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NSW GOVERNMENT

# M1 Pacific Motorway extension to Raymond Terrace

## Environmental impact statement – Chapter 7: Traffic and transport

Transport for NSW | July 2021

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# 7. Traffic and transport

This chapter describes the potential traffic and transport impacts that may be generated by the construction and operation of the project and presents the approach to the management of these impacts.

The desired performance outcomes for the project relating to traffic and transport, as outlined in the SEARs, are:

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

**Table 7-1** outlines the SEARs that relate to traffic and transport and identifies where they are addressed in this EIS. The full assessment of traffic and transport impacts is provided in the Traffic and Transport Working Paper (**Appendix G**).

Table 7-1 SEARs (traffic and transport)

| Secretary's requirement | Where addressed |
|---|---|
| 1. Transport and traffic | |
| 1. The Proponent must assess construction transport and traffic (vehicle, pedestrian and cyclists) impacts, including, but not necessarily limited to: | |
| (a) the identification of transport routes and scheduling of movements, particularly outside standard construction hours; | **Section 7.4.1** provides consideration of construction traffic movements, including activities outside of standard construction hours.<br>**Section 5.4.13** presents proposed working hours (including out-of-hours work). Information on the location of construction ancillary facilities and haulage routes is provided in **Section 5.4.3** and **Section 5.4.12** respectively. |
| (b) the indicative number, frequency and size of construction related vehicles (passenger, commercial and heavy vehicles, including spoil management movements); | **Section 7.4.1** provides information of the number, frequency and size of construction related vehicles. |
| (c) indicative construction worker parking | **Section 7.4.1** describes construction worker parking. |
| (d) the nature of existing traffic (types and number of movements) on construction access routes (including consideration of peak traffic times, land uses, in particular sensitive receivers, and parking arrangements); | **Section 7.3** presents the existing traffic and land uses surrounding the project.<br>**Section 7.4** discusses the impacts of construction traffic on impacted land uses, existing parking arrangements and sensitive receivers, including residences, pedestrians and cyclists. |
| (e) access constraints and impacts on public transport, pedestrians and cyclists; | **Section 7.4.3** assesses impacts on public transport, pedestrians and cyclists. |
| (f) impacts to the operation of rail lines in the Lower Hunter, including the Main Northern Rail Line and rail infrastructure in Hexham; | **Section 7.4.3** assesses impacts on rail infrastructure. |
| (g) the need to close, divert or otherwise reconfigure elements of the road and cycle network associated with construction of the project; and | **Section 7.4** provides details of the need to close, divert or reconfigure the road network, including the cycle network. |

| Secretary's requirement | Where addressed |
|---|---|
| (h) the cumulative traffic impacts of other major development projects preparing for or commencing construction in the vicinity of the proposal. | **Section 7.3.9** outlines future growth and future land use relevant to the Emerging Black Hill Precinct.<br>**Section 7.6** and **Chapter 23** (cumulative impacts) discuss the cumulative traffic impact of constructing this project with other projects. |
| 2. The Proponent must assess (and model) the operational transport impacts of the project including, but not necessarily limited to: | |
| (a) forecast travel demand and traffic volumes for the project and the surrounding road, cycle and public transport network; | **Section 7.3.3** analyses traffic growth trends in the study area.<br>**Section 7.2.3** describes how future traffic demand was determined. |
| (b) travel time analysis; | **Section 7.3.3** and the Traffic and Transport Working Paper (**Appendix G**) present a travel time analysis of the existing road network.<br>**Section 7.5.2** discusses the travel time impacts that occur as a result of the project. |
| (c) performance of key interchanges and intersections by undertaking a level of service analysis at key locations; | **Section 7.3.3** presents the existing Level of Service of key intersections in the network.<br>**Section 7.5.4** and **Section 7.5.5** present the performance outcomes of key intersections and interchanges during operation. |
| (d) wider transport interactions and modifications (local and regional roads, cycling, public and freight transport); | **Section 7.5** details the project's impact on local roads within the study area. No regional roads are located within the study area.<br>**Section 7.5.9** summarises the project's impact on public transport infrastructure including rail and bus services.<br>**Section 7.5.6** discusses impacts on freight.<br>**Section 7.5.7** discusses the impact on regional connectivity.<br>**Section 7.5.9** discusses the impact on the cycle network. |
| (e) access to identified and future development areas, such as the Beresfield and Tomago industrial areas; | **Section 7.5** discusses access to future development areas that have been identified within the study area. |
| (f) transport connectivity to and from existing communities and centres (such as Newcastle, Raymond Terrace, the Lower Hunter and Port of Newcastle), | **Section 7.5.7** summarises the impact to transport connectivity for communities within and surrounding the study area. |
| (g) impacts on Newcastle Airport and Williamtown RAAF Base, maritime traffic on the Hunter River, Port of Newcastle and rail infrastructure; | **Section 7.5.9** discusses impacts to the Newcastle Airport, Williamtown RAAF Base, the Hunter River, the Port of Newcastle and rail infrastructure. |
| (h) impacts on cyclists and pedestrian access and safety; and | **Section 7.5.9** discusses the impacts on cyclists and the impacts on pedestrians.<br>**Section 7.5.8** discusses the improvements to safety as a result of the project. |
| (i) opportunities to integrate cycling and pedestrian elements with surrounding networks (existing and proposed) and within the project. | **Section 7.5.9** and **Chapter 5** discuss the integration of the project's cycling infrastructure with existing and proposed cycling infrastructure and discusses the proposed improvements to the pedestrian network in association with the existing pedestrian network. |

## 7.1 Policy and planning setting

The project will provide benefits for road users at the local, regional and state level and will contribute towards achieving some of the goals identified in the following strategic plans:

- Infrastructure Priority List 2020 (Infrastructure Australia 2021)
- Future Transport Strategy 2056 (Transport for NSW 2018a)
- Regional NSW Services and Infrastructure Plan (NSW Government 2018)
- NSW Freight and Ports Plan (Transport for NSW 2018b)
- Moving More with Less 2018 (Transport for NSW 2018c)
- Greater Newcastle Metropolitan Plan 2036 (DPE 2018)
- Greater Newcastle Future Transport Plan (Transport for NSW 2018e)
- Hunter Regional Plan 2036 (DPE 2016).

Further detail on the above strategic plans, and how they apply to the project, is provided in **Chapter 3**.

The traffic and transport assessment was prepared to assess the potential impacts of the project in accordance with the following guidelines:

- Guide to Traffic Management Part 3: Traffic Studies and Analysis (Austroads 2017a)
- Guide to Traffic Generating Developments (RTA 2002)
- Motorway design guide: Capacity and flow analysis (Roads and Maritime Services 2017b)
- Highway Capacity Manual 2016 (Transportation Research Board 2016)
- Traffic Modelling Guidelines (Roads and Maritime Services 2013a)
- Cycling aspects of Austroads guides (Austroads 2017b)
- NSW Bicycle Guidelines v 1.2 (RTA 2005b)
- Planning Guidelines for Walking and Cycling (DIPNR 2004).

## 7.2 Assessment methodology

### 7.2.1 Overview

Assessment of the transport and traffic impacts involved the following key steps to identify project impacts during construction and operation:

- Review of the existing environment including existing traffic survey data, existing and future land use, crash data and public transport information
- Development, validation and calibration of a traffic model including:
  - Consideration of forecasts for population and employment growth and inter-regional traffic growth for 2028 (year of opening), 2038 (10 years after opening) and 2048 (20 years after opening)
  - A ‘without’ project assessment for the years 2028, 2038 and 2048 to provide a ‘without project’ baseline
  - Development of a future traffic model for 2028, 2038 and 2048 that includes the project
  - Development of sensitivity scenarios to quantify impacts from the Emerging Black Hill Precinct.
- Identification of construction impacts, including construction traffic and impacts on pedestrians, cyclists, maritime traffic and local access
- Assessment of operational traffic benefits and impacts on transport services, both quantitatively from the traffic modelling outputs and qualitatively

- Assessment of cumulative impacts as a result of project construction and operation, both quantitatively through the use of the traffic model and qualitatively based on the most recent and public available information.

A detailed description of the assessment methodology is presented in the Traffic and Transport Working Paper (**Appendix G**).

### 7.2.2 Study area

The project is located within the City of Newcastle and Port Stephens Council local government areas (LGAs) in the Hunter Region, north of Newcastle NSW. The study area for the transport and traffic assessment of the project covers the area displayed in **Figure 7-1** and includes:

- Major roads of state importance, including the M1 Pacific Motorway, the Pacific Highway, the New England Highway, John Renshaw Drive, the Hunter Expressway (via John Renshaw Drive), Tomago Road and Weakleys Drive
- The residential areas of Black Hill, Beresfield, Tarro, Heatherbrae and Raymond Terrace
- The semi-rural and urban areas of Black Hill, Tarro and Heatherbrae
- The light industrial, heavy industrial and commercial areas of Beresfield, Hexham, Tomago and Heatherbrae.

While the study area includes relevant roads and areas that would be impacted by the project, the traffic model used in this assessment was developed across a broader area than the study area to also capture potential improvements to the Pacific Highway at Hexham, which is located outside the study area.

### 7.2.3 Traffic model development

Traffic modelling was carried out in accordance with the Traffic Modelling Guidelines (Roads and Maritime Services 2013a) and as described in the Traffic and Transport Working Paper (**Appendix G**). A VISSIM microsimulation traffic model was used to simulate the movement of individual vehicles based on car-following, lane changing and gap acceptance algorithms. These vehicle-to-vehicle interactions provided the basis for calculating delays. The scenarios modelled are described in **Table 7-2**.

Table 7-2 Modelled scenarios

| Scenario Name | Year | With the project | Without project | Description |
|---|---|---|---|---|
| Base | 2017 | N | N | This scenario reflects the transport network as it was in 2017 with no new projects or upgrades. The year 2017 was adopted as the existing year, as traffic counts were carried out at this time[1]. |
| Without project | 2028 | N | Y | These scenarios include the listed network changes without the project and provide a model for comparative purposes. Network changes assumed for these scenarios are described in Traffic and Transport Working Paper (**Appendix G**). |
| Without project | 2038 | N | Y | |
| Without project | 2048 | N | Y | |
| With project | 2028 | Y | Y | These scenarios include the listed network changes with the project and have been compared against the future year 'without project' models to determine the impact of the project. |
| With project | 2038 | Y | Y | |
| With project | 2048 | Y | Y | |

(1) Planned traffic counts were not carried out in 2020 as the COVID-19 pandemic resulted in substantial changes to traffic volumes and were not considered to be representative of an average year.

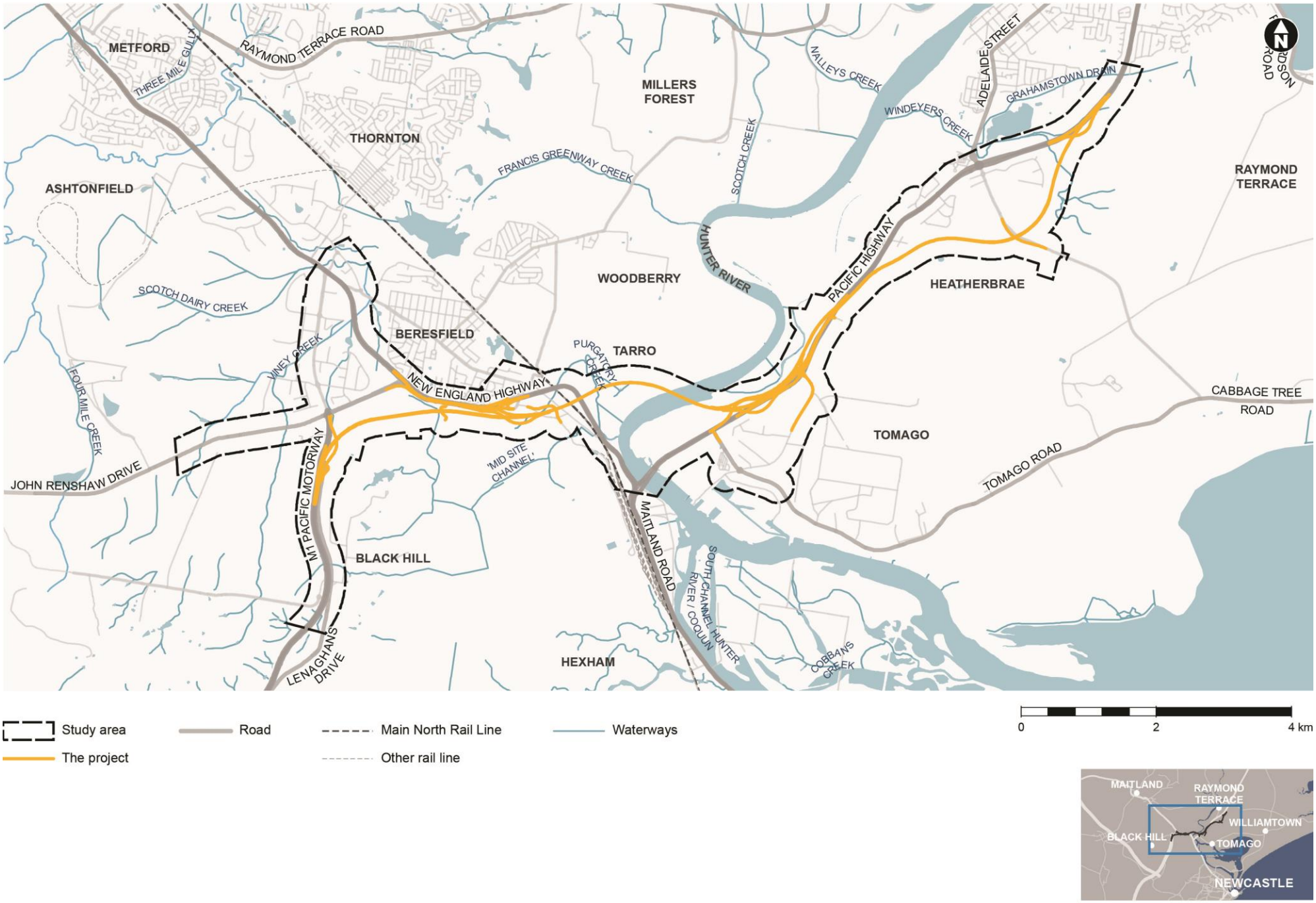


Figure 7-1 Traffic and transport study area

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The Sydney Traffic Forecasting Model (STFM) was used originally to develop the future growth across the network. The STFM modelling results were analysed and found to overestimate the future growth compared to historical growth rates. As such a 1.5 per cent per annum growth rate was adopted which aligns with historic growth in the region and represents a reasonable growth rate for future horizons. The Emerging Black Hill Precinct (refer to Section 4.10 of the Traffic and Transport Working Paper (**Appendix G**)) was not included in the future growth of the STFM. Therefore, a specific assessment and inclusion of future growth for this proposed development precinct, which is anticipated to be a major traffic generating development precinct, was included in addition to the yearly growth rate.

### 7.2.4 Sensitivity modelling

To quantify the impact of the Emerging Black Hill Precinct, sensitivity testing was carried out for peak periods in 2038. Two modelling scenarios were tested as follows:

- Scenario 1: Incorporating on and off ramps at the Black Hill Road interchange with the M1 Pacific Motorway to allow for direct connection to the Emerging Black Hill Precinct from the south
- Scenario 2: No traffic generated from the Emerging Black Hill Precinct.

### 7.2.5 Assessment criteria

The performance of operational traffic was modelled to provide an overview of the road network at a network level and at a single point level to compare the performance of each modelled scenario.

Network-wide statistics used for the assessment included:

- At a network level:
  - Road network performance can be assessed with network-wide statistics. These statistics are extracted from the traffic model for the morning and evening peak periods and include average speed, vehicle throughput and total time travelled within the modelled network.
- At a single point:
  - The performance of an intersection and its LoS is determined by the average delay per vehicle
  - At an interchange level, which is calculated from the density of traffic and the capacity of the entry ramp.

At individual locations, level of service (LoS) is used to determine the performance of intersections and interchanges, and ranges from A to F (refer to **Table 7-3**). Intersection LoS is determined by the average delay per vehicle. Interchange LoS is determined by vehicle interactions (including merges, diverges and weaving) that occur within 450 metres of the interchange. LoS A generally described free flowing traffic that is unaffected by other road users in comparison to LoS F, which described a road environment where, in the context of traffic signals and roundabouts, traffic approaching an intersection is unable to pass, resulting in queuing.

