6.0 Construction Haulage Traffic and Transport Assessment – Bridge works

6.1 Summary

This chapter presents the assessment of the potential impacts of the proposed upgrade work to bridges which cross the current rail corridor. This includes pedestrian, rail and road traffic bridges.

Many of the bridge works rely on the diversion of traffic from one bridge onto one or more parallel bridges crossing the corridor in the vicinity. For the purposes of this assessment, it is assumed the construction program would, where feasible, restrict works from being carried out simultaneously on adjacent bridges, including pedestrian / road traffic bridges. Where these interdependencies between works occur, they are identified within the individual descriptions and assessments that follow in this chapter.

It is assumed that bridge works would be scheduled to minimise disruption to the traffic network and would not interface with the Baseline TTP and Refined Baseline TTP scenario buses.

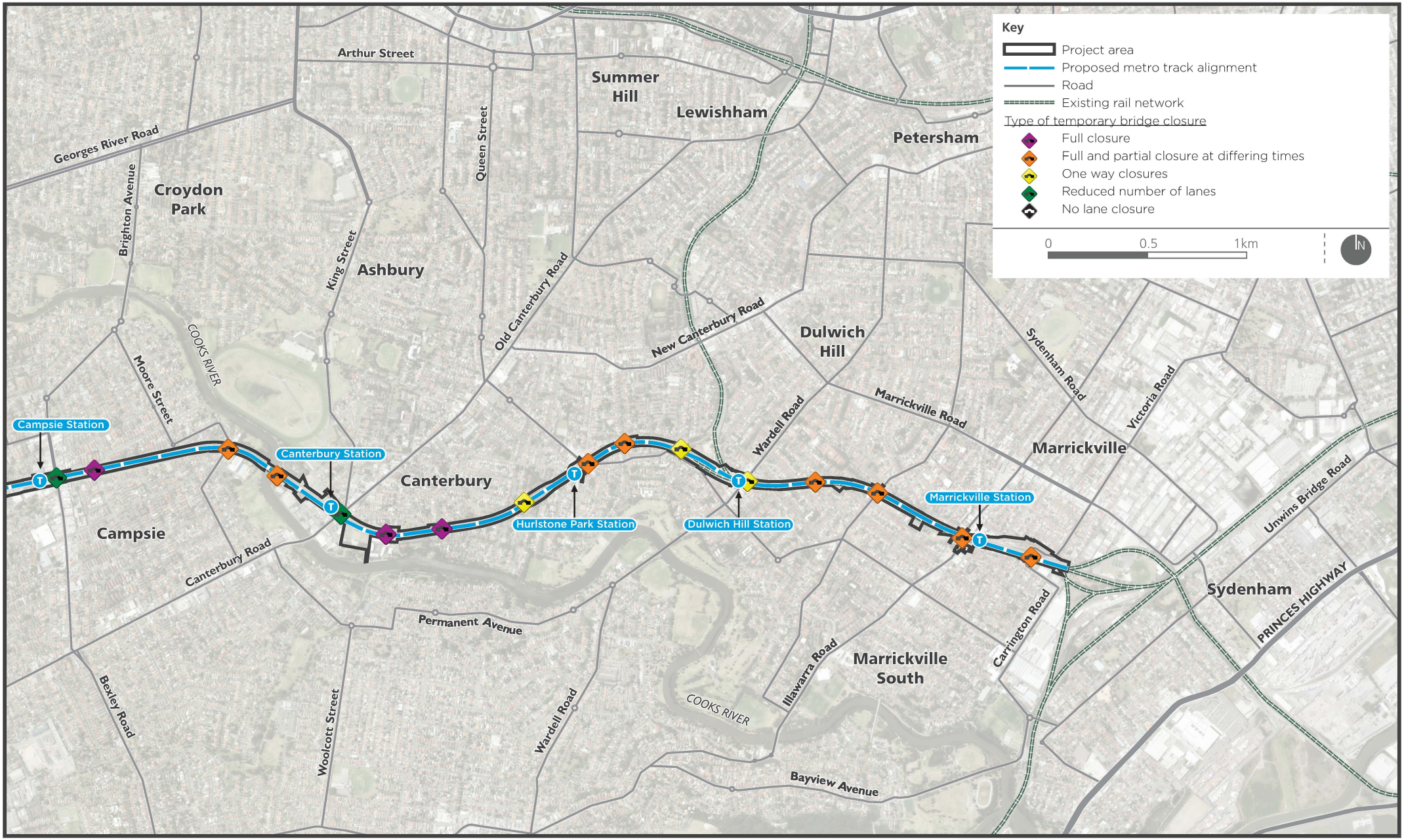
As outlined in Chapter 4, the assessment and methodology of the bridge work has been split into two distinct sections; within the project area between Sydenham to Belmore and Belmore to Bankstown. This is due to the different assumptions that apply to these two sections of the project alignment. A full description of the scope of the bridge work can be found in the main EIS Chapter 9 – Project description – construction.

The scope of work assumed for this assessment is included in **Appendix D**, and relates to the construction phase of the project only, with all bridge structures being reinstated to provide unchanged alignment and amenity for pedestrians, cyclists and motorised traffic on the completion of the bridge upgrade work. As such no assessment of the operational phase is required in relation to the bridge closures discussed within this chapter.

The assessment demonstrates that access is retained to all locations throughout construction, although for some areas and at some periods during construction, local access may be via a short diversion. This is a key issue, especially in relation to access for emergency vehicles where additional discussion and communications would be held to ensure that they are aware of the available routes as the construction progresses.

Figure 6.1 displays the location of the bridge works within the project area. There are a total of 26 bridges with differing types of bridge closures. An overview of the bridge closures is shown in the figure overleaf. More information regarding each bridge is discussed in the following sub-sections.

In many cases, bridge works would be undertaken at night and during weekends when traffic flows are generally lower and congestion related impacts would be reduced. **Sections 4.5.4** and **4.5.9** provide an example of the level of traffic reductions that can be expected during these periods.



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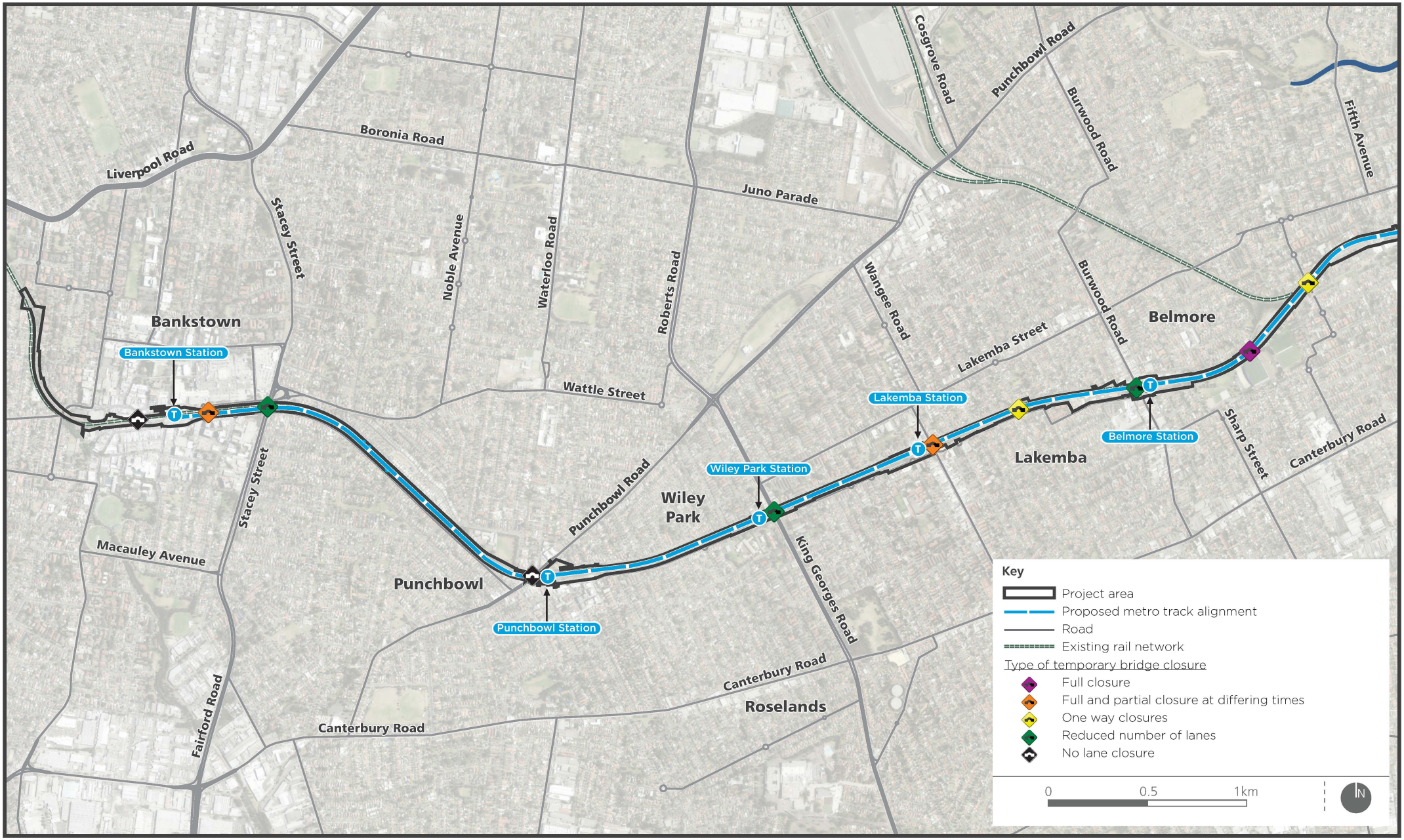
Bridge closures - map 1

FIGURE 6.1



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Overview of the project - map 2

FIGURE 6.1

6.2 Bridge Construction Sequencing

Appendix I provides a summary diagram showing a possible sequencing of bridge construction program for the project. The diagrams show at a conceptual level how the construction activities could occur in relation to the possessions which are proposed for the project.

Potential closures and diversion routes are indicative, based on the current stage of the design. Further detailed assessment would be undertaken in the future, if required, when a more detailed construction strategy and program has been developed and to inform the specific construction traffic management plans for the sites.

The diagrams in **Appendix I** also identifies the dependencies between bridges, as diversions are generally to adjacent bridges and cannot have closures or restrictions at the same time.

6.3 Bridge Traffic Data and Closures

Table 6.1 overleaf outlines the existing Average Daily Traffic (ADT) for bridges impacted by bridge works within the project area. The table also includes forecast construction haulage traffic and Baseline TTP volumes. The method of calculating the ADTs from the peak hourly flow has been discussed in **Section 3.1.5.**

The required closure time and type of closure to enable the necessary works has also been provided. The term “half lane closure” has been used to describe a situation which involves the need to reduce the road width by 1.5-2m to create a safe work area. This has been assessed as a closure of one lane of traffic, although it is possible that as part of the CTMP for longer term works a contractor could investigate the opportunities for narrowing lanes for the duration of the works on multi-lane bridges (instead of lane closures) which would lead to a reduced effect.

The volumes presented in **Table 6.1** are ADTs which reflect an average daily traffic flow. As such they would generally reflect flow levels biased towards the five weekdays as opposed to the two weekend days. The tables are provided to give context to the relative contributions that the bridges provide to the local road network.

The individual assessments carried out in sections 6.3 and below do not consider a reduction in traffic at weekends and during night periods. Where closure periods are noted as “during weekends and nights” or where the length of the closure period is three days or less, it is expected that these upgrade works would be conducted during weekends, public holiday periods or nights. The volumes during these periods are generally less than weekdays and the presentation of data is therefore conservative. In the intersection summary tables, the naming conventions (for example B.11 and H.11) are a standard file reference for the project and provided a cross reference point during the modelling and to the intersections diagrams provided in **Appendix A**.

As stated in **Section 6.2** above, the information contained in the table below is based on initial design and construction options, and is subject to further refinement as the design progresses.

Table 6.1 Bridge Works - ADT and Closure information

Station	Road	Closure Time	Closure Type	Existing ADT (Vehicles per day)			Additional Construction Haulage ADT (Vehicles per day)		
				Total	LV	HV	Total	LV	HV
Marrickville	Charlotte Avenue Underbridge	14 weeks	Half lane closure	7,900	7,400	500	220	110	110
		3 days	Full closure						
	Illawarra Road Overbridge	28 days	Half lane closure	11,900	11,100	800	330	110	220
		2 days	Full closure						
	Livingstone Road Overbridge	2 days	Full Closure	12,200	11,800	400	40	0	40
		8 months during weekends and nights	Narrow lanes						
	Albermarle Street Overbridge	1 month	Full closure	Albermarle Street is a minor road which did not contain any traffic count data or data in the strategic transport model, for this link at the time of reporting.					
		7 months during weekends and nights	Mix of half lane and full closure						
Dulwich Hill	Wardell Road Overbridge	6 months during weekends and nights	Half lane closure	14,400	14,000	400	240	110	130
	Ness Avenue / Terrace Road Underbridge	6 months during weekends and nights	Half lane closure	1,300	1,300	0	460	220	240
Hurlstone Park	Garnet Street Overbridge	8 months during weekends and nights	Half lane closures	2,200	2,200	0	40	0	40
		2 days	Full closure						
	Duntroon Street Overbridge	8 months during weekends and nights	Half lane closures	2,000	1,900	100	220	110	110
		2 days	Full closure						
	Foord Avenue Overbridge	6 months during weekends and nights	Half lane closures	Foord Avenue is a minor road which did not contain any traffic count data or data in the strategic transport model, for this link at the time of reporting.					

Station	Road	Closure Time	Closure Type	Existing ADT (Vehicles per day)			Additional Construction Haulage ADT (Vehicles per day)		
				Total	LV	HV	Total	LV	HV
	Melford Street Overbridge	8 months during weekends and nights	Full closure	Although Melford Street is not a minor road, there was no traffic count data or volume data in the strategic transport model, for this link at the time of reporting.					
Canterbury	Canterbury Road Overbridge	8 months during weekends and nights	One northbound and one southbound lane closure (reduction from 2 to 1 lane in each direction).	51,300	47,800	3,500	260	110	150
	Cooks River / Charles Street Underbridge	6 months during weekends and nights	Mix of half lane and full closure	1,000	800	200	260	110	150
	Wairoa M24 Street Underbridge	6 months during weekends and nights	Half lane closure	10,100	10,000	100	0	0	0
		1 day (overnight)	Full closure						
Campsie	Beamish Street Overbridge	6 months during weekends and nights	Half lane closure	18,900	18,500	400	120	60	60
	Loch Street Overbridge	6 months during weekends and nights	Half lane closure	15,600	14,300	1,300	20	0	20
Belmore	Burwood Road Overbridge	6 months during weekends and nights	Half lane closure	19,700	17,600	2,100	440	220	220
		4 weeks continuous	Half lane closure						
Lakemba	Moreton Street Overbridge	6 months during weekends and nights	Half lane closure	16,800	15,600	1,200	90	0	90
		4 weeks continuous	Half lane closure						

Station	Road	Closure Time	Closure Type	Existing ADT (Vehicles per day)			Additional Construction Haulage ADT (Vehicles per day)		
				Total	LV	HV	Total	LV	HV
	Haldon Street Overbridge	6 months during weekends and nights	Half lane closure	15,000	14,100	900	220	110	110
		4 weeks continuous	Half lane closure						
Wiley Park	King Georges Road Overbridge	3 weeks	One southbound lane closure (reduction from 4 to 3 lanes southbound).	96,800	86,700	10,100	220	110	110
Punchbowl	Punchbowl Road Overbridge	6 months during weekends and nights	No closure necessary	50,500	47,000	3,500	180	90	90
Bankstown	Stacey Street Overbridge	6 months during weekends and nights	One northbound and southbound closure (reduction for 3 to 2 lanes in each direction).	66,000	56,300	9,700	500	130	370
		4 weeks continuous	One northbound and southbound closure (reduction for 3 to 2 lanes in each direction).						
	North Terrace to South Terrace Underbridge	6 months during weekends and nights	Half lane closure	The North Terrace to South Terrace is a minor road which did not contain any traffic count data or data in the strategic transport model, for this link at the time of reporting.					
		4 weeks continuous	Full lane closure						
	Chapel Road Overbridge	6 months during weekends	No closures necessary	34,800	30,700	4,100	0	0	0

The following sections provide an overview of the proposed approach to undertake the works shown in the table above. As shown in the table the impact of the works varies by bridge, with some requiring works that can be achieved with some short term closures of footpaths, and others require several months of full closure to all modes on weekends and at night.

The approach that has been taken is to attempt to retain access for pedestrians and cyclists, and where possible two way flow for traffic. Where this is not possible, access for pedestrians and one way traffic flow was the next most preferable, with the direction of flow selected to produce the better diversion flow with respect to the available road network and the consideration of turning vehicles. Where routes on the cycle network would be impacted, an alternative route has been identified, although it is recognised that the added distance this would require may result in some cyclists choosing to dismount and walk through the pedestrian route where available.

In some cases, where the traffic flows are low, shuttle working is proposed, with alternating traffic flow, and pedestrian and cycle access retained.

The least preferable approach would be full closures, and this was selected only in cases where there was a full bridge deck replacement or the roadway is narrow and there is not sufficient space to create a safe work zone and also provide traffic flow. In this case diversion routes have been prepared, and an assessment carried out of the effect on pedestrians, cyclists, bus route diversion and intersection delays for all traffic (including buses) on the diversion routes.

6.4 Sydenham to Belmore Bridge Closures

Bridge closures between west of Sydenham and Belmore within the project area occur during the scheduled annual ARTC track possessions and therefore would not occur during school holiday periods. This applies to the following bridges:

- Charlotte Avenue Underbridge
- Illawarra Road Overbridge
- Livingstone Road Overbridge
- Albermarle Street Overbridge
- Wardell Road Overbridge
- Ness Avenue / Terrace Road Underbridge
- Garnet Street Overbridge
- Duntroon Street Overbridge
- Melford Street Overbridge
- Church Street / Hutton Street Footbridge
- Canterbury Road Overbridge
- Cooks River / Charles Street Underbridge
- Wairoa M24 Street Underbridge
- Duke Street Footbridge
- Beamish Street Overbridge
- Loch Street Overbridge
- Pedestrian Access Oval Underbridge.

The remainder of this chapter provides an assessment of the effects of these bridge closures. Refer to **Appendix G** for the traffic diversion diagrams and **Appendix H** for the detailed intersection movement summary tables.

6.5 Charlotte Avenue Underbridge

The Charlotte Avenue Underbridge is a 23m long twin deck bridge that carries the T3 Bankstown Line and the ARTC Goods Line between Sydenham and Marrickville. **Figure 6.2** shows the Underbridge location. The Underbridge carries approximately 7,900 vehicles per day.

In the order of 220 construction haulage vehicle trips[42] are expected to be made using Charlotte Avenue Underbridge over a 24 hour period while compound or worksite activities are occurring. During the AM and PM peak hours it is are expected that 10 light vehicle and 10 heavy vehicles trips would be performed using this route.

6.5.1 Diversion Route

The upgrade works require a lane closure of Charlotte Avenue Underbridge for 14 weeks; 7 weeks per side of the bridge. This is followed by a three day full closure of Charlotte Avenue. The three day closure would occur over a long weekend with management of traffic addressed in detailed traffic management plans.

During the half lane closure, traffic is assumed to use the Illawarra Road Overbridge as the diversion route as it is the closest alternative bridge to cross the railway line. The diversion route is shown in **Figure 6.2**.

Northbound and southbound traffic would be diverted to the Illawarra Road Overbridge separately. The following intersections are impacted by the diversion:

- Illawarra Road / Warren Road intersection
- Marrickville Road / Illawarra Road intersection
- Marrickville Road / Victoria Road intersection
- Illawarra Road / Petersham Road intersection
- Marrickville Road mid-block pedestrian crossing
- Warren Road / Carrington Road intersection.

Northbound Lane Closure Intersection Performance

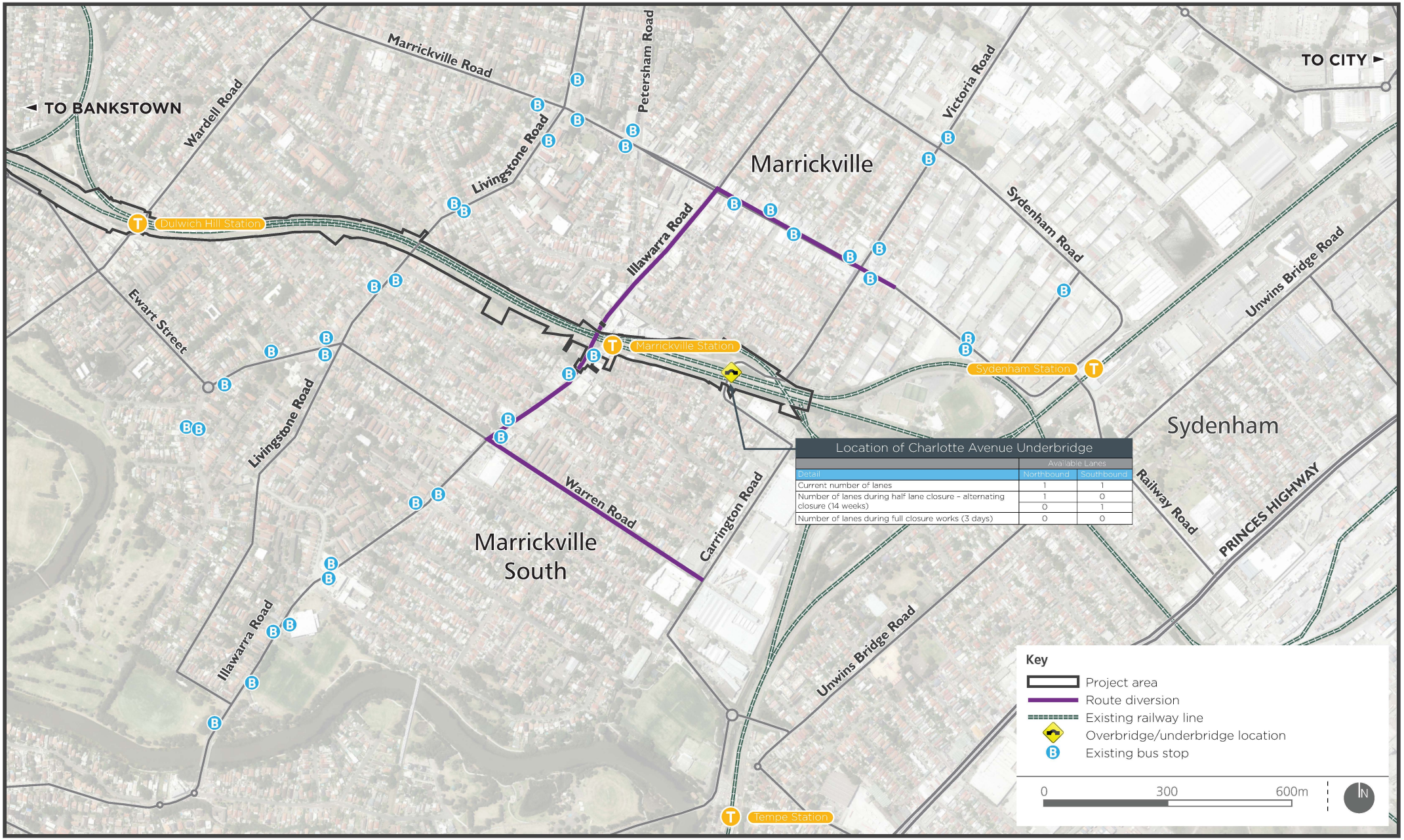
In order for the Marrickville Road / Victoria Road intersection to perform adequately during the traffic diversion scenario, the following assumptions have been built into the SIDRA model:

- the existing B-phase (green signal for all of the movements from the Victoria Road south approach) is deactivated during the AM peak hour
- inclusion of a new phase (green signal for all of the movements from the Illawarra Road south approach) during the AM peak
- removal of the on-street parking from the eastbound side of Marrickville Road within 50 metres north and south of the Marrickville Road / Illawarra Road intersection providing longer approach and exit lanes during the AM peak.

AM Peak Intersection Performance

Table 6.2 presents the Charlotte Bridge Northbound Closure Assessment – AM Peak.

[42] A trip is a one-way vehicular movement from one point to another excluding the return journey. Therefore a vehicle entering and leaving a land use is counted as two trips.



