



Summary Report | June 2012

Northern Beaches Bus Rapid Transit (BRT) Pre-Feasibility Study



Transport
for NSW

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Executive Summary

The NSW Government made a commitment to examine the feasibility of Bus Rapid Transit (BRT) for the Northern Beaches of Sydney. This report provides a summary of the findings from a pre-feasibility study undertaken in response to that commitment.

The initial scope of the study was to assess the feasibility of BRT on the North-South Corridor between the Northern Beaches and the Sydney CBD but it was extended to also include the East-West Corridor between Chatswood and Dee Why. This was in response to the Shore Regional Organisation of Councils (SHOROC) which considered the East-West Corridor a priority for investment because increased capacity on that route could take pressure off the North-South Corridor.

The two main problems with public transport services in the region are:

- reliability and travel time variability of current bus services (buses between Spit Junction and Wynyard can vary from timetable by 15 to 20 minutes)
- slow travel speeds of buses in the peak periods.

Bus priority measures already operate on the North-South Corridor. Key components include: a continuous dedicated bus lane between Mona Vale and Seaforth; transit lanes; intersection upgrades; and, bus priority at traffic signals. Further work has been planned and is programmed for implementation.

On the East-West Corridor, dedicated bus lanes are in operation on three sections of the route and bus priority is provided at one intersection.

The study initially assessed 15 BRT options that would improve bus travel speeds and operations in the peak and off peak periods and increase the overall use of public transport to meet existing and future demand on both corridors. Six of these were short listed for further analysis. None of the short listed options require widening of the road except for bus stops and at intersections and in some cases to widen bridges.

The results of the analysis indicate the six short listed options are effective in reducing trip times and trip time variability for public transport users. A rapid economic appraisal shows the costs of the BRT options are higher than the benefits. This is partly because dedicating additional road space to BRT will reduce the space available and increase congestion for private vehicles.

The options all assume bus priority 24 hours a day. In practice this would be a 'final state' (or may not be required along the full length of the corridor) and in the interim bus priority measures would apply for a shorter period of the day and/or parts of the corridors would be shared with general traffic as options are delivered incrementally. More detailed appraisal of options accounting for this variation would most likely reduce the costs relative to the benefits. The options could also be expanded to include options that are broader than BRT measures. For example, a general traffic tunnel under Military Road could be further considered – this option was not shortlisted although it ranked highly in an initial multi-criteria analysis because it was considered out of scope of BRT measures.

Several options are feasible from a construction and deliverability perspective and implementing preferred options using a staged approach coupled with re-configuring existing services could increase the economic viability of progressing BRT on the Northern Beaches.

The NSW Government is seeking comment on the options considered in the pre-feasibility study.

1. Introduction

This summary report outlines the findings of the Northern Beaches Bus Rapid Transit (BRT) Pre-Feasibility Study (the Study). The Study was undertaken between June 2011 and March 2012 because of the NSW Government's commitment to examine the feasibility of Bus Rapid Transit (BRT) for the Northern Beaches of Sydney (the Region). The study region is shown in Figure 1.1. The detail of the study is documented in *Northern Beaches Bus Rapid Transit (BRT) Study – Pre-Feasibility Report*.

Bus priority measures already operate on the North-South Corridor. These have been targeted to improve travel time reliability, maximise efficiency of road space and encourage public transit use along the North-South Corridor. Key components include: a continuous dedicated bus lane between Mona Vale and Seaforth, transit lanes, intersection upgrades, additional road space and bus priority at traffic signals.

Dedicated bus lanes are also operating in three sections of the East-West Corridor and bus priority is provided at one key intersection. Roads and Maritime Services (RMS) is also seeking approval to undertake a Corridor Development Strategy with the aim of providing a higher level of bus priority on the corridor.

Despite these improvements there remain two main issues with public transport services along the corridors:

- The reliability and travel time variability of the current bus services. For example the travel time of a limited stops bus between Spit Junction and Wynyard can vary from the timetable by 15 to 20 minutes on some mornings depending on traffic congestion levels.
- The travel speed of buses in the peak periods. The Auditor-General identified the Pittwater-Spit-Military Road corridor as the second-slowest commuter route in Sydney.

Demand on the transport system will continue to grow which will result in additional pressure on existing services. The Northern Beaches region is shown in Figure 1.1. Its population of 263,000 is forecast to increase by 45,000 by 2036 and employment of 97,000 is expected to grow by 25,500 over the same period. Already 128,000 commute trips and 900,000 non-commute trips are made in the region each weekday.

The objectives of the Study are to provide the NSW Minister for Transport and the Northern Beaches community with:

- A description of BRT and whether or not it can provide the required step change in public transport for the Region.
- Solutions to identified problems, recognising the bus priority work already implemented by RMS along the Pittwater Road corridor.
- A preliminary assessment of the benefits and costs of BRT options linking the Region with the Sydney, North Sydney and Chatswood CBDs.
- Key BRT impacts and possible mitigation strategies.
- Road and bus network changes required to accommodate BRT operations.
- Physical and operational options to address key pinch points on the road corridor.