LoS D is the target performance level generally accepted. If the performance of an intersection, interchange or midblock segment falls below LoS D, investigations should be initiated to determine if suitable remediation can be provided. However, limited road capacity and high demand mean that LoS E and LoS F are regularly experienced by motorists, particularly during peak periods.

Table 7-3 LoS criteria

| LOS | Average vehicles delay (s) | Traffic signals and roundabouts |
|---|---|---|
| A | d ≤ 10 | Free flowing traffic virtually unaffected by other road users |
| B | 10 < d ≤ 20 | Steady flow of traffic allowing manoeuvrability |
| C | 20 < d ≤ 35 | Stable flow of traffic restricting manoeuvrability |
| D | 35 < d ≤ 50 | Limited stable flow and all drivers restricted in movement |
| E | 50 < d ≤ 70 | Operating at capacity with unstable traffic flow |
| F | 70 < d | Traffic approaching the intersection exceeds ability for traffic to pass resulting in queueing |

## 7.3 Existing environment

### 7.3.1 Road network

Transport uses a hierarchal system that designates the road network into state, regional and local roads based on the predominant function of a road. State roads comprise of major arterial roads and motorways, regional roads perform a sub-arterial function and local roads are the remaining council controlled roads.

The study area also includes roads that form part of the National Land Transport Network (NLTN). The NLTN is a network of nationally important road and rail infrastructure links and their intermodal connections.

The functional hierarchy of the existing road network within and surrounding the study area is presented in **Figure 7-2**.

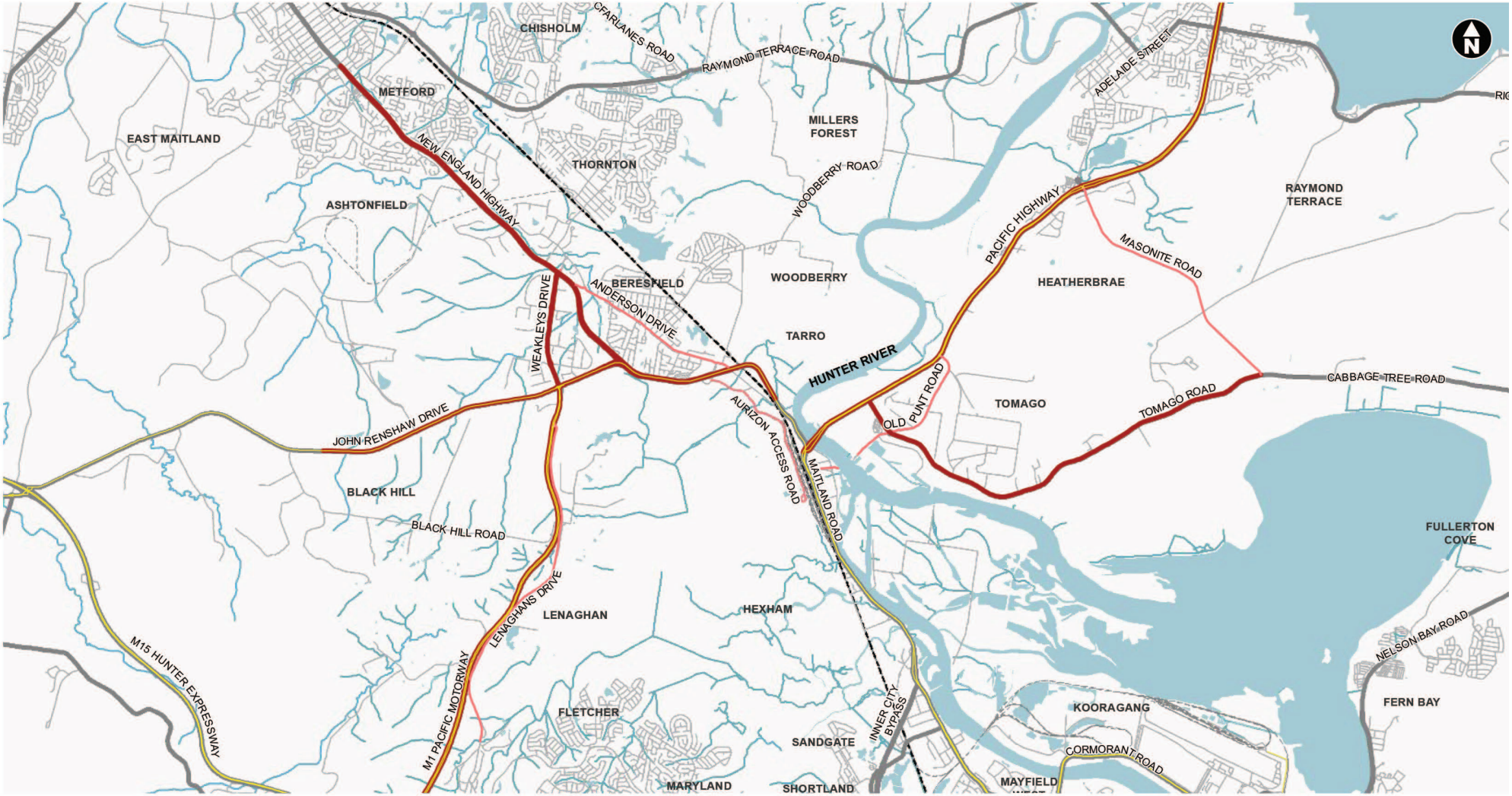


Figure 7-2 Existing road network

**Table 7-4** describes the existing traffic conditions for state roads in the study area from traffic surveys carried out in 2017. No regional roads were identified within the study area.

Local roads within the study area include Old Punt Road, Masonite Road, Anderson Drive and the Aurizon access road. Further information on these roads is presented in the Traffic and Transport Working Paper (**Appendix G**).

Table 7-4 Existing traffic conditions for state roads in the study area

| Road | Configuration | Average speed limit (km/h) | Existing average vehicles | Description |
|---|---|---|---|---|
| M1 Pacific Motorway | Dual carriageway with two lanes in each direction | 110 | About 40,600 per weekday (20 per cent heavy vehicles) | Key north-south corridor linking Sydney to the Central Coast, Newcastle and Hunter region that forms NLTN, a defined national network of important road and rail infrastructure links and their intermodal connections. |
| Pacific Highway | Dual carriageway with two lanes in each direction | 80 | About 51,800 vehicles per weekday north of Hexham Bridge (18 per cent heavy vehicles) | The intersection of Pacific Highway and Tomago Road provides key connections to employment areas in Tomago, Newcastle Airport and the Williamtown Royal Australian Air Force (RAAF) Base. |
| New England Highway | Dual carriageway road with two lanes in each direction | 90 (west of Tarro)<br>80 (East of Tarro) | About 42,200 vehicles per weekday through Thornton (23 per cent heavy vehicles)<br>About 61,000 vehicles per weekday north of the Pacific Highway (22 per cent heavy vehicles) | Key east-west link between Newcastle and the Lower Hunter, forming part of the NLTN and providing access to the Port of Newcastle. |
| John Renshaw Drive | Single carriageway with one lane in each direction (west of the M1 Pacific Motorway)<br>Single carriageway with two lanes in each direction (east of the M1 Pacific Motorway) | 100 (west of the M1 Pacific Motorway)<br>80 (east of the M1 Pacific Motorway) | About 32,000 vehicles per weekday west of Weakleys Drive (13 per cent heavy vehicles) | Key east-west corridor linking the M15 Hunter Expressway and the towns of Kurri Kurri and Cessnock with the M1 Pacific Motorway and New England Highway, forming part of the NLTN. |
| Tomago Road | One lane of travel in each direction along the majority of its length, with flaring at intersections to provide increased capacity | 60 | About 14,200 vehicles per weekday east of Pacific Highway (9 per cent heavy vehicles) | Connects Nelson Bay Road to the east and the Pacific Highway to the west. The intersection with the Pacific Highway is a T-intersection controlled by traffic signals, with right turns from Tomago Road onto the Pacific Highway prohibited. |
| Weakleys Drive | Single carriageway with one to two lanes in each direction | 60 | About 20,900 vehicles per weekday north of John Renshaw Drive (19 per cent heavy vehicles) | North-south connection between the M1 Pacific Motorway and New England Highway and serves the adjoining light industrial land uses. |

### 7.3.2 Land use

The study area includes a mix of land uses, including rural and agricultural uses, environmental and water resources, manufacturing and industrial uses, services and utilities, and residential uses of varying densities. Key commercial centres within the study area include Black Hill, Tarro, Beresfield, Tomago, Heatherbrae and Raymond Terrace. Key manufacturing and industrial centres close to the project include Beresfield, Hexham, Tomago, and Heatherbrae. Heatherbrae is located south of Raymond Terrace and has been identified as an 'enterprise corridor' and destination for bulky goods retail.

The Port of Newcastle is a major seaport located in the City of Newcastle and is a major driver of commercial activity in the region. The Port of Newcastle is over 15 kilometres south-east of the project.

One designated rest area is located at the Beresfield Service Centre on John Renshaw Drive. This rest area provides for both light and heavy vehicles.

Most formal parking areas are associated with businesses and industrial developments, with limited formal parking or demand on the state roads in the study area. Informal public parking in the study area is generally limited to verges and local roads.

Newcastle Airport is located in Williamtown around 17 kilometres by road east of the Pacific Highway/ Tomago Road intersection and around 13 kilometres by road east of the Pacific Highway/Masonite Road intersection. The airport is owned by City of Newcastle Council and Port Stephens Council on land leased from the Australian Department of Defence. The airport runway is shared with Williamtown RAAF Base, which is located north of the runway and west of Medowie Road. Tomago Road provides the most direct route to and from the airport and is currently most commonly used as an access route to the airport.

Further detail on existing land use is presented in **Chapter 14** (land use and property).

### 7.3.3 Existing road performance

#### *Traffic volumes and growth*

Traffic surveys were carried out between 10 October 2017 and 23 October 2017 at various locations in the study area to gain an understanding of daily traffic volumes and traffic composition. The average daily traffic volumes observed on key routes throughout the study area are presented in **Figure 7-3**.

When considering daily and seasonal variation in traffic volumes, weekday traffic volumes are higher than weekend traffic volumes, and school holiday volumes are higher than weekend volumes but lower than weekday volumes. Further, seasonal fluctuations in traffic volumes have peaks which coincide with the Christmas/New Year period and Easter.

A review of the average annual daily traffic counts between 2006 and 2017 indicate that traffic in the study area has increased by about two to three per cent each year. Traffic growth has reduced since 2015, with the rate of increase reducing to about one per cent growth per year. Planned traffic counts were not carried out in 2020 as the COVID-19 pandemic resulted in substantial changes to traffic volumes and were not considered to be representative of an average year.

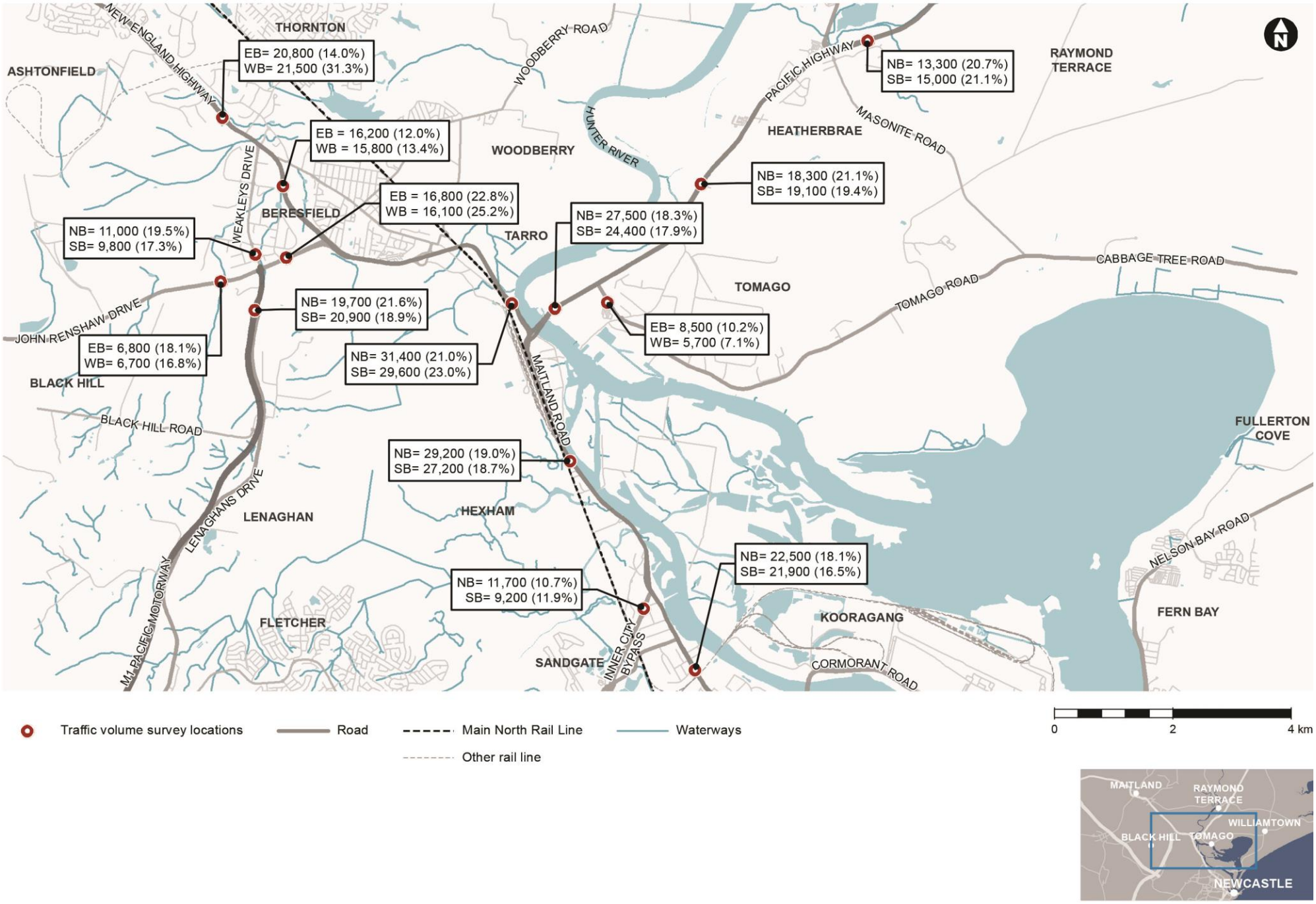


Figure 7-3 Daily traffic volumes of key routes in the study area

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### *Travel time*

Travel times between the five key locations shown on **Figure 7-4**. **Table 7-5** displays the recorded travel times for the morning and evening peak periods. Overall, average travel speeds range between 66 to 76 kilometres per hour for north-eastbound traffic and 56 to 66 kilometres per hour for south-westbound traffic.

Table 7-5 Existing travel time

| From | To | Distance (km) | Observed travel time (min:sec) | Travel speed (km/h) |
|---|---|---|---|---|
| Morning peak period (8–9am) | | | | |
| New England Highway | Maitland Road | 12.5 | 14:55 | 50 |
| | Pacific Highway | 16.3 | 13:26 | 73 |
| M1 Pacific Motorway | | 20.7 | 16:52 | 74 |
| John Renshaw Drive | | 18.0 | 15:13 | 71 |
| Pacific Highway | New England Highway | 16.6 | 16:26 | 61 |
| | M1 Pacific Motorway | 20.9 | 19:31 | 64 |
| | John Renshaw Drive | 18.2 | 17:24 | 63 |
| | Maitland Road | 13.2 | 14:06 | 56 |
| Maitland Road | Pacific Highway | 13.3 | 13:25 | 59 |
| | New England Highway | 12.6 | 12:24 | 61 |
| Evening peak period (5–6pm) | | | | |
| New England Highway | Maitland Road | 12.5 | 11:59 | 63 |
| | Pacific Highway | 16.3 | 13:26 | 73 |
| M1 Pacific Motorway | | 20.7 | 16:52 | 74 |
| John Renshaw Drive | | 18.0 | 15:13 | 71 |
| Pacific Highway | New England Highway | 16.6 | 16:26 | 61 |
| | M1 Pacific Motorway | 20.9 | 19:31 | 64 |
| | John Renshaw Drive | 18.2 | 17:24 | 63 |
| | Maitland Road | 13.2 | 13:46 | 57 |
| Maitland Road | Pacific Highway | 13.3 | 14:45 | 54 |
| | New England Highway | 12.6 | 13:11 | 57 |

On the Pacific Highway, travel times for north-eastbound traffic are shorter than travel times for south-westbound traffic. This can be attributed to the following additional delays experienced by south-westbound traffic at signalised intersections along the Pacific Highway:

- Uncontrolled left-turn movement onto the New England Highway/Pacific Highway intersection
- Movements to and from Tomago Road at the Pacific Highway/Tomago Road intersection
- Traffic signal phasing at the Pacific Highway/Old Punt Road intersection.