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Location and diversion routes - Charlotte Avenue underbridge

FIGURE 6.2

Table 6.2 Charlotte Avenue Underbridge Intersection Northbound closure Assessment – AM Peak

Charlotte Avenue Underbridge Northbound Closure – AM Peak				
Scenario	**Existing**	**Future**	**Construction**	**Traffic Diversion**
B.16 Illawarra Road / Warren Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1407	1545	1545	2322
Average Delay per Vehicle (Average over all arms in seconds)	23	25	25	197
LoS (Overall)	B	B	B	F
DoS (Worst Movement)	0.76	0.81	0.81	1.30
B.17 Marrickville Road / Illawarra Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1762	1935	1960	2636
Average Delay per Vehicle (Average over all arms in seconds)	19	22	24	208
LoS (Overall)	B	B	B	F
DoS (Worst Movement)	0.79	0.83	0.87	1.29
B.18 Marrickville Road / Victoria Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	2034	2234	2234	2184
Average Delay per Vehicle (Average over all arms in seconds)	30	49	49	31
LoS (Overall)	C	D	D	C
DoS (Worst Movement)	0.79	1.03	1.03	0.95
H.19 Illawarra Road / Petersham Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1158	1271	1297	2004
Average Delay per Vehicle (Average over all arms in seconds)	16	17	16	62
LoS (Worst Movement)	B	B	B	E
DoS (Worst Movement)	0.47	0.50	0.52	1.01
H.38 Marrickville Road mid-block pedestrian crossing (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1039	1141	1166	1866
Average Delay per Vehicle (Average over all arms in seconds)	4	4	4	38
LoS (Worst Movement)	A	A	A	C
DoS (Worst Movement)	0.45	0.49	0.50	0.98
Warren Road / Carrington Road (Priority Controlled)				**Year Capped: 2023**
Demand Flow (veh)	1216	1335	1335	1479
Average Delay per Vehicle (Average over all arms in seconds)	4	6	6	7
Average Delay per Vehicle (Worst Movement in seconds)	19	30	30	18
LoS (Worst Movement)	C	C	C	B
DoS (Worst Movement)	0.58	0.75	0.75	0.53

For three of the six intersections modelled, the increase in delay resulting from future traffic growth, construction traffic and traffic diversions results in a level of service 'C' or better. A level of service 'C' would not cause delays above that which could be reasonably expected in the peak hour in Sydney.

The following information describes the modelling results based on the assumption that all diverted traffic uses the route outlined in **Figure 6.2**. This is a scenario that presents a worst case for assessment. It could reasonably be expected that drivers would use a range of diversion routes which would spread the area of influence to a greater number of intersections, resulting in a reduced impact to the modelled intersections.

The Illawarra Road / Warren Road intersection has a current level of service 'B'. The LoS remains as 'B' for the future and construction scenarios, but increases to 'F' while the diversion is in place.

The right turning movement from the Warren Road south approach is the worst performing movement with congestion and delay increasing to over five minutes in the Traffic Diversion scenario. It is unlikely drivers would wait five minutes to turn right in practice. Instead, drivers would either reroute using parallel routes, or turn right in less than satisfactory gaps.

The Marrickville Road / Illawarra Road intersection has a level of service 'B' for existing, future and construction scenarios. The intersection experiences a decline in amenity as a result of the bridge diversion works. The intersection has a LoS of 'B' in the Construction scenario, worsening to a LoS 'F' in the Traffic Diversion scenario.

The movements from Marrickville west approach are the worst performing movements with delays of over five minutes. Drivers queuing to turn left at the intersection would likely use alternative local roads such as Despointes Street to avoid waiting at the intersection.

The Illawarra Road / Petersham Road intersection has an existing level of service 'B'. The LoS remains as 'B' for the future and construction scenarios, but increases to 'E' while the diversion is in place. Some drivers may choose to reroute to avoid queuing at the intersection, however it is expected that a one minute delay during peak hour traffic to the worst movement at the intersection would not be sufficiently long enough to encourage a large number of diversions.

PM Peak Intersection Performance

Table 6.3 presents the Charlotte Bridge Northbound Closure Assessment – PM Peak.

Table 6.3 Charlotte Avenue Underbridge Intersection Northbound closure Assessment – PM Peak

Charlotte Avenue Underbridge Northbound Closure – PM Peak				
Scenario	**Existing**	**Future**	**Construction**	**Traffic Diversion**
B.16 Illawarra Road / Warren Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1671	1847	1847	2158
Average Delay per Vehicle (Average over all arms in seconds)	19	22	22	59
LoS (Overall)	B	B	B	E
DoS (Worst Movement)	0.69	0.89	0.89	1.04
B.17 Marrickville Road / Illawarra Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1824	2016	2041	2205
Average Delay per Vehicle (Average over all arms in seconds)	19	20	23	55
LoS (Overall)	B	B	B	D
DoS (Worst Movement)	0.60	0.73	0.81	1.04

Charlotte Avenue Underbridge Northbound Closure – PM Peak				
Scenario	**Existing**	**Future**	**Construction**	**Traffic Diversion**
B.18 Marrickville Road / Victoria Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	2353	2600	2600	2568
Average Delay per Vehicle (Average over all arms in seconds)	38	66	66	40
LoS (Overall)	C	E	E	C
DoS (Worst Movement)	0.95	1.07	1.07	0.96
H.19 Petersham Road / Illawarra Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1250	1381	1407	1718
Average Delay per Vehicle (Average over all arms in seconds)	13	12	12	12
LoS (Worst Movement)	A	A	A	D
DoS (Worst Movement)	0.51	0.53	0.55	0.62
H.38 Marrickville Road mid-block pedestrian crossing (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1138	1257	1283	1594
Average Delay per Vehicle (Average over all arms in seconds)	4	5	5	45
LoS (Worst Movement)	A	A	A	A
DoS (Worst Movement)	0.49	0.54	0.56	0.56
Warren Road / Carrington Road (Priority Controlled)				**Year Capped: 2023**
Demand Flow (veh)	1216	1335	1335	1789
Average Delay per Vehicle (Average over all arms in seconds)	4	6	6	10
Average Delay per Vehicle (Worst Movement in seconds)	19	30	30	91
LoS (Worst Movement)	C	C	C	F
DoS (Worst Movement)	0.58	0.75	0.75	0.93

For four of the six intersections modelled, the increase in delay resulting from future traffic growth, construction traffic and traffic diversions results in a level of service ‘D’ or better. A level of service ‘D’ would not cause delays above that which could be reasonably expected in the peak hour in Sydney.

The Illawarra Road / Warren Road intersection is forecast to experience a decline in amenity as a result of the addition of the diverted traffic. The intersection has a LoS of ‘B’ in the existing, future and construction scenario, worsening to a LoS ‘E’ in the traffic diversion scenario.

The right turning movement from the Warren Road south approach is the worst performing movement with a delay of nearly 2 minutes. In practice, it is likely that the average delay would be reduced as drivers would turn right in less than satisfactory gaps.

The intersection of Warren Road / Carrington Road has a level of service ‘C’ during existing, future and construction scenarios. The intersection is expected to experience increased delays during the PM peak with a LoS ‘F’ and delay of 1.5 minutes. This is based on the worst movement. Additional traffic is being added to Warren Road which increases volumes on the minor road. Outside of the

constraints of the modelled assumptions, in reality much of this traffic would divert to a number of parallel roads, relieving some of the demand on the Warren Road / Carrington Road intersection.

The seasonal traffic patterns discussed in Chapter 3 shows that during the mid-year school holidays traffic reduces by some 5%, and 15% following term 4. As a result, it can be seen that should some if the works be undertaken in the term 4 holiday this could be expected to allow the diversion route to operate within capacity. Noting the proposed works consist of two periods of 7 weeks, this would imply that the works would need to be undertaken over a period spanning 12 months.

Southbound Lane Closure Intersection Performance

AM Peak assessment

Table 6.4 presents the Charlotte Bridge Southbound Closure Assessment – AM Peak.

Table 6.4 Charlotte Avenue Underbridge Intersection Southbound Closure Assessment – AM Peak

Charlotte Avenue Underbridge Southbound Closure – AM Peak				
Scenario	**Existing**	**Future**	**Construction**	**Traffic Diversion**
B.16 Illawarra Road / Warren Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1407	1545	1545	1732
Average Delay per Vehicle (Average over all arms in seconds)	23	25	25	25
LoS (Overall)	B	B	B	B
DoS (Worst Movement)	0.76	0.81	0.81	0.81
B.17 Marrickville Road / Illawarra Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1762	1935	1960	2151
Average Delay per Vehicle (Average over all arms in seconds)	19	22	24	24
LoS (Overall)	B	B	B	B
DoS (Worst Movement)	0.79	0.83	0.87	0.88
B.18 Marrickville Road / Victoria Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	2034	2234	2234	2218
Average Delay per Vehicle (Average over all arms in seconds)	30	49	49	34
LoS (Overall)	C	D	D	C
DoS (Worst Movement)	0.79	1.03	1.03	0.91
H.19 Petersham Road / Illawarra Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1158	1271	1297	1489
Average Delay per Vehicle (Average over all arms in seconds)	16	17	16	15
LoS (Worst Movement)	B	B	B	B
DoS (Worst Movement)	0.47	0.50	0.52	0.52

Charlotte Avenue Underbridge Southbound Closure – AM Peak				
Scenario	**Existing**	**Future**	**Construction**	**Traffic Diversion**
H.38 Marrickville Station Overbridge (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1039	1141	1166	1357
Average Delay per Vehicle (Average over all arms in seconds)	4	4	4	4
LoS (Worst Movement)	A	A	A	A
DoS (Worst Movement)	0.45	0.49	0.50	0.50
Carrington Road / Warren Road (Priority Controlled)				**Year Capped: 2023**
Demand Flow (veh)	1216	1335	1335	1331
Average Delay per Vehicle (Average over all arms in seconds)	4	6	6	40
Average Delay per Vehicle (Worst Movement in seconds)	19	30	30	129
LoS (Worst Movement)	C	C	C	F
DoS (Worst Movement)	0.58	0.75	0.75	1.10

For four of the five intersections modelled, the increase in delay resulting from future traffic growth, construction haulage traffic and traffic diversions results in a LoS 'C' or better. A LoS 'C' would not cause delays above that which could be reasonably expected in the peak hour in Sydney.

The Carrington Road / Warren Road intersection is forecast to experience a decline in amenity as a result of the addition of the diverted traffic. The intersection has a LoS of 'C' in the existing, future and construction scenarios, worsening to a LoS 'F' in the Traffic Diversion scenario.

The movements from the Warren Road west approach are the worst performing movements with delays increasing to over two minutes in the traffic diversion scenario. The modelled average delay over all arms is 40 seconds, implying that the majority of the delay is occurring at the Warren Road west approach, with minimal delay at the major (through) movement.

It is expected that much of the diverted traffic being added to the Warren Road West would divert to the parallel roads, relieving some of the demand on the Warren Road / Carrington Road intersection.

PM Peak Assessment

Table 6.5 presents the Charlotte Bridge Southbound Closure Assessment – PM Peak.

Table 6.5 Charlotte Avenue Underbridge Intersection Southbound Closure Assessment – PM Peak

Charlotte Avenue Underbridge Southbound Closure – PM Peak				
Scenario	**Existing**	**Future**	**Construction**	**Traffic Diversion**
B.16 Illawarra Road / Warren Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1671	1847	1847	2569
Average Delay per Vehicle (Average over all arms in seconds)	19	22	22	458
LoS (Overall)	B	B	B	F
DoS (Worst Movement)	0.69	0.89	0.89	3.24

Charlotte Avenue Underbridge Southbound Closure – PM Peak				
Scenario	**Existing**	**Future**	**Construction**	**Traffic Diversion**
B.17 Marrickville Road / Illawarra Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1824	2016	2041	2755
Average Delay per Vehicle (Average over all arms in seconds)	19	20	23	176
LoS (Overall)	B	B	B	F
DoS (Worst Movement)	0.60	0.73	0.81	1.43
B.18 Marrickville Road / Victoria Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	2353	2600	2600	2544
Average Delay per Vehicle (Average over all arms in seconds)	38	66	66	246
LoS (Overall)	C	E	E	F
DoS (Worst Movement)	0.95	1.07	1.07	1.74
H.19 Petersham Road / Illawarra Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1250	1381	1407	2128
Average Delay per Vehicle (Average over all arms in seconds)	13	12	12	44
LoS (Worst Movement)	A	A	A	D
DoS (Worst Movement)	0.51	0.53	0.55	0.99
H.38 Marrickville Station Overbridge (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1138	1257	1283	2004
Average Delay per Vehicle (Average over all arms in seconds)	4	5	5	76
LoS (Worst Movement)	A	A	A	F
DoS (Worst Movement)	0.49	0.54	0.56	1.05
Carrington Road / Warren Road (Priority Controlled)				**Year Capped: 2023**
Demand Flow (veh)	1216	1335	1335	1424
Average Delay per Vehicle (Average over all arms in seconds)	4	6	6	187
Average Delay per Vehicle (Worst Movement in seconds)	19	30	30	314
LoS (Worst Movement)	C	C	C	F
DoS (Worst Movement)	0.58	0.75	0.75	1.33

The Petersham Road / Illawarra Road intersection has a residual LoS ‘D’ after modelling the diverted traffic. A level of service ‘D’ would not cause delays above that which could be reasonably expected in the peak hour in Sydney.

The remaining five intersections in the area around Charlotte Avenue Underbridge have a level of service ‘F’ after allowing for the diverted traffic. This demonstrates that the southbound lane closures would have a much greater effect on the surrounding road network in the PM peak than the northbound lane closures.

It is therefore recommended that southbound traffic always uses the Charlotte Avenue Underbridge in the PM peak and the northbound traffic would always be the movement diverted, irrespective of which lane would be closed for bridge works. This would enable the diversion to occur with only localised impact.

6.5.2 Bus Network

As no bus route uses the Charlotte Avenue Underbridge, bus routes would not be affected by the works on this bridge.

6.5.3 Pedestrians and Cyclists

During the half lane closures, pedestrians would be diverted to the other side of the road which would remain open. Temporary traffic management would need to be in place at both ends of the bridge to aid pedestrians crossing the road. During the full bridge closures over three days, prior notification would be provided to cyclists and pedestrians that alternative crossing of the rail corridor would be required.

6.6 Illawarra Road Overbridge

Illawarra Road Overbridge in Marrickville is a two span bridge with a central pier. The bridge spans the ARTC Goods Line and the current rail alignment. The bridge is approximately 34m in length, carrying one lane of traffic in each direction. Refer to **Figure 6.3** for Illawarra Road Overbridge location. The Overbridge carries approximately 11,900 vehicles per day.

In the order of 330 construction vehicle trips are expected to be made using Illawarra Road Overbridge over a 24 hour period while compound or worksite activities are occurring. During the AM and PM peak hours it is are expected that 10 light vehicle and 20 heavy vehicles trips would be performed using this route. However, preliminary construction scheduling information suggests that the bridge works at Illawarra Road would not coincide with the construction activities that utilise this bridge as a construction haulage route.

6.6.1 Diversion Route

When modelling Illawarra Road Overbridge it was assumed that the construction works would require 28 days of half lane closures (14 days per side) and two days of full closure. The two day full closure was assumed to occur over a weekend, during which time traffic would be diverted to Charlotte Avenue Underbridge and Livingstone Road Overbridge. These assumptions were based on the current stage of design at the time of modelling. Further analysis of the bridge structure has identified the duration of the bridge replacement may need to be greater and require a full closure for up to 4 weeks.

The 28 days of half lane closures would not occur during school holiday periods as the works need to occur during ARTC possession periods which are done outside of school holiday periods. The closures would therefore potentially impact peak weekday traffic volumes and could impact the surrounding local road network. However, the traffic analysis did examine the impacts of separate northbound and southbound bridge closures during the weekday am and pm peak hours as a worst case scenario.

The diversion routes assume that, for the half lane southbound closure, 50% of the traffic would divert to Charlotte Avenue Underbridge and 50% would divert to Livingstone Road Overbridge, as shown in **Figure 6.3**. During the northbound closure, it is assumed that all traffic would divert to Charlotte Avenue Underbridge due to the banned right turn movement at the Livingstone Road – Warren Road intersection.

Illawarra Road Overbridge is on a number of bus routes. Buses would be diverted to Livingstone Road Overbridge during the half lane closures where passengers can access bus stops on Livingstone Road. Passengers accessing/exiting Marrickville Station would be required to walk 650m to bus stop 220496 or 2204104 on Livingstone Road.

Through development of the design it has been noted that Warren Road and Schwebel Street may be unsuitable for bus operations due to the narrow carriageway widths. Temporary changes may be required to the route to enable these diversion routes to be used, such as implementing clearways which would result in the temporary loss of parking. Measures to manage identifying potential road

modifications are provided in chapter 9.0 and would be further examined as part of the construction traffic management plan process.

Since modelling the intersections, the design has progressed. From consultation with key stakeholders it is thought that further full closures of Illawarra Road Overbridge may be required (of up to 4 weeks) to complete the works and these full closures could occur outside of night / weekend works, that is, they would impact daytime peak period traffic and multi modal access. This would be finalised during detailed design and construction planning. Further consultation and co-ordination would be undertaken once sufficient information is available and work would be subject to an additional impact assessment if required.

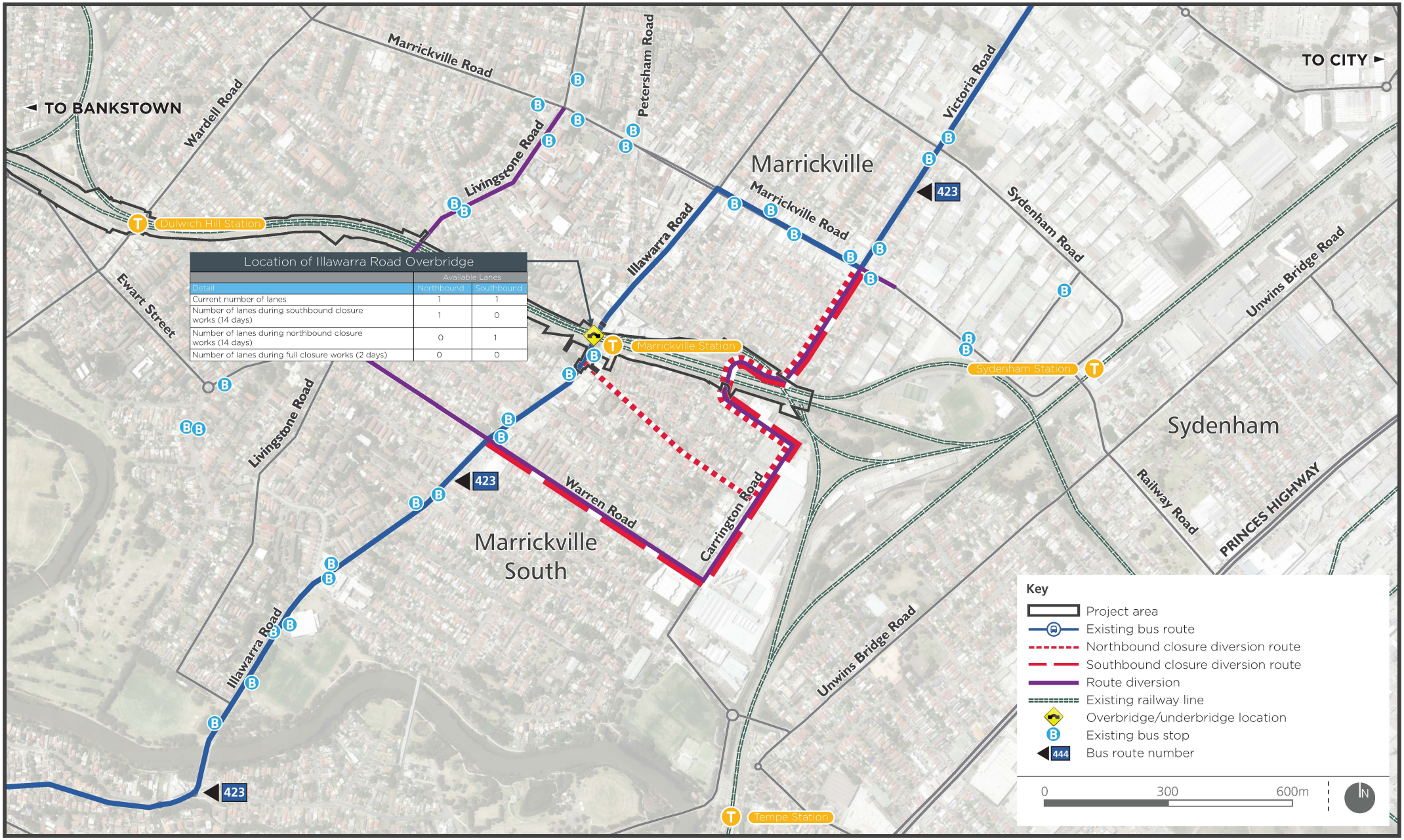
The information presented below is based on the outputs from the time of modelling; i.e. that the full closure would occur over night / weekend works and would not impact peak weekday traffic volumes and only the half lane closures may impact peak weekday traffic volumes. However, the traffic analysis did examine the impacts of separate northbound and southbound bridge closures during the weekday am and pm peak hours as a worst case scenario.

6.6.2 Intersection Performance

As mentioned above, due to the partial closure of Illawarra Road Overbridge during construction, the following intersections are directly impacted in both peak periods by traffic diversion:

- Carrington Road / Warren Road
- Marrickville Road / Illawarra Road
- Marrickville Road / Victoria Road
- Illawarra Road / Warren Road
- Marrickville Road / Livingstone Road[43]
- Livingstone Road / Warren Road[44].

[43] Due to insufficient data at the time of reporting, this intersection has not been modelled
[44] Due to insufficient data at the time of reporting, this intersection has not been modelled



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Location and diversion routes - Illawarra Road overbridge

FIGURE 6.3

Southbound Diversion

AM Peak Intersection Performance

Table 6.6 below shows a summary of the intersection assessment undertaken for this bridge.

Table 6.6 Illawarra Road Overbridge Southbound Closure Assessment – AM Peak

Illawarra Road Overbridge – Southbound Diversion AM Peak				
Scenario	**Existing**	**Future**	**Construction**	**Traffic Diversion**
Demand Flow (veh)	1407	1545	1545	1294
Average Delay per Vehicle (Average over all arms in seconds)	23	25	25	24
LoS (Overall)				
DoS (Worst Movement)	0.76	0.81	0.81	0.68
Demand Flow (veh)	1762	1935	1960	2031
Average Delay per Vehicle (Average over all arms in seconds)	19	22	24	26
LoS (Overall)				
DoS (Worst Movement)	0.79	0.83	0.87	0.86
Demand Flow (veh)	2034	2234	2234	2355
Average Delay per Vehicle (Average over all arms in seconds)	30	49	49	901
LoS (Overall)				
DoS (Worst Movement)	0.79	1.03	1.03	3.50
Demand Flow (veh)	1216	1335	1335	1457
Average Delay per Vehicle (Average over all arms in seconds)	4	6	6	9
Average Delay per Vehicle (Worst Movement in seconds)	19	30	30	53
LoS (Worst Movement)				
DoS (Worst Movement)	0.58	0.75	0.75	0.90

For three of the four intersections modelled, the increase in delay resulting from future traffic growth, construction haulage traffic and traffic diversion results in a LoS ‘D’ or better. A level of service ‘D’ would not cause delays above that which could be reasonably expected in the peak hour in Sydney.

The Marrickville Road / Victoria Road intersection is forecast to experience a decline in amenity as a result of the southbound traffic diversion. The intersection has an existing LoS of ‘C’ which worsens to a LoS ‘F’ for the Traffic Diversion scenario. The through and right turning movements from the Victoria Road south approach are the worst performing movements with modelled delays showing that demand would significantly exceed capacity and result in significant delays.

The additional 105 vehicles of diverted traffic turning right from the Marrickville Road west approach, dictates the green time for this intersection, resulting in less green time for the Victoria Road south approach.

The main source of delay would arise as a result of the opposed right turn movement, and suggests that if not otherwise mitigated, there is potential for the delays to result in drivers choosing to turn in less than satisfactory gaps through frustration. It is also expected that another portion of the diverted traffic would avoid the intersection by using Unwins Bridge Road continuing onto Richardson Crescent while the Illawarra Road Bridge Works are being undertaken.

Notwithstanding some level of increased delay would be experienced at the intersection as the high volumes of traffic using Illawarra Road Overbridge are diverted elsewhere. Given the degree of saturation which shows the demand is significantly over capacity, undertaking the works during holidays would not significantly reduce the delays.

PM Peak Intersection Performance

Table 6.7 below shows a summary of the intersection assessment undertaken for this bridge.