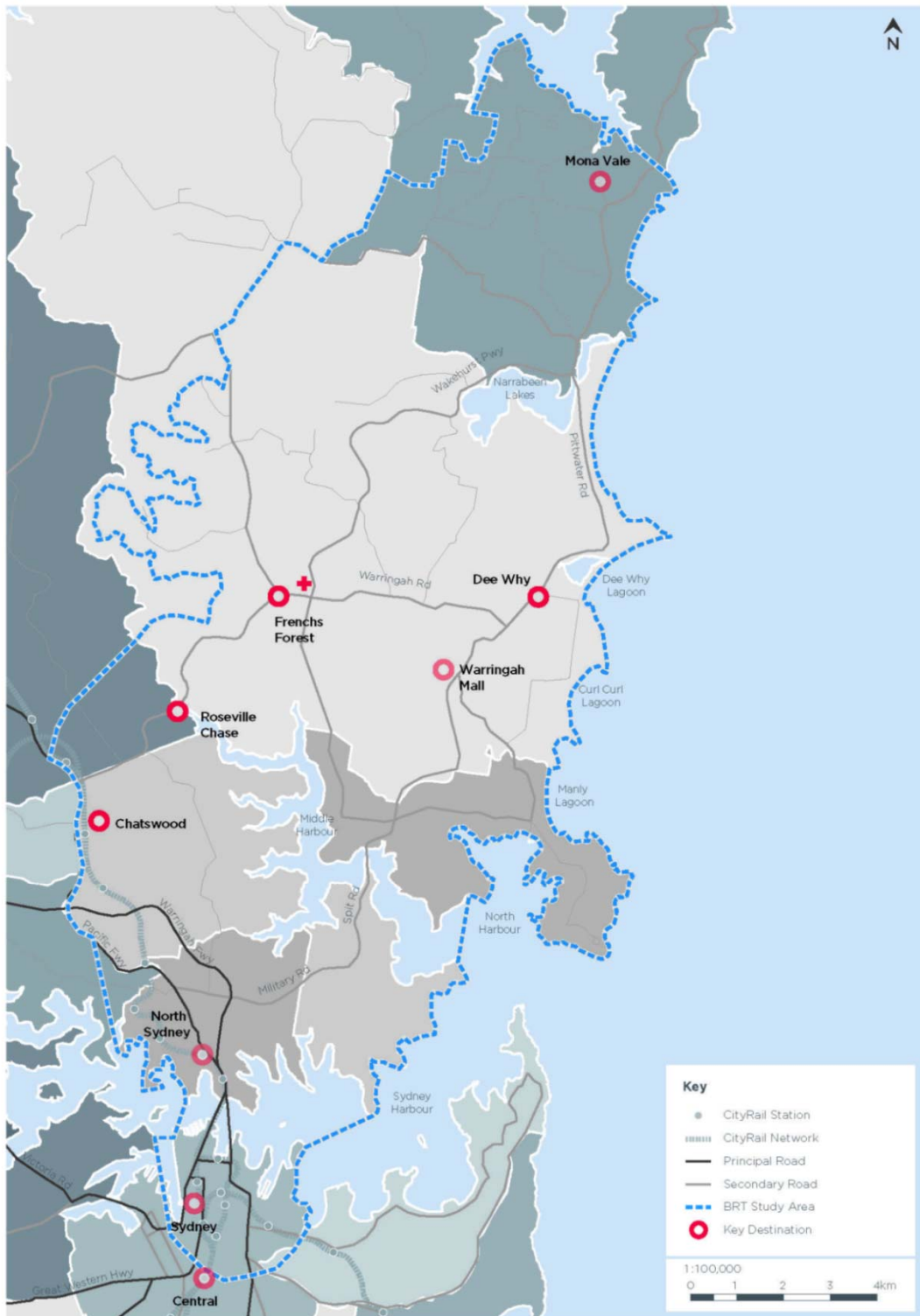


Figure 1.1: Northern Beaches BRT Region

2. Development of options

The study team developed a long list of BRT options for the Northern Beaches for assessment – 10 for the North-South Corridor and 5 for the East-West Corridor.

BRT systems typically include:

- frequent services.
- exclusive roadway/priority over other modes providing improved travel times and reliability.
- high quality stations.
- high quality vehicles.
- off-board fare collection.
- real-time passenger information.
- system identity/branding.

The options developed for the study included various combinations of dedicated bus lanes (in the kerb lane or on the median lane), peak tidal flow arrangements and supporting infrastructure investments including options that replace existing bridges (at the Spit and Narrabeen) with wider bridges and a tunnel to by-pass Military Road.

All options focused on the existing road corridors complemented by a redesign of the bus network aimed at making the network easier to understand and use. While consideration was given to alternative corridors, it was considered unlikely that the existing trunk corridors could be substituted or alternative “greenfield” corridors developed because of:

- the investment already made in the existing road infrastructure.
- the density of development adjacent to the existing corridors.
- the high cost, potential environmental impacts and requirement for property acquisition.

2.1 Shortlist of options

The set of 15 options were reduced to six using multi-criteria analysis. Each option was scored against a set of assessment criteria. The six shortlisted options were then subject to more detailed assessment. A brief description of the options and the rationale for whether or not an option was shortlisted is provided in Table 2.1.

Table 2.1: Description of preliminary options and outcome of Multi-Criteria Assessment

Name	Alignment of NWRL	Description	Rationale for inclusion/exclusion on short list
North-South Corridor			
Priority Works	☑ Option 1	Upgrade existing kerbside bus lanes to 24 hour.	Option ranked third in the multi-criteria analysis and warranted closer analysis.
BRT on median	☑ Option 2	Segregated median BRT lanes and local buses on the kerbside.	Dedicated BRT running along the centre of the road carriageway is a mid-ranking option. There are constraints associated with centre running BRT in terms of bus operations and access/egress issues for passengers but further analysis of a median running option was considered warranted.
BRT on kerb	☑ Option 3	Segregated kerbside BRT lanes and passing bays at all bus stops.	Dedicated BRT running along the kerb ranked favourably. This provides opportunities to use and augment existing kerbside bus infrastructure and does not require passengers to change their access/egress arrangements.
Traffic tunnel	☒	General traffic tunnel from Warringah to CBD providing road capacity for BRT.	This ranked highest amongst the options but was not considered because of its likely high cost, assessment complexity, delivery challenges and the likelihood that it would adversely impact on the achievement of the study's public transport objectives. It was considered beyond the scope of BRT measures.
Tidal flow median	☒	Peak hour tidal flow lane in the median along Military Road.	This was a mid ranking option and warranted closer scrutiny as part of the evaluation of the BRT on median option rather than a separate option (Option 2). Although tidal flow may provide additional short to medium measures, it may be a less reliable long term option depending on whether future levels of contra-peak traffic can be accommodated on fewer lanes.
Tidal flow kerbside	☒	Peak hour tidal flow lane on the kerb along Military Road.	This was considered to have merit and warranted closer scrutiny as part of the BRT on kerb option rather than a separate option (Option 3).
North side interchange	☑ Option 4	Segregated kerbside BRT lanes with rail interchange at North Sydney.	This was considered a longer term alternative that warranted scrutiny to assess its ability to relieve bus congestion in the CBD and facilitate modal interchange.

Name	Alignment of NWRL	Description	Rationale for inclusion/exclusion on short list
BRT viaduct	<input type="checkbox"/>	Overhead bus viaduct on Military Road.	Provision of dedicated BRT running via an elevated viaduct along Military Road between Spit Junction and Neutral Bay ranked second highest amongst all the broad BRT options. It was not shortlisted because of adverse amenity impacts that could not be ameliorated and would be unlikely to garner community support.
Military Road widening	<input type="checkbox"/>	Widen Military Road to increase bus capacity for BRT.	The option of providing additional BRT (road) capacity along Military Road through carriageway widening between Medusa Street and Neutral Bay was considered. This would result in the need for in excess of 160 partial and full property acquisitions. The adverse urban amenity, community disruption, visual, property, cost and business impacts would be significant and further consideration was not considered warranted.
BRT tunnel	<input checked="" type="checkbox"/> Option 5	Kerbside BRT on Pittwater Rd and bus tunnel under Military Road.	The provision of a dedicated two lane bus tunnel beneath Military Road between Spit Junction and the Warringah Freeway ranked favourably because of its ability to deliver bus travel time and general traffic relief and warranted further consideration despite its greater cost compared to other options.
East-West Corridor			
Priority Works	<input checked="" type="checkbox"/> Option 6	Upgrade existing kerbside bus lanes to 24 hour.	It was decided to treat these East-West Corridor options as one with potential to implement aspects of each in stages with BRT on median or BRT on kerb longer term options compared to the priority works.
BRT on median		Segregated median BRT lanes and provision for local buses on the kerbside.	
BRT on kerb		Segregated kerbside BRT lanes and passing bays at all bus stops.	
Tidal flow Boundary Street	<input type="checkbox"/>	Peak hour tidal flow lane in the median on Boundary Street, Chatswood.	Some targeted tidal flow options may have short term merit but in parts of the corridor these rank poorly because of constrained road capacity and minimal travel time and operational benefits.
Widen Wakehurst Parkway	<input type="checkbox"/>	Widen Wakehurst Parkway to increase bus capacity for BRT.	The option of widening Wakehurst Parkway at selected pinch points between Pittwater Road, North Narrabeen and Warringah Road, Frenchs Forest was considered as a relief route to Pittwater Road. The option ranked poorly because of its inaccessibility to key centres and sources of patronage, incompatibility with broader bus plans, road capacity constraints and limited relieve at key pinch points.

2.2 Travel time improvements

Three generic BRT scenarios were tested using TfNSW's Strategic Transport Model (STM) to provide an indication of the travel time savings for the options:

- Kerbside and Median BRT Options
- Kerbside BRT with Bus Tunnel Option
- Kerbside BRT with north side Interchange Option.

