

4.3 Busway scenario

The *Busway Scenario* will involve converting the existing Johnsonville railway line to a guided busway.

The busway will operate in a similar fashion to rail between Johnsonville town centre in the north and Hutt Road in the south. The busway will be a dedicated right-of-way with buses able to enter from and exit to the existing road network and travel the length of the busway with no delays from congestion.

The busway will be one-lane wide for most of its length because of the narrow corridor, steep drops and narrow tunnels¹⁴. In addition buses will be fitted with a guidance system to ensure safe operation and provide an improved ride quality. One possible guidance system is the “O-Bahn” type system used in Adelaide which works by fitting small guide wheels on standard buses and installing raised curbs on the busway to guide the buses. Further details on guidance systems are available in the Scenarios Technical Appendices document.

As the busway will only be one-lane wide it will operate in the peak direction only with return buses using the existing road network. The busway will operate with services running along the busway from Johnsonville to the CBD during the morning peak and then switching at some point during the day so that services travel back along the busway from the CBD to Johnsonville during the evening peak.

4.3.1 Proposed service improvements

This section explores possible service improvements under the *Busway Scenario*.

4.3.1.1 Operation of busway and other bus services

Combined with a comprehensive package of bus priority measures the busway will form the backbone of a mass transit corridor providing reliable, efficient peak services from the northern suburbs through to the CBD.

It is proposed that the busway will operate with a mixture of express and ‘rail replacement’ bus services to replace the existing trains during peak periods. Express services will operate from Churton Park, Grenada Village, Glenside, Paparangi and Newlands with services from the last four areas turning right at the Newlands Overbridge to travel north and enter the busway at Johnsonville. The busway will improve the journey time reliability for all these services, although

¹⁴ A two-lane busway was looked at but is not considered viable due to cost and construction difficulties – refer to the SKM Technical Appendices to Scenarios document for more detail.

travel time for services that currently use the Ngauranga Gorge will increase from 16 minutes to approximately 20 minutes¹⁵.

Express services are expected to be full by the time they enter the busway and will run through to the CBD without stopping. Other services could also enter part way along the busway when full.

Rail replacement services will carry people who currently use the train, stopping at every stop on the busway. These services will not start in Johnsonville town centre but will start in nearby residential areas (for example, Johnsonville West) so as to provide additional coverage and to pick up passengers before entering the busway.

Another way of operating the busway would be to run rail replacement bus services and services from Churton Park and Tawa (which would operate as express services) on the busway. All other bus services would operate on roads, including services from Grenada Village, Glenside, Paparangi and Newlands which would continue to travel down the Ngauranga Gorge.

An alternative way of operating the busway would be to reserve it for exclusive use by express buses travelling from Churton Park, Grenada Village, Glenside, Paparangi and Newlands. Rail replacement services would run on existing roads parallel to the busway to Ngaio Station and then down the busway to the CBD. This would have the advantage of providing shorter travel times for express users.

In addition to peak express services on the busway, normal non-express services will run throughout the day (including peak periods) on existing roads and will ensure a bus service to most bus stops at all times of the day. This should reduce any confusion arising from peak direction services operating only on the busway.

There are clearly many ways in which the busway could be operated. If it is chosen as the preferred scenario, further work will be undertaken to determine the details.

It may be possible to use cleaner environmentally friendly alternatives to diesel buses such as hybrid diesel-electric and hydrogen fuel cell buses in the future. This will need to be considered in detail before proceeding with any bus-based option.

Further detail on the proposed operation of the *Busway Scenario* is contained in the Scenarios Technical Appendices document.

¹⁵ These figures are travel time between Newlands overbridge and the Lambton bus interchange. Current schedules show travel time of 16 minutes, although during peak periods actual travel times are often significantly longer.

4.3.1.2 Coverage of services

The proposed bus routes for this *Busway Scenario* are shown in Figure 6. The proposed bus routes are as follows:

- **Proposed routes along busway (X, Y, Z)**
 These three routes will replace the existing train services. They will operate on the busway stopping at all stations, with return and non-peak services running on existing roads. It is expected that these routes will not start in Johnsonville town centre but rather start in nearby residential areas (1–2km away) to provide additional coverage and pick up additional passengers before entering the busway.
- **Proposed route in West Johnsonville (W)**
 This route will replace route 46 and route 53, serve Johnsonville West and Broadmeadows, and will enter the busway at Khandallah.
- **Proposed routes in Churton Park (54) and Glenside (59)**
 These routes operate in line with the general improvements to bus services discussed in section 3.1 except that peak express services could enter the busway at Johnsonville rather than use Ngauranga Gorge.
- **Proposed routes in Paparangi (55), Newlands (56) and Grenada Village (57)**
 These routes operate in line with the general improvements to bus services discussed in section 3.1 except that peak express services could cross the Newlands over-bridge and travel north on the motorway to enter the busway at Johnsonville rather than use Ngauranga Gorge.
- **Proposed routes in Ngaio, Homebush and Khandallah (43, 44, 45)**
 These routes will remain similar to existing services but the frequency of these services will be improved.
- **An alternative for West Johnsonville, Ngaio, Homebush and Khandallah (B, K)**
 An alternative to proposed routes W, 43, 44 above would to implement new routes for Broadmeadows (B) and Khandallah (K) in line with the general improvements to bus services discussed in section 3.1. Proposed route B would service Johnsonville West, Broadmeadows, Khandallah and Cashmere (Homebush and Onslow Roads) and would operate on existing streets. Proposed route K would replace the Ngaio Gorge, Cockayne Road, Te Kainga, and Khandallah Village section of routes 43 and 44 and would also operate on existing streets. These changes would result in a longer journey times for Johnsonville West and Broadmeadows, however the additional catchment would mean more frequent peak services and possible off-peak and weekend service improvements.

- **Note regarding Onslow College**

At present a significant number of students travel on the railway line in the counter-peak direction to Onslow College, alighting at Raroa Station and walking to the college.

Proposed busway routes X, Y and Z will provide services to Onslow College. These routes will also increase the size of the public transport catchment area as they extend through a much greater area than the existing railway line. There is also an opportunity to divert other routes to provide direct access to the school.

4.3.1.3 Frequency of services and travel time

The frequency of services along the busway would be 3 to 5 minutes during peak periods and 10 minutes during non-peak periods. These frequencies are a substantial improvement on the existing train service and will be achieved by the three new bus services that will replace the existing train service.

The new busway services, which stop at every station, will take approximately 21 minutes to travel between Johnsonville and the Lambton bus interchange. This is comparable to the existing train service.

Express services entering or leaving the busway at Johnsonville will take approximately 17 minutes to travel between Johnsonville and the Lambton bus interchange. Express services from Newlands will take approximately 20 minutes to travel from the Newlands over-bridge via Johnsonville to the Lambton bus interchange compared to 16 minutes on current schedules which use Ngauranga Gorge¹⁶.

The shortest possible travel time depends on how fast buses can travel on the busway. The maximum speed achievable is constrained by the horizontal alignment of the route and necessity for speed restrictions through tunnels. It may be possible to achieve shorter journey times than those used above but further investigation is required. A possible two minute saving could be achieved but will need to be confirmed through detailed design work.

4.3.1.4 Capacity of services

The maximum theoretical capacity of the busway significantly exceeds likely demand based on current patterns of growth. A peak planning capacity of 6,000 passengers per hour can be achieved on the busway with articulated buses operating as express services with one minute headways and

¹⁶ Current schedules show travel time of 16 minutes, although during peak periods actual travel times are often significantly longer.

limited stops. Under the same conditions non-articulated buses would achieve a peak planning capacity of 3,300 passengers per hour¹⁷.

For this scenario it has been assumed that articulated buses would provide a new service along the busway to replace the existing train service. However, the feasibility of using articulated buses still needs to be confirmed.

The limited capacity of the CBD to cater for additional bus services from the northern suburbs is a major issue. One way of addressing this issue could be to run northbound services that currently terminate at the Lambton bus interchange through to Johnsonville or other destinations in the northern suburbs. For example buses that currently run from Houghton Bay or other areas through the CBD to Lambton bus interchange could be extended through to Johnsonville. This could reduce the number of buses running through the CBD but the travel time reliability of longer routes may be adversely affected as these routes would have fewer opportunities to make up lost time arising from traffic conditions along their routes.

4.3.2 Bus priority measures

A number of bus priority measures are required under the *Busway Scenario* to enable the efficient operation of the busway and bus network. The following bus priority measures may be required:

- Bus lanes along Hutt Road and Thorndon Quay between the busway entrance and Lambton Interchange. Reallocation of car parking and removal of the existing angle parking, may be required
- Bus priority measures at intersections around Johnsonville centre
- Construction of a bus interchange at Johnsonville to replace the existing train station

Bus priority measures are required through the CBD and are being investigated as part of the Ngauranga to Airport study. Priority measures are required to maintain journey times for all bus services through the CBD, including services from outside the Study area. A description of the CBD bus priority measures is contained in the Scenarios Technical Appendices document.