Table 6.7 Illawarra Road Overbridge Southbound Closure Assessment – PM Peak

Illawarra Road Overbridge – Southbound Diversion PM Peak				
Scenario	Existing	Future	Construction	Traffic Diversion
B.16 Illawarra Road / Warren Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1671	1847	1847	1185
Average Delay per Vehicle (Average over all arms in seconds)	19	22	22	21
LoS (Overall)	B	B	B	B
DoS (Worst Movement)	0.69	0.89	0.89	0.51
B.17 Marrickville Road / Illawarra Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1824	2016	2041	2169
Average Delay per Vehicle (Average over all arms in seconds)	19	20	23	25
LoS (Overall)	B	B	B	B
DoS (Worst Movement)	0.60	0.73	0.81	0.81
B.18 Marrickville Road / Victoria Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	2353	2600	2600	2903
Average Delay per Vehicle (Average over all arms in seconds)	38	66	66	216
LoS (Overall)	C	E	E	F
DoS (Worst Movement)	0.95	1.07	1.07	1.88
Carrington Road / Warren Road (Priority Controlled)				**Year Capped: 2023**
Demand Flow (veh)	1328	1468	1468	1853
Average Delay per Vehicle (Average over all arms in seconds)	3	5	5	52
Average Delay per Vehicle (Worst Movement in seconds)	20	34	34	466
LoS (Worst Movement)	B	C	C	F
DoS (Worst Movement)	0.47	0.65	0.65	1.44

For two of the four intersections modelled, the increase in delay resulting from future traffic growth, construction traffic and traffic diversion results in a Level of Service 'B' or better. A Level of Service 'B' would not cause delays above that which could be reasonably expected in the peak hour in Sydney.

In the PM peak the Marrickville Road / Victoria Road intersection is again forecast to experience a decline in amenity as a result of the southbound traffic diversion. The intersection has a LoS of 'E' for the future and construction scenarios, worsening to a LoS 'F' for the Traffic Diversion scenario.

The right turning movement from the Marrickville Road west approach onto Victoria Road is the worst performing movement with modelled Degree of Saturation of 1.88 showing the intersection would have approaching double the demand compared to the capacity. The additional 266 diverted vehicles turning right from the Marrickville Road west approach, dictates the green time for this intersection, resulting in less green time for the other approaches.

The intersection of Carrington Road / Warren Road is also expected to experience increased delays as a result of the southbound traffic diversion, especially during the PM peak. The intersection has a LoS of 'C' for the future and construction scenarios, worsening to a LoS 'F' during the Traffic Diversion scenario. The level of service is dictated by the worst movement, which has a modelled theoretical delay of over seven minutes. The overall intersection delay is nearly one minute, which implies that the main (through) movement is experiencing minimal delay.

Northbound Diversion

AM Peak Intersection Performance

Table 6.8 below shows a summary of the intersection assessment undertaken for this station.

Table 6.8 Illawarra Road Overbridge Northbound Closure Assessment – AM Peak

Illawarra Road Overbridge – Northbound Diversion AM Peak				
Scenario	**Existing**	**Future**	**Construction**	**Traffic Diversion**
B.16 Illawarra Road / Warren Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1407	1545	1545	954
Average Delay per Vehicle (Average over all arms in seconds)	23	25	25	34
LoS (Overall)	B	B	B	C
DoS (Worst Movement)	0.76	0.81	0.81	0.83
B.17 Marrickville Road / Illawarra Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1762	1935	1960	1734
Average Delay per Vehicle (Average over all arms in seconds)	19	22	24	11
LoS (Overall)	B	B	B	A
DoS (Worst Movement)	0.79	0.83	0.87	0.57
B.18 Marrickville Road / Victoria Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	2034	2234	2234	2856
Average Delay per Vehicle (Average over all arms in seconds)	30	49	49	202
LoS (Overall)	C	D	D	F
DoS (Worst Movement)	0.79	1.03	1.03	1.30

Illawarra Road Overbridge – Northbound Diversion AM Peak				
Scenario	**Existing**	**Future**	**Construction**	**Traffic Diversion**
Carrington Road / Warren Road (Priority Controlled)				**Year Capped: 2023**
Demand Flow (veh)	1216	1335	1335	1427
Average Delay per Vehicle (Average over all arms in seconds)	4	6	6	7
Average Delay per Vehicle (Worst Movement in seconds)	19	30	30	31
LoS (Worst Movement)	C	C	C	C
DoS (Worst Movement)	0.58	0.75	0.75	0.78

For three of the four intersections modelled, the increase in delay resulting from future traffic growth, construction haulage traffic and traffic diversion results in a level of service 'C' or better. A level of service 'C' would not cause delays above that which could be reasonably expected in the peak hour in Sydney.

The Marrickville Road / Victoria Road intersection is forecast to experience a decline in amenity as a result of the northbound traffic diversion. The intersection has a LoS of 'D' for the future and construction scenarios, worsening to a LoS 'F' for the Traffic Diversion scenario.

Movements from the Victoria Road south approach are the worst performing movements with delays of over five minutes. The total additional 686 diverted vehicles from the Victoria Road south approaches totals more than the existing total traffic flow at that approach. Although the higher traffic flow secures a longer green time for the Victoria Road south approach, this is still not enough to address the effects of additional vehicles.

Like the southbound diversion, it is expected that the delays for the worst movement would be much lower than the model predicts as drivers would pull out in less than satisfactory gaps, during amber periods or reroute with potential negative safety impacts.

PM Peak Intersection Performance

Table 6.9 below shows a summary of the intersection assessment undertaken for this bridge.

Table 6.9 Illawarra Road Overbridge Northbound Closure Assessment – PM Peak

Illawarra Road Overbridge – Northbound Diversion PM Peak				
Scenario	**Existing**	**Future**	**Construction**	**Traffic Diversion**
B.16 Illawarra Road / Warren Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1671	1847	1847	1395
Average Delay per Vehicle (Average over all arms in seconds)	19	22	22	22
LoS (Overall)	B	B	B	B
DoS (Worst Movement)	0.69	0.89	0.89	0.90
B.17 Marrickville Road / Illawarra Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1824	2016	2041	1870
Average Delay per Vehicle (Average over all arms in seconds)	19	20	23	16
LoS (Overall)	B	B	B	B
DoS (Worst Movement)	0.60	0.73	0.81	0.82

Illawarra Road Overbridge – Northbound Diversion PM Peak				
Scenario	**Existing**	**Future**	**Construction**	**Traffic Diversion**
B.18 Marrickville Road / Victoria Road (Signals)				**Year Capped: 2023**
Demand Flow (veh)	2353	2600	2600	2954
Average Delay per Vehicle (Average over all arms in seconds)	38	66	66	103
LoS (Overall)	C	E	E	F
DoS (Worst Movement)	0.95	1.07	1.07	1.14
Carrington Road / Warren Road (Priority Controlled)				**Year Capped: 2023**
Demand Flow (veh)	1328	1468	1468	1544
Average Delay per Vehicle (Average over all arms in seconds)	3	5	5	5
Average Delay per Vehicle (Worst Movement in seconds)	20	34	34	36
LoS (Worst Movement)	B	C	C	C
DoS (Worst Movement)	0.47	0.65	0.65	0.69

For three of the four intersections modelled, the increase in delay resulting from future traffic growth, construction haulage traffic and traffic diversion results in a LoS 'C' or better. A LoS 'C' would not cause delays above that which could be reasonably expected in the peak hour in Sydney.

The Marrickville Road / Victoria Road intersection is forecast to experience a decline in amenity as a result of the northbound traffic diversion. The intersection has a LoS of 'E' for the future and construction scenarios, worsening to a LoS 'F' for the Traffic Diversion scenario.

While the average delay has increased from 38 seconds in the existing scenario to 103 seconds in the traffic diversion scenario, nearly half of this additional delay occurs as a result of the future traffic growth. Future growth is not a result of the Sydney Metro Sydenham to Bankstown Project and can therefore not be attributed to the project.

The left turn movement from the Marrickville Road east approach is the worst performing movement with average delays of over three minutes.

The high delay for this movement can be attributed to the additional eastbound through movement along Marrickville Road which prevents right turn traffic making the movement in gaps between oncoming traffic. Not being able to make the right turn, the traffic blocks the middle westbound lane and reduces the throughput capacity which in turn reduces the left-turn and through capacity and increases the delays.

Inevitably, some traffic would reroute and other traffic would turn right in less than satisfactory gaps. This would reduce the delays through the intersection.

6.6.3 Bus Network

The bridge works result in a half road closure during day and night works on Illawarra Road Bridge.

Currently the bus route 423 and L23 crosses the Illawarra Road Overbridge. The diversion routes are shown in **Figure 6.3**. During the southbound bridge closure period, the route would be redirected via Victoria Road, across the Charlotte Avenue Underbridge, along Myrtle Street and Carrington Road and then would re-join the existing bus route via Warren Road. During the northbound bridge closure and given there would be no right turn provision at Illawarra Road / Warren Road intersection, buses would turn right onto Schwebel Street and continue through Carrington Road and Myrtle Street, cross the Charlotte Avenue Underbridge and join the existing bus route via Victoria Road.

Northbound buses are redirected through Schwebel Street due to the existing “No Right Turn” restriction from Illawarra Road into Warren Road. Whilst southbound buses can be redirected through Schwebel Street, this is not recommended due to the narrow carriageway width and on-street parking. Allowing both directional bus routes would potentially require parking restrictions and as such two way bus diversions via Schwebel Street may not be feasible. Therefore the above separate north and southbound diversion routes are those most likely to be adopted for the short full closure period.

The northbound bus diversion would result in two stops on Marrickville Road not being served. The nearest northbound stop to Marrickville station would remain in operation. The southbound bus diversion would result in two stops on Marrickville Road and two stops on Illawarra Road not being served. The provision of a temporary stop on Illawarra Road, south of Warren Road would assist transfer between bus and Marrickville station albeit these stops would be approximately 400m from the station entrance.

6.6.4 Pedestrians and Cyclists

There are footpaths on both sides of Illawarra Road. During the half lane closures, pedestrians and cyclists would be diverted to the other side of the road which has remained open. Temporary traffic management would need to be in place at both ends of the bridge to aid pedestrians and cyclists. During the two day full closure, the shortest diversion route for pedestrians would be to use the Livingstone Road overbridge which is approximately 650m to the west. Signage would be required to direct pedestrians. Due to the lack of footpaths on Herb Greedy Place, pedestrians would be required to walk through McNeilly Park. Further assessment in relation to the suitability of this route would be undertaken during the preparation of CEMP, including consultation with the local Council. In the event that this route is not considered to be appropriate, pedestrians would be directed to follow the northbound traffic diversion route.

6.7 Livingstone Road Overbridge

Livingstone Road Overbridge in Marrickville, as shown on **Figure 6.4** is a steel girder bridge with a concrete bridge deck. The bridge deck spans 4 tracks; two ARTC Goods Lines and two T3 Bankstown Lines. The Overbridge carries approximately 12,200 vehicles per day.

Some 40 construction haulage vehicle trips are expected to be made using Livingstone Road Overbridge over a 24 hour period while compound or worksite activities are occurring. During the AM and PM peak hours, construction haulage trips would comprise of four heavy vehicle trips.

6.7.1 Diversion Route

The Livingstone Road Bridge requires a full closure for 48 hours to waterproof and asphalt the bridge. During that time traffic would be diverted to Illawarra Road Overbridge shown in **Figure 6.4**. This would not have a major impact on the traffic network as the road closure would occur during a weekend as the bridge services residential catchments.

The remaining upgrade works requiring narrow lane closures one at a time over an eight month period, are unlikely to have a major impact on the traffic network as they would occur during nights and weekends. These works would be covered by a detailed traffic management plan which would take account of the high levels of demand, including weekend levels at this location.

6.7.2 Bus Network

Currently bus route 412 crosses the Livingstone Road Overbridge (refer to **Figure 6.4**). During the full bridge closure period, the bus route would be redirected along Warren Road and Illawarra Road, over the Illawarra Road Overbridge, across Petersham Road and then join the existing route via Marrickville Road as shown in **Figure 6.4.** The return route follows the same road network in reverse. The diversion would result in three northbound and three southbound stops not being served, and buses calling at the existing stops on Illawarra Road and Marrickville Road instead,

6.7.3 Pedestrians and Cyclists

This bridge has footpaths on either side and during the narrow lane closures, it is likely that pedestrians and cyclists would be diverted to one side of the bridge. Temporary traffic management would be in place at either end of the bridge to aid pedestrians and cyclists.

During the 48 hour close down period pedestrians and cyclists would be unable to use the Livingstone Road Overbridge. They would be diverted to Illawarra Road Overbridge some 650m to the east or 450m to Albermarle Street Overbridge to the west.

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Location and diversion routes - Livingstone Road overbridge

FIGURE 6.4

6.8 Albermarle Street Overbridge

The Albermarle Street Overbridge located in Marrickville, as shown in **Figure 6.5**, is a three span steel girder bridge with a concrete bridge deck of approximately 30m in length. The bridge spans four tracks; two ARTC Goods Lines, two tracks across the T3 Bankstown Line.

his bridge is on a haulage route, but the volumes are anticipated to be extremely low, in the order of two to three construction haulage vehicle trips a day.

6.8.1 Diversion Route

The bridge requires a full closure for four weeks. This would be followed by weekend and night works for a further seven months. The weekend and night works are expected to entail a series of half lane and full lane closures. During these closure periods, traffic would be diverted to the Livingstone Road Over Bridge, as shown in **Figure 6.5**.

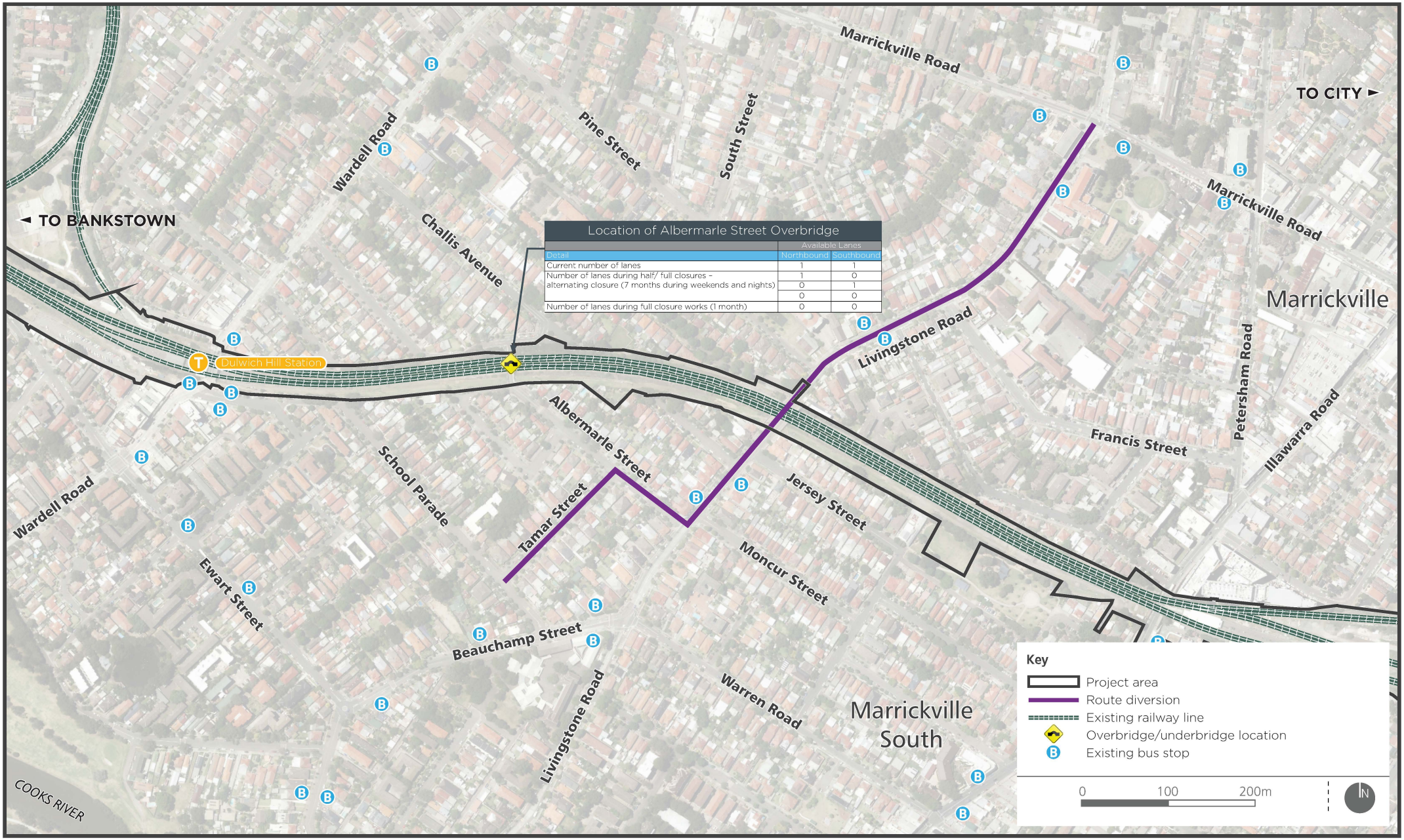
This is not expected to have a significant impact on the surrounding local road network as the bridge services a small residential catchment. These works would be covered by a detailed traffic management plan.

6.8.2 Bus Network

Currently no bus routes cross the Albermarle Street Overbridge and no bus routes would be affected by work undertaken on the bridge.

6.8.3 Pedestrians and Cyclists

Bridge works would require closure of the footpath on the eastern side of the bridge. This footpath would be closed during weekend half lane closures of the westbound lane and during the four week full bridge closure. Pedestrians would need to use the Livingstone Road Overbridge to the east or Wardell Road Overbridge to the west, if they wish to cross the railway lines during this time, these each being some 500m away.



Location and diversion route - Albermarle Street overbridge

FIGURE 6.5

6.9 Wardell Road Overbridge

Wardell Road Overbridge located in Dulwich Hill, as shown in **Figure 6.6**, is a three span concrete girder bridge with a total length of approximately 27m. The bridge carries one lane of traffic in each direction and provides direct access to Dulwich Hill Station. The bridge spans four railway lines; two ARTC Goods Lines and two Bankstown Lines. Approximately 14,400 vehicles per day (estimated from September 2016 peak hour traffic counts) use the Overbridge.

In the order of 240 construction haulage vehicle trips are expected to be made using Illawarra Road Overbridge over a 24 hour period while compound or worksite activities are occurring. During the AM and PM peak hours it is are expected that 10 light vehicle and 12 heavy vehicles trips would be performed using this route.

6.9.1 Diversion Route

The Wardell Road Overbridge upgrade works require half lane closures periodically during weekends and nights over six months. During these half lane closures, northbound or southbound traffic would be diverted to Livingstone Road Overbridge, as shown in **Figure 6.6**.

Traffic volumes are similar for northbound and southbound movements and as a consequence during the northbound closure, the southbound traffic would be diverted to Livingstone Road Overbridge and during the southbound closure, the northbound traffic again diverted to Livingstone Road Overbridge. These works would be covered by a detailed traffic management plan. Although the works for this diversion route would occur during weekends and nights, the following high volume intersections would be impacted:

- Marrickville Road / Livingstone Road[45]
- Warren Road / Livingstone Road[46]

Traffic has not been diverted to the Albermarle Street Overbridge despite it being the closest bridge to the east, as the bridge currently serves a small residential catchment and is therefore assumed to be incapable of carrying the diverted traffic from Wardell Road Overbridge.

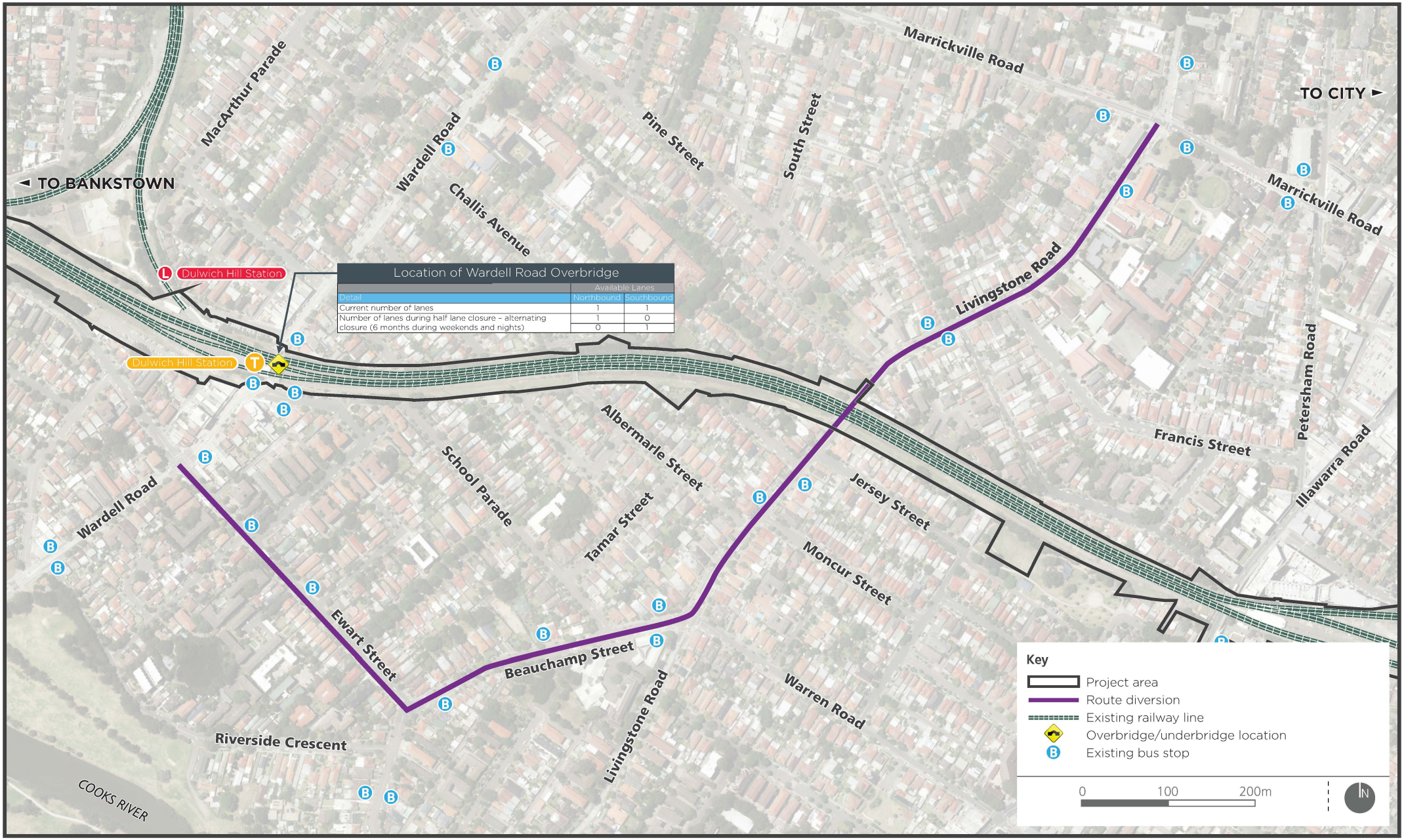
6.9.2 Bus Network

Currently no service bus routes cross the Wardell Road Overbridge.

6.9.3 Pedestrians and Cyclists

Construction activities required for the bridge upgrade would result in a half closure during construction. This bridge has footpaths on either side and during the half lane night and weekend closures, pedestrians and cyclists would be diverted to the side of the bridge which remains open. An uncontrolled pedestrian crossing exists on the southern end of the bridge and can be used to aid pedestrian and cyclist movements. Temporary traffic management would be in place at the northern end of the bridge to aid pedestrians and cyclists.

[45] Due to insufficient data at the time of reporting, this intersection has not been modelled
[46] Due to insufficient data at the time of reporting, this intersection has not been modelled



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Location and diversion route - Wardell Road overbridge

FIGURE 6.6

6.10 Ness Avenue / Terrace Road Underbridge

The Ness Avenue / Terrace Road Underbridge located in Dulwich Hill, as shown in **Figure 6.7** is a three span steel girder bridge with a concrete deck that has a length of approximately 28m. The underbridge is estimated to carry approximately 1,300 vehicles per day (estimated from December 2016 peak hour traffic counts).

The bridge carries traffic over the ARTC Goods Lines and Bankstown Lines.

In the order of 460 construction haulage vehicle trips are expected to be made using Ness Avenue / Terrace Road Underbridge over a 24 hour period while compound or worksite activities are occurring. During the AM and PM peak hours there is expected to be 20 light vehicle and 22 heavy vehicles trips.

6.10.1 Diversion Routes

The bridge requires half lane closures during weekends and nights over a six month period to complete the upgrade works. During the half lane closures, it is assumed that half of the traffic would divert to Wardell Road Overbridge and the remainder to Garnet Street Overbridge, as shown in **Figure 6.7**. As the work is only occurring during weekends and nights, diversions would be addressed in detailed traffic management plans.

The following intersection would likely be impacted by the diversion:

- Marrickville Road / Wardell Road[47].