Table 2.2 shows the results for both corridors. It is estimated that the introduction of dedicated BRT on either the kerbside lanes or in the central median along the North-South Corridor could deliver travel time savings of between 7 to 13 minutes for limited and express bus services. The construction of a bus tunnel under Military Road increases the travel time saving to 17 minutes. The overall travel time of a peak period bus trip between Mona Vale and the Sydney CBD could be reduced from 74 to 57 minutes under the bus tunnel option. Travel time savings of 3 to 5 minutes could be achieved on the East-West Corridor.

Table 2.2: Estimated Travel Time Savings

Route Type	Route Section	Travel Time				
		Without Project "Current"	Kerb / median BRT		Bus Tunnel	
		Time	Time	Saving	Time	Saving
All stops	Spit Junction to Wynyard	26	23	-3	23	-3
	Spit Junction to Wynyard (<i>via</i> North Sydney interchange)		27	+1	27	+1
Limited-stops	Mona Vale to Wynyard	74	61	-13	57	-17
	Mona Vale to Wynyard (<i>via</i> North Sydney interchange)		67	-7	63	-11
Express	Mona Vale to Wynyard	66	53	-13	49	-17
	Mona Vale to Wynyard (<i>via</i> North Sydney interchange)		59	-7	55	-11
Warringah Road	Narraweena to Skyline	11	8	-3		
	Frenchs Forest to Chatswood East	19	14	-5		

3. North-South Corridor

Five of the shortlisted options were for the North-South Corridor which links the Sydney CBD with Mona Vale via Pittwater, Spit and Military Roads (refer Figure 3.1). This is one of Sydney's busiest bus corridors with a total of 74 bus routes operating along it. Between 7am and 9am, approximately 9,600 passenger and 210 buses enter the CBD from this corridor. This represents 35% of total buses and 45% of total bus passengers entering the CBD via the Sydney Harbour Bridge. Of all services travelling along Military Road in the morning peak, half are limited-stops and express services to the City.

Although the majority of services are to the CBD around 25% travel to North Sydney, St Leonards and Chatswood.

Each of the five options, their advantages and disadvantages and the outcome of a rapid economic appraisal are outlined in the following sections.



Figure 3.1: North-South Corridor

3.1 Option 1: North-South Priority Works

Option 1 is shown in Figure 3.2 and is a package of bus priority works that includes:

- removal of on-street parking over the entire length of the corridor and replacement with off-street parking
- replacement of existing bus lanes with 24-hour kerb-side bus lanes between Mona Vale and Neutral Bay
- upgrade bus stops at 9 key locations on the corridor to include high quality shelters and customer information
- widening the existing roadway at six key locations to provide right turn lanes to eliminate discontinuities in the existing bus priority measures.

Table 3.1: Advantages and disadvantages of Option 1.

Advantages	Disadvantages
<ul style="list-style-type: none"> • Provides a constant level of priority across the corridor for 24 hours in both directions. • Eliminates six points of congestion where three lanes are reduced to two at right turns, improving travel time and reliability for all services. 	<ul style="list-style-type: none"> • Does not address the pinch points of Narrabeen and Spit Bridges which are only 4 lanes wide. • Does not provide stopping or overtaking facilities at the majority of bus stops.

Option 1 has one of the highest economic returns of all the options assessed though the costs are higher than the benefits (refer Table 3.2).

Table 3.2: Option 1 Outcomes of rapid economic appraisal

	Total costs (\$m)	Total benefits (\$m)	Benefit cost ratio	NPV (\$m)
Option 1	336	226	0.67	(110)

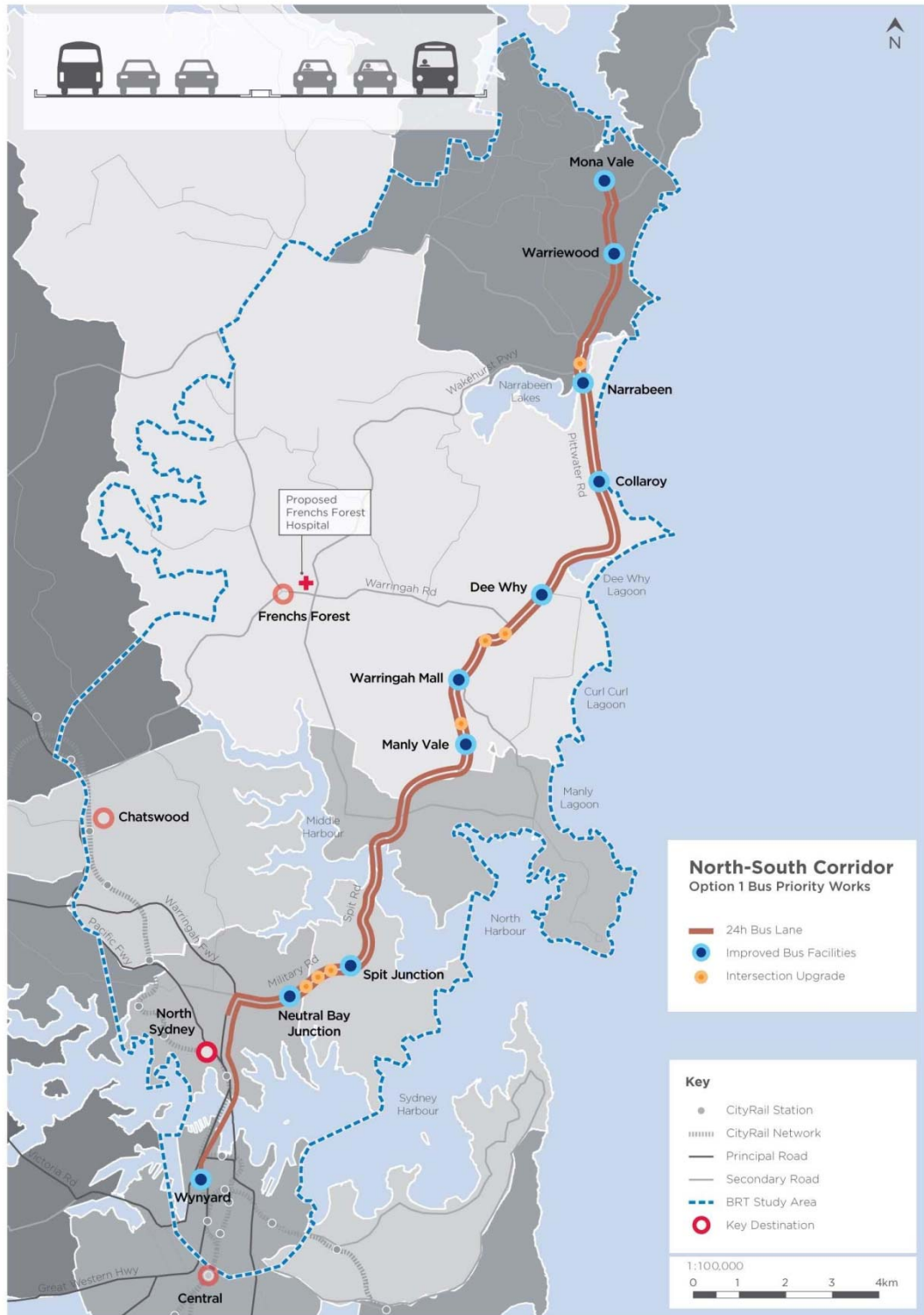


Figure 3.2: Priority works Option 1

3.2 Option 2: North-South Median BRT

Option 2 would provide a dedicated BRT over the entire length of the corridor. It is illustrated in Figure 3.2 and would include:

- Removal of on-street parking and widening the roadway at key locations as for Option 1.
- BRT on the median/centre lanes.
- Replacement of the Spit and Narrabeen bridges with six lane bridges.
- Upgraded BRT stations on the median with pedestrian overpasses providing access.