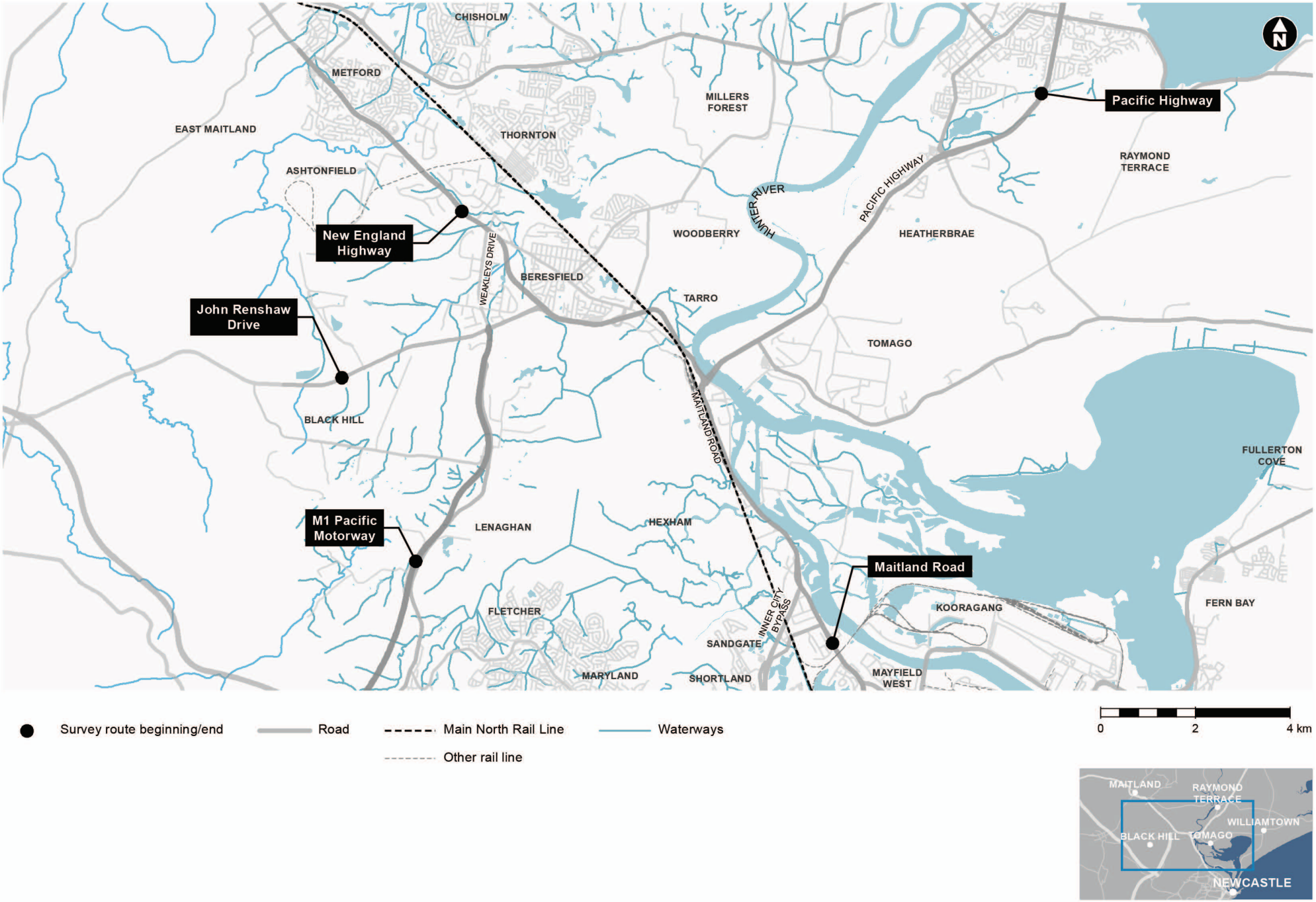


Figure 7-4 Travel time survey routes

### *Origin-destination surveys*

Origin-destination surveys within the study area were completed as part of the Outer Newcastle Study in 2017.

The following morning peak observations were made:

- For trips entering the study area at M1 Pacific Motorway, Black Hill, Weakleys Drive, Beresfield was the most common destination accounting for 41 per cent of recorded vehicles. The Pacific Highway, Heatherbrae was the next most common destination accounting for 12 per cent of trips. Tomago Road, Tomago was also a common destination and attracted nine per cent of trips
- The largest movement recorded during the morning peak was the southbound movement from the New England Highway into Newcastle, 47 per cent of trips entering the study area at the New England Highway travelled to the Pacific Highway in Sandgate. Trips from the New England Highway to Tomago or Heatherbrae were also common, with a total of 13 per cent of trips travelling in this direction
- The most frequent destination (15 per cent) for trips entering the study area from Pacific Highway, Heatherbrae was to M1 Pacific Motorway
- The largest heavy vehicle movement in the morning peak was the southbound movement from Weakleys Drive to the M1 Pacific Motorway. Other common heavy vehicle routes were from Pacific Highway in Sandgate to both the New England Highway and the M1 Pacific Motorway.

The following evening peak observations were made:

- For trips entering the study area at M1 Pacific Motorway, Black Hill, Weakleys Drive, Beresfield was the most common destination accounting for 46 per cent of recorded vehicles. The Pacific Highway, Heatherbrae was the next most common destination accounting for 17 per cent of trips. Tomago Road, Tomago was also a common destination and attracted seven per cent of trips
- The largest movement recorded during the evening peak was the northbound movement from Newcastle to the New England Highway
- The most frequent destination (33 per cent) for trips entering the study area from Pacific Highway, Heatherbrae was to M1 Pacific Motorway
- The largest heavy vehicle movement in the evening peak was both southbound and northbound, between Weakleys Drive and the M1 Pacific Motorway.

An earlier origin-destination survey carried out for Heatherbrae traffic in 2016 determined that in the northbound direction there was almost an even split between through trips and local trips. In the southbound direction, a greater proportion (69 per cent) of trips were local trips. From these results, it can be expected the provision of a bypass would substantially reduce traffic travelling through Heatherbrae as vehicles would have an alternative faster route.

### *Intersection performance*

The traffic modelling results from the calibrated and validated 2017 base model were extracted to gain an understanding of current performance for the intersections presented in **Figure 7-5**. Intersection delays and LoS for these intersections for the morning and afternoon peak periods is provided in **Table 7-6**, with intersection performance of LoS D or worse shaded in pink.

The M1 Pacific Motorway/Weakleys Drive/John Renshaw Drive intersection during the evening peak hour operates at a LoS E. At the time of the traffic data collection exercise and the construction of the base model, this intersection was a roundabout. It has since been upgraded to a signalised intersection. The performance of the M1 Pacific Motorway/Weakleys Drive/John Renshaw Drive intersection is likely to have improved as a result of the intersection upgrade to traffic signals.

Overall, the model results indicate the evening peak is more congested than the morning peak as vehicles experience longer delays at the assessed intersection. However, the existing intersection delay and LoS for the majority of intersections in the study area were operating at a satisfactory LoS (D or better) in 2017.

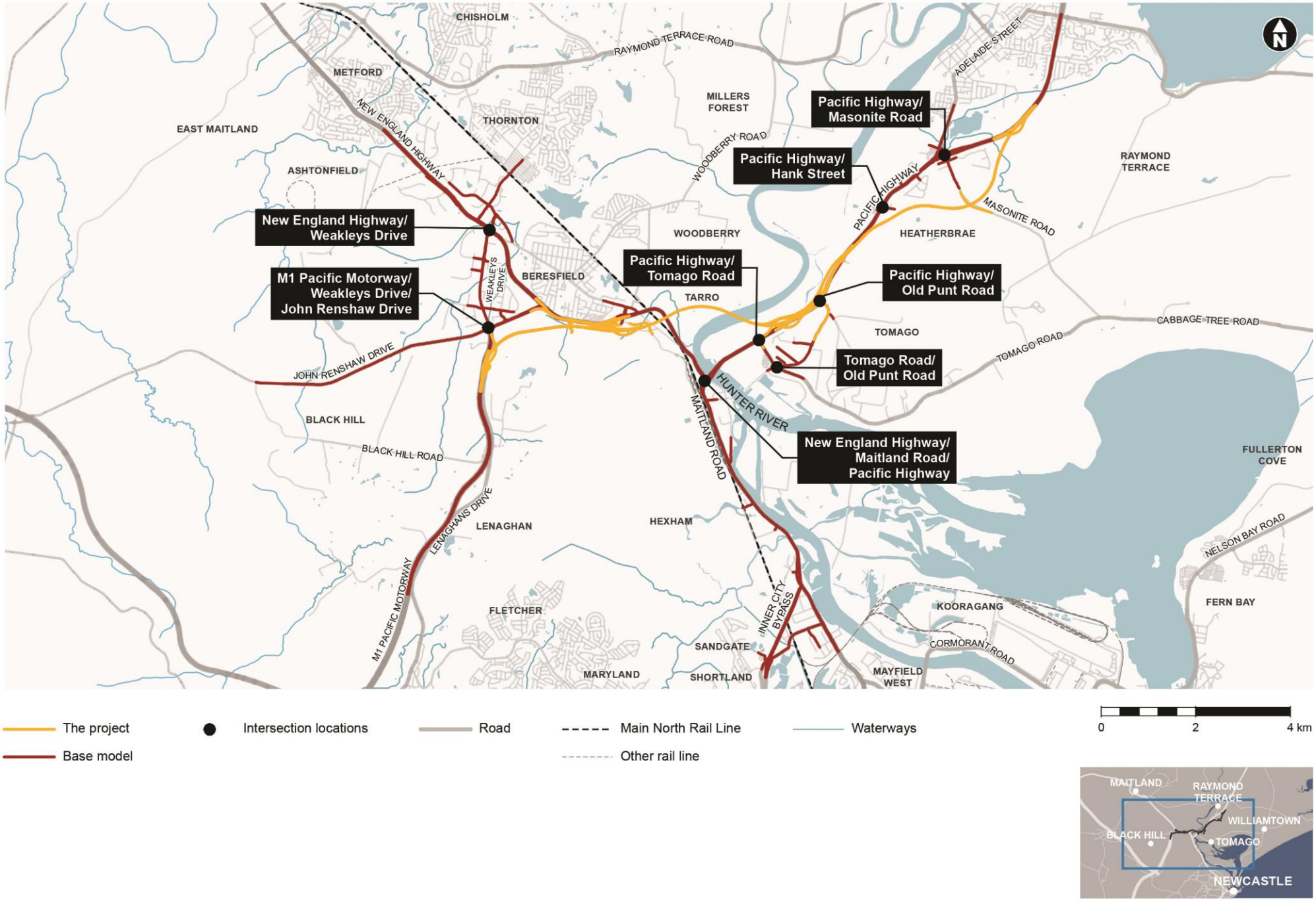


Figure 7-5 Locations of intersections assessed

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Table 7-6 Performance of modelled intersections in 2017

| Intersection | Type | Morning (8–9am) | | Evening (5–6pm) | |
|---|---|---|---|---|---|
| | | Avg delay (sec) | LoS | Avg delay (sec) | LoS |
| M1 Pacific Motorway/Weakleys Drive/John Renshaw Drive, Black Hill | Roundabout* | 27 | C | 63 | E |
| New England Highway/Weakleys Drive, Beresfield | Signalised | 11 | B | 18 | B |
| New England Highway/Maitland Road/Pacific Highway | Signalised | 19 | B | 19 | B |
| Pacific Highway/Tomago Road, Tomago | Signalised | 15 | B | 11 | B |
| Pacific Highway/Old Punt Road, Tomago | Signalised | 18 | B | 10 | B |
| Old Punt Road/Tomago Road, Tomago | Roundabout | 4 | A | 1 | A |
| Pacific Highway/Hank Street, Heatherbrae | Signalised | 11 | B | 10 | A |
| Pacific Highway/Masonite Road, Heatherbrae | Roundabout | 10 | B | 10 | A |

* At the time of the traffic data collection exercise and the construction of the base model, the M1 Pacific Motorway/Weakleys Drive/John Renshaw Drive intersection was a roundabout. This has since been upgraded to a signalised intersection, which has been used in the traffic modelling.

### 7.3.4 Road safety and crash history

Crashes on roads in the study area for the five-year period from October 2014 to September 2019 are shown in **Table 7-7**. In summary, a total of 289 crashes were recorded, of which six were fatal. The New England Highway and Pacific Highway recorded the highest number of crashes. Combined, these highways form the longest length of road in the study area and carry the highest traffic volumes. Further information of crash rates in the study area, expressed as crashes per 100 million vehicle kilometres travelled (VKT), are provided in the Traffic and Transport Working Paper (**Appendix G**).

Table 7-7 Total crashes on roads in the study area between October 2014 and September 2019

| Road | Section | No. of fatal crashes | No. of injury crashes | No. of non-casualty (tow-away) crashes | Total |
|---|---|---|---|---|---|
| John Renshaw Drive | 500m west of M1 Pacific Motorway to New England Highway | 1 | 3 | 4 | 8 |
| M1 Pacific Motorway | North of Black Hill to John Renshaw Drive | 1 | 24 | 23 | 48 |
| New England Highway | West of Thornton Rd to Old Maitland Road | 1 | 70 | 50 | 121 |
| Old Punt Road | Tomago Road to Pacific Highway | 0 | 2 | 1 | 3 |
| Pacific Highway | New England Highway to Richardson Road | 2 | 55 | 36 | 93 |
| Tomago Road | 500m west of Tomago Aluminium to Pacific Highway | 0 | 5 | 2 | 7 |

| Road | Section | No. of fatal crashes | No. of injury crashes | No. of non-casualty (tow-away) crashes | Total |
|---|---|---|---|---|---|
| Weakleys Drive | John Renshaw Drive to New England Highway | 1 | 4 | 4 | 9 |
| **Total** | | **6** | **163** | **120** | **289** |

## 7.3.5 Public transport

### *Bus network and coach services*

Ten local buses operate in the study area providing connections to Newcastle, Raymond Terrace, Newcastle Airport, Nelson Bay and Maitland. Most bus routes in the study area use the lower order road network, with the exception of:

- Route 140 that operates on Pacific Highway and Maitland Road
- Routes 145, 181 and 182 that operate on the A4 New England Highway west of Weakleys Drive.

Most routes operate at 30 to 60 minute frequencies on weekdays, 60 minute frequencies on Saturdays and 120 minute frequencies on Sundays. **Figure 7-6** shows the bus routes in the study area.

Long-distance coach services pass through the study area to provide inter-regional connections to Port Macquarie, Kempsey, Coffs Harbour, Grafton Ballina, Byron Bay, Gold Coast and Brisbane (operated by Greyhound and Premier Motor Service via the Pacific Highway) and to Tamworth, Armidale, Glen Innes, Tenterfield, Stanthorpe, Warwick and Brisbane (operated by Greyhound via the New England Highway). There are a total of four services in each direction per day.

### *Rail network*

The rail network in the study area consists of the Main North Rail Line, with four tracks that broadly run parallel to the New England Highway and Pacific Highway, and primarily serves freight traffic from the Hunter Valley mining industry. Railway stations close to the project are located at Thornton, Beresfield, Tarro, Hexham and Sandgate as shown in **Figure 7-7**. These stations are serviced by the Hunter Line, which is an intercity line operated by NSW TrainLink and connects Hamilton (Newcastle) with Maitland, Scone and Dungog.

The average morning peak hour service frequency at Thornton and Beresfield towards Hamilton (Newcastle) is 10 to 20 minutes, compared to 60 minutes at Tarro, Hexham and Sandgate. Similarly, in the evening peak hour, the average service frequency at Thornton and Beresfield towards Scone/Dungog is 10 to 20 minutes, compared to 30 to 60 minutes at Tarro, Hexham and Sandgate.

