure time (in hours) and time to closure (in hours) during the flood scenarios with and without the Project. A high-level assessment of the alternative routes for crossings where there is an increase in closure times during flood events is also presented.

5.2.2 Impacts on key river crossing low points and alternate routes during flood events

Table 5-1 to Table 5-3 show the number of hours the major river crossings would be closed during flood events for existing conditions and with the Project. These are 50th percentile values based on a range of different modelled flood scenarios. Appendix C contains additional information on the range of closure times (10th, 50th and 90th percentiles) possible for each event at each crossing. There are no ranges for the PMF as only a single event was modelled.

For the purpose of this assessment, it was assumed that all major roads leading to river crossings have sufficient elevations and would remain open during flood events.

The results in the tables have been colour-coded with red indicating an increase in closure time and green indicating a decrease in closure time.

Table 5-1. Major road river crossings closure time (50th percentile) during flood events for existing conditions and with Project

Description	Bridge Name	Phase	Hours closed for a range of flood events								
			1 in 5	1 in 10	1 in 20	1 in 50	1 in 100	1 in 200	1 in 500	1 in 1000	PMF
Bridge on Cattai Road over Cattai Creek	Cattai Creek Bridge	Current	94	124	140	151	157	166	175	181	230
		Project	205	333	349	359	348	343	335	328	309
Bridge on Springwood Road over Hawkesbury River	Yarramundi Bridge	Current	72	105	119	131	138	147	154	160	198
		Project	81	304	322	344	329	316	309	305	284
Bridge on Bridge Street over Hawkesbury River	Windsor Bridge (New)	Current	59	88	105	116	125	135	145	149	182
		Project	209	328	356	369	358	352	343	338	265
Bridge on Bells Line of Road over Hawkesbury River	North Richmond Bridge	Current	49	80	94	108	115	126	136	140	171
		Project	0	42	70	128	152	166	179	186	244
Bridge on Richmond Road over South Creek		Current	0	0	0	41	54	64	75	81	108
		Project	0	0	0	0	0	28	61	72	112
Bridge on Hawkesbury Valley Way over South Creek	Jim Anderson Bridge	Current	0	0	0	0	0	30	45	52	84
		Project	0	0	0	0	0	0	0	29	83
Bridge on Great Western Hwy over Nepean River	Victoria Bridge	Current	0	0	0	0	0	0	0	0	51
		Project	0	0	0	0	0	0	0	0	44
Bridge on M4 Motorway over Nepean River		Current	0	0	0	0	0	0	0	0	46
		Project	0	0	0	0	0	0	0	0	36
Bridge on Great Western Hwy over South Creek	Penrith Valley Bridge	Current	0	0	0	0	0	0	0	0	40
		Project	0	0	0	0	0	0	0	0	16
Bridge on M4 Motorway over Ropes Creek		Current	0	0	0	0	0	0	0	0	18
		Project	0	0	0	0	0	0	0	0	0
Bridge on M4 Motorway over South Creek		Current	0	0	0	0	0	0	0	0	0
		Project	0	0	0	0	0	0	0	0	0
Bridge on Silverdale Road over Nepean River	Blaxland Crossing Bridge	Current	0	34	49	55	60	64	70	71	93
		Project	0	32	44	50	56	60	68	70	88

Red shading = increase in closure time Green shading = decrease in closure time

Table 5-2. Major rail river crossings closure time (50th percentile) during flood events for existing conditions and with Project

Description	River/creek crossing	Percentile	Hours closed for a range of flood events								
			1 in 5	1 in 10	1 in 20	1 in 50	1 in 100	1 in 200	1 in 500	1 in 1000	PMF
Penrith Rail crossing	Nepean River	Current	0	0	0	0	0	0	0	0	51
		With Project	0	0	0	0	0	0	0	0	44
South Creek Rail crossing	South Creek	Current	0	0	0	0	0	0	0	0	35
		With Project	0	0	0	0	0	0	0	0	17
Richmond/Windsor Rail crossing	South Creek	Current	0	49	71	84	94	102	114	119	147
		With Project	0	0	26	93	133	145	157	171	202

Red shading = increase in closure time Green shading = decrease in closure time

Table 5-3. Major ferry crossings closure time (50th percentile) during flood events for existing conditions and with Project

Description	Phase	Hours closed for a range of flood events								
		1 in 5	1 in 10	1 in 20	1 in 50	1 in 100	1 in 200	1 in 500	1 in 1000	PMF
Sackville Ferry crossing	Current	66	97	109	123	131	141	149	154	189
	Project	61	108	147	194	208	216	229	239	276
Lower Portland Ferry crossing	Current	44	76	88	102	114	119	125	130	162
	Project	29	58	73	118	141	143	148	162	225
Webbs Creek Ferry crossing	Current	0	5	45	66	75	81	86	92	124
	Project	0	0	15	40	59	70	74	79	136
Wisemans Ferry crossing	Current	0	5	45	66	75	81	86	92	124
	Project	0	0	15	40	59	70	74	79	136

Red shading = increase in closure time Green shading = decrease in closure time

Key findings for each of the crossings are:

- Cattai Creek Bridge at Cattai – This is the lowest level bridge considered in the assessment (about 2 metres AHD) and is prone to flooding and closure during all modelled flood events. The number of hours that this bridge would be closed would approximately double for all events except the PMF under the Project scenario. This is because the low-level flooding caused by the emptying of the flood mitigation zone would result in a longer closure time of the bridge. Although the bridge would be closed for longer there are nearby alternative routes which would remain open.
- Yarramundi Bridge – This is the second lowest level bridge considered in the assessment (about 5.61 metres AHD) and is prone to flooding and closure during all modelled flood events. The number of hours that this bridge would be closed would increase by about two to three times for all events except the 1 in 5 chance in a year flood event and PMF under the Project scenario. There would still be an increase in closure time for these two events, however, the increase would not be as large as for other events. Increased closure times are due to the low-level flooding caused by the emptying of the flood mitigation zone. Although the bridge would be closed for longer there are alternative routes.
- Windsor Bridge (New) – The number of hours that this bridge would be closed would increase by about two to three times for all events except for the PMF under the Project scenario. There would still be an increase in closure time for the PMF, however, the increase would not be as large as for other events. Increased closure times are due to the low-level flooding caused by the emptying of the flood mitigation zone.
- North Richmond Bridge – The North Richmond Bridge is closed during all flood events under existing conditions. With the Project, the North Richmond Bridge would remain open during the 1 in 5 chance in a year event and would be closed for shorter periods during the 1 in 10 chance in a year flood event and the 1 in 20 chance in a year flood event. For the other events there would a minor increase in the number of hours closed under the Project scenario.
- Jim Anderson Bridge – Under existing conditions, the Jim Anderson Bridge is closed during flood events greater than the 1 in in 100 chance in a year event. With the Project, the bridge would only be closed during events greater than the 1 in 500 chance in a year flood event and would be closed for shorter periods of time.
- Victoria Bridge, M4 Motorway Bridge (Nepean River), M4 Motorway Bridge (Ropes Creek) and Great Western Highway Bridge will remain open and operational during all flood events apart from the PMF under existing conditions and under the Project scenario. All these bridges would be closed during PMF event, however there would be a small reduction in the time that they are closed with the Project.
- Blaxland Crossing Bridge – Apart from the 1 in 5 chance in a year flood event the bridge would be closed during all flood events both under existing conditions and under the Project scenario. However, there would be a small reduction in the time that the bridge was closed due to the Project.
- The Penrith and South Creek rail crossings would remain open during all flood events under existing conditions and under the Project scenario except for the PMF event. There would be small reduction in the number of hours the Penrith and South Creek rail crossings are closed under the Project scenario during the PMF.
- Windsor/Richmond rail crossing would be closed under existing conditions during the 1 in 10 chance in a year flood event and all larger floods. Under the Project scenario the Windsor/Richmond rail crossing would remain open during the 1 in 10 chance in a year flood – and there would a reduction in closure time during the 1 in 20 chance in a year flood. For all other floods there would be an increase in closure times.
- Sackville Ferry crossing – This ferry crossing is closed during all flood events and the period of closure would increase by about 50 percent under the Project scenario for all flood events apart from the 1 in 5 chance in a year flood, where it would decrease slightly.
- Portland Ferry crossing – This ferry crossing is closed during all flood events and the period of closure would increase by about 25 percent under the Project scenario for all flood events apart from the 1 in 5 1 in 10, and 1 in 20 chance in a year floods, where closure times would decrease slightly.
- Webbs Creek Ferry and Wisemans Ferry crossings have identical closure patterns as they are adjacent to each other and results for both assessment criteria are relatively similar. The ferries remain open for the 1 in 5 chance in a year flood and close for more severe events under existing conditions. Under the Project scenario, the ferries would also remain open for the 1 in 10 chance in a year flood event and there would be a decrease in the time the ferries are closed for all other floods, apart from the PMF where there would be a small increase in the number of hours the ferries are closed under the Project scenario.

Generally, the Project would result in a reduction or no change in closure times apart from low level crossings such as Yarramundi Bridge, the Cattai Creek bridge at Cattai, Windsor Bridge and some ferry crossings. The low-level crossings

would experience an increase in closure times due to the emptying of the flood mitigation zone. Some crossing would experience a reduction in closure times for smaller events and an increase in closure time for larger events.

Figure 5-1 to Figure 5-8 show the operational status of the major roads and river crossings for the five events nominated in the SEARS, as well the 1 in 200 and 1 in 500 chance in a year events under existing conditions and under the Project scenario.

5.2.3 Alternative routes

It is beyond the scope of the assessment to determine alternative routes for all crossings and all flood events. Only those that would be impacted by the Project and would experience a significantly greater period of closure (that is, increase of more than two days for a range of flood events) have been considered for identifying potential alternative routes. This includes the Yarramundi Bridge, the Cattai Creek bridge at Cattai and the Sackville Ferry. These crossings are all low level and already experience extended periods of closure during flood events. However, with the Project they would experience increased closure periods. The capacity of alternative routes during the flood mitigation zone discharge would not be affected by evacuations as the flood peak (and any resulting evacuations) would have occurred.

Yarramundi Bridge

Yarramundi Bridge provides an east-west crossing of Nepean River between Yarramundi and Agnes Bank. Estimated peak traffic volumes are about 1,000 vehicles per hour and the average daily traffic volume is estimated to be about 12,000 vehicles per day (Urban Research and Planning 2015). While there is no information on travel destinations for vehicles using the bridge, it is likely that movements would be predominately vehicles either from or towards Winmalee and Yarramundi. There may also be some through traffic to/from the upper Blue Mountains to/from Windsor/Richmond.

There are also a number of current road and bridge upgrades which are relevant to potential alternative routes including:

- Grose River Bridge – a new bridge over the Grose River just north of the Yarramundi Bridge is in its final stages of development and approval. This would provide a road link from Yarramundi to North Richmond – which currently does not exist. Based upon the proposed development program, this bridge would be open by the time the Project is operational.
- Richmond Bridge – There have been a number of recent upgrade programs for intersections and the approaches to the Richmond Bridge to reduce congestion. In May 2018, the NSW Government announced $25 million over four years for upgrades to the Richmond Road corridor between Richmond and North Richmond. This included funding to build improvements at the March Street and Bosworth Street intersection in Richmond and funding for planning the duplication of Richmond Bridge to reduce congestion between Richmond and North Richmond. The duplication of Richmond Bridge would include a new higher-level bridge. At this stage, there is no estimated time for the provision of the duplicated bridge.
- Windsor Bridge – the new Windsor Bridge at Windsor has recently been opened for traffic. It is higher than the existing bridge and would be open for longer than the existing bridge during floods.

Figure 5-1. Operational status of major river crossings and roads during the 1 in 5 chance in a year flood event

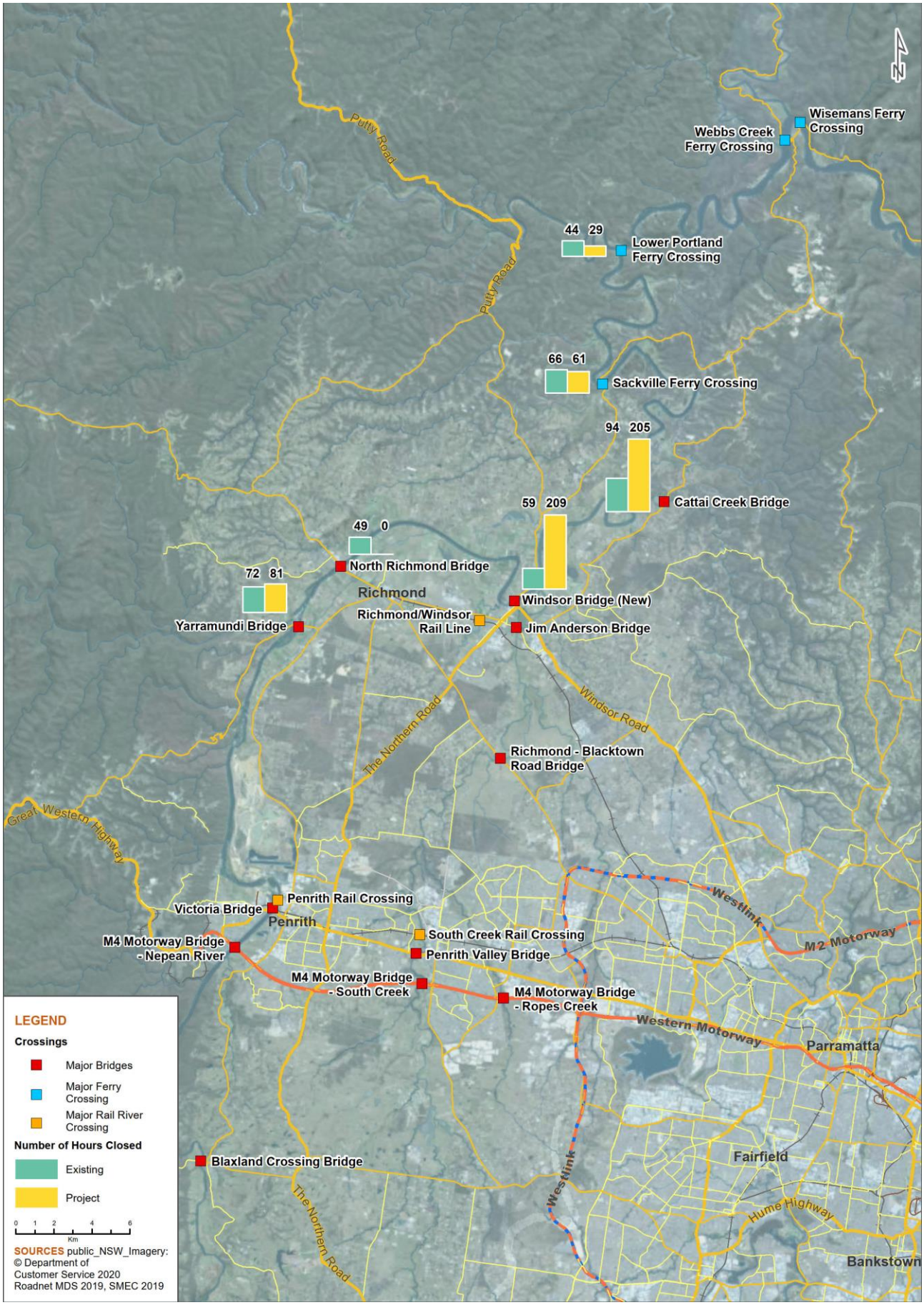


Figure 5-2. Operational status of major river crossings and roads during the 1 in 10 chance in a year flood event

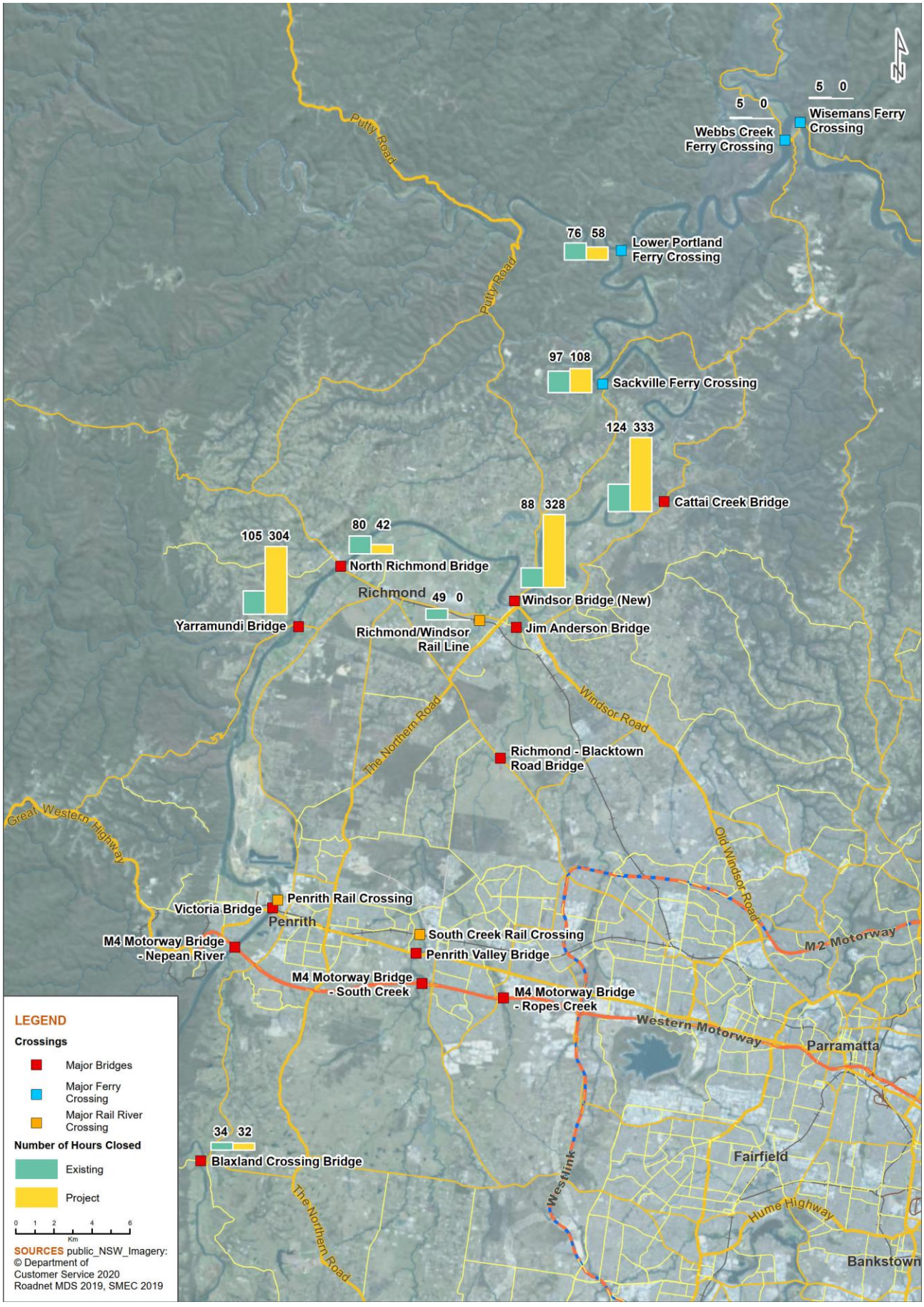


Figure 5-3. Operational status of major river crossings and roads during the 1 in 20 chance in a year flood event

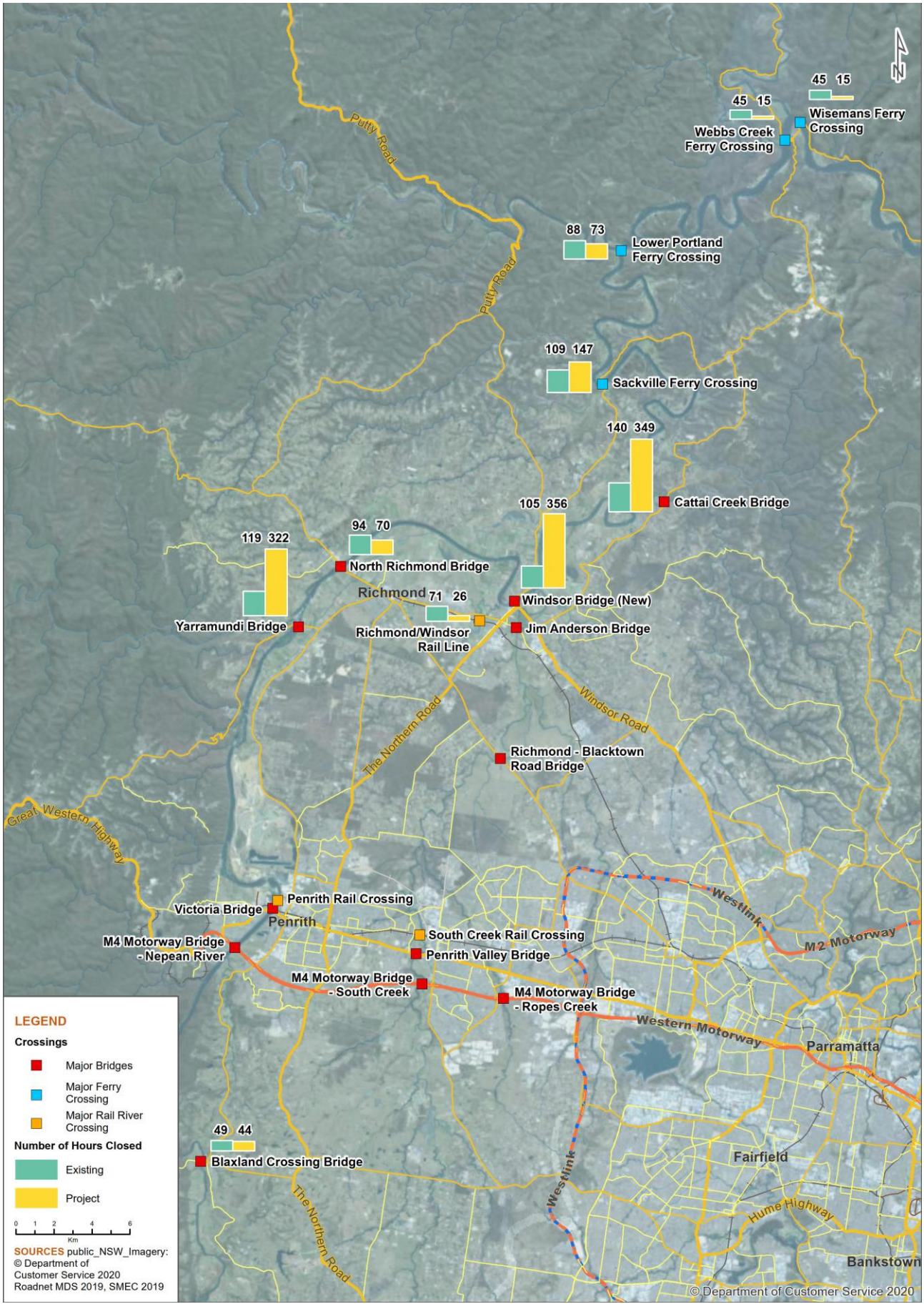


Figure 5-4. Operational status of major river crossings and roads during the 1 in 100 chance in a year flood event