A median BRT system requires all passengers to access the centrally located BRT platforms either via grade separated pedestrian/cyclist bridges or to wait and cross the road. It does not provide priority for local bus services as BRT stations will be widely spaced and local buses would still use the kerbside lane for drop-offs and pick-ups at local stops. The advantages and disadvantages of Option 2 are summarised in Table 3.3.

Table 3.3: Advantages and disadvantages of Option 2

Advantages	Disadvantages
<ul style="list-style-type: none"> • Exclusive operation for BRT express services for the entire length of the corridor. • Dedicated median Stations. • Eliminates six points of congestion where three lanes are reduced to two at right turns improving travel time and reliability for all services. • Additional capacity on Spit and Narrabeen Bridges 	<ul style="list-style-type: none"> • Reduction in priority for local bus services which would share the kerbside lane with local traffic. • Stations on the median will increase access and egress travel time and increase the potential for accidents. • On-street parking removed to compensate for conversion of median lanes for BRT operation and maintain general traffic capacity.

Option 2 has the highest BCR of all the options assessed. The costs are higher than the benefits and it has a negative net present value of \$140 million (refer Table 3.4).

Table 3.4: Option 2 Outcomes of rapid economic appraisal

	Total costs (\$m)	Total benefits (\$m)	Benefit cost ratio	NPV (\$m)
Option 2	488	348	0.71	(140)

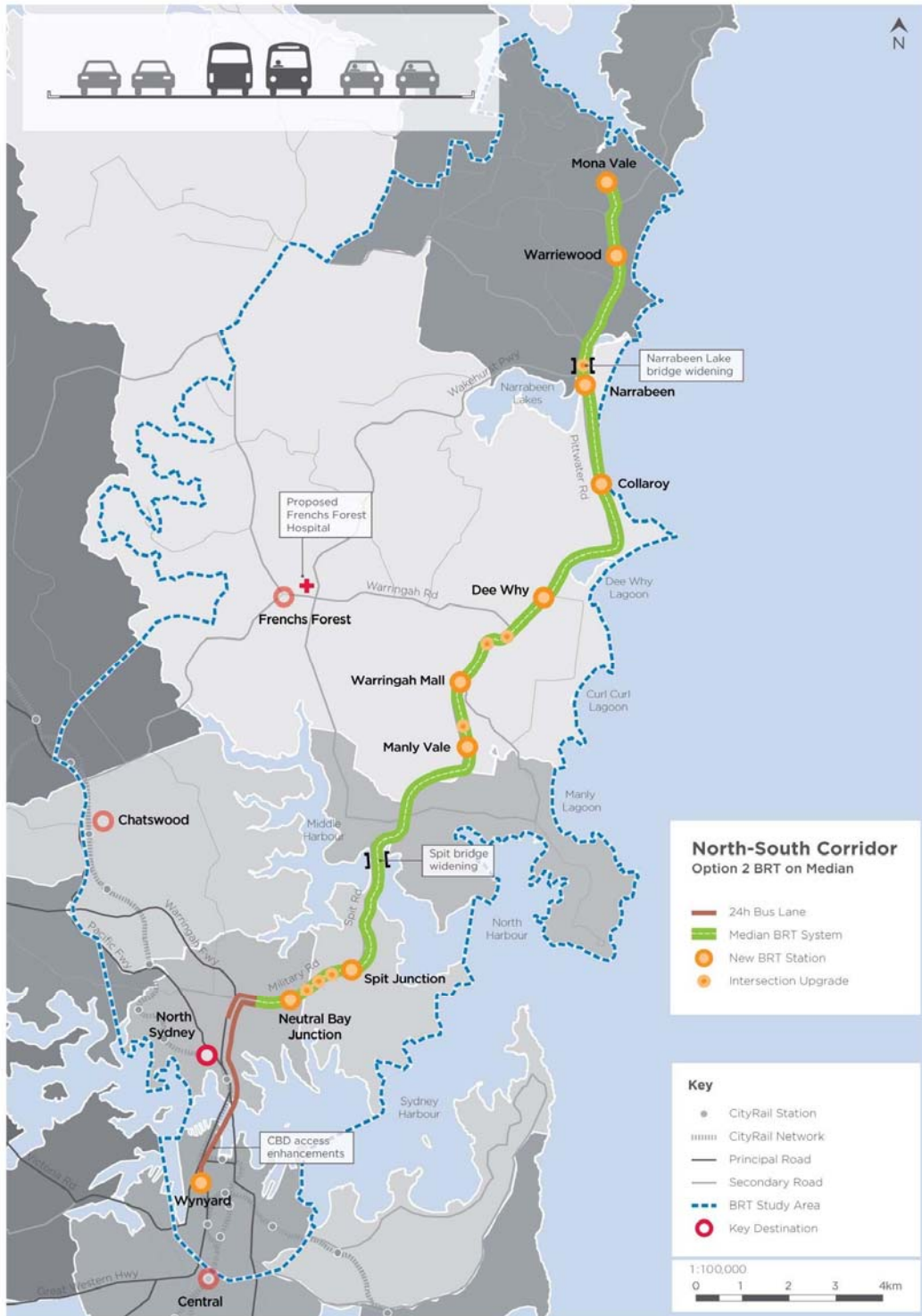


Figure 3.3: Option 2 Median BRT

3.3 Option 3: North-South Kerbside BRT

Option 3 (shown in Figure 3.4) would provide a dedicated BRT running along the kerb. Some of its features are common to Option 2 but configured for the kerbside and include:

- Removal of on-street parking and widening the roadway at key locations as for Option 1.
- Exclusive 24 hour kerbside BRT lanes.
- Overtaking bays at all bus stops.
- Replacement of the Spit and Narrabeen bridges with 6 lane bridges.

This option differs from Option 1 as the kerbside BRT would be fully segregated from other traffic. Passing bays at bus stops would mean express buses are also able to avoid more frequently stopping local buses.

Table 3.5: Advantages and disadvantages of Option 3

Advantages	Disadvantages
<ul style="list-style-type: none"> • Exclusive operation for BRT express services for the entire length of the corridor. • Kerbside running provides opportunities to use and augment existing infrastructure and does not require passengers to change their access arrangements. • Passing bays for bus overtaking. • Additional capacity on Spit and Narrabeen Bridges 	<ul style="list-style-type: none"> • Requirement for property acquisition.

Option 3 has a relatively high cost compared to Option 1 with the biggest difference being additional costs for property acquisition (to provide space for additional infrastructure including for additional passing bays). The BCR is marginally lower than Options 1 and 2 (refer Table 3.6).