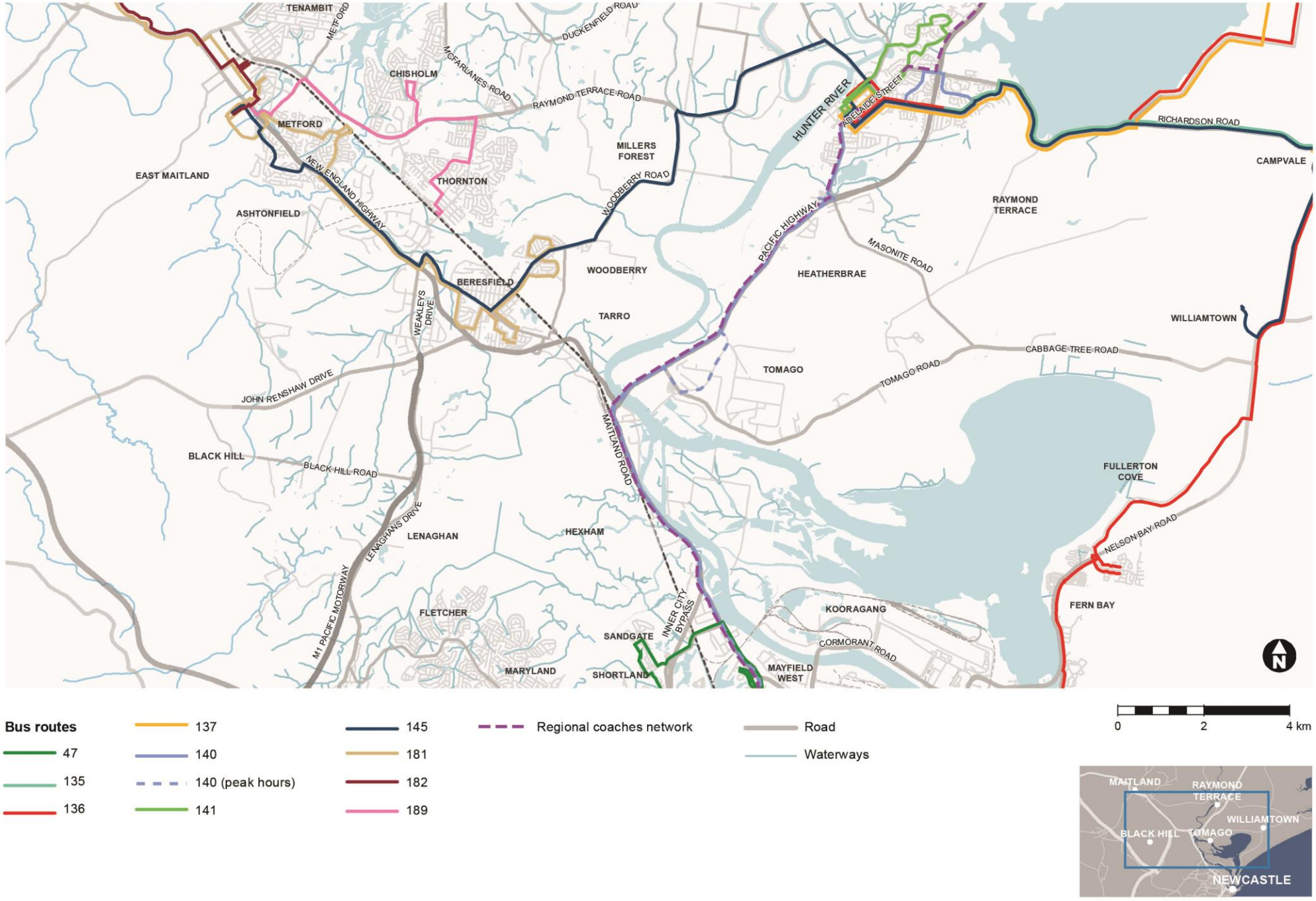



Figure 7-6 Operating bus services

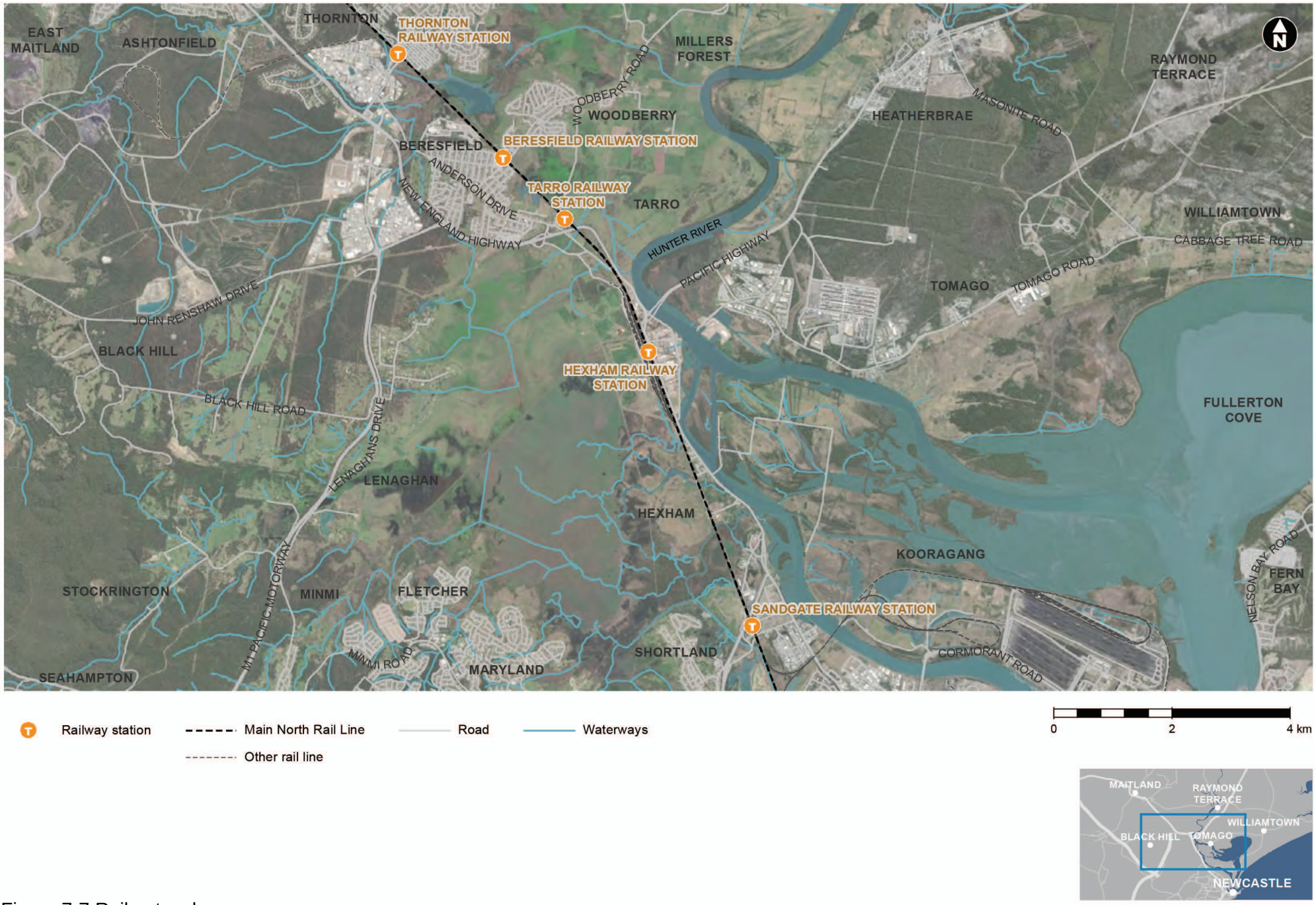



Figure 7-7 Rail network

## 7.3.6 Freight

### *Heavy vehicles and freight*

The M1 Pacific Motorway, New England Highway and Pacific Highway provide a substantial north-south freight route. Major freight activity precincts near the study area include the Beresfield industrial area and Tomago industrial area, as shown in **Figure 7-8**. Other freight activity precincts include Newcastle, Port of Newcastle, Newcastle Airport and Williamtown RAAF Base. **Figure 7-8** displays the approved B-Double routes within and surrounding the study area.

Heavy vehicles contribute up to 26 per cent of daily traffic volumes, and there are higher percentages south of the project from the M1 Pacific Motorway to the Pacific Highway at Hexham (**Figure 7-3**).

The southbound Hexham Bridge is restricted from access by oversize overmass (OSOM) vehicles larger than 6.5 metres wide and/or 5.2 metres high due to the nature of the bridge design. The southbound bridge also has a load limitation which does not allow for vehicles over 68 tonnes. As a result, the southbound bridge does not provide access for higher productivity vehicles (PBS Class 2B vehicles up to 30 metres long and 90.5 tonnes in mass), as well as some OSOM vehicles from the adjacent Tomago industrial area and areas further away. A permit to travel contraflow over the northbound bridge at Hexham may be required for OSOM vehicles.

The New England Highway between Hexham Bridge and Weakleys Drive has restrictions on vehicles exceeding 3.2 metres wide or 22.0 metres long, they are not permitted to travel between 7:00am and 9:00am and 4:00pm and 6:00pm Monday to Friday. The Pacific Highway between Hexham and Raymond Terrace also has numerous restrictions on OSOM vehicles. Vehicle combinations exceeding 3.2 metres wide or 22.0 metres long must contact the Transport Pacific Highway Coordinator at least 48 hours prior to travel to gain access to the road network.

### *Freight rail*

The Main North Rail Line supports the haulage of coal between 35 coal mines located in the Hunter Valley and the Port of Newcastle for export, known as the Hunter Valley Coal Chain. This infrastructure is owned by RailCorp and managed by the Australian Rail Track Corporation (ARTC). Collectively the Hunter Valley Coal Chain facilitates about 22,000 train movements per year, which equates to 60 train movements per day. In the study area, freight trains run on two dedicated tracks (one towards and one away from the Port of Newcastle). Coal trains are separated from passenger trains, while general cargo/container trains share tracks with passenger trains.

The Hexham Train Support Facility servicing Aurizon coal trains is located to the west of the Main North Rail Line, partially within the study area. The Hexham Train Support Facility is consistent with the ARTC strategy of continuous improvement associated within the Hunter Valley Corridor Capacity Strategy which would reduce reliance on the existing and future road network.

## 7.3.7 Walking and cycling

Limited pedestrian infrastructure exists within the operational footprint. Existing infrastructure includes footpaths on some local roads and signalised pedestrian crossings at the Pacific Highway and Tomago Road intersection.

There are no existing dedicated cycle paths within the within the operational footprint, therefore cyclists use the shoulders of the existing road network. Inter-regional movement is facilitated on road shoulders on the M1 Pacific Motorway, New England Highway/Maitland Road and Pacific Highway and are classified by the Cycleway Finder V3 (Transport for NSW 2020b) as high difficulty routes. Weakleys Drive, John Renshaw

Drive and Tomago Road are also designated as high difficulty on-road routes. Anderson Drive through Beresfield and Tarro is designated as a low difficulty on-road route.

Dedicated shared paths are provided at the following locations:

- North of the existing bridge over the Hunter River (eastern side), Tomago to the intersection of Maitland Road/Old Maitland Road, Hexham (about 840 metres continuous length)
- Anderson Drive west of Byron Street, Beresfield to Glenwood Drive east of Thornton Road, Thornton (about 1.4 kilometres continuous length)
- Pacific Highway north of Motto Lane, Heatherbrae to Swan Street south of Sturgeon Street, Raymond Terrace (about 2.5 kilometres continuous length).

A marked cycle lane is provided on New England Highway in the southbound direction between the exit-ramp to the existing bridge over the Hunter River and the intersection with the Pacific Highway. The recent upgrade to the M1 Pacific Motorway and Weakleys Drive intersection provides painted shoulders for cyclists and designates crossing locations.

Cyclists use the existing road shoulders and traffic lanes to travel through the area. These include connections along:

- The M1 Pacific Motorway
- The New England Highway
- Weakleys Drive
- Anderson Road
- John Renshaw Drive
- Shortland to Tarro shared path
- Hexham to Kurri Kurri.

The following dedicated off road cycleways are proposed by the City of Newcastle (2020):

- Richmond Vale Rail Trail
- Shortland to Tarro shared path: ultimately providing links to Minmi and the proposed Richmond Vale Rail Trail.

The current cycle network in the study area is predominantly on high difficulty on-road routes. The current cycle network in the study area is further described in the Traffic and Transport Working Paper (**Appendix G**).

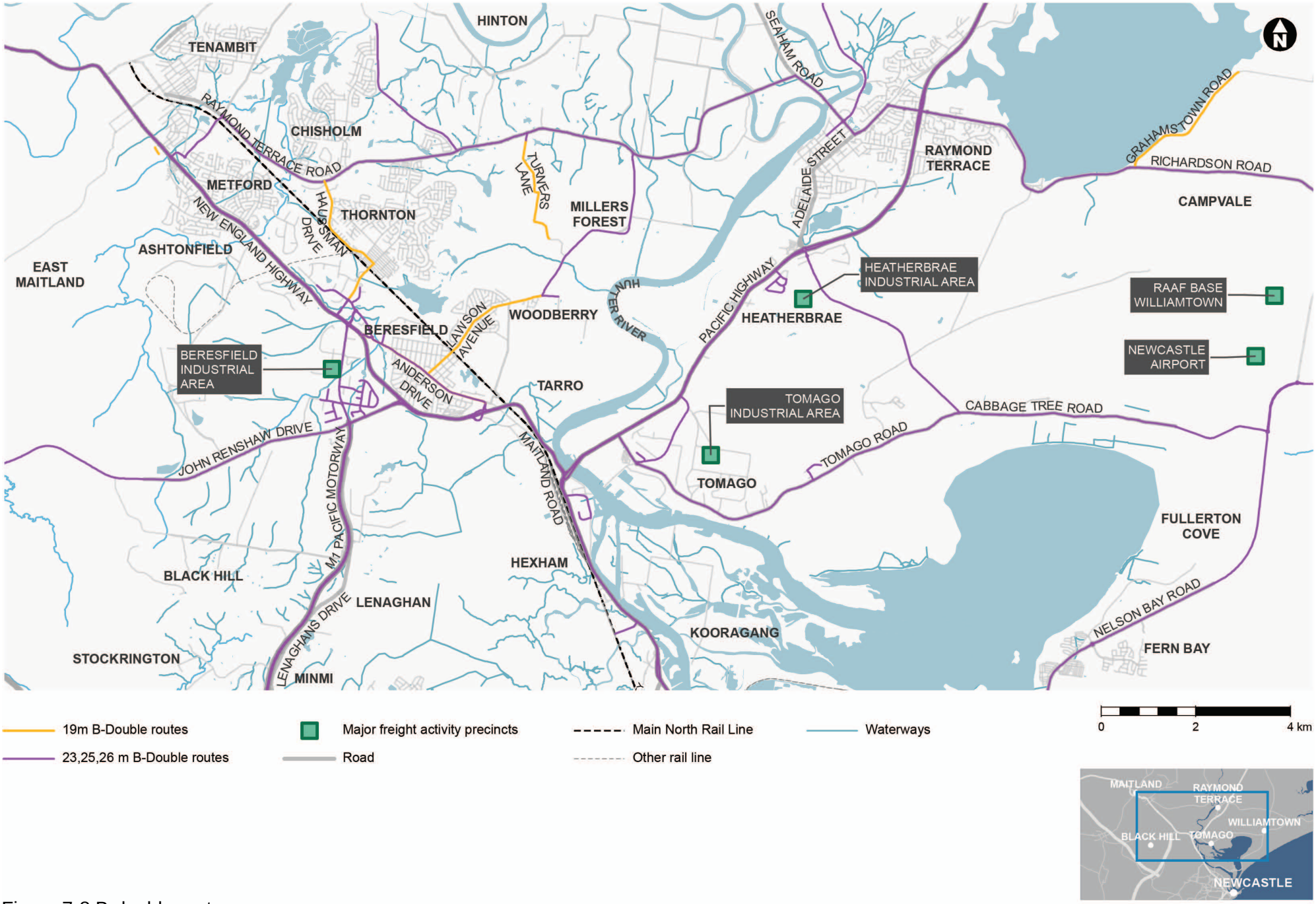



Figure 7-8 B-double routes

### 7.3.8 Maritime traffic

The Hunter River is a major river in NSW running between Newcastle and Liverpool Range in NSW. Within the study area is a navigable channel used by both commercial and recreational users.

The Hexham Bridge (northbound and southbound) passes over the Hunter River within the study area. The old Hexham Bridge carries southbound traffic and is a steel truss bridge with a central lifting span. While down it has a clearance height of 4.7 metres. The newer northbound bridge which carries northbound traffic has a fixed 10 metre clearance height. About eight trawlers regularly use the area, larger vessels can be booked for the bridge to be lifted providing greater clearance. The bridge is raised about 120 times per year and is also closed for bi-annual maintenance. When the bridge is raised, southbound traffic over the bridge is temporary stopped for approximately five minutes.

