PART B

Environmental assessment

BOTANY RAIL DUPLICATION

ENVIRONMENTAL IMPACT STATEMENT

Botany Rail Duplication

Environmental Impact Statement

Part B – Environmental assessment

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8. TRAFFIC AND TRANSPORT

This chapter provides a summary of the traffic, transport and access impact assessment. A full copy of the assessment report is provided as *Technical Report 1 – Traffic and Transport Impact Assessment*.

8.1 Assessment approach

A summary of the approach to the assessment is provided in this section, including the legislation, guidelines and policies driving the approach, and the methodology used to undertake the assessment. A more detailed description of the approach and methodology is provided in *Technical Report 1 – Traffic and Transport Impact Assessment*.

8.1.1 Legislative and policy context to the assessment

Future Transport 2056 Strategy

Future Transport 2056 (TfNSW 2018a) is a customer focused 40-year strategy that outlines a vision, strategic directions and customer outcomes for the state's transport system. It is supported by a range of services and infrastructure plans, including the *Greater Sydney Services and Infrastructure Plan* (TfNSW 2018c) which established specific outcomes for the Greater Sydney area. The plan defines the Greater Sydney Strategic Freight Network which consists of the most significant road and rail corridors that support freight movement across Greater Sydney.

A key objective of the plan is to improve connections between Sydney's ports in the east and the manufacturing and distribution facilities which are primarily based in Western Sydney. The project would assist in improving freight rail capacity and efficiency to Port Botany thereby achieving this key objective.

NSW Freight and Ports Plan 2018–2023

The *NSW Freight and Ports Plan 2018–2033* (TfNSW 2018d) is a supporting plan to *Future Transport 2056* (TfNSW 2018a). The plan outlines five objectives around central elements including:

- economic growth
- efficiency, connectivity and access
- capacity
- safety
- sustainability.

The project would be consistent with the identified objectives as it would:

- provide the infrastructure to support continued economic growth within the region
- increase efficiency/capacity for freight activity by duplicating the existing section of single track
- ensure continued freight activities via rail to and from the Port Botany
- facilitate a safer environment by increasing the capacity of the rail corridor and potentially reducing the demand for the movement of freight by road.

State Infrastructure Strategy 2018–2038

The *State Infrastructure Strategy* is a long-term strategy that assesses the current state of infrastructure within NSW. *Building Momentum: State Infrastructure Strategy 2018–2038* (Infrastructure NSW, 2018b) is the most recent version of this strategy and outlines 122 recommendations for infrastructure across NSW. Of relevance to the project is recommendation 60 which recommends that, among other initiatives, that Transport for NSW finalises business cases to fund investment in the Botany Rail Duplication. The development of the project is therefore consistent with this recommendation.

2015–2024 Sydney Metropolitan Freight Strategy

This strategy (ARTC, 2015) states that the Botany freight yard has sufficient capacity until 2030. However, the yard already suffers congestion at peak times due to port activities. To overcome these constraints, the strategy recommends a range of infrastructure upgrades within the Port Botany Rail Yard itself, along with the duplication of the single-track section of the line by 2023. The development of the project is therefore consistent with this recommendation.

NSW Ports' 30-year Master Plan

Navigating the Future: NSW Ports' 30 Year Master Plan (NSW Ports, 2015) outlines NSW Ports' priorities and objectives for Port Botany over the next 30 years. It recognises that Port Botany would continue to have a vital role as Australia's premier port. The project supports many of the objectives of the masterplan seeking to improve the rail connection between Port Botany and Sydney's strategic rail freight networks.

Other guidelines

A number of other guidelines identified as part of the project SEARs were considered as part of the preparation of this EIS. The relevance of these guidelines is summarised below:

- *Guide to Traffic Management – Part 3 Studies and Analysis (Austroads 2007)* – The traffic assessment that was completed for the project was conducted with reference to this report.
- *NSW Sustainable Design Guidelines Version 3.0 (TfNSW 2013)* – While not specifically relevant to the assessment of traffic impacts associated with the project, these guidelines would be considered as part of the detailed design of project elements such as new bridge structures along the length of the project.
- *Guide to Traffic Generating Developments, Version 2.2* (RTA, 2002) – As this guide is designed to assess the impacts of a development on the road network, it was not considered to be relevant to the assessment of the project, as the guideline typically assesses impacts associated with new traffic generating developments.
- *Cycling Aspects of Austroads Guide* (Austroads, 2017) – While cycling is an important part of the transport system, the planning, design and construction of a bicycle corridor has not been included in the project. The opportunity to include an active transport corridor as part of the project was considered during the design and development phase of the project. However, the existing rail corridor was identified to have limited space to accommodate an active transport path and was not considered to be consistent with the objectives for the project (refer to section 1.2.1). These guidelines were therefore not applied to the traffic impact assessment associated with the project. However, the development of the project would not preclude the provision of an active transport path (or similar) by others in the future.

- *NSW Bicycle Guidelines* (RTA, 2003) – These guidelines were not applied to the traffic impact assessment associated with the project for the reasons noted above. Notwithstanding, the potential for impacts on existing cycling infrastructure was examined. The assessment concluded that there would be no impact on existing bicycle facilities.
- *Planning Guidelines for Walking and Cycling* (DPINR, 2004) – As the project would involve duplication of the Botany Line, these guidelines were not considered to be applicable during the assessment of the traffic impacts.

A detailed description of the legislative and policy context for the assessment is provided in section 2 of *Technical Report 1 – Traffic and Transport Impact Assessment*.

8.1.2 Methodology

Key tasks

For the purpose of the traffic and transport assessment, the activities which may affect the road network were defined as follows:

- ***'Typical'*** construction includes day-to-day construction activities that would occur throughout the duration of the project (haulage of materials, transport of construction workforce, rail line duplication activities) and within the approved working hours. The primary activity which would impact the road network is the generation of construction related vehicles and site access arrangements.
- ***'Temporary road closure construction'*** stages refer to the occasional period when road or lane closures are required to support the construction of the Robey Street, O'Riordan Street or Southern Cross rail bridges. The primary activity which would impact the road network are road diversions.

The assessment of potential traffic, transport and access impacts associated with the project involved:

- reviewing the project design (including proposed indicative construction methodology)
- reviewing existing freight rail, road features, traffic, transport services, pedestrian and cyclist facilities, and available traffic survey data
- estimating the traffic volumes that would be generated during construction
- undertaking a qualitative assessment of the potential impacts during construction of the project ('typical' construction impacts), including impacts on the operation of the local road network, pedestrians, cyclists, and public transport network
- undertaking a quantitative assessment of key road closures at the following intersections ('temporary road or lane closure' construction activities):
  - Robey Street
  - O'Riordan Street
  - Southern Cross Drive
- assessing the potential impacts on the road network during operation
- assessing potential operational impacts on the wider transport network, including impacts on cyclists, pedestrians, and public transport
- providing mitigation measures to manage the potential impacts on traffic, transport and access.

A detailed description of the assessment methodology is provided in section 3 of *Technical Report 1 – Traffic and Transport Impact Assessment*.

Study area

For the purpose of this traffic and transport assessment, a study area (as shown in Figure 8.1) was adopted that incorporated the project site (as identified in section 2.1 of this EIS) and a wider area surrounding the project site. The study area was established to incorporate sections of the surrounding street network that would be used or potentially impacted during the construction of the project (such as for construction haulage routes etc). The study area typically includes an area around one kilometre from the project site (with the exception of the Sydney Airport site).

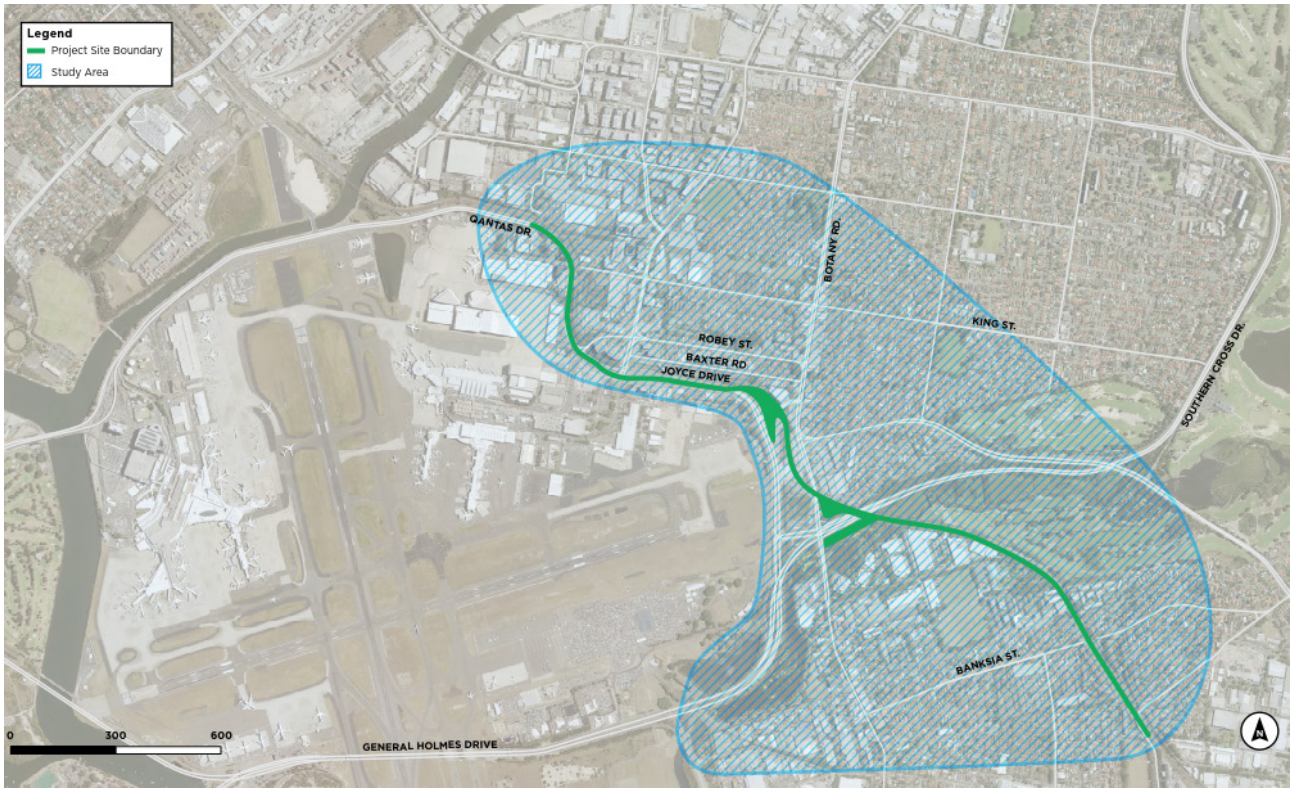

Figure 8.1 Study area – traffic and transport assessment

8.1.3 Risks identified

The preliminary environmental risk assessment undertaken for the project (provided in Appendix B) included potential risks associated with traffic, transport and access. Potential risks were considered according to the impacts that may be generated by the construction and operation of the project. The likelihood, consequence and overall risk level of each potential risk were assessed, with avoidance and management measures defined for each potential risk.

Further information on the risk assessment, including the approach, methodology, and the full results, is provided in Appendix B.

The assessed risks prior to mitigation associated with potential traffic, transport and access impacts (with a rating of medium or above) were:

- Very high risk:
  - closure of roads due to proposed bridge works including congestion impacts due to diversions
- High risk:
  - construction traffic impacts, including temporary delays to local and regional traffic
  - impacts on emergency services through delays in access due to works
- Medium risk:
  - impacts on pedestrian and cyclist movements in the vicinity of the project
  - impacts on access to private property.

These potential risks and impacts were considered as part of the assessment. The assessment also considered matters identified by the SEARs and by stakeholders (as described in Chapters 3 and 4). The residual risk levels, following implementation of the mitigation measures proposed in this EIS, are discussed in section 8.6.4.

8.1.4 How potential impacts have been avoided/minimised

As described in Chapters 6 and 7, design development and construction planning has included a focus on avoiding or minimising the potential for environmental impacts during all key phases of the process. With respect to potential traffic, transport and access impacts, the project has sought to avoid or minimise potential impacts where possible.

In line with this approach, potential impacts have been avoided or minimised by project elements such as:

- initial assessment of the Botany Road bridge mitigated the need for demolition and replacement of the existing bridge structure at this location, removing the need for any full road closures of Botany Road to undertake works on the bridge
- where possible, the construction access points and construction traffic routes have been directed away from sensitive areas including areas of higher pedestrian movements to minimise potential impacts during construction.

8.2 Existing environment

8.2.1 Rail and road freight network

The movement of freight within the Greater Sydney region requires a focus on efficiency to ensure its important contribution to the NSW economy.

The freight network in NSW consists of ports and shipping channels, airports and prescribed airspace, roads, rail lines, pipelines, intermodal terminals and freight-related precincts. Of particular importance to the project are the existing rail freight network and the road freight network. These existing networks, within the vicinity of the project, are described below.

Rail freight network

Rail freight in Sydney is serviced by a network of dedicated corridors across the metropolitan area, shared with passenger rail. The rail network is used to transport raw construction materials, household waste, interstate and regional cargo, and import and export containers to and from Port Botany. The Botany Line forms part of the wider Sydney Metropolitan Freight Network which is maintained and operated by ARTC. The project site, which is currently configured with a single track, is located along the Botany Line. The section of single track is around three kilometres in length, extending between Mascot and Botany.

The Botany Line joins the existing Goods Line at Marrickville Junction, which in turn interfaces with the Sydney Trains Network at this location. The number of trains varies from week to week and day to day as freight operates on an as-needed basis and not on a defined schedule. A review of ARTC's *Master Train Plan* (April 2019) indicated that the Botany Line is regularly used with train arrivals ranging from 24 to 33 each day.

There is currently one at-grade road crossing of the Botany Line (also referred to as a level crossing) where it intersects with General Holmes Drive between Joyce Drive and Botany Road. The level crossing and associated infrastructure was approved for removal as part of the Airport East Precinct upgrade project (currently under construction). The Airport East project closed the level crossing by extending Wentworth Avenue to General Holmes Drive through a new rail underbridge. The underbridge was also constructed to allow for a future duplication of the track (the current project).

Table 8.1 provides an overview of the current typical maximum number of freight train movements on the Botany Line (total bidirectional train movements).

Table 8.1 Typical daily freight train movements on Botany Line

DAY OF THE WEEK	TOTAL (BOTH DIRECTIONS)
Monday	26
Tuesday	31
Wednesday	29
Thursday	33
Friday	30
Saturday	26
Sunday	24

Source: Master Train Plan – 28-04-2019 V1 (ARTC, 2019)

Road freight network

Around 80 percent of greater Sydney's freight movements is undertaken by road (*NSW Freight and Ports Plan* 2018–2023, TfNSW, 2018d). The motorways and major roads that are considered key roads in Greater Sydney's freight network, include:

- M1 Pacific Motorway
- Hume Motorway
- M4/Great Western Highway
- M5 East
- WestConnex (under construction)
- M5 West
- M7 Westlink
- Parramatta Road
- Foreshore road
- NorthConnex (under construction).

The impact of congestion is a key issue for road freight, causing increasing costs due to longer travel times and increased fuel consumption. In 2015, avoidable congestion costs were estimated at $6.1 billion (Bureau of Infrastructure, Transport and Regional Economics). This is expected to rise considerably by 2030. Key corridors within the vicinity of the project that are anticipated to be impacted further due to increasing traffic congestion include:

- the roads surrounding Port Botany and Sydney Airport including Foreshore Road
- the M5 West – a major corridor for both passenger and freight traffic
- the M4/Great Western Highway – a busy freight corridor between Sydney and the Central West.

Further details of the existing rail and road freight network is provided in section 4.2 of *Technical Report 1 – Traffic and Transport Impact Assessment*.

8.2.2 Traffic and transport environment

This section provides a description of the land uses and transport network surrounding the project site.

Road network

All roads in the vicinity of the Botany Line are classified as local, other than Southern Cross Drive, General Holmes Drive, O'Riordan Street, Botany Road, Foreshore Road and the section of Robey Street between O'Riordan Street and Qantas Drive. The local roads are the responsibility of Bayside Council and generally are considered to only provide for local access.

There are a number of major arterial roads in the identified study area including (see Figure 1.1):

- **M1 Southern Cross Drive–General Holmes Drive** – which extends along the southern edge of the airport, connecting the M5 East Motorway and the Eastern Distributor.
- **Airport Drive and Qantas Drive** – which run along the northern edge of the airport between West Botany Street/M5 East and O'Riordan Street/Joyce Drive. These roads provide an important east–west connection between the International and Domestic airports, and for over-height or restricted freight vehicles that cannot use General Holmes Drive due to the low clearance tunnel under the runway.
- **Joyce Drive and General Holmes Drive** – a state road beginning at the intersection of Joyce Drive and O'Riordan Street, extending to meet the M1 on the eastern side of the airport.
- **Botany Road** – a state road and an important north–south connection between the Sydney CBD in the north and Botany in the south.
- **Foreshore Road** – a four-lane divided road which connects Port Botany to M1 General Holmes Drive and is an important link for road freight to and from the port.
- **O'Riordan Street and Robey Street** – which form the primary north–south corridor between the Sydney CBD and Sydney Airport. As a part of the Airport North Precinct upgrade works by Transport for NSW, Robey Street and O'Riordan Street form a one-way couplet.
- **Wentworth Avenue** – a state road that is generally four to six lanes wide and has a posted speed limit of 60 kilometres per hour between General Holmes Drive-Joyce Drive and Sutherland Street.
- **Mill Pond Drive** – a state road that is generally nine to eleven lanes wide and provides an important east–west connection between General Holmes Drive and Botany Road, while also providing access between the airport district and Southern Cross Drive eastbound.

Peak hour traffic

Weekday

The counts of intersection turning movements were collected during the weekday morning peak (6.00 am to 10.00 am) and afternoon peak (3.00 pm to 7.00 pm) periods to identify existing traffic volumes at key intersections within the study area. Surveys were conducted in June 2018 at the following intersections:

- Botany Road and Mill Pond Drive
- General Holmes Drive and Mill Pond Drive
- General Holmes Drive and Joyce Drive
- Joyce Drive and O'Riordan Street
- Qantas Drive and Robey Street
- Robey Street and O'Riordan Street.

Weekend

The weekend peak hour was determined through intersection turning count surveys during the typical weekend peak periods (from 10.00 am to 2.00 pm) in September 2018. The surveys were undertaken at the following intersections:

- Qantas Drive and Joyce Drive between Robey Street and Wentworth Avenue
- Botany Road between Wentworth Avenue and Robey Street
- Robey Street and O'Riordan Street.

The results of the survey indicated that the Sunday peak had the highest volumes of traffic and the peak hour was between 1 pm and 2 pm.

Further details of the traffic surveys undertaken are provided in section 4.3.3 of *Technical Report 1 – Traffic and Transport Impact Assessment*.

On street parking

Existing on-street parking within the study area is characterised by the following:

- Short-term parking ranging from half-hour up to three hour periods is typically available within the proximity of commercial and retail precincts (eg Botany town centre) within the study area. These are generally applicable from 8.00 am to 6.00 pm on weekdays and from 8.00 am to midday on Saturday.
- Timed parking, with applied restrictions of three to eight hour periods is typically available in residential streets within walking distance (up to around 800 metres) of the surrounding commercial, retail and other employment areas. These are generally applicable from 8 am to 6 pm on weekdays and from 8 am to midday on Saturday; and are supported by the use of a Residential Parking Scheme.
- Unrestricted parking is provided in residential streets that are outside the typical walking distance of key commercial, retail or employment areas.
- No on-street parking is permitted on key motorways and arterial roads, including Southern Cross Drive, Airport Drive, Joyce Drive, Wentworth Avenue and O'Riordan Street.

Site visits undertaken in October 2018 as part of this assessment observed the utilisation of on-street parking within the study area as follows:

- high parking utilisation and high turnover observed within the vicinity of the Botany town centre
- high parking utilisation within the vicinity of the business park/light industrial areas north of Sir Reginald Ansett Drive, although there was a longer time restriction
- high utilisation and low-turnover in the spaces located within the business park/industrial area located between Mill Pond and Booralee Park
- high parking utilisation in areas around the medium to high density residential areas, including those located around Mascot station and near the Botany Aquatic Centre.
- low to medium utilisation in the residential areas located at further walking distance from major trip generators (ie commercial, business park, industrial areas and Airport).

Public transport

Rail services

The two closest passenger rail stations to the study area are Mascot Station and the Sydney Domestic Airport Station. Both stations are serviced by the T8 Airport and South Line. The underground portion of the line extends from Wolli Creek to Central with stations at the International Airport, Domestic Airport, Mascot and Green Square. A section of T8 line in tunnel runs directly below O'Riordan Street close to the project.