Table 3.6: Option 3 Outcomes of rapid economic appraisal

	Total costs (\$m)	Total benefits (\$m)	Benefit cost ratio	NPV (\$m)
Option 3	572	354	0.62	(218)

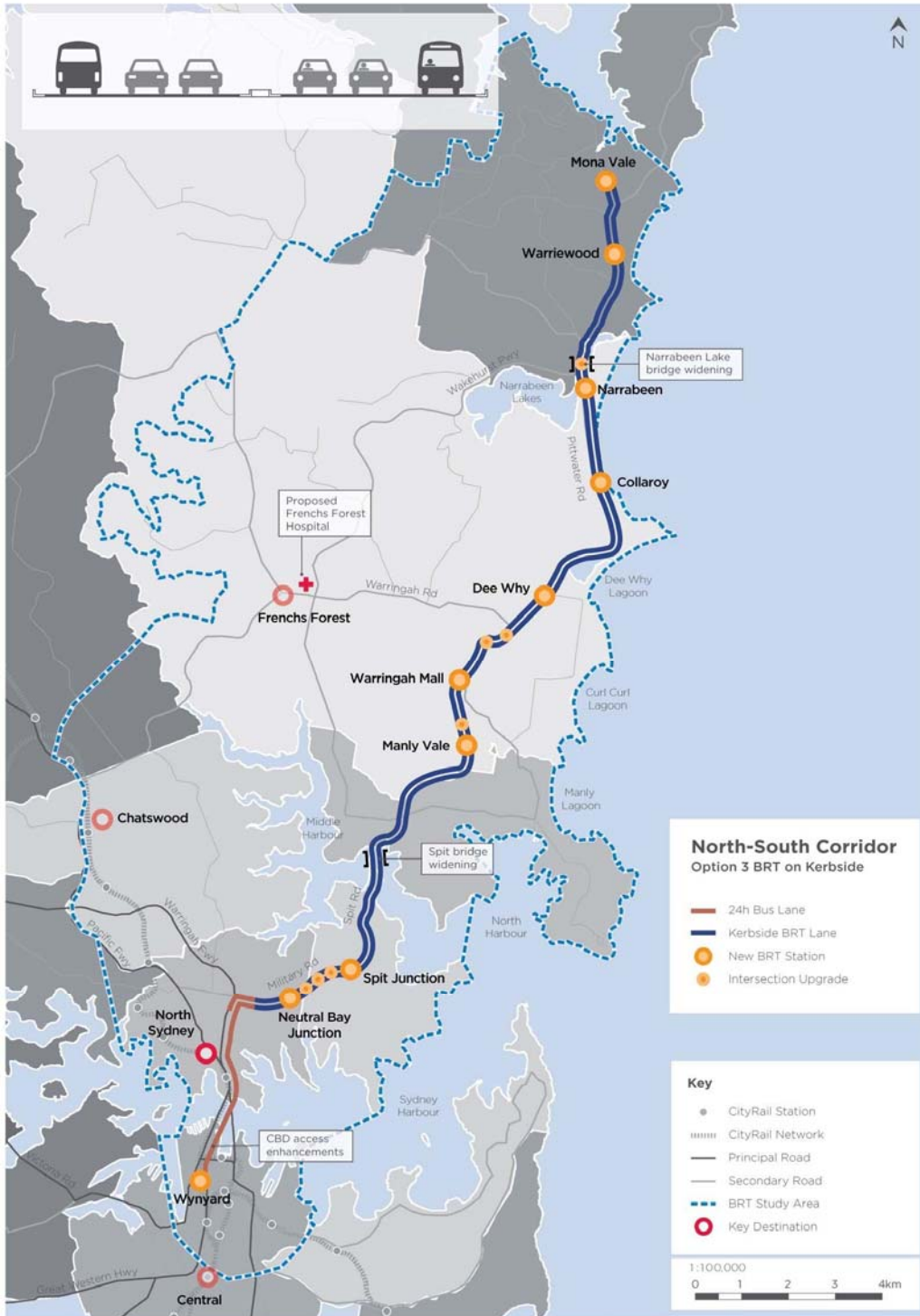


Figure 3.4: Option 3 Kerbside BRT

3.4 Option 4: North-South Northern Interchange BRT

Option 4 (shown in Figure 3.5) would provide a dedicated BRT running along the kerb as for Option 3 but this option would include an interchange north of the harbour bridge. A north side interchange facility is identified as a priority in the Shore Regional Organisation of Council's *Shaping our Future* strategy.¹

Key features would include:

- Extension of Military Road improvements to a new rail station at North Sydney (an underground interchange facility at Neutral Bay was also considered but North Sydney was preferred because it aligns with the long term rail plan for a second harbour crossing serving a new station in the North Sydney area).
- A dedicated interchange facility providing transfer onto rail.
- Provision of sufficient stand capacity to accommodate bus and passenger volumes designed to allow rapid transfers.
- Provision of driver and layover facilities.

Table 3.7: Advantages and disadvantages of Option 4

Advantages	Disadvantages
<ul style="list-style-type: none"> • Reduction in bus volumes entering the CBD (a proportion would be diverted to North Sydney). 	<ul style="list-style-type: none"> • Forced interchange at North Sydney for passengers travelling beyond North Sydney to the Sydney CBD. • Trip lengths could be longer than a direct bus to the Sydney CBD in the off-peak.

Option 4 is a relatively high cost option but has a similar benefit cost ratio to Options 1 and 2. Option 4 has the highest costs for property acquisition of all the options (refer Table 3.8).

Table 3.8: Option 4 Outcomes of rapid economic appraisal

	Total costs (\$m)	Total benefits (\$m)	Benefit cost ratio	NPV (\$m)
Option 4	552	372	0.67	(181)

¹ Shaping our Future – our regional strategy <http://shoroc.com/shaping-our-future>, SHOROC, 2010/2011.