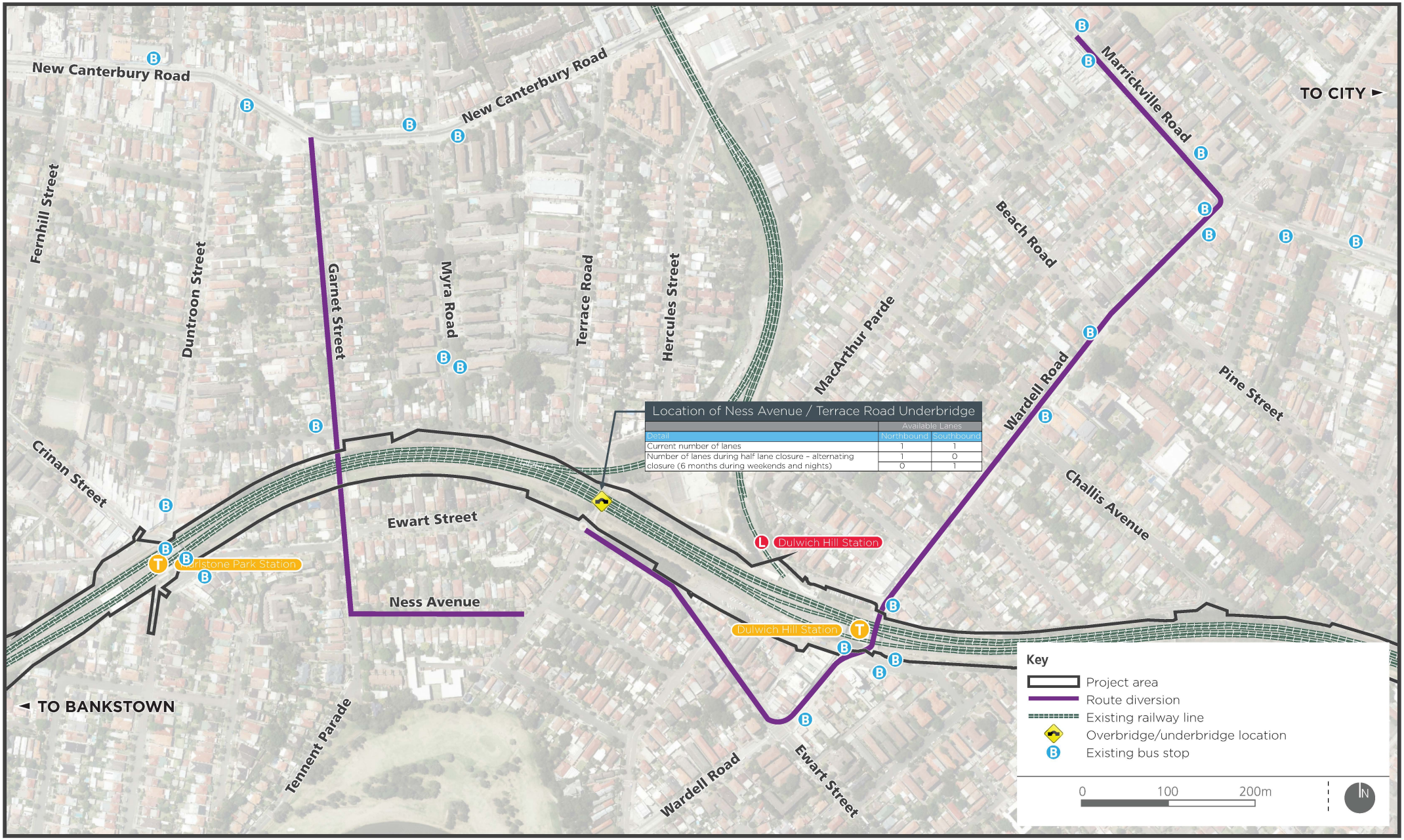
6.10.2 Bus Network

Currently no bus routes use the Ness Avenue / Terrace Road Underbridge and consequently the works required on the bridge would not affect existing public transport.

6.10.3 Pedestrians and Cyclists

Construction activities required for the bridge upgrade would result in a half closure during construction. There are footpaths outside of the brick piers on both sides of the road and during the half lane night and weekend closures, pedestrians and cyclists would be diverted to the side of the road which has remained open. Temporary traffic management would be in place at both ends of the bridge to aid pedestrians and cyclists.

[47] Due to insufficient data at the time of reporting, this intersection has not been modelled



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Location and diversion routes - Ness Avenue / Terrace Road underbridge

FIGURE 6.7

6.11 Garnet Street Overbridge

Garnet Street Overbridge located in Hurlstone Park, as shown in **Figure 6.8** is a three span concrete girder bridge of approximately 26m in length. The bridge has one lane of traffic in each direction and is estimated to carry less than 2,200 vehicles per day (estimated from December 2016 peak hour traffic counts).

The bridge spans four rail lines; two ARTC Goods Lines and two Bankstown Lines.

Some 40 construction haulage vehicle trips are expected to be made using Garnet Street Overbridge over a 24 hour period while compound or worksite activities are occurring. During the AM and PM peak hours, construction haulage traffic would comprise of four heavy vehicle trips.

6.11.1 Diversion Routes

Garnet Street Overbridge requires half lane closures during weekend and night works over a period of eight months. The bridge also requires 48 hours of full closure for waterproofing and asphalt works. The full closure would occur during a weekend and would be managed by a detailed traffic management plan; therefore no modelling has been undertaken.

The diversion route assumes half of all traffic would reroute to Duntroon Street Overbridge and the remainder to Ness Avenue / Terrace Road Overbridge, as shown in **Figure 6.8**.

6.11.2 Bus Network

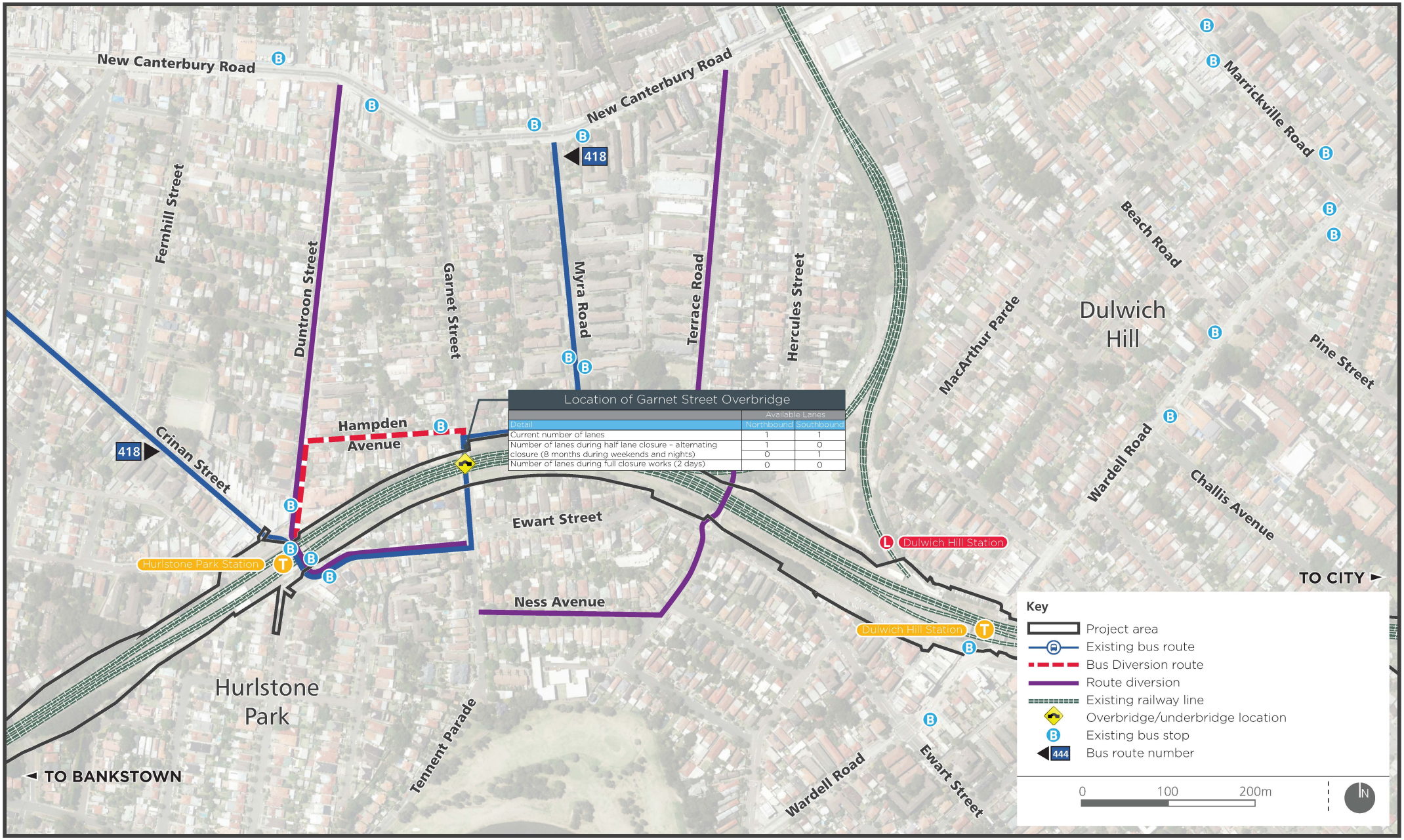
Bus route 418 crosses the Garnet Street Overbridge. During the full bridge closure period, it would be redirected along Garnet Street where it would re-join the existing route via Duntroon Street as shown in Figure **6**.**8**.

The return route travels the same route in reverse.

6.11.3 Pedestrians and Cyclists

A half lane closure would be required for the works at Garnet Street Overbridge. The bridge has a footpath on the eastern side and a narrow footpath on the western side and during the half lane night and weekend closures, pedestrians and cyclist would be diverted to the side of the road which remains open. Temporary traffic management would be in place at both ends of the bridge to aid pedestrians and cyclists.

During the 48 hour full closure, pedestrians and cyclists wishing to cross the railway lines would need to be diverted 400m to Ness Avenue / Terrace Road Underbridge to the east or 350m to Duntroon Street Overbridge to the west.



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Location and diversion routes - Garnet Street Overbridge

FIGURE 6.8

6.12 Duntroon Street Overbridge

Duntroon Street Overbridge located at Hurlstone Park, as shown in **Figure 6.9**, is a three span jack arch girder bridge deck with an overall length of approximately 27m. The bridge carries two lanes of traffic providing access to Hurlstone Park Station. The Overbridge carries approximately 2,000 vehicles per day (estimated from September 2016 peak hour traffic counts).

The bridge spans four railway lines; two ARTC Goods Lines and two Bankstown Lines.

In the order of 220 construction haulage vehicle trips are expected to be made using Duntroon Street Overbridge over a 24 hour period while compound or worksite activities are occurring. During the AM and PM peak hours there is expected to comprise of 10 light vehicle and 10 heavy vehicle trips.

6.12.1 Diversion Routes

Duntroon Street Overbridge requires half lane closures for weekends and nights over an eight month period. The bridge also requires 48 hours of full closure for waterproofing and asphalt works. The full closure would occur over a weekend and would be managed by a detailed traffic management plan.

The diversion route during half lane and full lane closure would be via Garnet Street Overbridge, as shown in **Figure 6.9**. The diversion route is not expected to impact any high volume intersections, and therefore no modelling has occurred.

6.12.2 Bus Network

Currently the bus routes 406, 418 and N40 cross the Duntroon Street Overbridge.

During the full bridge closure period, the bus routes 406 and N40 would be redirected through Floss Street and Garnet Street, across the Garnet Street Overbridge and then join the existing bus route via Duntroon Street as shown in **Figure 6.9**. The return route would follow the same path in reverse. These diversions would result in one northbound and one southbound stop not being served. These stops are the closest stops to Hurlstone Park station; the provision of a pair of stops on Duntroon Street (immediately before the diversion) would aid transfer between these buses and the station and could also be served by route 418.

The bus route 418 would be redirected through Garnet Street where it would join the existing route via Duntroon Street as shown in the **Figure 6.9**. The return route would follow the same path but in the opposite direction. This diversion would result in three northbound stops and one southbound stop not being served, including the stops closest to Hurlstone Park station.

6.12.3 Pedestrians and Cyclists

Duntroon Street Overbridge has wide footpaths on either side of the bridge and during the half lane night and weekend closures, pedestrians and cyclists would be diverted to the side of the road which has remained open. The uncontrolled pedestrian crossing at the northern end of the bridge can be used to aid pedestrian and cyclists movement during the diversion. Temporary traffic management would need to be in place at the southern end of the bridge to aid the pedestrians and cyclists in the absence of a pedestrian crossing.

During the 48 hour full closure, pedestrians and cyclists wishing to cross the railway lines would be diverted 350m to Garnet Street Overbridge to the east or 600m to Foord Avenue Underbridge to the west.

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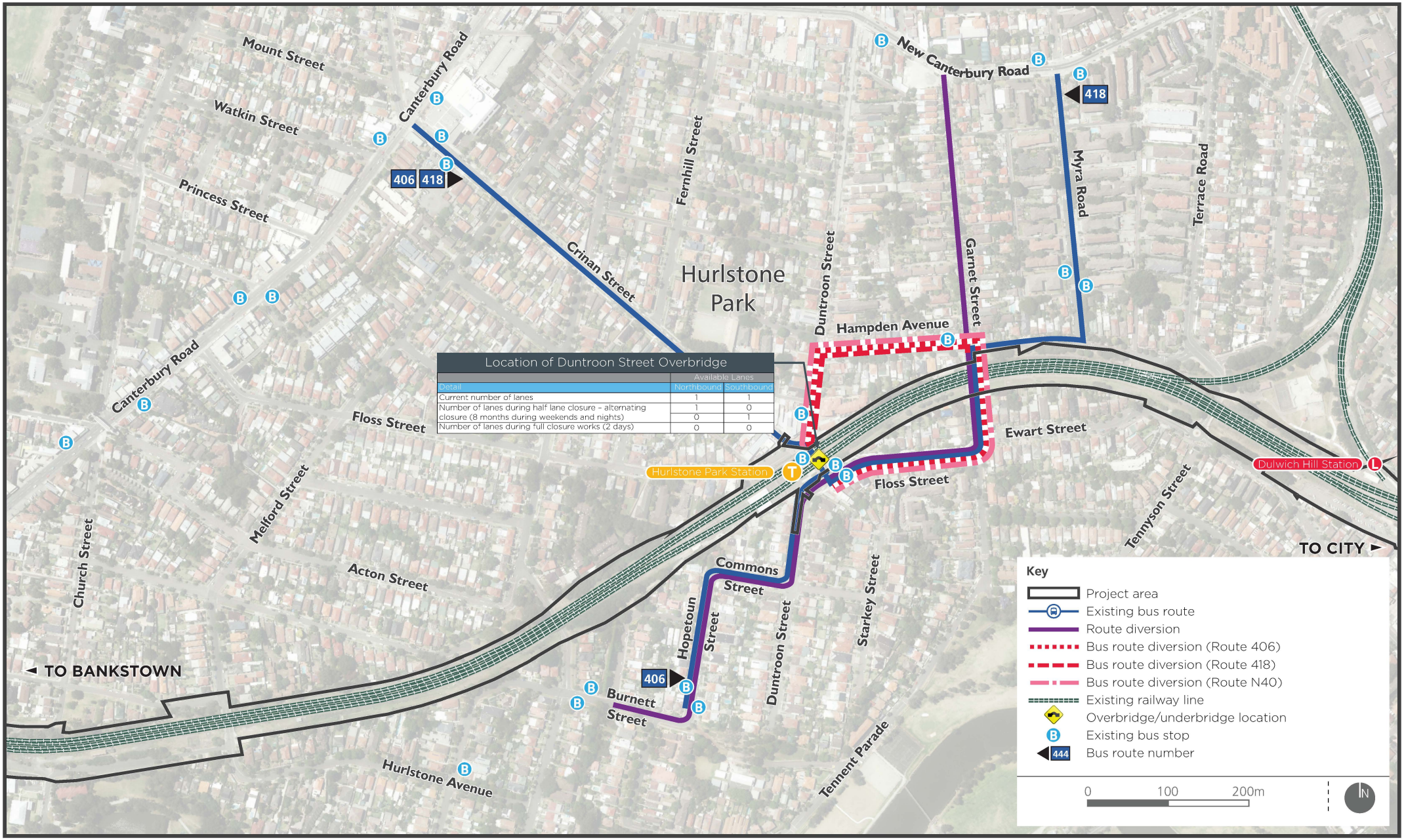

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Location and diversion routes - Duntroon Street overbridge

FIGURE 6.9

6.13 Foord Avenue Underbridge

Foord Avenue Underbridge located in Hurlstone Park, as shown in **Figure 6.10**, is a two span concrete girder bridge deck of approximately 11m in length. The bridge carries the ARTC Goods Lines and the Bankstown Lines.

This bridge is on a construction haulage route, but the volumes are anticipated to be extremely low, in the order of two to three construction haulage vehicle trips a day.

6.13.1 Diversion Routes

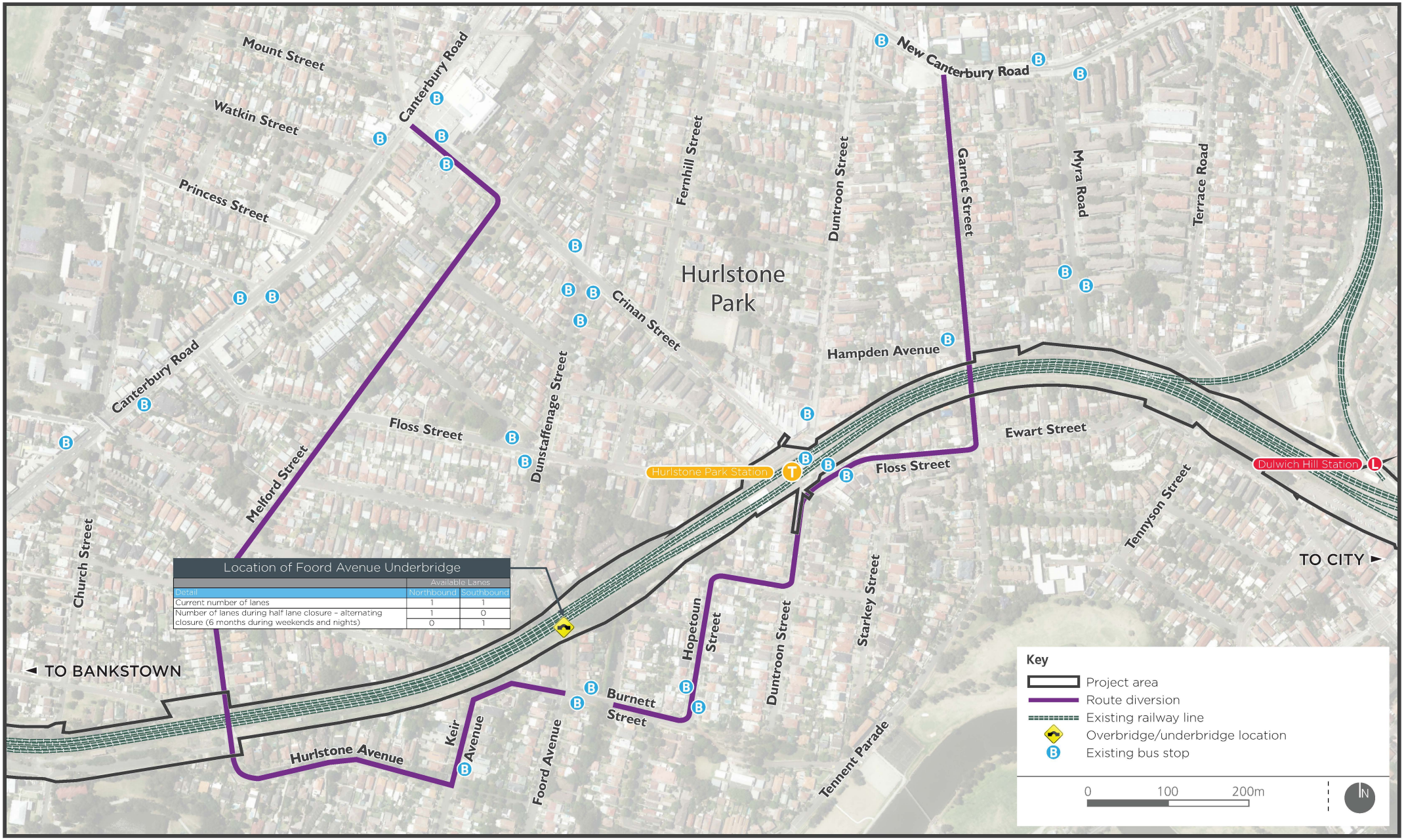
Foord Avenue Underbridge requires half lane closures during weekend and night works over a six month period to complete the works. Half of the traffic would be diverted to Melford Street Overbridge and the remainder to Duntroon Street Overbridge during the half lane closures, as shown in **Figure 6.10**. These weekend and night works would be covered by detailed traffic management plans. Diversions from closures have not been modelled as closures would be during weekends and nights.

6.13.2 Bus Network

Currently no bus routes use the Foord Avenue Underbridge and therefore no bus route would be impacted by the bridge works.

6.13.3 Pedestrians and Cyclists

This bridge does not have any footpaths and consequently the closure of Foord Avenue would not affect pedestrians. The bridge construction would require half lane night and weekend closures which would mean cyclists would be diverted to the side of the road which has remained open.



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Location and diversion routes - Foord Avenue underbridge

FIGURE 6.10

6.14 Melford Street Overbridge

Melford Street Overbridge located at Hurlstone Park, as shown in **Figure 6.11** is a three span concrete girder bridge of approximately 26m in length. The bridge has one lane of traffic in each direction. It crosses four railway tracks; two ARTC Goods Lines and two Bankstown Lines.

This bridge is on a construction haulage route, but the volumes are anticipated to be extremely low, in the order of two to three construction haulage vehicle trips a day.

6.14.1 Diversion Routes

The Melford Street Overbridge is narrow and therefore requires full closure during upgrade works. The full closure would occur during weekends and nights over an eight month period. Diverted traffic would use Foord Avenue, as shown in **Figure 6.11**.

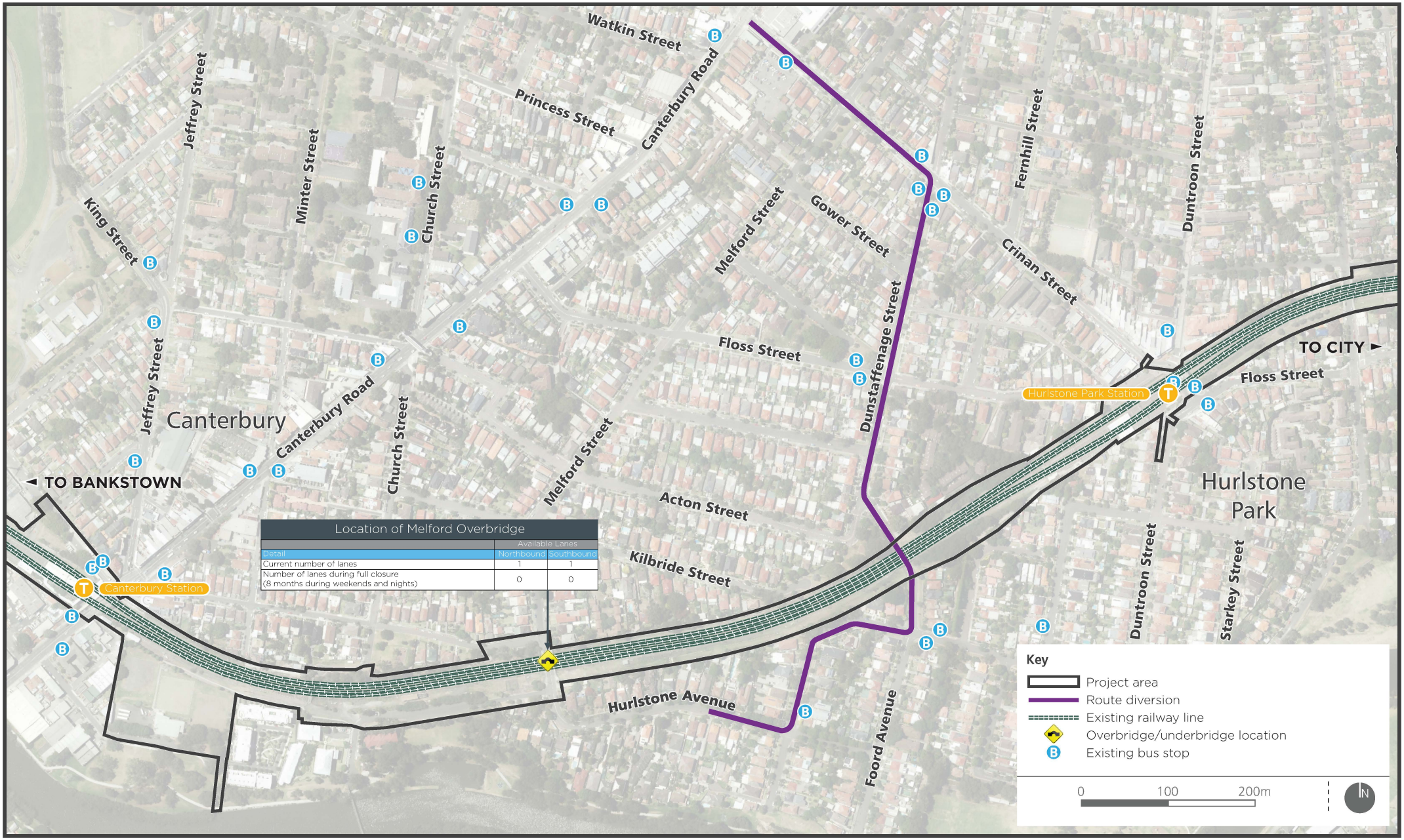
These weekend and night works would be covered by a detailed traffic management plan.