Bus services

The study area surrounding the project in Mascot and Botany is served by bus routes from the Eastern Suburbs and Inner West districts, including the following:

- **Routes 400, 400N, 420 and 420N** – connect the International and Domestic Terminals to Mascot station via Airport Drive, Qantas Drive and O'Riordan Street.
- **Route 305** – runs from Railway Square to Mascot, terminating at Stamford Plaza between Robey Street and Qantas Drive.
- **Routes M20, 307, 309, 310, L09, X09 and X10** – run in a north–south direction along Botany Road from Botany towards the city.
- **Route M20** – runs in a north–south direction from Botany Road in Botany towards the CBD and north to Gore Hill.
- **Routes 301 and 303** – runs in an east–west direction along King Street before joining Botany Road and continuing south.

Bus stops are available along these services at regular spacing (generally around every 200 metres to 400 metres). Figure 8.2 shows the bus network within Mascot and Botany.

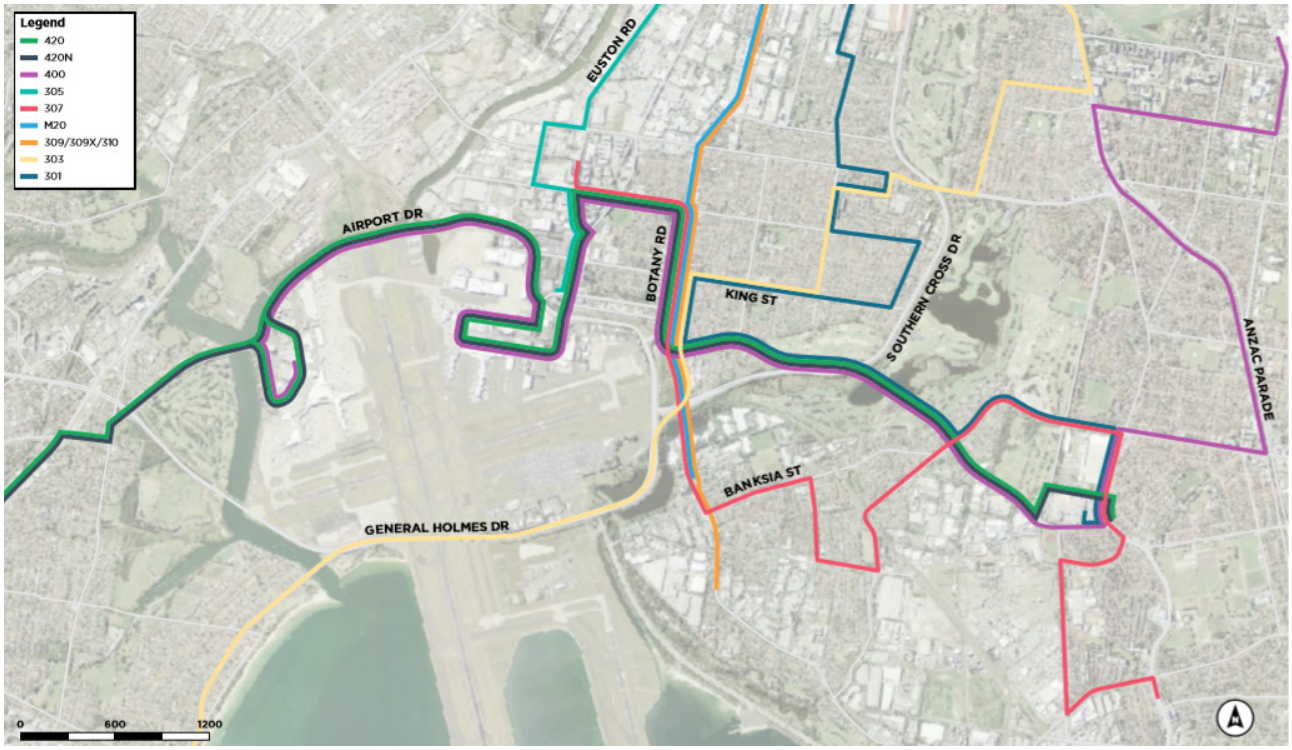

Figure 8.2 Bus routes within the project area

Point to point transport

Point-to-point transport such as taxis, hire cars, tourist services and rideshare services provide important mobility options for first and last mile trips. In the study area, designated taxi ranks are generally available within the vicinity of transport hubs (ie train stations, airport terminals).

Active transport

Cycling network

Currently there are no dedicated cycling facilities within the project site. However, there are a number of active transport corridors located in the wider study area. These are provided in a variety of forms including shared paths and dedicated cycleways. Active transport infrastructure (see Figure 8.3) in the broader vicinity of the project site includes:

- the Bourke Road Cycleway
- the Alexandra Canal cycleway
- a shared path located along Wentworth Avenue between Dranesfield Avenue and Bay Street.

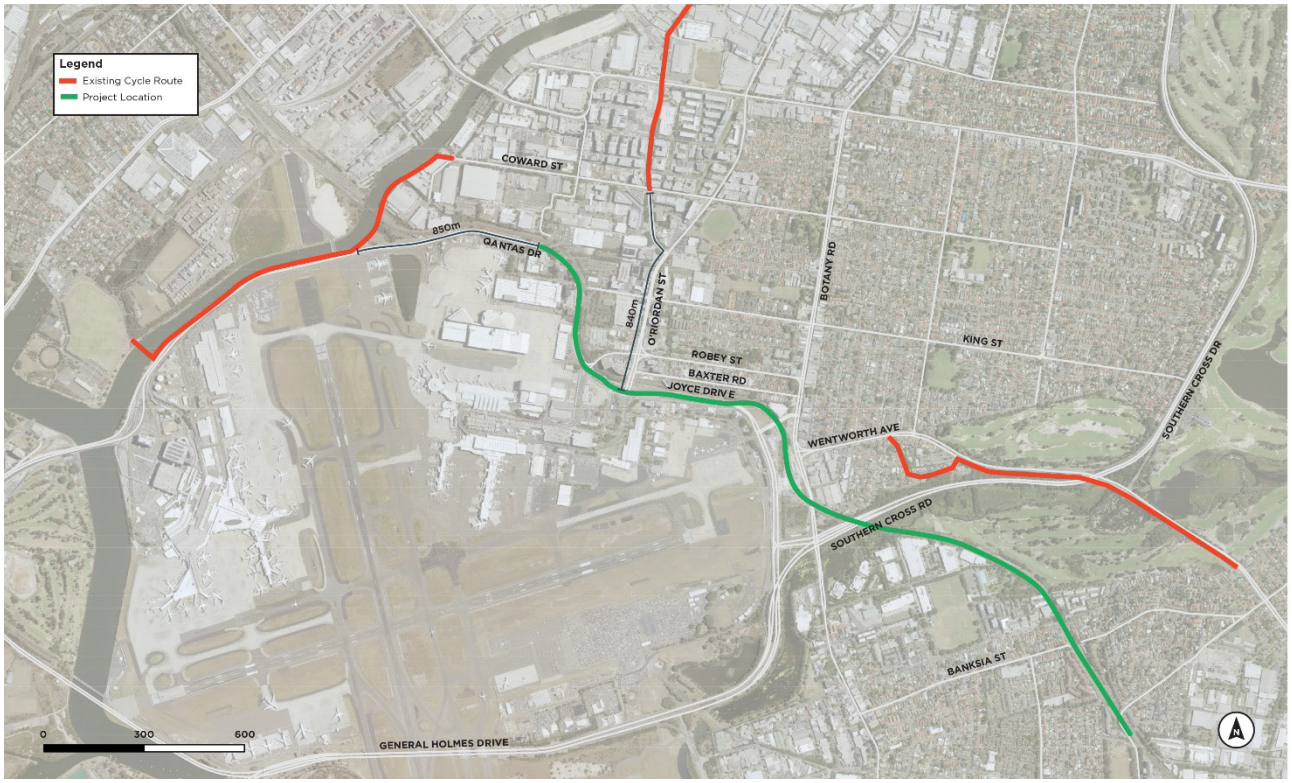

Figure 8.3 Active transport network

Pedestrian network

The pedestrian network is more developed than the bicycle network. The roads in the study area are typical of an urban environment with most streets consisting of footpaths on either side, or as a minimum, footpaths on one side of the road. Southern Cross Drive, has no footpath network. There is an existing pedestrian crossing over the Botany Line at Banksia Street. This crossing provides access for residents on either side of the rail line to schools, shopping and recreational amenities.

The Domestic Airport (Terminals 2 and 3) is linked to the Mascot Town Centre north of the study area, with pedestrian access to the terminal precinct located along at-grade roadside footpaths via Robey Street and O'Riordan Street to the north.

Further details of the existing traffic and transport network is provided in Chapter 4 of *Technical Report 1 – Traffic and Transport Impact Assessment*.

8.3 Assessment of construction impacts

Construction impacts associated with the project have been considered based on the two main construction scenarios identified in section 8.2.1 above, being:

- *Typical* construction stage which includes typical construction activities that would occur throughout the duration of the project.
- *Temporary road closure construction* stages required to support the construction of the Robey Street, O'Riordan Street or Southern Cross rail bridges.

The assessment of each of these scenarios is provided in the following sections.

8.3.1 Typical construction stage

Road network operation

The estimated traffic volumes accessing each site gate during construction is shown in Table 5.3 of *Technical Report 1 – Traffic and Transport Impact Assessment* for both the morning (AM) and afternoon (PM) peak periods. The construction traffic includes workers travelling to and from the sites. It is divided into light vehicles and heavy vehicles (over 4.5 tonnes and 12.5 metres long). Not all sites/gates would be active throughout the full duration of the construction program as the individual construction activities would have varying durations and schedules. As such, the numbers presented in Table 5.3 of *Technical Report 1 – Traffic and Transport Impact Assessment* are cumulative and represent the typical traffic volumes that would be generated in the AM and PM peak periods for when each individual work site is in operation.

To identify the impact of the day-to-day construction traffic on the road network, the traffic numbers shown in Table 5.3 of *Technical Report 1 – Traffic and Transport Impact Assessment* were distributed across the road network within the study area (see detailed methodology outlined in section 3.3.1 of *Technical Report 1 – Traffic and Transport Impact Assessment*).

The percentage of the additional construction traffic to the road network was compared against the total traffic volumes at the key intersections during the AM and PM peak periods in year 2022 (baseline modelling forecast year). The focus of the qualitative assessment was at nearby intersections, as the impacts of increased traffic volumes would be greatest at these locations. The overall increase in peak period traffic volumes at key intersections for 2022 are shown in Table 8.2 and Table 8.3. The year 2022 was selected as the assessment year as it aligns with the base year for the proposed future Sydney Gateway project, currently being developed by Roads and Maritime.

Table 8.2 Total intersection traffic volume and construction traffic – AM peak hour

INTERSECTION NAME	2018 INTERSECTION TRAFFIC VOLUME (veh/h)*	2022 INTERSECTION TRAFFIC VOLUME (veh/h)	CONSTRUCTION TRAFFIC VOLUME (veh/h)**	TOTAL 2022 TRAFFIC VOLUME (veh/h)	CONSTRUCTION TRAFFIC AS A PERCENTAGE OF BACKGROUND TRAFFIC
Botany Road/Banksia Street	N/A	–	53	–	–
Botany Road/Bay Street	N/A	–	40	–	–
Botany Road/Mill Pond Drive	5,387	5,496	145	5,641	2.6%
General Holmes Drive/Mill Pond Drive	5,185	5,289	122	5,411	2.3%
Botany Road/Wentworth Avenue	N/A	–	68	–	–
General Holmes Drive/Joyce Drive/ Construction access	3,957	4,037	86	4,123	2.1%
Joyce Drive/O'Riordan Street	5,214	5,319	52	5,371	1.0%
Qantas Drive/Robey Street	5,554	5,666	55	5,721	1.0%
Robey Street/O'Riordan Street	4,063	4,145	60	4,205	1.4%
Botany Road/Robey Street	N/A	–	149	–	–
Botany Road/King Street	N/A	–	159	–	–

N/A – Traffic counts data not available

* 2018 Traffic counts data

** Total construction traffic (veh/h) at intersections

Table 8.3 Total intersection traffic volume and construction traffic – PM peak hour

INTERSECTION NAME	2018 INTERSECTION TRAFFIC VOLUME(veh/h)*	2022 INTERSECTION TRAFFIC VOLUME (veh/h)	CONSTRUCTION TRAFFIC (veh/h)**	TOTAL 2022 TRAFFIC VOLUME (veh/h)	CONSTRUCTION TRAFFIC AS A PERCENTAGE OF BACKGROUND TRAFFIC
Botany Road/Banksia Street	N/A	–	56	–	–
Botany Road/Bay Street	N/A	–	44	–	–
Botany Road/Mill Pond Drive	5,728	5,843	58	5,901	1.0%
General Holmes Drive/Mill Pond Drive	5,549	5,661	42	5,703	0.7%
Botany Road/Wentworth Avenue	N/A	–	27	–	–
General Holmes Drive/Joyce Drive/ Construction access	4,028	4,109	37	4,146	0.9%
Joyce Drive/O'Riordan Street	4,909	5,008	23	5,031	0.5%
Qantas Drive/Robey Street	4,613	4,706	42	4,748	0.9%
Robey Street/O'Riordan Street	4,385	4,473	21	4,494	0.5%
Botany Road/Robey Street	N/A	–	60	–	–
Botany Road/King Street	N/A	–	65	–	–

N/A – Traffic counts data not available

* 2018 Traffic counts data

** Total construction traffic (veh/h) at intersections

The results in Table 8.2 and Table 8.3 indicate that the maximum percentage increase in total traffic volume at any intersection would be up to around 2.6 percent in the AM peak at Botany Road and Mill Pond Drive. In the PM peak, the percentage increase in traffic at any intersection (where existing traffic volume data is available) is not expected to exceed around 1.0 percent. Based upon these relatively modest increases, the construction traffic generated by the project is likely to have a negligible impact on key intersections and the overall road network operation during construction. It was determined that further assessment of impact on intersection level of service was not required.

However, there may be occasional localised impacts on the efficiency of intersections and adjacent roads close to the construction site access gates as a consequence of slow moving heavy (construction) vehicles manoeuvring in and out the site.

The identified impacts on the function of intersections in proximity to the construction site gates as well as the adjacent road links are indicated in Appendix A1 of *Technical Report 1 – Traffic and Transport Impact Assessment*. In general, the assessment of these intersections indicates there is potential for short duration high impacts at the following gates:

- Botany Triangle: due to its close proximity to the Botany Road and Mill Pond Drive intersection.
- Joyce Drive – O'Riordan Street (in): due to its close proximity to the Joyce Drive and O'Riordan Street intersection.
- O'Riordan Street – Robey Street (in): due to its close proximity to the Qantas Drive and Robey Street intersection.
- O'Riordan Street – Robey Street (out): due to its close proximity to the Joyce Drive and O'Riordan Street intersection.
- Qantas Drive (out): due to its close proximity to the Qantas Drive and Robey Street intersection.
- Lancastrian Drive: due to its close proximity to the Qantas Drive and Lancastrian Drive intersection.

On-street parking

As described in section 7.6.5, where possible, parking for workers would be provided within compounds and work sites to accommodate both the projected workforce and construction vehicles at all times. It is expected that the construction contractor would manage the parking supply for both the projected workforce and construction vehicles at all times without utilising on-street parking around compounds and work sites. As the on-street parking around compounds and work sites would be restricted for the workforce to use, the impact on the demand and availability of existing on-street parking in the vicinity of the construction sites and compounds is expected to be negligible.

Local amenity

There is potential for a decrease in the local neighbourhood amenity through increased construction traffic along local streets. In particular, the slight increase in 'heavy vehicle' traffic may be noticeable to local residents due to increased noise resulting from braking or travelling over existing speed control measures (such as speed bumps). However, as the volume of construction traffic is low compared to existing traffic volumes, the effects of the temporary increase on the road network is not expected to substantially impact the local neighbourhood in the study area.

Public transport

The impacts on public transport services (buses) would be limited to the overall road network impacts described above, since the buses in the study area typically travel in general traffic lanes. No bus stops would be impacted as part of the construction works during typical construction stage works.

The project would be undertaken above the rail tunnel servicing the T8 – Airport & South Line. The works are however not expected to have any impact on the operation of the existing passenger train network.

Active transport

The construction works would mostly be undertaken within the Botany Line rail corridor. Therefore, impacts on pedestrian and cyclist infrastructure is considered minimal. The potential increase in construction traffic on the identified construction vehicle routes and at the construction access gates may lead to intermittent disruptions to pedestrian and cyclist movements along the existing adjacent footpaths and intersection crossing points. While likely to result in minimal overall travel time impacts on pedestrian and cyclists, these delays are likely to be most prevalent at gate crossing points (if stopped to give way to entering or exiting construction vehicles).

The impact on pedestrian and cyclist safety would also be at its greatest in the vicinity of the gates due to the increased vehicle activity. The gate locations where impacts on footpath users are likely to occur are:

- Banksia Street
- Morgan Street
- Botany Road (adjacent Mill Stream)
- Botany Road (Botany Triangle)
- Joyce Drive–O'Riordan Street (in and out)
- Qantas Drive (in and out).

Point-to-point transport

As noted in section 8.3.1, the overall increase in traffic volumes on the road network generated by the project is not expected to be greater than around 2.6 percent and generally in the order of around 1.0 percent. This level of additional traffic is unlikely to have any tangible effect on point-to-point transport mode travel times in the study area.

Temporary lane closures

There may be a need to implement temporary lane closures on road to support safe and efficient access to the construction gates for larger vehicles and to allow for major construction activities such as installing cranes to build and remove bridge structures. If a traffic lane is required to be closed, it may lead to a short duration reduction in mid-block capacity of the road, which may increase network congestion around the surrounding streets.

8.3.2 Road closure – Robey Street and O'Riordan Street

Overview

Closing Robey Street (between Qantas Drive and O'Riordan Street) or O'Riordan Street (between Qantas Drive and Robey Street) is required to conduct construction activities, ensure worker and general public safety, and as a result of space constraints (for activities such as moving, demolishing and erecting new bridge structures over these streets). A 54-hour weekend closure (from 11 pm Friday to 5 am Monday) would be required to avoid impacts on weekday peak period traffic. ARTC is currently in consultation with Roads and Maritime, Traffic Management Centre and the Transport for NSW Sydney Coordination Office regarding the proposed temporary closures. To facilitate the proposed scope of works, approximately 10 weekend road closures over the proposed three-year construction period would be required.

Only one of the roads is anticipated to be closed at one time, resulting in a detour around the closed portion of road. These closures are shown and discussed further in the following sections. The impact of the proposed weekend closures was assessed at the following key intersections:

- Qantas Drive/Robey Street
- Qantas Drive/O'Riordan Street
- O'Riordan Street/Robey Street

- Robey Street/Botany Road
- General Holmes Drive/Botany Road
- General Holmes Drive/Joyce Drive
- General Holmes Drive/Wentworth Avenue
- Botany Road/Wentworth Avenue.

The Level of Service (LoS) for each intersection analysed was assessed in accordance with Transport for NSW guidelines *(Guide to Traffic Generating Developments*, Roads and Traffic Authority, October 2002), which is shown in Table 8.4. Under these guidelines, the performance of a signalised intersection is measured by the average intersection delay measured in seconds per vehicle.

Table 8.4 Level of Service criteria for intersections

LEVEL OF SERVICE	AVERAGE DELAY (seconds per vehicle)	TRAFFIC SIGNALS
A	Less than 14	Good operation
B	15 to 28	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Operating near capacity
E	57 to 70	At capacity; at signals, incidents would cause excessive delays; roundabouts require other control mode
F	Greater than 71	Unsatisfactory with excessive queuing

Robey Street closure

Proposed detour route

In consultation with Transport for NSW, three existing approach routes to the Robey Street underpass were identified and an alternative detour route developed. The existing and proposed detour routes are described in the following and depicted in Figure 8.4 and Figure 8.5.

- Route 1A:
    - **Existing route**: Left turn from Qantas Drive into Robey Street, then left from Robey Street to O'Riordan Street.
    - **Detour Route**: Travel along Joyce Drive and General Holmes Drive, left turn to Wentworth Avenue, travel along Botany Road, left turn to Robey Street, right turn to O'Riordan Street.
- Route 1B:
    - **Existing route**: Northbound through movement from Seventh Street onto Robey Street, left from Robey Street to O'Riordan Street.
    - **Detour Route**: Right turn to Joyce Drive and General Holmes Drive, left turn to Wentworth Avenue, travel along Botany Road, left turn to Robey Street, right turn to O'Riordan Street.
- Route 1C:
    - **Existing route**: Right turn from Joyce Drive to Robey Street, left from Robey Street to O'Riordan Street
    - **Detour Route**: Turn right onto Wentworth Avenue (rather than travel along Joyce Drive), travel along Botany Road, left turn to Robey Street, right turn to O'Riordan Street.