4.3.3 Advantages and disadvantages

This section highlights some of the advantages and disadvantages of the *Busway Scenario*.

¹⁷ The planning capacity used was 100 passengers for articulated buses and 55 passengers for non-articulated buses

4.3.3.1 Advantages

- Frequency of buses replacing trains 3 to 5 minutes during peak periods. Frequency of all other bus services 4 to 15 minutes during peak periods
- Journey times similar for existing train users who travel on the busway with improvements for some express services
- Travel time reliability for busway services not affected by traffic incidents and congestion (expected to be majority of peak period commuters)
- Seamless service possible through CBD to Courtenay Place
- Vehicles more comfortable reliable and attractive (new buses)
- Waiting environment more comfortable (new bus shelters including busway stations)

4.3.3.2 Disadvantages

- Travel time reliability for bus services not on the busway affected by traffic incidents and congestion (expected to be minority of peak period commuters)
- CBD congestion and traffic incidents will impact all services which run on roads
- CBD will require bus priority measures for additional buses. Road capacity and parking spaces in CBD may be reduced
- Where additional bus priority measures are provided, the resultant decrease in road space for other users will increase general congestion
- Potentially confusing operation for non-regular users as different bus stops may operate at different times of the day
- Difficult and expensive to change route of busway but easy to change or extend bus routes at either end
- Closure of Johnsonville railway line during construction

4.3.4 Costs and funding

The total cost of the *Busway Scenario* will be in the order of \$120–130m in today's equivalent dollars (net present value) with \$65–75m of this spent in the next ten years. These figures include an allocation of \$3m for bus priority measures from the Lambton bus interchange through the CBD to Courtenay Place.

The majority of the costs for this scenario are associated with decommissioning the existing railway line, building the busway, providing bus priority measures, constructing bus platforms and shelters at stations and providing shelters adjacent to the existing train station locations.

In calculating the costs of this scenario it was assumed that buses would be purchased by private operators and paid for by a combination of fares and subsidies as happens with existing bus services.

To fund this scenario Greater Wellington will need to contribute a total of \$55–65m in today’s equivalent dollars with \$30–40m of this to be funded in the next 10 years as part of the current LTCCP. Land Transport NZ will fund the balance in accordance with their existing funding policies.

4.3.5 Implementation and construction

It is proposed for the *Busway Scenario* to be completed by 2011/12 with construction taking 12 – 18 months. Details of the possible timeframe and construction period are outlined below.

Approval will be required from central government to use the Johnsonville railway line for non-rail purposes.

4.3.5.1 Timeframe for implementation

A possible timeframe for the implementation of the *Busway Scenario* is outlined in Table 5 below.

■ **Table 5: Tasks and timeframes for implementation of *Busway Scenario***

Task	Timing
CBD bus route improvements	07/08
Johnsonville hub improvements	07/08
Hutt Road bus priority measures	07/08
Busway construction	10/11-11/12
Rail replacement service during construction	10/11-11/12
New articulated buses (12 units)	11/12
Purchase of new buses (7 units) and service improvements to provide for general improvements to bus services	08/09
Articulated bus replacement (12 units)	25/26
Replacement buses (7 units)	25/26

The timetable given in this table is relatively optimistic and may need to be extended to allow for obtaining resources consents and funding.