6.14.2 Bus Network

Currently no bus route crosses the Melford Street Overbridge and therefore no bus route would be impacted by the bridge works.

6.14.3 Pedestrians and Cyclists

Construction activities associated with the bridge upgrade would impact on pedestrian and cycle paths. The bridge has footpaths on either side and during the closure pedestrians and cyclists would be diverted to the Church Street/Hutton Street Footbridge approximately 350m to the west. Cyclists could also be diverted to the Foord Avenue Underbridge.



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Location and diversion route - Melford Street overbridge

FIGURE 6.11

6.15 Church Street / Hutton Street Footbridge

The Church Street / Hutton Street Footbridge located near Canterbury Station, as shown in **Figure 6.12** , is a two span steel girder bridge of approximately 23m in length. The bridge is used to allow pedestrians to cross four railway lines; two ARTC Goods Lines and two Bankstown Lines

6.15.1 Diversion Routes

This bridge is used for pedestrians only and therefore would not require the diversion of vehicles.

6.15.2 Pedestrians and Cyclists

The bridge works would require the footbridge to be closed periodically over six months. During these closure periods, pedestrians and cyclists wishing to cross the railway lines would be diverted 350m to Melford Street Overbridge to the east or 450m to Canterbury Road Overbridge to the west.

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Location of the Church Street / Hutton Street footbridge

FIGURE 6.12

6.16 Canterbury Road Overbridge

Canterbury Road Overbridge near Canterbury Station, as shown in **Figure 6.13**, is a three span jack arch girder bridge deck of approximately 28m in length. The bridge carries two lanes of traffic in each direction and is adjacent to Canterbury Station. The Overbridge carries approximately 51,300 vehicles per day.

It spans four railway lines; two ARTC Goods Lines and two Bankstown Lines.

In the order of 260 construction haulage vehicle trips are expected to be made using Canterbury Road Overbridge over a 24 hour period while compound or worksite activities are occurring. During the AM and PM peak hours there is expected to be 10 light vehicle and 14 heavy vehicle trips.

6.16.1 Diversion Routes

Canterbury Road Overbridge would require traffic barriers and safety screen upgrades, general maintenance, waterproofing, throw screens, bridge parapet replacement and asphalt works. These works would require lane closures during weekends and nights over an eight month period to upgrade the bridge. During these lane closures, the number of lanes would be reduced to one lane in each direction. This allows the bridge to retain contra flow while enabling the upgrade works to continue.

These traffic diversions occur during weekends and nights and would therefore be managed by detailed traffic management plans. Any works related to the creation of traffic management plans would be done in consultation with RMS.

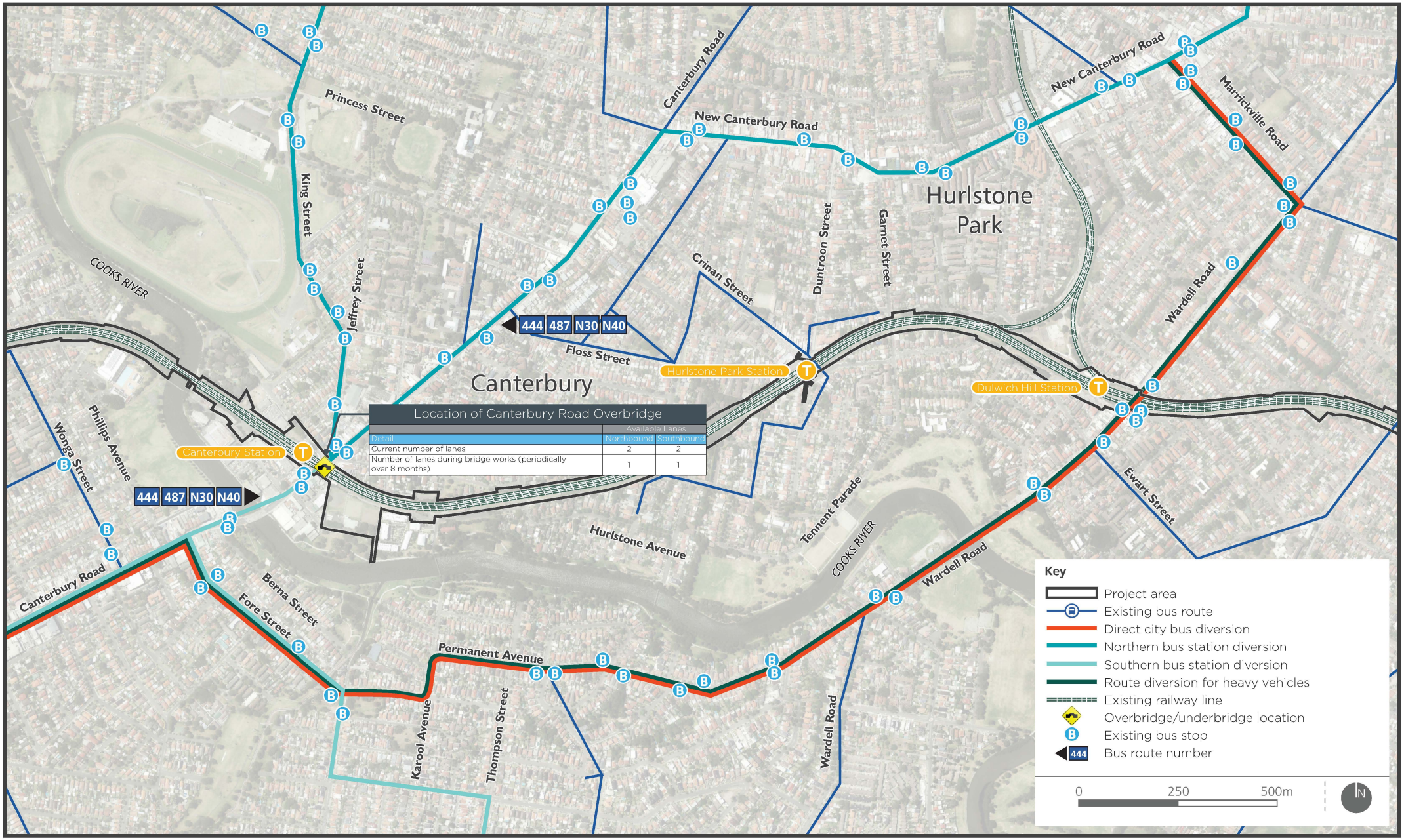
The Broughton Street approach could be closed while the reduced numbers of lanes are in operation. This would increase the phase split provided to the through movement. The impact on Broughton Street would be insignificant as it is a closed loop, providing a quick diversion to the Charles Street – Canterbury Road intersection for light vehicles.

6.16.2 Bus Network

Currently the bus routes 444, 487, 491, N30, N40 and 632s cross the Canterbury Road Overbridge. As the bridge would remain operative in both directions, the bus routes can continue their normal operation, however, they would be impacted by traffic management measures such as stop/go operations or by traffic congestion.

6.16.3 Pedestrians and Cyclists

The bridge has footpaths on either side and during the half lane closures pedestrians and cyclists would be diverted to the side of the bridge which has not been closed. Traffic management would be in place to facilitate the safe movement of pedestrians and cyclists across the road.



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Location and diversion routes - Canterbury Road overbridge

FIGURE 6.13

6.17 Cooks River / Charles Street Underbridge

The bridge (located in Canterbury) is made up of two separate structures; a masonry arch structures and a steel girder structure with a concrete bridge deck. The bridge is approximately 73.5m in length carrying the ARTC Goods Lines and Bankstown Lines across the river as shown in **Figure 6.14**.

In the order of 260 construction haulage vehicle trips are expected to be made using Canterbury Road Overbridge over a 24 hour period while compound or worksite activities are occurring. During the AM and PM peak hours there is expected to be 10 light vehicle and 14 heavy vehicle trips.

6.17.1 Diversion Routes

The Cooks River / Charles Street Underbridge requires a series of full and half closures during weekends and nights over a six month period to complete the upgrade works. During this time traffic would be diverted to the Canterbury Road Overbridge, as shown in **Figure 6.14**.

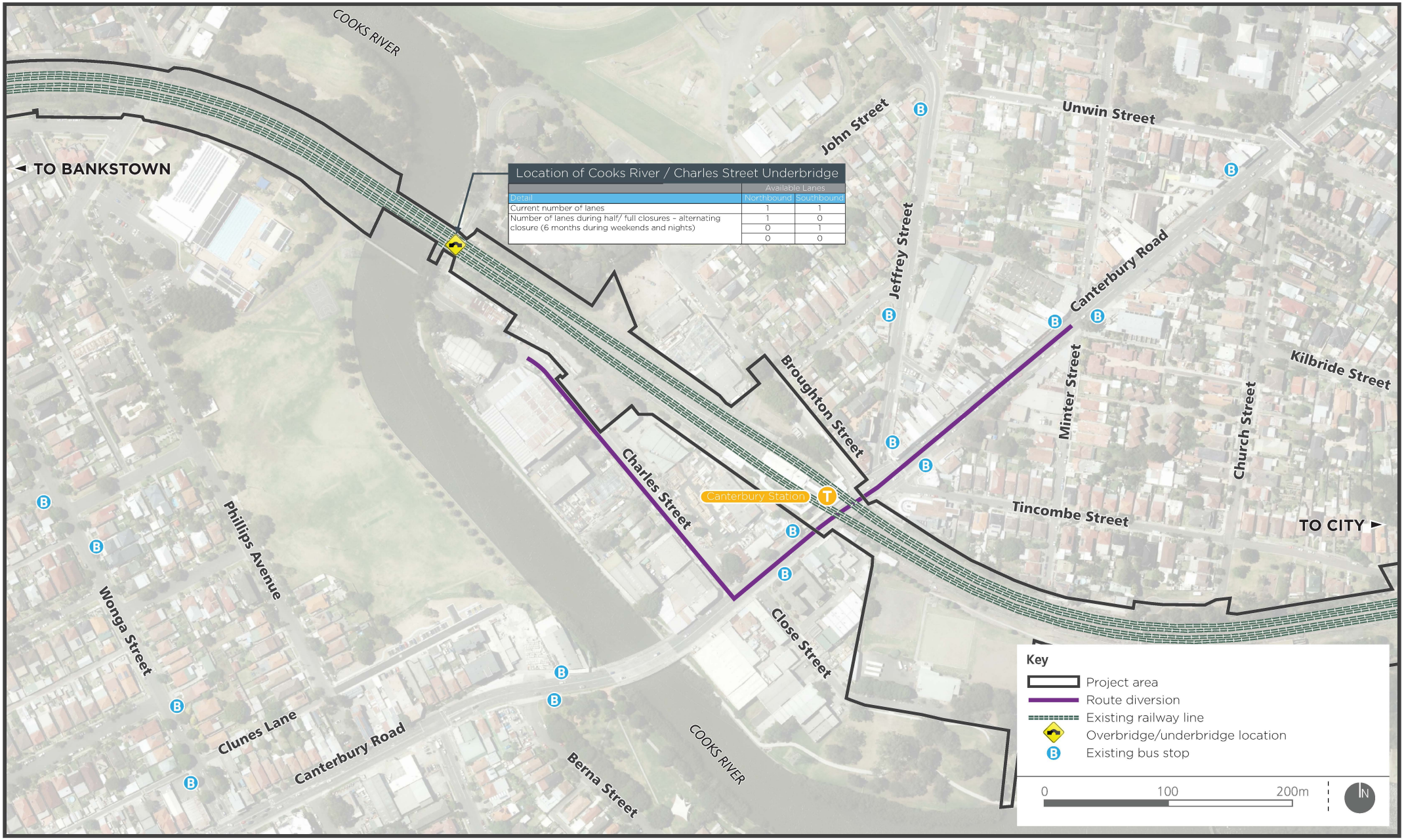
As shown above, this bridge forms a small closed loop (i.e. the road starts and ends at Canterbury Road like a crescent) and would therefore entail insignificant impacts from the closures and therefore no modelling has been undertaken. These closures would be managed with detailed traffic management plans.

6.17.2 Bus Network

Currently no bus route uses the Cooks River / Charles Street Underbridge and therefore no bus route would be affected by the bridge works.

6.17.3 Pedestrians and Cyclists

The Cooks River/Charles Street Underbridge has very narrow footpaths. It forms part of the Cooks River Cycleway and therefore generates high volumes of pedestrian and cyclist traffic, particularly on weekends. Works would therefore be encouraged to occur during night periods to minimise disruption to active transport modes. During closures, pedestrians and cyclists currently using this Underbridge would be required to divert 550m to the Canterbury Road Overbridge to the east.



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Location and diversion route - Cooks River / Charles Street underbridge

FIGURE 6.14

6.18 Wairoa M24 Street Underbridge

The Wairoa M24 Street Underbridge (located in Canterbury) is approximately 27.5m in length and made up of two separate structures; a masonry arch structure and a steel girder with concrete deck. The structures carry two ARTC Goods Lines and two Bankstown Lines as shown in **Figure 6.15**.

The underbridge carries approximately 10,100 vehicles per day (estimated from December 2016 peak hour traffic counts).

Construction haulage vehicles are not expected to use Wairoa M24 Street Underbridge.

6.18.1 Diversion Routes

Wairoa Street Underbridge requires half lane closures during weekends on nights over a six month period during which time traffic would be subject to traffic management measures contained in a Traffic Management Plan including measures such as manual traffic control and diversions. Traffic control work has been assessed during peak hours and the volume of traffic is sufficiently low to enable this type of traffic management without significant delays. **Figure 6.15** shows the diversion route during the Wairoa Street Underbridge closure.

A full closure would be required overnight to install the crash barrier. During the full closure traffic would be diverted to the Beamish Street Overbridge as this is the closest bridge with north – south movements.

Measures to manage weekend and night works would be addressed in detailed traffic management plans and no additional modelling work is required.

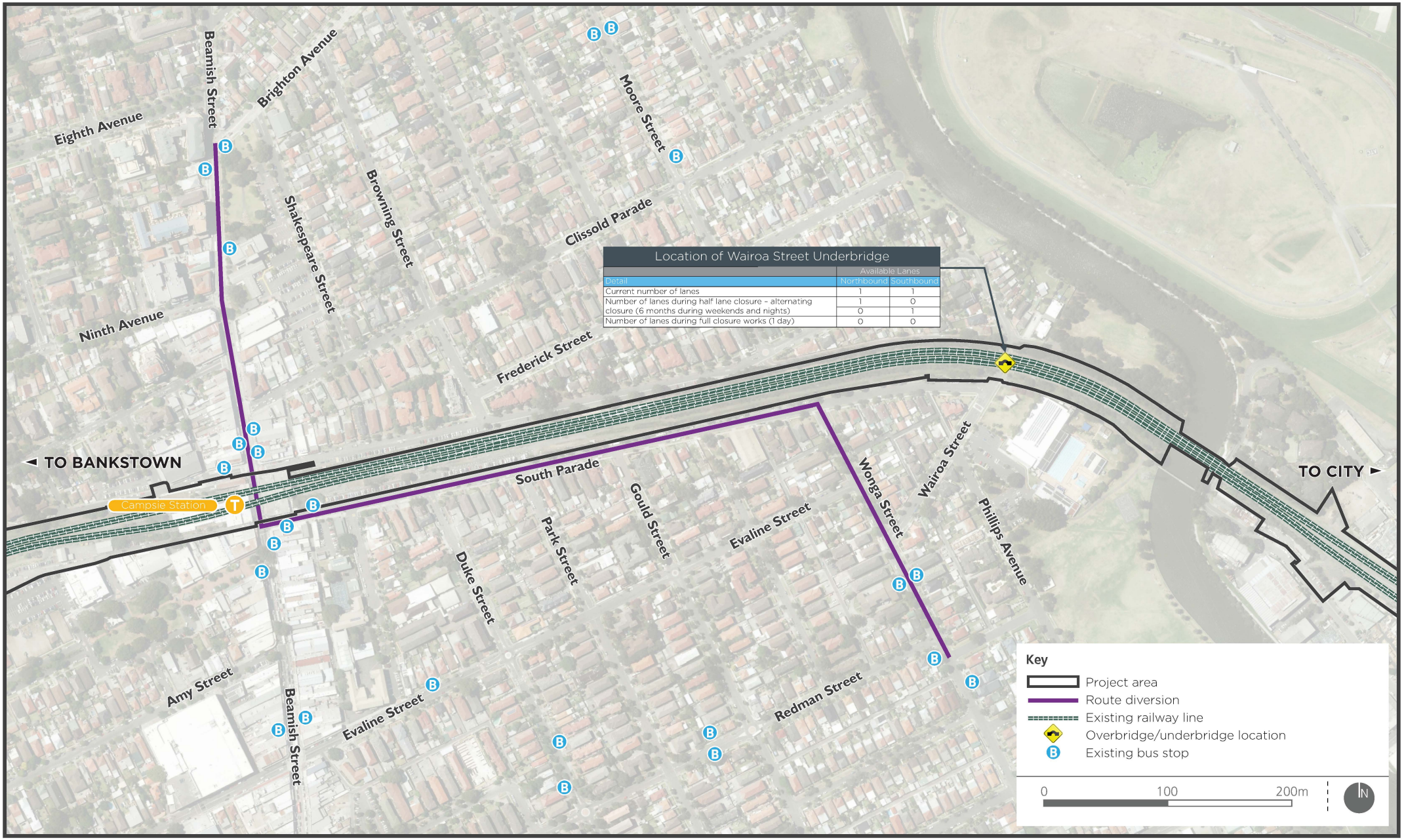
6.18.2 Bus Network

Currently no bus routes use the Wairoa Street Underbridge and therefore no bus route would be impacted by the bridge works.

6.18.3 Pedestrians and Cyclists

Construction activities near the Wairoa M24 Street Overbridge would require half a lane night and weekend closures, during which pedestrians and cyclists would be diverted to the side of the road which has remained open. Temporary traffic management would need to be in place at both ends of the bridge to aid pedestrians and cyclists.

It is expected that pedestrian and cyclist volumes during the full lane closure would be minimal during the night works. Pedestrians would be diverted 700m to the Duke Street Footbridge to the west. It is not expected that any pedestrians or cyclists would divert to Canterbury Road Overbridge as it follows a north east – south west route rather than a north – south route.



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Location and diversion route - Wairoa M24 Street underbridge

FIGURE 6.15

6.19 Duke Street Footbridge

The Duke Street Footbridge located in Campsie is a multi-span structure. The bridge crosses four railway lines; two ARTC Goods Lines and two Bankstown Lines as shown in **Figure 6.16**.

6.19.1 Diversion Routes

This bridge is used for pedestrians and cyclists only and therefore would not require the diversion of vehicles.

6.19.2 Pedestrians and Cyclists

Construction activities required for the Footbridge upgrade requires periodic closures over a six month period. During this time pedestrians and cyclists would need to divert 700m to Wairoa M24 Street Underbridge to the east or 200m to Beamish Street Overbridge to the west.

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Location of the Duke Street Footbridge

FIGURE 6.16

6.20 Beamish Street Overbridge

The Beamish Street Overbridge located in Campsie, is a three span jack arch girder bridge deck with an overall length of approximately 26m. Two lanes of traffic cross the bridge in each direction and it provides access to Campsie Station. The bridge spans four railway lines; two ARTC Goods Lines and two Bankstown Lines as shown in **Figure 6.17**.

Approximately 18,900 vehicles per day use the bridge.

In the order of 120 construction haulage vehicle trips are expected to be made using Beamish Street Overbridge over a 24 hour period while compound or worksite activities are occurring. During the AM and PM peak hours there is expected to be five light vehicle and five heavy vehicle trips.

6.20.1 Diversion Routes

The bridge requires lane closures during nights and weekends over a six month period. One way traffic would be implemented and the diverted traffic would use Loch Street Overbridge, as shown in **Figure 6.17**. Management measures for weekend and night diversion works would be in detailed traffic management plans.

It is recognised that the retail nature of the land uses adjacent to this bridge result in demand flows on weekends which are closer to weekday commuter peak levels than for other areas. However, whilst weekend 'retail' peaks are generally much longer than weekday morning and evening peaks, potentially spanning most of the day from mid- morning to late afternoon, the absolute levels are generally below the shorter and sharper weekday peaks. As such, the assessment has been based on data collected during weekday peaks, but recognising that the effects would occur during a weekend, as a conservative assessment.

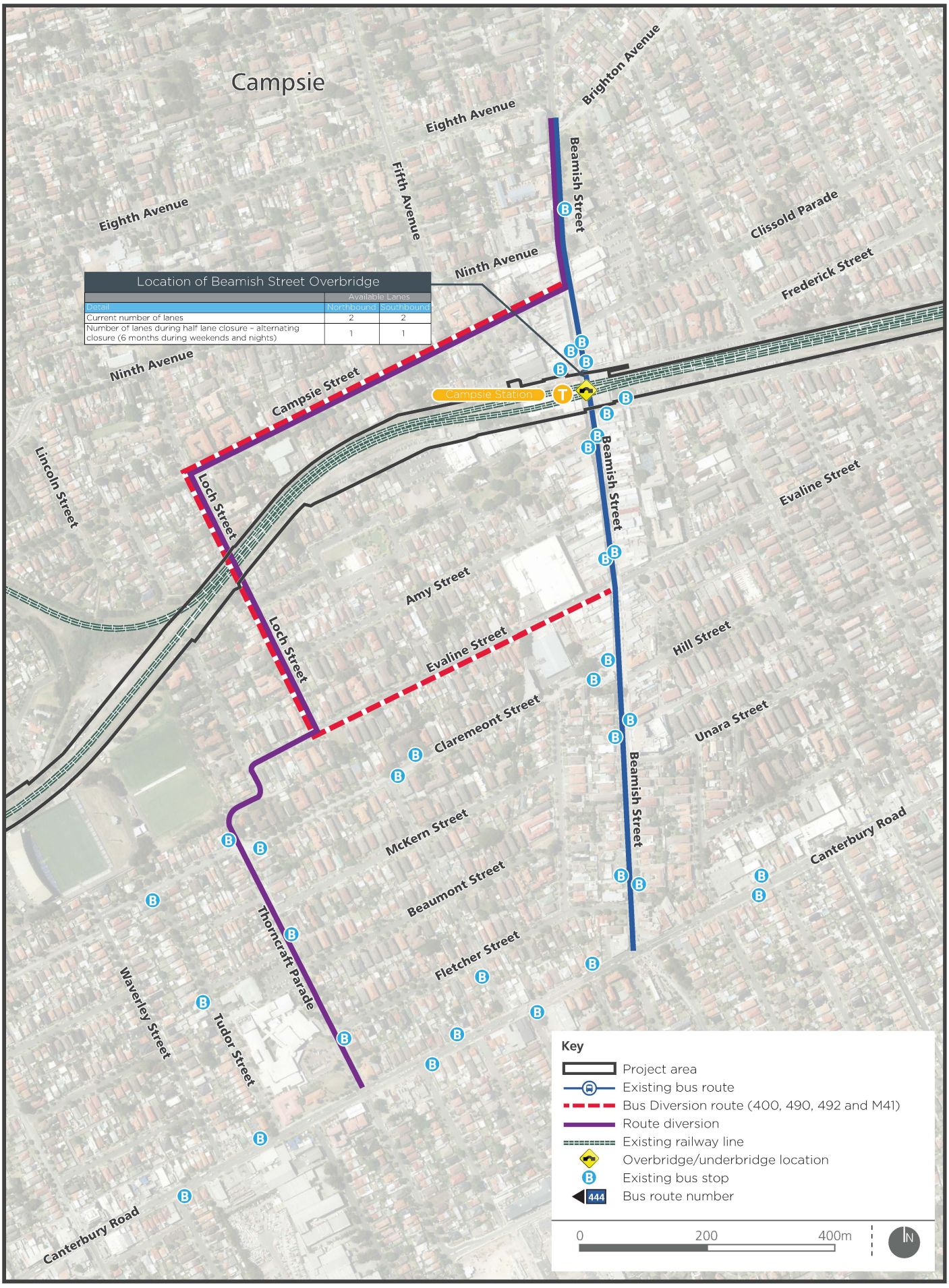
6.20.2 Bus Network

Currently bus routes 400, 490, 492 and M41 cross the Beamish Street Overbridge. During the one-way bridge closure periods, the blocked direction of all of these bus routes would be redirected through Evaline Street and Loch Street, cross the Loch Street Overbridge and join the existing paths via Campsie Street as shown in **Figure 6.17**. The return route similarly travels the route in the opposite direction.