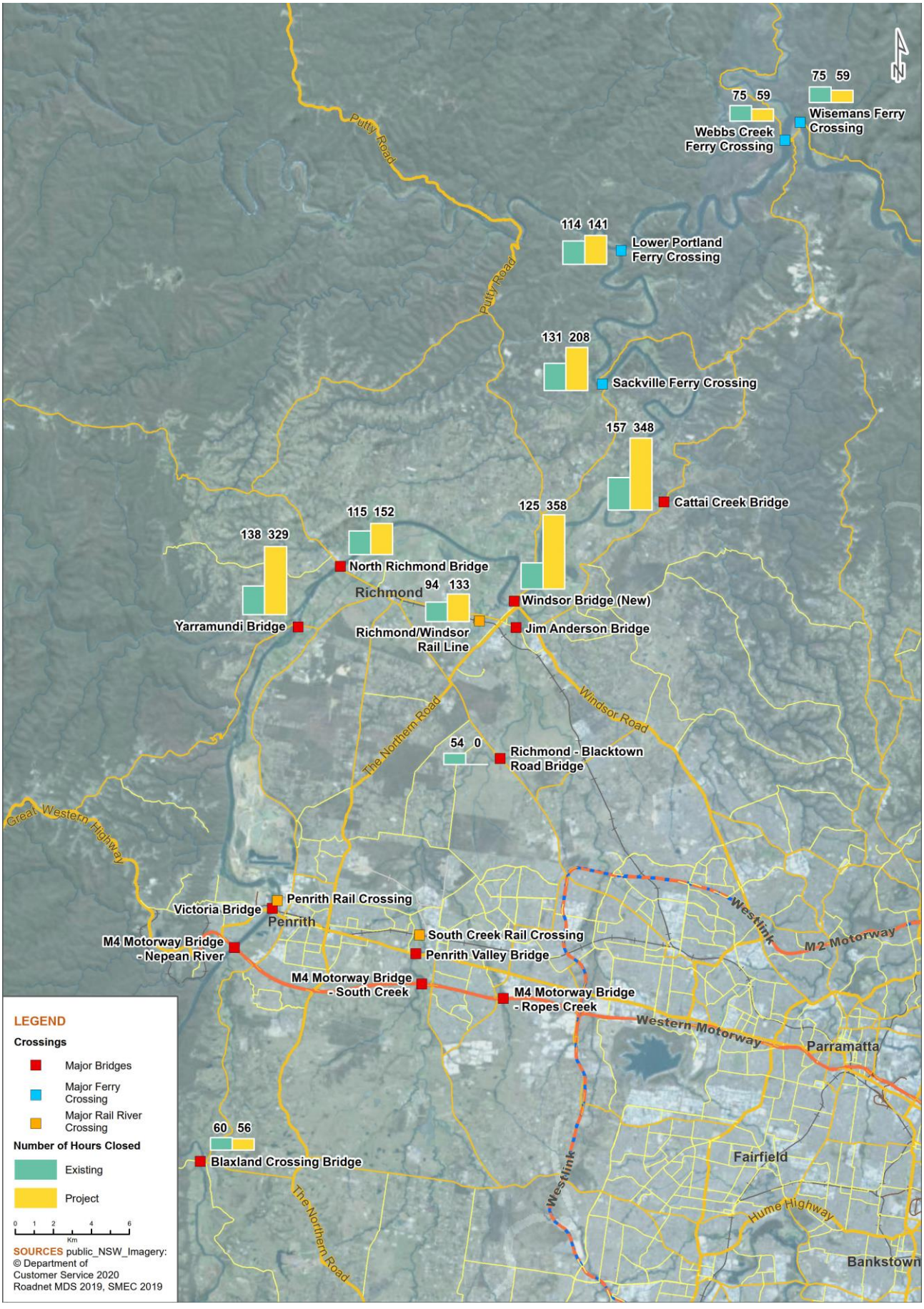


Figure 5-5. Operational status of major river crossings and roads during the 1 in 200 chance in a year flood event

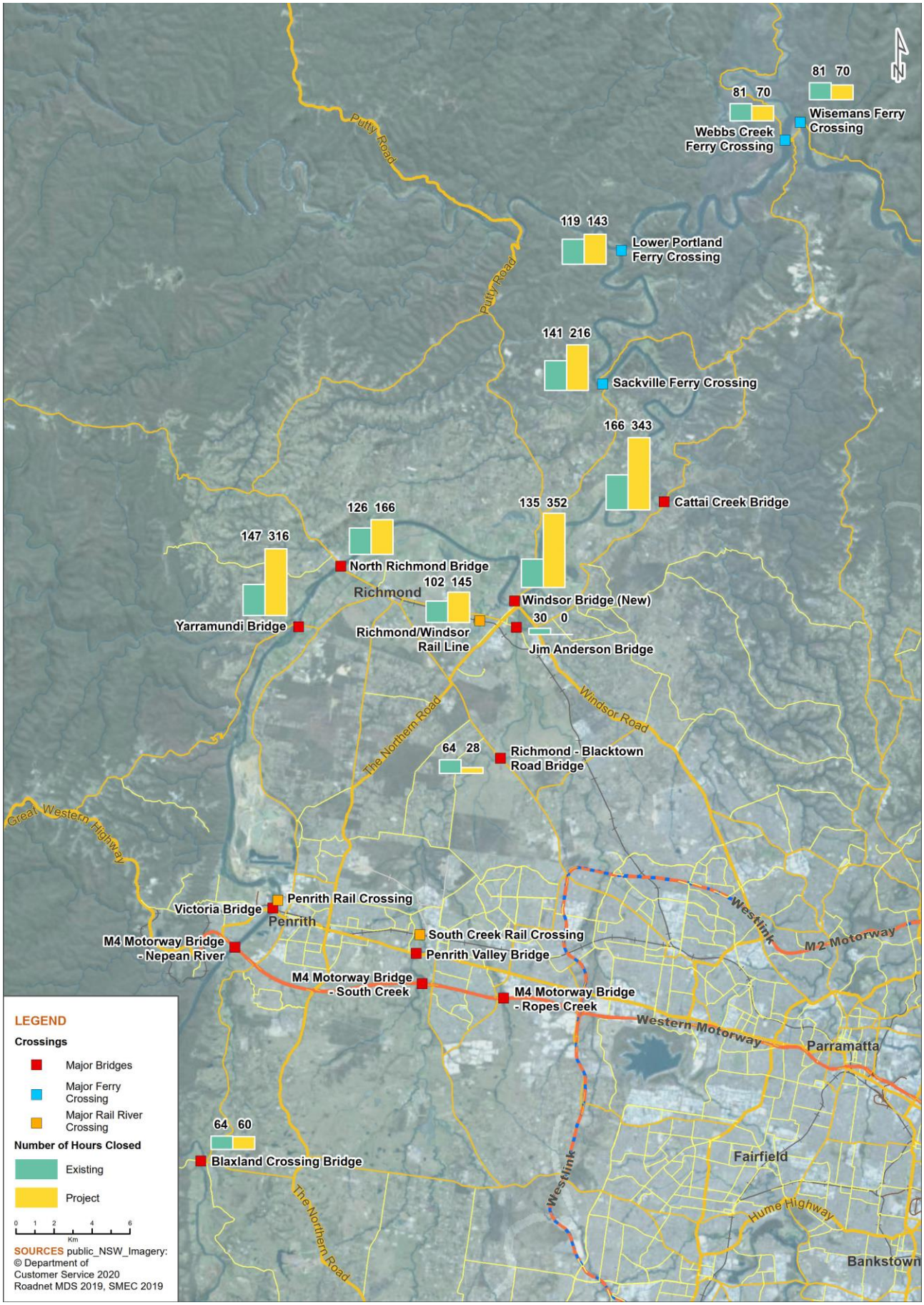


Figure 5-6. Operational status of major river crossings and roads during the 1 in 500 chance in a year flood event

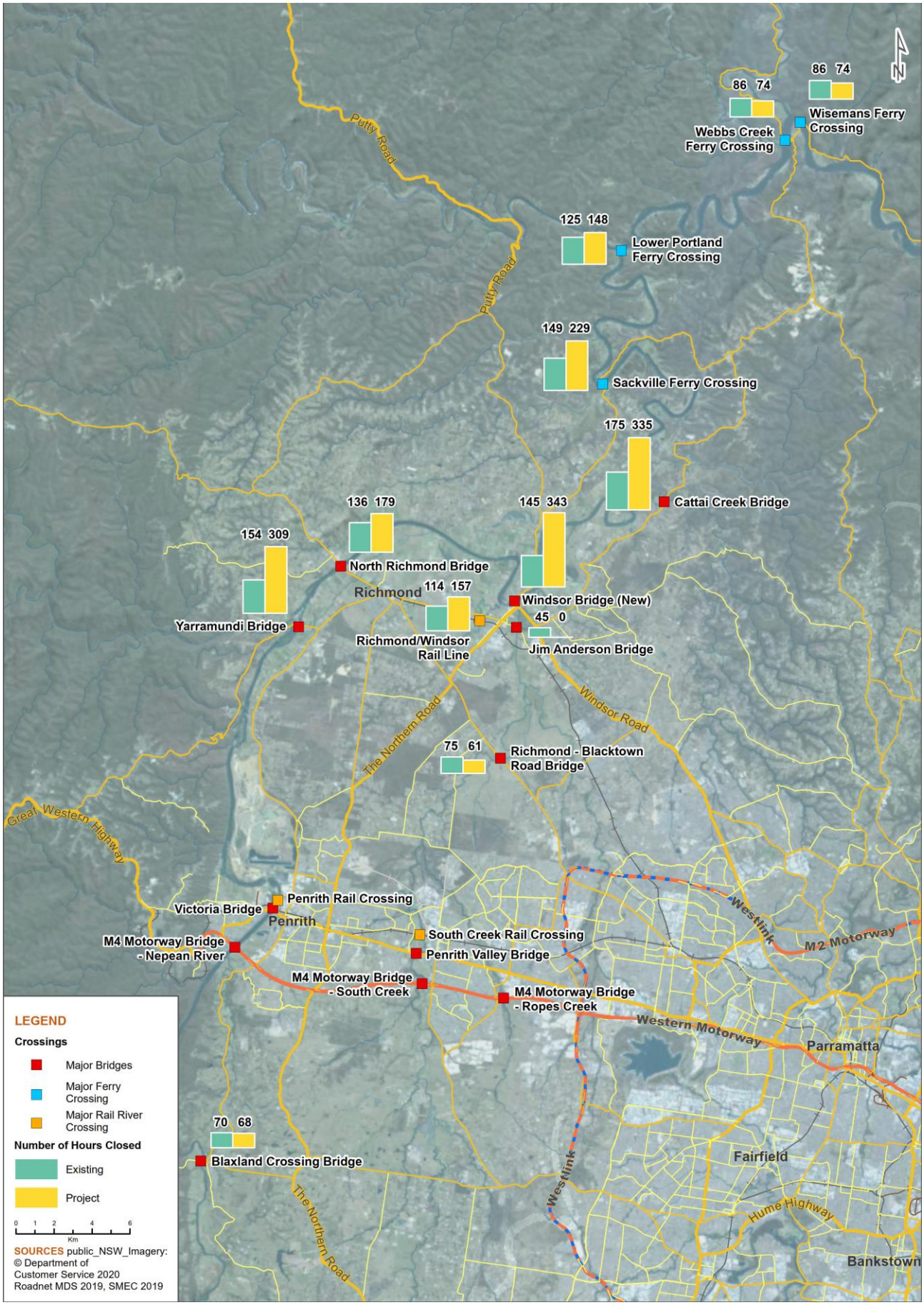


Figure 5-7. Operational status of major river crossings and roads during the 1 in 1,000 chance in a year flood event

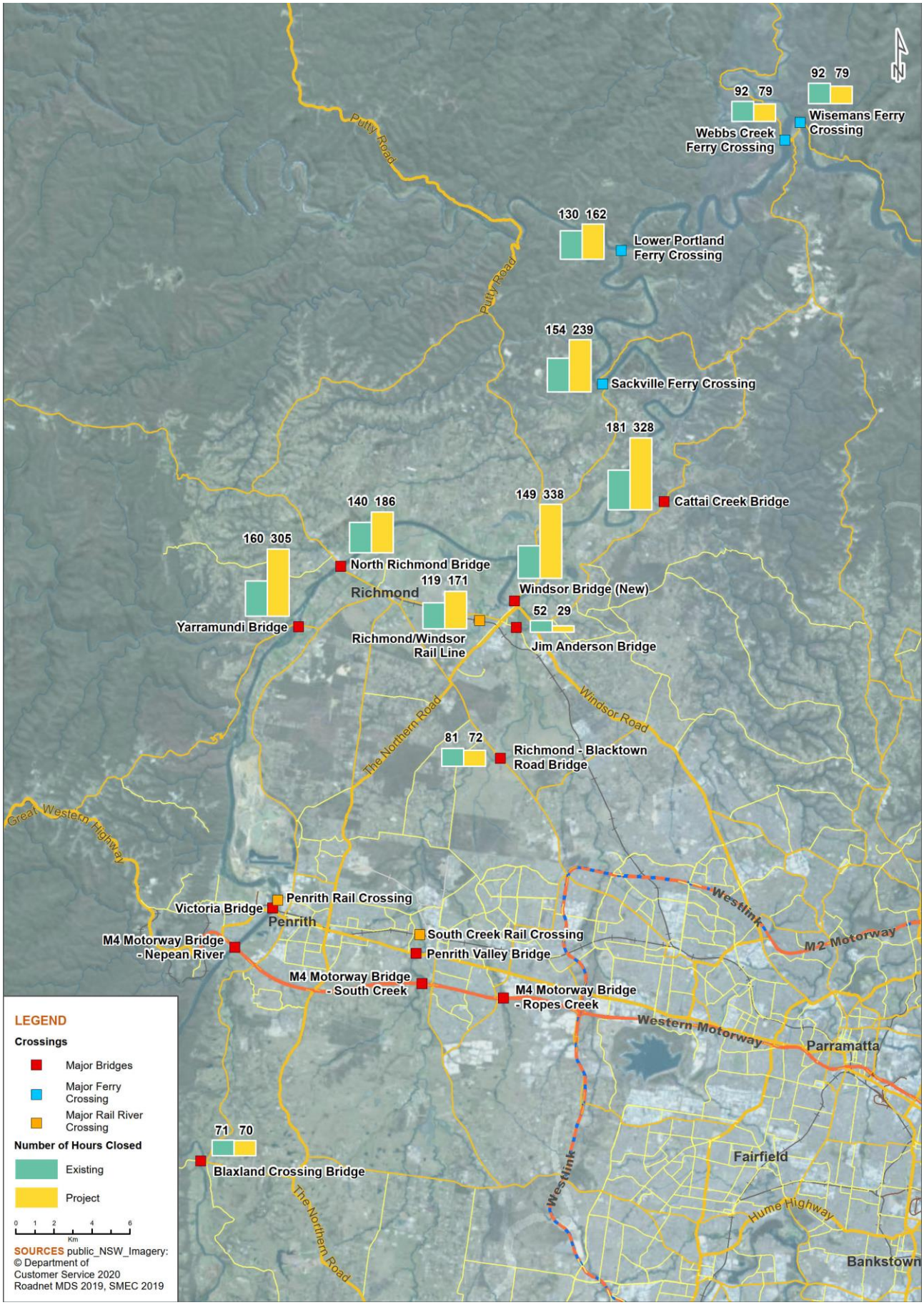
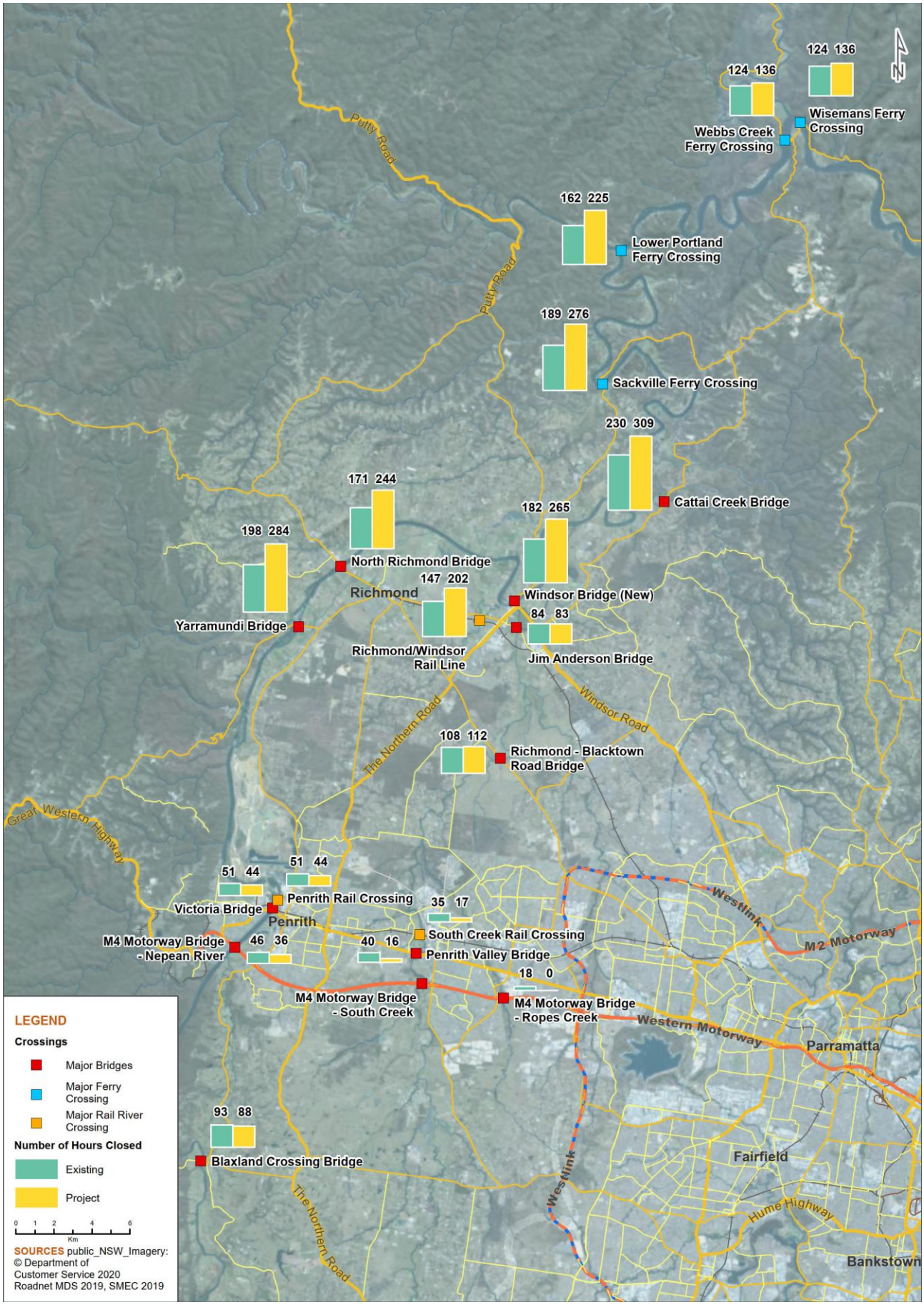


Figure 5-8. Operational status of major river crossings and roads during the probable maximum flood (PMF) event



The largest increases in closure times of the Yarramundi Bridge would be for events between the 1 in 10 chance in a year flood and the 1 in 100 chance in a year flood event when the bridge would be closed about 200 additional hours on average – which is about 8.5 days. The smallest increase would be for the 1 in 5 chance in a year (20% AEP) flood event where the bridge would be closed for an extra four days. The increased closure times relative to the time periods for the major floods events is extremely small – for example the 8.5 extra days of closure for a 1 in 20 chance in a year (5% AEP) flood would on average result in Yarramundi Bridge being closed an extra 0.1% of time over a 20-year period.

There are three potential alternative routes to cross the Hawkesbury-Nepean River and access or depart from Yarramundi and Winmalee. These are:

- Richmond Bridge – The alternative route would include (from west to east) Springwood Road, the new Grose River bridge, Ashtons Road, Grose River Road, Grose Vale Road and Bells Line of Road, Richmond Bridge and Kurrajong Road. For the 1 in 5 and 1 in 10 chance in a year flood event, the Project would result in the Richmond Bridge being closed for shorter periods, however for larger flood events the bridge would be closed for one to two days longer.
- M4 Motorway bridges – The alternative route would include (from west to east) Springwood Road, Hawkesbury Road, the Great Western Highway, M4 Motorway and the M4 Motorway bridges. At least one of the two M4 bridges would be open during all modelled events including PMF.
- Victoria Bridge Great Western Highway – The alternative route would include (from west to east) Springwood Road, Hawkesbury Road, M4 Motorway, the Great Western Highway, Victoria Bridge and High Street. This route would be available for floods up to and including the 1 in 100 chance in a year (1% AEP) flood event.

Given the small increase in closure times relative to the occurrence of major flood events and the temporary nature of any closure, network modelling was not warranted to assess impacts. However, the capacity of potential alternative routes to manage diverted traffic was assessed to identify any potential congestion issues resulting from the Project. Two-hour peak period traffic data for alternative routes was sourced and a theoretical capacity calculated based upon a typical lane capacity of 1,750 vehicles per hour (Table 5-4).

Table 5-4. Peak traffic numbers on alternatives routes for Yarramundi Bridge

Road	Year	Time period (2 hours)	Eastbound (vehicles)	Westbound (vehicles)	Theoretical capacity (vehicles)
Yarramundi Bridge	2013	AM Peak	623	1,344	3,500
		PM Peak	1,325	454	3,500
Great Western Highway at Falconbridge	2017	AM Peak	3,956	2,393	7,000
		PM Peak	3,885	3,855	7,000
Richmond Bridge	2013	AM Peak	3,030	1,433	3,500
		PM Peak	1,893	2,813	3,500
Windsor Bridge (Old)	2019	AM Peak	949	2,137	3,500
		PM Peak	2,343	1,127	3,500
High Street (near Victoria Bridge)	2017	AM Peak	3,737	2,064	3,500
		PM Peak	2,661	3,786	3,500
M4 Motorway Penrith	2016	AM Peak	10,417	5,542	10,500
		PM Peak	7,053	11,343	10,500

Source: Urban Research and Planning (2015) and RMS Traffic Volume Viewer

However, it should be noted that the lane capacity during an emergency evacuation condition could be affected by a number of factors and is typically lower than the lane capacity during a normal situation. Of potential alternative routes, locations where traffic volumes are approaching their theoretical capacity include Richmond Bridge, Victoria Bridge and the M4 Motorway. However, the predominant movement of traffic across Yarramundi Bridge in each of the peak periods is generally opposite to the typical peak traffic movement at the other locations. For example, the highest traffic movement during the AM peak across Yarramundi Bridge is east to west, whereas at other locations it is

west to east. Consequently, the relatively small potential increase in traffic on the alternative routes from the Yarramundi Bridge closure is unlikely to result in any increased congestion for the relatively short period diversions are required.

Windsor Bridge (New) at Windsor

The new Windsor Bridge at Windsor provides a north-south crossing of the Hawkesbury River at Windsor.. Morning and evening peak traffic numbers over the old Windsor Bridge in 2019 are presented in Table 5-5. The alternative route to cross the Hawkesbury River is via the Richmond Bridge, accessed via Wilberforce Road, Singleton Road, Kurmond Road, Maddens Road, Slopes Road, Crooked Lane, and Bells Line of Road. The Richmond Bridge is closed during all flood events under existing conditions. Under the Project scenario, the Richmond Bridge would remain open during the 1 in 5 chance in a year event and would be closed for shorter periods during the 1 in 10 chance in a year flood and the 1 in 20 chance in a year flood. For more severe floods, there would be a minor increase in the number of hours closed.

The alternative route if both bridges are closed is via the proposed Grose River bridge to Yarramundi. The routes from Yarramundi are discussed above.

Table 5-5. Peak two-hour traffic numbers on Windsor Bridge (old) in 2019

Road	Year	Time period (2 hours)	Eastbound (vehicles)	Westbound (vehicles)	Theoretical capacity (vehicles)
Windsor Bridge (Old)	2019	AM Peak	949	2,137	3,500
		PM Peak	2,343	1,127	3,500

Cattai Creek Bridge at Cattai

Cattai Creek Bridge at Cattai provides a north-south crossing of Cattai Creek at Cattai. Estimated AM and PM peak traffic volumes are only available for Cattai Road north of Pitt Town and are low (Arcadis 2018) in both directions (Table 5-6).

For most events the Cattai Creek Bridge at Cattai would be closed for an additional seven to eight days. The smallest increase would be for the 1 in 5 chance in a year flood event where the bridge would be closed for an extra 4.5 days. The increased closure times relative to the time periods for the major floods events is extremely small – for example the extra 8 days of closure for a 1 in 10 chance in a year flood would on average result in Cattai Creek Bridge at Cattai being closed an extra 0.2% of time over a 10-year period.

The alternative route from north to south is through Halcrows Road, Cattai Ridge Road and Pitt Town Dural Road. There is no traffic volume information available for these roads, however, typically traffic volumes would be low as the area is not highly developed. Given the small number of vehicles that use Cattai Road in peak periods, it is unlikely that there would be a congestion issue when the bridge is closed.

Table 5-6. Peak traffic number on alternatives routes for closure of Cattai Creek Road bridge

Road	Year	Time period (1 hour)	Northbound (vehicles)	Southbound (vehicles)	Theoretical capacity (vehicles)
Cattai Road - north of Pitt Town	2018	AM Peak	135	248	1,750
		PM Peak	175	154	1,750

Major ferry crossings

The Sackville Ferry provides a north-south crossing of the Hawkesbury River at Sackville. The ferry has a capacity of about 200 to 300 vehicles a day. The alternative route if the ferry is closed (from south of the river to north), would be via Sackville Road, King Street, Wilberforce Road, Windsor Road, Bridge Street, Macquarie Street, Hawkesbury Valley Way, Groves Ave, Windsor Road, Pitt Town Road, Cattai Road, Wisemans Ferry Road and Sackville Ferry Road.

The Lower Portland Ferry provides east-west crossing of the Hawkesbury River at Lower Portland. This is a cable ferry and operates on demand with a capacity of three small cars per trip. The alternative route if the ferry is closed (from west of the river to east), would be via West Portland Road, Sackville Road, King Street, Wilberforce Road, Windsor Road, Bridge Street, Macquarie Street, Hawkesbury Valley Way, Groves Ave, Windsor Road, Pitt Town Road, Cattai Road, Wisemans Ferry Road, Sackville Ferry Road and River Road.