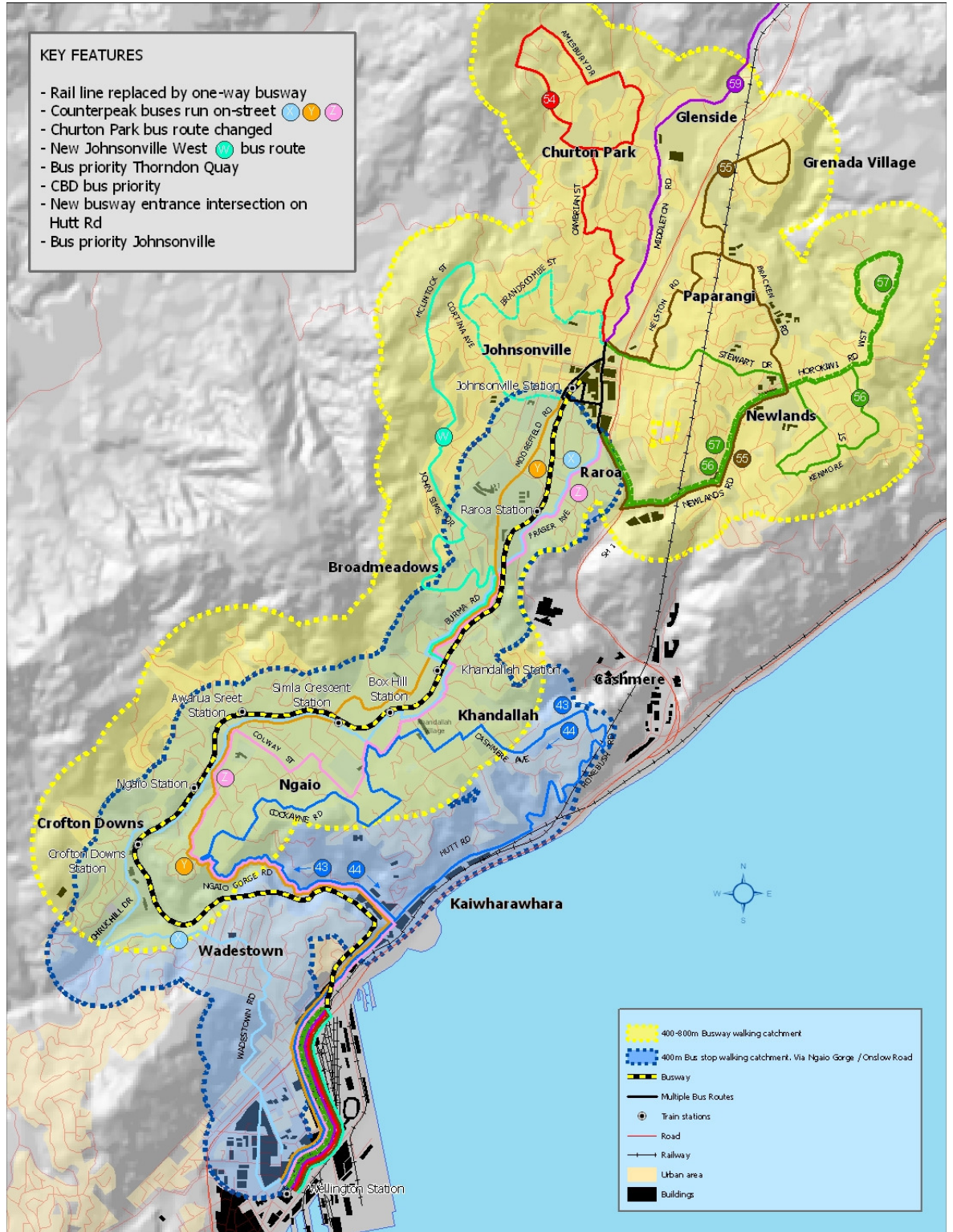
4.3.5.2 Construction period

There would be a period where train services have to be stopped to construct the busway. This could take 12 – 18 months because of the constrained nature of the site and would require implementation of a bus service operating on the existing road network while construction takes place. If bus priority measures from Ngaio Gorge into the CBD were implemented prior to the closure of the rail service, the level of service during construction of the busway would be equivalent to that for the bus on-street scenario. Construction could be staged with the section from Ngaio to the CBD constructed first and available for use within one year.

4.3.6 Other *Busway Scenario* options considered

In developing the *Busway Scenario* a number of other busway options were considered including the possibility of a two-lane busway and the use of alternative busway technology. Further technical information on this scenario and the other options considered is available the Scenarios Technical Appendices document.

■ **Figure 6 : Bus Routes for *Busway Scenario* Operations**



4.4 Light Rail scenario

The *Light Rail Scenario* will involve replacing the existing trains with new light rail vehicles running on an extended Johnsonville railway line through the CBD to Courtenay Place.

The general improvements to bus services discussed in section 3.1 will be implemented in addition to light rail improvements.

4.4.1 Proposed service improvements

This section explores possible service improvements under the *Light Rail Scenario*.

4.4.1.1 Operation of light rail and bus services

Light rail vehicles will operate on the existing railway line much as trains do at present but with some infrastructure improvements.

The railway line between Johnsonville and the Wellington railway station will require similar infrastructure improvements as outlined for the 10 minute *Enhanced Rail Scenario* in section 4.1, except tunnel lowering will not be required. However, to extend services through to Courtenay Place significant additional infrastructure will be required including construction of an 'at-grade' twin track line through the CBD and reconfiguration of existing CBD bus routes.