These diversions would result in routes bypassing several bus stops and therefore temporary bus facilities would be required on the diversion route which may include stops on Campsie Street and Evaline Street.

6.20.3 Pedestrians and Cyclists

The Beamish Street Overbridge has footpaths on either side and during the half lane night and weekend closures, pedestrians and cyclists would be diverted to the side of the road which remains open. Temporary traffic management would be put in place at both ends of the bridge to aid pedestrians and cyclists.



Location and diversion routes - Beamish Street overbridge

FIGURE 6.17

6.21 Loch Street Overbridge

Loch Street Overbridge located in Campsie, is a four span concrete girder structure with an overall length of approximately 36.5m as shown in **Figure 6.18**. The bridge carries one lane of traffic in each direction and spans four railway lines; two ARTC Goods Lines and two Bankstown Lines.

Approximately 15,600 vehicles per day use the bridge.

In the order of 20 construction haulage vehicle trips are expected to be made using Beamish Street Overbridge over a 24 hour period while compound or worksite activities are occurring. During the AM and PM peak hours there is expected to be two light vehicle trips.

6.21.1 Diversion Routes

The bridge requires half lane closures during weekend and nights over a six month period to complete the upgrade works. During this time traffic would be diverted to the Beamish Street Overbridge, as shown in **Figure 6.18**. These night and weekend works would be managed in accordance with detailed traffic management plans.

6.21.2 Bus Network

Currently no bus routes cross the Loch Street Bridge and therefore no bus routes would be impacted by the bridge closure program.

6.21.3 Pedestrians and Cyclists

The Loch Street Overbridge has footpaths on either side of the bridge. During the half lane night and weekend closures, pedestrians and cyclists would be diverted to the side of the road which remains open. Temporary traffic management would be in place at both ends of the bridge to aid pedestrians and cyclists.

Location and diversion route - Loch Street overbridge

FIGURE 6.18

6.22 Pedestrian Access Oval Underbridge

The Pedestrian Access Oval Underbridge located in Belmore, is a 7m span concrete footbridge which provides pedestrian access to Belmore Sportsground as shown in **Figure 6.19**. The bridge currently spans two Bankstown Lines; however the bridge may need to be widened in the future to accommodate a new turnback for rail.

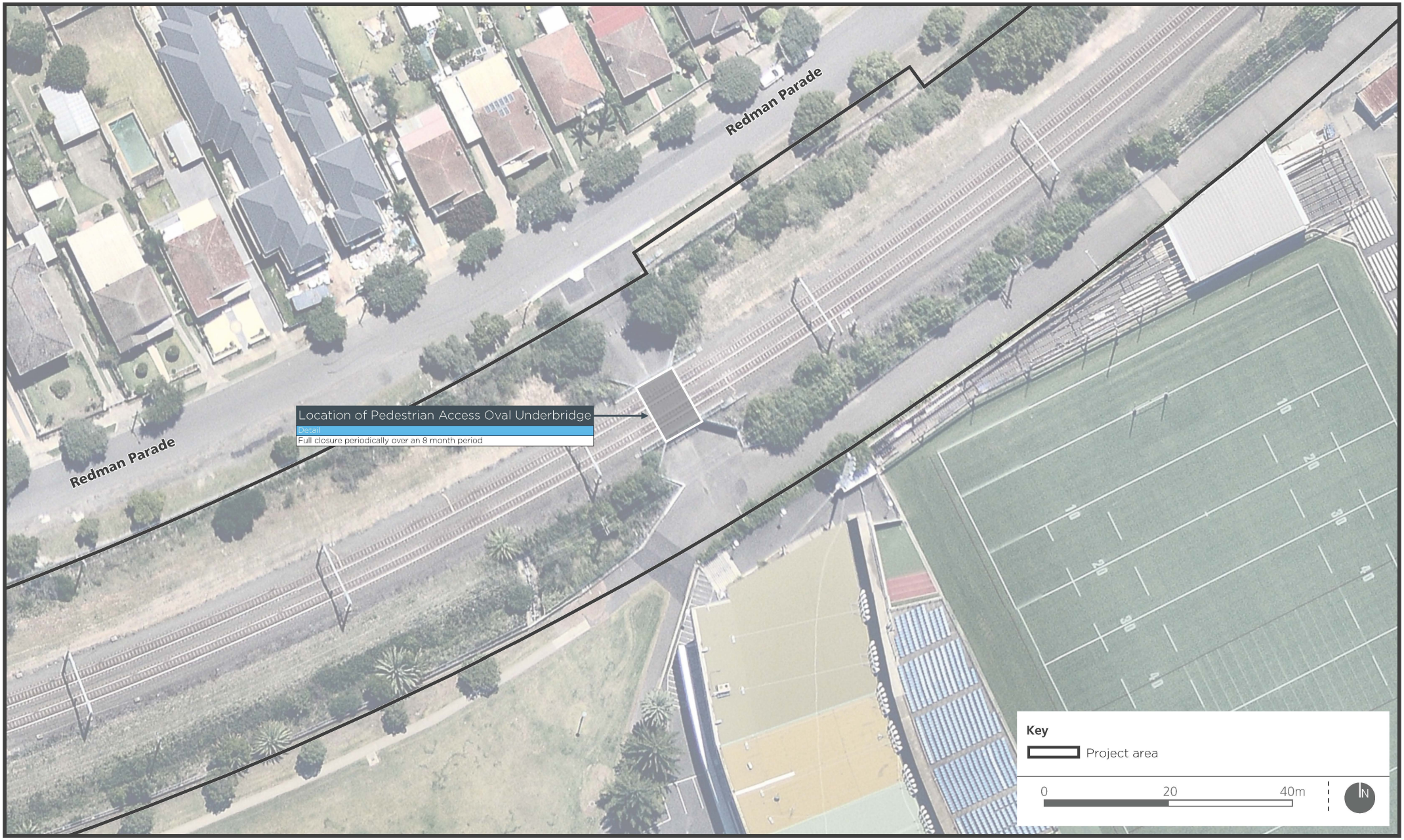
6.22.1 Diversion Routes

This Underbridge is used for pedestrians only and therefore would not require the diversion of vehicles.

6.22.2 Pedestrians and Cyclists

The bridge construction works require full closure during weekends and nights periodically over an eight month period. During this time pedestrians and cyclists would divert 550m to the Loch Street Overbridge to the east or 650m to the Burwood Road Overbridge to the west.

The timing of these closures would be co-ordinated to avoid conflict with events at the Belmore Sportsground.



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Location of the Pedestrian Access Oval underbridge

FIGURE 6.19

6.23 Other Bridges

The Sewer Line Underbridge requires construction works, but does not perform a transport function. The bridge is accessed via the specific location within the worksite described and assessed in Chapter 5. The nature of these works results in minor vehicle movements (less than 10 a day), would not have a significant effect on intersection performance and as such has not been explicitly modelled.

6.24 Belmore to Bankstown Bridge Closures

Works which result in lane or total closure of bridges closures between Belmore and Bankstown are assumed to occur outside of the periods when the TTS is operating during school holiday periods in December and July. In some cases works not requiring possessions could be undertaken during term one and three school holidays to reduce the impacts of the works where the impacts have been assessed to be significant.

It has been assumed that some works at track level requiring possessions can occur during the times that Baseline TTP or Refined Baseline TTP is operating, such as activities to increase the impact protection to piers.

These assumptions are applied to the assessment of the following bridges:

- Burwood Road Overbridge
- Moreton Street Overbridge
- Haldon Street Overbridge
- King Georges Road Overbridge
- Punchbowl Road Overbridge
- Stacey Street Overbridge
- North Terrace to South Terrace Overbridge; and
- Chapel Road Overbridge.

Further detail regarding these assumptions is provided in Chapter 4.

6.25 Burwood Road Overbridge

Burwood Road Overbridge, as shown in **Figure 6.20,** is a two span concrete girder structure with an overall length of approximately 34m which crosses both tracks of the Bankstown Line. There are two lanes of traffic in each direction providing access to Belmore Station. The Overbridge is estimated to carry approximately 19,700 vehicles per day (estimated from April 2016 peak hour traffic counts).

Some 440 construction haulage vehicle trips are expected to be made using Burwood Road Overbridge over a 24 hour period while compound or worksite activities are occurring. During the AM and PM peak hours, there would be in the order of 20 light vehicle and 20 heavy vehicle trips using the bridge.

6.25.1 Diversion Route

The bridge works would occur over six months of weekend works which are not dependent on school holiday periods and four weeks of half lane closures (two weeks per side).

The bridge works cannot occur while the TTS is in operation as Burwood Road Overbridge is directly adjacent to Belmore Railway Station and the TTS routes are likely to travel along Burwood Road Overbridge. The lane closure works would therefore need to occur while the TTP is not in operation.

During the half lane closures, southbound traffic would divert to Moreton Street Overbridge, as shown in **Figure 6.20**. As the half lane closures are not limited to night works or weekends, the affected intersections have been modelled to determine the likely level of impact from diversions.

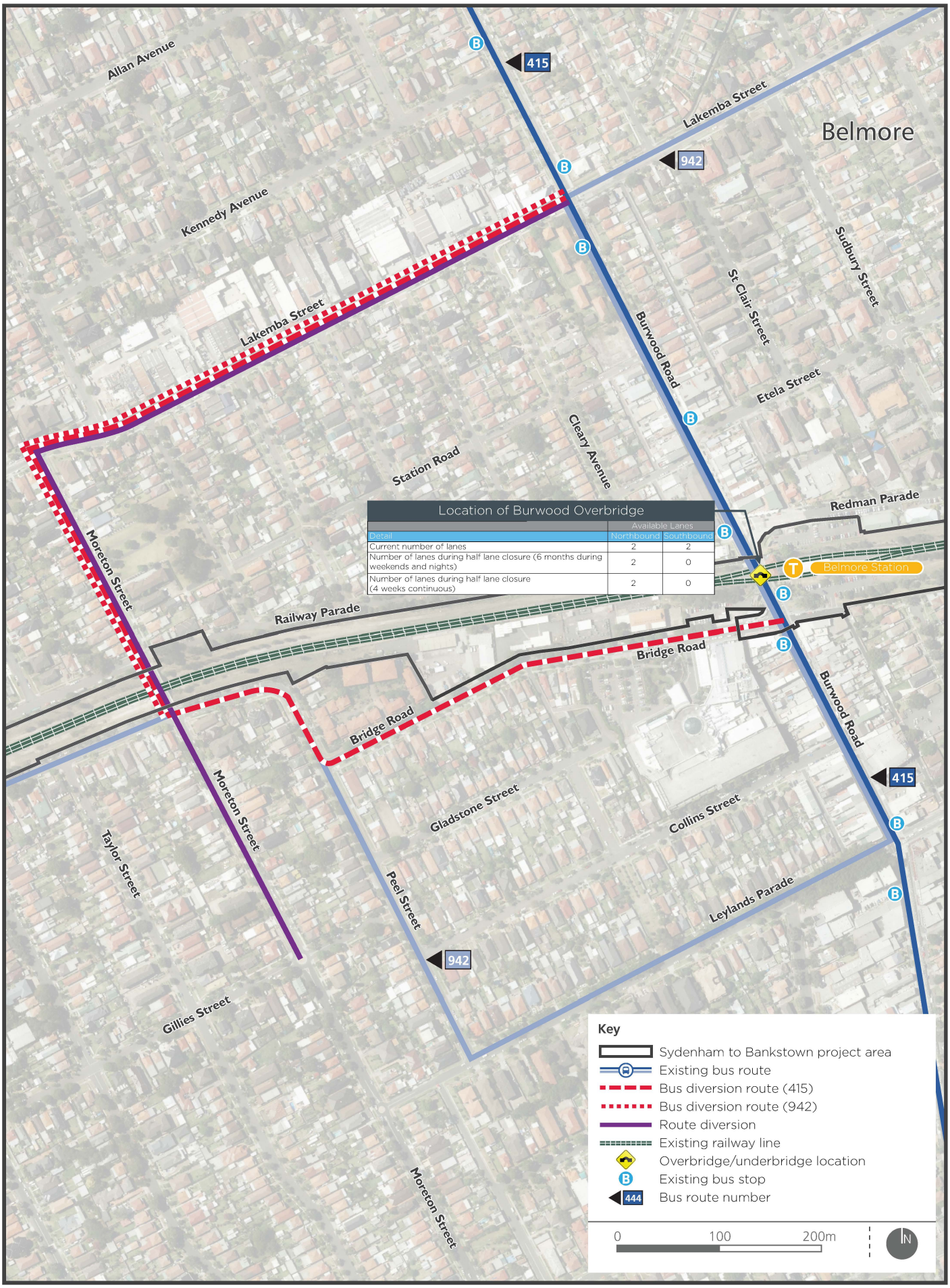
The following intersections were modelled:

- Burwood Road / Bridge Road
- Burwood Road / Redman Parade
- Burwood Road / Lakemba Road
- Moreton Street / Lakemba Road[48]
- Moreton Street / The Boulevarde[49].

In order for the Burwood Road / Lakemba Road intersection to perform adequately during the Traffic Diversion scenario, it was assumed for modelling purposes that parking would be removed from the Lakemba Road approaches in both the AM and PM peak periods. This would be a temporary measure in order to improve the throughput in the given green time and reduce the conflict time with the opposed right turn for the Burwood Road **north** approach.

An alternative option which has not been investigated further is for the southbound traffic to be run contraflow down Burwood Road. These assumptions would be further considered during detailed design.

[48] Due to insufficient data at the time of reporting, this intersection has not been modelled
[49] Due to insufficient data at the time of reporting, this intersection has not been modelled



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Location and diversion routes - Burwood Road overbridge

FIGURE 6.20

6.25.2 AM Peak Intersection Performance

Table 6.10 below shows a summary of the intersection assessment undertaken for this bridge.

Table 6.10 Burwood Road Overbridge Intersection Assessment – AM Peak

Burwood Road Overbridge Closure – AM Peak				
Scenario	**Existing**	**Future**	**Construction**	**Traffic Diversion**
Demand Flow (veh)	1736	1760	1795	1021
Average Delay per Vehicle (Average over all arms in seconds)	11	12	20	3
Average Delay per Vehicle (Worst Movement in seconds)	266	322	611	28
LoS (Worst Movement)				
DoS (Worst Movement)	0.95	1.03	1.39	0.40
Demand Flow (veh)	1652	1813	1845	1044
Average Delay per Vehicle (Average over all arms in seconds)	3	4	4	2
Average Delay per Vehicle (Worst Movement in seconds)	55	93	110	9
LoS (Worst Movement)				
DoS (Worst Movement)	0.63	0.69	0.72	0.38
Demand Flow (veh)	2149	2300	2309	2202
Average Delay per Vehicle (Average over all arms in seconds)	24	36	34	46
LoS (Overall)				
DoS (Worst Movement)	0.84	0.96	0.92	1.03
Demand Flow (veh)	1821	1999	1999	2763
Average Delay per Vehicle (Worst Movement in seconds)	9	11	11	307
Average Delay per Vehicle (Average over all arms in seconds)	11	14	14	750
LoS (Overall)				
DoS (Worst Movement)	0.73	0.83	0.83	1.81
Demand Flow (veh)	1527	1677	1677	2441
Average Delay per Vehicle (Worst Movement in seconds)	8	10	10	241
Average Delay per Vehicle (Average over all arms in seconds)	16	19	19	375
LoS (Overall)				
DoS (Worst Movement)	0.67	0.75	0.75	1.40

For two of the five intersections modelled, the level of service resulting from the traffic diversion is 'C' or better. A LoS 'C' would not cause delays above that which could be reasonably expected in the peak hour in Sydney.

Burwood Road / Bridge Road and Burwood Road / Redman Parade have a level of service 'F' for the construction scenario. The assessment and proposed mitigation for the construction effects is discussed in **Section 5.8** in the previous Chapter. Under the diversion scenarios the intersections perform satisfactorily without mitigation.

The Lakemba Street / Moreton Street and The Boulevarde / Moreton Street intersections are forecast to experience a decline in amenity as a result of the addition of the diverted traffic. Both intersections have LoS of 'B' in the Future and Construction scenarios, worsening to a LoS 'F' in the Traffic Diversion scenario.

At the Lakemba Street / Moreton Street intersection, the movements from the Lakemba Street east approach are the worst performing movements with delays of over 12 minutes.

At The Boulevarde / Moreton Street intersection, the movements from the Moreton Street north approach are the worst performing movements with delays of over six minutes.

The diversion route assumes all diverted traffic uses Moreton Street Bridge and traffic waits for satisfactory gaps before moving into the traffic stream. Outside the modelled assumptions drivers would choose a range of diversion routes, particularly the Loch Street Bridge, and would pull out into less than satisfactory gaps. This would reduce the demand and delays at the two intersections noted.

It is noted that whilst the demand has been demonstrated to reduce by up to 15% in the holiday periods, this would still be insufficient to allow the diversion to occur with only local effects. As such the CTMP would be required to consider additional mitigation measures, including those detailed in Chapter 9.

6.25.3 PM Peak Intersection Performance

Table 6.11 below shows a summary of the intersection assessment undertaken for this bridge.

Table 6.11 Burwood Road Overbridge Intersection Assessment – PM Peak

Burwood Road Overbridge Closure – PM Peak				
Scenario	**Existing**	**Future**	**Construction**	**Traffic Diversion**
B.08 Burwood Road / Bridge Road (Priority Controlled)				**Year Capped: 2018**
Demand Flow (veh)	1735	1787	1822	911
Average Delay per Vehicle (Average over all arms in seconds)	10	14	22	3
Average Delay per Vehicle (Worst Movement in seconds)	198	297	581	12
LoS (Worst Movement)	F	F	F	A
DoS (Worst Movement)	0.89	1.05	1.39	0.34
B.09 Burwood Road / Redman Parade (Priority Controlled)				**Year Capped: 2023**
Demand Flow (veh)	1625	1795	1826	970
Average Delay per Vehicle (Worst Movement in seconds)	3	4	4	2
Average Delay per Vehicle (Average over all arms in seconds)	56	103	124	8
LoS (Worst Movement)	D	F	F	A
DoS (Worst Movement)	0.65	0.72	0.74	0.35

Burwood Road Overbridge Closure – PM Peak				
Scenario	**Existing**	**Future**	**Construction**	**Traffic Diversion**
H.20 Burwood Road / Lakemba Street (Signals)				**Year Capped: 2023**
Demand Flow (veh)	2315	2558	2567	2442
Average Delay per Vehicle (Average over all arms in seconds)	21	27	28	57
LoS (Overall)	B	B	B	D
DoS (Worst Movement)	0.62	0.90	0.90	1.12
Lakemba Street / Moreton Street (Roundabout)				**Year Capped: 2023**
Demand Flow (veh)	1977	2185	2185	3079
Average Delay per Vehicle (Worst Movement in seconds)	11	17	17	521
Average Delay per Vehicle (Average over all arms in seconds)	14	24	24	1125
LoS (Overall)	A	B	B	F
DoS (Worst Movement)	0.74	0.88	0.88	2.23
The Boulevarde / Moreton Street (Roundabout)				**Year Capped: 2023**
Demand Flow (veh)	1723	1904	1904	2798
Average Delay per Vehicle (Worst Movement in seconds)	12	17	17	365
Average Delay per Vehicle (Average over all arms in seconds)	22	43	43	822
LoS (Overall)	B	C	C	F
DoS (Worst Movement)	0.70	0.87	0.87	1.86

For three of the five intersections modelled, the increase in delay resulting from the traffic diversion is 'D' or better. A level of service 'D' would not cause delays above that which could be reasonably expected in the peak hour in Sydney.

Like the AM Peak, Burwood Road / Bridge Road and Burwood Road / Redman Parade have a level of service 'F' for the construction scenario

The Lakemba Street / Moreton Street and The Boulevarde / Moreton Street intersections are forecast to experience a decline in amenity as a result of the addition of the diverted traffic. The intersections have LoS of 'B' and 'C' in the Future and Construction scenarios, worsening to a LoS 'F' in the Traffic Diversion scenario.

The movements from the Lakemba Street east approach at the Lakemba Street / Moreton Street intersection have a modelled delay of over 18 minutes in the traffic diversion scenario.

The movements from the The Boulevarde east approach at the The Boulevarde / Moreton Street intersection would also deteriorate to an average delay of nearly 14 minutes.

As with the AM Peak, the diversion route assumes all diverted traffic uses Moreton Street Bridge and traffic waits for satisfactory gaps before moving into the traffic stream. In reality, drivers would choose a range of diversion routes, particularly the Loch Street Bridge, and would pull out into less than satisfactory gaps. This would reduce the demand and delays at the two intersections noted.

Timing the works to co-incide with the term one or three holidays would not be sufficient mitigation to provide acceptable levels of service and therefore further mitigations should be developed as part of the CTMP.

6.25.4 Bus Network

During the northbound closure periods bus route 415 would be redirected through Bridge Road, across the Moreton Street Bridge and along Lakemba Street. The reverse would occur during southbound closure periods. These diversion routes are shown in **Figure 6.20**.

A temporary bus stop could be established on Lakemba Street to reduce the distance that bus passengers north of the railway line need to walk to access an operational bus stop. The maximum additional walking distance would then be 550m. There should be no extra walking distance required for passengers south of the railway line as the diversion route joins the existing route immediately south of the station.

During the north and southbound bridge closure periods bus route 942 would be redirected across the Moreton Street bridge and along Lakemba Street as shown in **Figure 6.20**. This service would not serve the area to the south of Belmore station during these bridge closure periods.

This diversion route misses six bus stops in one direction and five in the other. The diversion is expected to occur during weekend works and two sets of two week school holiday periods. During this time bus passengers would need to walk up to 1.2km to reach the closest operational bus stop.

6.25.5 Pedestrians and Cyclists

Burwood Road Overbridge has footpaths on either side and during the half lane closures, pedestrians and cyclists would be diverted to the side of the road which remains open. Temporary traffic management would be in place at both ends of the bridge to aid pedestrians and cyclists.

6.26 Moreton Street Overbridge

Moreton Street Overbridge located in Lakemba, as shown in **Figure 6.21**, is a four span bridge with concrete girders of approximately 30m in length. The bridge carries one lane of traffic in each direction across two Bankstown Lines. The Overbridge is estimated to carry approximately 16,800 vehicles per day.

Some 90 construction haulage vehicle trips are expected to be performed using Moreton Street Overbridge over a 24 hour period while compound or worksite activities are occurring. During the AM and PM peak hours eight heavy vehicle trips would use the bridge.

6.26.1 Diversion Route

The bridge works result in six months of weekend works (half-lane closures) which are not dependent on school holiday periods and four weeks of half lane closures (two weeks per side). During the half lane closures, traffic would divert to Burwood Road Overbridge, as shown **Figure 6.21**. Following this diversion, the following intersection are impacted:

- Moreton Street / Leylands Parade[50]
- Burwood Road / Leylands Parade[51].