### 7.3.9 Traffic growth and future land use

Traffic volumes were extracted from Transport's traffic volume viewer for four traffic counting stations within the study area to complement the count data and the average annual daily traffic (AADT) for each year. The results indicate that historically traffic has experienced an increase of about two to three per cent each year. However, the data displays a reduction in traffic growth since 2015, with the rate of increase reducing to about one per cent AADT growth.

As described in **Section 3.1**, the study area is covered by the Hunter Regional Plan 2036 (DPE 2016) and Greater Newcastle Metropolitan Plan 2036 (DPE 2018), which outlines the future land use vision for the Hunter and Greater Newcastle areas.

Beresfield and Black Hill are proposed to be a freight and logistics hub, with complementary manufacturing and light industrial activity. Three precincts are identified within this location, including:

- Beresfield Precinct, which will support freight and logistics, manufacturing and other light industrial uses
- Emerging Black Hill Precinct, located west of the M1 Pacific Motorway, which is proposed to be the subject of a master plan that considers freight and logistic uses, the adjoining former mine site and road access to John Renshaw Drive
- Thornton Precinct, which is proposed to support expanded business and light industrial uses.

Tomago is proposed to be an advanced manufacturing and industrial area. Local planning for the Tomago Industrial Precinct would look to enable the efficient movement of goods by protecting freight routes connecting Tomago to Newcastle Airport and Port of Newcastle. The Tomago Shipbuilding Precinct located next to the Hunter River is identified as a location to promote the development of shipbuilding industries that maximise opportunities to secure defence contracts.

The Emerging Black Hill Precinct would be a major traffic generating development within the study area and is located south of John Renshaw Drive and west of M1 Pacific Motorway. The development is about 300 hectares of net development area, which is expected to generate substantial traffic volumes onto the adjacent road network. The Emerging Black Hill Precinct has been included in the traffic modelling for future horizon years (2028, 2038 and 2048). The development is a key generator of traffic in the region for future horizon and accounts for about 11 per cent of all trips in the study area by 2038 and 12 per cent by 2048.

## 7.4 Assessment of potential construction impacts

This section describes the construction traffic impacts that would result from the construction activities, indicative program and ancillary facilities described in **Chapter 5**.

### 7.4.1 Construction traffic

Construction of the project is expected to begin in 2023 and end in 2028, with work occurring across the full length of the construction footprint during this period.

#### *Construction workforce travel*

The size and composition of the construction workforce would vary over the duration of construction depending on the activities carried out and the construction program and staging. The workforce is expected to peak at about 1050 workers per year, including construction workers and professional and administrative staff. Multiple work crews may construct the project at any one time.

Construction staff would have parking available at the main compound with 200 spaces and satellite compounds with 40 spaces. Personnel would be advised of suitable parking arrangements as part of the compulsory project induction and would be encouraged to carpool.

It is expected that all construction workers would park within the construction footprint and therefore not impact on existing parking arrangements within the study area.

#### *Construction work hours*

The recommended standard hours for construction as noted in the Interim Construction Noise Guideline (DECC 2009a) are:

- 7am–6pm Monday to Friday
- 8am–1pm on Saturdays
- No work on Sundays.

There are some situations where construction may need to be carried out outside of the recommended standard construction hours. As the majority of work would be away from residences and sensitive receivers (particularly north of Tarro), Transport is seeking approval for standard construction hours plus:

- An extra hour at the start and end of each day Monday to Friday
- An extra five hours on a Saturday
- Work on Sunday and public holiday from 7am–5pm.

This is referred to as ‘extended construction hours’ and would apply across the project. Transport would carry out targeted consultation with affected residents before work starts.

Transport aims to achieve a balance between amenity and more efficient delivery of major infrastructure upgrades. As a result, Transport is investigating opportunities for ensuring delivery of the benefits of the project as soon as possible. Early completion of construction would provide considerable benefits to the community and road users. In particular, extended working hours would:

- Reduce the volume of traffic on roads during peak hours due to construction staff and construction vehicles travelling to and from the construction site outside of peak traffic periods
- Time benefits, including potentially bringing forward the opening date for the project by increasing the allowable construction hours

- Cause less disruption to sensitive receivers, the community, local business, motorists, pedestrians and cyclists as work would be completed earlier than compared to adopting standard work hours
- Enable greater flexibility in project scheduling. This would enable the contractor to make allowances for adverse weather and potential flooding events.

The proposed extended construction hours would only apply to normal construction activities. If required, blasting would only be carried out Monday to Friday between 9am–5pm and Saturday between 9am–1pm.

### *Out-of-hours work*

The Interim Construction Noise Guideline (DECC 2009a) also recognises there are some situations where specific construction work may need to be carried out outside the recommended standard hours.

In addition to standard working hours and extended construction hours, some construction activities would need to be carried out during evening and night time periods (referred to as 'out-of-hours work'). The activities that may need to be carried out out-of-hours include:

- Delivery of plant and materials that is required outside construction work hours as requested by police or other authorities for safety reasons (e.g. oversized deliveries)
- Installation of traffic controls, such as concrete barriers
- Traffic switches between each construction phase
- Operation of concrete and asphalt batching plants within ancillary facilities
- Resurfacing of asphalt pavement on existing roads and concrete and asphalt pouring
- Construction work interfacing with the M1 Pacific Motorway, New England Highway and the Pacific Highway, including construction of overbridge piers for the M1 Pacific Motorway entry and exit ramps and ramp tie-ins with the M1 Pacific Motorway, cross drainage below existing roads, pavement, surfacing, line markings, kerbs and traffic islands, traffic signs and signals
- Short-term traffic diversions along the existing road network (M1 Pacific Motorway, New England Highway, John Renshaw Drive, Masonite Road, and the Pacific Highway)
- Bridge construction work over the Main North Rail Line and existing roads including the New England Highway, Pacific Highway and Old Punt Road traffic along existing road networks (including establishing temporary protection work, installation of girders, sealing of joints, establishing temporary screens to enable construction to continue on the deck, and removal of temporary work)
- Utility modifications, relocations or protection measures work
- Removal of existing static signage and installation of new signs
- Removal of existing traffic barriers and installation of temporary and permanent traffic barriers
- Removal of existing lane marking and application of new lane marking on existing roads
- Any work that does not cause noise emissions to be audible at any sensitive receiver
- Emergency work to avoid the loss of lives, property and/or to prevent environmental harm.

Out-of-hours construction activities would be supported by out-of-hours operation of temporary ancillary facilities.

The exact timing of out-of-hours work would depend on construction activities, construction techniques and constraints imposed by the affected communities or the relevant authorities (utility authorities or road/motorway operators) and would be subject to the requirements of the construction contractor.

The potential construction noise and vibration impacts are presented in **Chapter 8** (noise and vibration). Extended and out-of-hours work would be managed through the implementation of a Construction Noise and Vibration Management Plan which would include feasible and reasonable mitigation measures to minimise the potential for adverse impact on the local community.

### *Haulage routes and use of the existing road network*

The majority of the project would be constructed from the existing road network, with many of the construction traffic movements not anticipated to impact traffic on existing roads, except at access points. **Figure 5-25** shows the haulage routes that would be used during construction.

Where construction traffic movements are unable to be confined to the construction footprint, the existing road network would be used. Where possible, heavy vehicle movements would primarily use state roads including the M1 Pacific Motorway, Pacific Highway and New England Highway, however there may be other roads that could be used by the project, including:

- Medowie Road
- Masonite Road
- Old Punt Road
- Anderson Drive
- Aurizon access road
- Woodlands Drive
- Woodbury Road
- Adelaide Street
- Seaham Road.

Impacts of construction activities and movements on pedestrians and cyclists are discussed in the section below. Further, extended and out-of-hours work would be managed through the implementation of a Traffic Management Plan and a Construction Noise and Vibration Management Plan which would include feasible and reasonable mitigation measures to minimise the potential for adverse impact on the local community.

### *Ancillary facilities*

Twenty-one ancillary facilities have been identified along the length of the project (**Figure 5-1**) and potential functions (including accesses and indicative construction worker parking locations) are discussed in the Traffic and Transport Working Paper (**Appendix G**). For the purposes of this assessment, it is assumed that all ancillary facilities would be used for construction purposes. This assessment is expected to be conservative as not all sites would necessarily be used for construction, and not all sites would be functioning at all times over the construction period. It is expected that all construction workers would park within the construction footprint and therefore not impact on existing parking arrangements within the study area.

Access points at each of the ancillary facilities frontages would be provided with adequate sight distances relating to the posted speed limit. This would allow vehicles on the road network to see vehicles exiting from the ancillary facilities and would allow sufficient room to slow down and stop if necessary. This approach would also provide vehicles waiting to exit from the ancillary facilities with adequate sight distance to see approaching vehicles and determine acceptable gaps. It should be noted that ancillary facilities are generally connected, which would mean that construction traffic movements may fluctuate as they move between sites internally.

### *Construction traffic movements*

The most substantial contribution to additional vehicle movements on the existing road network would occur at access points to the ancillary facilities and at roads being used for haulage. As shown in **Table 7-8**, about 2,800 daily vehicle movements are anticipated to support construction, comprising about 1,300 daily heavy vehicle movements and about 1,500 light vehicle movements. While no construction vehicle movements have been estimated for construction activities outside standard construction hours, they are anticipated to be below the peak hour movement numbers listed in **Table 7-8**.

Table 7-8 Daily construction traffic movement numbers (in and out)

| Ancillary facility | Heavy vehicles | | Light vehicles | | Total vehicles | Peak hour total vehicles |
|---|---|---|---|---|---|---|
| | Daily | Peak | Daily | Peak | | |
| AS1 | 26 | 3 | 46 | 4 | 72 | 7 |
| AS2 | 64 | 6 | 46 | 5 | 110 | 11 |
| AS3 | 210 | 21 | 154 | 15 | 364 | 36 |
| AS4 | 42 | 4 | 10 | 1 | 52 | 5 |
| AS5 | 54 | 5 | 46 | 5 | 100 | 10 |
| AS6 | 0 | 0 | 46 | 5 | 46 | 5 |
| AS7 | 128 | 13 | 154 | 15 | 282 | 28 |
| AS8 | 0 | 0 | 46 | 5 | 46 | 5 |
| AS9 | 90 | 9 | 46 | 5 | 136 | 14 |
| AS10 | 108 | 11 | 154 | 15 | 262 | 26 |
| AS11 | 50 | 5 | 46 | 5 | 96 | 10 |
| AS12 | 70 | 7 | 46 | 5 | 116 | 12 |
| AS13 | 156 | 16 | 46 | 4 | 202 | 20 |
| AS14 | 24 | 2 | 46 | 5 | 70 | 7 |
| AS15 | 38 | 4 | 10 | 1 | 48 | 5 |
| AS16 | 128 | 13 | 154 | 15 | 282 | 28 |
| AS17 | 12 | 1 | 154 | 16 | 166 | 17 |
| AS18 | 34 | 3 | 10 | 1 | 44 | 4 |
| AS19 | 18 | 2 | 154 | 15 | 172 | 17 |
| AS20 | 40 | 4 | 10 | 1 | 50 | 5 |
| AS21 | 26 | 3 | 46 | 4 | 72 | 7 |
| **Total** | **1,318** | **132** | **1470** | **147** | **2788** | **279** |

### *Construction traffic on the existing road network*

The majority of the access points at each of the ancillary facilities are left in/left out arrangements with dedicated deceleration and acceleration lanes. The exceptions are AS8, which uses an existing u-turn lane on Maitland Road, and AS4 and AS5, which connect to low volume roads (Quarter Sessions Road and Aurizon access road respectively).

While the majority of construction traffic movements would occur within the construction footprint, away from existing roads, construction traffic on the existing road network is expected to be mainly from transportation of fill, delivery of pre-cast elements and materials to on-site batch plants as well as concrete and asphalt from on-site or nearby batch plants. Construction traffic would also include trucking contaminated material or dewatering discharge offsite. Vehicles delivering pre-cast concrete elements for the main viaduct, interchanges and bridges could be oversize, overmass, or both. Oversize and overmass

vehicles are likely to be escorted and travel at slower speeds than other vehicles on the existing road network.

Based on the existing traffic volumes on roads within the study area (refer to **Table 7-4**), the low number of peak hour construction traffic movements (on average 132 heavy vehicles and 147 light vehicles) and that the majority of the ancillary facilities are accessed via dedicated left in/left out arrangements, minimal delays and queuing to the surrounding network are anticipated as a result of construction traffic accessing ancillary facilities.

#### *Temporary changes to the road network during construction*

To accommodate construction activities and delivery of materials to various sites across the project, the following temporary traffic intersections are proposed at the following locations:

- New England Highway eastbound exit ramp at Tarro
- Aurizon access road at Tarro
- Anderson Drive at Tarro
- Tomago Road intersection with the Pacific Highway at Tomago
- Old Punt Road intersection with the Pacific Highway at Tomago
- Masonite Road
- Temporary turn provisions (possibly including acceleration and deceleration lanes) for entry and exit to ancillary facilities across the entire project.

The temporary intersections would improve direct access and connectivity for construction activities while reducing delays to general traffic by removing unnecessary heavy vehicle movements. These temporary traffic intersections would be subject to final design, construction staging and contractor usage of ancillary facilities.

Generally, during construction, traffic switches would occur within adjacent carriageways between each stage. However, construction also involves changes to traffic conditions such as alternate-flows which may pose a risk to motorists if appropriate controls such as temporary signage and line markings are not properly implemented. Temporary short-term diversions, road closures and temporary traffic intersections may be required to support construction. Additionally, where temporary pavement is required to be constructed close to existing traffic lanes, construction is likely to impact existing traffic including speed limit reductions, lane closures, traffic switches and temporary lane configurations. To minimise disruptions, some sections of temporary pavement could be constructed out-of-hours**.** Where possible, shoulders would be temporarily narrowed to provide adequate working width for the work, which may result in a reduction in speed limits.

Key impacts associated with the use of temporary pavements are expected to be associated with the tie ins with the existing road network. Depending on sight distance, clearances and pavement geometry, speed limits may need to be reduced in the vicinity of the temporary pavement. These speed limit reductions may result in temporary and localised traffic delays.

### 7.4.2 Impact on property access

During construction, access to properties near to construction work would be maintained although temporary changes may be required for some properties at Black Hill, Hexham, Tarro, Tomago, Heatherbrae and Raymond Terrace. This includes required adjustments to existing tracks and trails for utility infrastructure and associated easements.

These properties may require alternate access strategies during construction. Where the project severs existing access tracks, (including fire trails) turnaround facilities would be provided on access tracks to allow vehicles to turn around or alternate access to the road network would be provided. Access tracks and driveway adjustments would be confirmed during detailed design and consultation with property owners.

Access to all existing and proposed infrastructure for maintenance purposes would be provided by maintaining existing access and easement arrangements where possible or developing alternative maintenance access arrangements where required.

Access to roads and properties being impacted and managed during construction include:

- Aurizon access road, serving multiple properties
- Access to TransGrid easement in Black Hill and Tomago
- Access to Hunter Water Corporation utilities and property at Tarro and Heatherbrae
- Private property at Tarro, west of the new Tarro interchange
- Access across the future Newcastle Power Station proposed by AGL at Tomago
- Access to the Hunter Region Botanic Gardens
- Access to the existing forestry plantation north of Masonite Road.

The above changes to access would be managed throughout construction and become permanent changes once the project is completed.

Further information on property access impacts during construction are discussed in the Traffic and Transport Working Paper (**Appendix G**).

Permanent access changes that would continue during operation of the project are further discussed in **Section 7.5.7**.

### 7.4.3 Other transport modes

#### *Public transport*

As described in **Chapter 5**, three bus stops on the Pacific Highway would be temporarily relocated during construction. No bus routes would be impacted by the construction of the project, as bus routes travelling within the construction footprint would travel on temporary diversions as necessary in consultation with affected bus operators.

#### *Pedestrians*

As described in **Chapter 5**, pedestrian volumes within the construction footprint are anticipated to be very low given the lack of pedestrian infrastructure (refer to **Section 7.3**). No separated walking and cycling paths would be impacted as a result of the project. Pedestrian traffic management will be implemented as part of the Traffic Management Plan and associated traffic control plans. As a result, impacts to pedestrians during construction of the project are considered to be minor.