Further detail on the proposed operation of the *Light Rail Scenario* is contained in the Scenarios Technical Appendices document.

4.4.1.2 Coverage of services

The proposed light rail and bus routes for the *Light Rail Scenario* are shown in Figure 7. Figure 8 shows a potential light rail route through the CBD.

This scenario also includes the general improvements to bus services discussed in section 3.1.

4.4.1.3 Frequency of services and travel time

The frequency of services along the railway line during peak periods would be 10 minutes between Johnsonville and the Wellington railway station and approximately 3 minutes through the CBD. During off-peak periods the frequency of service would be between 15 and 30 minutes along the Johnsonville railway line and 6 minutes through the CBD.

To achieve these peak frequencies 13 light rail vehicles will be required to operate on the Johnsonville railway line section. An additional eight light rail vehicles will be required to operate through the CBD and one additional light rail vehicle on the Johnsonville railway line section so that the timetable can be maintained even with irregular services running through the CBD.

4.4.1.4 Capacity of services

A peak planning capacity of 1,400 passengers per hour can be achieved on the Johnsonville railway section with a 10-minute service frequency¹⁸.

4.4.2 Bus priority measures

Light rail systems require a high level of priority over other traffic to provide an efficient and reliable service and in many cases are given their own right of way and priority over other traffic at intersections.

The existing bus route through the CBD is heavily congested and is currently shared by conventional buses, trolley buses and general traffic. Road space would need to be reallocated to enable light rail tracks to be placed on lanes currently used by buses and general traffic. It is likely that existing bus lanes would need to be opened up to general traffic. This would have a significant impact on existing bus services and general traffic.

Further detail on the priority measures that could be required for the *Light Rail Scenario* is contained in the Scenarios Technical Appendices document.

4.4.3 Advantages and disadvantages

This section highlights some of the advantages and disadvantages of the *Light Rail Scenario*.

4.4.3.1 Advantages

- Frequency of light rail services 10 minutes during peak periods (3 minutes for CBD section). Frequency of all other bus services 4 to 15 minutes during peak periods
- Journey times are similar for existing rail users who travel on light rail
- Travel time reliability for light rail services from Johnsonville to Wellington Station not affected by traffic incidents and congestion
- Seamless service possible through CBD to Courtenay Place
- Vehicles more comfortable reliable and attractive (new light rail vehicles)
- Waiting environment more comfortable (upgraded light rail stations)
- Potential for regular clock-face timetable (same time past the hour)

¹⁸ The planning capacity used is 230 passengers per light rail train (2 vehicles)

4.4.3.2 Disadvantages

- Travel time reliability for light rail services between Wellington Station and Courtenay Place affected by traffic incidents and congestion, which will worsen as traffic grows
- Travel time reliability for bus services affected by traffic incidents and congestion, which will worsen as traffic grows
- CBD congestion and traffic incidents will impact all services which run on roads including light rail
- CBD will require significant priority measures for light rail and consequential changes to bus priority measures. Road capacities and parking spaces in the CBD will be reduced
- Where additional bus priority measures are provided, the resultant decrease in road space for other users will increase general congestion
- Difficult and expensive to change route or extend coverage of light rail service
- Disruption on Johnsonville railway line and through CBD during construction

4.4.4 Costs and funding

The total cost of the *Light Rail Scenario* will be in the order of \$165–175m in today's equivalent dollars (net present value) with \$90–100m of this spent in the next 10 years. These figures include an allocation of \$50–70m to extend the existing Johnsonville railway line through the CBD. This compares to the other scenarios which all included \$3m for additional bus priority measures through the CBD¹⁹.

The majority of the costs for this scenario are associated with building the light rail extension through the CBD, purchasing new light rail vehicles, providing light rail and bus priority measures, and constructing platform stops. An allowance has also been made for the half life refurbishment of the light rail vehicles.

To fund this scenario Greater Wellington will need to contribute a total of \$70–80m in today's equivalent dollars with \$35–40m of this to be funded in the next 10 years as part of the current LTCCP. Land Transport NZ will fund the balance in accordance with their existing funding policies.

¹⁹ The Ngauranga to Airport Study will investigate the potential for light rail extension through the CBD on a region wide basis.

4.4.5 Implementation and construction

It is proposed for new light rail services to commence operation by 2012/13.

4.4.5.1 Timeframe for implementation

A possible timeframe for the implementation of the *Light Rail Scenario* is outlined in Table 6 below.