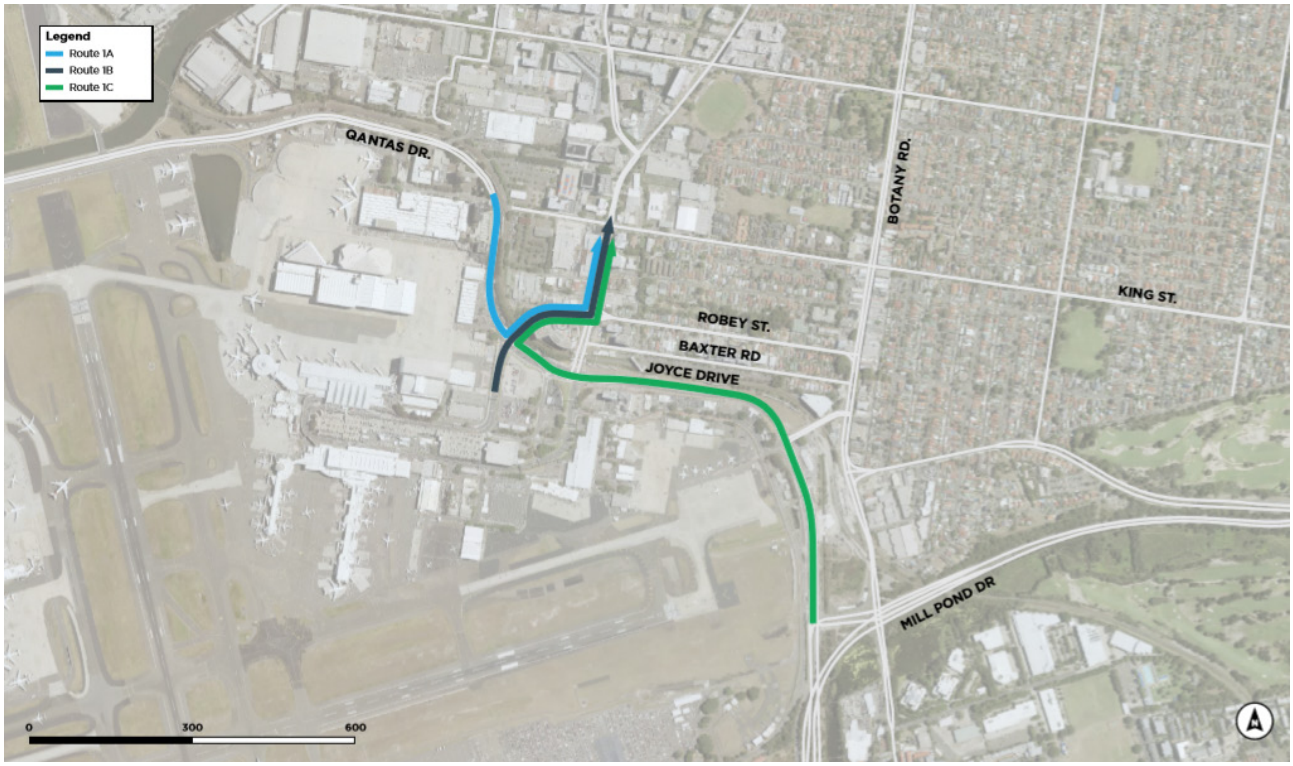

Figure 8.4 Key existing routes for Robey Street

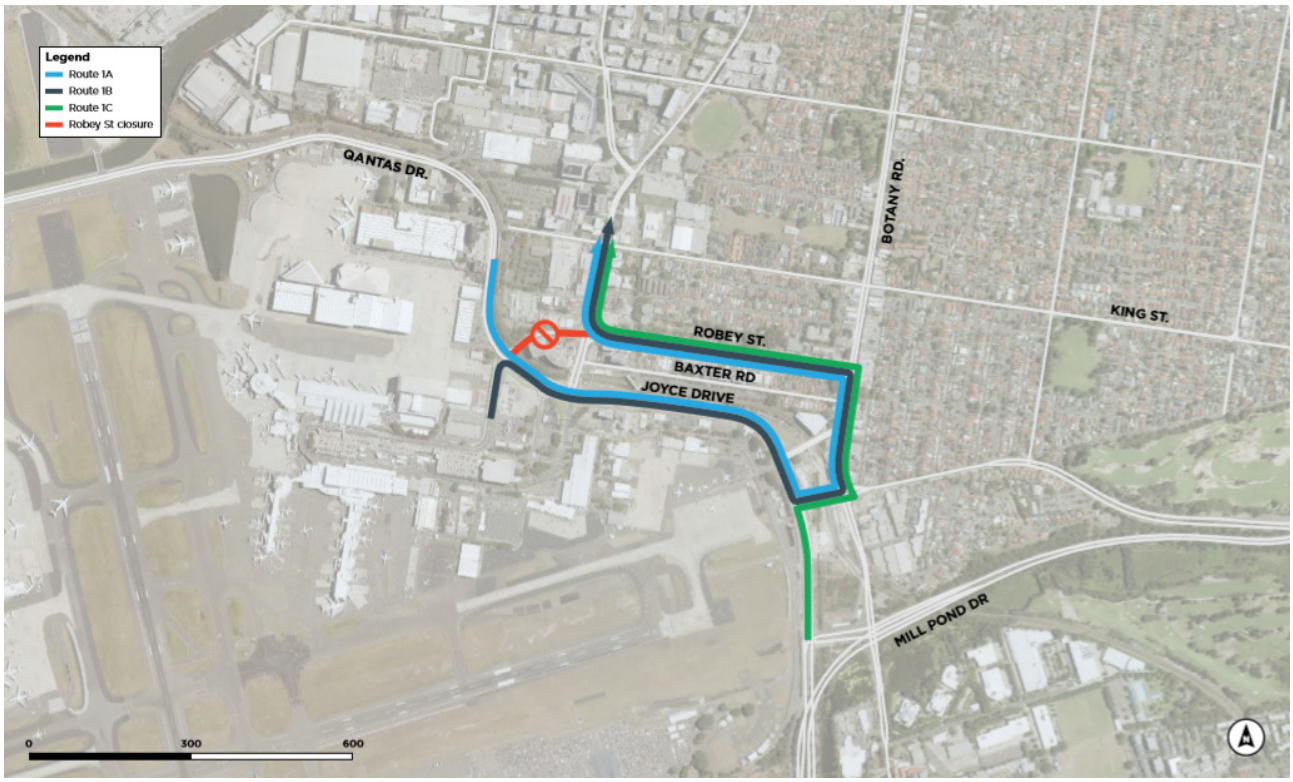

Figure 8.5 Key detour routes for Robey Street (during proposed closure)

The detailed forecast 2022 Base and 2022 Robey Street closure traffic volumes at key intersections, along with the intersection SIDRA performance results are shown in Table 5.7 of *Technical Report 1 – Traffic and Transport Impact Assessment*.

The diversion of traffic due to the proposed detours would result in adverse impacts on the following intersections, with increased delays and intersection capacity exceeded:

- Qantas Drive/Robey Street (degree of saturation > 1.0, LoS F, average delay 193 seconds), compared to a degree of saturation < 1.0, LoS D and average delay of 52 seconds in base year (2022).
- O'Riordan Street/Robey Street (degree of saturation > 1.0, LoS F, average delay 84 seconds), compared to a degree of saturation < 1.0, LoS C and average delay of 32 seconds in base year (2022).
- General Holmes Drive/Wentworth Avenue (degree of saturation > 1.0, LoS F, average delay 82 seconds), compared to a degree of saturation < 1.0, LoS B and average delay of 23 seconds in base year (2022).
- Botany Road/Wentworth Avenue (degree of saturation > 1.0, LoS F, average delay 186 seconds), compared to a degree of saturation < 1.0, LoS C and average delay of 40 seconds in base year (2022).

For vehicles travelling along each of the key impacted routes (1A, 1B and 1C, as shown in Figure 8.5), the detours would result in the following increase in average travel times during the identified Sunday 1 pm-2 pm peak period:

- Detour route 1A: increase of 11.9 minutes
- Detour route 1B: increase of 19.5 minutes
- Detour route 1C: increase of 8.1 minutes.

As such, the anticipated maximum delay for vehicles using the road network during the proposed weekend closure of Robey Street is anticipated to be about 10 to 20 minutes during the Robey Street closure.

Public transport

As bus services travelling via and through the identified detour routes operate with general traffic and without priority, they are expected to experience similar delays to other road users (as described above). Bus route 400 and 420, which travels along Robey Street, between O'Riordan Street and Qantas Drive, during its outbound (eastbound) route would be directly impacted by the Robey Street weekend closures, requiring a detour to be implemented. Inbound (westbound) bus routes would not be detoured. An extract of the route diagram for bus route 400 is shown in Figure 8.6.

Alternatives for bus route 400 have been identified to identify potential impacts and delays as a result of each option. Alternative bus routes during the Robey Street closure would include:

- Option A – servicing all bus stops. This option has been designed to ensure all existing bus stops will be serviced during the closure. Outbound bus services to follow a proposed detour route in an eastbound direction, via Joyce Drive, General Holmes Drive, Wentworth Avenue, Botany Road, and Robey Street to O'Riordan Street.
- Option B – priority for on-time running. This option has been designed to provide a route which is would be more reliable for buses on-time running, and remove the 2-kilometre detour considered in Option A.
- Option C – balancing on-time running and accessibility. This option has been developed to ensure services to the Mascot town centre on Botany Road is maintained, while selecting a route that is less impacted by the closure of Robey Street. The eastbound detour route will travel via Joyce Drive, General Holmes Drive, Botany Road, Coward Street, Sutherland Street before continuing its journey eastbound at Wentworth Avenue.

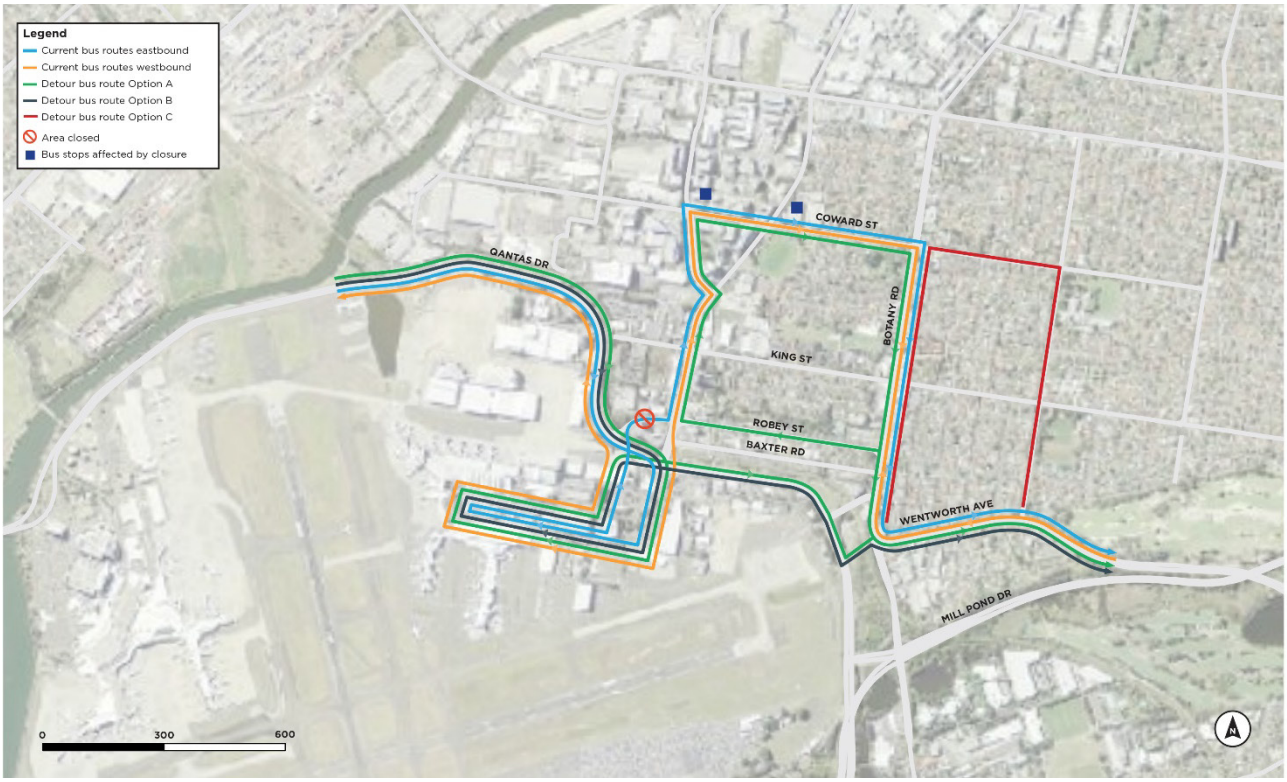

Figure 8.6 Robey Street closure – bus detour routes – 400 and 420

Considering the available options above, it is considered that Option C is ideal for Route 400 and 420 during the day, where a balance of accessibility and on-time running are important. However, Option A would be more ideal for Route 420N, as it prioritises accessibility for all stops and is less likely to be affected by potential traffic congestion issues, due to the low background traffic at night time.

In addition, routes M20, 303, 301, 307, 309, 310, L09, XO9, X10 all run along roads that are proposed as part of the Robey Street detour route. Therefore, these bus services would be affected to some degree by the delays as a result of congestion generated by the diversion away from Robey Street.

ARTC would continue to consult with Transport for NSW regarding the final decision for the preferred detour route.

Active transport

There are no dedicated on-road cycle facilities on Robey Street, however a pedestrian footpath is provided on both sides of the road which would also be closed as a result of the road closure. Pedestrians and cyclists would be diverted to Qantas Drive and O'Riordan Street as an alternate route to bypass the Robey Street closure. While this would increase trip distance (by approximately 100 metres), the overall impact is likely to be minimal. Appropriate signage would also be provided to ensure that pedestrians are appropriately directed to alternative pedestrian routes.

Point-to-point transport

Point-to-point transport modes would be subject to the same road network delays and detours as general traffic, as described earlier in this section. In particular, those trips to/from the Airport terminals would be subject to additional travel time, and therefore potential additional passenger costs.

Parking

There is no on-street parking on this section of Robey Street, therefore there would be no parking impact resulting from the temporary road closure.

O'Riordan Street closure

Proposed detour route

In consultation with Transport for NSW, three existing approach routes to the O'Riordan Street underpass were identified and an alternative detour route developed. The existing and proposed detour routes are described below and depicted in Figure 8.7 and Figure 8.8.

- Route 2A:
    - **Existing route**: Southbound from O'Riordan Street, turning right into Qantas Drive.
    - **Detour Route**: Left turn onto Robey Street, right turn onto Botany Road, right turn into Wentworth Avenue, travel along General Holmes Drive or Joyce Drive.
- Route 2B:
    - **Existing route**: Southbound through movement from O'Riordan Street to Sir Reginald Ansett Drive.
    - **Detour Route**: Left turn onto Robey Street, right turn onto Botany Road, right turn into Wentworth Avenue, travel along General Holmes Drive/Joyce Drive, left turn into Sir Reginald Ansett Drive.
- Route 2C:
    - **Existing route**: Southbound from O'Riordan Street into Joyce Drive.
    - **Detour Route**: Left turn onto Robey Street, right turn onto Botany Road, right turn into Wentworth Avenue, left turn into General Holmes Drive for travel south.

The forecast 2022 Base and 2022 O'Riordan Street closure traffic volumes at key intersections, along with the intersection SIDRA performance results are shown in Table 5.8 of *Technical Report 1 – Traffic and Transport Impact Assessment*.

This shift in traffic volumes due to the proposed detours would result in adverse impacts on the following intersections, with increased vehicle delays and intersection capacity being exceeded:

- Robey Street/Botany Road (degree of saturation > 1.0, LoS F, average delay 74 seconds), compared with degree of saturation <1.0, LoS B and average delay of 19 seconds (in base year)
- Botany Road/Wentworth Avenue (degree of saturation > 1.0, LoS F, average delay 177 seconds), compared with degree of saturation <1.0, LoS C and average delay of 40 seconds (in base year)

For vehicles travelling along each of the key impacted routes (2A, 2B and 2C, as shown in Figure 8.8), the detours would result in the following changes in average travel times:

- Detour route 2A and 2B: increase of 9.9 minutes
- Detour route 2C: increase of 7.9 minutes.

The average delay for vehicles using the road network is anticipated to be about 10 minutes during the O'Riordan Street closure.

Figure 8.7 Impacted key routes for O'Riordan Street

Figure 8.8 Key detour routes for O'Riordan Street (during proposed closure)

Public transport

As bus services travelling via and through the identified detour routes operate with general traffic and without priority they are expected to experience similar delays to other road users. Bus route 400, which travels along O'Riordan Street during its trip towards the airport, would be directly impacted by the O'Riordan Street weekend closures. Bus route 420 would also be directly impacted by the O'Riordan Street weekend closures.

Alternatives for bus route 400 and 420 have been examined to identify potential impacts and delays as a result of each option. Alternative bus routes during the O'Riordan Street closure would include (see Figure 8.9):

- Option A – servicing all bus stops. This option has been designed to ensure all existing bus stops will be serviced during the closure. Inbound bus services would follow the proposed detour route 2B in the westbound direction, via Robey Street, Botany Road, Wentworth Avenue, General Holmes Drive and Joyce Drive, to the intersection of Joyce Drive–Qantas Drive–Sir Reginald Ansett Drive.
- Option B – priority for on-time running. This option has been designed to provide a route that would be more reliable for buses on-time running and remove the 2-kilometre detour considered in Option A.
- Option C – balancing on-time running and accessibility. This option has been developed to ensure services to the Mascot town centre on Botany Road is maintained, while selecting a route that is less impacted by the closure of O'Riordan Street. The westbound detour route would travel via Sutherland Street, Coward Street, Botany Road, General Holmes Drive and Joyce Drive, before continuing its journey westbound at Joyce Drive–Qantas Drive–Sir Reginald Ansett Drive intersection.

Considering the available options above, it is considered that Option C is ideal for Route 400 and 420 during the day, where a balance of accessibility and on-time running are important. However, Option A would be more suitable for Route 420N, as it prioritises accessibility for all stops and is less likely to be affected by potential traffic congestion issues, due to the low background traffic at night time.

As per the Robey Street closure, routes M20, 303, 301, 307, 309, 310, L09, XO9 and X10 all run along roads that are to be used as part of the O'Riordan Street detour route. Therefore, these bus services would be affected by the delays as a result of congestion generated by the diversion away from O'Riordan Street.

As with the Robey Street closure, ARTC would continue to consult with Transport for NSW regarding the final decision for the preferred detour route.

Active transport

There are no dedicated on-road cycle facilities on O'Riordan Street, however a pedestrian footpath is provided on both sides of the road and this would also be closed as a result of the road closure. Pedestrians and cyclists would be diverted to Qantas Drive and Robey Street as an alternate route to bypass the O'Riordan Street closure. While this would increase trip distance (by approximately 260 metres), the overall impact is considered to be manageable.

Point-to-point transport

Point-to-point transport modes would be subject to the same road network delays and detours as general traffic, described earlier in this section. In particular, those trips to and from the Airport terminals would be subject to additional travel time, and therefore result in additional passenger costs.

Parking

There is no on-street parking on this section of O'Riordan Street, so there would be no parking impact resulting from the temporary road closure.

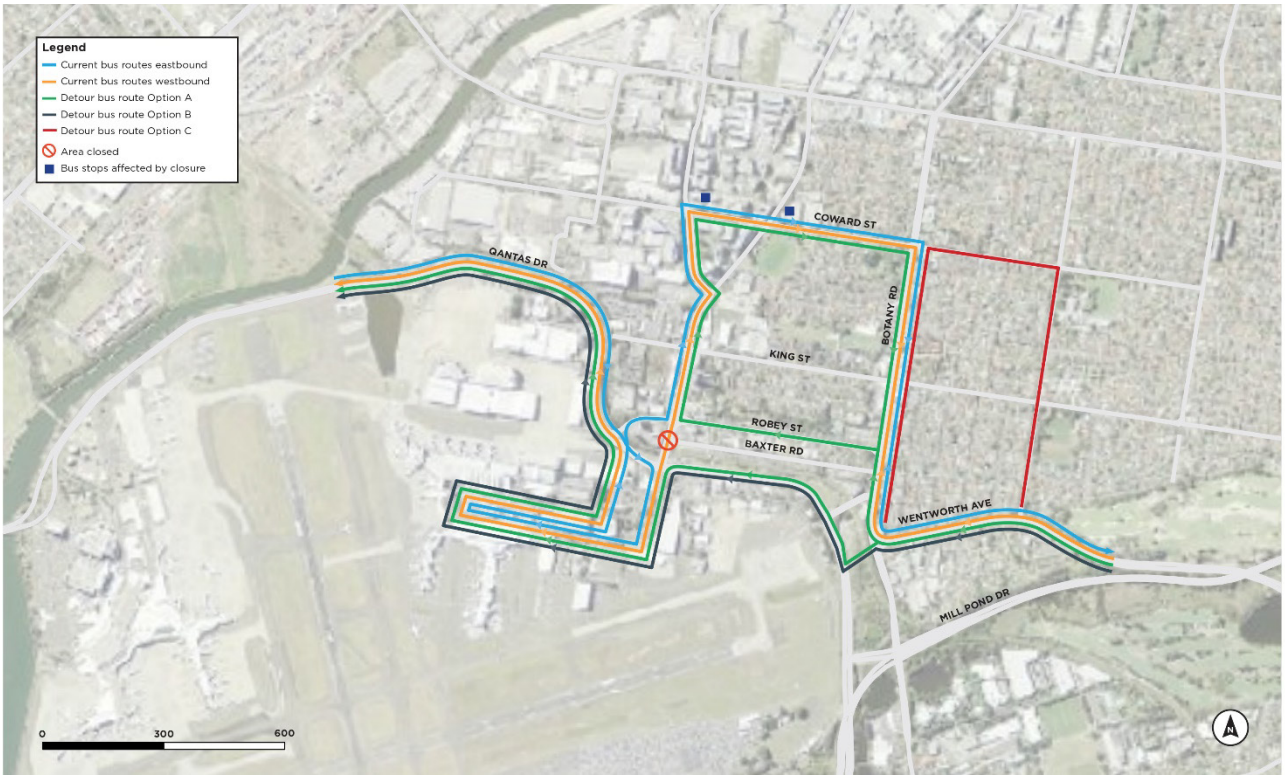

Figure 8.9 O'Riordan Street closure – bus detour routes for 400 and 420

8.3.3 Road closure – Southern Cross Drive

Proposed road closure arrangement

There are three potential road closure arrangements for Southern Cross Drive to correspond with the types of works required at the rail overpass on Southern Cross Drive. Works are proposed generally with closure of the carriageway in one direction with an additional lane closure in the opposing direction. Full closure is not currently anticipated, however given that work in this area is subject to multiple constraints including approval for access within the OLS, it has been considered as a worst-case scenario. In all cases, the road closure period will be between 11 pm to 5 am to align with the airport curfew. Around six closures are anticipated across the three-year construction period.