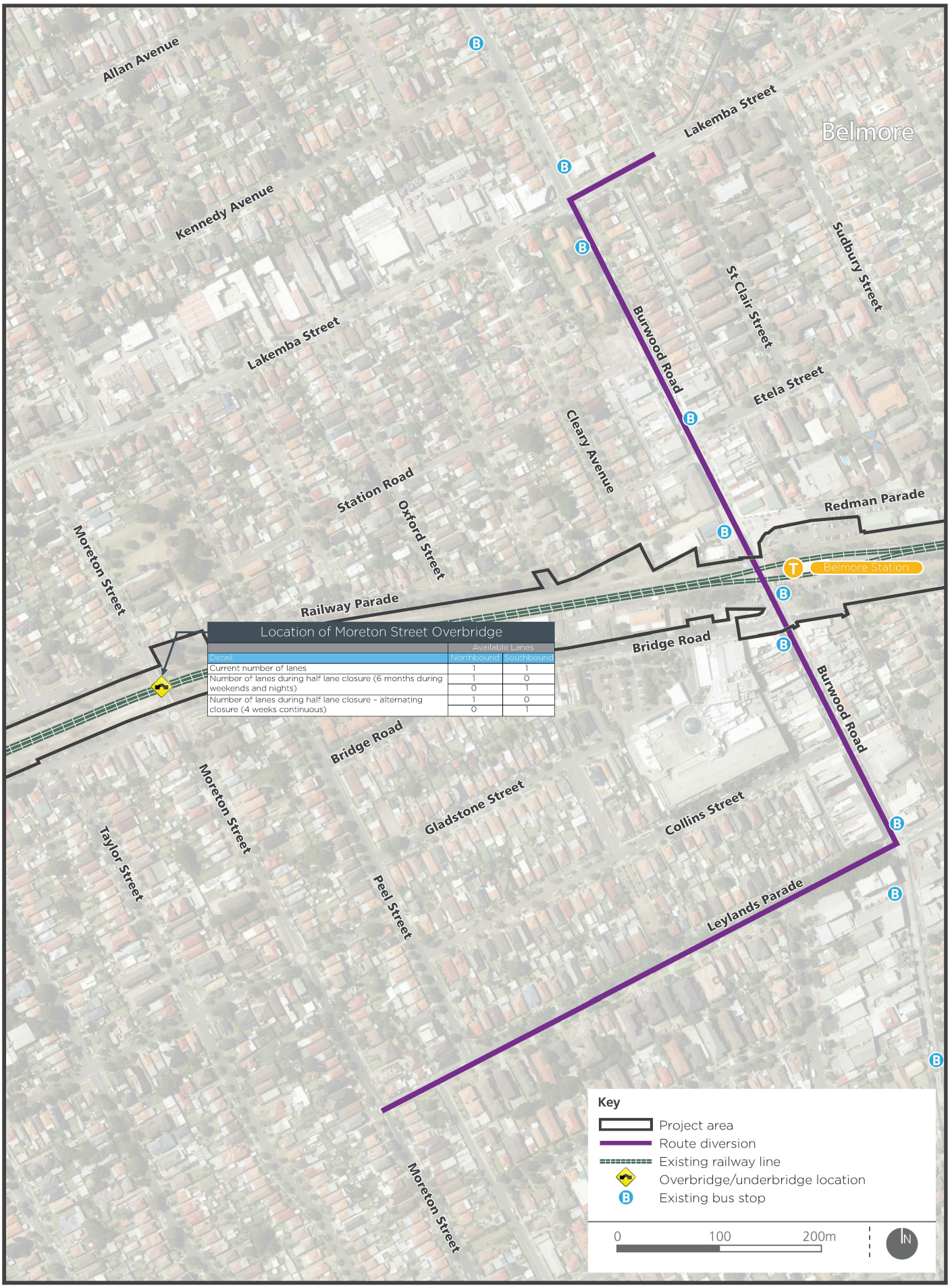
6.26.2 Bus Network

Currently no bus routes cross the Moreton Street Overbridge and therefore no bus routes would be affected by the works on Moreton Street Overbridge.

6.26.3 Pedestrians and Cyclists

The bridge has footpaths on either side. During the half lane closures, pedestrians and cyclists would be diverted to the side of the road which remains open. Temporary traffic management would be in place at both ends of the bridge to aid pedestrians and cyclists.

[50] Due to insufficient data at the time of reporting, this intersection has not been modelled
[51] Due to insufficient data at the time of reporting, this intersection has not been modelled



Location and diversion route - Moreton Street overbridge

FIGURE 6.21

6.27 Haldon Street Overbridge

Haldon Street Overbridge located in Lakemba, as shown on **Figure 6.22**, is a two span concrete girder structure with an overall length of approximately 27m. The Overbridge carries approximately 15,000 vehicles per day (estimated from April 2016 peak hour traffic counts).

There are two lanes in each direction which span two Bankstown Lines.

In the order of 220 construction haulage vehicle trips are expected to be performed using Haldon Street Overbridge over a 24 hour period while compound or worksite activities are occurring. During the AM and PM peak hours there is expected to be 10 light vehicle and 10 heavy vehicle trips.

6.27.1 Diversion Route

The bridge works result in six months of weekend works (half-lane closures) which are not dependent on school holiday periods and four weeks of full lane closures.

The bridge works cannot occur while the TTS is in operation as Haldon Street Overbridge is directly adjacent to Lakemba Railway Station.

During the full lane closures, both southbound and northbound traffic would divert to Moreton Street Overbridge, as shown in **Figure 6.22**. As the full lane closures are not limited to night works or weekends, the affected intersections have been modelled to determine the level of impact to the operation of intersections.

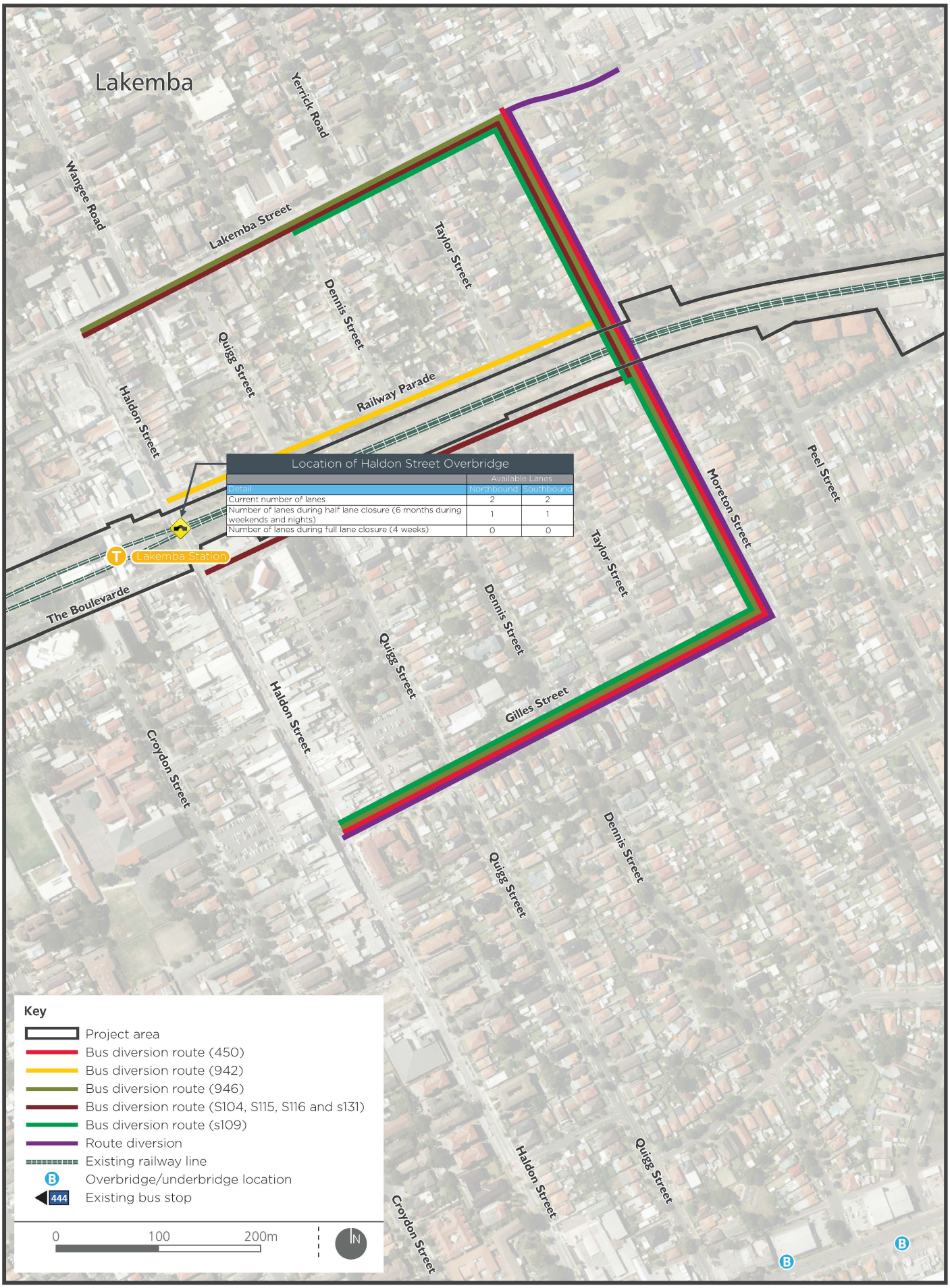
The following intersections were modelled:

- The Boulevarde / Haldon Street
- Haldon Street / Railway Parade
- Lakemba Street / Haldon Street
- Lakemba Street / Moreton Street
- The Boulevarde / Moreton Street.

As a result of the bridge closure, the **east** and **west** approaches for the Lakemba Street / Haldon Street intersection have become double through movements.

6.27.2 AM Peak Intersection Performance

Table 6.12 below shows a summary of the intersection assessment undertaken for this bridge.



Location and diversion routes - Haldon Street overbridge

FIGURE 6.22

Table 6.12 Haldon Street Overbridge Intersection Assessment – AM Peak

Haldon Street Overbridge Closure – AM Peak				
Scenario	**Existing**	**Future**	**Construction**	**Traffic Diversion**
B.07 The Boulevarde / Haldon Street (Signals)				**Year Capped: 2021**
Demand Flow (veh)	1964	2102	2139	1223
Average Delay per Vehicle (Average over all arms in seconds)	29	65	91	18
LoS (Overall)	C	E	F	B
DoS (Worst Movement)	0.93	1.05	1.12	0.52
H.08 Haldon Street / Railway Parade (Priority Controlled)				**Year Capped: 2023**
Demand Flow (veh)	1376	1511	1527	154
Average Delay per Vehicle (Average over all arms in seconds)	8	20	32	4
Average Delay per Vehicle (Worst Movement in seconds)	65	186	326	7
LoS (Worst Movement)	E	F	F	A
DoS (Worst Movement)	0.72	1.03	1.22	0.08
H.09 Lakemba Street / Haldon Street (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1757	1929	1929	1393
Average Delay per Vehicle (Average over all arms in seconds)	15	15	15	19
LoS (Overall)	B	B	B	B
DoS (Worst Movement)	0.58	0.59	0.59	0.43
Lakemba Street / Moreton Street (Roundabout)				**Year Capped: 2023**
Demand Flow (veh)	1821	1999	1999	2652
Average Delay per Vehicle (Average over all arms in seconds)	9	11	11	100
Average Delay per Vehicle (Worst Movement in seconds)	11	14	14	200
LoS (Overall)	A	B	B	F
DoS (Worst Movement)	0.73	0.83	0.83	1.19
The Boulevarde / Moreton Street (Roundabout)				**Year Capped: 2023**
Demand Flow (veh)	1527	1677	1677	2014
Average Delay per Vehicle (Average over all arms in seconds)	8	10	10	66
Average Delay per Vehicle (Worst Movement in seconds)	16	19	19	216
LoS (Overall)	B	B	B	F
DoS (Worst Movement)	0.67	0.75	0.75	1.20

For three of the five intersections modelled, the increase in delay resulting from the traffic diversion is 'B' or better. A level of service 'B' would not cause delays above that which could be reasonably expected in the peak hour in Sydney.

The Lakemba Street / Moreton Street and The Boulevarde / Moreton Street intersections are forecast to experience a decline in amenity as a result of the addition of the diverted traffic. In the future and construction scenarios both intersections have LoS of 'B', worsening to a LoS 'F' in the traffic diversion scenario.

The movements from the Lakemba Street west approach at the Lakemba Street / Moreton Street intersection are shown to deteriorate to an average delay of over three minutes.

The movements from the The Boulevarde west approach at the The Boulevarde / Moreton Street intersection are also shown to deteriorate to an average delay of over three minutes.

The model assumes all traffic currently using Haldon Street Overbridge would divert to Moreton Street Overbridge. In practice, some vehicles would divert to King Georges Road Overbridge which would reduce the delays on both of the heavily impacted intersections.

The three minute delays for Lakemba Street / Moreton Street and The Boulevarde / Moreton Street are for the worst movement. These result from all of the additional traffic being added to the major movement which provides no gaps in the traffic flow for vehicles from the side arms to join into the priority movement. Some of the diverted traffic that uses the Moreton Street Bridge would approach the intersections from different directions. This would reduce the volume of additional traffic taking the major movement and provide more gaps for the minor flow.

Noting the Degree of Saturation is showing the intersection is some 30% above the practical capacity of the intersection, significant delays would be expected.

6.27.3 PM Peak Intersection Performance

Table 6.13 below shows a summary of the intersection assessment undertaken for this bridge.

Table 6.13 Haldon Street Overbridge Intersection Assessment – PM Peak

Haldon Street Overbridge Closure – PM Peak				
Scenario	**Existing**	**Future**	**Construction**	**Traffic Diversion**
B.07 The Boulevarde / Haldon Street (Signals)				**Year Capped: 2021**
Demand Flow (veh)	1988	2138	2175	1364
Average Delay per Vehicle (Average over all arms in seconds)	31	61	79	16
LoS (Overall)	C	E	F	B
DoS (Worst Movement)	0.95	1.10	1.16	0.73
H.08 Haldon Street / Railway Parade (Priority Controlled)				**Year Capped: 2023**
Demand Flow (veh)	1381	1526	1541	70
Average Delay per Vehicle (Average over all arms in seconds)	10	22	31	4
Average Delay per Vehicle (Worst Movement in seconds)	57	177	271	6
LoS (Worst Movement)	E	F	F	A
DoS (Worst Movement)	0.74	1.06	1.18	0.03

Haldon Street Overbridge Closure – PM Peak				
Scenario	**Existing**	**Future**	**Construction**	**Traffic Diversion**
H.09 Lakemba Street / Haldon Street (Signals)				**Year Capped: 2023**
Demand Flow (veh)	1905	2105	2105	1492
Average Delay per Vehicle (Average over all arms in seconds)	14	13	13	21
LoS (Overall)	B	A	A	B
DoS (Worst Movement)	0.52	0.57	0.57	0.93
Lakemba Street / Moreton Street (Roundabout)				**Year Capped: 2023**
Demand Flow (veh)	1977	2185	2185	2751
Average Delay per Vehicle (Worst Movement in seconds)	11	17	17	165
Average Delay per Vehicle (Average over all arms in seconds)	14	24	24	360
LoS (Overall)	A	B	B	F
DoS (Worst Movement)	0.74	0.88	0.88	1.38
The Boulevarde / Moreton Street (Roundabout)				**Year Capped: 2023**
Demand Flow (veh)	1723	1904	1904	2488
Average Delay per Vehicle (Worst Movement in seconds)	12	17	17	250
Average Delay per Vehicle (Average over all arms in seconds)	22	43	43	785
LoS (Overall)	B	C	C	F
DoS (Worst Movement)	0.70	0.87	0.87	1.84

For three of the five intersections modelled, the increase in delay resulting from the traffic diversion is 'B' or better. A LoS 'B' would not cause delays above that which could be reasonably expected in the peak hour in Sydney.

The Lakemba Street / Moreton Street and The Boulevarde / Moreton Street intersections are forecast to experience a decline in amenity as a result of the addition of the diverted traffic. In the future and construction scenarios both intersections have LoS of 'C' or better, worsening to a LoS 'F' in the traffic diversion scenario.

The movements from the Lakemba Street east approach at the Lakemba Street / Moreton Street intersection would have an average delay of six minutes.

The movements from The Boulevarde west approach at The Boulevarde / Moreton Street intersection have an average delay of 13 minutes.

The model assumes all traffic currently using Haldon Street Overbridge would divert to Moreton Street Overbridge. It is anticipated some vehicles would divert to King Georges Road Overbridge which would reduce the delays on both of the heavily impacted intersections.

The delays of over six minutes for Lakemba Street / Moreton Street and The Boulevarde / Moreton Street are for the worst movement. These result from all of the additional traffic joining the major movement which provides no gaps in the traffic flow for vehicles from the minor flow. As with the AM Peak, some of the diverted traffic that uses the Moreton Street Bridge would approach the intersections from different directions. This would reduce the volume of additional traffic using the major movement and provide more gaps for the minor flow.

Noting the Degree of Saturation is showing the intersection is some 30% above the practical capacity of the intersection, significant delays would be expected.

6.27.4 Bus Network

Currently the bus routes 450, 942, 946, S104, S109, S115, S116 and S131 cross the Haldon Street Overbridge. During the half bridge closure periods these have been assessed as follows:

Bus Route 450 Diversion

The bus route 450 would be redirected through Gillies Street and Moreton Street, then cross the Moreton Street Overbridge and join the existing route as shown in **Figure 6.22**. The return route similarly travels the same route in the opposite direction. The Boulevarde has not been used for the diversion route as the left and right turn movements at Haldon Street / The Boulevarde appear to be too sharp for bus movements. Swept path analyses would be undertaken to confirm this.

During the closure period the three bus stops of 219591, 219592 and 219593 in the Burwood to Hurstville direction and the four bus stops of 219583, 219584 and 219585 in the Hurstville to Burwood direction are missed as a result of the proposed diversion. The bus stops of 219591 and 219592 need to be temporarily relocated (by 230 and 500 metres, respectively) to the location of the bus stop 219590 at Lakemba Street / Moreton Street intersection which needs to be temporarily relocated by 40 metres from the western side of the intersection to the eastern side. Bus stops 219593 and 219594 would need to be temporarily relocated by 280 metres and 40 metres respectively to the southern side of Haldon Street / Gillies Street intersection. Space for a temporary bus stop would be achieved through temporarily removing three on-street car parks.

The bus stop 219583 needs to be temporarily relocated by 280 metres to the location of the bus stop 219582 to the south of the Haldon Street / Gillies Street intersection. The bus stops 219584 and 219585 need to be temporarily relocated (by 500 and 250 metres, respectively) to the location of the bus stop 219520 at the Lakemba Street / Moreton Street intersection. This bus stop needs to be temporarily relocated by 90 metres from the western side of the intersection to the eastern side by temporarily removing three on-street car parks.

Bus Route 942 Diversion

The bus route 942 would be redirected through Railway Parade, across the Moreton Street Overbridge and then re-join the existing bus route as shown in **Figure 6.22**. The return route follows the path in the reverse direction.

The diverted bus route misses one bus stop in the eastbound direction on The Boulevarde and no bus stops in the westbound direction. Bus passengers walking to a bus stop would need to walk up to 350m further as a result of the diversion.

Bus Route 946 Diversion

The bus route 946 would be redirected through Gillies Street and Moreton Street, across the Moreton Street Overbridge and then to re-join the existing bus route as shown in **Figure 6.22.** The return route similarly travels the route in the opposite direction.

Bus Route S104 Diversion

The bus route S104 would be redirected through The Boulevarde, across the Moreton Street Overbridge where it re-joins the existing bus route via Lakemba Street as shown in the **Figure 6.22.** The return route similarly travels the route in the opposite direction.

Bus Route S109 Diversion

Bus route S109 would be redirected through Gillies Street and Moreton Street, across the Moreton Street Overbridge where it re-joins the existing bus route as shown in **Figure 6.22.** The return route similarly travels the route in the opposite direction.

Bus Routes S115, S116 and S131 Diversions

The bus routes S115, S116 and S131 would be redirected through The Boulevarde, across the Moreton Street Overbridge and the re-join the existing paths via Lakemba Street as shown in the **Figure 6.22.** The return route similarly travels the route in the opposite direction.

6.27.5 Pedestrians and Cyclists

Haldon Street Bridge has footpaths on either side and during the closure pedestrians and cyclists would divert 550m to Moreton Street Overbridge to the east or 950m to King Georges Road Overbridge to the west.

6.28 King Georges Road Overbridge

The King Georges Road Overbridge in Wiley Park, as shown in **Figure 6.23** , is a three span concrete girder structure with an overall span of approximately 31m. The bridge has seven lanes of traffic across two Bankstown Lines with approximately 96,800 vehicles a day at this location.

In the order of 220 construction haulage vehicle trips are expected to be made using King Georges Road Overbridge over a 24 hour period while compound or worksite activities are occurring. During the AM and PM peak, 10 light vehicle and 10 heavy vehicle trips would be made using the bridge.

6.28.1 Diversion Route

The bridge works result in one south bound lane closure on the eastern side of the bridge for a maximum of three weeks.

The bridge works cannot occur while the TTS is in operation as King Georges Road Overbridge is directly adjacent to Wiley Park Railway Station. The lane closure works would therefore occur while the TTS in not running.

During the lane closure, the number of lanes would remain the same in the northbound direction but reduce from four to three lanes in the southbound direction. This allows the bridge to retain its flows while enabling the upgrade works to continue.

As the lane closure is not limited to night works or weekends, the affected intersections have been modelled with weekday flows.

As the works only require one lane closure, no traffic diversion routes are needed.

6.28.2 AM Peak Intersection Performance

Table 6.14 below shows a summary of the intersection assessment undertaken for this bridge.

Table 6.14 King Georges Overbridge Intersection Assessment – AM Peak

King Georges Road Overbridge – AM Peak				
Scenario	Existing	Future	Construction	Traffic Diversion
H.06 King George Road / Lakemba Street (Signals)				**Year Capped: 2023**
Demand Flow (PCU)	5881	6483	6528	6528
Average Delay per Vehicle (Average over all arms in seconds)	23	30	31	32
LoS (Overall)	B	C	C	C
DoS (Worst Movement)	0.86	0.95	0.97	0.97
B.06 King George Road / The Boulevarde (Signals)				**Year Capped: 2023**
Demand Flow (PCU)	5868	6468	6517	6517
Average Delay per Vehicle (Average over all arms in seconds)	35	45	48	46
LoS (Overall)	C	D	D	D
DoS (Worst Movement)	0.95	0.98	1.02	1.01

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Location and diversion route - for King Georges Road overbridge

FIGURE 6.23

Both of the intersections modelled have a level of service 'D' or better with the traffic diversion. A level of service 'D' would not cause delays above that which could be reasonably expected in the peak hour in Sydney.

The minor reduction in delay and degree of saturation at the King Georges Road / The Boulevarde intersection is a result of the improved optimisation of signal timings in the Traffic Diversion scenario.

6.28.3 PM Peak Intersection Performance

Table 6.15 below shows a summary of the intersection assessment undertaken for this bridge.

Table 6.15 King Georges Overbridge Intersection Assessment – PM Peak

King Georges Road Overbridge – PM Peak				
Scenario	Existing	Future	Construction	Traffic Diversion
H.06 King Georges Road / Lakemba Street (Signals)				**Year Capped: 2023**
Demand Flow (PCU)	5656	6277	6322	6322
Average Delay per Vehicle (Average over all arms in seconds)	25	43	45	121
LoS (Overall)	B	D	D	F
DoS (Worst Movement)	0.83	0.98	0.98	1.11
B.06 King Georges Road / The Boulevarde (Signals)				**Year Capped: 2023**
Demand Flow (PCU)	5796	6432	6481	6481
Average Delay per Vehicle (Average over all arms in seconds)	35	55	55	60
LoS (Overall)	C	D	D	E
DoS (Worst Movement)	0.84	0.98	0.98	0.99

The King Georges Road / Lakemba Street intersection has a current level of service 'B'. The intersection performance deteriorates to a LoS 'D' with future and construction traffic, deteriorating further to 'F' with the traffic diversion. This decline in amenity is a result of the lane closure on the King Georges Road Overbridge causing longer queues on the bridge and increasing the modelled average delay per vehicle to two minutes.

The King Georges Road / The Boulevarde intersection has a current level of service 'C'. The intersection is forecast to experience a decline in amenity as a result of the lane closure on the King Georges Road Overbridge with a LoS of 'D' in the construction scenario worsening to LoS 'E' in the traffic diversion scenario with a delay of one minute. As there was no traffic diversion, this decline can be attributed to lane reduction while maintaining the same volume through the intersection.

In reality some vehicles would reroute to Haldon Street Overbridge or Punchbowl Road Overbridge while the bridge works are occurring. This would reduce the demand through the King Georges Road / Lakemba Street and the King Georges Road / The Boulevarde intersections. Whilst it is noted that these intersections are already somewhat congested in the peak periods, with the dispersion of the traffic across multiple routes and with the additional mitigation measures discussed in Chapter 9, it can be expected that the additional delays can be managed.

Should the bridge works be performed during the term 1-3 school holiday periods (when there is no TTS running), the worst movement at the King Georges Road / Lakemba Street intersections would be improved, although demand would still be likely to exceed capacity meaning that people would either divert from the area or change travel time to avoid the peak.

6.28.4 Bus Network

Currently the bus routes 942 and S128 cross the King Georges Road Overbridge. As the bridge closure only requires one of the four southbound lanes to be closed, no bus diversions are necessary.

6.28.5 Pedestrians and Cyclists

King Georges Road Overbridge has footpaths on either side and during the one lane closure, pedestrians and cyclists would be diverted to the western side of the road. Temporary traffic management would be in place at both ends of the bridge to aid pedestrians and cyclists.

6.29 Punchbowl Road Overbridge

Punchbowl Road Overbridge located in Punchbowl, as shown in **Figure 6.24** is a two span concrete girder structure with an approximate length of 48m. The bridge carries two lanes of traffic in each direction over two Bankstown Lines. The bridge is estimated to carry approximately 50,500 vehicles per day.