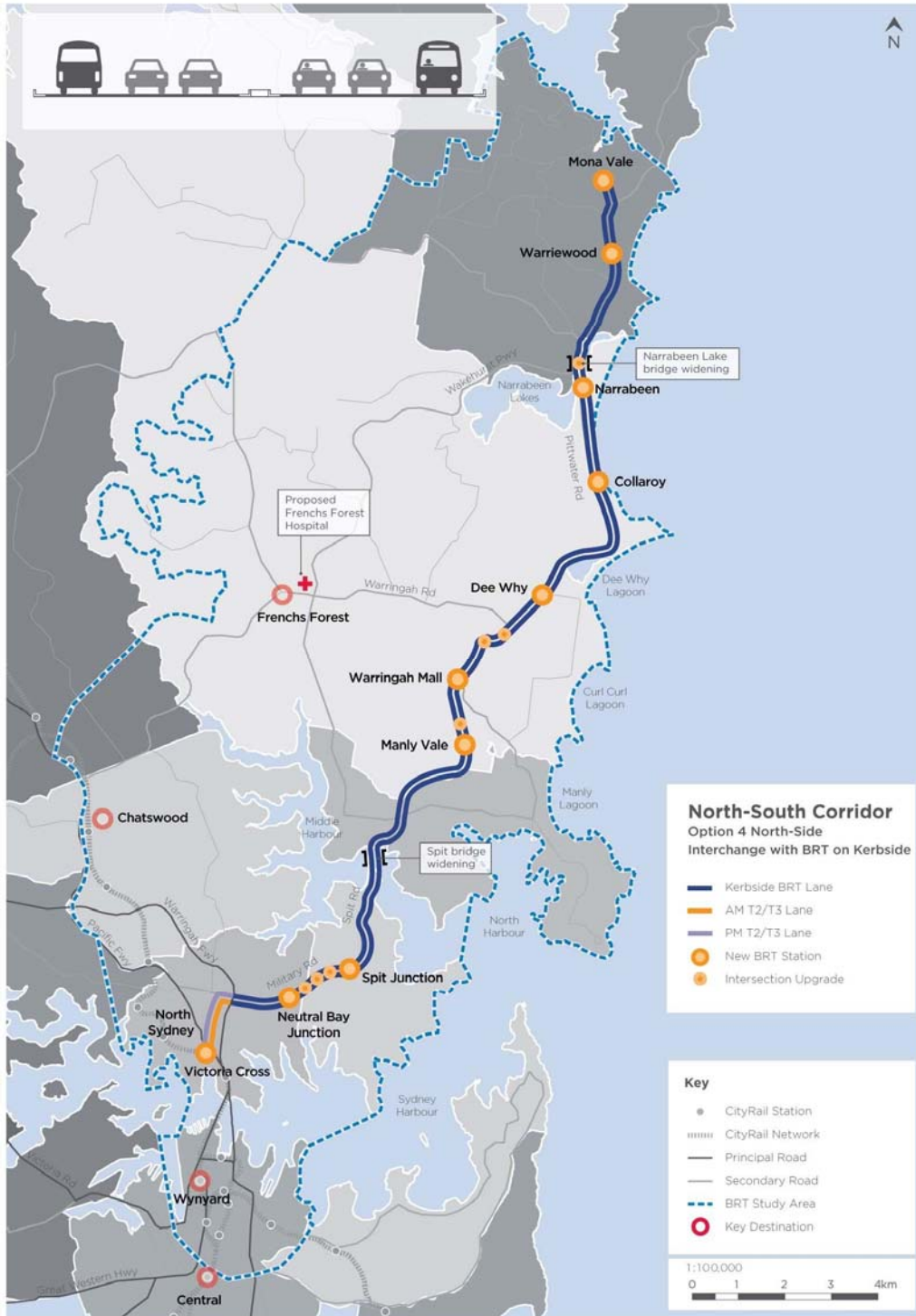


Figure 3.5: Option 4 Northern Interchange BRT

3.5 Option 5: North-South Tunnel BRT

Option 5 (shown in Figure 3.6) enhances road capacity through incorporation of a dedicated 2 lane bus tunnel for a section of the corridor. Any tunnel option is only likely to be considered for the Military Road corridor because of the high cost and because other roads along the corridor are capable of providing adequate priority for buses. The key features of this option are:

- BRT on the kerbside from Mona Vale to Spit Junction as described for Option 3.
- A two lane dedicated bus tunnel beneath Military Road between the Spit Junction and Warringah Freeway which would join the Sydney Harbour Bridge bus lane.

The capacity of a bus tunnel would only be fully utilised during peak periods. Bypassing the Military Road corridor may also limit travel and interchange options for some customers.

Table 3.9: Advantages and disadvantages of Option 5

Advantages	Disadvantages
<ul style="list-style-type: none"> • Full priority operation in tunnel. • New underground bus stations. • Release of road space on Military Road to general traffic and local bus services. • Greatest travel time savings of all options. 	<ul style="list-style-type: none"> • Construction impacts. • Large capital costs. • Limited interchange options for passengers travelling to North Sydney.

Option 5 is the highest cost option. The biggest component of the cost is tunnelling (refer Table 3.10).

Table 3.10: Option 5 Outcomes of rapid economic appraisal

	Total costs (\$m)	Total benefits (\$m)	Benefit cost ratio	NPV (\$m)
Option 5	1,212	466	0.38	(746)

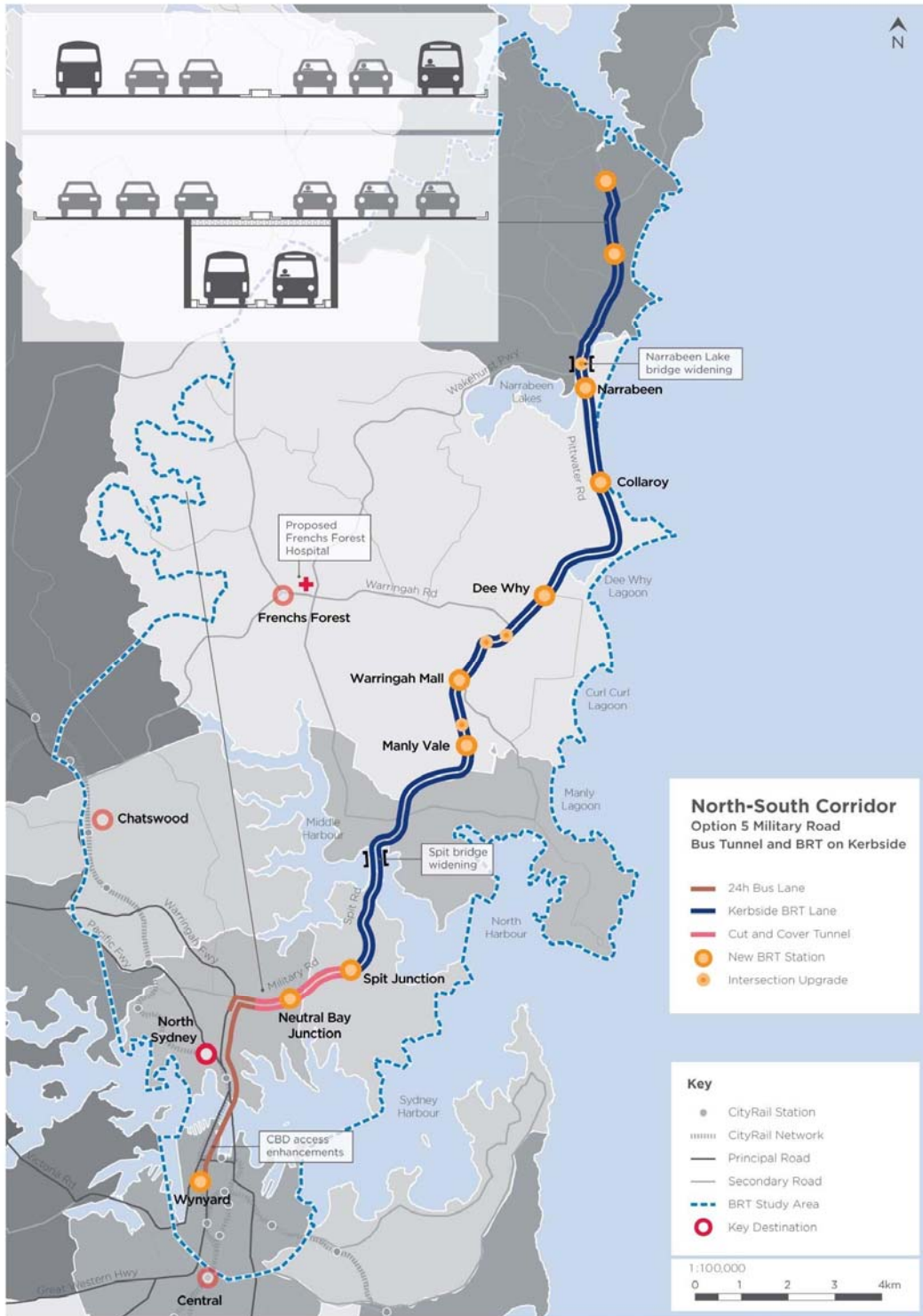


Figure 3.6: Option 5 Tunnel BRT

3.6 Tidal flow options

A number of other options were developed that incorporated tidal flow arrangements that provide an additional bus lane in the peak direction. This would provide opportunities for bus services to overtake other bus services without mixing with general traffic. The additional lane could be provided in the median or outside lanes as shown in Figure 3.7 and Figure 3.8.

Tidal flow bus lane arrangements could be implemented in the short term and in corridor segments where a combination of traffic congestion and corridor width constraints may otherwise make it difficult to provide a high level of priority to buses.