The Wisemans ferry and Webbs Creek Ferries provide east-west crossings of the Hawkesbury River at Wisemans Ferry. The alternative route if the Wisemans Ferry is closed (from west of the river to east), would be via Old Northern Road, Mid Dural Road, Galston Road, Pacific Highway and Wisemans Ferry Road. The alternative route if the Webbs Creek Ferry is closed (from East of the river to west), would be via Old Northern Road, Cattai Road, Pitt Town Road, Windsor Road, Groves Ave, Hawkesbury Valley Way, Macquarie Street, Bridge Street, Windsor Road, Wilberforce Road, King Street, Sackville Road, West Portland Road, Green Road, Bicentenary Road and Chaseling Road North.

Given the relatively small number of vehicles that would be diverted due to the closure of these ferry crossings, there would be no capacity issues on any of these roads.

5.2.4 Impacts on time to the closure of a crossing

The main benefit of the project is the reduction of downstream flood peaks, which reduces both the number of people needing to evacuate and the likelihood that critical evacuation routes are cut. For those flood events that still cut evacuation routes with the Project, it is critical that these routes get cut no earlier than and preferably later than they would with the current dam. Table 5-7 shows the number of hours after the beginning of an event a crossing remains open. Only major road crossings are shown in Table 5-7. The railway is not considered to be a major means of evacuation, and the ferry crossings have low capacities and therefore would also not be considered to be major evacuation routes.

The delay in floods reaching critical levels downstream with the Project would vary for each modelled flood event, as depends on the specific sequence of inflows for that event. For example, for all the flood events that were modelled to reach the 1 in 100 chance per year flood planning level in the Richmond/Windsor and cut the Jim Anderson Bridge (17.3 metres AHD) with the current dam, with the Project 86% will no longer reach that level. For those modelled flood events that still reach 17.3m with the Project:

- 7.2% of flood events will be delayed reaching 17.3m by over 15 hours
- 4.6% of flood events will be delayed reaching 17.3m by 10 to 15 hours
- 2.1% of flood events will be delayed reaching 17.3m by 5 to 10 hours
- 0.2% of flood events will be delayed reaching 17.3m by less than 5 hours
- No flood events will reach 17.3 metres faster

The Project achieves similar delays for larger flood events. For example, for all the flood events that were modelled to cut the Castlereagh Road evacuation route (20.2 metres AHD, approximately 1 in 700 chance per year) with the current dam, with the Project 80% will no longer reach that level. For those modelled flood events that still reach 20.1m with the Project:

- 5.9% of flood events will be delayed reaching 20.2m by over 15 hours
- 9.6% of flood events will be delayed reaching 20.2m by 10 to 15 hours
- 4.1% of flood events will be delayed reaching 20.2m by 5 to 10 hours
- No flood events will be delayed reaching 20.2 metres by less than 5 hours.

While some delays in closing time are relatively short, any extra time can be critical in evacuations as a single lane with traffic travelling at 40 kilometres an hour has a capacity of about 1,500-1,750 vehicles per hour. Assuming two people per vehicle, an extra hour for evacuation could allow about 3,000 to 3,500 extra people to be evacuated.

Table 5-7. Number of hours before a river crossing is closed for different flood events for the existing conditions and with the Project

	1 in 5 chance in a year (hours to closure)		1 in 10 chance in a year (hours to closure)		1 in 20 chance in a year (hours to closure)		1 in 100 chance in a year (hours to closure)		PMF (hours to closure)	
	Existing	Project	Existing	Project	Existing	Project	Existing	Project	Existing	Project
Cattai Creek Road Bridge	8 (3-22)	10 (4-23)	8 (2-14)	8 (3-19)	6 (2-13)	7 (3-17)	5 (2-11)	6 (3-14)	6	3
Yarramundi Road Bridge	3 (1-17)	6 (3-21)	3 (1-9)	5 (3-17)	2 (1-5)	4 (2-14)	2 (1-4)	4 (2-10)	1	3
Windsor Road Bridge (New)	Not closed	Not closed	Not closed	Not closed	30 (21-45)	Not closed	21 (15-34)	39 (29-54)	8	14
North Richmond Road Bridge	4 (3-17)	17 (6-27)	5 (3-19)	11 (5-22)	3 (2-12)	9 (4-20)	3 (2-10)	6 (4-19)	2	5
Richmond- Blacktown Road Bridge	Not closed	Not closed	Not closed	Not closed	46 (35-64)	Not closed	38 (26-55)	59 (43-75)	20	28
Jim Anderson Bridge	Not closed	Not closed	Not closed	Not closed	Not closed	Not closed	29 (21-41)	Not closed	18	24
Victoria Road Bridge	Not closed	Not closed	Not closed	Not closed	Not closed	Not closed	Not closed	Not closed	53	64
M4 Motorway Bridge - Nepean River (west)	Not closed	Not closed	Not closed	Not closed	Not closed	Not closed	Not closed	Not closed	Not closed	Not closed
M4 Motorway Bridge - Nepean River (east)	Not closed	Not closed	Not closed	Not closed	Not closed	Not closed	Not closed	Not closed	81	110
M4 Motorway - South Creek	Not closed	Not closed	Not closed	Not closed	Not closed	Not closed	Not closed	Not closed	69	93
Great Western Highway - South Creek	Not closed	Not closed	Not closed	Not closed	Not closed	Not closed	Not closed	Not closed	7	8
Blaxland Crossing Road Bridge (Wallacia)	15 (11-29)	15 (12-29)	12 (8-26)	13 (9-26)	10 (5-19)	11 (8-20)	8 (3-15)	10 (7-18)	7	8

Red shading = increase in number of hours before closure; Green shading = decrease in number of hours before closure; Range is 10th to 90th percentile

Hours to closure indicated in brackets

5.3 Traffic and transport impacts – upstream

The upstream impacts of the Project are confined to the existing catchment special areas around Lake Burragorang and Warragamba Dam. Access to the special areas is restricted and generally the public is not permitted to access the special areas without permission. There are no public roads or rail lines in the special areas that would be impacted by the Project.

The vast majority of the special areas are owned by various departments of the NSW Government, with the National Parks and Wildlife Service generally responsible for managing the special areas. However, there remain small areas of private landholdings within the Special Areas which are accessed via unsealed roads and fire trails. Private land holdings are located along the Wollondilly River and the upper Coxs River and Yerranderie. Only two private lots would be impacted by the Project and these would only be impacted in during the PMF. The access road to these lots would experience some additional flooding, however, the increase in the period of flooding would be hours – and consequently minor. Other private landholdings and Yerranderie generally access their properties from the south or west and these unsealed roads and fire trails would not be impacted by the Project and therefore there would be no change in the access.

Some fire trails, especially those adjacent to the dam and rivers would experience greater extents and durations of flooding under the Project scenario. Only WaterNSW catchment staff and NPWS staff use the fire trails. The impact on fire trails is discussed in Chapter 20 (Protected and sensitive lands) of the EIS. It should be also noted that fire trails and access to the Special Areas are generally closed after substantial rainfall events and hence before any significant increase in dam storage levels to limit damage to the trails and prevent any incidents or emergencies.

6 Summary of impacts

Presented in the following sections is a summary of the impacts of the construction and operation of the Project.

6.1 Construction

Key findings of the construction traffic and transport assessment of the Project are summarised in Table 6-1 below.

Table 6-1. Project impact assessment summary

Impacts	Level	Assessment
Road and intersection capacity	**Minor**	All intersections are performing with good level of service with the additional construction traffic. All intersections have spare capacity to accommodate additional traffic.
Pavement condition	**Major**	Roads along the southern route have poor/very poor pavement condition. As such, additional heavy trucks along this route may have detrimental impacts on the surface condition
Average travel speed	**Moderate**	Additional slow-moving heavy trucks may reduce the network travel speeds.
Property access	**Moderate**	Proposed heavy vehicle routes would not result in a reduction in access however safety may be impacted in the existing residential and commercial access locations in Silverdale and Wallacia areas
Pedestrian and cyclist	**Moderate**	The southern route passes through the commercial areas and schools (pedestrian and cyclist active area) in Tahmoor, Picton and The Oaks and would increase safety risks in these areas. There will be some interaction of construction related heavy vehicle movements with pedestrians and cyclist along part of Silverdale Road and Production Avenue and would increase safety risks in these areas.
Public transport	**Minor**	All roads have spare capacity. There would be no impacts on the operation of existing public transport services.
Local parking	**Minor**	All construction vehicles would be parked inside the construction site. Some impacts would occur for the visitors' parking.
Blaxland Crossing Bridge	**Minor**	Allowable weight of construction trucks including the construction materials is less than the maximum loading capacity of Blaxland Crossing bridge. As such, no adverse impacts are anticipated on Blaxland Crossing bridge.

It should be noted that the level of impacts identified in above Table 6-1 are qualitative based on the understanding of potential impacts of proposed construction activities and associated construction related vehicle movements on the surrounding road network.

6.2 Operation

6.2.1 Traffic impacts at Warragamba Dam

Once the Project is operational, there would be no additional activities at Warragamba Dam that would generate traffic. Consequently, there would be no change in the current traffic volumes associated with the dam operation– which are minimal and within the capacity of the current road network.

6.2.2 Traffic and transport impacts – downstream

Impact on closure times of key crossings

There would be both impacts and benefits from the Project on the closure times for downstream key crossings.

Low level crossings such as the Cattai Creek Bridge at Cattai, Yarramundi Bridge and the new Windsor Bridge would experience substantially longer periods of closure under the Project scenario for all flood events. The Richmond Bridge crossing of the Nepean River and the new Windsor Bridge would also experience longer closure times for floods more severe than 1 in 50 chance in a year flood, however, there would be reduced closure times for other lesser flood events. The Sackville Ferry and potentially the Lower Portland Ferry would also experience longer closure times under the Project scenario. The key crossings would remain closed after the flood peak due to draining of the flood mitigation zone. There would be alternative routes to the areas which would use these crossings (for example, Yarramundi/Winmalee and McGraths Hill/Windsor), however, motorists would experience longer travel times.

Higher level key crossings would experience benefits, that is, a decrease or no change in the duration of closure times under the Project scenario. The extent of the benefits would be variable, depending on the level of the crossing and the size of the flood events – but some crossings would remain open during certain flood events under the Project scenario, when under existing conditions they would be closed.

Overall the benefits of the Project in reducing key crossing closure times far outweigh the impacts of the Project on low level crossings.

Impact on time to closure of key crossings

The Project would result in a delay in the downstream flood level peak – which in turn may provide an increase in time before a key crossing is closed and allow more residents to evacuate.

The Project would delay the closure of key crossings or they would remain unchanged. The most significant benefits in delaying the closure of key crossings are predicted for the more severe flood events, where mass evacuations are more likely to be required.

Also, some key crossings would no longer close during specific flood events which would allow them to maintain their flood evacuation function when under existing conditions they would be closed.

Overall the benefits of the Project in delaying the time to closure of downstream key crossings is substantial and would allow the evacuation of a greater number of people especially during severe flood events.

6.2.3 Traffic and transport impacts – upstream

The Project would not impact any upstream public roads. There would be a minor loss of access to two remnant private lots in the Special Area during significant and rare flood events, however other access to private land holdings would remain unaffected. Impacts on fire trails and other assets in the special areas are assessed in Chapter 17 of the EIS (Socio-economic, land use and property).

7 Mitigation measures

The following mitigation measures are proposed to minimise the potential impacts of Project on traffic and transport during the construction and operation of the Project.

7.1 General mitigation measures

Specific mitigation measures for each of the impacts of additional Project construction traffic on the surrounding road networks are presented in Table 7-1. The table also presents the method, timing, and the responsibility for implementing the mitigation measures. A construction traffic management plan would be prepared by the construction contractor to further develop the proposed construction mitigation measures.

As the Project would largely result in benefits to downstream key crossings, extensive mitigation measures are not required. For key crossings which would experience impacts, the mitigation measure available are limited as changing the flood mitigation zone discharge rate or re-building the crossings at higher levels are not practical.

RMS is currently developing the 'Hawkesbury-Nepean Valley Regional Flood Evacuation Road Master Plan' which will include a detailed investigation of the impacts of flood events on the road network of the Hawkesbury-Nepean Valley floodplain and the preparation of an evacuation road network plan and suitable flood road design standards. Specifically, this study will include a scenario which considers evacuation associated with a raised Warragamba Dam wall. Additionally, the SES Hawkesbury Nepean Valley Flood Plan would manage any flood emergency evacuation and would be revised if the dam is raised.

Table 7-1. Proposed mitigation measures for minimising impacts on surrounding road network

Impact	ID	Measure	Timing	Responsibility
Impacts from construction traffic	TT1	A construction traffic management plan will be prepared which will detail processes to minimise delays and disruptions and identify and respond to changes in road safety due to Project construction works. The plan will be prepared in accordance with applicable guidelines and relevant standards, guides and manuals. The plan will: ▪ include a construction contingency plan to manage traffic in the event of emergency road closures due to flood, fire, and/or road accidents, road repair works and bridge load limits ▪ ensure all relevant stakeholders are considered during all stages of the Project ▪ provide safe routes for pedestrians and cyclists during construction ▪ comprehensively communicate changes in traffic conditions on roads or paths to community, emergency services, public transport operators, other road user groups and other affected stakeholders ▪ identify measures to manage the movements of construction-related traffic to minimise traffic and access disruptions in the public road network ▪ minimise the use of local roads by the Project's heavy vehicles and identify haulage routes ▪ propose a car parking strategy for construction staff ▪ consider truck telematics to assist the project managers and road network managers to ensure mass limits are adhere to and to reduce congestion/improve safety during peak construction periods. ▪ speed management of construction related vehicles to cross Blaxland Crossing Bridge and continuous monitoring of bridge performance	Pre-construction	Construction Contractor
Worker vehicle impacts	TT2	Carpooling will be encouraged to minimise number of employee vehicles travelling to the site.	Construction	Construction Contractor
Off-site queuing of heavy vehicles	TT3	Queueing of heavy vehicles will be permitted only within the site perimeter.	Construction	Construction Contractor
Access to construction area	TT4	All construction traffic will use Production Avenue to access the site.	Construction	Construction Contractor
Safety of intersection	TT5	The Warradale Road/Production Avenue intersection will be reviewed against the latest relevant Austroads guidelines (for example, sight distances) and appropriate modifications made in consultation with Wollondilly Council to ensure compliance.	Pre-construction	Construction Contractor
	TT6	Temporary traffic signals will be installed at Warradale Road/Production Avenue intersection.	Pre-construction	Construction Contractor

Impact	ID	Measure	Timing	Responsibility
Impacts on road condition	TT7	Regular inspection and maintenance will be carried out on Park Road, Silverdale Road, Farnsworth Avenue, Production Avenue and Warradale Road.	Construction	Construction Contractor
	TT8	A road dilapidation report will be prepared in consultation with the relevant road authority for the Park Road, Silverdale Road, Farnsworth Avenue, Production Avenue and Warradale Road.	Pre-construction	Construction Contractor
Out-of-hours heavy vehicle movements	TT9	Heavy vehicle site access will be restricted to the standard working hours only. No heavy vehicle access will be permitted for periods outside standard working hours unless required for an emergency, delivery of oversize plant or for other justifiable reason as detailed in the construction traffic management plan.	Construction	Construction Contractor
Road safety	TT10	Stage 1 road safety audit will be undertaken at the detailed construction traffic management plan development stage.	Pre-construction	Construction Contractor
Impacts on visitor parking	TT11	Provision of using existing car park facilities on Farnsworth Avenue for visitor centre and Haviland Park will be considered.	Construction	Construction Contractor
	TT12	Parking strategy will be developed to understand the demand and supply of parking spaces for the visitor centre and Haviland Park during the construction stage.	Construction	Construction Contractor
Safety of school buses	TT13	Consideration will be given to ensure that general construction traffic will be minimised during periods of school bus operations.	Construction	Construction Contractor
Cycling facilities	TT14	Secure bike parking will be provided at the construction compound	Construction	Construction Contractor
Bridge and road closures during flood mitigation zone discharge	TT15	WaterNSW will keep the Bureau of Meteorology (BoM) informed of the discharge volumes from the FMZ. BoM will then combine these releases with other inflows and rainfall forecasts and tell the SES, TfNSW and Councils what the forecast river levels are at agreed gauge locations according to the NSW Flood Warning Service Level Specification.	Operation	WaterNSW
Source of construction materials	TT16	Consideration shall be given for materials recovery and re-use opportunities from nearby construction sites such as Western Sydney Airport (WSA), metro or rail tunnels	Construction	Construction Contractor
Alternate mode to transfer construction materials	TT17	Consideration shall be given to use alternate modes such as rail, where possible, to transfer the construction materials from long distance to reduce number of constructions related heavy vehicle movements on roads	Construction	Construction Contractor

7.2 Construction contingency plan

A high-level contingency plan, as shown in Table 7-2, has been developed to manage the traffic during the construction period in the event of an emergency road closures due to flood, fire, and/or road accidents; road repair works and load limits of the bridges. The construction traffic management plans would include detailed traffic management plans to address the abovementioned issues including emergency evacuation plans.

Table 7-2. Construction contingency plan for Project

Event	Proposed contingency plan	When to be implemented	Responsibility
Flood and fire	All workers, sub-contractors and suppliers shall be provided with proper training on emergency evacuation plan during flood and/or fire	Throughout the construction period	Construction contractor
Flood, fire, road accidents, major pavement failure, loading capacity of Blaxland Crossing bridge	Feasibility of using alternate route (The Northern Road-Cobbitty Road-Werombi Road- South part of Silverdale Road) shall be checked to access the construction site in the event of road closure during development of construction traffic management plan	Before commencement of construction	Construction contractor
Major pavement failure and loading capacity of Blaxland Crossing bridge	Reduced loading capacity of trucks shall be considered	During the emergency event scenarios	Construction contractor
Road breakdown, road accident, major pavement failure	Trained personnel shall be deployed to the event location to manage/control traffic movements in consultation with concerned authorities	During the emergency event scenarios	Construction contractor

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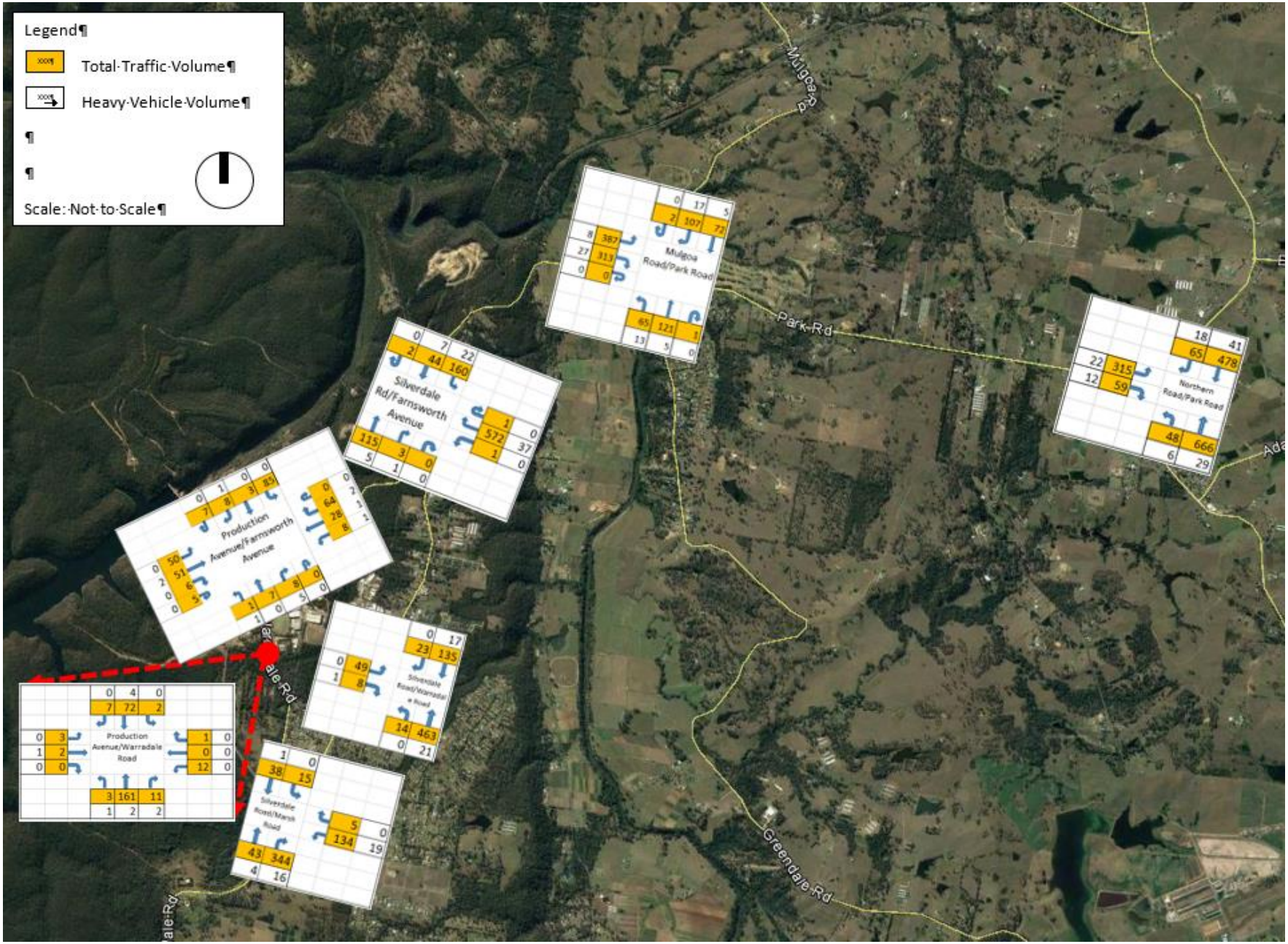
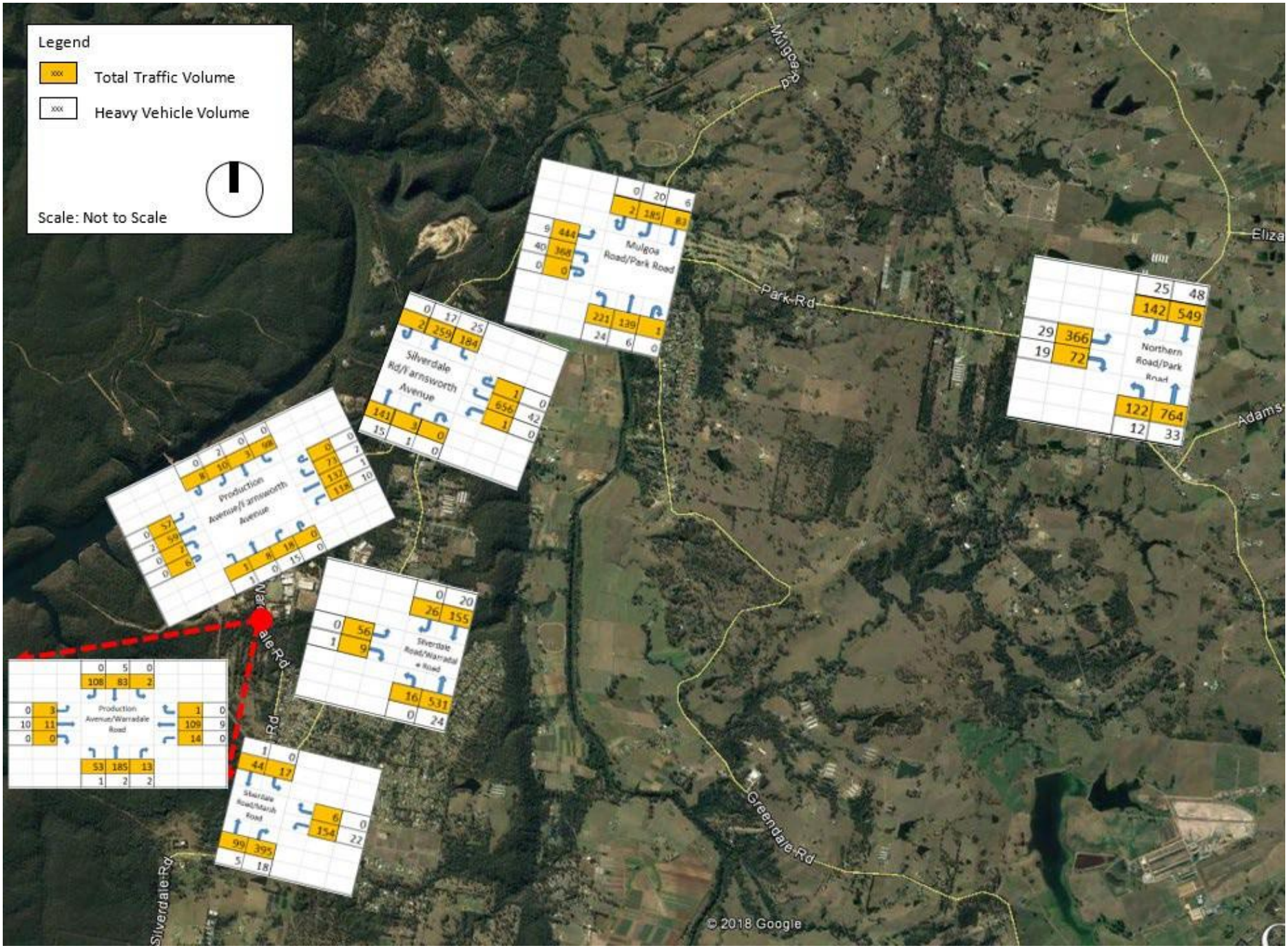
Appendix A – Intersection turning volume for year 2022