It is anticipated that any required road closures would typically occur between Monday and Thursday, however there may be some periods where weekend closures are required (such as to align with a scheduled track possession period). As such, potential assessment of both weekday and weekend period impacts has been undertaken.

The types of road closures proposed are:

- **Full road closure** – This represents the worst-case scenario and would have the most impact on the road network. Both directions on the Southern Cross Drive would be impacted and traffic would be detoured via Wentworth Avenue and General Holmes Drive or Joyce Drive to travel southwest bound or northwest bound respectively.
- **Eastbound carriageway road closure** – The road closure proposes to occupy the entire eastbound carriageway and one westbound lane. Eastbound traffic on the Southern Cross Drive would be detoured via Wentworth Avenue. The westbound carriageway would operate at a reduced capacity.

- **Westbound carriageway road closure –** The road closure proposes to occupy the entire westbound carriageway and one eastbound lane. Westbound traffic on the Southern Cross Drive would be detoured via Wentworth Avenue. The eastbound carriageway would operate at a reduced capacity.

The detailed staging of the bridge works and the proposed staging would be developed by the construction contractor and would subject to approval by the relevant roads authority. At this stage, six major closures are anticipated during the project's construction period.

Proposed detour routes

The identified detour routes during the proposed closure of Southern Cross Drive in either direction are shown in Figure 8.10.

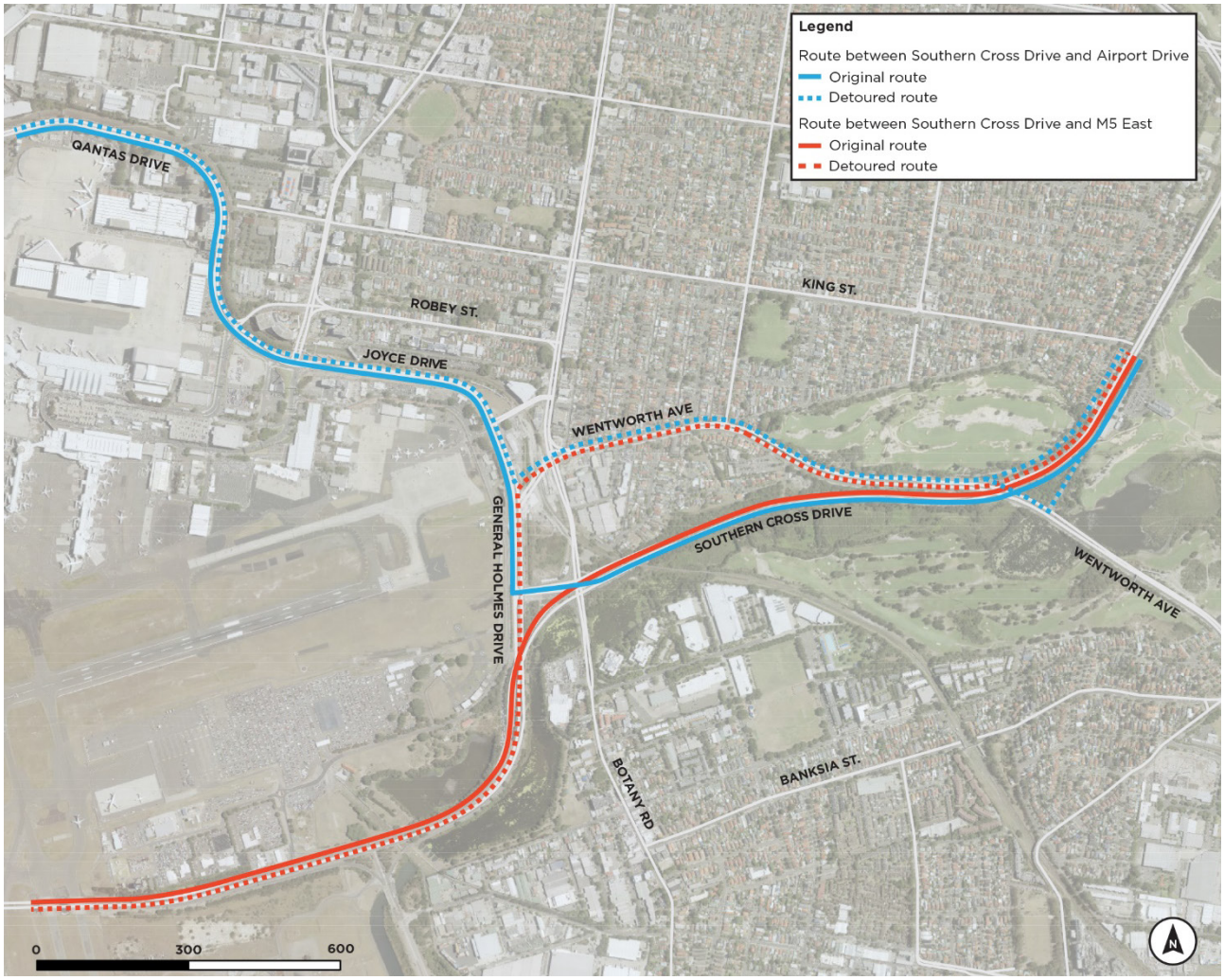

Figure 8.10 Proposed detour routes during Southern Cross Drive closure

The detour routes as shown in Figure 8.10 include:

- Route between Southern Cross Drive and Sydney CBD as well as Qantas Drive/Airport Drive in the northwest direction will be detoured via Wentworth Avenue–General Holmes Drive–Joyce Drive–Qantas Drive.
- Route between Southern Cross Drive and Sydney CBD as well as the M5 East in the southwest direction will be detoured via Wentworth Avenue–General Holmes Drive/M5 East.

Assessment of potential weekday closure

The highest night time one-hour traffic volume on Southern Cross Drive during the midweek period was recorded on Thursday between 11 pm and midnight, where flows on Southern Cross Drive reached 900 vehicles/hour and 400 vehicles/hour in the westbound and eastbound directions respectively. Although a higher bidirectional volume was observed on Wednesday between 4 am and 5 am, modelling indicated that the westbound closure would have a far more significant impact on network performance. Therefore, the one-hour volume for Thursday 11 pm to mid-night was identified as the critical weekday period as the westbound flow was higher during this time period.

Overall, the assessment of the proposed detour routes identified that:

- Modelling results of the 2022 traffic condition the during critical weekday evening peak period 11 pm to midnight are summarised Table 8.5 with key findings as follows:
    - the six key intersections affected by the proposed closure currently operate satisfactorily, with the worst performing intersections (Mill Pond Drive / Botany Road) operating at a level of service B, not surpassing maximum desirable level of service D typically applied in NSW
    - a full-closure during this period would result in slight deterioration of road network performance, with level of service C forecasted at Mill Pond-Botany Road. However, the six key intersections affected by proposed closure would operate satisfactorily, achieving a level of service C or better
    - road closure impacting the eastbound carriageway and one westbound lane would result in slight deterioration of the road network performance. The existing level of service at the assessed intersections are generally able to be maintained.
- The most adverse travel time increase observed during full road closure is observed in the route travelling eastbound from M5 to Southern Cross Drive in the weekday period 11 pm to midnight. The current travel time of approximately 6.7 minutes would be increased to approximately 9.5 minutes, representing an increase of 42 percent (or around 2.8 minutes). Similar delay is also experienced in the closure of the westbound carriageway. The modelling results for the critical peak hour (11 pm to midnight) during the weekday night time period is tabulated in Table 8.6.

Table 8.5 Intersection performance comparison across all road closure scenario (weekday 11 pm-midnight)

ID	INTERSECTION	NO CLOSURE		FULL CLOSURE			EASTBOUND CARRIAGEWAY CLOSURE			WESTBOUND CARRIAGEWAY CLOSURE		
		DELAY (S)	LOS	DELAY (S)	LOS [1]	INCREASED DELAY FROM 'NO CLOSURE' (S)	DELAY (S)	LOS	INCREASED DELAY FROM 'NO CLOSURE' (S)	DELAY (S)	LOS	INCREASED DELAY FROM 'NO CLOSURE' (S)
1	General Holmes Drive–Wentworth Avenue	15	B	24	B	9	27	B	12	17	B	2
2	General Holmes Drive–Mill Pond Drive	16	B	18	B	2	19	B	3	17	B	1
3	Mill Pond Drive–Botany Road	28	B	42	C	14	31	C	3	35	C	7
4	Wentworth Avenue–Botany Road	20	B	22	B	2	23	B	3	22	B	2
5	Wentworth Avenue–Southern Cross Drive on-ramp	9	A	8	A	-1	9	A	0	9	A	0
6	Wentworth Avenue–Southern Cross Drive off-ramp	2	A	21	B	19	2	A	0	21	B	19

(1) Level of service (LoS)

Table 8.6 Key route performance across all road closure scenario (11pm-midnight on weekday)

TRAVEL TIME ROUTE	NO CLOSURE TRAVEL TIME	FULL CLOSURE		EASTBOUND CARRIAGEWAY CLOSURE		WESTBOUND CARRIAGEWAY CLOSURE	
	TRAVEL TIME (MINUTES: SECONDS)	TRAVEL TIME (MINUTES: SECONDS)	INCREASE FROM 'NO CLOSURE' (%)	TRAVEL TIME (MINUTES: SECONDS)	INCREASE FROM 'NO CLOSURE' (%)	TRAVEL TIME (MINUTES: SECONDS)	INCREASE FROM 'NO CLOSURE' (%)
Airport Drive to Southern Cross Drive (citybound)	6:43	8:04	20%	7:49	16%	6:50	2%
Southern Cross Drive to Airport Drive (north-west bound)	7:03	7:51	11%	7:24	5%	7:49	11%
M5 West to Southern Cross Drive (citybound)	6:46	9:35	42%	9:33	41%	6:46	0%
Southern Cross Drive to M5 East (south-west bound)	7:20	9:24	28%	7:20	0%	9:19	27%

Assessment of potential weekend closure

Weekend night traffic volumes were higher than on any weekday evening. During the peak/critical hour (11 pm to midnight), the traffic volume on the Southern Cross Drive was in the order of 2,400 vehicles/hour and 900 vehicles/hour in the westbound and eastbound direction respectively. Friday was found to be the peak week-day period and during the critical hour it carries approximately 1,300 vehicles/hour and 780 vehicles/hour in the respective westbound and eastbound direction, indicating a lower traffic volume than the weekend periods.

Overall, the assessment of the proposed detour routes identified that:

- Modelling results of the 2022 traffic conditions during the peak traffic hour period (Saturday 11.00 pm to midnight) are summarised in Table 8.7 with key findings as follows:
    - The six key intersections affected by the proposed closure currently operate satisfactorily, with the worst performing intersections (Mill Pond Drive–Botany Road and Wentworth Avenue–Botany Road) operating at a level of service C, better than the worst acceptable level of service D typically applied in NSW.
    - A full-closure during this period would adversely impact the performance of the network with level of service F observed at General Holmes Drive–Mill Pond Drive and Wentworth Avenue–Southern Cross Drive off-ramp; level of service E is found at General Holmes Drive–Wentworth Avenue.
    - Road closure impacting the eastbound carriageway and one westbound lane would result in slight deterioration of the road network performance, however still within the threshold of level of service D, which will be experienced at the worst-performing intersection (Wentworth Avenue–Botany Road). Other intersections would operate with acceptable level of service.
    - Road closure impacting the westbound carriageway and one eastbound lane would generally have a higher impact on the road network. Wentworth Avenue–Southern Cross Drive off-ramp would operate at level of service F and Wentworth Avenue–Botany Road will operate at level of service E. A substantial intersection delay of 354 seconds (approximately six minutes) on average would be experienced at the intersection of Wentworth Avenue–Southern Cross Drive off-ramp. This intersection currently operates at level of service A with an average delay of five seconds.
- Modelling results of the 2022 traffic conditions during the second highest peak hour (Saturday midnight to 1.00 am) are summarised in Table 8.8 with key findings as follows:
    - The six key intersections affected by the proposed closure currently operate satisfactorily, with the worst performing intersection (Mill Pond Drive–Botany Road and Wentworth Avenue–Botany Road) operating at a Level of Service C, not surpassing maximum desirable level of service D.
    - A full-closure during this period would result in deterioration of the road network performance, with level of service F forecast at Wentworth Avenue–Southern Cross Drive off-ramp. level of service D is forecast at the intersection of General Holmes Drive–Wentworth Avenue and Wentworth Avenue–Botany Road.
    - Road closure impacting the eastbound carriageway and one westbound lane would result in slight deterioration of the road network performance. The existing levels of service at the assessed intersections are generally able to be maintained.
    - Road closure impacting the westbound carriageway and one eastbound lane would have a higher impact on the road network compared with the eastbound carriageway closure.

- A level of service D is forecasted at the intersection of Wentworth Avenue–Botany Road with an average delay of 42 seconds. This is an increase of one second from the baseline (no closure) operation.

  The worst performing intersection, Wentworth Avenue–Southern Cross Drive off-ramp, is forecast to operate at a level of service F with the average delay at the intersection estimated at 173 seconds (approximately three minutes), which is half the delay of those assessed in the period 11:00 pm to midnight. This level of service is not desirable and the average delay of 173 seconds would be a substantial increase on the four seconds assessed without any road closure.

- Impacts on travel time for the key routes affected by the detour correspond with the findings of intersection performance above. The modelling results for the critical peak hour (11.00 pm to midnight) and the second highest peak hour (midnight to 1.00 am) during the weekend night time period are shown in Table 8.9 and Table 8.10 respectively. The key findings of the analysis are as follows:
  - All routes are expected to be subjected to increased travel time.
  - The most adverse travel time increase observed during full road closure is observed in the route travelling westbound from Southern Cross Drive to M5 in the weekend period 11:00 pm to midnight. The current travel time of approximately 7.5 minutes would be increased to approximately 19 minutes, representing an increase of 148 percent. Similar delay is also experienced in the closure of the westbound carriageway. Due to the higher traffic volume affected in the westbound direction, the closure of the westbound carriageway is considered to be the key driver of substantial delay experienced in the road network.

    During this period, closure of the eastbound carriageway would result in a slight increase in travel time. The worst increase is observed for the citybound route from M5 to Southern Cross Drive. This route would experience an increase from under 7 minutes to approximately 11 minutes.
  - In the second weekend peak hour period (midnight to 1 am), greatest travel time increase observed during full road closure is observed in the route travelling westbound from Southern Cross Drive to M5. The current travel time of approximately 7.5 minutes would be increased to approximately 13.5 minutes, representing an increase of 86 percent. Similar delay is also experienced in the closure of the westbound carriageway. Due to the higher traffic volume affected in the westbound direction, the closure of the westbound carriageway is considered to be the key driver of substantial delays experienced in the road network.

    During this period, closure of the eastbound carriageway would result in a slight increase in travel time. The worst increase is observed for the citybound route from M5 to Southern Cross Drive. This route would experience an increase from under 7 minutes to approximately 11 minutes.

Table 8.7 Intersection performance comparison across all road closure scenarios (11 pm–midnight on weekend)

ID	INTERSECTION	NO CLOSURE		FULL CLOSURE			EASTBOUND CARRIAGEWAY CLOSURE			WESTBOUND CARRIAGEWAY CLOSURE		
		DELAY (S)	LOS	DELAY (S)	LOS	INCREASED DELAY FROM 'NO CLOSURE' (S)	DELAY (S)	LOS	INCREASED DELAY FROM 'NO CLOSURE' (S)	DELAY (S)	LOS	INCREASED DELAY FROM 'NO CLOSURE' (S)
1	General Holmes Drive–Wentworth Avenue	25	B	67	E	42	38	C	13	25	B	0
2	General Holmes Drive–Mill Pond Drive	24	B	75	F	51	28	B	4	16	B	-8
3	Mill Pond Drive–Botany Road	29	C	42	C	31	31	C	2	35	C	6
4	Wentworth Avenue–Botany Road	39	C	54	D	15	44	D	5	63	E	24
5	Wentworth Avenue–Southern Cross Drive on-ramp	11	A	12	A	1	11	A	0	10	A	-1
6	Wentworth Avenue–Southern Cross Drive off-ramp	5	A	359	F	354	16	B	11	354	F	349

Table 8.8 Intersection performance comparison across all road closure scenario (midnight–1 am on weekend)

ID	INTERSECTION	NO CLOSURE		FULL CLOSURE			EASTBOUND CARRIAGEWAY CLOSURE			WESTBOUND CARRIAGEWAY CLOSURE		
		DELAY (S)	LOS	DELAY (S)	LOS	INCREASED DELAY FROM 'NO CLOSURE' (S)	DELAY (S)	LOS	INCREASED DELAY FROM 'NO CLOSURE' (S)	DELAY (S)	LOS	INCREASED DELAY FROM 'NO CLOSURE' (S)
1	General Holmes Drive–Wentworth Avenue	24	B	48	D	24	41	C	17	26	B	2
2	General Holmes Drive–Mill Pond Drive	23	B	24	B	1	26	B	3	14	B	-9
3	Mill Pond Drive–Botany Road	28	C	41	C	13	32	C	4	35	C	7
4	Wentworth Avenue–Botany Road	41	C	52	D	11	38	C	-3	42	D	1
5	Wentworth Avenue–Southern Cross Drive on-ramp	11	A	11	A	0	11	A	0	11	A	0
6	Wentworth Avenue–Southern Cross Drive off-ramp	4	A	141	F	137	15	B	11	173	F	169

Table 8.9 Key route performance across all road closure scenario (11 pm–midnight on weekend)

TRAVEL TIME ROUTE	NO CLOSURE TRAVEL TIME	FULL CLOSURE		EASTBOUND CARRIAGEWAY CLOSURE		WESTBOUND CARRIAGEWAY CLOSURE	
	TRAVEL TIME (MINUTES: SECONDS)	TRAVEL TIME (MINUTES: SECONDS)	INCREASE FROM 'NO CLOSURE' (%)	TRAVEL TIME (MINUTES: SECONDS)	INCREASE FROM 'NO CLOSURE' (%)	TRAVEL TIME (MINUTES: SECONDS)	INCREASE FROM 'NO CLOSURE' (%)
Airport Drive to Southern Cross Drive (citybound)	6:32	8:47	34%	8:46	34%	8:54	36%
Southern Cross Drive to Airport Drive (northwest bound)	7:41	17:15	124%	9:41	26%	17:39	130%
M5 West to Southern Cross Drive (citybound)	6:48	15:30	128%	10:58	61%	9:16	36%
Southern Cross Drive to M5 East (southwest bound)	7:32	18:42	148%	10:14	36%	19:18	156%

Table 8.10 Key route performance across all road closure scenario (midnight–1 am on weekend)

TRAVEL TIME ROUTE	NO CLOSURE TRAVEL TIME	FULL CLOSURE		EASTBOUND CARRIAGEWAY CLOSURE		WESTBOUND CARRIAGEWAY CLOSURE	
	TRAVEL TIME (MINUTES: SECONDS)	TRAVEL TIME (MINUTES: SECONDS)	INCREASE FROM 'NO CLOSURE' (%)	TRAVEL TIME (MINUTES: SECONDS)	INCREASE FROM 'NO CLOSURE' (%)	TRAVEL TIME (MINUTES: SECONDS)	INCREASE FROM 'NO CLOSURE' (%)
Airport Drive to Southern Cross Drive (citybound)	6:35	8:57	36%	8:43	32%	9:11	40%
Southern Cross Drive to Airport Drive (northwest bound)	7:39	11:40	52%	9:39	26%	12:18	61%
M5 West to Southern Cross Drive (citybound)	6:44	11:16	68%	10:49	61%	9:09	36%
Southern Cross Drive to M5 East (southwest bound)	7:20	13:41	86%	9:58	36%	14:10	93%

Public transport

Rail services

The road closure location on Southern Cross Drive is not within the vicinity of passenger rail lines. As such, there would be no expected impacts on the passenger rail network.