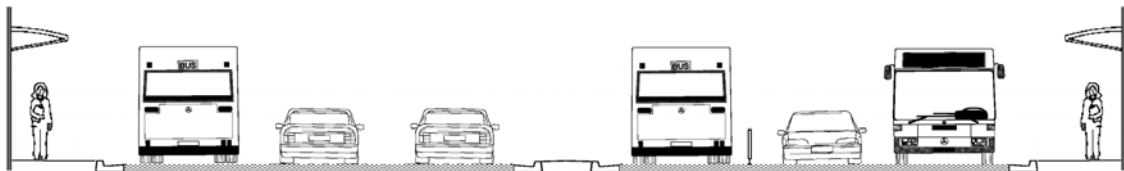


Figure 3.7: Tidal Flow Express BRT on median lane

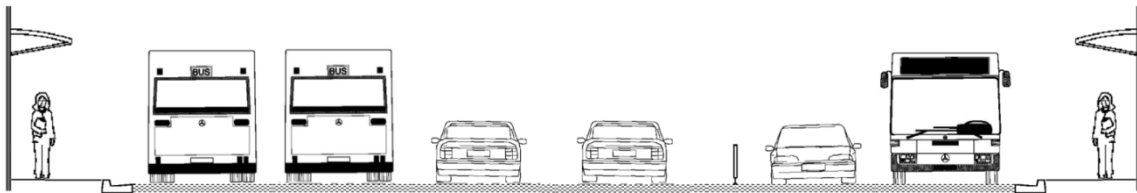


Figure 3.8: Tidal Flow Express BRT on outside lane

The options provide bus priority for the peak direction and would allow on-street parking to be maintained in the off-peak. They may provide a short to medium solution but their longer term effectiveness is dependent on whether current and future levels of contra-peak traffic could be accommodated in fewer lanes.

A tidal BRT option was not shortlisted but tidal flow options could be further explored as part of the staged implementation of a preferred option.

4. East-West Corridor

The East-West Corridor links the Chatswood CBD with Dee Why via Warringah Road, Boundary and Archer Streets. Forest Coach Lines and Sydney Buses operate approximately 20 bus services on the corridor.

Some sections do not have a service. For example, there is no service on Warringah Road between Pittwater Road and Allambie. There is also no direct express connection between Chatswood and Dee Why / Brookvale. Estimated weekly patronage is less than 30,000 trips compared to more than 140,000 trips on the North-South Corridor.

Only one option, Option 6, was shortlisted for the corridor as the costs and benefits for several of the options were considered to be similar.



Figure 4.1: East-West Corridor

4.1 Option 6: East –West Kerbside BRT

Option 6 (shown in Figure 4.2) features:

- Replacement of existing bus lanes and clearways with 24 hour kerbside bus lanes.
- Removing off-peak on-street parking along the corridor.
- Widening of Warringah Road at Forest Way intersection.
- Improved access into Chatswood including increased capacity at Chatswood interchange.

Table 4.1: Advantages and disadvantages of Option 6

Advantages	Disadvantages
<ul style="list-style-type: none"> • Consistent level of priority over much of the corridor. • Enhanced priority into Chatswood. 	<ul style="list-style-type: none"> • Significant increase in general traffic congestion for other road users.

Option 6 is relatively low cost compared to other options but the costs are higher than the benefits with a cost benefit ratio of 0.54 (refer Table 4.2).

Table 4.2: Option 6 Outcomes of rapid economic appraisal

	Total costs (\$m)	Total benefits (\$m)	Benefit cost ratio	NPV (\$m)
Option 6	77	41	0.54	(36)

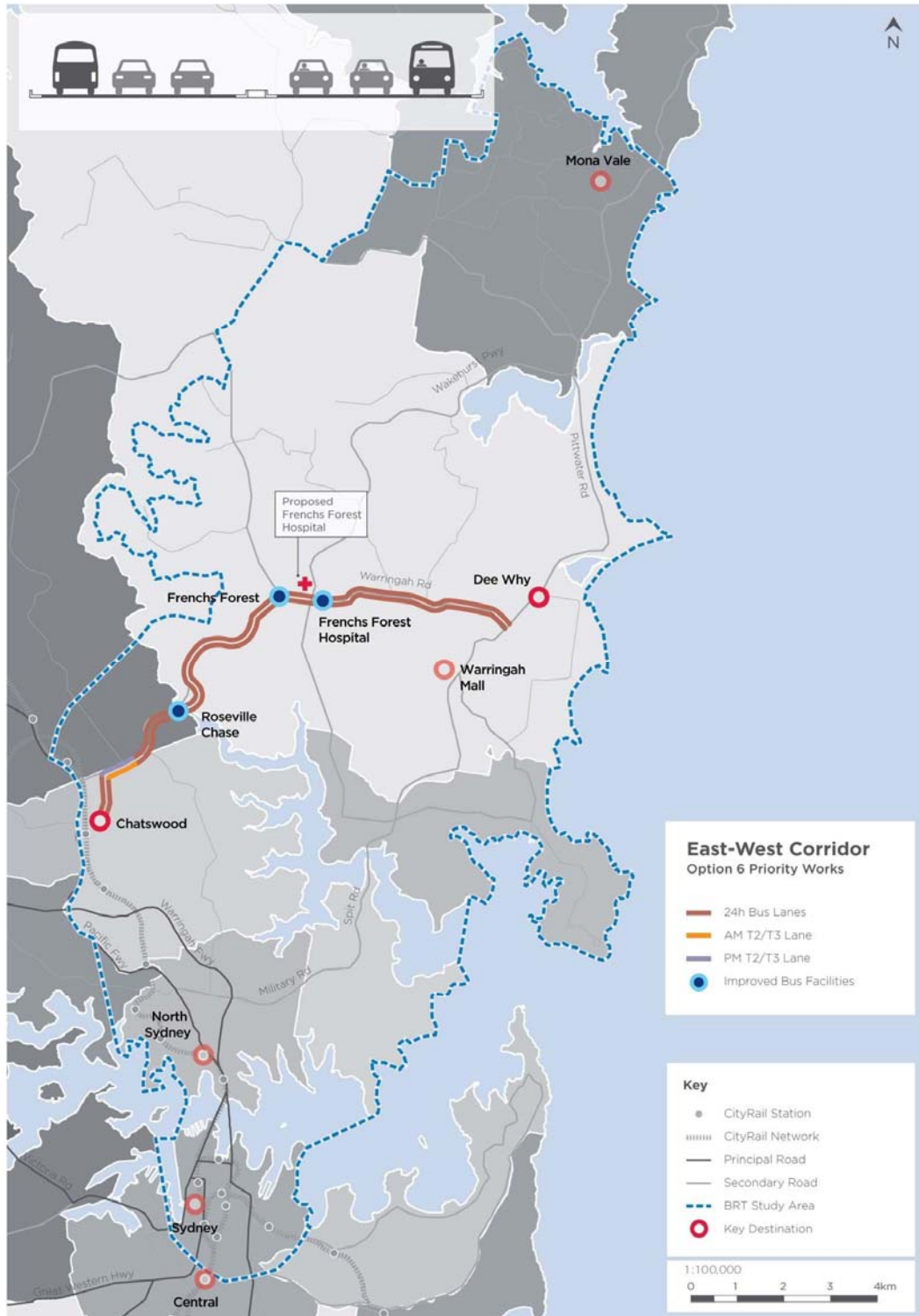


Figure 4.2: Option 6 East-West Kerbside BRT

5. Bus Network Considerations

The effectiveness of each infrastructure option in improving passenger outcomes on both corridors is closely aligned with implementing supporting bus network improvements.

It is proposed to make it easier for people to understand the systems on the two corridors, how they function, and where to wait for buses by:

- providing a simpler core network of full-time routes (seven days and seven nights) supported by demand-driven peak-hour supplementary routes.
- providing supporting infrastructure (e.g. branding, signage and other station like infrastructure) and streamlining stopping patterns.

While a more detailed review will be required to develop a final network of services key features for the corridors will be:

- a tiered network structure for routes on the trunk North-South Corridor from Mona Vale to the City.
- new and improved connections operating on the East-West Corridor (Warringah Road).