2022 Traffic volume AM peak without Warragamba Dam raising project construction traffic



2022 Traffic volume PM peak without Warragamba Dam Raising project construction traffic

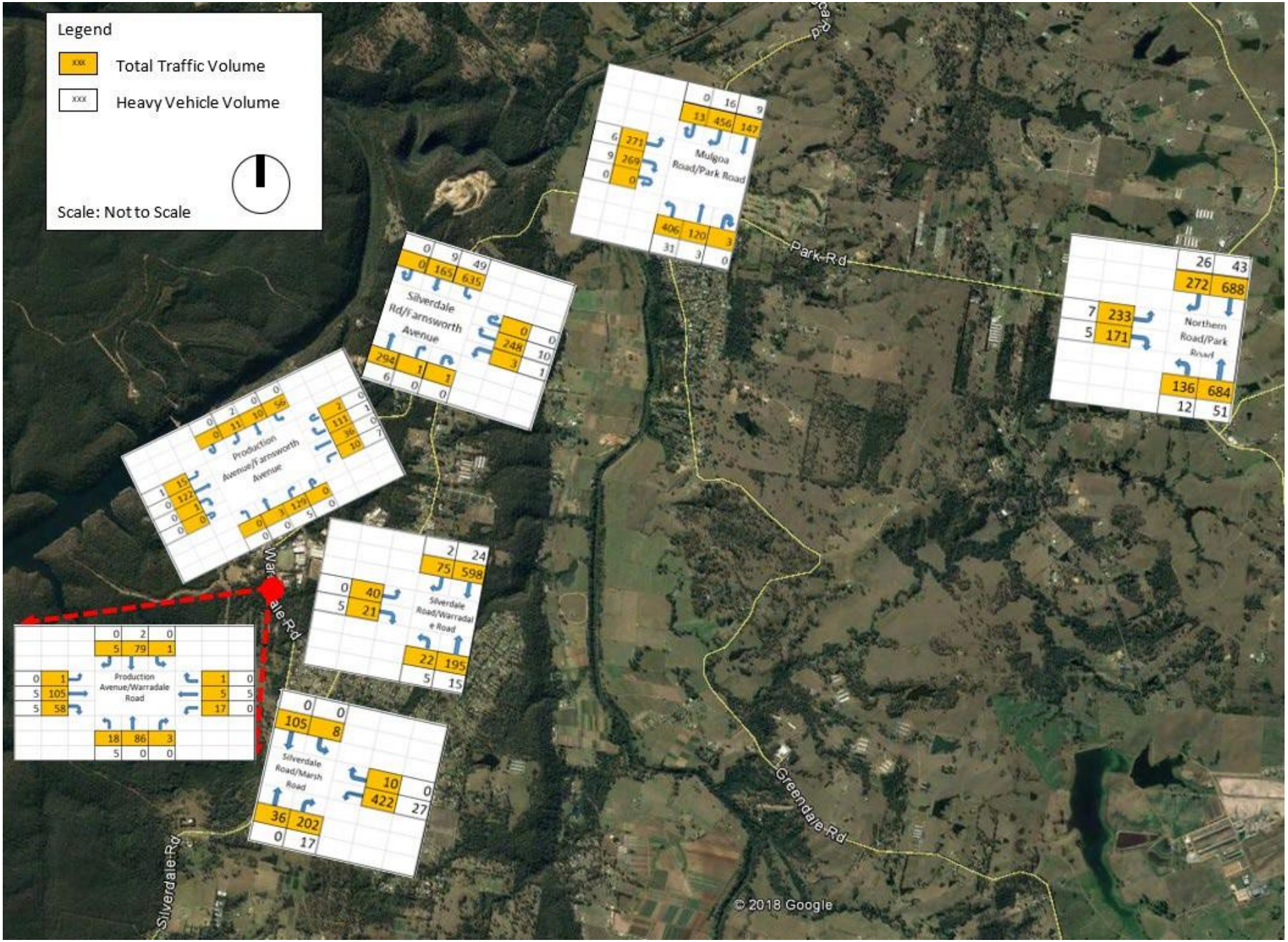
2022 Traffic volume AM Peak with Warragamba Dam raising project construction traffic (Scenario 1)



2022 Traffic volume PM peak with Warragamba Dam raising project construction traffic (Scenario 1)

2022 Traffic volume AM peak with Warragamba Dam raising project construction traffic (Scenario 2)

2022 Traffic volume PM peak with Warragamba Dam raising project construction traffic (Scenario 2)



Appendix B – SIDRA Intersection analysis output

MOVEMENT SUMMARY

Site: 1 [01-Park Road-Silverdale Road-Mulgoa Road Roundabout-WD 2018 AM]

Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Park Road											
1	L2	68	20.0	0.176	4.1	LOS A	1.0	7.4	0.33	0.59	47.7
3a	R1	127	4.1	0.176	6.6	LOS A	1.0	7.4	0.33	0.59	49.1
3u	U	1	0.0	0.176	9.1	LOS A	1.0	7.4	0.33	0.59	29.3
Approach		197	9.6	0.176	5.8	LOS A	1.0	7.4	0.33	0.59	48.6
NorthEast: Mulgoa Road											
24a	L1	76	6.9	0.215	6.6	LOS A	1.2	9.4	0.55	0.69	46.4
26a	R1	113	15.9	0.215	9.7	LOS A	1.2	9.4	0.55	0.69	51.2
26u	U	2	0.0	0.215	11.8	LOS A	1.2	9.4	0.55	0.69	52.6
Approach		191	12.2	0.215	8.5	LOS A	1.2	9.4	0.55	0.69	49.8
West: Silverdale Road											
10a	L1	407	2.1	0.578	5.2	LOS A	4.3	31.2	0.42	0.59	52.7
12	R2	329	8.6	0.578	9.0	LOS A	4.3	31.2	0.42	0.59	46.2
12u	U	1	0.0	0.578	10.6	LOS A	4.3	31.2	0.42	0.59	53.3
Approach		738	5.0	0.578	6.9	LOS A	4.3	31.2	0.42	0.59	50.5
All Vehicles		1125	7.0	0.578	7.0	LOS A	4.3	31.2	0.43	0.61	50.1

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2 [02-Silverdale Road-Farnsworth Avenue-WD 2018 AM]

Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Farnsworth Avenue											
2	T1	121	4.3	0.134	6.6	LOS A	0.6	4.3	0.52	0.64	51.1
3	R2	3	33.3	0.134	11.7	LOS A	0.6	4.3	0.52	0.64	52.5
3u	U	1	0.0	0.134	12.9	LOS A	0.6	4.3	0.52	0.64	54.8
Approach		125	5.0	0.134	6.8	LOS A	0.6	4.3	0.52	0.64	51.2
East: Silverdale Road East											
4	L2	1	0.0	0.413	4.3	LOS A	1.8	13.6	0.15	0.62	51.5
6	R2	602	6.5	0.413	8.8	LOS A	1.8	13.6	0.15	0.62	49.0
6u	U	1	0.0	0.413	10.7	LOS A	1.8	13.6	0.15	0.62	53.3
Approach		604	6.4	0.413	8.8	LOS A	1.8	13.6	0.15	0.62	49.0
North: Silverdale Road North											
7	L2	168	13.8	0.142	4.2	LOS A	0.5	3.9	0.03	0.49	52.0
8	T1	46	15.9	0.142	4.3	LOS A	0.5	3.9	0.03	0.49	54.0
9u	U	2	0.0	0.142	10.5	LOS A	0.5	3.9	0.03	0.49	52.2
Approach		217	14.1	0.142	4.3	LOS A	0.5	3.9	0.03	0.49	52.5
All Vehicles		946	8.0	0.413	7.5	LOS A	1.8	13.6	0.17	0.59	50.0

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 3 [03-Production Avenue-Warradale Road- WD 2018 AM]

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Warradale Road South											
1	L2	3	33.3	0.100	5.0	LOS A	0.1	0.6	0.03	0.04	48.6
2	T1	169	1.2	0.100	0.0	LOS A	0.1	0.6	0.03	0.04	49.6
3	R2	12	18.2	0.100	5.0	LOS A	0.1	0.6	0.03	0.04	48.6
Approach		184	2.9	0.100	0.4	NA	0.1	0.6	0.03	0.04	49.5
East: Production Avenue East											
4	L2	13	0.0	0.009	7.6	LOS A	0.0	0.3	0.16	0.90	44.9
5	T1	1	0.0	0.009	7.7	LOS A	0.0	0.3	0.16	0.90	44.8
6	R2	1	0.0	0.009	8.0	LOS A	0.0	0.3	0.16	0.90	43.7
Approach		15	0.0	0.009	7.7	LOS A	0.0	0.3	0.16	0.90	44.8
North: Warradale Road North											
7	L2	2	0.0	0.047	4.9	LOS A	0.0	0.3	0.06	0.06	48.8
8	T1	76	5.6	0.047	0.0	LOS A	0.0	0.3	0.06	0.06	49.3
9	R2	7	0.0	0.047	5.0	LOS A	0.0	0.3	0.06	0.06	48.4
Approach		85	4.9	0.047	0.6	NA	0.0	0.3	0.06	0.06	49.2
West: Production Avenue West											
10	L2	3	0.0	0.005	7.9	LOS A	0.0	0.1	0.26	0.90	44.0
11	T1	2	50.0	0.005	10.2	LOS A	0.0	0.1	0.26	0.90	44.1
12	R2	1	0.0	0.005	8.0	LOS A	0.0	0.1	0.26	0.90	44.6
Approach		6	16.7	0.005	8.7	LOS A	0.0	0.1	0.26	0.90	44.1
All Vehicles		291	3.6	0.100	1.0	NA	0.1	0.6	0.05	0.11	49.0

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 4 [04-Silverdale Road-Warradale Road Intersection- WD 2018 AM]

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Silverdale Road North											
25	T1	142	12.6	0.094	0.4	LOS A	0.2	1.5	0.18	0.09	57.7
26	R2	24	0.0	0.094	7.1	LOS A	0.2	1.5	0.18	0.09	51.8
Approach		166	10.8	0.094	1.3	NA	0.2	1.5	0.18	0.09	57.0
NorthWest: Warradale Road											
27	L2	52	0.0	0.058	9.4	LOS A	0.2	1.6	0.48	0.90	42.7
29	R2	8	12.5	0.058	10.0	LOS A	0.2	1.6	0.48	0.90	44.2
Approach		60	1.8	0.058	9.5	LOS A	0.2	1.6	0.48	0.90	43.0
SouthWest: Silverdale Road South											
30	L2	15	0.0	0.263	5.6	LOS A	0.0	0.0	0.00	0.02	57.1
31	T1	487	4.5	0.263	0.0	LOS A	0.0	0.0	0.00	0.02	59.7
Approach		502	4.4	0.263	0.2	NA	0.0	0.0	0.00	0.02	59.6
All Vehicles		728	5.6	0.263	1.2	NA	0.2	1.6	0.08	0.11	57.6

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 5 [05-Silverdale Road-Marsh Road Intersection- WD 2018 AM]

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Silverdale Road South											
11	T1	45	9.3	0.230	0.7	LOS A	0.0	0.0	0.00	0.48	55.6
3a	R1	362	4.7	0.230	3.3	LOS A	0.0	0.0	0.00	0.48	52.6
Approach		407	5.2	0.230	3.0	NA	0.0	0.0	0.00	0.48	52.9
NorthEast: Silverdale Road East											
24a	L1	141	14.2	0.091	5.4	LOS A	0.0	0.3	0.04	0.56	48.1
26b	R3	5	0.0	0.091	7.4	LOS A	0.0	0.3	0.04	0.56	49.7
Approach		146	13.7	0.091	5.5	NA	0.0	0.3	0.04	0.56	48.2
North: Marsh Road											
7b	L3	16	0.0	0.067	9.6	LOS A	0.2	1.4	0.41	0.98	47.6
5	T1	40	2.6	0.067	9.5	LOS A	0.2	1.4	0.41	0.98	40.0
Approach		56	1.9	0.067	9.5	LOS A	0.2	1.4	0.41	0.98	42.8
All Vehicles		609	6.9	0.230	4.2	NA	0.2	1.4	0.05	0.54	50.4

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 6 [06-Farnsworth Avenue-Production Avenue- WD 2018 AM]

Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Production Avenue											
1	L2	1	100.0	0.017	4.2	LOS A	0.1	0.6	0.22	0.49	44.8
22	T1	7	0.0	0.017	3.4	LOS A	0.1	0.6	0.22	0.49	46.2
3	R2	8	62.5	0.017	8.3	LOS A	0.1	0.6	0.22	0.49	48.2
3u	U	1	0.0	0.017	9.3	LOS A	0.1	0.6	0.22	0.49	48.2
Approach		18	35.3	0.017	6.0	LOS A	0.1	0.6	0.22	0.49	47.3
NorthEast: Farnsworth Avenue East											
4	L2	8	12.5	0.077	4.3	LOS A	0.4	2.7	0.13	0.57	49.0
5	T1	29	3.6	0.077	4.5	LOS A	0.4	2.7	0.13	0.57	50.3
26	R2	67	3.1	0.077	8.7	LOS A	0.4	2.7	0.13	0.57	50.1
6u	U	1	0.0	0.077	10.6	LOS A	0.4	2.7	0.13	0.57	54.5
Approach		106	4.0	0.077	7.2	LOS A	0.4	2.7	0.13	0.57	50.1
NorthWest: Fourth Street											
27	L2	89	0.0	0.085	3.4	LOS A	0.4	3.0	0.22	0.46	50.3
28	T1	3	0.0	0.085	3.4	LOS A	0.4	3.0	0.22	0.46	47.0
29	R2	8	12.5	0.085	7.7	LOS A	0.4	3.0	0.22	0.46	45.4
29u	U	7	0.0	0.085	9.3	LOS A	0.4	3.0	0.22	0.46	47.0
Approach		108	1.0	0.085	4.1	LOS A	0.4	3.0	0.22	0.46	49.8
SouthWest: Farnsworth Avenue West											
30	L2	53	0.0	0.094	3.4	LOS A	0.4	2.9	0.22	0.43	43.7
11	T1	54	3.9	0.094	3.4	LOS A	0.4	2.9	0.22	0.43	51.5
12	R2	6	0.0	0.094	7.6	LOS A	0.4	2.9	0.22	0.43	47.4
12u	U	5	0.0	0.094	9.3	LOS A	0.4	2.9	0.22	0.43	47.9
Approach		118	1.8	0.094	3.9	LOS A	0.4	2.9	0.22	0.43	48.3
All Vehicles		351	3.9	0.094	5.1	LOS A	0.4	3.0	0.19	0.48	49.2

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 7 [07-Northern Road-Park Road Intersection- WD 2018 AM]

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northern Road South											
4	L2	51	12.5	0.426	5.7	LOS A	0.0	0.0	0.00	0.04	57.3
5	T1	701	4.4	0.426	0.1	LOS A	0.0	0.0	0.00	0.04	59.5
Approach		752	4.9	0.426	0.4	NA	0.0	0.0	0.00	0.04	59.4
North: Northern Road North											
11	T1	503	8.6	0.277	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	68	27.7	0.082	9.7	LOS A	0.4	3.2	0.66	0.80	49.1
Approach		572	10.9	0.277	1.2	NA	0.4	3.2	0.08	0.10	58.4
West: Park Road											
1	L2	332	7.0	0.747	20.8	LOS B	6.0	45.4	0.84	1.38	45.6
3	R2	62	20.3	0.747	37.8	LOS C	6.0	45.4	0.84	1.38	42.6
Approach		394	9.1	0.747	23.5	LOS B	6.0	45.4	0.84	1.38	45.1
All Vehicles		1717	7.8	0.747	6.0	NA	6.0	45.4	0.22	0.37	55.1

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Park Road-Silverdale Road-Mulgoa Road Roundabout- WD 2018 PM]

Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Park Road											
1	L2	368	6.6	0.560	8.0	LOS A	4.6	34.1	0.76	0.85	45.7
3a	R1	111	2.9	0.560	10.5	LOS A	4.6	34.1	0.76	0.85	46.4
3u	U	3	0.0	0.560	13.0	LOS A	4.6	34.1	0.76	0.85	25.0
Approach		482	5.7	0.560	8.6	LOS A	4.6	34.1	0.76	0.85	45.8
NorthEast: Mulgoa Road											
24a	L1	135	6.3	0.455	5.3	LOS A	3.4	24.5	0.41	0.60	46.7
26a	R1	418	3.5	0.455	8.1	LOS A	3.4	24.5	0.41	0.60	51.9
26u	U	12	0.0	0.455	10.6	LOS A	3.4	24.5	0.41	0.60	52.9
Approach		564	4.1	0.455	7.5	LOS A	3.4	24.5	0.41	0.60	51.0
West: Silverdale Road											
10a	L1	192	2.7	0.254	4.9	LOS A	1.4	9.9	0.31	0.57	53.2
12	R2	117	3.6	0.254	8.6	LOS A	1.4	9.9	0.31	0.57	47.0
12u	U	1	0.0	0.254	10.2	LOS A	1.4	9.9	0.31	0.57	53.8
Approach		309	3.1	0.254	6.3	LOS A	1.4	9.9	0.31	0.57	51.4
All Vehicles		1356	4.4	0.560	7.6	LOS A	4.6	34.1	0.51	0.68	49.7

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2 [Silverdale Road-Farnsworth Avenue- WD 2018 PM]

Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Farnsworth Avenue											
2	T1	82	1.3	0.071	4.8	LOS A	0.3	1.8	0.28	0.48	52.9
3	R2	1	0.0	0.071	9.2	LOS A	0.3	1.8	0.28	0.48	55.0
3u	U	1	0.0	0.071	11.2	LOS A	0.3	1.8	0.28	0.48	55.9
Approach		84	1.3	0.071	4.9	LOS A	0.3	1.8	0.28	0.48	52.9
East: Silverdale Road East											
4	L2	3	33.3	0.184	5.0	LOS A	0.6	4.7	0.22	0.64	50.3
6	R2	227	4.2	0.184	9.0	LOS A	0.6	4.7	0.22	0.64	48.9
6u	U	1	0.0	0.184	11.0	LOS A	0.6	4.7	0.22	0.64	53.1
Approach		232	4.5	0.184	9.0	LOS A	0.6	4.7	0.22	0.64	49.0
North: Silverdale Road North											
7	L2	582	7.8	0.440	4.2	LOS A	1.9	14.3	0.03	0.49	52.4
8	T1	147	2.9	0.440	4.2	LOS A	1.9	14.3	0.03	0.49	54.7
9u	U	1	0.0	0.440	10.5	LOS A	1.9	14.3	0.03	0.49	52.4
Approach		731	6.8	0.440	4.2	LOS A	1.9	14.3	0.03	0.49	52.9
All Vehicles		1046	5.8	0.440	5.3	LOS A	1.9	14.3	0.09	0.52	51.9

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 3 [Production Avenue-Warradale Road- WD 2018 PM]

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Warradale Road South											
1	L2	13	0.0	0.051	4.6	LOS A	0.0	0.2	0.02	0.09	48.9
2	T1	79	0.0	0.051	0.0	LOS A	0.0	0.2	0.02	0.09	49.3
3	R2	3	0.0	0.051	4.7	LOS A	0.0	0.2	0.02	0.09	48.6
Approach		95	0.0	0.051	0.8	NA	0.0	0.2	0.02	0.09	49.2
East: Production Avenue East											
4	L2	16	0.0	0.011	7.6	LOS A	0.0	0.3	0.16	0.89	44.9
5	T1	1	0.0	0.011	7.4	LOS A	0.0	0.3	0.16	0.89	44.8
6	R2	1	0.0	0.011	7.6	LOS A	0.0	0.3	0.16	0.89	43.7
Approach		18	0.0	0.011	7.6	LOS A	0.0	0.3	0.16	0.89	44.8
North: Warradale Road North											
7	L2	1	0.0	0.042	4.7	LOS A	0.0	0.2	0.03	0.04	49.1
8	T1	73	2.9	0.042	0.0	LOS A	0.0	0.2	0.03	0.04	49.6
9	R2	4	0.0	0.042	4.8	LOS A	0.0	0.2	0.03	0.04	48.7
Approach		78	2.7	0.042	0.3	NA	0.0	0.2	0.03	0.04	49.6
West: Production Avenue West											
10	L2	1	0.0	0.004	7.6	LOS A	0.0	0.1	0.18	0.90	44.1
11	T1	1	0.0	0.004	7.4	LOS A	0.0	0.1	0.18	0.90	44.9
12	R2	3	0.0	0.004	7.6	LOS A	0.0	0.1	0.18	0.90	44.7
Approach		5	0.0	0.004	7.6	LOS A	0.0	0.1	0.18	0.90	44.6
All Vehicles		196	1.1	0.051	1.4	NA	0.0	0.3	0.04	0.16	48.7

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 4 [Silverdale Road-Warradale Road Intersection- WD 2018 PM]

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Silverdale Road North											
25	T1	548	4.0	0.321	0.1	LOS A	0.5	3.9	0.10	0.07	58.5
26	R2	68	3.1	0.321	6.3	LOS A	0.5	3.9	0.10	0.07	52.6
Approach		617	3.9	0.321	0.8	NA	0.5	3.9	0.10	0.07	58.0
NorthWest: Warradale Road											
27	L2	37	0.0	0.044	8.0	LOS A	0.2	1.1	0.27	0.90	43.1
29	R2	15	0.0	0.044	9.9	LOS A	0.2	1.1	0.27	0.90	45.1
Approach		52	0.0	0.044	8.5	LOS A	0.2	1.1	0.27	0.90	43.8
SouthWest: Silverdale Road South											
30	L2	16	0.0	0.104	5.5	LOS A	0.0	0.0	0.00	0.05	56.7
31	T1	179	7.6	0.104	0.0	LOS A	0.0	0.0	0.00	0.05	59.3
Approach		195	7.0	0.104	0.5	NA	0.0	0.0	0.00	0.05	59.1
All Vehicles		863	4.4	0.321	1.2	NA	0.5	3.9	0.09	0.11	57.3

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 5 [Silverdale Road-Marsh Road Intersection- WD 2018 PM]

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Silverdale Road South											
11	T1	33	0.0	0.121	0.7	LOS A	0.0	0.0	0.00	0.46	55.9
3a	R1	181	6.4	0.121	3.3	LOS A	0.0	0.0	0.00	0.46	52.6
Approach		214	5.4	0.121	2.9	NA	0.0	0.0	0.00	0.46	53.1
NorthEast: Silverdale Road East											
24a	L1	383	5.5	0.231	5.3	LOS A	0.1	0.5	0.02	0.57	48.4
26b	R3	9	0.0	0.231	6.9	LOS A	0.1	0.5	0.02	0.57	49.8
Approach		393	5.4	0.231	5.3	NA	0.1	0.5	0.02	0.57	48.5
North: Marsh Road											
7b	L3	7	0.0	0.076	8.8	LOS A	0.2	1.5	0.39	1.01	47.5
5	T1	51	0.0	0.076	9.6	LOS A	0.2	1.5	0.39	1.01	39.9
Approach		58	0.0	0.076	9.5	LOS A	0.2	1.5	0.39	1.01	41.3
All Vehicles		664	4.9	0.231	4.9	NA	0.2	1.5	0.05	0.58	49.0

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 6 [Farnsworth Avenue-Production Avenue- WD 2018 PM]

Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Production Avenue											
1	L2	1	0.0	0.022	3.5	LOS A	0.1	0.6	0.23	0.57	44.0
22	T1	3	0.0	0.022	3.5	LOS A	0.1	0.6	0.23	0.57	44.7
3	R2	22	0.0	0.022	7.6	LOS A	0.1	0.6	0.23	0.57	49.1
3u	U	1	0.0	0.022	9.4	LOS A	0.1	0.6	0.23	0.57	47.0
Approach		27	0.0	0.022	7.1	LOS A	0.1	0.6	0.23	0.57	48.4
NorthEast: Farnsworth Avenue East											
4	L2	5	40.0	0.099	4.6	LOS A	0.5	3.5	0.11	0.59	48.5
5	T1	33	0.0	0.099	4.4	LOS A	0.5	3.5	0.11	0.59	50.0
26	R2	102	1.0	0.099	8.6	LOS A	0.5	3.5	0.11	0.59	50.0
6u	U	2	0.0	0.099	10.6	LOS A	0.5	3.5	0.11	0.59	54.2
Approach		142	2.2	0.099	7.5	LOS A	0.5	3.5	0.11	0.59	50.0
NorthWest: Fourth Street											
27	L2	52	0.0	0.055	3.2	LOS A	0.3	1.8	0.16	0.44	50.6
28	T1	9	0.0	0.055	3.2	LOS A	0.3	1.8	0.16	0.44	47.3
29	R2	9	11.1	0.055	7.5	LOS A	0.3	1.8	0.16	0.44	45.9
29u	U	1	0.0	0.055	9.2	LOS A	0.3	1.8	0.16	0.44	47.5
Approach		72	1.5	0.055	3.9	LOS A	0.3	1.8	0.16	0.44	49.6
SouthWest: Farnsworth Avenue West											
30	L2	14	7.7	0.030	3.6	LOS A	0.1	0.9	0.25	0.42	43.5
11	T1	20	0.0	0.030	3.5	LOS A	0.1	0.9	0.25	0.42	51.6
12	R2	1	0.0	0.030	7.7	LOS A	0.1	0.9	0.25	0.42	47.4
12u	U	1	0.0	0.030	9.4	LOS A	0.1	0.9	0.25	0.42	47.9
Approach		36	2.9	0.030	3.9	LOS A	0.1	0.9	0.25	0.42	48.9
All Vehicles		277	1.9	0.099	6.1	LOS A	0.5	3.5	0.15	0.53	49.6

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 7 [Northern Road-Park Road Intersection- WD 2018 PM]

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northern Road South											
4	L2	123	6.8	0.434	5.7	LOS A	0.0	0.0	0.00	0.10	57.1
5	T1	627	7.6	0.434	0.1	LOS A	0.0	0.0	0.00	0.10	59.0
Approach		751	7.4	0.434	1.0	NA	0.0	0.0	0.00	0.10	58.7
North: Northern Road North											
11	T1	631	6.2	0.342	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	247	8.9	0.253	9.3	LOS A	1.2	9.4	0.68	0.88	50.0
Approach		878	7.0	0.342	2.6	NA	1.2	9.4	0.19	0.25	56.7
West: Park Road											
1	L2	97	4.3	0.345	13.1	LOS A	1.4	9.9	0.74	1.06	49.0
3	R2	40	5.3	0.345	30.6	LOS C	1.4	9.9	0.74	1.06	45.6
Approach		137	4.6	0.345	18.3	LOS B	1.4	9.9	0.74	1.06	48.0
All Vehicles		1765	7.0	0.434	3.2	NA	1.4	9.9	0.15	0.25	56.7

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [01-Park Road-Silverdale Road-Mulgoa Road Roundabout-2022 AM Scenario 1]

Park Road-Silverdale Road-Mulgoa Road Roundabout-2022 AM Scenario 1

Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Park Road											
1	L2	233	10.9	0.364	6.1	LOS A	2.4	18.1	0.51	0.64	51.7
3a	R1	146	4.3	0.364	8.6	LOS A	2.4	18.1	0.51	0.64	44.4
3u	U	1	0.0	0.364	11.0	LOS A	2.4	18.1	0.51	0.64	53.4
Approach		380	8.3	0.364	7.1	LOS A	2.4	18.1	0.51	0.64	48.6
NorthEast: Mulgoa Road											
24a	L1	87	7.2	0.340	7.3	LOS A	2.2	16.4	0.66	0.76	51.3
26a	R1	195	10.8	0.340	10.3	LOS A	2.2	16.4	0.66	0.76	50.7
26u	U	2	0.0	0.340	12.5	LOS A	2.2	16.4	0.66	0.76	44.4
Approach		284	9.6	0.340	9.4	LOS A	2.2	16.4	0.66	0.76	50.9
West: Silverdale Road											
10a	L1	467	2.0	0.688	5.5	LOS A	6.3	46.7	0.56	0.62	44.2
12	R2	387	10.9	0.688	9.4	LOS A	6.3	46.7	0.56	0.62	51.9
12u	U	1	0.0	0.688	10.9	LOS A	6.3	46.7	0.56	0.62	52.9
Approach		856	6.0	0.688	7.3	LOS A	6.3	46.7	0.56	0.62	47.3
All Vehicles		1520	7.3	0.688	7.6	LOS A	6.3	46.7	0.57	0.65	48.3

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2 [02-Silverdale Road-Farnsworth Avenue-2022 AM Scenario 1]

Silverdale Road-Farnsworth Avenue Roundabout-2022 AM Scenario 1
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Farnsworth Avenue											
2	T1	148	10.6	0.196	7.4	LOS A	1.0	7.9	0.65	0.73	53.2
3	R2	3	33.3	0.196	12.5	LOS A	1.0	7.9	0.65	0.73	52.0
3u	U	1	0.0	0.196	13.5	LOS A	1.0	7.9	0.65	0.73	54.2
Approach		153	11.0	0.196	7.6	LOS A	1.0	7.9	0.65	0.73	53.2
East: Silverdale Road East											
4	L2	1	0.0	0.579	5.6	LOS A	3.4	25.3	0.48	0.72	50.5
6	R2	691	6.4	0.579	10.2	LOS A	3.4	25.3	0.48	0.72	51.3
6u	U	1	0.0	0.579	12.0	LOS A	3.4	25.3	0.48	0.72	52.3
Approach		693	6.4	0.579	10.2	LOS A	3.4	25.3	0.48	0.72	51.3
North: Silverdale Road North											
7	L2	194	13.6	0.292	4.2	LOS A	1.3	9.8	0.04	0.45	54.5
8	T1	273	6.6	0.292	4.2	LOS A	1.3	9.8	0.04	0.45	56.2
9u	U	2	0.0	0.292	10.5	LOS A	1.3	9.8	0.04	0.45	57.2
Approach		468	9.4	0.292	4.3	LOS A	1.3	9.8	0.04	0.45	55.4
All Vehicles		1314	8.0	0.579	7.8	LOS A	3.4	25.3	0.34	0.62	52.9

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 3 [03-Production Avenue-Warradale Road-2022 AM Scenario 1]

Production Avenue-Warradale Road Intersection-2022 AM Scenario 1
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Warradale Road South											
1	L2	56	1.9	0.144	4.6	LOS A	0.1	0.8	0.03	0.14	48.6
2	T1	195	1.1	0.144	0.0	LOS A	0.1	0.8	0.03	0.14	49.1
3	R2	14	15.4	0.144	5.0	LOS A	0.1	0.8	0.03	0.14	48.1
Approach		264	2.0	0.144	1.3	NA	0.1	0.8	0.03	0.14	49.0
East: Production Avenue East											
4	L2	15	0.0	0.128	7.7	LOS A	0.4	3.0	0.30	0.97	44.8
5	T1	115	8.3	0.128	8.9	LOS A	0.4	3.0	0.30	0.97	44.5
6	R2	1	0.0	0.128	8.8	LOS A	0.4	3.0	0.30	0.97	44.5
Approach		131	7.3	0.128	8.8	LOS A	0.4	3.0	0.30	0.97	44.5
North: Warradale Road North											
7	L2	2	0.0	0.108	5.2	LOS A	0.5	3.8	0.34	0.32	47.0
8	T1	87	6.0	0.108	0.5	LOS A	0.5	3.8	0.34	0.32	47.4
9	R2	114	0.0	0.108	5.2	LOS A	0.5	3.8	0.34	0.32	46.7
Approach		203	2.6	0.108	3.2	NA	0.5	3.8	0.34	0.32	47.0
West: Production Avenue West											
10	L2	3	0.0	0.022	8.0	LOS A	0.1	0.7	0.37	0.99	44.3
11	T1	12	90.9	0.022	13.6	LOS A	0.1	0.7	0.37	0.99	43.0
12	R2	1	0.0	0.022	9.2	LOS A	0.1	0.7	0.37	0.99	44.1
Approach		16	66.7	0.022	12.2	LOS A	0.1	0.7	0.37	0.99	43.3
All Vehicles		614	5.0	0.144	3.8	NA	0.5	3.8	0.20	0.40	47.1

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 4 [04-Silverdale Road-Warradale Road Intersection-2022 AM Scenario 1]

Silverdale Road-Warradale Road Intersection-2022 AM Scenario 1
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Silverdale Road North											
25	T1	163	12.9	0.109	0.5	LOS A	0.2	1.8	0.20	0.09	58.3
26	R2	27	0.0	0.109	7.5	LOS A	0.2	1.8	0.20	0.09	52.6
Approach		191	11.0	0.109	1.5	NA	0.2	1.8	0.20	0.09	57.4
NorthWest: Warradale Road											
27	L2	59	0.0	0.073	9.8	LOS A	0.3	2.0	0.52	0.92	47.1
29	R2	9	11.1	0.073	10.5	LOS A	0.3	2.0	0.52	0.92	46.7
Approach		68	1.5	0.073	9.9	LOS A	0.3	2.0	0.52	0.92	47.1
SouthWest: Silverdale Road South											
30	L2	17	0.0	0.301	5.6	LOS A	0.0	0.0	0.00	0.02	58.1
31	T1	559	4.5	0.301	0.0	LOS A	0.0	0.0	0.00	0.02	59.8
Approach		576	4.4	0.301	0.2	NA	0.0	0.0	0.00	0.02	59.7
All Vehicles		835	5.7	0.301	1.3	NA	0.3	2.0	0.09	0.11	57.9

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 5 [05-Silverdale Road-Marsh Road Intersection-2022 AM Scenario 1]

Silverdale Road-Marsh Road Intersection-2022 AM Scenario 1
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Silverdale Road South											
11	T1	104	5.1	0.174	1.1	LOS A	0.7	5.3	0.03	0.46	51.6
3a	R1	416	4.6	0.174	4.6	LOS A	0.7	5.3	0.03	0.46	54.8
Approach		520	4.7	0.174	3.9	NA	0.7	5.3	0.03	0.46	54.1
NorthEast: Silverdale Road East											
24a	L1	162	14.3	0.104	5.4	LOS A	0.0	0.3	0.02	0.58	52.7
26b	R3	6	0.0	0.104	6.5	LOS A	0.0	0.3	0.02	0.58	49.8
Approach		168	13.8	0.104	5.4	NA	0.0	0.3	0.02	0.58	52.6
North: Marsh Road											
7b	L3	18	0.0	0.085	9.9	LOS A	0.3	1.8	0.45	1.00	47.3
5	T1	46	2.3	0.085	10.2	LOS A	0.3	1.8	0.45	1.00	46.7
Approach		64	1.6	0.085	10.1	LOS A	0.3	1.8	0.45	1.00	46.9
All Vehicles		753	6.4	0.174	4.7	NA	0.7	5.3	0.06	0.53	53.1

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 6 [06-Farnsworth Avenue-Production Avenue-2022 AM Scenario 1]

Farnsworth Avenue-Production Avenue Roundabout-2022 AM Scenario 1
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Production Avenue											
1	L2	1	100.0	0.034	5.0	LOS A	0.1	1.3	0.34	0.54	45.6
22	T1	8	0.0	0.034	3.8	LOS A	0.1	1.3	0.34	0.54	42.7
3	R2	19	83.3	0.034	9.3	LOS A	0.1	1.3	0.34	0.54	47.2
3u	U	1	0.0	0.034	9.7	LOS A	0.1	1.3	0.34	0.54	47.9
Approach		29	57.1	0.034	7.5	LOS A	0.1	1.3	0.34	0.54	45.8
NorthEast: Farnsworth Avenue East											
4	L2	124	8.5	0.236	4.3	LOS A	1.4	9.8	0.16	0.49	50.0
5	T1	139	0.8	0.236	4.5	LOS A	1.4	9.8	0.16	0.49	51.3
26	R2	77	2.7	0.236	8.7	LOS A	1.4	9.8	0.16	0.49	46.6
6u	U	1	0.0	0.236	10.7	LOS A	1.4	9.8	0.16	0.49	55.8
Approach		341	4.0	0.236	5.4	LOS A	1.4	9.8	0.16	0.49	49.7
NorthWest: Fourth Street											
27	L2	103	0.0	0.101	2.4	LOS A	0.5	3.6	0.26	0.39	45.1
28	T1	3	0.0	0.101	2.0	LOS A	0.5	3.6	0.26	0.39	43.3
29	R2	9	11.1	0.101	6.1	LOS A	0.5	3.6	0.26	0.39	43.2
29u	U	8	0.0	0.101	7.4	LOS A	0.5	3.6	0.26	0.39	40.6
Approach		124	0.8	0.101	3.0	LOS A	0.5	3.6	0.26	0.39	44.6
SouthWest: Farnsworth Avenue West											
30	L2	60	0.0	0.111	3.6	LOS A	0.5	3.5	0.26	0.45	42.4
11	T1	62	3.4	0.111	3.6	LOS A	0.5	3.5	0.26	0.45	51.0
12	R2	7	0.0	0.111	7.7	LOS A	0.5	3.5	0.26	0.45	47.9
12u	U	6	0.0	0.111	9.5	LOS A	0.5	3.5	0.26	0.45	48.7
Approach		136	1.6	0.111	4.1	LOS A	0.5	3.5	0.26	0.45	46.6
All Vehicles		631	5.3	0.236	4.7	LOS A	1.4	9.8	0.21	0.47	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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 7 [07-Northern Road-Park Road Intersection-2022 AM Scenario 1]

Northern Road-Park Road Intersection-2022 AM Scenario 1
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northern Road South											
4	L2	128	9.8	0.531	5.7	LOS A	0.0	0.0	0.00	0.08	57.0
5	T1	804	4.3	0.531	0.1	LOS A	0.0	0.0	0.00	0.08	59.1
Approach		933	5.1	0.531	0.9	NA	0.0	0.0	0.00	0.08	58.8
North: Northern Road North											
11	T1	578	8.7	0.319	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	149	17.6	0.228	11.8	LOS A	1.0	8.1	0.75	0.92	48.1
Approach		727	10.6	0.319	2.5	NA	1.0	8.1	0.15	0.19	57.0
West: Park Road											
1	L2	385	7.9	1.353	344.9	LOS F	83.9	642.8	1.00	6.13	8.9
3	R2	76	26.4	1.353	373.9	LOS F	83.9	642.8	1.00	6.13	8.8
Approach		461	11.0	1.353	349.7	LOS F	83.9	642.8	1.00	6.13	8.9
All Vehicles		2121	8.2	1.353	77.2	NA	83.9	642.8	0.27	1.43	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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [01-Park Road-Silverdale Road-Mulgoa Road Roundabout-2022 AM Scenario 2]

Park Road-Silverdale Road-Mulgoa Road Roundabout-2022 AM Scenario 2

Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Park Road											
1	L2	228	8.8	0.357	6.0	LOS A	2.4	17.5	0.50	0.64	51.8
3a	R1	146	4.3	0.357	8.6	LOS A	2.4	17.5	0.50	0.64	44.4
3u	U	1	0.0	0.357	11.0	LOS A	2.4	17.5	0.50	0.64	53.4
Approach		376	7.0	0.357	7.0	LOS A	2.4	17.5	0.50	0.64	48.6
NorthEast: Mulgoa Road											
24a	L1	87	7.2	0.337	7.2	LOS A	2.1	16.2	0.65	0.75	51.4
26a	R1	195	10.8	0.337	10.3	LOS A	2.1	16.2	0.65	0.75	50.8
26u	U	2	0.0	0.337	12.4	LOS A	2.1	16.2	0.65	0.75	44.4
Approach		284	9.6	0.337	9.3	LOS A	2.1	16.2	0.65	0.75	50.9
West: Silverdale Road											
10a	L1	467	2.0	0.682	5.5	LOS A	6.2	45.6	0.56	0.62	44.2
12	R2	383	9.6	0.682	9.4	LOS A	6.2	45.6	0.56	0.62	51.9
12u	U	1	0.0	0.682	10.9	LOS A	6.2	45.6	0.56	0.62	52.9
Approach		852	5.4	0.682	7.3	LOS A	6.2	45.6	0.56	0.62	47.4
All Vehicles		1512	6.6	0.682	7.6	LOS A	6.2	45.6	0.56	0.65	48.3

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2 [02-Silverdale Road-Farnsworth Avenue-2022 AM Scenario 2]

Silverdale Road-Farnsworth Avenue Roundabout-2022 AM Scenario 2
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Farnsworth Avenue											
2	T1	143	7.4	0.186	7.3	LOS A	1.0	7.3	0.64	0.72	53.3
3	R2	3	33.3	0.186	12.5	LOS A	1.0	7.3	0.64	0.72	52.0
3u	U	1	0.0	0.186	13.5	LOS A	1.0	7.3	0.64	0.72	54.2
Approach		147	7.9	0.186	7.5	LOS A	1.0	7.3	0.64	0.72	53.3
East: Silverdale Road East											
4	L2	1	0.0	0.576	5.5	LOS A	3.4	24.9	0.47	0.71	50.5
6	R2	691	6.4	0.576	10.1	LOS A	3.4	24.9	0.47	0.71	51.3
6u	U	1	0.0	0.576	11.9	LOS A	3.4	24.9	0.47	0.71	52.3
Approach		693	6.4	0.576	10.1	LOS A	3.4	24.9	0.47	0.71	51.3
North: Silverdale Road North											
7	L2	194	13.6	0.288	4.2	LOS A	1.3	9.5	0.04	0.45	54.5
8	T1	268	5.1	0.288	4.2	LOS A	1.3	9.5	0.04	0.45	56.2
9u	U	2	0.0	0.288	10.5	LOS A	1.3	9.5	0.04	0.45	57.2
Approach		464	8.6	0.288	4.3	LOS A	1.3	9.5	0.04	0.45	55.5
All Vehicles		1304	7.3	0.576	7.7	LOS A	3.4	24.9	0.34	0.62	52.9

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 3 [03-Production Avenue-Warradale Road-2022 AM Scenario 2]

Production Avenue-Warradale Road Intersection-2022 AM Scenario 2
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Warradale Road South											
1	L2	61	10.3	0.149	4.7	LOS A	0.1	0.9	0.03	0.15	48.5
2	T1	195	1.1	0.149	0.0	LOS A	0.1	0.9	0.03	0.15	49.1
3	R2	14	15.4	0.149	5.0	LOS A	0.1	0.9	0.03	0.15	48.1
Approach		269	3.9	0.149	1.3	NA	0.1	0.9	0.03	0.15	48.9
East: Production Avenue East											
4	L2	15	0.0	0.122	7.7	LOS A	0.4	2.8	0.30	0.97	44.8
5	T1	111	4.8	0.122	8.7	LOS A	0.4	2.8	0.30	0.97	44.5
6	R2	1	0.0	0.122	8.7	LOS A	0.4	2.8	0.30	0.97	44.5
Approach		126	4.2	0.122	8.6	LOS A	0.4	2.8	0.30	0.97	44.6
North: Warradale Road North											
7	L2	2	0.0	0.109	5.2	LOS A	0.5	3.8	0.35	0.32	46.9
8	T1	87	6.0	0.109	0.5	LOS A	0.5	3.8	0.35	0.32	47.4
9	R2	114	0.0	0.109	5.2	LOS A	0.5	3.8	0.35	0.32	46.7
Approach		203	2.6	0.109	3.2	NA	0.5	3.8	0.35	0.32	47.0
West: Production Avenue West											
10	L2	3	0.0	0.027	8.0	LOS A	0.1	0.9	0.40	0.99	43.9
11	T1	7	85.7	0.027	13.3	LOS A	0.1	0.9	0.40	0.99	42.6
12	R2	5	100.0	0.027	14.2	LOS A	0.1	0.9	0.40	0.99	43.0
Approach		16	73.3	0.027	12.4	LOS A	0.1	0.9	0.40	0.99	43.0
All Vehicles		615	5.3	0.149	3.7	NA	0.5	3.8	0.20	0.39	47.2

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 4 [04-Silverdale Road-Warradale Road Intersection-2022 AM Scenario 2]

Silverdale Road-Warradale Road Intersection-2022 AM Scenario 2
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Silverdale Road North											
25	T1	163	12.9	0.110	0.5	LOS A	0.2	1.9	0.20	0.09	58.3
26	R2	27	0.0	0.110	7.6	LOS A	0.2	1.9	0.20	0.09	52.6
Approach		191	11.0	0.110	1.5	NA	0.2	1.9	0.20	0.09	57.4
NorthWest: Warradale Road											
27	L2	59	0.0	0.086	9.9	LOS A	0.3	2.4	0.53	0.93	47.0
29	R2	15	42.9	0.086	12.8	LOS A	0.3	2.4	0.53	0.93	45.6
Approach		74	8.6	0.086	10.5	LOS A	0.3	2.4	0.53	0.93	46.7
SouthWest: Silverdale Road South											
30	L2	22	23.8	0.306	5.8	LOS A	0.0	0.0	0.00	0.02	57.0
31	T1	559	4.5	0.306	0.0	LOS A	0.0	0.0	0.00	0.02	59.8
Approach		581	5.3	0.306	0.3	NA	0.0	0.0	0.00	0.02	59.6
All Vehicles		845	6.8	0.306	1.4	NA	0.3	2.4	0.09	0.12	57.7

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 5 [05-Silverdale Road-Marsh Road Intersection-2022 AM Scenario 2]

Silverdale Road-Marsh Road Intersection-2022 AM Scenario 2
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Silverdale Road South											
11	T1	104	5.1	0.176	1.1	LOS A	0.7	5.4	0.03	0.46	51.6
3a	R1	420	5.8	0.176	4.6	LOS A	0.7	5.4	0.03	0.46	54.8
Approach		524	5.6	0.176	3.9	NA	0.7	5.4	0.03	0.46	54.1
NorthEast: Silverdale Road East											
24a	L1	166	16.5	0.108	5.4	LOS A	0.0	0.3	0.02	0.58	52.6
26b	R3	6	0.0	0.108	6.5	LOS A	0.0	0.3	0.02	0.58	49.8
Approach		173	15.9	0.108	5.5	NA	0.0	0.3	0.02	0.58	52.5
North: Marsh Road											
7b	L3	18	0.0	0.087	9.9	LOS A	0.3	1.9	0.46	1.01	47.2
5	T1	46	2.3	0.087	10.3	LOS A	0.3	1.9	0.46	1.01	46.7
Approach		64	1.6	0.087	10.2	LOS A	0.3	1.9	0.46	1.01	46.8
All Vehicles		761	7.6	0.176	4.8	NA	0.7	5.4	0.06	0.53	53.0

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 6 [06-Farnsworth Avenue-Production Avenue-2022 AM Scenario 2]

Farnsworth Avenue-Production Avenue Roundabout-2022 AM Scenario 2
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Production Avenue											
1	L2	1	100.0	0.028	5.0	LOS A	0.1	1.0	0.33	0.53	45.5
22	T1	8	0.0	0.028	3.8	LOS A	0.1	1.0	0.33	0.53	42.7
3	R2	15	71.4	0.028	9.1	LOS A	0.1	1.0	0.33	0.53	47.5
3u	U	1	0.0	0.028	9.7	LOS A	0.1	1.0	0.33	0.53	47.8
Approach		25	45.8	0.028	7.1	LOS A	0.1	1.0	0.33	0.53	45.7
NorthEast: Farnsworth Avenue East											
4	L2	120	5.3	0.231	4.3	LOS A	1.3	9.5	0.16	0.50	50.1
5	T1	139	0.8	0.231	4.5	LOS A	1.3	9.5	0.16	0.50	51.3
26	R2	77	2.7	0.231	8.7	LOS A	1.3	9.5	0.16	0.50	46.6
6u	U	1	0.0	0.231	10.7	LOS A	1.3	9.5	0.16	0.50	55.8
Approach		337	2.8	0.231	5.4	LOS A	1.3	9.5	0.16	0.50	49.7
NorthWest: Fourth Street											
27	L2	103	0.0	0.100	2.3	LOS A	0.5	3.5	0.25	0.39	45.1
28	T1	3	0.0	0.100	2.0	LOS A	0.5	3.5	0.25	0.39	43.3
29	R2	9	11.1	0.100	6.1	LOS A	0.5	3.5	0.25	0.39	43.2
29u	U	8	0.0	0.100	7.4	LOS A	0.5	3.5	0.25	0.39	40.6
Approach		124	0.8	0.100	2.9	LOS A	0.5	3.5	0.25	0.39	44.6
SouthWest: Farnsworth Avenue West											
30	L2	60	0.0	0.111	3.5	LOS A	0.5	3.5	0.25	0.44	42.4
11	T1	62	3.4	0.111	3.5	LOS A	0.5	3.5	0.25	0.44	51.1
12	R2	7	0.0	0.111	7.7	LOS A	0.5	3.5	0.25	0.44	47.9
12u	U	6	0.0	0.111	9.4	LOS A	0.5	3.5	0.25	0.44	48.8
Approach		136	1.6	0.111	4.0	LOS A	0.5	3.5	0.25	0.44	46.6
All Vehicles		622	3.9	0.231	4.7	LOS A	1.3	9.5	0.20	0.46	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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 7 [07-Northern Road-Park Road Intersection-2022 AM Scenario 2]