■ **Table 6: Tasks and timeframes for implementation of *Light Rail Scenario***

Task	Timing
Johnsonville Station Refurbishment	07/08
Infrastructure improvements to Johnsonville railway line	07/08
Purchase of new buses (4 units) and service improvements to provide for general improvements to bus services	08/09
Light rail track construction to Courtenay Place	11/12-12/13
New Light rail vehicles (22 units)	12/13
Raroa, Khandallah, Simla Crescent, Awarua Street & Crofton Downs stations refurbishment	15/16
Box Hill & Ngaio stations refurbishment	16/17
Replacement buses (4 units)	23/24
Half life refurbishment of light rail vehicles (22 units)	26/27

The timetable given in this table is relatively optimistic and may need to be extended to allow for obtaining resource consents and funding.

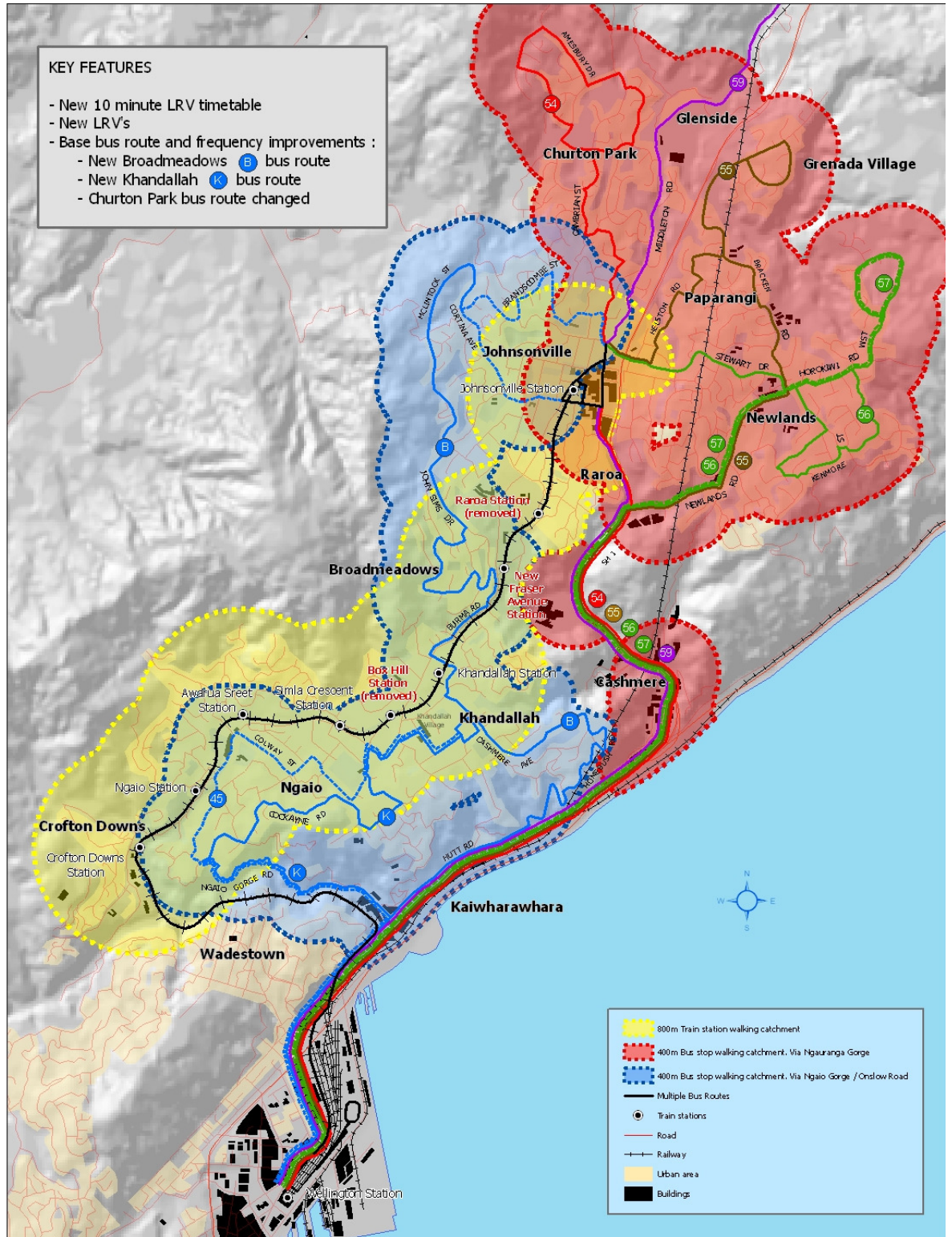
4.4.5.2 Construction period

Construction of the CBD section of the line could take a significant period of time with significant service relocation required prior to installation of the track.