These network features are outlined in sections 5.1 and 5.2

5.1 North-South Corridor: Bus Network Rationalisation

The North-South Corridor will continue to be a significant focus for public transport, both for trips to/from the City as well as for connections between residential and employment activity centres within the Region.

A tiered network structure for this corridor would provide consistency of service along different sectors of the corridor, recognising the different characteristics of each.

Using a simplified route numbering system, the four network tiers would be:

- Northern Beaches Rapid (routes 1 to 9).
- Warringah Rapid (routes 10 to 20).
- All-stops (routes 100 to 110).
- Local (routes 200 and above).

There may also be scope to improve ferry operations and connecting bus services.

The tiered network would have a common stopping pattern. More trips would be provided on trunk routes with other routes restructured to operate local services with interchange onto the trunk BRT routes at key locations. The number of services going beyond Wynyard would be reduced.

A schematic of the proposed network is shown in Figure 5.1.

NORTHERN BEACHES RAPID	
	All stops
	Limited stops
	Peak hours
(Elanora Heights, Bilgola Plateau, Narrabeen Lakes)	
WARRINGAH RAPID	
	All stops
	Limited stops
	Peak hours
(Wheeler Heights, Wingala, Allambie, Manly)	
	All stops
	Peak hours
	Major bus stop and interchange point

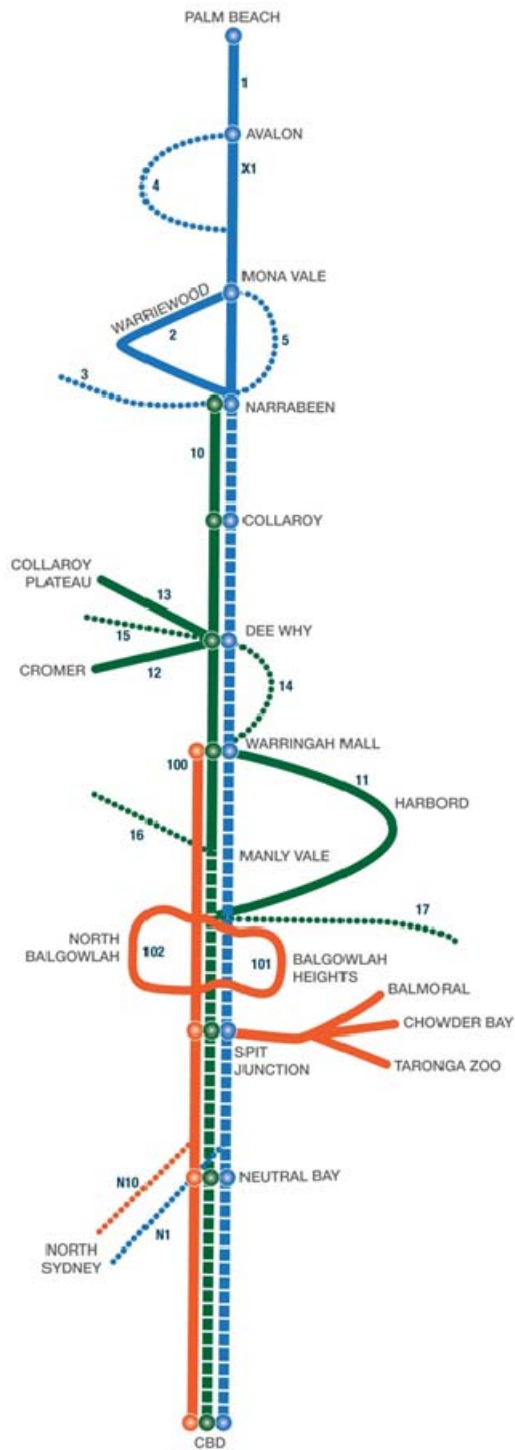


Figure 5.1: North-South Corridor Bus Network Rationalisation

5.2 East-West Corridor: Proposed Bus Network

Network legibility on this corridor is better than the North-South Corridor. Improvements to service levels along Warringah Road, and the extent and range of bus priority measures will provide the most immediate step change in service provision along this corridor.

For example, bus connections on the Warringah Road corridor could be improved through:

- A new full time route (169) from Manly to Chatswood *via* Warringah Mall, Dee Why and Frenchs Forest.
- A new full time route (271) from Warringah Mall to the City *via* Narraweena, Beacon Hill and Frenchs Forest.
- A new direct connection from Manly to Chatswood *via* Allambie Heights and Frenchs Forest (Route 280A).
- Amendment to route 139 (Manly to Warringah Mall *via* Harbord) to instead operate Manly to Chatswood *via* Harbord, Dee Why and Frenchs Forest.
- The withdrawal of peak-hour only Route L60 between Mona Vale and Chatswood.

A schematic of the east-west connections on and around the Warringah Road corridor is shown in Figure 5.2.

A schematic of the east-west connections on and around the Warringah Road corridor is shown below.

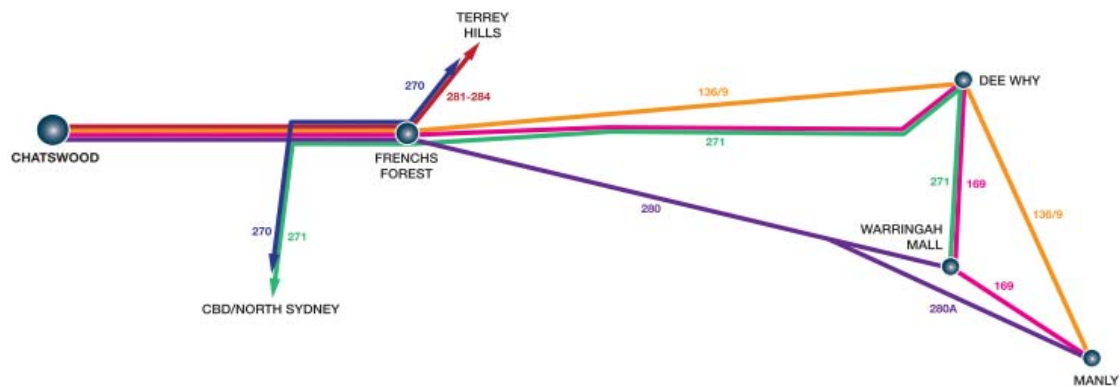


Figure 5.2: Indicative Revised Network of Routes using the Warringah Road Corridor

6. Summary of key findings

The study has confirmed the feasibility of constructing and delivering a package of BRT measures on the identified corridors in the Northern Beaches. These include infrastructure options as well as operational changes to the network that can be progressed with or without infrastructure changes. The results of the preliminary economic analyses indicate the costs for the options considered are higher than the benefits. Each option assumed 24 hour bus priority – there is scope to apply measures for a shorter period of the day which would reduce the negative impacts (and costs) for private vehicles without significantly reducing benefits. More detailed analysis of options with these variations may show increased economic viability.

Implementation of any option needs to take into account:

- The impacts on general traffic, given that these road corridors suffer congestion at peak times and removal of general traffic lanes for BRT will make congestion worse for private vehicles.
- The provision of exclusive running lanes for BRT impact on-street parking and access for both residents and businesses along the corridors.
- The significant property acquisition required as a result of constrained road reservation widths which add substantially to project costs.
- The impacts associated with the provision of high quality stations and passing lane facilities.
- Cost allocation for the replacement of Spit Bridge and widening of Narrabeen Bridge as well as the costs associated with the emerging Wynyard bus interchange concepts.

TfNSW is now seeking comment on these options and the initial findings to inform the direction of more detailed studies and analysis.

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