Northern Road-Park Road Intersection-2022 AM Scenario 2
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northern Road South											
4	L2	125	7.6	0.528	5.7	LOS A	0.0	0.0	0.00	0.08	57.2
5	T1	804	4.3	0.528	0.1	LOS A	0.0	0.0	0.00	0.08	59.1
Approach		929	4.8	0.528	0.9	NA	0.0	0.0	0.00	0.08	58.8
North: Northern Road North											
11	T1	578	8.7	0.319	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	147	15.7	0.218	11.4	LOS A	1.0	7.6	0.75	0.91	48.4
Approach		725	10.2	0.319	2.4	NA	1.0	7.6	0.15	0.18	57.1
West: Park Road											
1	L2	382	7.4	1.293	292.5	LOS F	73.6	560.4	1.00	5.63	10.2
3	R2	74	24.3	1.293	321.4	LOS F	73.6	560.4	1.00	5.63	10.1
Approach		456	10.2	1.293	297.2	LOS F	73.6	560.4	1.00	5.63	10.2
All Vehicles		2111	7.8	1.293	65.4	NA	73.6	560.4	0.27	1.31	28.8

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [01-Park Road-Silverdale Road-Mulgoa Road Roundabout-2022 PM Scenario 1]

Park Road-Silverdale Road-Mulgoa Road Roundabout-2022 PM Scenario 1

Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Park Road											
1	L2	433	8.5	0.733	13.8	LOS A	8.8	65.7	0.95	1.07	47.2
3a	R1	126	2.5	0.733	16.1	LOS B	8.8	65.7	0.95	1.07	41.0
3u	U	3	0.0	0.733	18.6	LOS B	8.8	65.7	0.95	1.07	48.5
Approach		562	7.1	0.733	14.3	LOS A	8.8	65.7	0.95	1.07	45.6
NorthEast: Mulgoa Road											
24a	L1	155	6.1	0.644	8.3	LOS A	6.4	46.6	0.75	0.79	50.6
26a	R1	480	3.5	0.644	11.0	LOS A	6.4	46.6	0.75	0.79	50.3
26u	U	14	0.0	0.644	13.5	LOS A	6.4	46.6	0.75	0.79	43.8
Approach		648	4.1	0.644	10.4	LOS A	6.4	46.6	0.75	0.79	50.2
West: Silverdale Road											
10a	L1	285	2.2	0.470	5.1	LOS A	3.4	24.4	0.43	0.61	44.3
12	R2	288	5.1	0.470	8.9	LOS A	3.4	24.4	0.43	0.61	52.3
12u	U	1	0.0	0.470	10.5	LOS A	3.4	24.4	0.43	0.61	53.1
Approach		575	3.7	0.470	7.0	LOS A	3.4	24.4	0.43	0.61	48.0
All Vehicles		1785	4.9	0.733	10.6	LOS A	8.8	65.7	0.71	0.82	48.0

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2 [02-Silverdale Road-Farnsworth Avenue-2022 PM Scenario 1]

Silverdale Road-Farnsworth Avenue Roundabout-2022 PM Scenario 1
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Farnsworth Avenue											
2	T1	315	3.3	0.276	5.2	LOS A	1.2	8.7	0.37	0.52	54.7
3	R2	1	0.0	0.276	9.5	LOS A	1.2	8.7	0.37	0.52	54.6
3u	U	1	0.0	0.276	11.5	LOS A	1.2	8.7	0.37	0.52	55.6
Approach		317	3.3	0.276	5.2	LOS A	1.2	8.7	0.37	0.52	54.7
East: Silverdale Road East											
4	L2	3	33.3	0.215	5.2	LOS A	0.8	5.7	0.26	0.65	50.2
6	R2	261	4.0	0.215	9.2	LOS A	0.8	5.7	0.26	0.65	52.1
6u	U	1	0.0	0.215	11.1	LOS A	0.8	5.7	0.26	0.65	53.0
Approach		265	4.4	0.215	9.1	LOS A	0.8	5.7	0.26	0.65	52.0
North: Silverdale Road North											
7	L2	668	7.7	0.514	4.2	LOS A	2.6	19.7	0.03	0.48	54.7
8	T1	179	8.2	0.514	4.2	LOS A	2.6	19.7	0.03	0.48	56.2
9u	U	1	0.0	0.514	10.5	LOS A	2.6	19.7	0.03	0.48	57.2
Approach		848	7.8	0.514	4.2	LOS A	2.6	19.7	0.03	0.48	55.0
All Vehicles		1431	6.2	0.514	5.3	LOS A	2.6	19.7	0.15	0.52	54.4

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 3 [03-Production Avenue-Warradale Road-2022 PM Scenario 1]

Production Avenue-Warradale Road Intersection-2022 PM Scenario 1
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Warradale Road South											
1	L2	15	0.0	0.058	4.6	LOS A	0.0	0.2	0.02	0.09	49.0
2	T1	91	0.0	0.058	0.0	LOS A	0.0	0.2	0.02	0.09	49.4
3	R2	3	0.0	0.058	4.8	LOS A	0.0	0.2	0.02	0.09	48.7
Approach		108	0.0	0.058	0.8	NA	0.0	0.2	0.02	0.09	49.4
East: Production Avenue East											
4	L2	18	0.0	0.024	7.7	LOS A	0.1	0.8	0.18	0.98	45.0
5	T1	9	100.0	0.024	10.3	LOS A	0.1	0.8	0.18	0.98	44.1
6	R2	1	0.0	0.024	8.5	LOS A	0.1	0.8	0.18	0.98	44.7
Approach		28	33.3	0.024	8.9	LOS A	0.1	0.8	0.18	0.98	44.7
North: Warradale Road North											
7	L2	1	0.0	0.049	4.8	LOS A	0.0	0.2	0.03	0.04	49.2
8	T1	83	6.3	0.049	0.0	LOS A	0.0	0.2	0.03	0.04	49.7
9	R2	5	0.0	0.049	4.8	LOS A	0.0	0.2	0.03	0.04	48.9
Approach		89	5.9	0.049	0.4	NA	0.0	0.2	0.03	0.04	49.6
West: Production Avenue West											
10	L2	106	0.0	0.213	7.8	LOS A	0.8	5.9	0.22	0.93	45.0
11	T1	115	8.3	0.213	8.0	LOS A	0.8	5.9	0.22	0.93	44.7
12	R2	56	0.0	0.213	8.0	LOS A	0.8	5.9	0.22	0.93	44.8
Approach		277	3.4	0.213	7.9	LOS A	0.8	5.9	0.22	0.93	44.9
All Vehicles		503	4.8	0.213	5.1	NA	0.8	5.9	0.14	0.59	46.6

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 4 [04-Silverdale Road-Warradale Road Intersection-2022 PM Scenario 1]

Silverdale Road-Warradale Road Intersection-2022 PM Scenario 1
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Silverdale Road North											
25	T1	629	4.0	0.370	0.1	LOS A	0.7	4.9	0.12	0.07	58.9
26	R2	79	2.7	0.370	6.5	LOS A	0.7	4.9	0.12	0.07	53.1
Approach		708	3.9	0.370	0.8	NA	0.7	4.9	0.12	0.07	58.2
NorthWest: Warradale Road											
27	L2	42	0.0	0.054	8.1	LOS A	0.2	1.3	0.30	0.90	47.5
29	R2	17	0.0	0.054	10.6	LOS A	0.2	1.3	0.30	0.90	47.5
Approach		59	0.0	0.054	8.8	LOS A	0.2	1.3	0.30	0.90	47.5
SouthWest: Silverdale Road South											
30	L2	18	0.0	0.119	5.6	LOS A	0.0	0.0	0.00	0.05	57.9
31	T1	205	7.7	0.119	0.0	LOS A	0.0	0.0	0.00	0.05	59.5
Approach		223	7.1	0.119	0.5	NA	0.0	0.0	0.00	0.05	59.4
All Vehicles		991	4.4	0.370	1.2	NA	0.7	4.9	0.10	0.11	57.7

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 5 [05-Silverdale Road-Marsh Road Intersection-2022 PM Scenario 1]

Silverdale Road-Marsh Road Intersection-2022 PM Scenario 1
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Silverdale Road South											
11	T1	38	0.0	0.080	1.1	LOS A	0.3	2.4	0.06	0.46	51.4
3a	R1	207	6.6	0.080	4.6	LOS A	0.3	2.4	0.06	0.46	54.5
Approach		245	5.6	0.080	4.1	NA	0.3	2.4	0.06	0.46	54.0
NorthEast: Silverdale Road East											
24a	L1	440	5.5	0.271	5.3	LOS A	0.2	1.1	0.02	0.58	53.1
26b	R3	24	0.0	0.271	6.3	LOS A	0.2	1.1	0.02	0.58	49.8
Approach		464	5.2	0.271	5.3	NA	0.2	1.1	0.02	0.58	52.9
North: Marsh Road											
7b	L3	8	0.0	0.179	9.0	LOS A	0.5	3.7	0.48	1.03	47.1
5	T1	111	0.0	0.179	10.5	LOS A	0.5	3.7	0.48	1.03	46.6
Approach		119	0.0	0.179	10.4	LOS A	0.5	3.7	0.48	1.03	46.6
All Vehicles		828	4.6	0.271	5.7	NA	0.5	3.7	0.10	0.61	52.2

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 6 [06-Farnsworth Avenue-Production Avenue-2022 PM Scenario 1]

Farnsworth Avenue-Production Avenue Roundabout-2022 PM Scenario 1
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Production Avenue											
1	L2	1	0.0	0.123	3.7	LOS A	0.5	3.7	0.28	0.61	44.9
22	T1	3	0.0	0.123	3.6	LOS A	0.5	3.7	0.28	0.61	41.8
3	R2	140	6.8	0.123	7.9	LOS A	0.5	3.7	0.28	0.61	48.5
3u	U	1	0.0	0.123	9.5	LOS A	0.5	3.7	0.28	0.61	46.6
Approach		145	6.5	0.123	7.8	LOS A	0.5	3.7	0.28	0.61	48.2
NorthEast: Farnsworth Avenue East											
4	L2	16	73.3	0.123	5.0	LOS A	0.7	5.0	0.13	0.58	48.1
5	T1	38	0.0	0.123	4.4	LOS A	0.7	5.0	0.13	0.58	50.0
26	R2	117	0.9	0.123	8.7	LOS A	0.7	5.0	0.13	0.58	45.5
6u	U	2	0.0	0.123	10.6	LOS A	0.7	5.0	0.13	0.58	54.2
Approach		173	7.3	0.123	7.4	LOS A	0.7	5.0	0.13	0.58	46.8
NorthWest: Fourth Street											
27	L2	59	0.0	0.078	3.2	LOS A	0.4	2.8	0.43	0.47	44.8
28	T1	11	0.0	0.078	2.8	LOS A	0.4	2.8	0.43	0.47	43.0
29	R2	12	18.2	0.078	7.1	LOS A	0.4	2.8	0.43	0.47	42.8
29u	U	1	0.0	0.078	8.2	LOS A	0.4	2.8	0.43	0.47	40.3
Approach		82	2.6	0.078	3.8	LOS A	0.4	2.8	0.43	0.47	44.2
SouthWest: Farnsworth Avenue West											
30	L2	16	6.7	0.133	4.3	LOS A	0.6	4.4	0.39	0.48	42.2
11	T1	128	0.0	0.133	4.2	LOS A	0.6	4.4	0.39	0.48	50.7
12	R2	1	0.0	0.133	8.4	LOS A	0.6	4.4	0.39	0.48	47.6
12u	U	1	0.0	0.133	10.1	LOS A	0.6	4.4	0.39	0.48	48.4
Approach		146	0.7	0.133	4.3	LOS A	0.6	4.4	0.39	0.48	49.6
All Vehicles		546	4.6	0.133	6.1	LOS A	0.7	5.0	0.28	0.54	47.5

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 7 [07-Northern Road-Park Road Intersection-2022 PM Scenario 1]

Northern Road-Park Road Intersection-2022 PM Scenario 1
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northern Road South											
4	L2	146	10.1	0.503	5.7	LOS A	0.0	0.0	0.00	0.10	56.9
5	T1	720	7.5	0.503	0.1	LOS A	0.0	0.0	0.00	0.10	58.9
Approach		866	7.9	0.503	1.0	NA	0.0	0.0	0.00	0.10	58.6
North: Northern Road North											
11	T1	724	6.3	0.393	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	288	10.2	0.366	11.6	LOS A	2.0	15.4	0.75	0.97	48.4
Approach		1013	7.4	0.393	3.3	NA	2.0	15.4	0.21	0.28	56.1
West: Park Road											
1	L2	247	3.8	1.957	882.5	LOS F	139.0	1005.7	1.00	7.54	3.8
3	R2	182	4.0	1.957	899.1	LOS F	139.0	1005.7	1.00	7.54	3.8
Approach		429	3.9	1.957	889.6	LOS F	139.0	1005.7	1.00	7.54	3.8
All Vehicles		2308	6.9	1.957	167.4	NA	139.0	1005.7	0.28	1.56	15.8

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [01-Park Road-Silverdale Road-Mulgoa Road Roundabout-2022 PM Scenario 2]

Park Road-Silverdale Road-Mulgoa Road Roundabout-2022 PM Scenario 2

Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Park Road											
1	L2	427	7.6	0.722	13.4	LOS A	8.5	62.8	0.94	1.06	47.4
3a	R1	126	2.5	0.722	15.8	LOS B	8.5	62.8	0.94	1.06	41.1
3u	U	3	0.0	0.722	18.2	LOS B	8.5	62.8	0.94	1.06	48.7
Approach		557	6.4	0.722	14.0	LOS A	8.5	62.8	0.94	1.06	45.9
NorthEast: Mulgoa Road											
24a	L1	155	6.1	0.638	8.0	LOS A	6.3	45.4	0.74	0.78	50.7
26a	R1	480	3.5	0.638	10.8	LOS A	6.3	45.4	0.74	0.78	50.4
26u	U	14	0.0	0.638	13.2	LOS A	6.3	45.4	0.74	0.78	44.0
Approach		648	4.1	0.638	10.2	LOS A	6.3	45.4	0.74	0.78	50.3
West: Silverdale Road											
10a	L1	285	2.2	0.464	5.1	LOS A	3.3	23.7	0.43	0.60	44.3
12	R2	283	3.3	0.464	8.8	LOS A	3.3	23.7	0.43	0.60	52.4
12u	U	1	0.0	0.464	10.5	LOS A	3.3	23.7	0.43	0.60	53.1
Approach		569	2.8	0.464	7.0	LOS A	3.3	23.7	0.43	0.60	48.0
All Vehicles		1775	4.4	0.722	10.4	LOS A	8.5	62.8	0.70	0.81	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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2 [02-Silverdale Road-Farnsworth Avenue-2022 PM Scenario 2]

Silverdale Road-Farnsworth Avenue Roundabout-2022 PM Scenario 2
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Farnsworth Avenue											
2	T1	309	2.0	0.269	5.1	LOS A	1.2	8.4	0.36	0.52	54.7
3	R2	1	0.0	0.269	9.5	LOS A	1.2	8.4	0.36	0.52	54.6
3u	U	1	0.0	0.269	11.5	LOS A	1.2	8.4	0.36	0.52	55.6
Approach		312	2.0	0.269	5.2	LOS A	1.2	8.4	0.36	0.52	54.7
East: Silverdale Road East											
4	L2	3	33.3	0.214	5.1	LOS A	0.8	5.7	0.25	0.65	50.2
6	R2	261	4.0	0.214	9.2	LOS A	0.8	5.7	0.25	0.65	52.1
6u	U	1	0.0	0.214	11.1	LOS A	0.8	5.7	0.25	0.65	53.0
Approach		265	4.4	0.214	9.1	LOS A	0.8	5.7	0.25	0.65	52.1
North: Silverdale Road North											
7	L2	668	7.7	0.509	4.2	LOS A	2.6	19.2	0.03	0.48	54.7
8	T1	174	5.5	0.509	4.2	LOS A	2.6	19.2	0.03	0.48	56.3
9u	U	1	0.0	0.509	10.5	LOS A	2.6	19.2	0.03	0.48	57.2
Approach		843	7.2	0.509	4.2	LOS A	2.6	19.2	0.03	0.48	55.0
All Vehicles		1420	5.6	0.509	5.3	LOS A	2.6	19.2	0.14	0.52	54.4

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 3 [03-Production Avenue-Warradale Road-2022 PM Scenario 2]

Production Avenue-Warradale Road Intersection-2022 PM Scenario 2
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Warradale Road South											
1	L2	19	27.8	0.062	4.8	LOS A	0.0	0.2	0.02	0.10	48.5
2	T1	91	0.0	0.062	0.0	LOS A	0.0	0.2	0.02	0.10	49.5
3	R2	3	0.0	0.062	4.8	LOS A	0.0	0.2	0.02	0.10	48.7
Approach		113	4.7	0.062	1.0	NA	0.0	0.2	0.02	0.10	49.3
East: Production Avenue East											
4	L2	18	0.0	0.019	7.7	LOS A	0.1	0.6	0.17	0.95	45.0
5	T1	5	100.0	0.019	10.3	LOS A	0.1	0.6	0.17	0.95	44.1
6	R2	1	0.0	0.019	8.4	LOS A	0.1	0.6	0.17	0.95	44.7
Approach		24	21.7	0.019	8.5	LOS A	0.1	0.6	0.17	0.95	44.8
North: Warradale Road North											
7	L2	1	0.0	0.048	4.8	LOS A	0.0	0.2	0.03	0.04	49.2
8	T1	83	2.5	0.048	0.0	LOS A	0.0	0.2	0.03	0.04	49.7
9	R2	5	0.0	0.048	4.8	LOS A	0.0	0.2	0.03	0.04	48.9
Approach		89	2.4	0.048	0.4	NA	0.0	0.2	0.03	0.04	49.6
West: Production Avenue West											
10	L2	106	0.0	0.216	7.8	LOS A	0.8	6.0	0.22	0.92	45.0
11	T1	111	4.8	0.216	7.9	LOS A	0.8	6.0	0.22	0.92	44.8
12	R2	61	8.6	0.216	8.4	LOS A	0.8	6.0	0.22	0.92	44.7
Approach		278	3.8	0.216	7.9	LOS A	0.8	6.0	0.22	0.92	44.9
All Vehicles		504	4.6	0.216	5.0	NA	0.8	6.0	0.14	0.58	46.6

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 4 [04-Silverdale Road-Warradale Road Intersection-2022 PM Scenario 2]

Silverdale Road-Warradale Road Intersection-2022 PM Scenario 2
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Silverdale Road North											
25	T1	629	4.0	0.370	0.1	LOS A	0.7	4.9	0.12	0.07	58.9
26	R2	79	2.7	0.370	6.5	LOS A	0.7	4.9	0.12	0.07	53.1
Approach		708	3.9	0.370	0.9	NA	0.7	4.9	0.12	0.07	58.2
NorthWest: Warradale Road											
27	L2	42	0.0	0.070	8.1	LOS A	0.2	1.8	0.32	0.91	47.2
29	R2	22	23.8	0.070	12.7	LOS A	0.2	1.8	0.32	0.91	46.4
Approach		64	8.2	0.070	9.7	LOS A	0.2	1.8	0.32	0.91	46.9
SouthWest: Silverdale Road South											
30	L2	23	22.7	0.124	5.8	LOS A	0.0	0.0	0.00	0.06	56.8
31	T1	205	7.7	0.124	0.0	LOS A	0.0	0.0	0.00	0.06	59.5
Approach		228	9.2	0.124	0.6	NA	0.0	0.0	0.00	0.06	59.2
All Vehicles		1001	5.4	0.370	1.4	NA	0.7	4.9	0.10	0.12	57.5

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 5 [05-Silverdale Road-Marsh Road Intersection-2022 PM Scenario 2]

Silverdale Road-Marsh Road Intersection-2022 PM Scenario 2
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Silverdale Road South											
11	T1	38	0.0	0.082	1.1	LOS A	0.3	2.5	0.04	0.47	51.4
3a	R1	218	8.2	0.082	4.6	LOS A	0.3	2.5	0.04	0.47	54.5
Approach		256	7.0	0.082	4.1	NA	0.3	2.5	0.04	0.47	54.1
NorthEast: Silverdale Road East											
24a	L1	444	6.4	0.268	5.3	LOS A	0.1	0.5	0.01	0.58	53.1
26b	R3	11	0.0	0.268	6.3	LOS A	0.1	0.5	0.01	0.58	49.8
Approach		455	6.3	0.268	5.3	NA	0.1	0.5	0.01	0.58	53.0
North: Marsh Road											
7b	L3	8	0.0	0.180	9.0	LOS A	0.5	3.7	0.48	1.03	47.1
5	T1	111	0.0	0.180	10.6	LOS A	0.5	3.7	0.48	1.03	46.6
Approach		119	0.0	0.180	10.5	LOS A	0.5	3.7	0.48	1.03	46.6
All Vehicles		829	5.6	0.268	5.7	NA	0.5	3.7	0.08	0.61	52.3

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 6 [06-Farnsworth Avenue-Production Avenue-2022 PM Scenario 2]

Farnsworth Avenue-Production Avenue Roundabout-2022 PM Scenario 2
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Production Avenue											
1	L2	1	0.0	0.118	3.7	LOS A	0.5	3.4	0.27	0.61	44.9
22	T1	3	0.0	0.118	3.6	LOS A	0.5	3.4	0.27	0.61	41.8
3	R2	136	3.9	0.118	7.8	LOS A	0.5	3.4	0.27	0.61	48.6
3u	U	1	0.0	0.118	9.5	LOS A	0.5	3.4	0.27	0.61	46.7
Approach		141	3.7	0.118	7.7	LOS A	0.5	3.4	0.27	0.61	48.3
NorthEast: Farnsworth Avenue East											
4	L2	11	70.0	0.118	4.9	LOS A	0.6	4.7	0.13	0.58	48.2
5	T1	38	0.0	0.118	4.4	LOS A	0.6	4.7	0.13	0.58	50.0
26	R2	117	0.9	0.118	8.7	LOS A	0.6	4.7	0.13	0.58	45.5
6u	U	2	0.0	0.118	10.6	LOS A	0.6	4.7	0.13	0.58	54.2
Approach		167	5.0	0.118	7.5	LOS A	0.6	4.7	0.13	0.58	46.7
NorthWest: Fourth Street											
27	L2	59	0.0	0.077	3.2	LOS A	0.4	2.7	0.42	0.47	44.8
28	T1	11	0.0	0.077	2.8	LOS A	0.4	2.7	0.42	0.47	43.0
29	R2	12	18.2	0.077	7.1	LOS A	0.4	2.7	0.42	0.47	42.8
29u	U	1	0.0	0.077	8.2	LOS A	0.4	2.7	0.42	0.47	40.3
Approach		82	2.6	0.077	3.7	LOS A	0.4	2.7	0.42	0.47	44.2
SouthWest: Farnsworth Avenue West											
30	L2	16	6.7	0.132	4.3	LOS A	0.6	4.4	0.39	0.47	42.2
11	T1	128	0.0	0.132	4.2	LOS A	0.6	4.4	0.39	0.47	50.8
12	R2	1	0.0	0.132	8.3	LOS A	0.6	4.4	0.39	0.47	47.6
12u	U	1	0.0	0.132	10.1	LOS A	0.6	4.4	0.39	0.47	48.4
Approach		146	0.7	0.132	4.2	LOS A	0.6	4.4	0.39	0.47	49.6
All Vehicles		537	3.1	0.132	6.1	LOS A	0.6	4.7	0.28	0.54	47.5

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 7 [07-Northern Road-Park Road Intersection-2022 PM Scenario 2]

Northern Road-Park Road Intersection-2022 PM Scenario 2
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northern Road South											
4	L2	146	8.6	0.502	5.7	LOS A	0.0	0.0	0.00	0.10	56.9
5	T1	720	7.5	0.502	0.1	LOS A	0.0	0.0	0.00	0.10	58.9
Approach		866	7.7	0.502	1.0	NA	0.0	0.0	0.00	0.10	58.6
North: Northern Road North											
11	T1	724	6.3	0.393	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	286	9.6	0.360	11.5	LOS A	2.0	15.0	0.75	0.97	48.5
Approach		1011	7.2	0.393	3.3	NA	2.0	15.0	0.21	0.27	56.2
West: Park Road											
1	L2	245	3.0	1.892	824.0	LOS F	132.9	954.2	1.00	7.41	4.1
3	R2	180	2.9	1.892	840.8	LOS F	132.9	954.2	1.00	7.41	4.0
Approach		425	3.0	1.892	831.1	LOS F	132.9	954.2	1.00	7.41	4.1
All Vehicles		2302	6.6	1.892	155.4	NA	132.9	954.2	0.28	1.53	16.7

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Park Road-Silverdale Road-Mulgoa Road Roundabout-2022 AM without Dev]

Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Park Road											
1	L2	79	20.0	0.207	4.2	LOS A	1.2	9.0	0.37	0.60	47.6
3a	R1	146	4.3	0.207	6.7	LOS A	1.2	9.0	0.37	0.60	49.0
3u	U	1	0.0	0.207	9.3	LOS A	1.2	9.0	0.37	0.60	29.1
Approach		226	9.8	0.207	5.9	LOS A	1.2	9.0	0.37	0.60	48.4
NorthEast: Mulgoa Road											
24a	L1	87	7.2	0.262	7.0	LOS A	1.6	12.1	0.62	0.73	46.0
26a	R1	129	16.3	0.262	10.2	LOS A	1.6	12.1	0.62	0.73	50.9
26u	U	2	0.0	0.262	12.2	LOS A	1.6	12.1	0.62	0.73	52.4
Approach		219	12.5	0.262	8.9	LOS A	1.6	12.1	0.62	0.73	49.5
West: Silverdale Road											
10a	L1	467	2.0	0.673	5.5	LOS A	5.9	42.7	0.53	0.62	52.4
12	R2	378	8.6	0.673	9.4	LOS A	5.9	42.7	0.53	0.62	45.8
12u	U	1	0.0	0.673	10.9	LOS A	5.9	42.7	0.53	0.62	53.0
Approach		846	5.0	0.673	7.2	LOS A	5.9	42.7	0.53	0.62	50.1
All Vehicles		1292	7.1	0.673	7.3	LOS A	5.9	42.7	0.52	0.63	49.8

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2 [Silverdale Road-Farnsworth Avenue-2022 AM without Dev]

Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Farnsworth Avenue											
2	T1	139	4.5	0.164	7.2	LOS A	0.8	5.7	0.58	0.68	50.8
3	R2	3	33.3	0.164	12.5	LOS A	0.8	5.7	0.58	0.68	52.3
3u	U	1	0.0	0.164	13.5	LOS A	0.8	5.7	0.58	0.68	54.5
Approach		143	5.1	0.164	7.4	LOS A	0.8	5.7	0.58	0.68	50.8
East: Silverdale Road East											
4	L2	1	0.0	0.474	4.3	LOS A	2.3	17.1	0.17	0.62	51.4
6	R2	691	6.4	0.474	8.9	LOS A	2.3	17.1	0.17	0.62	48.9
6u	U	1	0.0	0.474	10.7	LOS A	2.3	17.1	0.17	0.62	53.2
Approach		693	6.4	0.474	8.8	LOS A	2.3	17.1	0.17	0.62	48.9
North: Silverdale Road North											
7	L2	194	13.6	0.161	4.2	LOS A	0.6	4.7	0.03	0.49	52.0
8	T1	53	16.0	0.161	4.3	LOS A	0.6	4.7	0.03	0.49	54.0
9u	U	2	0.0	0.161	10.5	LOS A	0.6	4.7	0.03	0.49	52.2
Approach		248	14.0	0.161	4.3	LOS A	0.6	4.7	0.03	0.49	52.5
All Vehicles		1084	8.0	0.474	7.6	LOS A	2.3	17.1	0.20	0.60	49.9

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 3 [Production Avenue-Warradale Road-2022 AM without Dev]

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Warradale Road South											
1	L2	3	33.3	0.114	5.1	LOS A	0.1	0.7	0.03	0.04	48.6
2	T1	195	1.1	0.114	0.0	LOS A	0.1	0.7	0.03	0.04	49.6
3	R2	14	15.4	0.114	5.0	LOS A	0.1	0.7	0.03	0.04	48.6
Approach		212	2.5	0.114	0.4	NA	0.1	0.7	0.03	0.04	49.5
East: Production Avenue East											
4	L2	15	0.0	0.011	7.7	LOS A	0.0	0.3	0.17	0.89	44.9
5	T1	1	0.0	0.011	7.8	LOS A	0.0	0.3	0.17	0.89	44.8
6	R2	1	0.0	0.011	8.1	LOS A	0.0	0.3	0.17	0.89	43.7
Approach		17	0.0	0.011	7.7	LOS A	0.0	0.3	0.17	0.89	44.8
North: Warradale Road North											
7	L2	2	0.0	0.054	5.0	LOS A	0.1	0.4	0.07	0.06	48.8
8	T1	87	6.0	0.054	0.1	LOS A	0.1	0.4	0.07	0.06	49.3
9	R2	8	0.0	0.054	5.0	LOS A	0.1	0.4	0.07	0.06	48.4
Approach		98	5.4	0.054	0.6	NA	0.1	0.4	0.07	0.06	49.2
West: Production Avenue West											
10	L2	3	0.0	0.006	8.0	LOS A	0.0	0.1	0.28	0.90	43.9
11	T1	2	50.0	0.006	10.4	LOS A	0.0	0.1	0.28	0.90	44.1
12	R2	1	0.0	0.006	8.1	LOS A	0.0	0.1	0.28	0.90	44.5
Approach		6	16.7	0.006	8.8	LOS A	0.0	0.1	0.28	0.90	44.1
All Vehicles		333	3.5	0.114	1.0	NA	0.1	0.7	0.06	0.11	49.0

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 4 [Silverdale Road-Warradale Road Intersection-2022 AM without Dev]

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Silverdale Road North											
25	T1	163	12.9	0.109	0.5	LOS A	0.2	1.8	0.20	0.09	57.6
26	R2	27	0.0	0.109	7.5	LOS A	0.2	1.8	0.20	0.09	51.7
Approach		191	11.0	0.109	1.5	NA	0.2	1.8	0.20	0.09	56.9
NorthWest: Warradale Road											
27	L2	59	0.0	0.073	9.8	LOS A	0.3	2.0	0.52	0.92	42.4
29	R2	9	11.1	0.073	10.5	LOS A	0.3	2.0	0.52	0.92	43.9
Approach		68	1.5	0.073	9.9	LOS A	0.3	2.0	0.52	0.92	42.6
SouthWest: Silverdale Road South											
30	L2	17	0.0	0.301	5.6	LOS A	0.0	0.0	0.00	0.02	57.1
31	T1	559	4.5	0.301	0.0	LOS A	0.0	0.0	0.00	0.02	59.7
Approach		576	4.4	0.301	0.2	NA	0.0	0.0	0.00	0.02	59.6
All Vehicles		835	5.7	0.301	1.3	NA	0.3	2.0	0.09	0.11	57.5

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 5 [Silverdale Road-Marsh Road Intersection-2022 AM without Dev]

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Silverdale Road South											
11	T1	52	10.2	0.263	0.7	LOS A	0.0	0.0	0.00	0.48	55.5
3a	R1	416	4.6	0.263	3.3	LOS A	0.0	0.0	0.00	0.48	52.5
Approach		467	5.2	0.263	3.0	NA	0.0	0.0	0.00	0.48	52.9
NorthEast: Silverdale Road East											
24a	L1	162	14.3	0.105	5.5	LOS A	0.0	0.4	0.05	0.56	48.1
26b	R3	6	0.0	0.105	7.7	LOS A	0.0	0.4	0.05	0.56	49.7
Approach		168	13.8	0.105	5.5	NA	0.0	0.4	0.05	0.56	48.2
North: Marsh Road											
7b	L3	18	0.0	0.083	9.9	LOS A	0.3	1.8	0.45	1.00	47.4
5	T1	46	2.3	0.083	10.0	LOS A	0.3	1.8	0.45	1.00	39.7
Approach		64	1.6	0.083	10.0	LOS A	0.3	1.8	0.45	1.00	42.5
All Vehicles		700	6.9	0.263	4.3	NA	0.3	1.8	0.05	0.55	50.4

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 6 [Farnsworth Avenue-Production Avenue-2022 AM without Dev]

Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Production Avenue											
1	L2	1	100.0	0.019	4.3	LOS A	0.1	0.6	0.24	0.49	44.8
22	T1	8	0.0	0.019	3.4	LOS A	0.1	0.6	0.24	0.49	46.2
3	R2	9	66.7	0.019	8.5	LOS A	0.1	0.6	0.24	0.49	48.1
3u	U	1	0.0	0.019	9.3	LOS A	0.1	0.6	0.24	0.49	48.2
Approach		20	36.8	0.019	6.1	LOS A	0.1	0.6	0.24	0.49	47.3
NorthEast: Farnsworth Avenue East											
4	L2	9	11.1	0.088	4.3	LOS A	0.4	3.1	0.14	0.57	49.0
5	T1	34	3.1	0.088	4.5	LOS A	0.4	3.1	0.14	0.57	50.2
26	R2	77	2.7	0.088	8.7	LOS A	0.4	3.1	0.14	0.57	50.1
6u	U	1	0.0	0.088	10.7	LOS A	0.4	3.1	0.14	0.57	54.5
Approach		121	3.5	0.088	7.2	LOS A	0.4	3.1	0.14	0.57	50.0
NorthWest: Fourth Street											
27	L2	103	0.0	0.099	3.5	LOS A	0.5	3.5	0.24	0.46	50.2
28	T1	3	0.0	0.099	3.5	LOS A	0.5	3.5	0.24	0.46	47.0
29	R2	9	11.1	0.099	7.8	LOS A	0.5	3.5	0.24	0.46	45.4
29u	U	8	0.0	0.099	9.4	LOS A	0.5	3.5	0.24	0.46	46.8
Approach		124	0.8	0.099	4.2	LOS A	0.5	3.5	0.24	0.46	49.7
SouthWest: Farnsworth Avenue West											
30	L2	60	0.0	0.110	3.5	LOS A	0.5	3.4	0.24	0.44	43.5
11	T1	62	3.4	0.110	3.5	LOS A	0.5	3.4	0.24	0.44	51.5
12	R2	7	0.0	0.110	7.6	LOS A	0.5	3.4	0.24	0.44	47.4
12u	U	6	0.0	0.110	9.4	LOS A	0.5	3.4	0.24	0.44	47.8
Approach		136	1.6	0.110	4.0	LOS A	0.5	3.4	0.24	0.44	48.2
All Vehicles		401	3.7	0.110	5.1	LOS A	0.5	3.5	0.21	0.49	49.2

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 7 [Northern Road-Park Road Intersection-2022 AM without Dev]

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northern Road South											
4	L2	58	12.7	0.488	5.8	LOS A	0.0	0.0	0.00	0.04	57.3
5	T1	804	4.3	0.488	0.1	LOS A	0.0	0.0	0.00	0.04	59.5
Approach		862	4.9	0.488	0.5	NA	0.0	0.0	0.00	0.04	59.3
North: Northern Road North											
11	T1	578	8.7	0.319	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	79	26.7	0.115	11.0	LOS A	0.5	4.2	0.70	0.88	48.3
Approach		657	10.9	0.319	1.4	NA	0.5	4.2	0.08	0.11	58.2
West: Park Road											
1	L2	380	6.9	1.123	149.3	LOS F	42.9	323.9	1.00	3.94	17.3
3	R2	72	20.6	1.123	174.6	LOS F	42.9	323.9	1.00	3.94	16.9
Approach		452	9.1	1.123	153.3	LOS F	42.9	323.9	1.00	3.94	17.3
All Vehicles		1971	7.9	1.123	35.8	NA	42.9	323.9	0.26	0.96	37.9

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [01-Park Road-Silverdale Road-Mulgoa Road Roundabout-2022 PM Without Dev]

Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Park Road											
1	L2	423	6.5	0.686	12.4	LOS A	7.4	54.5	0.88	1.01	48.1
3a	R1	126	2.5	0.686	14.9	LOS B	7.4	54.5	0.88	1.01	41.6
3u	U	3	0.0	0.686	17.3	LOS B	7.4	54.5	0.88	1.01	49.3
Approach		553	5.5	0.686	13.0	LOS A	7.4	54.5	0.88	1.01	46.4
NorthEast: Mulgoa Road											
24a	L1	155	6.1	0.532	5.6	LOS A	4.4	31.7	0.49	0.62	52.0
26a	R1	480	3.5	0.532	8.4	LOS A	4.4	31.7	0.49	0.62	51.7
26u	U	14	0.0	0.532	10.9	LOS A	4.4	31.7	0.49	0.62	44.9
Approach		648	4.1	0.532	7.8	LOS A	4.4	31.7	0.49	0.62	51.6
West: Silverdale Road											
10a	L1	220	2.9	0.297	5.0	LOS A	1.7	12.4	0.36	0.58	44.7
12	R2	134	3.9	0.297	8.7	LOS A	1.7	12.4	0.36	0.58	52.9
12u	U	1	0.0	0.297	10.4	LOS A	1.7	12.4	0.36	0.58	53.6
Approach		355	3.3	0.297	6.4	LOS A	1.7	12.4	0.36	0.58	47.5
All Vehicles		1556	4.4	0.686	9.3	LOS A	7.4	54.5	0.60	0.75	48.7

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2 [02-Silverdale Road-Farnsworth Avenue-2022 PM Without Dev]

Silverdale Road-Farnsworth Avenue Roundabout-2022 PM Without Dev
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Farnsworth Avenue											
2	T1	95	1.1	0.083	4.9	LOS A	0.3	2.2	0.31	0.49	55.0
3	R2	1	0.0	0.083	9.3	LOS A	0.3	2.2	0.31	0.49	54.8
3u	U	1	0.0	0.083	11.3	LOS A	0.3	2.2	0.31	0.49	55.8
Approach		97	1.1	0.083	5.0	LOS A	0.3	2.2	0.31	0.49	55.0
East: Silverdale Road East											
4	L2	3	33.3	0.213	5.1	LOS A	0.8	5.6	0.25	0.65	50.2
6	R2	261	4.0	0.213	9.1	LOS A	0.8	5.6	0.25	0.65	52.1
6u	U	1	0.0	0.213	11.0	LOS A	0.8	5.6	0.25	0.65	53.0
Approach		265	4.4	0.213	9.1	LOS A	0.8	5.6	0.25	0.65	52.1
North: Silverdale Road North											
7	L2	668	7.7	0.505	4.2	LOS A	2.5	18.4	0.03	0.48	54.7
8	T1	169	3.1	0.505	4.2	LOS A	2.5	18.4	0.03	0.48	56.3
9u	U	1	0.0	0.505	10.5	LOS A	2.5	18.4	0.03	0.48	57.3
Approach		839	6.8	0.505	4.2	LOS A	2.5	18.4	0.03	0.48	55.1
All Vehicles		1201	5.8	0.505	5.3	LOS A	2.5	18.4	0.10	0.52	54.3

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 3 [03-Production Avenue-Warradale Road-2022 PM Without Dev]

Production Avenue-Warradale Road Intersection-2022 PM Without Dev
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Warradale Road South											
1	L2	15	0.0	0.058	4.6	LOS A	0.0	0.2	0.02	0.09	49.0
2	T1	91	0.0	0.058	0.0	LOS A	0.0	0.2	0.02	0.09	49.4
3	R2	3	0.0	0.058	4.8	LOS A	0.0	0.2	0.02	0.09	48.7
Approach		108	0.0	0.058	0.8	NA	0.0	0.2	0.02	0.09	49.4
East: Production Avenue East											
4	L2	18	0.0	0.013	7.7	LOS A	0.1	0.4	0.17	0.89	45.0
5	T1	1	0.0	0.013	7.5	LOS A	0.1	0.4	0.17	0.89	44.8
6	R2	1	0.0	0.013	7.7	LOS A	0.1	0.4	0.17	0.89	44.8
Approach		20	0.0	0.013	7.7	LOS A	0.1	0.4	0.17	0.89	45.0
North: Warradale Road North											
7	L2	1	0.0	0.048	4.8	LOS A	0.0	0.2	0.03	0.04	49.2
8	T1	83	2.5	0.048	0.0	LOS A	0.0	0.2	0.03	0.04	49.7
9	R2	5	0.0	0.048	4.8	LOS A	0.0	0.2	0.03	0.04	48.9
Approach		89	2.4	0.048	0.4	NA	0.0	0.2	0.03	0.04	49.6
West: Production Avenue West											
10	L2	1	0.0	0.005	7.7	LOS A	0.0	0.1	0.19	0.89	45.1
11	T1	1	0.0	0.005	7.5	LOS A	0.0	0.1	0.19	0.89	44.9
12	R2	3	0.0	0.005	7.7	LOS A	0.0	0.1	0.19	0.89	44.8
Approach		5	0.0	0.005	7.7	LOS A	0.0	0.1	0.19	0.89	44.9
All Vehicles		223	0.9	0.058	1.4	NA	0.1	0.4	0.04	0.16	48.9

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 4 [04-Silverdale Road-Warradale Road Intersection-2022 PM Without Dev]

Silverdale Road-Warradale Road Intersection-2022 PM Without Dev
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Silverdale Road North											
25	T1	629	4.0	0.370	0.1	LOS A	0.7	4.9	0.12	0.07	58.9
26	R2	79	2.7	0.370	6.5	LOS A	0.7	4.9	0.12	0.07	53.1
Approach		708	3.9	0.370	0.8	NA	0.7	4.9	0.12	0.07	58.2
NorthWest: Warradale Road											
27	L2	42	0.0	0.054	8.1	LOS A	0.2	1.3	0.30	0.90	47.5
29	R2	17	0.0	0.054	10.6	LOS A	0.2	1.3	0.30	0.90	47.5
Approach		59	0.0	0.054	8.8	LOS A	0.2	1.3	0.30	0.90	47.5
SouthWest: Silverdale Road South											
30	L2	18	0.0	0.119	5.6	LOS A	0.0	0.0	0.00	0.05	57.9
31	T1	205	7.7	0.119	0.0	LOS A	0.0	0.0	0.00	0.05	59.5
Approach		223	7.1	0.119	0.5	NA	0.0	0.0	0.00	0.05	59.4
All Vehicles		991	4.4	0.370	1.2	NA	0.7	4.9	0.10	0.11	57.7

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 5 [05-Silverdale Road-Marsh Road Intersection-2022 PM Without Dev]

Silverdale Road-Marsh Road Intersection-2022 PM Without Dev
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Silverdale Road South											
11	T1	38	0.0	0.080	1.1	LOS A	0.3	2.4	0.06	0.46	51.4
3a	R1	207	6.6	0.080	4.6	LOS A	0.3	2.4	0.06	0.46	54.5
Approach		245	5.6	0.080	4.1	NA	0.3	2.4	0.06	0.46	54.0
NorthEast: Silverdale Road East											
24a	L1	440	5.5	0.271	5.3	LOS A	0.2	1.1	0.02	0.58	53.1
26b	R3	24	0.0	0.271	6.3	LOS A	0.2	1.1	0.02	0.58	49.8
Approach		464	5.2	0.271	5.3	NA	0.2	1.1	0.02	0.58	52.9
North: Marsh Road											
7b	L3	8	0.0	0.096	8.9	LOS A	0.3	1.9	0.43	1.03	47.2
5	T1	58	0.0	0.096	10.3	LOS A	0.3	1.9	0.43	1.03	46.7
Approach		66	0.0	0.096	10.2	LOS A	0.3	1.9	0.43	1.03	46.7
All Vehicles		776	4.9	0.271	5.3	NA	0.3	2.4	0.07	0.58	52.6

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 6 [06-Farnsworth Avenue-Production Avenue-2022 PM Without Dev]

Farnsworth Avenue-Production Avenue Roundabout-2022 PM Without Dev
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Production Avenue											
1	L2	1	0.0	0.025	3.6	LOS A	0.1	0.6	0.25	0.58	45.2
22	T1	3	0.0	0.025	3.5	LOS A	0.1	0.6	0.25	0.58	42.0
3	R2	25	0.0	0.025	7.7	LOS A	0.1	0.6	0.25	0.58	49.0
3u	U	1	0.0	0.025	9.5	LOS A	0.1	0.6	0.25	0.58	46.9
Approach		31	0.0	0.025	7.2	LOS A	0.1	0.6	0.25	0.58	48.0
NorthEast: Farnsworth Avenue East											
4	L2	6	33.3	0.113	4.5	LOS A	0.6	4.1	0.11	0.59	48.6
5	T1	38	0.0	0.113	4.4	LOS A	0.6	4.1	0.11	0.59	50.0
26	R2	117	0.9	0.113	8.6	LOS A	0.6	4.1	0.11	0.59	45.5
6u	U	2	0.0	0.113	10.6	LOS A	0.6	4.1	0.11	0.59	54.2
Approach		163	1.9	0.113	7.5	LOS A	0.6	4.1	0.11	0.59	46.7
NorthWest: Fourth Street											
27	L2	59	0.0	0.062	2.1	LOS A	0.3	2.1	0.17	0.35	45.4
28	T1	11	0.0	0.062	1.7	LOS A	0.3	2.1	0.17	0.35	43.5
29	R2	11	10.0	0.062	5.8	LOS A	0.3	2.1	0.17	0.35	43.5
29u	U	1	0.0	0.062	7.2	LOS A	0.3	2.1	0.17	0.35	40.8
Approach		81	1.3	0.062	2.6	LOS A	0.3	2.1	0.17	0.35	44.8
SouthWest: Farnsworth Avenue West											
30	L2	16	6.7	0.035	3.7	LOS A	0.1	1.0	0.27	0.42	42.5
11	T1	23	0.0	0.035	3.6	LOS A	0.1	1.0	0.27	0.42	51.2
12	R2	1	0.0	0.035	7.7	LOS A	0.1	1.0	0.27	0.42	48.0
12u	U	1	0.0	0.035	9.5	LOS A	0.1	1.0	0.27	0.42	48.8
Approach		41	2.6	0.035	3.9	LOS A	0.1	1.0	0.27	0.42	47.3
All Vehicles		316	1.7	0.113	5.8	LOS A	0.6	4.1	0.16	0.50	46.4

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 7 [07-Northern Road-Park Road Intersection-2022 PM Without Dev]

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northern Road South											
4	L2	141	7.5	0.498	5.7	LOS A	0.0	0.0	0.00	0.10	57.0
5	T1	720	7.5	0.498	0.1	LOS A	0.0	0.0	0.00	0.10	58.9
Approach		861	7.5	0.498	1.0	NA	0.0	0.0	0.00	0.10	58.6
North: Northern Road North											
11	T1	724	6.3	0.393	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	284	8.9	0.351	11.3	LOS A	1.9	14.5	0.74	0.96	48.7
Approach		1008	7.0	0.393	3.2	NA	1.9	14.5	0.21	0.27	56.2
West: Park Road											
1	L2	112	4.7	0.562	19.5	LOS B	2.5	18.0	0.85	1.15	43.4
3	R2	46	4.5	0.562	48.3	LOS D	2.5	18.0	0.85	1.15	40.8
Approach		158	4.7	0.562	27.9	LOS B	2.5	18.0	0.85	1.15	42.6
All Vehicles		2027	7.0	0.562	4.2	NA	2.5	18.0	0.17	0.27	55.8

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 7 [Northern Road-Park Road Intersection-2022 AM Scenario 1]

Northern Road-Park Road Intersection-2022 AM Scenario 1
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northern Road South											
4	L2	128	9.8	0.311	5.7	LOS A	0.0	0.0	0.00	0.14	56.6
5	T1	402	8.6	0.311	0.0	LOS A	0.0	0.0	0.00	0.14	58.6
Approach		531	8.9	0.311	1.4	NA	0.0	0.0	0.00	0.14	58.1
North: Northern Road North											
11	T1	289	17.5	0.168	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R2	149	17.6	0.120	7.8	LOS A	0.6	4.8	0.58	0.72	50.8
Approach		439	17.5	0.168	2.7	NA	0.6	4.8	0.20	0.24	56.5
West: Park Road											
1	L2	385	7.9	0.548	12.6	LOS A	4.2	32.0	0.64	1.10	51.2
3	R2	76	26.4	0.548	21.9	LOS B	4.2	32.0	0.64	1.10	47.4
Approach		461	11.0	0.548	14.1	LOS A	4.2	32.0	0.64	1.10	50.5
All Vehicles		1431	12.2	0.548	5.9	NA	4.2	32.0	0.27	0.48	55.0

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 7 [Northern Road-Park Road Intersection-2022 AM Scenario 2]

Northern Road-Park Road Intersection-2022 AM Scenario 2
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northern Road South											
4	L2	125	7.6	0.308	5.7	LOS A	0.0	0.0	0.00	0.14	56.7
5	T1	402	8.6	0.308	0.0	LOS A	0.0	0.0	0.00	0.14	58.6
Approach		527	8.4	0.308	1.4	NA	0.0	0.0	0.00	0.14	58.2
North: Northern Road North											
11	T1	289	17.5	0.168	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R2	147	15.7	0.116	7.7	LOS A	0.6	4.6	0.57	0.71	50.9
Approach		437	16.9	0.168	2.6	NA	0.6	4.6	0.19	0.24	56.6
West: Park Road											
1	L2	382	7.4	0.532	12.4	LOS A	4.0	30.1	0.63	1.09	51.5
3	R2	74	24.3	0.532	21.1	LOS B	4.0	30.1	0.63	1.09	47.6
Approach		456	10.2	0.532	13.8	LOS A	4.0	30.1	0.63	1.09	50.9
All Vehicles		1420	11.6	0.532	5.7	NA	4.0	30.1	0.26	0.47	55.1