In the order of 180 construction haulage vehicle trips are expected to use Punchbowl Road Overbridge over a 24 hour period while compound or worksite activities are occurring. During the AM and PM peak hours there is expected to be eight light vehicle and eight heavy vehicle trips.

6.29.1 Diversion Route

The bridge would undergo maintenance works over a period of 6 months of weekend works. These weekend works are not dependent on school holiday periods.

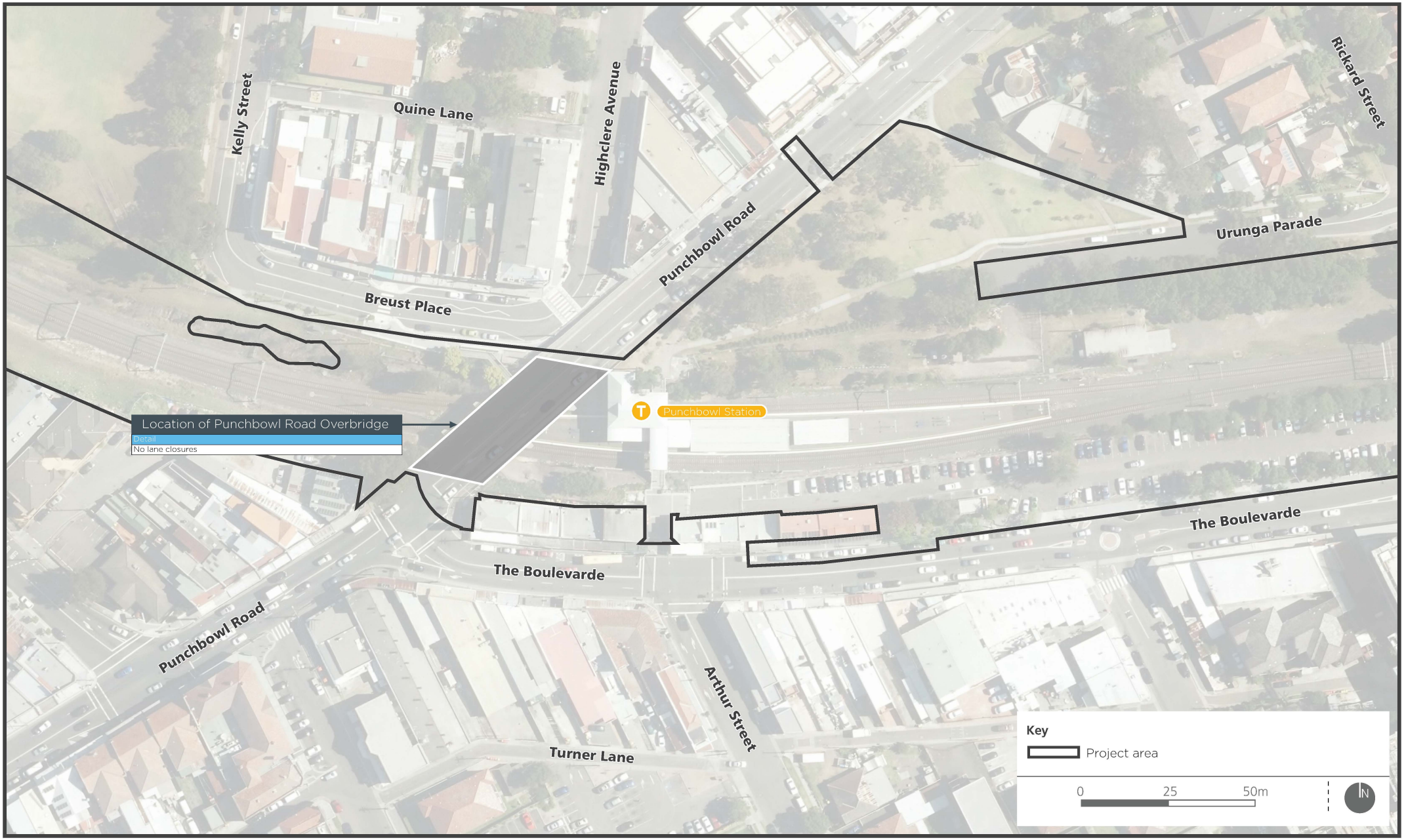
The works do not require any lane closures and thus no diversion routes.

6.29.2 Bus Network

Currently the bus routes 940, 941, S14, S114 and S126 cross the Punchbowl Road Overbridge. Given the bridge remains operative in both directions, the bus routes can continue their normal operation, however, they may be impacted due to the use of traffic management such as stop/go traffic control or owing to congestion.

6.29.3 Pedestrians and Cyclists

It is expected that one side of the footpath on the Punchbowl Road Overbridge would be closed to enable the maintenance works to be undertaken. Pedestrians and cyclists would be diverted to the side of the road which remains open during construction. Temporary traffic management would be in place at both ends of the bridge to aid pedestrians and cyclists.



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Location of the Punchbowl Road Overbridge

FIGURE 6.24

6.30 Stacey Street Overbridge

Stacey Street Overbridge in Bankstown, as shown in **Figure 6.25**, is a three span concrete girder structure with an overall length of approximately 90m. The bridge carries three lanes of traffic in each direction across the rail lines and North Terrace. The AADT of the Overbridge is estimated to be in the order of 66,000 vehicles per day.

Some 500 construction haulage vehicle trips are expected to use Stacey Street Overbridge over a 24 hour period while compound or worksite activities are occurring. During the AM and PM peak hours there is expected to be 12 light vehicle and 34 heavy vehicle trips.

6.30.1 Diversion Route

The bridge works result in six months of weekend works (half-lane closures) which are not dependent on school holiday periods and four weeks of half lane closures (two weeks per side).

During these half lane closures, the number of lanes would be reduced to two lanes in each direction. This allows the bridge to retain two directional flow while enabling the upgrade works to continue. As the half lane closures are not limited to night works or weekends, the Stacey Street / Wattle Street intersection has been modelled to determine the impact of bridge works.

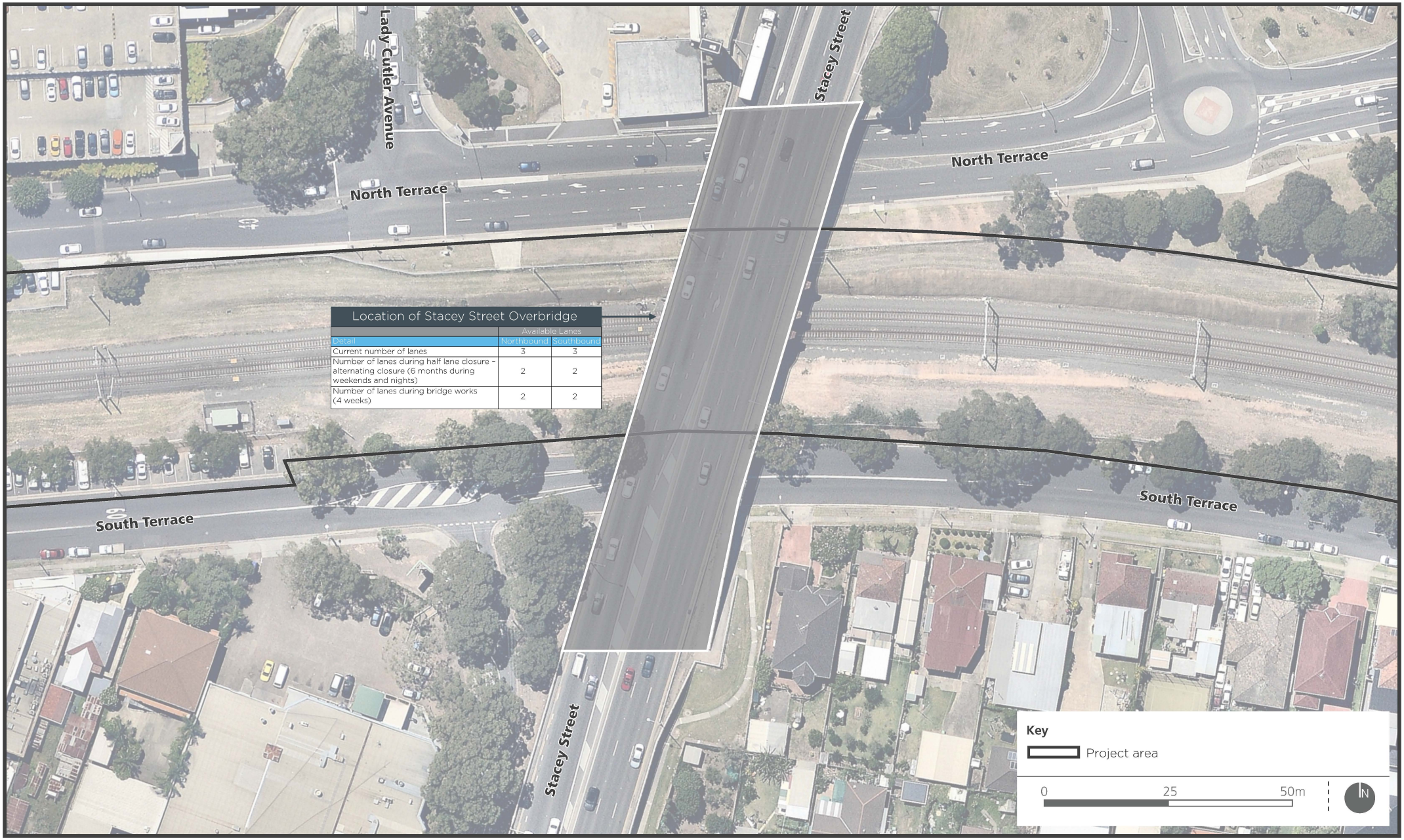
The through lane from the eastern approach at Stacey Street – Wattle Street would carry the left turning traffic during the southbound closure as the slip lane would be blocked.

6.30.2 Assessment of diversion

The proposed temporary traffic management strategy for lane reduction at the Stacey Street Overbridge would be as follow:

- The length of the northbound right-turn bay at the Stacey Street / Wattle Street intersection would be reduced from the existing 100 metres to 30 metres.
- The northbound kerbside lane over the bridge would be closed but two northbound lanes are retained using the existing hatched area prior to the northbound right turn bay and the space provided by reducing the length of the northbound right-turn bay.
- The southbound kerbside lane over the bridge would be closed. The southbound kerbside lane north of the Stacey Street / Wattle Street intersection is blocked for the through traffic, converting the lane into a left-turn only lane.
- The Give-way configuration from the Wattle Street east approach to the Stacey Street south at the Stacey Street / Wattle Street intersection would be retained.

No traffic diversion has been modelled as a result of the lane reduction at the Stacey Street Overbridge due to retention of at least two lanes of contra flow.



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Location of the Stacey Street overbridge

FIGURE 6.25

6.30.3 AM Peak Intersection Performance

Table 6.16 below shows a summary of the intersection assessment undertaken for this bridge.

Table 6.16 Stacey Street Overbridge Intersection Assessment – AM Peak

Stacey Street Overbridge – AM Peak				
Scenario	Existing	Future	Construction	Traffic Diversion
H.02 Stacey Street / Wattle Street (Signals)				**Year Capped: 2023**
Demand Flow (Veh)	4598	5049	5064	5064
Average Delay per Vehicle (Average over all arms in seconds)	16	16	17	154
LoS (Overall)	B	B	B	F
DoS (Worst Movement)	0.80	0.89	0.89	1.14

The Stacey Street / Wattle Street intersection is forecast to experience a decline in amenity as a result of the lane closures. The intersection has a LoS of 'B' in the existing, future and construction scenarios, worsening to a LoS 'F' in the traffic diversion scenario.

Right turn movement from the Stacey Street south approach is the worst performing movement with congestion and delay increasing from the construction scenario(1.5 minutes of delay) to the traffic diversion scenario (over six minutes of delay). The through movement from the Stacey Street south approach is also noticeably deteriorated with delays increasing from 12 seconds to over three minutes.

During the four weeks of half lane closures it is anticipated that a number of drivers travelling to / from the north-east would reroute to Punchbowl Road Overbridge. It is also expected that a number of vehicles travelling between the south and the Bankstown shops would turn onto Stanley Street at the Stanley Street / Stacey Street intersection and use the North Terrace to South Terrace Underbridge. This would reduce the demand on the Stacey Street / Wattle Street intersection, but increase the demand on the Stacey Street / Stanley Street and North to South Terrace Underbridge intersections.

If the works were performed during the term 2 school holiday period then the anticipated reduction in traffic for the worst movement at the Stacey Street / Wattle Street intersection would not be improved sufficiently enough to operate at below capacity ..

6.30.4 PM Peak Intersection Performance

Table 6.17 below shows a summary of the intersection assessment undertaken for this station. .

Table 6.17 Stacey Street Overbridge Intersection Assessment – PM Peak

Stacey Street Overbridge – PM Peak				
Scenario	Existing	Future	Construction	Traffic Diversion
H.02 Stacey Street / Wattle Street (Signals)				**Year Capped: 2018**
Demand Flow (Veh)	5882	6058	6074	6074
Average Delay per Vehicle (Average over all arms in seconds)	33	39	40	199
LoS (Overall)	C	C	C	F
DoS (Worst Movement)	0.91	1.10	1.10	1.34

The Stacey Street / Wattle Street intersection is forecast to experience a decline in amenity as a result of the lane closures. The intersection has a LoS of 'C' in the existing, future and construction scenarios, worsening to a LoS 'F' in the traffic diversion scenario.

Right turn movement from the Stacey Street south approach is the worst performing movement with delays increasing from approximately 1.5 minutes to nearly eight minutes.

The additional delay is primarily due to the reduction of the length and capacity of the northbound right-turn bay in both peak hours. The northbound queues in the AM peak and southbound queues in the PM peak, are likely to exceed the upstream intersections.

Like the AM Peak, it is expected that a number of vehicles would divert to adjacent bridges, reducing the demand at the Stacey Street / Wattle Street intersection.

The anticipated reduction in traffic for the worst movement at the Stacey Street / Wattle Street intersection would not be improved sufficiently enough to operate at below capacity during school holiday periods.

6.30.5 Bus Network

There are currently no bus routes crossing this bridge. Bus routes 939 and 970 travel from the east to north and reverse at the Stacey Street / Wattle Street intersection and would not be affected by the bridge works.

6.30.6 Pedestrians and Cyclists

Stacey Street Overbridge has a footpath on the eastern side only and during the northbound closure pedestrians can continue to use this footpath.

During the southbound closure pedestrians would need to reroute and it is expected that pedestrians would divert 300m to the North Terrace / South Terrace Underbridge to the west. A diversion to Punchbowl Overbridge would be 1.6 km. Temporary traffic management would be in place at both ends of the bridge to aid pedestrians and this would cater for the pedestrian demands to the shopping centre.

6.31 North Terrace to South Terrace Underbridge

The North Terrace to South Terrace Underbridge is an 18m single span steel arch truss bridge with track slab above, as shown in **Figure 6.26** .

Construction haulage vehicles are not expected to use North Terrace to South terrace Underbridge while compound or worksite activities are occurring.

6.31.1 Diversion Route

The bridge works would result in six months of weekend works (half-lane closures) and four weeks of full lane closures.

During the half lane closures, traffic would divert to Stacey Street Overbridge. The full closure is not expected to have a significant impact on traffic as the bridge is used to connect one high rise/mixed use area to another high rise/mixed use area. It is not used to connect residential dwellings to an arterial road or motorway. There are connections to Stacey Street north and south of the railway line which are used to connect these high rise/mixed use areas in Bankstown to main arterials and motorways. This underbridge is recognised as an important local link to the shopping centre in the north, but the diverted traffic would need to use Stacey Street Overbridge as the alternative route.

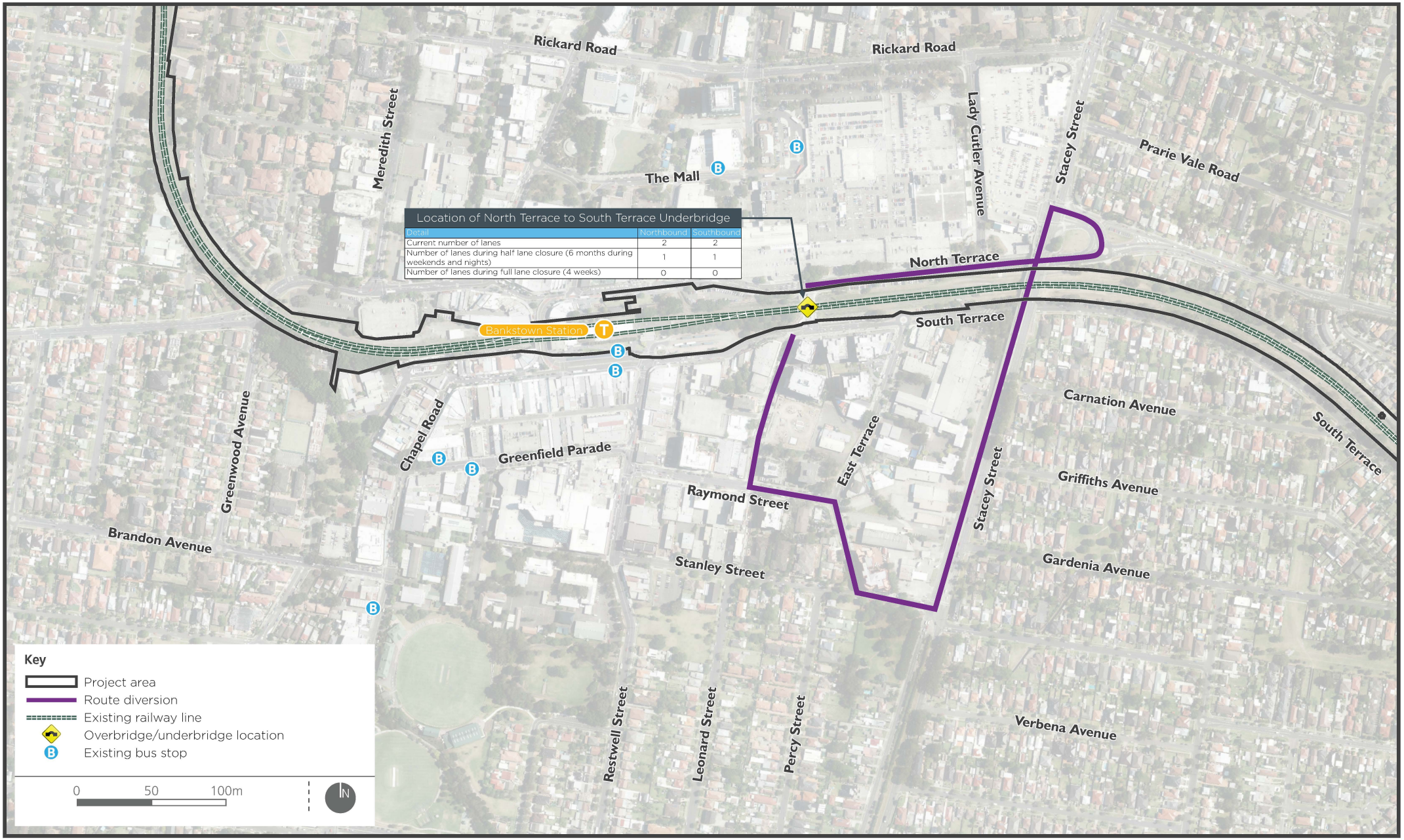
Due to the low impact of this underbridge, the bridge does not require modelling and works can instead be managed by detailed traffic management plans.

6.31.2 Bus Network

There are currently no bus routes using this underbridge. Bus routes N40 and 487 cross the South Terrace / West Terrace intersection and would not be affected by the bridge closure program.

6.31.3 Pedestrians and Cyclists

The underbridge has footpaths on either side and during the closure pedestrians and cyclists would need to reroute. They would likely divert 300m to the Stacey Street Overbridge to the east or 300m to the Chapel Road Overbridge to the west.



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Location and diversion routes - North Terrace to South Terrace underbridge

FIGURE 6.26

6.32 Chapel Road Overbridge

The Chapel Road Overbridge is a four span concrete plank bridge deck with an approximate length of 26m, as shown in **Figure 6.27**. The bridge is restricted to bus traffic only and carries bus lanes in each direction.

The Overbridge carries approximately 34,800 vehicles per day (estimated from September 2016 peak hour traffic counts).

Construction haulage vehicles are not expected to use Chapel Road Overbridge while compound or worksite activities are occurring.

6.32.1 Diversion Route

The bridge would undergo maintenance works and collision protection works over six months of weekend works not dependent on school holiday periods. These works would not require any lane closures.

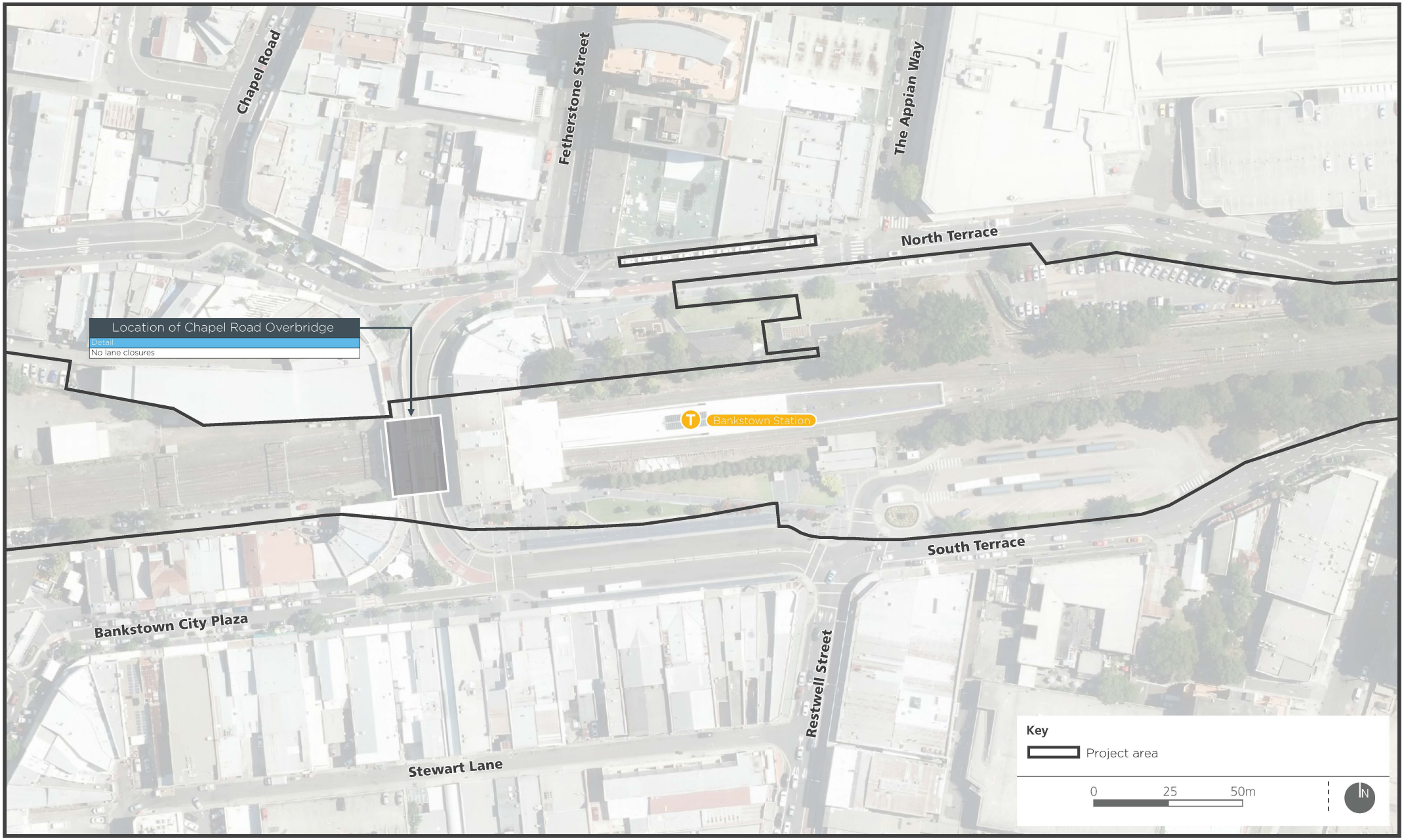
The works are expected to be constructed from the wide pedestrian footpaths with no lane closures.

6.32.2 Bus Network

Currently a large number of bus routes cross the Chapel Road Overbridge. Given the bridge remains operative in both directions, the bus routes can continue their normal operation, however, they might be impacted by the use of traffic management measures such as stop/go traffic control management.

6.32.3 Pedestrians and Cyclists

Chapel Road Overbridge includes a footpath on both sides of the bridge. It is expected that one footpath would be closed to enable the works to be undertaken. Pedestrians would be diverted to the footpath which remains open. Temporary traffic management would be in place at both ends of the bridge to aid pedestrians and cyclists.



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Location of the Chapel Road overbridge

FIGURE 6.27

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