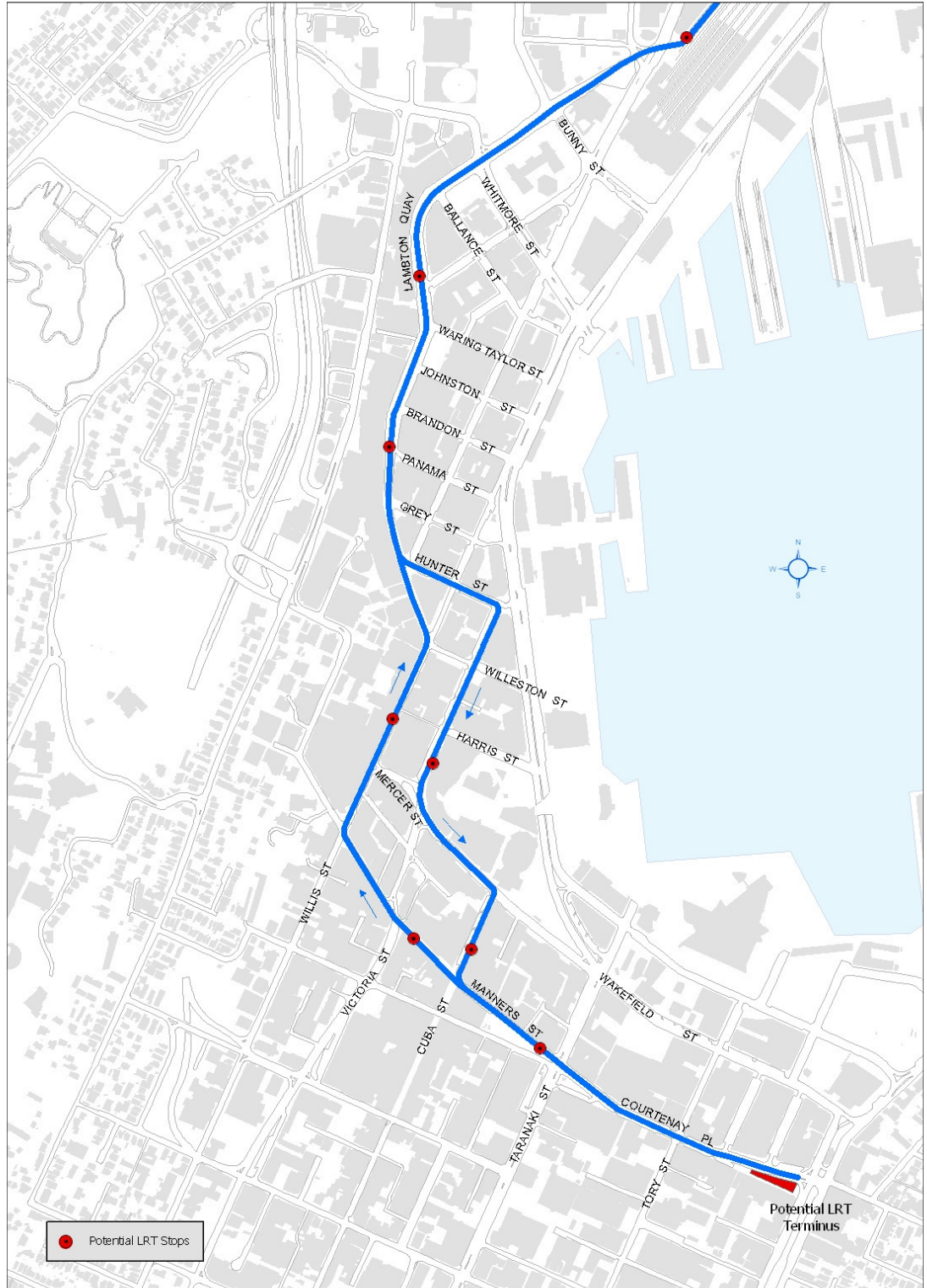
4.4.6 Other *Light Rail Scenario* options considered

In developing this *Light Rail Scenario* some other options were considered, including the possibility that low floor vehicles be operated on the Johnsonville railway line where high floor vehicles and elevated platforms are currently used. Further technical information on this scenario and other options considered is available in the Scenarios Technical Appendices document.