#### *Cyclists*

No existing cycle routes would be impacted by construction of the project. The proposed Shortland to Tarro shared path would be intersected by the project with a possible diversion to the realigned Aurizon access road. Where practical, minimum two metre shoulders have been adopted during construction to minimise disruption to cyclists. However, shoulders would be reduced at the Tarro interchange. Measures to maintain cyclist access (including communication, signage and alternative routes) will be implemented as part of the Traffic Management Plan and associated traffic control plans.

#### *Rail*

The viaduct (B05) would be constructed over the Main North Rail Line. Track possessions would be used to establish temporary protection work and to install the precast bridge girders over the rail line. Pre-defined periods of track work would be used for such activities to minimise the impact on the rail network. There would be minimal impact to rail infrastructure at Hexham as the construction contractor would likely work in and around ARTC shutdowns to construct over the rail. Impact to rail operations from project construction are expected to be negligible.

#### *Maritime traffic*

While it is not anticipated that large scale dredging of the Hunter River would be required, localised dredging may be necessary within the construction footprint at the temporary wharf locations, to support viaduct construction and/or to provide sufficient draft for the barges at localised low areas of the Hunter River.

The construction contractor would manage barge movements to ensure that the impacts on inbound and outbound marine traffic are minimised. In addition, a navigational channel would be kept open during construction. As such, impacts on maritime traffic during construction are anticipated to be low and manageable.

Given the Port of Newcastle is over 15 kilometres south east of the project, there would also be no impact on the functionality of the port during construction.

## 7.5 Assessment of potential operation impacts

### 7.5.1 Road network performance

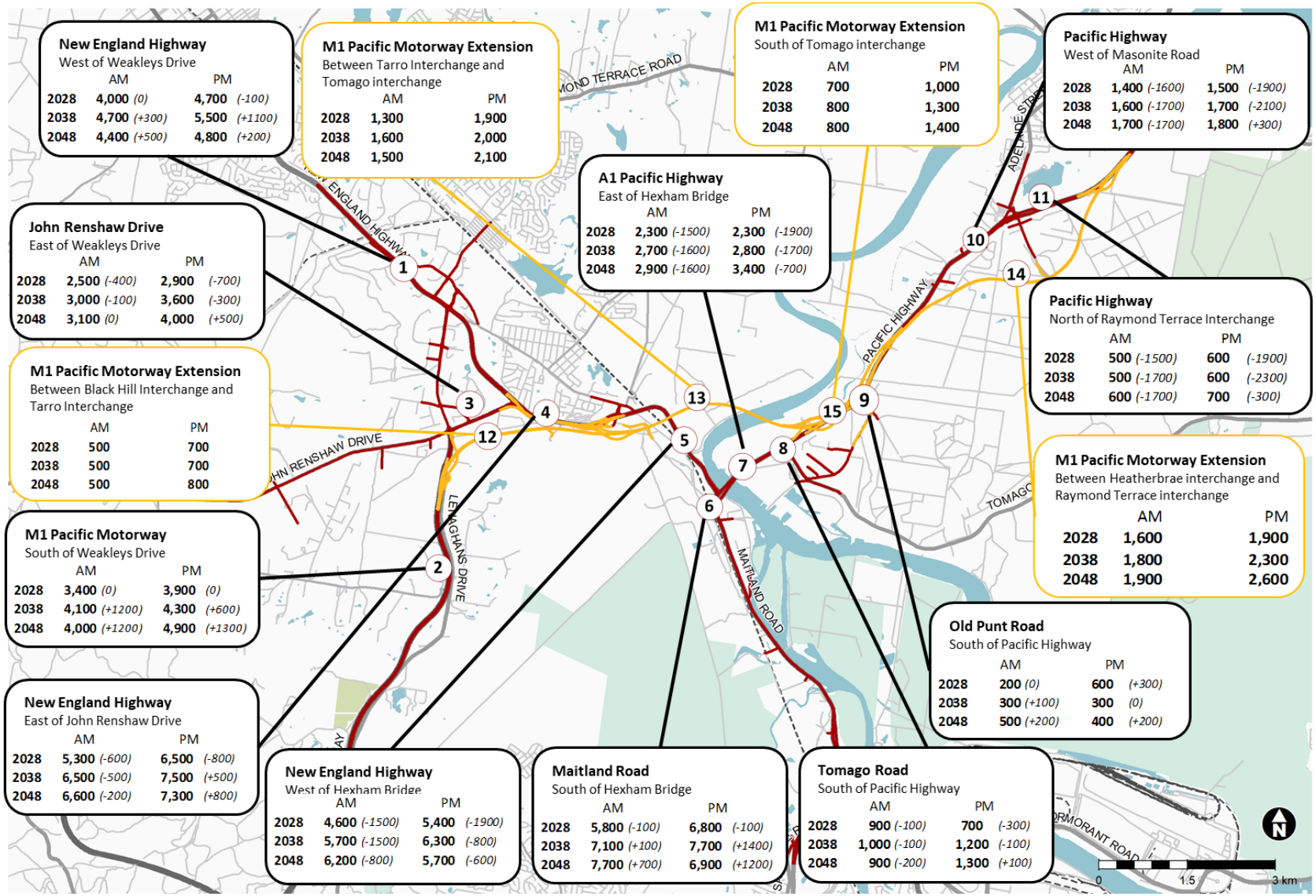
#### *Traffic volumes*

Modelled peak hour and daily 'with project' traffic volumes for 2028, 2038 and 2048 are presented in **Figure 7-9** and **Figure 7-10**. The figures display the peak hour traffic volumes in bold and the change in traffic volume from the 'without project' model is provided in brackets.

Analysis of the modelled traffic flows in 2028, the anticipated year of opening the project, in the 'with project' scenario shows the following key differences throughout the network:

- The New England Highway to the west and the Pacific Highway to the east of the existing Hexham Bridge would likely see substantially reduced traffic flow as a result of the project. These locations are expected to experience a reduction in traffic flow between about 20 to 45 per cent
- Substantial reductions in traffic flows are likely on John Renshaw Drive east of Weakleys Drive, with a reduction of up to 13 per cent in the morning peak (8-9am) and 19 per cent in the evening peak (5-6pm)
- The largest reduction in traffic is expected to occur on Pacific Highway west of Masonite Road, which is likely to experience about a 50 per cent reduction in traffic flow in both peak periods. The project would result in a shift in traffic flow from the Pacific Highway to the project, reducing traffic through Heatherbrae
- The volume of traffic travelling on Old Punt Road would increase in the evening peak period (about a 109 per cent increase) as a result of the project. As shown in **Table 7-12** to **Table 7-14**, the project would result in an improvement in level of service for the intersections along Old Punt Road. This outcome would be expected to occur due to the improved connectivity to the project. This increase in traffic on Old Punt Road correlates with a decrease in traffic travelling on Tomago Road, as the improved connectivity from Old Punt Road provides an alternative route for vehicles.

Analysis of the 2038 and 2048 volumes show a similar pattern with a reduction in daily traffic on John Renshaw Drive, New England Highway and Pacific Highway, as well as an increase in traffic on the existing M1 Pacific Motorway south of Weakleys Drive. This increase is expected as the project provides greater capacity for north and southbound traffic which reduces the unreleased trips (trips where vehicles which are unable to enter the modelled network due to congestion) that occur in the 'without project' traffic model.




**Legend**

**Count location**

**Year** **With Project modelled volume** (Change in volume from 'without project' model)

Figure 7-9 Modelled peak period traffic volumes (8–9am and 5pm–6pm)

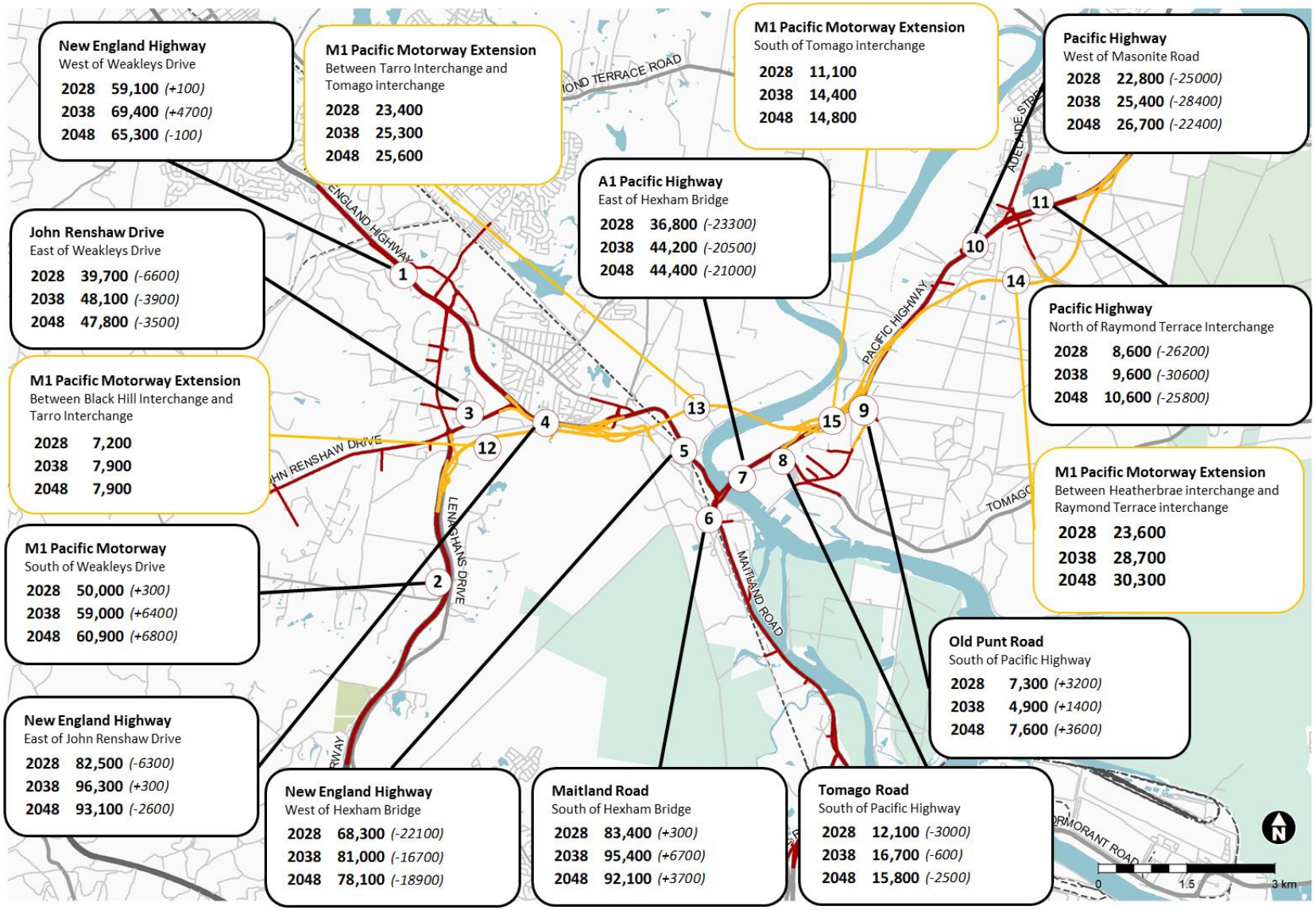



Figure 7-10 Estimated daily traffic volumes

### 7.5.2 Travel time performance

A comparison between the travel times modelled in the 'without project' and 'with project' indicates that the project substantially improves overall travel times for both the morning and evening peaks across all future modelled years. Travel time improvements on key routes are shown in **Table 7-9** and **Table 7-10**.

Table 7-9 Travel time improvements for key routes across the project (morning peak)

| Origin | Destination | 2028 | | | 2048 | | |
|---|---|---|---|---|---|---|---|
| | | Travel time without project | Travel time with project | Time saved | Travel time without project | Travel time with project | Time saved |
| M1 Pacific Motorway | Pacific Highway | 20:35 | 11:32 | 9:03 | 55:53 | 17:41 | 38:12 |
| | Maitland Road | 21:11 | 16:34 | 4:37 | 59:07 | 33:24 | 25:43 |
| Pacific Highway | M1 Pacific Motorway | 19:05 | 11:34 | 7:31 | 31:13 | 11:40 | 19:33 |
| | New England Highway | 15:52 | 10:10 | 5:42 | 24:03 | 10:20 | 13:43 |
| | Maitland Road | 17:24 | 14:00 | 3:24 | 24:35 | 19:55 | 4:40 |
| Maitland Road | Pacific Highway | 16:37 | 13:55 | 2:42 | 18:03 | 15:00 | 3:03 |

Table 7-10 Travel time improvements for key routes across the project (evening peak)

| Origin | Destination | 2028 | | | 2048 | | |
|---|---|---|---|---|---|---|---|
| | | Travel time without project | Travel time with project | Time saved | Travel time without project | Travel time with project | Time saved |
| M1 Pacific Motorway | Pacific Highway | 21:17 | 11:32 | 9:45 | 37:53 | 19:50 | 18:03 |
| | Maitland Road | 20:26 | 16:49 | 3:37 | 44:23 | 29:22 | 15:01 |
| Pacific Highway | M1 Pacific Motorway | 21:04 | 11:29 | 9:35 | 1:08:50 | 30:21 | 38:29 |
| | New England Highway | 17:58 | 10:16 | 7:42 | 1:07:05 | 38:09 | 28:56 |
| | Maitland Road | 16:07 | 13:37 | 2:30 | 1:06:21 | 30:11 | 36:10 |
| Maitland Road | Pacific Highway | 16:21 | 14:27 | 1:54 | 47:20 | 26:43 | 29:37 |

During the morning peak, travel times for most origin and destination combinations would likely reduce as a result of the project when compared with the 'without project' scenarios. Key morning peak hour outcomes include:

- Travel times along the road corridor between Black Hill and Raymond Terrace would reduce by about 39 to 74 per cent. In 2048, this improvement in travel time equates to a saving of about 30 minutes per vehicle
- The project would result in a reduction of about 35 to 60 per cent in travel times from the New England Highway at the western edge of the study area to Pacific Highway at the eastern edge of the study area. These improvements equate to a travel time saving of about 15 minutes per vehicle in 2048
- Travel times from the Pacific Highway to the New England Highway and the M1 Pacific Motorway would reduce by at least 36 per cent in 2028 and by about 60 per cent in 2048. In 2048, this improvement in travel time equates to a saving of 15 to 20 minutes per vehicle
- Improved travel times to and from Maitland Road, as travel times from and to key locations would be reduced by greater than 22 per cent in each of the future horizon years.

The evening peak hour results indicate travel times for most origin and destination combinations are likely to decrease as a result of the project when compared with the 'without project' scenarios. This is consistent for all the future years modelled. Key evening peak hour outcomes include:

- Travel times along the road corridor between Black Hill and Raymond Terrace would reduce by about 46 to 72 per cent. In 2048, this improvement in travel time equates to a saving of about 35 minutes per vehicle
- The project would result in about a 28 to 64 per cent reduction in travel times from the New England Highway at the western edge of the study area to Pacific Highway at the eastern edge of the network. These improvements equate to a travel time saving of about 15 minutes per vehicle in 2048
- Travel times from the Pacific Highway to the New England Highway and the M1 Pacific Motorway would reduce by at least 45 per cent in 2028 and about 42 per cent in 2048. In 2048, this improvement in travel time equates to a saving of 30 minutes per vehicle
- The project also improves travel times between Maitland and key locations with a reduction by greater than 12 per cent in each of the future horizon years.

When sensitivity modelling was carried out for the scenarios noted in **Section 7.2.4** for the Emerging Black Hill Precinct with an alternate access or with no traffic generated from the future proposed site, delays across the road network were reduced, which would correlate to improved travel times across the network.

These improvements would substantially reduce travel times between Newcastle, Raymond Terrace, Maitland and other regional industrial areas. Furthermore, the project would provide key infrastructure for movements along the eastern coast of Australia, improving travel time and travel time reliability between Brisbane in the north and Melbourne and Sydney. It is anticipated that travel times in off peak periods and holiday periods between Maitland and Raymond Terrace, and between Black Hill and Raymond Terrace would also markedly improve as vehicles can travel less distance at consistently higher speeds without the traffic signals interrupting traffic flow.

Further comparison between the travel times from 'without project' and 'with project' scenarios is presented in the Traffic and Transport Working Paper (**Appendix G**).