Bus services

There are currently no public transport bus services on Southern Cross Drive, as such the road closure would not directly impact them. However, bus services are currently available on Wentworth Avenue, which is the detour routes for the proposed road closure.

Regular bus service 400 and 420 conclude their service approximately around midnight and 1.00am respectively (Transport for NSW information website). Route 420N (night service), however continues to service the route, arriving hourly between 1.00 am and 5.00 am.

Buses may therefore experience slight delays through the proposed detour route, during the implementation of the road closure.

Active transport

There are no dedicated pedestrian or bicycle facilities on Southern Cross Drive. Active transport use however is typically done during daylight, outside of the proposed road closure period. However, this does not preclude any on-road bicycle access. As such, cyclists would be detoured in the same manner as motorised vehicles. It is considered that the proposed impact to the active transport mode in general would be minimal.

Taxi transport

Point-to-point transport modes would be subject to the same road network delays and detours as general traffic, described earlier in this section. However, as the major attractor/generator for point-to-point transport mode (Kingsford Smith Airport) would not be operating during the proposed road closure period, the impact to this mode is considered to be minimal.

Parking

All parking would be contained within the work site, presenting no impact on the surrounding roads.

8.4 Assessment of operational impacts

As described previously, the primary driver of the project is to support improved rail efficiency to and from Port Botany and enable more freight to be moved by rail to meet expected increases in freight demands over the long term.

Following completion of construction, the project is not expected to result in any permanent changes to the existing road network, pedestrian footpaths or bus networks. There would be no impacts during operational period given the project lies within the existing rail corridor which was allocated with the intent of duplication in the future. In addition, the project would not preclude the establishment of any new active transport corridors outside or adjacent to the current rail corridor.

The duplication of the Botany Line would unlock additional rail network capacity (with improved travel times through the Botany Line), resulting in a potential increase in the number of freight rail services supporting the movement of goods. By 2030, the Botany Duplication Project is expected to allow for increased freight movement on the Botany Line from the current average of about 20 trains per day (per direction) up to around 45 trains per day (per direction) by 2030, based on current and predicted operational requirements identified by ARTC.

The project also presents an opportunity to encourage a shift of freight transport from road towards rail. The increased rail capacity also has the potential to reduce the number of number of trucks in the region This would also support a potential reduction in the rate of growth in truck movements and associated traffic congestion around Sydney Airport and Port Botany. The reduction of heavy vehicle traffic on the road network would not only free up capacity for general traffic, it also has the potential to provide road safety advantages. Based on the data available in the NSW Freight and Ports Plan 2018–2023, the provision of a single 600-metre long freight train is roughly equivalent to the haulage capacity of around 54 trucks.

While overall there may not be any noticeable decrease in congestion levels on the road network, the cost of freight movement may decrease as freight is shifted from a mode which can be severely impacted by road network congestion to another which has no interaction with other modes. The increased efficiency of the existing rail line as a result of the project would be a vital part of the solution to encourage freight to be transported by rail, reducing the need to transport freight by road and therefore overall congestion on the roads around Port Botany and Sydney Airport.

8.5 Cumulative impacts

8.5.1 Cumulative construction impacts

Cumulative construction traffic, transport and access impacts may occur if construction on the project occurs at the same time as construction on other nearby projects. Table 8.11 summarises the potential cumulative construction traffic, transport and access impacts identified.

Table 8.11 Summary of cumulative construction traffic, transport and access impacts

PROJECT	POTENTIAL CUMULATIVE CONSTRUCTION TRAFFIC, TRANSPORT AND ACCESS IMPACTS
Sydney Gateway road project	Construction of the proposed Sydney Gateway project is expected to commence during the construction of the project, resulting in simultaneous construction. Construction of the two projects is likely to increase the overall level of traffic using the existing road network, increasing the potential impact and duration of the traffic delays and other impacts experienced by drivers and pedestrians/cyclists.
WestConnex Stage 3a (the M4–M5 Link)	The proposed opening of WestConnex Stage 3a (the M4–M5 Link) would have notable network impacts with the construction of the T2/T3 viaduct, which is proposed to begin in late 2022, and which coincides with the project's bridge construction works at Robey Street, O'Riordan Street and Southern Cross Drive. Construction (and subsequent operation) of the two projects would have the potential to result in increases to general traffic in the local area. Additionally, should the two projects not overlap directly, increased construction traffic fatigue may still be experienced by drivers, pedestrians and cyclists.
Qantas Flight Training Centre	Should construction of this facility overlap with construction of the project, the increased amount of traffic between the two projects is not expected to result in significant impacts on the existing traffic network.

PROJECT	POTENTIAL CUMULATIVE CONSTRUCTION TRAFFIC, TRANSPORT AND ACCESS IMPACTS
Airport North and Airport East upgrades	It is anticipated that both the Airport North and Airport East upgrade projects would be completed when the construction of the project begins. However, while not directly overlapping, construction fatigue from ongoing increases in traffic levels (as a result of ongoing construction works) may be experienced by drivers, pedestrians and cyclists.
F6 Extension – Stage 1	Should construction of this facility overlap with construction of the project, the increased amount of traffic between the two projects may result in increases to the overall level of traffic within the vicinity of the project (in particular at the western end of the project site).

Overall, it is likely that there would be some cumulative construction traffic impacts where construction of two (or more) of the identified projects are undertaken at the same time. The main cumulative impact would be associated with an overall potential increase in the amount of overall traffic using the local road network, rather than a specific increase in traffic at any one location.

Where more than one project occurs in the same area consecutively, there may also be a combined effect from the increased duration of impacts on nearby receivers. This effect is termed ‘construction fatigue’. There is the potential for construction traffic fatigue for drivers, pedestrians and cyclists who currently utilise the local road network. This is due to several consecutive and ongoing projects in the area including Airport East, Airport North, Sydney Gateway road project, Qantas Flight Training centre and the currently proposed project.

Further discussion regarding potential cumulative impacts is provided in section 5.4 of *Technical Report 1 – Traffic and Transport Impact Assessment*.

8.5.2 Cumulative operational impacts

As discussed in section 8.5, it is not expected that the project would result in any ongoing impacts on the existing road network, pedestrian footpaths or bus networks during operation of the project. As such, it is not anticipated that there would be any ongoing cumulative impacts between the Botany Rail Duplication project and other known proposed projects.

8.6 Management of impacts

8.6.1 Approach

The identified traffic, transport and access impacts identified would be reduced through a number of mitigation measures. These measures would be detailed as part of a Construction Transport, Traffic and Access Management Plan (CTTAMP) as part of the project CEMP. The CTTAMP would include the guidelines, general requirements and principles of traffic management to be implemented during construction. It would be prepared in accordance with Austroads Guide to Road Design (Austroads 2019), the Roads and Maritime Services *Traffic Control at Work Sites* manual (RMS 2018b) and AS1742.3 (2009): *Manual of uniform traffic control devices – Part 3: Traffic control for works on roads*, and other relevant standards and guidelines. It would seek to minimise delays and disruptions as well as identify and respond to changes in road safety as a result of project construction works.

The CTTAMP would outline a process to develop site-specific Traffic Management Plans in consultation with Transport for NSW. Part of this process would be to facilitate relevant licenses and permits for road occupation.

Further details on the approach to management of environmental impacts is provided in Chapter 24.

8.6.2 List of mitigation measures

The mitigation measures that would be implemented to address potential traffic, transport and access impacts are listed in Table 8.12. This table also outlines which mitigation measures (during the construction stage) would be implemented during the enabling works and main construction works. Further details regarding each of the identified mitigation measures are provided in section 6.2 to section 6.7 of *Technical Report 1 – Traffic and Transport Impact Assessment*.

Table 8.12 Traffic, transport and access mitigation measures

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
Construction	General management of traffic during the project	Implementation of a CTTAMP for main construction works. As a minimum, the plan will include: • identification of haulage routes • notification and consultation strategy with public and relevant authorities/stakeholders • special event and emergency services management • parking restrictions • protocol for monitoring cumulative traffic impact. The CTTAMP will also consider cumulative construction impacts and define a suitable management approach. The CTTAMP will not be created for enabling works, however the relevant mitigation measures will form part of the site EMPs. *Note: relevant mitigation measures will form part of the site EMP(s) for enabling works.*	✓	✓
	Localised vehicular, pedestrian, cyclists and public transport management around site accesses	Provide suitably designed construction site access which will consider: • road design guidelines • visible temporary regulatory, warning and guide signs • use of accredited traffic controllers where appropriate • provision of deceleration lanes at access points for busy roads.	✓	✓
	Increased heavy vehicles in the road network	• Administrative controls to limit truck activities during peak periods. • Implement radio communication and designated truck idling areas to minimise impact of truck queuing on public roads. • Temporary traffic controls.	✓	✓

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
	On-street parking management	• Maximise parking at each site and compound. • Encourage carpooling/cycling/public transport. • Providing shuttle buses between off-site parking locations. • Providing shuttle buses between the two main on-site compounds and smaller construction compounds.	✓	✓
	Public transport services travel time	• Consultation with service providers to develop alternative service arrangements. • Notification to the general public prior to implementation of service changes. • Changes to services during possessions.		✓
	Active transport facility closures and diversions	• Ensure appropriate detours such as maintaining access on at-least one side of the road. • Provide safe access across site gates.		✓
	Reduced accessibility on the road network. Detour can result in increased travel time.	• Manage closures during off-peak periods. • Select a bus detour route that would minimise impacts on punctuality of bus services and public transport accessibility to the community. • Implement suitable traffic management during closures to manage and guide motorists at the approaches and through or around the work sites. • Public information campaigns. • Truck travel time management.		✓

8.6.3 Consideration of the interaction between measures

In addition to the measures for traffic, transport and access described above, there would be interactions between the mitigation measures for noise and vibration (Chapter 9) and socio-economic (Chapter 19).

All mitigation measures for the project will be consolidated and described in the relevant management plan. The plan would identify measures that are common between different aspects. Common impacts and common mitigation measures will be consolidated to ensure consistency and implementation.

8.6.4 Managing residual impacts

A residual risk analysis was undertaken considering the impact assessment summarised in this chapter and implementation of the mitigation measures as recommended in section 8.6.2.

Despite the measures identified, there would likely be some residual impacts associated with the construction of the project. This would include delays along the key routes within the study area as well as at key intersections during road closure periods. Some delays may also result from general construction traffic and haulage accessing the main construction compounds and satellite work sites.

The residual risk levels for potential traffic, transport and access issues are detailed in Appendix B.

9. NOISE AND VIBRATION

This chapter provides a summary of the noise and vibration assessment undertaken by SLR Consulting. A full copy of the assessment report is provided as *Technical Report 2 – Noise and Vibration Impact Assessment*.

9.1 Assessment approach

A summary of the approach to the assessment is provided in this section, including the legislation, guidelines and policies driving the approach and the methodology used to undertake the assessment. A more detailed description of the approach and methodology is provided in *Technical Report 2 – Noise and Vibration Impact Assessment*.

9.1.1 Legislative and policy context to the assessment

Guidelines and policies for construction noise and vibration assessment

Interim Construction Noise Guideline (ICNG) (DECC, 2009)

The ICNG is used to assess and manage impacts from construction noise on residences and other sensitive land uses in NSW. It contains procedures for determining project specific Noise Management Levels (NMLs) for sensitive receivers based on the existing background noise in the area. The NMLs are not mandatory limits, however where construction noise levels are predicted to be or measured above the NMLs, feasible and reasonable work practices to minimise noise emissions should be investigated. The NMLs adopted for this noise assessment are outlined in section 9.2.3. The 'worst-case' noise levels from construction of a project are predicted and then compared to the NMLs in a 15-minute assessment period to determine the likely impact of the project (see section 9.3).

Other guidelines and policies

Other guidelines and policies relevant to the construction noise and vibration assessment for the project include:

- *Noise Policy for Industry* (NPfI) (EPA, 2017), which provides a method for assessing sleep disturbance and maximum noise level assessment, which was used in the selection of noise management levels and criteria (see section 9.2.3).
- *Road Noise Policy* (RNP) (DECCW, 2011), which provides a method for assessing construction traffic impacts on public roads, which was used in the construction traffic noise assessment (see section 9.3.2).
- *Assessing Vibration: a technical guideline* (DEC, 2006a), which is used to assess human comfort vibration impacts on sensitive receivers and was used in the construction vibration assessment (see section 9.3.3).
- *AS2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors,* which provides recommended design sound levels for internal areas of occupied spaces (see Table 9.5).
- *BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2* (BSI, 1993), which is used to assess vibration impacts (structural damage) on non-heritage sensitive structures (see section 9.3.3).
- *DIN 4150:Part 3 – 2016 Structural vibration – Effects of vibration on structures* (Deutsches Institute fur Normung, 1999), which is used to assess vibration impacts (structural damage) on heritage sensitive structures or where the structure is found to be unsound (see section 9.3.3).

Guidelines and policies for operational noise and vibration assessment

Rail Infrastructure Noise Guideline (RING) (EPA, 2013)

The RING is used to assess and manage potential airborne noise impact from the operation of new and redeveloped railway projects. The guideline provides non-mandatory 'trigger levels' for residential and other sensitive land uses. These trigger levels have been used to determine the criteria for the operational rail noise impact assessment (see section 9.4.1).

However, the RING does not provide specific criteria for hotels. Certain hotels may have people who reside permanently on site. Therefore, the RING residential criteria has been conservatively applied to hotels, noting that this assessment would only apply to areas of permanent residence within specific hotels. Other areas of hotels are considered commercial land uses, which do not have operational noise criteria as per the RING. The RING also provides ground-borne noise criteria for the operation of rail infrastructure projects. Ground-borne noise criteria only applies where internal ground-borne noise levels are higher than noise transmitted through the air. As discussed in section 9.4.1, the airborne noise impact is expected to be higher than the ground-borne noise impact for this project.

Other guidelines and policies

Other guidelines and policies relevant to the operational noise and vibration assessment for the project include:

- *Noise Prediction and Mitigation Guideline* (ARTC, 2018), which is an internal ARTC document that forms part of ARTC's Environmental Management System and provides guidance on the assessment and design of mitigation measures for ARTC projects (see section 9.6).
- *Assessing Vibration: a technical guideline* (DEC, 2006a), which is used to assess vibration impacts on sensitive receivers (see section 9.4.2).
- *AS2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors,* which provides recommended design sound levels for internal areas of occupied spaces (see Table 9.5).

9.1.2 Methodology

Key tasks

The noise and vibration assessment involved:

- identifying noise and vibration sensitive receivers
- identifying existing noise and vibration levels in the study area by measuring the noise levels through:
  - unattended noise monitoring in June, September and October 2018 (the noise monitoring locations are shown in Figure 9.1)
  - short-term attended noise monitoring at each noise monitoring location
  - train pass-by noise measurements in June and July 2018 at seven locations (see Table 4 in *Technical Report 2 – Noise and Vibration Impact Assessment*) to determine existing operational rail noise
- establishing noise and vibration criteria and management levels to provide a basis for assessing the potential for impacts during construction and operation of the project
- identifying the main potential noise and vibration sources during construction and operation
- developing a noise and vibration model based on 13 representative construction scenarios (see section 9.3.1) to predict airborne noise generated during construction
- developing and validating a noise and vibration model to predict noise levels from operation of the project (see section 4.2 in *Technical Report 2 – Noise and Vibration Impact Assessment*)

- assessing the potential for noise and vibration to exceed the applicable criteria and impact on the amenity of sensitive receivers
- identifying noise and vibration mitigation measures.

A detailed description of the assessment methodology is provided in sections 2 and 4 of *Technical Report 2 – Noise and Vibration Impact Assessment*.

Study area

For the purpose of the noise assessment, the study area (the area surrounding the project site) was divided into eight noise catchment areas (NCAs) (see section 9.2.2).

9.1.3 Risks identified

The preliminary environmental risk assessment undertaken for the project (provided in Appendix B) included potential risks associated with noise and vibration. Potential risks were considered according to the impacts that may be generated by the construction or operation of the project. The likelihood, consequence and overall risk level of each potential risk were assessed, with avoidance and management measures defined for each potential risk. Further information on the risk assessment, including the approach, methodology and full results, is provided in Appendix B.

The assessed risk level for potential noise and vibration risks (without mitigation) ranged from low to very high. Prior to assessment and identification of mitigation measures, risks with an assessed level of medium or above included:

- Very high:
    - noise impacts on local residents and sensitive receivers from out-of-hours construction activities
    - noise impacts on local residents and sensitive receivers from the operation of trains.
- High:
    - noise impacts on local residents and sensitive receivers from construction activities within standard work hours
    - noise impacts on local residents and sensitive receivers from out-of-hours construction traffic.
- Medium:
    - noise impacts on local residents and sensitive receivers from construction traffic during the day
    - damage to structures including heritage structures from vibration caused by construction activities.

These potential risks and impacts were considered as part of the assessment. This also considered matters identified by the SEARs and stakeholders (as described in Chapters 3 and 4). The residual risk levels, following implementation of the mitigation measures proposed in this EIS, are discussed in section 9.6.4.

9.1.4 How potential impacts have been avoided or minimised

As described in sections 6.1.2 and 7.1.1, design development and construction planning have included a focus on avoiding or minimising the potential for environmental impacts during all key phases of the process.

The potential for construction noise and vibration impacts has been minimised by:

- locating the construction access points and construction traffic routes away from sensitive areas
- considering the surrounding land uses when defining the use and operation of specific site compounds
- locating construction compounds and other construction areas within the existing rail corridor wherever possible.

Potential noise and vibration impacts during operation have been minimised by proposing a lubrication procedure to reduce high frequency wheel squeal from operational trains. The procedure would involve the application of a friction modifying agent (lubricant) to the top running surface of the rail, where it would be picked up by the wheels of passing trains.

9.2 Existing environment

9.2.1 Overview

Existing noise levels at the project site are generally dominated by transportation noise, with road, rail and aircraft noise affecting most locations during the day. This is because the project site is located close to:

- Sydney Kingsford Smith Airport
- Major roads including Joyce Drive, Qantas Drive and O'Riordan Street in the northwest and Southern Cross Drive and Botany Road in the southeast
- The Botany Line (runs through the project site), which is an existing freight rail line.

During the evening and night-time, ambient noise levels typically decrease due to a reduction in road traffic volumes on the surrounding road network and flight curfew at Sydney Airport from 11:00 pm to 6:00 am.

The project site is also surrounded by areas of residential receivers in Mascot and Botany and commercial areas near Sydney Airport and Botany Road, where noise from light industrial activities is present as times.

9.2.2 Noise catchment areas

The study area for the noise assessment is made up of eight NCAs, which are described in Table 9.1 and shown on Figure 9.1. Receivers that are potentially sensitive to noise and vibration have been categorised on the basis of their use, which includes residential dwellings, commercial/industrial buildings or 'other sensitive' land uses, such as educational institutions, childcare centres, medical facilities, places of worship, outdoor recreation areas, etc. The locations of receivers and the receiver types are shown in Figure 9.1. Table 2 of *Technical Report 2 – Noise and Vibration Impact Assessment* provides further details on the other (non-residential) sensitive receivers within the study area.