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 7 [Northern Road-Park Road Intersection-2022 PM Scenario 1]

Northern Road-Park Road Intersection-2022 PM Scenario 1
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northern Road South											
4	L2	146	10.1	0.306	5.7	LOS A	0.0	0.0	0.00	0.17	56.3
5	T1	360	14.9	0.306	0.0	LOS A	0.0	0.0	0.00	0.17	58.3
Approach		506	13.5	0.306	1.7	NA	0.0	0.0	0.00	0.17	57.7
North: Northern Road North											
11	T1	362	12.5	0.204	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R2	288	10.2	0.216	7.6	LOS A	1.1	8.6	0.59	0.74	51.1
Approach		651	11.5	0.216	3.4	NA	1.1	8.6	0.26	0.33	55.7
West: Park Road											
1	L2	247	3.8	0.693	14.9	LOS B	5.6	40.3	0.68	1.23	48.7
3	R2	182	4.0	0.693	23.9	LOS B	5.6	40.3	0.68	1.23	45.3
Approach		429	3.9	0.693	18.7	LOS B	5.6	40.3	0.68	1.23	47.2
All Vehicles		1586	10.1	0.693	7.0	NA	5.6	40.3	0.29	0.52	53.7

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 7 [Northern Road-Park Road Intersection-2022 PM Scenario 2]

Northern Road-Park Road Intersection-2022 PM Scenario 2
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northern Road South											
4	L2	146	8.6	0.305	5.7	LOS A	0.0	0.0	0.00	0.17	56.4
5	T1	360	14.9	0.305	0.0	LOS A	0.0	0.0	0.00	0.17	58.3
Approach		506	13.1	0.305	1.7	NA	0.0	0.0	0.00	0.17	57.7
North: Northern Road North											
11	T1	362	12.5	0.204	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R2	286	9.6	0.213	7.6	LOS A	1.1	8.4	0.58	0.73	51.1
Approach		648	11.2	0.213	3.4	NA	1.1	8.4	0.26	0.32	55.7
West: Park Road											
1	L2	245	3.0	0.677	14.4	LOS A	5.3	37.8	0.67	1.21	49.2
3	R2	180	2.9	0.677	23.2	LOS B	5.3	37.8	0.67	1.21	45.6
Approach		425	3.0	0.677	18.1	LOS B	5.3	37.8	0.67	1.21	47.6
All Vehicles		1580	9.6	0.677	6.8	NA	5.3	37.8	0.29	0.51	53.9

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 7 [Northern Road-Park Road Intersection-2022 AM without Dev]

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northern Road South											
4	L2	58	12.7	0.268	5.7	LOS A	0.0	0.0	0.00	0.07	57.1
5	T1	402	8.6	0.268	0.0	LOS A	0.0	0.0	0.00	0.07	59.3
Approach		460	9.2	0.268	0.7	NA	0.0	0.0	0.00	0.07	59.0
North: Northern Road North											
11	T1	289	17.5	0.168	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R2	79	26.7	0.062	7.6	LOS A	0.3	2.6	0.53	0.66	50.5
Approach		368	19.4	0.168	1.6	NA	0.3	2.6	0.11	0.14	57.7
West: Park Road											
1	L2	380	6.9	0.494	11.9	LOS A	3.5	26.4	0.62	1.05	52.3
3	R2	72	20.6	0.494	18.1	LOS B	3.5	26.4	0.62	1.05	48.3
Approach		452	9.1	0.494	12.9	LOS A	3.5	26.4	0.62	1.05	51.6
All Vehicles		1280	12.1	0.494	5.3	NA	3.5	26.4	0.25	0.44	55.8

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.
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 7 [Northern Road-Park Road Intersection-2022 PM Without Dev]

Northern Road-Park Road Intersection-2022 PM Without Dev
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northern Road South											
4	L2	141	7.5	0.301	5.7	LOS A	0.0	0.0	0.00	0.17	56.4
5	T1	360	14.9	0.301	0.0	LOS A	0.0	0.0	0.00	0.17	58.3
Approach		501	12.8	0.301	1.6	NA	0.0	0.0	0.00	0.17	57.8
North: Northern Road North											
11	T1	362	12.5	0.204	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R2	284	8.9	0.208	7.5	LOS A	1.1	8.2	0.58	0.73	51.2
Approach		646	10.9	0.208	3.3	NA	1.1	8.2	0.26	0.32	55.7
West: Park Road											
1	L2	112	4.7	0.216	9.8	LOS A	0.8	6.0	0.53	0.92	53.3
3	R2	46	4.5	0.216	16.5	LOS B	0.8	6.0	0.53	0.92	49.4
Approach		158	4.7	0.216	11.8	LOS A	0.8	6.0	0.53	0.92	52.1
All Vehicles		1305	10.9	0.301	3.7	NA	1.1	8.2	0.19	0.33	56.0

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 3 [Production Avenue-Warradale Road-2022 AM Scenario 1-Signal]

Production Avenue-Warradale Road Intersection-2022 AM Scenario 1
Signals - Fixed Time Isolated Cycle Time = 60 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Warradale Road South											
1	L2	56	1.9	0.620	28.0	LOS B	7.3	51.9	0.95	0.81	37.1
2	T1	195	1.1	0.620	23.4	LOS B	7.3	51.9	0.95	0.81	37.4
3	R2	14	15.4	0.620	28.1	LOS B	7.3	51.9	0.95	0.81	36.8
Approach		264	2.0	0.620	24.6	LOS B	7.3	51.9	0.95	0.81	37.3
East: Production Avenue East											
4	L2	15	0.0	0.684	36.1	LOS C	4.1	30.6	1.00	0.86	34.5
5	T1	115	8.3	0.684	31.5	LOS C	4.1	30.6	1.00	0.86	34.7
6	R2	1	0.0	0.684	36.1	LOS C	4.1	30.6	1.00	0.86	34.3
Approach		131	7.3	0.684	32.1	LOS C	4.1	30.6	1.00	0.86	34.7
North: Warradale Road North											
7	L2	2	0.0	0.679	32.4	LOS C	6.1	43.7	0.99	0.87	35.0
8	T1	87	6.0	0.679	27.9	LOS B	6.1	43.7	0.99	0.87	35.2
9	R2	114	0.0	0.679	32.4	LOS C	6.1	43.7	0.99	0.87	34.8
Approach		203	2.6	0.679	30.5	LOS C	6.1	43.7	0.99	0.87	35.0
West: Production Avenue West											
10	L2	3	0.0	0.114	33.3	LOS C	0.5	5.0	0.94	0.67	34.4
11	T1	12	90.9	0.114	28.7	LOS C	0.5	5.0	0.94	0.67	34.6
12	R2	1	0.0	0.114	33.3	LOS C	0.5	5.0	0.94	0.67	34.3
Approach		16	66.7	0.114	29.9	LOS C	0.5	5.0	0.94	0.67	34.6
All Vehicles		614	5.0	0.684	28.3	LOS B	7.3	51.9	0.97	0.84	35.9

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	24.4	LOS C	0.1	0.1	0.90	0.90
P2	East Full Crossing	53	24.4	LOS C	0.1	0.1	0.90	0.90
P3	North Full Crossing	53	24.4	LOS C	0.1	0.1	0.90	0.90
P4	West Full Crossing	53	22.6	LOS C	0.1	0.1	0.87	0.87
All Pedestrians		211	23.9	LOS C			0.89	0.89

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.

MOVEMENT SUMMARY

Site: 3 [Production Avenue-Warradale Road-2022 PM Scenario 1 - Signal]

Production Avenue-Warradale Road Intersection-2022 PM Scenario 1
Signals - Fixed Time Isolated Cycle Time = 60 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Warradale Road South											
1	L2	15	0.0	0.499	33.4	LOS C	3.2	22.4	0.98	0.77	35.3
2	T1	91	0.0	0.499	28.8	LOS C	3.2	22.4	0.98	0.77	35.6
3	R2	3	0.0	0.499	33.4	LOS C	3.2	22.4	0.98	0.77	35.2
Approach		108	0.0	0.499	29.5	LOS C	3.2	22.4	0.98	0.77	35.5
East: Production Avenue East											
4	L2	18	0.0	0.177	33.3	LOS C	0.8	7.4	0.95	0.70	34.6
5	T1	9	100.0	0.177	28.8	LOS C	0.8	7.4	0.95	0.70	34.8
6	R2	1	0.0	0.177	33.3	LOS C	0.8	7.4	0.95	0.70	34.4
Approach		28	33.3	0.177	31.1	LOS C	0.8	7.4	0.95	0.70	34.7
North: Warradale Road North											
7	L2	5	0.0	0.486	34.4	LOS C	2.7	19.2	0.99	0.76	35.1
8	T1	83	2.5	0.486	29.9	LOS C	2.7	19.2	0.99	0.76	35.3
9	R2	1	0.0	0.486	34.4	LOS C	2.7	19.2	0.99	0.76	35.0
Approach		89	2.4	0.486	30.2	LOS C	2.7	19.2	0.99	0.76	35.3
West: Production Avenue West											
10	L2	106	0.0	0.511	24.6	LOS B	7.0	50.5	0.89	0.78	37.8
11	T1	115	8.3	0.511	20.0	LOS B	7.0	50.5	0.89	0.78	38.1
12	R2	56	0.0	0.511	24.6	LOS B	7.0	50.5	0.89	0.78	37.7
Approach		277	3.4	0.511	22.7	LOS B	7.0	50.5	0.89	0.78	37.9
All Vehicles		503	4.2	0.511	26.0	LOS B	7.0	50.5	0.93	0.77	36.7

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	24.4	LOS C	0.1	0.1	0.90	0.90
P2	East Full Crossing	53	24.4	LOS C	0.1	0.1	0.90	0.90
P3	North Full Crossing	53	20.1	LOS C	0.1	0.1	0.82	0.82
P4	West Full Crossing	53	24.4	LOS C	0.1	0.1	0.90	0.90
All Pedestrians		211	23.3	LOS C			0.88	0.88

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.

MOVEMENT SUMMARY

Site: 3 [Production Avenue-Warradale Road-2022 AM Scenario 2 - Signal]

Production Avenue-Warradale Road Intersection-2022 AM Scenario 2
Signals - Fixed Time Isolated Cycle Time = 60 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Warradale Road South											
1	L2	61	10.3	0.642	28.4	LOS B	7.5	54.6	0.95	0.83	36.9
2	T1	195	1.1	0.642	23.8	LOS B	7.5	54.6	0.95	0.83	37.3
3	R2	14	15.4	0.642	28.5	LOS B	7.5	54.6	0.95	0.83	36.7
Approach		269	3.9	0.642	25.1	LOS B	7.5	54.6	0.95	0.83	37.1
East: Production Avenue East											
4	L2	15	0.0	0.649	35.6	LOS C	3.9	28.5	1.00	0.84	34.6
5	T1	111	4.8	0.649	31.0	LOS C	3.9	28.5	1.00	0.84	34.9
6	R2	1	0.0	0.649	35.6	LOS C	3.9	28.5	1.00	0.84	34.5
Approach		126	4.2	0.649	31.6	LOS C	3.9	28.5	1.00	0.84	34.8
North: Warradale Road North											
7	L2	2	0.0	0.679	32.4	LOS C	6.1	43.7	0.99	0.87	35.0
8	T1	87	6.0	0.679	27.9	LOS B	6.1	43.7	0.99	0.87	35.2
9	R2	114	0.0	0.679	32.4	LOS C	6.1	43.7	0.99	0.87	34.8
Approach		203	2.6	0.679	30.5	LOS C	6.1	43.7	0.99	0.87	35.0
West: Production Avenue West											
10	L2	3	0.0	0.121	33.4	LOS C	0.5	5.2	0.94	0.68	34.2
11	T1	7	85.7	0.121	28.9	LOS C	0.5	5.2	0.94	0.68	34.4
12	R2	5	100.0	0.121	33.9	LOS C	0.5	5.2	0.94	0.68	33.7
Approach		16	73.3	0.121	32.1	LOS C	0.5	5.2	0.94	0.68	34.1
All Vehicles		615	5.3	0.679	28.4	LOS B	7.5	54.6	0.97	0.84	35.8

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	24.4	LOS C	0.1	0.1	0.90	0.90
P2	East Full Crossing	53	24.4	LOS C	0.1	0.1	0.90	0.90
P3	North Full Crossing	53	24.4	LOS C	0.1	0.1	0.90	0.90
P4	West Full Crossing	53	22.6	LOS C	0.1	0.1	0.87	0.87
All Pedestrians		211	23.9	LOS C			0.89	0.89

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.

MOVEMENT SUMMARY

Site: 3 [Production Avenue-Warradale Road-2022 PM Scenario 2 - Signal]

Production Avenue-Warradale Road Intersection-2022 PM Scenario 2
Signals - Fixed Time Isolated Cycle Time = 60 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Warradale Road South											
1	L2	19	27.8	0.538	33.9	LOS C	3.4	24.5	0.99	0.78	35.0
2	T1	91	0.0	0.538	29.1	LOS C	3.4	24.5	0.99	0.78	35.5
3	R2	3	0.0	0.538	33.7	LOS C	3.4	24.5	0.99	0.78	35.1
Approach		113	4.7	0.538	30.0	LOS C	3.4	24.5	0.99	0.78	35.4
East: Production Avenue East											
4	L2	18	0.0	0.142	33.0	LOS C	0.7	5.8	0.94	0.69	34.5
5	T1	5	100.0	0.142	28.5	LOS B	0.7	5.8	0.94	0.69	34.8
6	R2	1	0.0	0.142	33.0	LOS C	0.7	5.8	0.94	0.69	34.4
Approach		24	21.7	0.142	31.4	LOS C	0.7	5.8	0.94	0.69	34.6
North: Warradale Road North											
7	L2	1	0.0	0.486	34.4	LOS C	2.7	19.2	0.99	0.76	35.1
8	T1	83	2.5	0.486	29.9	LOS C	2.7	19.2	0.99	0.76	35.3
9	R2	5	0.0	0.486	34.4	LOS C	2.7	19.2	0.99	0.76	35.0
Approach		89	2.4	0.486	30.2	LOS C	2.7	19.2	0.99	0.76	35.3
West: Production Avenue West											
10	L2	106	0.0	0.515	24.6	LOS B	7.0	50.9	0.89	0.78	37.8
11	T1	111	4.8	0.515	20.0	LOS B	7.0	50.9	0.89	0.78	38.1
12	R2	61	8.6	0.515	24.7	LOS B	7.0	50.9	0.89	0.78	37.6
Approach		278	3.8	0.515	22.8	LOS B	7.0	50.9	0.89	0.78	37.9
All Vehicles		504	4.6	0.538	26.2	LOS B	7.0	50.9	0.93	0.77	36.7

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	24.4	LOS C	0.1	0.1	0.90	0.90
P2	East Full Crossing	53	24.4	LOS C	0.1	0.1	0.90	0.90
P3	North Full Crossing	53	20.1	LOS C	0.1	0.1	0.82	0.82
P4	West Full Crossing	53	24.4	LOS C	0.1	0.1	0.90	0.90
All Pedestrians		211	23.3	LOS C			0.88	0.88

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.

Appendix C – Detailed crossing closure data

Detailed crossing closure data

Description	Bridge name	Percentile	Current Dam- Hours closed for different chance in a year floods								
			1 in 5	1 in 10	1 in 20	1 in 50	1 in 100	1 in 200	1 in 500	1 in 1000	PMF
Bridge on Cattai Road over Cattai Creek	Cattai Creek Bridge	10%ile	85	104	122	135	142	149	157	164	230
		50%ile	94	124	140	151	157	166	175	181	
		90%ile	117	142	152	164	171	178	188	206	
Bridge on Springwood Road over Hawkesbury River	Yarramundi Bridge	10%ile	62	83	100	112	123	131	138	143	198
		50%ile	72	105	119	131	138	147	154	160	
		90%ile	95	125	136	145	153	159	168	182	
Bridge on Bridge Street over Hawkesbury River	Windsor Bridge (New)	10%ile	52	73	90	104	112	120	128	132	182
		50%ile	59	88	105	116	125	135	145	149	
		90%ile	73	106	120	133	142	149	158	168	
Bridge on Bells Line of Road over Hawkesbury River	North Richmond Bridge	10%ile	40	63	79	94	102	110	118	123	171
		50%ile	49	80	94	108	115	126	136	140	
		90%ile	63	99	112	124	133	141	149	157	
Bridge on Richmond Road over South Creek		10%ile	0	0	0	37	49	57	66	69	108
		50%ile	0	0	0	41	54	64	75	81	
		90%ile	0	0	0	50	65	77	89	97	
Bridge on Hawkesbury Valley Way over South Creek	Jim Anderson Bridge	10%ile	0	0	0	0	0	24	38	43	84
		50%ile	0	0	0	0	0	30	45	52	
		90%ile	0	0	0	0	0	37	56	66	
Bridge on Great Western Hwy over Nepean River	Victoria Bridge	10%ile	0	0	0	0	0	0	0	0	51
		50%ile	0	0	0	0	0	0	0	0	
		90%ile	0	0	0	0	0	0	0	0	

Description	Bridge name	Percentile	Current Dam- Hours closed for different chance in a year floods								
			1 in 5	1 in 10	1 in 20	1 in 50	1 in 100	1 in 200	1 in 500	1 in 1000	PMF
Bridge on M4 Motorway over Nepean River	Penrith Valley Bridge	10%ile	0	0	0	0	0	0	0	0	46
		50%ile	0	0	0	0	0	0	0	0	
		90%ile	0	0	0	0	0	0	0	0	
Bridge on Great Western Hwy over South Creek		10%ile	0	0	0	0	0	0	0	0	40
		50%ile	0	0	0	0	0	0	0	0	
		90%ile	0	0	0	0	0	0	0	0	
Bridge on M4 Motorway over Ropes Creek		10%ile	0	0	0	0	0	0	0	0	18
		50%ile	0	0	0	0	0	0	0	0	
		90%ile	0	0	0	0	0	0	0	0	
Bridge on M4 Motorway over South Creek		10%ile	0	0	0	0	0	0	0	0	0
		50%ile	0	0	0	0	0	0	0	0	
		90%ile	0	0	0	0	0	0	0	0	
Bridge on Silverdale Road over Nepean River	Blaxland Crossing Bridge	10%ile	0	23	37	46	49	51	55	57	93
		50%ile	0	34	49	55	60	64	70	71	
		90%ile	0	54	0	77	82	83	86	91	
Bridge on Cattai Road over Cattai Creek	Cattai Creek Bridge	10%ile	77	200	275	329	322	317	314	308	309
		50%ile	205	333	349	359	348	343	335	328	
		90%ile	356	386	394	397	385	385	355	348	
Bridge on Springwood Road over Hawkesbury River	Yarramundi Bridge	10%ile	51	110	224	307	306	296	290	285	284
		50%ile	81	304	322	344	329	316	309	305	
		90%ile	308	366	367	377	365	339	328	325	

Description	Bridge name	Percentile	Current Dam- Hours closed for different chance in a year floods								
			1 in 5	1 in 10	1 in 20	1 in 50	1 in 100	1 in 200	1 in 500	1 in 1000	PMF
Bridge on Bridge Street over Hawkesbury River	Windsor Bridge (New)	10%ile	96	201	256	338	334	327	324	316	265
		50%ile	209	328	356	369	358	352	343	338	
		90%ile	364	396	404	405	390	391	362	357	
Bridge on Bells Line of Road over Hawkesbury River	North Richmond Bridge	10%ile	0	34	59	90	119	150	164	169	244
		50%ile	0	42	70	128	152	166	179	186	
		90%ile	0	58	99	164	180	188	196	210	
Bridge on Richmond Road over South Creek		10%ile	0	0	0	0	0	17	49	58	112
		50%ile	0	0	0	0	0	28	61	72	
		90%ile	0	0	0	0	0	41	75	92	
Bridge on Hawkesbury Valley Way over South Creek	Jim Anderson Bridge	10%ile	0	0	0	0	0	0	0	38	83
		50%ile	0	0	0	0	0	0	0	29	
		90%ile	0	0	0	0	0	0	0	24	
Bridge on Great Western Hwy over Nepean River	Victoria Bridge	10%ile	0	0	0	0	0	0	0	0	44
		50%ile	0	0	0	0	0	0	0	0	
		90%ile	0	0	0	0	0	0	0	0	
Bridge on M4 Motorway over Nepean River	Penrith Valley Bridge	10%ile	0	0	0	0	0	0	0	0	36
		50%ile	0	0	0	0	0	0	0	0	
		90%ile	0	0	0	0	0	0	0	0	
Bridge on Great Western Hwy over South Creek		10%ile	0	0	0	0	0	0	0	0	16
		50%ile	0	0	0	0	0	0	0	0	
		90%ile	0	0	0	0	0	0	0	0	

Description	Bridge name	Percentile	Current Dam- Hours closed for different chance in a year floods								
			1 in 5	1 in 10	1 in 20	1 in 50	1 in 100	1 in 200	1 in 500	1 in 1000	PMF
Bridge on M4 Motorway over Ropes Creek		10%ile	0	0	0	0	0	0	0	0	0
		50%ile	0	0	0	0	0	0	0	0	
		90%ile	0	0	0	0	0	0	0	0	
Bridge on M4 Motorway over South Creek		10%ile	0	0	0	0	0	0	0	0	0
		50%ile	0	0	0	0	0	0	0	0	
		90%ile	0	0	0	0	0	0	0	0	
Bridge on Silverdale Road over Nepean River	Blaxland Crossing Bridge	10%ile	0	23	33	40	43	46	51	54	88
		50%ile	0	32	44	50	56	60	68	70	
		90%ile	0	45	65	71	73	76	84	87	
Sackville Ferry Crossing		10%ile	56	81	96	110	118	126	132	138	189
		50%ile	66	97	109	123	131	141	149	154	
		90%ile	82	115	126	137	146	155	163	173	
Lower Portland Ferry Crossing		10%ile	26	61	79	91	100	102	107	110	162
		50%ile	44	76	88	102	114	119	125	130	
		90%ile	63	92	106	118	129	137	144	150	
Webbs Creek Ferry Crossing		10%ile	0	3	38	53	62	65	68	73	124
		50%ile	0	5	45	66	75	81	86	92	
		90%ile	0	16	56	78	90	97	106	112	
Wisemans Ferry Crossing		10%ile	0	3	38	53	62	65	68	73	124
		50%ile	0	5	45	66	75	81	86	92	
		90%ile	0	16	56	78	90	97	106	112	

Description	Bridge name	Percentile	Current Dam- Hours closed for different chance in a year floods								
			1 in 5	1 in 10	1 in 20	1 in 50	1 in 100	1 in 200	1 in 500	1 in 1000	PMF
Sackville Ferry Crossing		10%ile	36	64	88	138	140	139	177	198	276
		50%ile	61	108	147	194	208	216	229	239	
		90%ile	139	183	198	224	238	247	263	278	
Lower Portland Ferry Crossing		10%ile	16	34	48	67	82	87	92	96	225
		50%ile	29	58	73	118	141	143	148	162	
		90%ile	54	113	138	168	174	178	189	198	
Webbs Creek Ferry Crossing		10%ile	0	0	8	25	35	45	50	53	136
		50%ile	0	0	15	40	59	70	74	79	
		90%ile	0	0	30	77	93	105	110	116	
Wisemans Ferry Crossing		10%ile	0	0	8	25	35	45	50	53	136
		50%ile	0	0	15	40	59	70	74	79	
		90%ile	0	0	30	77	93	105	110	116	
Penrith Rail Crossing	Nepean River	10%ile	0	0	0	0	0	0	0	0	51
		50%ile	0	0	0	0	0	0	0	0	
		90%ile	0	0	0	0	0	0	0	0	
South Creek Rail Crossing	South Creek	10%ile	0	0	0	0	0	0	0	0	35
		50%ile	0	0	0	0	0	0	0	0	
		90%ile	0	0	0	0	0	0	0	0	
Richmond/Windsor Rail Crossing	South Creek	10%ile	0	41	60	76	85	92	100	104	147
		50%ile	0	49	71	84	94	102	114	119	
		90%ile	0	68	85	99	109	119	129	136	

Description	Bridge name	Percentile	Current Dam- Hours closed for different chance in a year floods								
			1 in 5	1 in 10	1 in 20	1 in 50	1 in 100	1 in 200	1 in 500	1 in 1000	PMF
Penrith Rail Crossing	Nepean River	10%ile	0	0	0	0	0	0	0	0	44
		50%ile	0	0	0	0	0	0	0	0	
		90%ile	0	0	0	0	0	0	0	0	
South Creek Rail Crossing	South Creek	10%ile	0	0	0	0	0	0	0	0	17
		50%ile	0	0	0	0	0	0	0	0	
		90%ile	0	0	0	0	0	0	0	0	
Richmond/Windsor Rail Crossing	South Creek	10%ile	0	0	12	51	65	87	128	134	202
		50%ile	0	0	18	71	113	127	141	148	
		90%ile	0	0	26	93	133	145	157	171	

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