### 7.5.3 Network statistics

A comparison of network statistics between the 'without project' and 'with project' scenarios for horizon years (2028, 2038 and 2048) are provided in **Table 7-11**. Comparison of the 'without project' and 'with project' scenarios for the horizon years indicates that:

- In 2028, there is a substantial increase in average network speed, particularly during the evening peak period with the forecast average network speed is likely to increase by 10 per cent. This is accompanied by a slight increase in vehicle throughput
- In 2038, a substantial improvement in the operational performance of the road network is likely. Up to an additional nine per cent of vehicles can complete their trips within the modelled period. The forecasted average network speed is likely to increase by 17 per cent in the morning peak and 31 per cent in the evening peak
- In 2048, substantial improvement in the operational performance of the road network is likely, particularly during the evening peak period. Forecast average network speed is likely to increase by 22 per cent in each of the peak periods.

Overall, the key network statistics demonstrate the project would provide positive outcomes for the performance of the road network in each of the modelled scenarios. The project results in a more efficient road network, that can cater to a higher volume of vehicles, while also maintaining faster travelling speeds for motorists. More detailed network statistic outputs are provided in the Traffic and Transport Working Paper (**Appendix G**).

Table 7-11 Network speed for horizon years (2025, 2038, 2048)

| Year | Network statistic | Morning peak | | Evening peak | |
|---|---|---|---|---|---|
| | | Without project | With project | Without project | With project |
| 2028 | Total throughput (vehicles) | 42,801 | 42,927 | 47,787 | 48,048 |
| | Network speed (km/h) | 59 | 64 | 55 | 61 |
| 2038 | Total throughput (vehicles) | 48,673 | 50,362 | 50,993 | 55,620 |
| | Network speed (km/h) | 45 | 53 | 37 | 49 |
| 2048 | Total throughput (vehicles) | 50,361 | 53,037 | 51,081 | 56,924 |
| | Network speed (km/h) | 35 | 43 | 29 | 37 |

### 7.5.4 Intersection performance

The operational performance at key intersections within the network is presented in **Table 7-12** to **Table 7-14**. LoS D is generally the accepted target performance level. Cells with pink shading represent intersections where performance is worse than LoS D.

Analysis of the modelled intersections shows that the project would result in the following key differences in intersection performance at the following locations:

- **New England Highway/ Pacific Highway/Maitland Road intersection**: The project would substantially improve the performance of this intersection during the evening period as vehicles travelling on the New England Highway between Tarro and Tomago would reroute to the project. This is most evident in the 2038 evening model, under 'without project' conditions, as the intersection operates

at a LoS E. When modelled with the project, the intersection operates as a satisfactory LoS D. The project markedly reduces the traffic demand for the right turn movement from the Pacific Highway to the New England Highway. This substantially reduces the overall demand at the intersection and would enable the reallocation of green time to other movements at the intersection, ultimately improving the performance of the intersection

- **Pacific Highway/Masonite Road**: The project provides a bypass of Heatherbrae, which substantially reduces the traffic demand and throughput at the Pacific Highway/Masonite Road roundabout. The reduction in demand is evidenced in the evening peak in both 2038 and 2048, as the intersection improves from operating at LoS E (in 2038) and LoS F (in 2048) to LoS A in both years as a result of the project
- **M1 Pacific Motorway/Weakleys Drive/John Renshaw Drive intersection**: The project would improve the performance of this intersection, as traffic travelling to or from the east of the model extent would reroute to use the project in 2028. However, the intersection is expected to perform at LoS E from 2038 onwards
- **Intersections along the Pacific Highway between Maitland Road and Masonite Road** would improve in performance. This is particularly noticeable in the 2038 and 2048 horizon years when flows on the Pacific Highway are forecast to exceed the capacity of these intersections. Removal of the east-west movements along this section of the Pacific Highway improves the performance of the Maitland Road and Masonite Road intersections with Pacific Highway and reduces volumes to within the road's capacity.

The high volume of vehicles generated from the Emerging Black Hill Precinct contributes substantially to the poor performance of the M1 Pacific Motorway/Weakleys Drive/John Renshaw Drive intersection at Black Hill in future years. The sensitivity modelling results where the Emerging Black Hill Precinct is not constructed show the operation of the M1 Pacific Motorway/Weakleys Drive/John Renshaw Drive intersection is substantially improved. Vehicle delays at the intersection were almost halved and operating LoS improved from LoS F in both peak periods to a LoS D in the morning peak and LoS E in the evening peak.

Table 7-12 Performance of modelled intersections in 2028

| Intersection | Type | 2028 'without project' | | | | 2028 'with project' | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 8-9am | | 5-6pm | | 8-9am | | 5-6pm | |
| | | Avg delay (sec) | LoS | Avg delay (sec) | LoS | Avg delay (sec) | LoS | Avg delay (sec) | LoS |
| M1 Pacific Motorway/ Weakleys Drive/ John Renshaw Drive, Black Hill | Signalised | 83 | F | 93 | F | 60 | E | 62 | E |
| New England Highway/ Weakleys Drive, Beresfield | Signalised | 18 | B | 20 | B | 28 | C | 33 | C |
| New England Highway/ Maitland Road/ Pacific Highway | Signalised | 18 | B | 48 | D | 23 | C | 30 | C |
| Pacific Highway/ Tomago Road, Tomago | Signalised | 18 | B | 18 | B | 17 | B | 15 | B |
| Pacific Highway/ Old Punt Road, Tomago | Signalised | 10 | A | 9 | A | 5 | A | 5 | A |

| Intersection | Type | 2028 'without project' | | | | 2028 'with project' | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 8-9am | | 5-6pm | | 8-9am | | 5-6pm | |
| | | Avg delay (sec) | LoS | Avg delay (sec) | LoS | Avg delay (sec) | LoS | Avg delay (sec) | LoS |
| Old Punt Road/ Tomago Road, Tomago | Roundabout | 4 | A | 3 | A | 3 | A | 5 | A |
| Pacific Highway/ Hank Street, Heatherbrae | Signalised | 12 | B | 10 | B | 11 | B | 9 | A |
| Pacific Highway/ Masonite Road, Heatherbrae | Roundabout | 8 | A | 17 | B | 3 | A | 4 | A |

* Cells with pink shading represent intersections where performance is worse than LoS D

Table 7-13 Performance of modelled intersections in 2038

| Intersection | Type | 2038 'without project' | | | | 2038 'with project' | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 8-9am | | 5-6pm | | 8-9am | | 5-6pm | |
| | | Avg delay (sec) | LoS | Avg delay (sec) | LoS | Avg delay (sec) | LoS | Avg delay (sec) | LoS |
| M1 Pacific Motorway/ Weakleys Drive/ John Renshaw Drive, Black Hill | Signalised | 180 | F | 120 | F | 124 | F | 151 | F |
| New England Highway/ Weakleys Drive, Beresfield | Signalised | 58 | E | 104 | F | 28 | C | 41 | D |
| New England Highway/ Maitland Road/ Pacific Highway | Signalised | 25 | C | 83 | F | 36 | D | 38 | D |
| Pacific Highway/ Tomago Road, Tomago | Signalised | 19 | B | 101 | F | 18 | B | 15 | B |
| Pacific Highway/ Old Punt Road, Tomago | Signalised | 10 | A | 86 | F | 5 | A | 5 | A |
| Old Punt Road/ Tomago Road, Tomago | Roundabout | 4 | A | 114 | F | 4 | A | 10 | A |
| Pacific Highway/ Hank Street, Heatherbrae | Signalised | 14 | B | 49 | D | 12 | B | 9 | A |
| Pacific Highway/ Masonite Road, Heatherbrae | Roundabout | 9 | A | 62 | E | 4 | A | 5 | A |

* Cells with pink shading represent intersections where performance is worse than LoS D

Table 7-14 Performance of modelled intersections in 2048

| Intersection | Type | 2048 'without project' | | | | 2048 'with project' | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 8-9am | | 5-6pm | | 8-9am | | 5-6pm | |
| | | Avg delay (sec) | LoS | Avg delay (sec) | LoS | Avg delay (sec) | LoS | Avg delay (sec) | LoS |
| M1 Pacific Motorway/ Weakleys Drive/ John Renshaw Drive, Black Hill | Signalised | 181 | F | 131 | F | 142 | F | 136 | F |
| New England Highway/ Weakleys Drive, Beresfield | Signalised | 91 | F | 91 | F | 62 | E | 96 | F |
| New England Highway/ Maitland Road/ Pacific Highway | Signalised | 76 | E | 83 | F | 38 | D | 70 | E |
| Pacific Highway/ Tomago Road, Tomago | Signalised | 41 | D | 89 | F | 31 | C | 120 | F |
| Pacific Highway/ Old Punt Road, Tomago | Signalised | 22 | C | 143 | F | 6 | A | 48 | D |
| Old Punt Road/ Tomago Road, Tomago | Roundabout | 4 | A | 153 | F | 6 | A | 139 | F |
| Pacific Highway/ Hank Street, Heatherbrae | Signalised | 15 | B | 73 | E | 13 | B | 10 | B |
| Pacific Highway/ Masonite Road, Heatherbrae | Roundabout | 15 | B | >200 | F | 4 | A | 5 | A |

* Cells with pink shading represent intersections where performance is worse than LoS D

### 7.5.5 Interchange analysis

A merge and diverge analysis was carried out at each proposed motorway entry and exit ramps for the project's interchanges to determine the performance of the ramp-motorway junction (merge/diverge influence area). **Table 7-15** presents the level of service in the modelled future horizon years for the proposed interchanges. In some instances, an interchange assessment could not be conducted due to nearby signalised intersections. In these cases, these assessments are represented by N/A.

Table 7-15 LoS performance of modelled interchanges

| Intersection | 2028 | | 2038 | | 2048 | |
|---|---|---|---|---|---|---|
| | Morning peak | Evening peak | Morning peak | Evening peak | Morning peak | Evening peak |
| Black Hill interchange – Northbound Diverge* | N/A | N/A | N/A | N/A | N/A | N/A |
| Black Hill interchange – Southbound Merge | B | F | B | F | B | F |

| Intersection | 2028 | | 2038 | | 2048 | |
|---|---|---|---|---|---|---|
| | Morning peak | Evening peak | Morning peak | Evening peak | Morning peak | Evening peak |
| Tarro interchange – Eastbound Merge | B | B | B | B | B | B |
| Tarro interchange – Westbound Diverge | A | A | A | A | A | N/A* |
| Tomago interchange – Eastbound Merge | A | B | B | B | A | B |
| Tomago interchange – Westbound Diverge 1 | A | A | A | A | A | A |
| Tomago interchange – Westbound Diverge 2 | B | A | B | B | B | B |
| Tomago interchange – Eastbound Diverge | A | A | A | A | A | A |
| Tomago Interchange – Westbound Merge | A | B | A | A | A | B |
| Raymond Terrace interchange – Eastbound Merge | A | B | B | B | B | B |
| Raymond Terrace interchange – Westbound Diverge | B | B | B | B | B | B |

* Due to a nearby signalised intersection or queueing upstream an interchange assessment could not be conducted at the Black Hill interchange – Northbound Diverge and Tarro interchange – Westbound Diverge
* Cells with pink shading represent intersections where performance is worse than LoS D

The Black Hill interchange southbound merge between Weakleys Drive and the M1 Pacific Motorway operates at LoS F during each of the assessed evening peak periods. This is due to the demand on the entry ramp exceeding its capacity during the assessed 15-minute peak period. The excess demand results in queueing on Weakleys Drive which extends to the M1 Pacific Motorway/Weakleys Drive/John Renshaw Drive intersection. This queueing impacts all southbound movements at the intersection and results in extensive queuing in 2038 onwards for the northern, eastern and western approaches. In 2048, the extensive queueing from the eastern approach increases in the evening peak to reach as far as the Tarro Interchange – Westbound Diverge.

Queuing from the south approach of the M1 Pacific Motorway/Weakleys Drive/John Renshaw Drive intersection does not create problems on the M1 Pacific Motorway which operates at LoS C. The M1 Pacific Motorway would continue to operate without major disruptions as the demand on the motorway is within the capacity and it is the motorway entry ramp that is constrained.

All other merges assessed across the project operate at an acceptable LoS C or better in each of the modelled scenarios, indicating that the project would experience a minimal decrease in performance due to merge points.

All diverge points assessed operate at LoS C or better in each of the modelled future horizon years. However, the Weakleys Drive northbound diverge cannot be assessed due to the influence of the downstream M1 Pacific Motorway/Weakleys Drive/John Renshaw Drive intersection. Queueing at the southern approach to this intersection extends to the northbound Weakleys Drive diverge point, causing a negative impact on the operation of the junction.

Overall, the interchange assessment shows the project would operate at LoS C or better across the modelled merge and diverge points for each of the scenarios.

#### *Sensitivity testing*

The traffic assessment carried out included the assumption that the Emerging Black Hill Precinct would be progressively developed, and the subsequent impacts of that development were included in the future operation of the road network. As a result, modelling was carried out as described in **Section 7.2.4** for two sensitivity scenarios for 2038 to quantify the impact of the Emerging Black Hill Precinct on the road network, particularly in relation to impacts to the Black Hill interchange southbound ramp to the M1 Pacific Motorway.

By 2038, it was assumed that 75 per cent of the Emerging Black Hill Precinct would be constructed. The development located south-west of the John Renshaw/Weakleys Drive intersection was found to be a major driver of traffic demand in the traffic model accounting for about 11 per cent of all traffic demand in 2038. While both scenarios modelled resulted in improvements to the performance of the road network, the sensitivity modelling identified the following under each scenario:

- Scenario 1: Black Hill Road interchange. The provision of south-facing ramps connecting Black Hill Road to the M1 Pacific Motorway was found to improve the performance of the road network, particularly during the evening peak. Improvements were evident at the M1 Pacific Motorway/Weakleys Drive/John Renshaw Drive and Black Hill interchange southbound merge, in the vicinity of the Emerging Black Hill Precinct These improvements are a result of more direct access to the site from the south, which reduces the distance travelled by vehicles accessing and departing the site. This consequently reduces the number of vehicles travelling the network surrounding the Emerging Black Hill Precinct and improved the southbound M1 Pacific Motorway ramp operation to LoS B
- Scenario 2: Sensitivity results. The sensitivity testing shows the removal of all Black Hill traffic from the 2038 road network would improve performance outcomes across the entire modelled network. There would be substantial improvements to the key network statistics along with intersection and interchange LoS improvements, with the M1 Pacific Motorway southbound ramp performance improving to LoS B. The improved outcomes are a result of less traffic demand which limits the build-up of queues and delays.

Further detail on interchange analyses, including sensitivity modelling results, is presented in the Traffic and Transport Working Paper (**Appendix G**).

### 7.5.6 Freight

As stated in **Section 7.3.6**, the current network has constraints for OSOM vehicles at both the southbound Hexham Bridge and at the New England Highway crossing of the Main North Rail Line. The project would provide an alternative route offering improved freight connectivity and allow free movement at these locations without the requirement for a permit.

Future land releases surrounding the study area are anticipated to substantially increase the generation of new freight movements in future years. This would be driven predominately by the Emerging Black Hill Precinct and developments around Tomago and Heatherbrae. Modelling indicates that without the project, there would be substantial congestion in the network, lengthy delays and increased travel times apply for all vehicles including freight.

Routes from the Pacific Highway (Sandgate) to both the New England Highway (Beresfield) and the M1 Pacific Motorway (Black Hill) carry a large volume of heavy vehicles (refer to **Figure 7-3**). Although vehicles travelling on these routes would not use the project, the redistribution of other traffic to the project would reduce congestion on other roads within the study area resulting in a reduction in travel times for all vehicles, including freight traffic by greater than 22 per cent during the peak hours.

Other routes between industrial areas such as Tomago, Black Hill, Beresfield and Raymond Terrace that carry a substantial volume of heavy vehicles would experience substantial reductions in delays and travel times as a result of the project. Furthermore, the project would also result in freer flowing traffic and greater efficiency of heavy vehicle operations.

The project would provide a free flowing high standard, access-controlled motorway that integrates with the NLTN. The project would contribute towards connecting Melbourne, Sydney and Brisbane via a high standard duplicated motorway and improve connectivity for state and national freight. The cumulative impact of projects on freight is discussed in **Chapter 23** (cumulative impacts).