Table 9.1 Noise catchment areas and surrounding land uses

NCA	DESCRIPTION OF NCA	OTHER SENSITIVE RECEIVERS WITHIN NCA
NCA01	Located to the north of the Botany Line and Sydney Airport. This catchment is mainly commercial with some distant residential receivers in the north, near Coward Street. A number of hotels are in this catchment, including the Stamford Plaza Hotel which is immediately north of the rail corridor. Robey Street Bridge and O'Riordan Street Bridge are in this catchment.	• Child care: Aero Kids Early Learning Centre, Toybox Early Learning • Place of worship: Citygate Fellowship Church • Hotel: Holiday Inn, Ibis Sydney Airport, Stamford Plaza Sydney Airport, Adina Apartments, Travelodge, Pullman Hostel • Outdoor passive: Coleman Reserve
NCA02	This catchment is south of the rail corridor and covers Sydney Airport. The catchment is mainly commercial with the Qantas Flight Training Centre to the west, and the Ibis Budget and Mantra Hotel near the Joyce Drive and O'Riordan Street intersection.	• Educational: Qantas Flight Training Centre • Hotel: Ibis Budget Sydney Airport, Mantra Hotel
NCA03	This catchment is located north of the rail corridor in Mascot and is mainly residential, with the nearest receivers opposite the rail corridor on Baxter Road. Two hotels, Quest Mascot and Felix Hotel, are located near O'Riordan Street.	• Educational: Mascot Public School • Library: Mascot Library • Hotel: The Branksome Hotel, Quest Mascot, Felix Hotel • Medical: Mascot Medical & Dental Centre • Outdoor passive: Robey Street Reserve, John Curtin Reserve
NCA04	Located east of the rail corridor in Mascot, north of Southern Cross Drive. The catchment is mainly residential with the nearest receivers being on Botany Road and McBurney Avenue. A commercial area is located near Wentworth Avenue and Botany Road. Southern Cross Drive Bridge is in the south extent of this NCA. Airport East construction works are currently being completed.	• None
NCA05	This catchment is north of the rail corridor and is the Eastlake Golf Course.	• Outdoor active: Eastlake Golf Course
NCA06	Located south of the rail corridor and to the south of Southern Cross Drive. The catchment is primarily commercial use. Mill Stream Bridge is located in the north of the catchment.	• Outdoor active: Botany Aquatic Centre, Booralee Park
NCA07	Located to the east of the rail corridor in Pagewood. This catchment is generally residential with the nearest receivers being adjacent to the project on Myrtle Street, Banksia Street and Ocean Street.	• Child care: Pagewood Kindergarten • Outdoor passive: Gaiarine Gardens
NCA08	Located to the west of the rail corridor in Botany. This catchment is mainly residential with the nearest receivers being adjacent to the project on Ellis Street, Morgan Street and Victoria Street.	• Outdoor active: Garnet Jackson Reserve

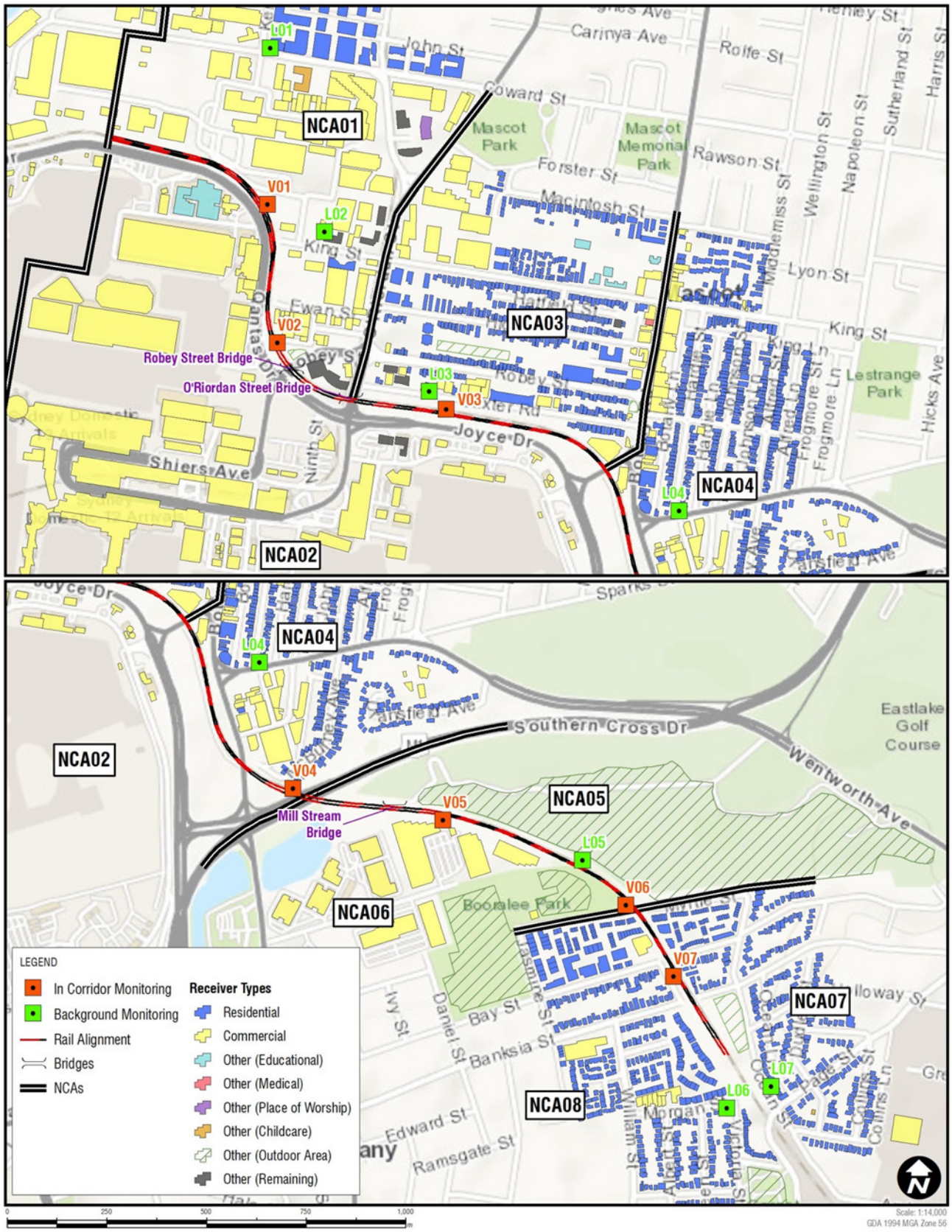

Figure 9.1 NCAs, receivers and noise monitoring locations within the noise assessment study area

9.2.3 Existing noise levels and noise management levels

Table 9.2 provides the noise levels that were measured during the unattended noise monitoring (see section 2.3 in *Technical Report 2 – Noise and Vibration Impact Assessment*). The noise monitoring locations (shown on Figure 9.1) were selected to measure background noise levels at front row receivers in each NCA. These locations would likely be most affected during construction of the project and represent the 'worst-case noise impacts' for the NCA.

The attended measurements (see section 2.4 in *Technical Report 2 – Noise and Vibration Impact Assessment*) were generally consistent with the results of the unattended noise monitoring and show that the existing noise levels are typically dominated by transportation sources including road, rail and aircraft noise, depending on location.

In addition, train pass-by levels were measured to determine the noise from existing rail operations on the Botany Line and validate the rail noise assessment model. Table 5 in *Technical Report 2 – Noise and Vibration Impact Assessment* presents the results of the train pass-by measurements.

The existing noise levels were used to develop project specific NMLs for residential receivers (see Table 9.3). NMLs for other receiver types are provided in Table 9.4 and Table 9.5.

Table 9.2 Summary of unattended noise logging results

ID	ADDRESS	MEASURED NOISE LEVEL (dBA)[1]					
		Background noise (RBL)			Average noise level (L_{Aeq})		
		Day	Evening	Night	Day	Evening	Night
L01	39 Kent Road, Botany	60	56	50	71	69	67
L02[2]	289 King Street, Mascot	60	58	53	68	66	64
L03	105 Baxter Road, Mascot	54	51	45	67	65	62
L04	87 Hardie Street, Mascot	57	54	48	69	66	64
L05	Eastlake Golf Club Pagewood	47	47 (49 actual)[3]	45	61	68	57
L06	13 Morgan Street, Botany	39	39 (41 actual)[3]	37	56	53	51
L07	38 Ocean Street, Pagewood	46	46	43	58	54	54

(1) Daytime is 7.00 am to 6.00 pm, evening is 6.00 pm to 10.00 pm and night-time is 10.00 pm to 7.00 am.

(2) This location was influenced by noise from nearby construction works.

(3) The monitored evening level was found to be higher than the daytime, therefore the NPfI requires that the evening level be reduced to match the daytime level.

Table 9.3 Residential receiver construction NMLs

NCA	REPRESENTATIVE BACKGROUND MONITORING LOCATION	NML ($L_{Aeq(15minute)}$ – dBA)				SLEEP DISTURBANCE SCREENING CRITERIA (RBL +15 dB)
		Standard construction (RBL +10 dB)	Out of hours (RBL +5 dB)			
		Daytime	Daytime[1]	Evening	Night-time	
NCA01	L01[2]	70	65	61	55	65
NCA02[3]	–	–	–	–	–	–
NCA03	L03	64	59	56	50	60
NCA04	L04	67	62	59	53	63
NCA05[3]	–	–	–	–	–	–
NCA06[3]	–	–	–	–	–	–
NCA07	L07	56	51	51	48	58
NCA08	L06	49	44	44	42	52

(1) Daytime out of hours includes 7.00 am to 8.00 am on Saturday, 1.00 pm to 6.00 pm on Saturday, and 8.00 am to 6.00 pm on Sunday and public holidays.

(2) NCA01 has two noise monitoring locations – L01 and L02. L01 has been used to set the NMLs for the catchment as it has lower background levels and results in more stringent criteria.

(3) NCA has no residential receivers.

Table 9.4 ICNG NMLs for other sensitive receivers

LAND USE	NML $L_{Aeq(15minute)}$ (APPLIED WHEN THE PROPERTY IS IN USE)
Classrooms at schools and other education institutions	Internal noise level 45 dBA[1]
Hospital wards and operating theatres	Internal noise level 45 dBA[1]
Places of Worship	Internal noise level 45 dBA[1]
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants)	External noise level 65 dBA
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion)	External noise level 60 dBA
Community centres	Refer to the recommended 'maximum' internal levels in AS 2107 for specific uses
Commercial	External noise level 70 dBA

(1) The criterion is specified as an internal noise level for this receiver category. As the noise model predicts external noise levels, it has been conservatively assumed that all schools and places of worship have openable windows, and external noise levels are 10 dB higher than the corresponding internal level. This is representative of windows being partially open to provide ventilation. Hospital wards are assumed to have fixed windows with 20 dB higher external levels.

Table 9.5 AS2107 NMLs for other sensitive receivers

USE	PERIOD	AS2107 CLASSIFICATION	NML $L_{Aeq(15minute)}$
Hotel	Daytime and evening	Bars and lounges	Internal noise level 50 dBA[1]
	Night-time	Sleeping Areas: Hotels near major road	Internal noise level 40 dBA[1]
Library	When in use	Reading areas	Internal noise level 45 dBA[1]

(1) These receivers are assumed to have fixed windows with a conservative 20 dB reduction assumed for external to internal noise levels.

9.3 Assessment of construction impacts

9.3.1 Construction scenarios and equipment assessed

Table 9.6 describes the representative scenarios that have been developed to assess the likely noise impacts from the various construction phases of the project. These scenarios represent the 'worst-case', as it is assumed that several items of construction equipment would be in use at the same time at the closest point to each receiver. In reality, it is anticipated that the worst-case noise levels would only last for short periods of time during the construction duration, and there would be periods when no (or limited) noisy construction activities occur.

Table 9.6 Summary of construction scenarios modelled

ID	SCENARIO	TYPE OF WORK	DESCRIPTION
1a	Enabling Works – Billboard Demolition	Fixed	Enabling works would be required early on in the project to allow the main construction activities to occur. These works are expected to include: • billboard removal – several existing billboards on Qantas Drive and Joyce Drive would likely be impacted by the project and would require removal • utility relocation/protection – ground works to adjust, relocate or protect existing services • vegetation clearing and property adjustment – works required to remove existing vegetation and adjust property boundaries before starting the main works. Works using noise intensive equipment would be required at certain times and would include the use of concrete saws during billboard removal and utility works, and chain saws and chippers during vegetation removal.
1b	Enabling Works – Utilities	Progressive	
1c	Enabling Works – Vegetation Clearing & Property Adjustments	Progressive	
2a	Compounds – Establishment	Fixed	The main compounds would be near the level crossing off General Holmes Drive, which is an existing compound off Banksia Street within the existing rail corridor. The main compounds would include site offices, worker amenities and workforce parking. Smaller satellite compounds would be located along the alignment and have limited worker amenities. Groundworks would be required to establish the compounds. Operation of the compounds would last throughout construction and would include deliveries, storage of equipment and materials, and typical worker activities. Compound operation generally has no requirement for noise intensive equipment.
2b	Compounds – Operations	Fixed	

ID	SCENARIO	TYPE OF WORK	DESCRIPTION
3a	Bridge Works – Demolition (including rockbreakers)	Fixed	There are four bridge locations in the project site – Mill Stream bridge, Southern Cross bridge, O'Riordan Street bridge and Robey Street bridge. New bridge structures would be required at each location and demolition and replacement of the existing bridge would be required at O'Riordan Street and Robey Street. Works using noise intensive equipment would be required at certain times during bridge demolition and would include the use of concrete saws or rockbreakers.
3b	Bridge Works – Construction	Fixed	
4a	Retaining Walls – Construction	Progressive	Retaining wall works would be required where the alignment is on embankment. Retaining wall works would include: • excavation and preparation of foundations • piling works, including construction of piling platforms • installation of panels and reinforcement.
5a	Track Works – Peak	Progressive	The track works would involve the construction of new track, the upgrading of existing track and installation of new crossovers, turnouts and catchpoints. The works would vary but could include: • ground works to excavate, backfill and compact formation layer • installing concrete sleepers, rail and fastenings • ballast placing and tamping track to final height • cutting and welding rails. The works have been categorised into 'Peak' and 'Typical' works. An example of 'Peak' work includes the use of noise intensive equipment for shorter durations along the project site. These could be concrete saws or track machines including a ballast tamper or ballast regulator. 'Typical' works are representative of noise levels outside the worst-case when noise intensive equipment isn't being used.
5b	Track Works – Typical	Progressive	
6a	Signalling (including the CSR)	Progressive	The existing CSR would require adjustment and relocation due to the new track alignment. New signalling equipment would also be required in certain locations. Signalling and CSR works would include: • ground excavation • installation of conduit and cable pulling • excavation and installation of pits • installation of equipment. Signalling works generally have no requirement for noise intensive equipment.
6b	Testing, Commissioning & Finishing	Progressive	Testing and commissioning works are required for the new track and signalling equipment prior to operation. Finishing works would include: • removal of temporary fencing • landscape activities • removal of ancillary compounds. Testing, commissioning and finishing works generally have no requirement for noise intensive equipment.

The locations of the construction activities modelled in the scenarios are shown in Figure 9.2.

Construction of a majority of the project would be carried out during standard construction hours. Standard construction hours as defined in the ICNG are:

- Monday to Friday: 7.00 am to 6.00 pm
- Saturday: 8.00 am to 1.00 pm
- Sundays and public holidays: no work.

However, evening and night-time work would be required at certain times (or for certain activities) for the full duration of construction to minimise impacts on road, rail and air traffic, and for safety reasons. For example, the construction works for the Robey, O'Riordan and Mill Stream bridges are highly constrained by the operational Botany Line and major roads, and therefore would require evening and night-time work for safety and access. Therefore, out-of-hours work (OOHW, see section 4.1.1.1 in *Technical Report 2 – Noise and Vibration Impact Assessment*) has been included in the construction noise assessment, as all scenarios would likely require construction activities to occur outside of standard construction hours at some point.

Some of the construction scenarios are progressive (would move along the alignment and would not impact the same receivers for the duration of the scenario) and some are fixed works (works that would remain in one place and may impact the same receivers for duration of the scenario).

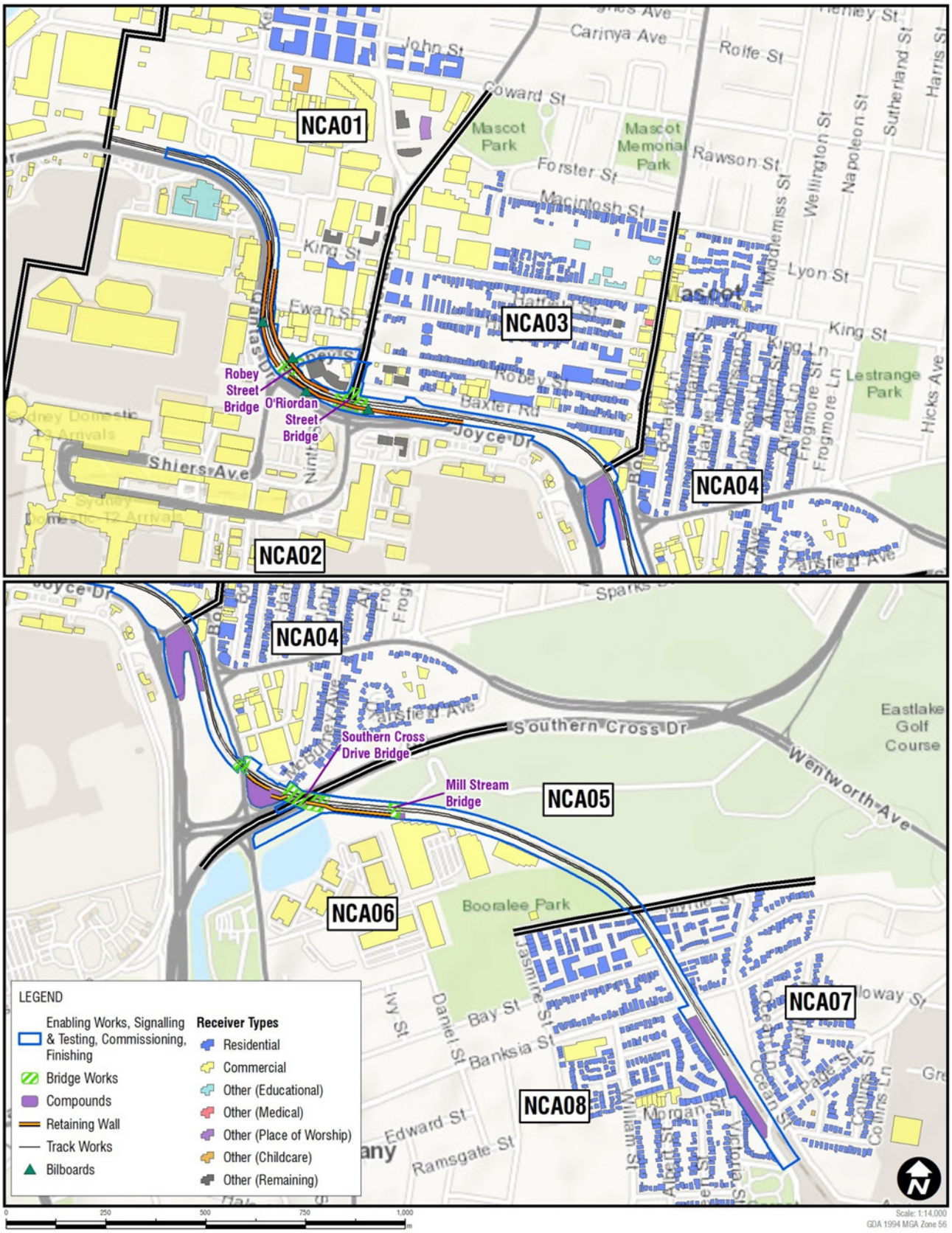

Figure 9.2 Location of construction works relative to NCAs and sensitive receivers

9.3.2 Construction noise assessment results

Predicted construction noise impacts on residential receivers

Table 9.7 presents the predicted exceedances of the adopted NMLs (see section 9.2.3) for residential receivers in each NCA during the construction scenarios outlined in section 9.3.1. The predicted construction noise level exceedances are presented for the most affected receiver within each NCA. This is conservative as receivers which are further away from the works and/or shielded from view would experience lower noise impacts.

Table 9.7 Predicted construction noise exceedances - residential receivers

PERIOD	ID	SCENARIO	CONSTRUCTION ACTIVITY	NCA01	NCA03	NCA04	NCA07	NCA08
Daytime	1a	Enabling Works	Billboard Demolition	·	●	·	·	·
	1b		Utilities	·	◆	◆	■	■
	1c		Veg. Clearing & Property Adjustment	·	◆	◆	■	■
	2a	Compounds	Establishment	·	·	·	●	■
	2b		Operations	·	·	·	·	◆
	3a	Bridge Works	Demolition (incl. rockbreaker)	·	●	◆	·	●
	3b		Construction	·	·	●	·	·
	4a	Retaining Walls	Construction	·	·	●	·	·
	5a	Track Works	Peak	·	◆	◆	■	■
	5b		Typical	·	·	·	●	◆
	6a	Signalling (incl. combined services route)		·	●	●	◆	■
	6b	Testing, Commissioning & Finishing		·	●	●	◆	■
Evening	1a	Enabling Works	Billboard Demolition	·	●	·	·	·
	1b		Utilities	●	■	◆	■	■
	1c		Veg. Clearing & Property Adjustment	●	■	■	■	■
	2a	Compounds	Establishment	·	·	·	●	■
	2b		Operations	·	·	·	·	◆
	3a	Bridge Works	Demolition (incl. rockbreaker)	·	◆	■	·	●
	3b		Construction	·	●	◆	·	·
	4a	Retaining Walls	Construction	·	●	◆	·	·
	5a	Track Works	Peak	●	■	■	■	■
	5b		Typical	·	●	●	◆	◆
	6a	Signalling (incl. combined services route)		·	◆	●	■	■
	6b	Testing, Commissioning & Finishing		·	◆	◆	■	■

PERIOD	ID	SCENARIO	CONSTRUCTION ACTIVITY	NCA01	NCA03	NCA04	NCA07	NCA08
Night-time	1a	Enabling Works	Billboard Demolition	·	◆	·	·	·
	1b		Utilities	●	■	■	■	■
	1c		Veg. Clearing & Property Adjustment	◆	■	■	■	■
	2a	Compounds	Establishment	·	●	●	◆	■
	2b		Operations	·	·	·	●	■
	3a	Bridge Works	Demolition (incl. rockbreaker)	●	◆	■	●	●
	3b		Construction	·	◆	■	·	●
	4a	Retaining Walls	Construction	●	◆	◆	·	●
	5a	Track Works	Peak	●	■	■	■	■
	5b		Typical	·	●	●	◆	■
	6a	Signalling (incl. combined services route)		·	◆	◆	■	■
	6b	Testing, Commissioning & Finishing		·	◆	◆	■	■

● Marginal to minor exceedance (1-10 dB) ◆ Moderate exceedance (11-20 dB) ■ High exceedance (>20 dB)
Cells with no coloured shape represent no exceedances of the NMLs
No results for NCA02, NCA05 or NCA06 are presented as there are no residential receivers within these NCAs

Scenarios resulting in the highest noise impacts

The results in Table 9.7 show that the highest noise impacts are predicted for scenarios that include use of noise intensive equipment such as rockbreakers, concrete saws or ballast tampers. This includes:

- Scenario 1b, Enabling Works – Utilities
- Scenario 1c, Enabling Works – Vegetation Clearing and Property Adjustment
- Scenario 2a, Compounds – Establishment
- Scenario 5a, Track Works – Peak
- Scenario 6a, Signalling including the combined services route
- Scenario 6b, Testing, Commissioning and Finishing.