■ **Figure 7: Light rail and bus routes for *Light Rail Scenario* operations**



■ **Figure 8: Potential light rail route through the CBD**



4.5 Other scenarios investigated but considered not appropriate

Four other scenarios were looked at during this phase of the study but ruled out from further investigation:

- Refurbishment of the existing English Electric Units
- Underground rail extensions into the CBD
- Personal Rapid Transit
- Monorail

Initial investigation has shown that these options are either not appropriate for the northern suburbs or fall outside the affordability envelope. The reasons are set out below.

4.5.1 Refurbishment of the existing English Electric trains

This scenario is to refurbish the existing English Electric Multiple Units (EEMUs) to allow them to continue to operate on the line.

The refurbishment work currently being undertaken would only extend the lives of the units for three to five years. A much more extensive refurbishment programme would be required to extend the lives of the units for some 10 years and would cost in the order of \$1m to \$2m per unit. At the end of the ten years, it is likely that due to their age and poor crash performance, the units would no longer be suitable for operation on the network and would need to be retired.

The EEMUs are already 50-years old and have low passenger appeal. The units utilise obsolete technology giving an inferior ride quality, poor crashworthiness compared to modern rolling stock, low passenger comfort and poor accessibility for the less able. Given these issues and the high cost of refurbishment for a limited life, refurbishment of the EEMUs for continued operation on the Johnsonville railway line is not considered a viable option. However, Tranz Metro have advised that they consider refurbishment a viable option.

Refer to the Scenarios Technical Appendices document for further information about EEMU refurbishment options considered.

4.5.2 Underground rail extension through CBD

This scenario is the same as in the 10 minute frequency *Enhanced Rail Scenario*, however includes the construction of a twin track underground railway line from Wellington Station to the Taranaki Street / Courtenay Place intersection.

New units and infrastructure improvements to give a 10 minute frequency on the Johnsonville railway line form only a small proportion of the cost of the underground rail construction. It has

therefore been assumed that a 10 minute frequency service would be provided on the Johnsonville railway line by new EMU units compatible with the rest of the Wellington network.

The investigations to date into this scenario suggest it would cost about \$300m in today's equivalent dollars (excluding operational costs and other improvements that would be required in any case). Given the level of funding available, this scenario is highly unlikely to be affordable. Even if only a proportion of the cost of the rail extension (based on patronage) was assumed to be borne by the northern suburbs, it would still be unaffordable.

The Ngauranga to Airport Study which is currently under way will investigate the potential for rail extension into the CBD on a region wide basis. If rail extension was found to have merit, then the potential for the Johnsonville railway line would need to be reconsidered.

Refer to the Scenarios Technical Appendices document for further information about rail extension scenarios considered.

4.5.3 Personal Rapid Transit

Personal Rapid Transit is automated small-group point-to-point transportation along separated guideways. Current systems have the vehicles running on two tracks on top of the guideway, though new concepts are being developed. The services can be timetabled or operated on demand. The operating speed and carrying capacity of this technology are low. This technology is in the early stages of its development and currently there are no larger scale systems in operation.

These types of systems have been considered in relation to the northern suburbs passenger transport needs. For their benefits to be realised, a comprehensive coverage of the CBD would be required, which is outside of the scope of this study. As there are also no large scale systems in operation, it is considered that the technology is not sufficiently proven to be considered in detail as part of this study.

4.5.4 Monorail

Monorail consists of vehicles supported by a single elevated beam from which the vehicles can be suspended below or straddle. The elevated nature of Monorail means that it has high visual impact and can be intrusive on the surrounding environment. The carrying capacity of each vehicle is limited but several vehicles can be linked to form a train. The maximum speed of Monorail is generally low compared with other Rapid Transit systems, though the overall travel times can be comparable due to the fact that Monorail doesn't compete for space with other transport modes. Station spacing can be similar to that for LRT systems; 400-800m within main centres and 800-1500m in other areas. The Monorail systems currently in place are generally short in length; the most extensive are up to 10km in length in Japan. The systems also tend to be operated in loops due to complexities of switching from one track to another.

A Monorail system has been considered in relation to the passenger transport needs of the northern suburbs. It is considered that a Monorail provides no more benefit than a traditional light rail but costs more. In addition, a comprehensive coverage of the CBD would be required to realise Monorail's claimed benefits and objections are likely to the way it looks. Therefore, Monorail will not be considered further as part of this study.