### 7.5.7 Regional and local community connectivity

#### *Regional connectivity*

The M1 Pacific Motorway, New England Highway, Pacific Highway and John Renshaw Drive form part of the NLTN and are a key component of the Sydney to Brisbane road link. In addition to facilitating substantial interstate freight movements between Victoria, NSW and Queensland, these roads provide the primary access to the City of Newcastle, Port of Newcastle, Newcastle Airport, Upper Hunter Valley mining developments, Maitland and other major employment and commercial centres in the Hunter Region. The reduction in delays, reduction in travel time and improved travel time reliability that occur as a result of the project, would provide enhanced connectivity to communities and activity centres in the Lower Hunter and Newcastle regions, including Newcastle, Raymond Terrace, the Port of Newcastle and Newcastle Airport. The additional capacity provided by the project would also ensure the long term reliability and functionality of the NLTN, state roads and local roads.

These benefits would enable the project to support future land use and development within the study area and the surrounding region, improving access and connectivity to current and future employment and growth areas to and from the M1 Pacific Motorway and Pacific Highway. The project would support:

- Future employment and population growth at Raymond Terrace, which is identified as a strategic centre within the Hunter Region
- Growth and development of employment precincts at Tomago and Thornton, Beresfield and Black Hill.

The project would provide enhanced access to the Beresfield and Tomago industrial areas by providing new entry and exit points, delivered through the Tarro and Tomago interchange. The project would also provide more efficient access to facilitate economic growth for the Lower Hunter and key regional employment areas, such as the Port of Newcastle, Newcastle Airport, Raymond Terrace and Black Hill.

#### *Property access*

The project would be constructed to full motorway standard with no direct access to properties from the main alignment. During operation, 23 lots would have the existing property access affected by the project. Where existing property accesses would be permanently affected by the project, access would be provided either from existing roads or new access provided as part of the project. Transport will continue to liaise with landowners during detailed design to confirm access arrangements.

Further information on property access impacts during operation are discussed in **Chapter 14** (land use and property).

## 7.5.8 Road safety

As described in **Chapter 4**, one of the key objectives of the project is to improve road safety. The project would have a positive impact on road safety in the study area by addressing the following issues:

- Rear end, multi-vehicle crashes are the most common type of crash occurring within the study area. Many of these crashes occur on the New England Highway and Pacific Highway and are caused by traffic congestion. The project would reduce congestion on the New England Highway and Pacific Highway and is anticipated to result in a reduction in rear-end type crashes
- Lane changes are the second most frequent type of crash in the study area with 66 per cent of these crashes occurring on the New England Highway. The project would reduce the number of vehicles travelling on the New England Highway which would reduce the risk of lane change crashes
- Access to and from the project is to be provided via grade-separated interchanges. This would reduce potential points of conflict between vehicles. Providing grade-separated interchanges would also result in free-flow conditions along the project, minimising the risk of congestion-related incidents
- Off road and off bend crashes are a common cause of fatal and serious injury crashes in the study area. The project provides improved road alignment, wider lanes and shoulders with barriers, and would minimise the risk and impact of any off-road crashes.

The project would deliver improved pedestrian access at HRBG and Masonite Road and improved access to cyclist connectivity and crossing points. These infrastructure changes coupled with a reduction of traffic volumes on the existing road network would reduce the interaction between vehicles, pedestrians and cyclists, resulting in improve safety outcomes in the study area.

## 7.5.9 Other transport modes

### *Public transport*

There would be no impact to the function of the Main North Rail Line and Hexham Train Support Facility during project operation. Access to Thornton, Beresfield, Tarro and Hexham railway stations, and ARTC assets via Tarro interchange would remain.

The project would not impact any current bus routes. Two bus stops would be included at the HRBG access along the Pacific Highway. The project would improve bus travel time reliability as a result of reduced traffic volumes on the existing road network. Decreased congestion and improved intersection performance would also benefit bus travel times.

Three bus stops would be relocated as described in **Chapter 5**. The relocated bus stops would be located as close as possible to the original bus stop locations, and pathways would be provided to maintain access to relocated bus stops. Consultation would be carried out with the affected bus operators during detailed design. Further information on operational impacts to public transport is presented in the Traffic and Transport Working Paper (**Appendix G**).

### *Pedestrians*

The study area is predominantly comprised of industrial land uses which leads to very low volumes of pedestrians. The project would result in fewer traffic movements on the existing road network as traffic reroutes to the M1 Pacific Motorway.

The project would provide a shared path about 900 metres long along the southbound lane of the realigned Masonite Road in order to provide safer pedestrian access and to accommodate future development in the surrounding area. No shared path would be provided along the main alignment.

The proposed signalised intersection at the HRBG would provide a signalised pedestrian crossing which will provide access to the bus stop located on the eastern side of the Pacific Highway. It will also offer

improved pedestrian access to the HRBG. Further information on operational impacts to pedestrians is presented in the Traffic and Transport Working Paper (**Appendix G**).

### *Cyclists*

The existing and proposed cycling network is shown in **Figure 5-1**. Cyclists would be able to use the 2.5 metre to three metre wide shoulders provided on the motorway and two metre to 2.5 metre wide sealed shoulders provided on ramps. This would improve cycle connectivity through the study area.

Changes to the existing cycle network include:

- A signalised crossing at the M1 Pacific Motorway/John Renshaw Drive intersection with connectivity to the project to provide a safe crossing location for cyclists
- Relocating the existing cyclist crossing on the New England Highway, just east of John Renshaw Drive further west before the northbound entry ramp at the Tarro interchange
- Provision of a westbound cyclist crossing on the New England Highway across John Renshaw Drive
- Replacing the existing gore crossings at the Tarro interchange with new ramps which would create a link between the main alignment in both directions and the future Richmond Vale Rail Trail from Tarro to Shortland
- Provision for northbound cyclists on the Pacific Highway crossing to access Old Punt Road and for crossing from Old Punt to access the northbound Pacific Highway Carriageway
- Provision for northbound cyclists on Pacific Highway to access the main alignment at Tomago interchange and to connect to the traffic signals at Tomago Road
- Provision for northbound cyclists on Pacific Highway to access the HRBG
- Provision for a shared path over the realigned Masonite Road.

Overall, the project would provide additional cycling routes and enhanced safety for cyclists. Further information on operational impacts to cyclists is presented in the Traffic and Transport Working Paper (**Appendix G**).

A dedicated off-road cycleway is proposed between Tarro and Shortland by the City of Newcastle for a distance of about 900 metres. This proposed future route would intersect with the project requiring a diversion along the realigned Aurizon access road.

### *Regional airport*

The project would have a positive impact on Newcastle Airport and Williamtown RAAF Base function once operational. It would reduce travel times and improve travel time reliability for trips to Newcastle Airport and Williamtown RAAF Base for traffic from Maitland, the M1 Pacific Motorway and areas west of the study area. The project would therefore result in improved access to the Newcastle Airport and Williamtown RAAF Base.

### *Maritime traffic*

The new bridge structures associated with the project would have a clearance of about 11 metres and would be supported by six sets of piers within the river. This is greater than the existing Hexham Bridge downstream which was a fixed clearance height of 10 metres. The bridge design over the Hunter River would allow for the continued use of the river by maritime traffic once built.

The project would result in impact to prawn trawling areas due to the design and location of the viaduct over the Hunter River. The project would be designed to allow the passage of commercial fishing vessels along the Hunter River, although the placement of piers would limit the ability to trawl along the shoreline near the viaduct. The project would require changes to trawling practices near to the bridge, with trawling nets required to be pulled in to pass under the bridge.

No other impacts to maritime traffic are expected and there would also be no impact on the functionality of the Port of Newcastle when the project is operational.

## 7.6 Cumulative impacts

Cumulative traffic and transport impacts may arise from the interaction of construction and operation activities of the project, and other approved or proposed projects in the area. When considered in isolation, specific project impacts may be considered minor. These minor impacts may, however, be more substantial when the impact of multiple projects on the same receivers is considered.

As discussed in **Section 7.2.3**, this transport and traffic assessment has included a number of planned or proposed projects to estimate the future conditions on the transport network surrounding the project. In many instances, this is a high-level qualitative assessment, but future road projects have also been captured in the traffic modelling as part of the future traffic growth across the Hunter Region as described in **Table 7-16**.

Overall, the contribution of the project to the cumulative impact on traffic and transport in the area is minor, considering construction would be managed through the implementation of a range of environmental management measures. Cumulative impacts are further discussed in **Chapter 23** (cumulative impacts).

Table 7-16 Potential cumulative traffic impacts for relevant identified projects

| Project (approval status) | Relevance in consideration of cumulative impact | Potential cumulative impact |
|---|---|---|
| Emerging Black Hill Precinct, which includes:<br>• Black Hill Employment Lands (In planning)<br>• Black Hill Hunter Business Park (In planning). | • Located south of John Renshaw Drive and west of M1 Pacific Motorway.<br>• Likely to be some overlap in the construction program, meaning the likelihood of concurrent (simultaneous) construction and operation<br>• Likely to be concurrent (simultaneous) operation. | The Emerging Black Hill Precinct is included in the traffic modelling for future horizon years. It has been assumed that 25 per cent of the development would be complete by 2028, 75 per cent by 2038 and 100 per cent by 2048. The development will be a key generator of traffic in the region for future scenarios and accounts for about 12 per cent of all trips in the study area by 2048.<br>There is likely to be some overlap in construction, as it is located within the project's construction footprint, to the south of John Renshaw Drive and west of M1 Pacific Motorway. However, there is a low likelihood for disruptions, with construction access likely to come from John Renshaw Drive west of the Weakleys Drive intersection which is outside the construction footprint. It is possible construction traffic would use the M1 Pacific Motorway and New England Highway to access the Emerging Black Hill Precinct, which may result in construction vehicles additional to what the project would contribute. These construction vehicle volumes are not expected to exceed capacity (including heavy vehicle capacity) of these state roads.<br>The impact of the Emerging Black Hill Precinct during project operation is captured throughout this report. Sensitivity testing of the development has been carried out as described in this chapter. In summary, the development substantially impacts the performance of the network in future horizon years due to the magnitude of traffic generated out of the development. |
| Kinross Industrial / Weathertex, Heatherbrae<br>(Approved) | • Located within the project's construction footprint to the north of the project in Heatherbrae.<br>• Potential to be consecutive (back to back) construction and concurrent (simultaneous) operation. | The timing for the Weathertex industrial development has not yet been announced, although some land has been cleared for the development to the north of the project. The industrial development is proposed on land identified for AS16. If the Weathertex industrial development is developed prior to or during construction this ancillary facilities would be unavailable to the project for use.<br>Construction of the project and Weathertex industrial development have the potential to extend potential disruptions relating to amenity and traffic (including access and travel times). The Weathertex industrial development operational traffic impact is captured as part of the future traffic demand growth within the study area. |
| Newcastle Power Station<br>(In planning) | • Located within the project's construction footprint at Tomago near Old Punt Road<br>• Potential to be consecutive (back to back) construction and concurrent (simultaneous) operation. | AGL propose to construct a 250 megawatt gas fired power station at Tomago, with gas pipelines and electricity transmission lines. Construction of the power station is due to commence in 2021 with the power station expected to be operational in 2022. The site for the proposed power station is located between the Pacific Highway and Old Punt Road, north of the Tomago industrial area (AGL 2019).<br>The power station would be located next to AS12 and AS13. The project has considered the AGL power station in its design. Cumulative traffic operational impacts are minimal, as the station would not generate large amounts of traffic as it would employ approximately 23 operational and maintenance people. |

| Project (approval status) | Relevance in consideration of cumulative impact | Potential cumulative impact |
|---|---|---|
| Hexham Straight<br>(In planning) | • Located about one kilometre south of the project at Hexham<br>• Potential to be consecutive (back to back) construction and concurrent (simultaneous) operation. | The Hexham Straight project has a funding commitment to proceed and the concept design and environmental assessment is currently being carried out. Transport plan to upgrade the Hexham Straight (Maitland Road) between Sandgate and the existing Hexham Bridge. The proposed scope of the Hexham Straight project involves the addition of an extra lane in both directions, replacement of the bridges at Ironbark Creek, adjustments to connecting roads as well as substantial utility relocation.<br>The concept design and environmental assessment are currently being carried out for the Hexham Straight project. The construction of the project has the potential to overlap with the construction of Hexham Straight which would result in additional impact on traffic and road access within the study area.<br>The Hexham Straight project has been captured in the traffic modelling as part of the 'without project' upgrades. The upgrades include an extra lane in each direction between Sandgate and the existing Hexham Bridge. For the 'without project' model, the lane configuration at the existing Hexham Bridge maintains the existing layout to ensure adequate operation.<br>The operational impact of the existing Hexham Bridge is captured in the 'without project' and project traffic model. A comparison between the two modelling scenarios has identified the benefits originating from the project. |
| Lower Hunter Freight Corridor<br>(in planning) | • The investigation area extends from Fassifern to Hexham and Tarro<br>• The design of the project allows for the Lower Hunter Freight Corridor. | The Transport Lower Hunter Freight Corridor (LHFC) forms a part of the NSW Freight and Ports Strategy (Transport for NSW 2018b) and in 2018 preliminary investigations were being carried out to assess options for a dedicated freight rail line between Fassifern and Hexham. |
| Richmond Vale Rail Trail to Shortland, including Shortland to Tarro cycleway<br>(In planning) | • Intersects the project at Tarro | This project is not expected to result in cumulative impact with the project. The Richmond Vale Rail Trail to Shortland would encourage additional pedestrian and cyclist use within the study area.<br>The Shortland to Tarro Bike Trail would intersect with the project and provide an additional pedestrian and cyclist routes within the study area. Overall, it would have minimal impact on the traffic within the study area. |

## 7.7 Environmental management measures

The environmental management measures that will be implemented to minimise the traffic and transport impacts of the project, along with the responsibility and timing for those measures, are presented in **Table 7-17**.

Table 7-17 Environmental management measures (traffic and transport)

| Impact | Reference | Management measure | Responsibility | Timing |
|---|---|---|---|---|
| Management of traffic during construction | TT01 | A Traffic Management Plan (TMP) will be prepared and implemented in accordance with the Traffic Control at Work Sites Manual (Roads and Maritime Services 2018b) and QA Specification G10 Control of Traffic. The TMP will include:<br>• Confirmation of haulage routes, including minimisation of haulage movements during peak periods on routes where feasible<br>• Access management plan to ensure access to properties can be maintained where it is safe and feasible during construction<br>• Site specific traffic control measures (including signage) to manage and regulate traffic movement<br>• Measures to manage temporary changes to the road network including use of barriers, lane occupancies or temporary road closures<br>• Measures to maintain pedestrian and cyclist access (including communication, signage and alternative routes)<br>• Requirements and methods to consult and inform the local community of impacts on the local road network (including for out of hours work)<br>• Access to ancillary and construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads<br>• A response plan for any construction traffic incident<br>• Consideration of other developments that may be under construction to minimise traffic conflict and congestion. | Contractor | Prior to construction/ construction |
| Property access | TT02 | Existing accesses to properties and businesses will be maintained during construction. Where this is not feasible or reasonable, temporary alternative access arrangements will be provided following consultation with the affected property and business owners. | Transport / Contractor | Detailed design/ prior to construction/ construction |

| Impact | Reference | Management measure | Responsibility | Timing |
|---|---|---|---|---|
| | TT03 | Access will be maintained to rail infrastructure facilities along Aurizon access road. Transport will liaise with Aurizon and ARTC during detail design and construction. | Transport / Contractor | Detailed design/ prior to construction/ construction |
| Impacts to bus services | TT04 | Any changes to bus stops will be implemented in consultation with Transport, relevant councils, and relevant bus operators. | Contractor | Prior to construction/ construction |
| Emergency vehicle access | TT05 | Where possible, access for emergency vehicles will be maintained at all times during construction. Any site-specific requirements will be determined in consultation with the relevant emergency services agency. | Contractor | Construction |
| Maritime impacts | TT06 | A navigational channel would be provided during construction within the Hunter River | Contractor | Construction |
| Damage or impacts on local road infrastructure | TT07 | A road dilapidation report will be prepared before impacts on local roads commence. The report will document the existing conditions of local roads. This report will be issued to councils and stakeholders as relevant. | Contractor | Prior to construction |
| Other relevant management measures | | | | |
| Cumulative impacts | CI01 | The construction contractor will review traffic impacts before the start of construction and as required during construction. Any changes to manage cumulative traffic impacts will be included in the TMP. | Contractor | Prior to construction/ construction |
| Business impacts | SE02 | Signage will be provided in accordance with Transport signage policy to inform the travelling public about services in Beresfield and Heatherbrae. | Transport | Construction. Prior to operation |
| Property acquisition | LU02 | Property adjustments will be completed in consultation with property owners/business managers. | Transport/ Contractor | Prior to construction/ construction |