Scenarios that do not require noise intensive equipment, such as Scenario 5b – Track Works – Typical, would generally result in considerably lower noise impacts than the worst-case scenarios predicted.

Figure 9.3 shows the locations of the predicted exceedances for the worst-case scenario, Scenario 1c – Enabling Works – Vegetation Clearing and Property Adjustment, which was identified to have the highest predicted noise levels, including the highest impacts for night-time work. During this scenario, high noise impacts are predicted to be experienced by the nearest receivers to the project site in most NCAs. However, the worst-case impacts would only occur for a relatively short period of time when noise intensive equipment is in use.

Several scenarios would require consecutive days of OOHW to minimise impacts on road, rail and air traffic and for safety reasons, which could result in sleep disturbance impacts at nearby receivers. These scenarios include (see section 5.6 in *Technical Report 2 – Noise and Vibration Impact Assessment*):

- Scenario 3b – Bridge Works – Construction, which would require major out-of-hours road closures for bridge construction at Southern Cross Drive.
- Scenario 3a – Bridge Works – Demolition, which would require major out-of-hours road closures for works near traffic lanes at Robey and O'Riordan Streets.
- Scenarios where works are required immediately adjacent to the active rail line. This would need to be carried out during morning rail possessions, such as Scenario 4a – Retaining Walls – Construction, Scenario 5a/b – Track Works, Scenario 6a – Signalling (including the CSR).

Scenario resulting in the longest duration noise impacts

The construction scenarios would occur for varying durations.

Scenario 2b – Compounds – Operation would occur for the longest period of time during the construction period compared to the other construction scenarios. This means that the noise impacts from Scenario 2b would be experienced for the longest period of time at surrounding sensitive receivers compared to the other scenarios. Scenario 2b is predicted to result in moderate to high noise level exceedances for the nearest row of residential receivers to the compound in NCA08, depending on the time of day.

Most affected residential receivers

NCA07 and NCA08 (located to the south of Eastlake Golf Course in Botany and Pagewood) would experience the highest noise impacts during construction of the project due to the close proximity of residential receivers in this area to the project site. These high noise impacts would be experienced at NCA07 and NCA08 during daytime, evening and night-time work for several construction scenarios.

NCA03 and NCA04 (located in Mascot near Joyce Drive and Botany Road) are also predicted to experience high noise impacts, however only during periods where evening or night-time work is required at these locations. During the daytime, the noise level exceedances at NCA03 and NCA04 are expected to be moderate to minor.

NCA01 is expected to experience some minor noise impacts during evening or night-time work.

The receivers which would potentially be affected by sleep disturbance impacts would generally be the same receivers where 'high' night-time impacts have been predicted.

Highly noise affected residential receivers

Residential receivers that are subject to noise levels of 75 dBA or greater are considered Highly Noise Affected by the ICNG. Highly noise affected residential receivers are predicted during:

- Scenario 1b – Enabling Works – Utilities within NCA08 (39 receivers), NCA07 (13 receivers), NCA04 (three receivers), NCA03 (three receivers)
- Scenario 1c – Enabling Works – Vegetation Clearing and Property Adjustment within NCA08 (72 receivers), NCA07 (32 receivers), NCA04 (8 receivers), NCA03 (11 receivers)
- Scenario 3a – Bridge Works – Demolition including rockbreaker within NCA04 (2 receivers)
- Scenario 3b – Bridge Works – Construction within NCA04 (one receiver)
- Scenario 5a – Track Works – Peak within NCA08 (40 receivers), NCA07 (21 receivers), NCA03 (seven receivers), NCA04 (four receivers)
- Scenario 6b – Testing, Commissioning and Finishing within NCA07 (one receiver).

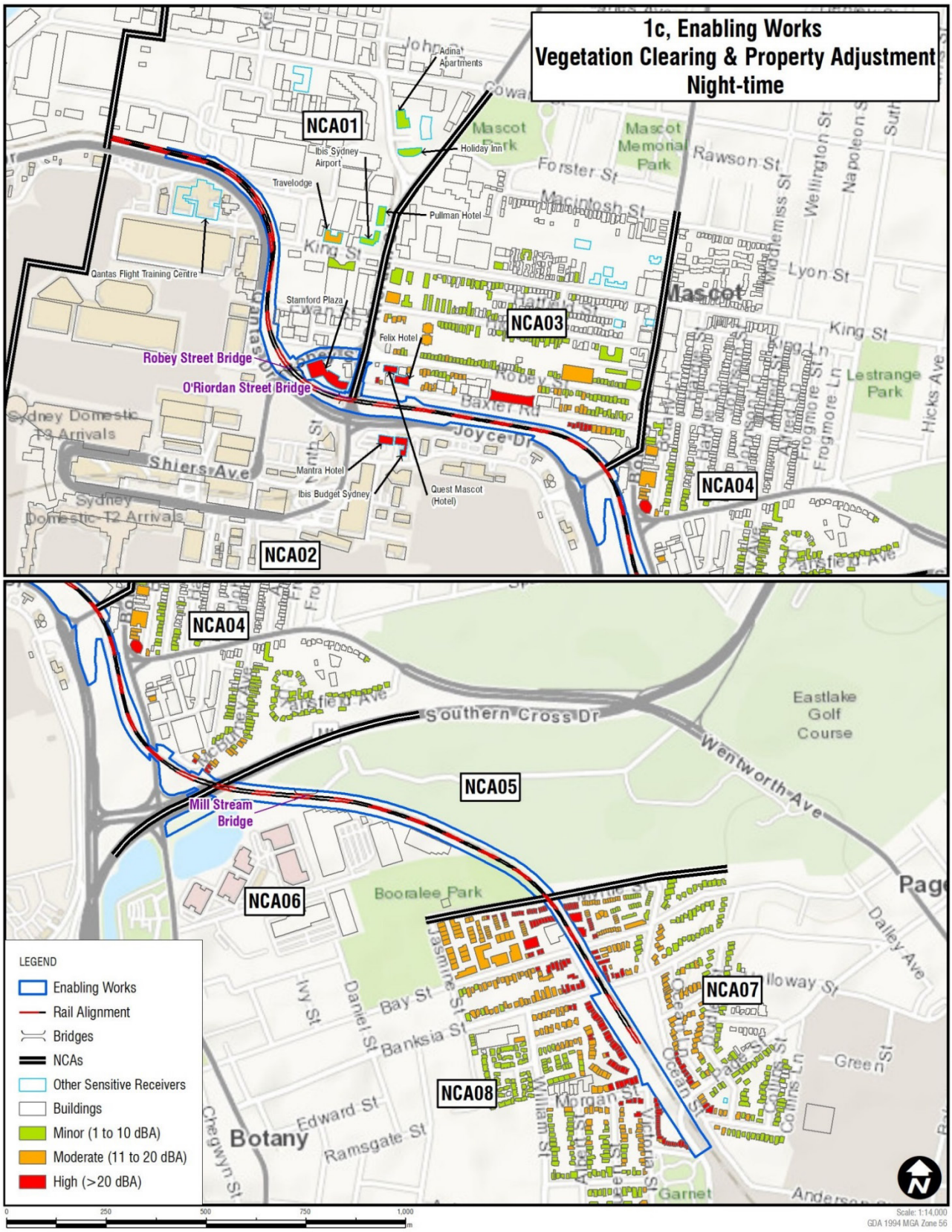

Figure 9.3 Predicted noise level exceedances for Scenario 1c during night-time work

Predicted construction noise impacts on other sensitive receivers

Table 9.8 presents the predicted exceedances of the adopted NMLs (see section 9.2.3) for the other sensitive receivers in each NCA during the construction scenarios outlined in section 9.3.1.

Figure 9.4 shows the locations of predicted noise level exceedances at other sensitive receivers during the worst-case scenarios. Similar to the assessment of residential impacts (see section 9.3.2), the worst-case scenarios include use of noise intensive equipment, which would only be typically used for short periods of time. The predicted noise levels without use of noise intensive equipment would be significantly lower.

During the worst-case scenarios, the following other sensitive receivers are predicted to experience high noise impacts from construction of the project:

- Stamford Plaza Hotel and Travelodge in NCA01
- Mantra Hotel and Ibis Budget Sydney Airport Hotel in NCA02
- Quest Hotel and Felix Hotel in NCA03
- The Qantas Flight Training Centre.

It is noted that a new hotel is proposed on Qantas Drive as part of the Sydney Airport T2/T3 Ground Access Solutions and Hotel project. This new hotel would be located around 60 metres south of the project site, which is a similar distance to the Mantra Hotel and Ibis Budget Hotel in NCA02. Should this hotel open during the construction of the project, the potential noise impacts would be comparable to the impacts predicted for the Mantra Hotel and Ibis Budget Hotel.

Another new hotel (the Holiday Inn) is also currently being constructed on Sarah Street in Mascot. If this hotel becomes operational during construction of the project, the potential construction noise impacts would be comparable to the impacts predicted for the Quest Hotel.

However, it is expected that the facade of the new hotels would be high performing, due to proximity to the airport, which would likely reduce the potential airborne construction noise impacts. The existing hotels listed above are also likely to have high performance facades and glazing due to high existing noise levels, which could potentially reduce construction noise to acceptable internal levels.

The Qantas Flight Training Centre provides flight training for pilots and cabin crew and operates continuously. It has several specialist flight simulators that are highly sensitive to noise impacts as they simulate aircraft warning sounds and events, which need to be easily discernible by pilots during training. However, it is noted that Qantas are proposing to relocate the centre to King Street in Mascot around 40 metres from the project site. If operational, the new centre could potentially be subject to high noise impacts during construction of this project. However, it is anticipated that the new centre would be constructed with appropriate facades to manage the high existing noise levels from the Botany Line and Sydney Airport, which would also likely mitigate the potential construction noise impacts from this project.

During the worst-case scenarios, the following other sensitive receivers are predicted to experience moderate or minor noise impacts from construction of the project:

- Aero Kids Early Learning Centre in NCA01
- Eastlake Golf Course in NCA05
- Booralee Park in NCA06
- Pagewood Kindergarten and Gaiarine Gardens in NCA07
- Other hotels within the study area.

The remaining ‘other sensitive’ receivers identified are not expected to experience noise impacts from construction of the project.

Table 9.8 Predicted construction noise exceedances – other sensitive receivers

ID	SCENARIO	ACTIVITY	NUMBER OF RECEIVERS																									
			Educational			Medical			Place of Worship			Child Care			Library			Outdoor Active			Outdoor Passive			Hotels – Daytime			Hotels – Night-time		
			1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB
1a	Enabling Works	Billboard Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	3	1	-	3	3	1
1b		Utilities	-	1	-	-	-	-	-	-	-	2	-	-	-	-	-	2	-	-	1	1	-	1	4	1	4	1	5
1c		Clearing and Property Adjustment	1	-	1	-	-	-	-	-	-	1	1	-	-	-	-	2	-	-	-	1	1	2	5	1	2	2	6
2a	Compounds	Establishment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-
2b		Operations	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
3a	Bridge Works	Demolition (incl. rockbreaker)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	2	3	-	4	2	3
3b		Construction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	4	-	-	1	4	-
4a	Retaining Walls	Construction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	4	1	-	3	4	1
5a	Track Works	Peak	-	-	1	-	-	-	-	-	-	2	-	-	-	-	-	2	-	-	-	2	-	1	4	1	4	1	5
5b		Typical	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	4	1	-
6a	Signalling (incl. combined services route)		1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	4	-	-	2	4	-
6b	Testing, Commissioning & Finishing		-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	4	1	-	1	4	1

Cells with no number represent no exceedances of the NMLs

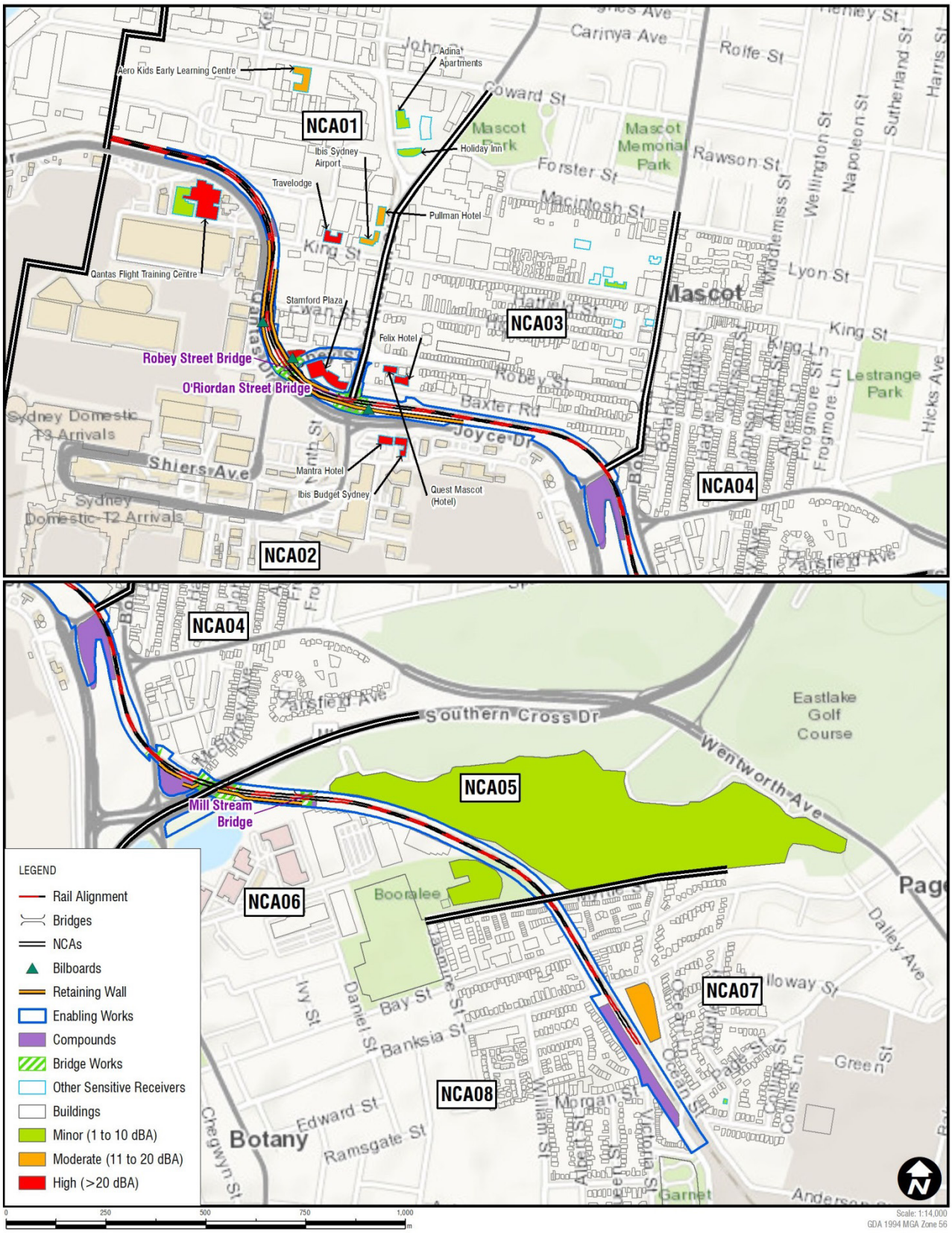

Figure 9.4 **Predicted noise exceedances at other sensitive receivers during the worst-case scenario**

Predicted construction noise impacts on commercial receivers

The assessment predicted that no commercial receivers within the study area would experience high noise impacts during construction of the project. However, several commercial receivers would experience moderate noise impacts including during:

- Scenario 1b, Enabling Works – Utilities for commercial receivers in NCA03, NCA04 and NCA08
- Scenario 1c, Enabling Works – Vegetation Clearing and Property Adjustment for commercial receivers in NCA01, NCA02, NCA03, NCA04, NCA06 and NCA08
- Scenario 3a, Bridge Works – Demolition (incl. rockbreaker) for commercial receivers in NCA06
- Scenario 5a, Track Works – Peak for commercial receivers in NCA01, NCA02, NCA03, NCA04, NCA06 and NCA08.

Figure 9.5 shows the locations of predicted worst-case construction noise impacts on commercial receivers.

Construction traffic noise assessment

The construction of the project would result in a temporary increase in the number of vehicles on roads surrounding the project site due to construction worker vehicles and material pick-up and deliveries. This has the potential to temporarily increase the existing road traffic noise levels on roads used by construction related traffic.

As shown on Figure 9.6, it is expected that the existing road traffic noise levels on major roads surrounding the project would only increase by up to 1 dBA due to construction related traffic. Therefore, construction traffic is unlikely to result in a noticeable increase in traffic noise levels. This is due to the high existing volumes of traffic that currently use the assessed routes.

However, if construction vehicles use smaller local roads to access the project site (which were not assessed as potential haulage routes in this assessment), there may be a noticeable increase in road traffic noise as the existing traffic volumes and corresponding traffic noise levels are likely to be relatively low on these roads. This potential impact is unlikely, as local road usage would be avoided where possible during construction of the project.

There would potentially be a requirement to close certain roads and traffic lanes during construction to allow works to be completed in a safe manner and to ease space constraints (refer to section 8.3). The potential impacts to receivers from detour traffic has been evaluated qualitatively and are summarised in Table 9.9.

Table 9.9 Qualitative noise impacts from detours

CLOSURE	ROADS USED FOR DETOUR	POTENTIAL IMPACTS
Robey Street or O'Riordan Street	Joyce Drive, General Holmes Drive, Wentworth Avenue, Botany Road, Robey Street	The majority of the proposed detour routes are busy arterial roads with high existing traffic volumes and few adjacent sensitive receivers, meaning the potential noise impacts are likely to be relatively minor. An exception to this is Robey Street, which has a much lower volume of existing traffic and residential receivers in close proximity. Road traffic noise levels on Robey Street would potentially be increased by >2.0 dB during detour periods.
Southern Cross Drive	Wentworth Avenue, General Holmes Drive, Joyce Drive, Qantas Drive	The majority of the proposed detour routes are busy arterial roads with high existing traffic volumes and few adjacent sensitive receivers. Wentworth Avenue does have adjacent residential receivers, however, existing volumes on this road are generally high. The potential noise impacts during detours of Southern Cross Drive are likely to be relatively minor.

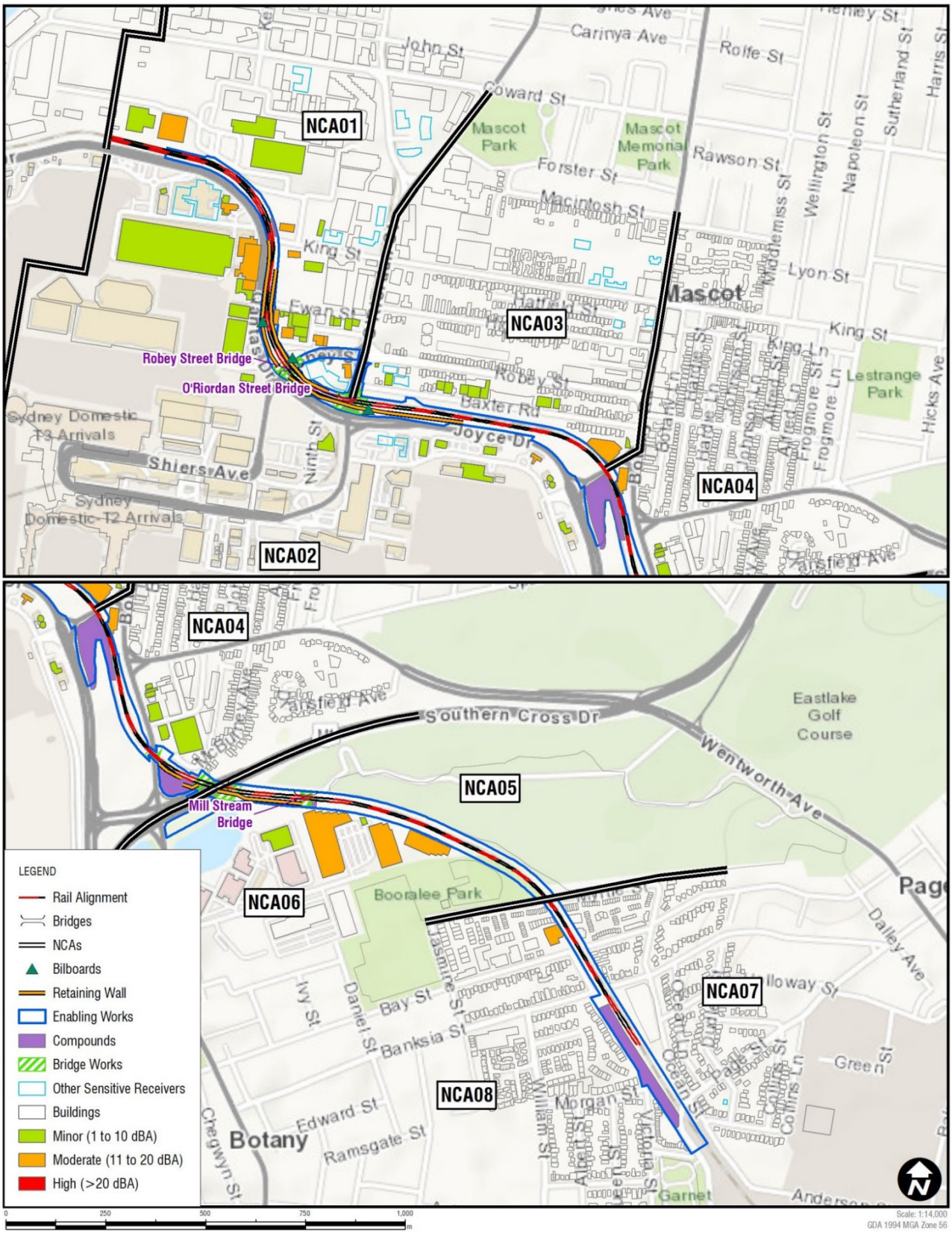

Figure 9.5 Predicted noise exceedances at commercial receivers during the worst-case scenario

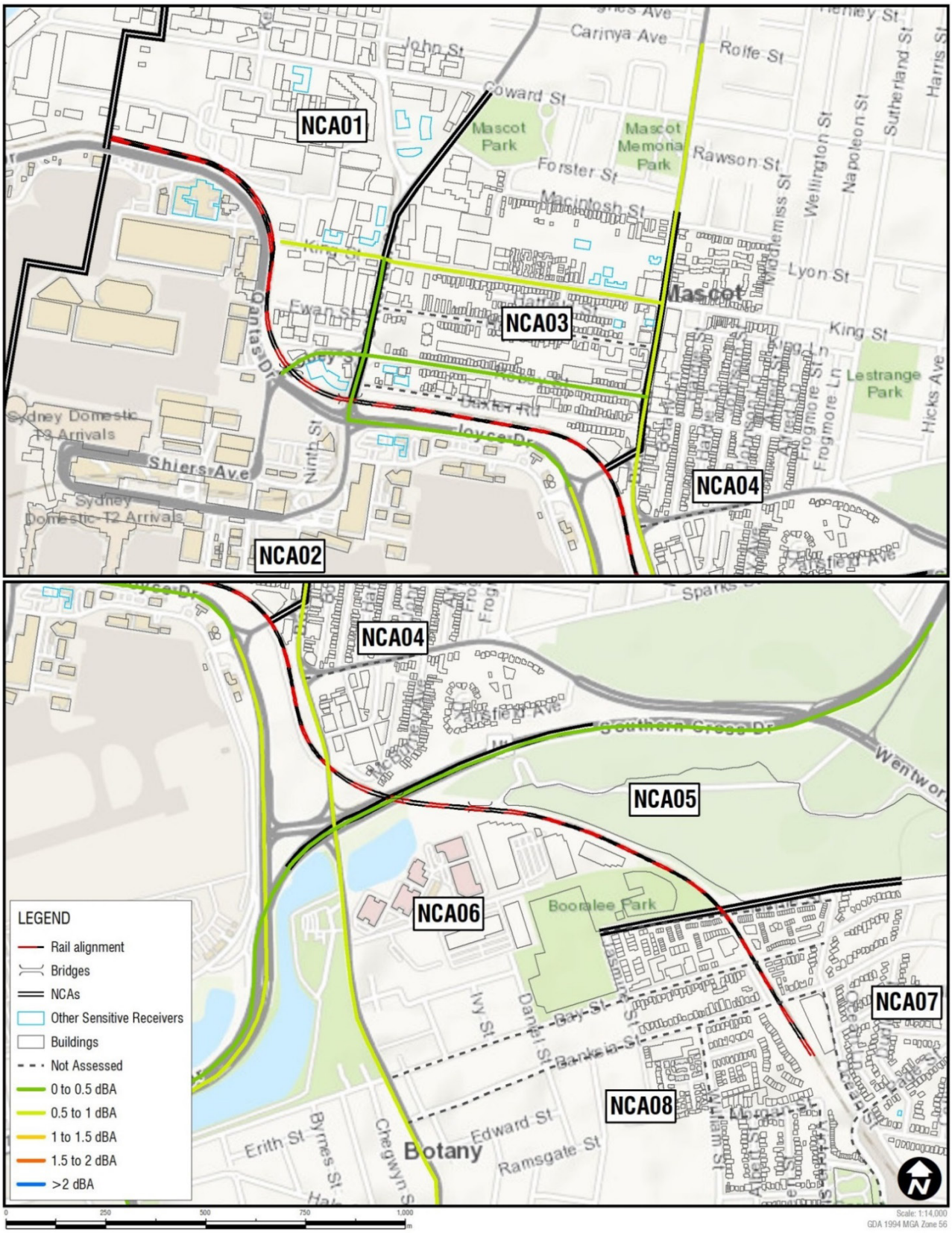

Figure 9.6 Predicted road traffic noise impacts from construction traffic

The locations of the construction activities modelled in the scenarios are shown in Figure 9.2.

Construction of a majority of the project would be carried out during standard construction hours. Standard construction hours as defined in the ICNG are:

- Monday to Friday: 7.00 am to 6.00 pm
- Saturday: 8.00 am to 1.00 pm
- Sundays and public holidays: no work.

However, evening and night-time work would be required at certain times (or for certain activities) for the full duration of construction to minimise impacts on road, rail and air traffic, and for safety reasons. For example, the construction works for the Robey, O'Riordan and Mill Stream bridges are highly constrained by the operational Botany Line and major roads, and therefore would require evening and night-time work for safety and access. Therefore, out-of-hours work (OOHW, see section 4.1.1.1 in *Technical Report 2 – Noise and Vibration Impact Assessment*) has been included in the construction noise assessment, as all scenarios would likely require construction activities to occur outside of standard construction hours at some point.

Some of the construction scenarios are progressive (would move along the alignment and would not impact the same receivers for the duration of the scenario) and some are fixed works (works that would remain in one place and may impact the same receivers for duration of the scenario).

9.3.3 Construction vibration assessment results

The main potential sources of vibration from the construction works would include vibratory rollers and rockbreakers. To assess the potential for construction vibration impacts, vibration offset distances have been estimated from the recommended minimum working distances for cosmetic damage (from BS7385 (BSI 1993) and DIN4150-3 (DIN 1993) and human comfort (from *Assessing Vibration: a technical guideline* (DEC, 2006a) (see section 3.1.1.6 in *Technical Report 2 – Noise and Vibration Impact Assessment*).

Figure 9.7 shows the locations surrounding the project site that may experience cosmetic damage or human comfort vibration related impacts from construction of the project.

Potential cosmetic damage vibration impacts

In general, the distance between the project site and nearest sensitive receivers is considered to be large enough to prevent cosmetic damage impacts. However, as shown on Figure 9.7, some buildings are located within the minimum recommended working distance for cosmetic damage. These buildings include:

- residential buildings near Myrtle Street, Ellis Street and Banksia Street in Botany
- six heritage items including:
  - Mascot (Robey Street) Underbridge in NCA01
  - Mascot (O'Riordan Street) Underbridge in NCA01
  - Sydney (Kingsford Smith) Airport Group in NCA02
  - Commonwealth Water Pumping and Sewerage Pumping Station in NCA02
  - Railway Bridge over Botany Road in NCA04
  - Botany Water Reserves in NCA05/NCA06.

The buildings listed above may experience cosmetic damage vibration related impacts, however the potential for this to occur would be minimised through implementation of management and mitigation measures (see section 9.6).

Additionally, three of the heritage items are rail bridges and therefore are not expected to be overly sensitive to potential vibration impacts from nearby construction works. BS 7385 states that 'a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive', which indicates that structures should not be assumed to be sensitive to vibration on the basis of being a heritage item alone.

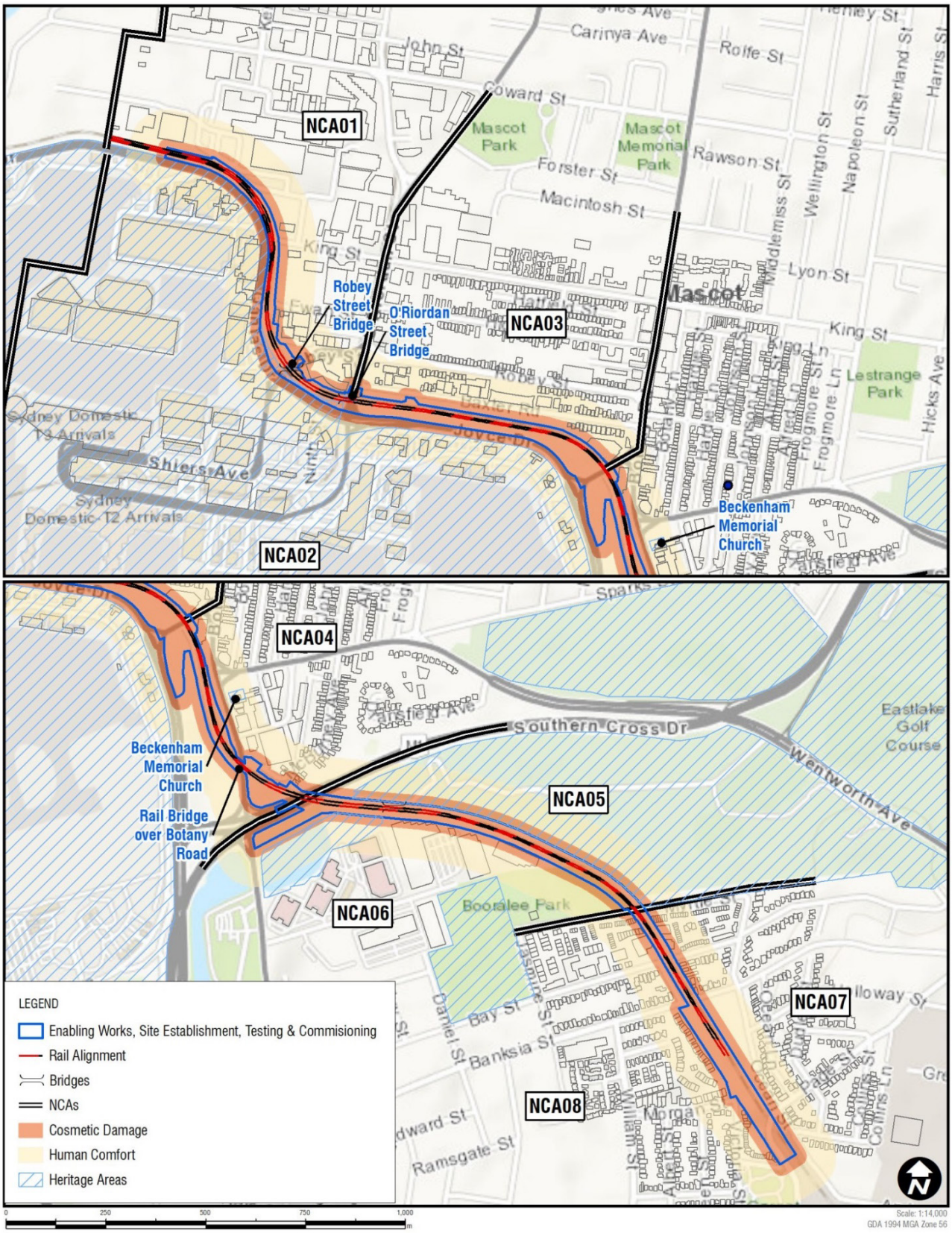

Figure 9.7 Potential construction vibration impacts during construction of the project

Potential human comfort vibration impacts

As shown on Figure 9.7, several sensitive receivers near the project site are within the human comfort minimum working distance. Occupants of these affected buildings may be able to perceive vibration impacts at times, when vibration generating equipment is in use. However, these impacts are likely to occur for relatively short durations when equipment such as rockbreakers or vibratory rollers are in use nearby.

9.4 Assessment of operational impacts

9.4.1 Overview of rail noise impacts during operation

Operational rail noise impacts have been predicted for all identified sensitive receivers in the study area. Figure 9.8 shows the location of residential and non-residential receivers that are predicted to experience noise levels above the adopted RING trigger levels. Operational rail noise contours are provided in Appendix D of *Technical Report 2 – Noise and Vibration Impact Assessment*.

In general, the operation of the project would result in increased rail noise levels due to:

- increased train speeds through the project site, which increases rail noise levels adjacent to the project and also increases the occurrence and noise level of trains going around curves
- a higher volume of trains predicted to use the project site
- the new track being closer to certain receivers. This is generally limited to receivers to the south of the alignment in NCA08, near Myrtle Street in Botany.

Further discussion on the predicted noise levels and the impacts on sensitive receivers is provided in the sections below.

The potential rail noise impacts from operation of the project would be higher in the 2034 future design scenario compared to in the 2024 project opening scenario, due to the assumption that more trains would use the Botany Line in the future. Therefore, the 2034 future design scenario has been assessed to consider the worst-case impacts from operation of the project.

Predicted rail noise impacts on residential receivers

Table 9.10 summarises the predicted rail noise levels and noise level increases, respectively, at residential receivers for the 2024 at-opening and 2034 design year scenarios. The tables show the highest noise levels in each NCA, which is typically at receivers nearest to the project site. There are no results for NCA02, NCA05 and NCA06 as these NCAs do not contain residential receivers. The locations of the exceedances are shown on Figure 9.8.

The results show the following:

- The existing rail noise levels in the study area are already high in most NCAs, where receivers are close to the rail tracks.
- The project is predicted to increase rail noise levels by up to 8 dB for maximum noise levels and up to 3 dB for daytime and night-time L_{Aeq} noise levels.
- The residential noise trigger levels are predicted to be exceeded in all NCAs, particularly due to exceedances of the maximum noise level criteria.
- In total, 182 exceedances of the noise trigger levels are predicted to occur in both the 2024 ‘at opening’ and 2034 ‘design year’ scenarios based on the current design of the project.
- Most noise level exceedances are predicted to occur in NCA03 (43 exceedances), NCA04 (52 exceedances), NCA07 (39 exceedances) and NCA08 (47 exceedances), because the residential receivers are closely grouped and located adjacent to curved track.
- The L_{Aeq} daytime and night-time noise levels increase by a greater degree for the 2034 scenario, compared to the at opening scenario, due to more train services being predicted by 2034.

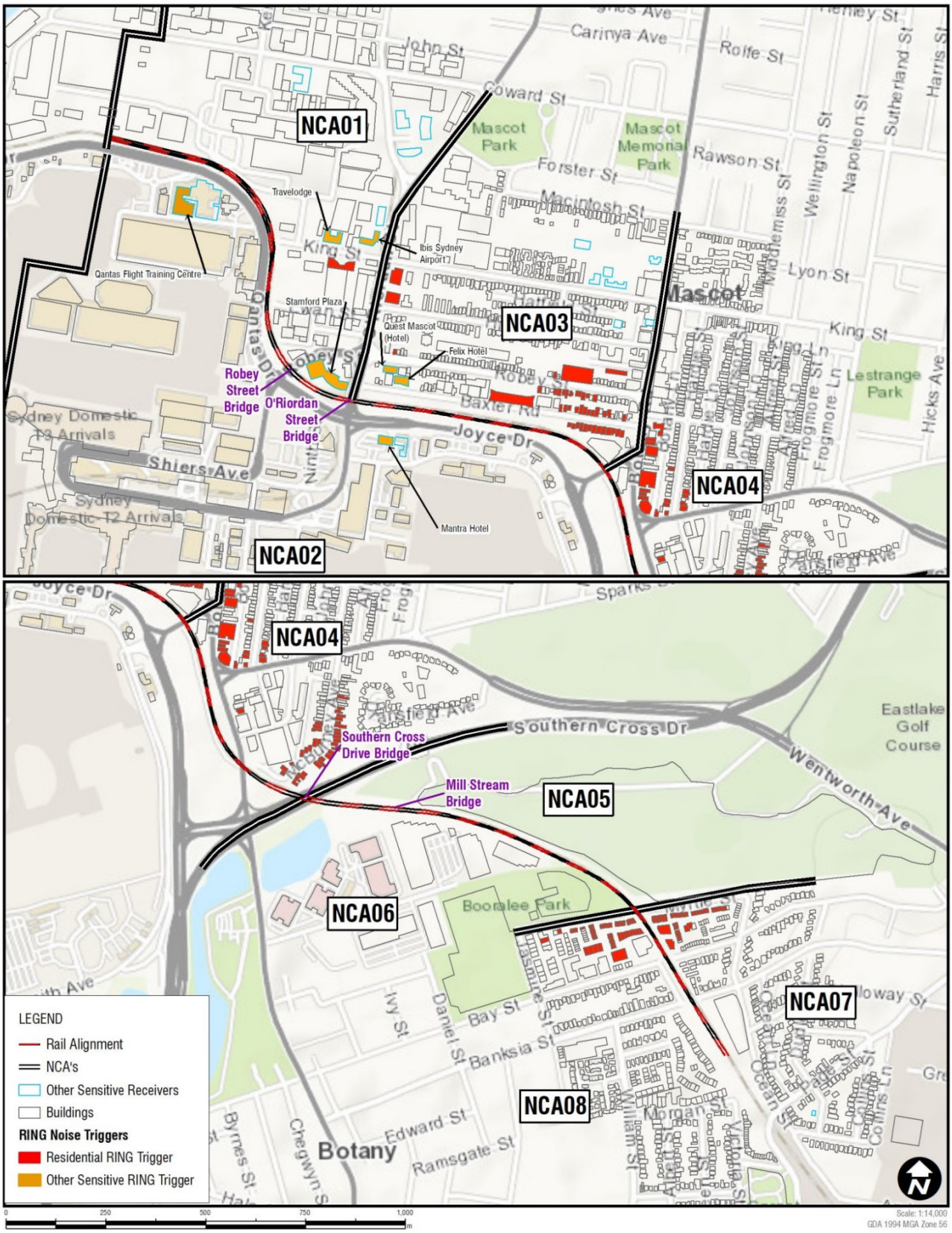

Figure 9.8 Locations of predicted RING noise trigger level exceedances during operation

Table 9.10 Summary of the predicted Operational Rail Noise Levels at Residential Receivers in each NCA

NCA	PREDICTED NOISE LEVEL (dBA)[1]												NUMBER OF RECEIVERS (2034)						
	Daytime LAeq(15hour)				Night-time LAeq(9hour)				Maximum LAmax[2]										
	At opening (2024)		Design year (2034)		At opening (2024)		Design year (2034)		At opening (2024)		Design year (2034)		Number of receivers with predicted exceedances of noise level criteria[3]			Number of receivers with noise level increases over the trigger level[4]			Receivers above both trigger levels
	Without project	With project	Without project	With project	Without project	With project	Without project	With project	Without project	With project	Without project	With project	Day	Night	Max	Day	Night	Max	-
Criteria[3]	**65**	**65**	**65**	**65**	**60**	**60**	**60**	**60**	**85**	**85**	**85**	**85**	**65**	**60**	**85**	**-**	**-**	**-**	-
NCA01	62	64	62	65	61	64	62	66	90	95	90	95	-	1	1	22	22	22	**1**
NCA03	70	72	71	73	70	72	71	73	99	104	99	104	19	37	57	268	276	274	**43**
NCA04	67	68	67	70	68	69	69	71	100	106	100	106	11	29	52	420	433	457	**52**
NCA07	65	66	65	67	69	70	70	72	101	106	101	106	30	98	107	16	39	105	**39**
NCA08	71	73	72	74	71	73	72	75	99	105	99	105	49	106	127	30	38	134	**47**
													TOTAL NUMBER OF RECEIVERS FOR FURTHER CONSIDERATION OF MITIGATION[5]						182

(1) The results are for the receiver with the highest predicted noise level in the controlling 2034 'with project' scenario in each NCA for the daytime, night-time and maximum noise levels. As such the daytime, night-time and maximum results may be for a different receiver in the same NCA. The receiver with the highest predicted 2034 'with project' noise level may not be subject to the largest increase in noise from the project in that NCA.

(2) Maximum refers to the LAmax noise level and applies to both the daytime and night-time

(3) RING residential absolute noise trigger level criteria for redeveloped rail projects

(4) Predicted noise level increases of the existing daytime or night-time rail noise levels by 2 dB or more, or the existing LAmax rail noise levels by 3 dB or more

(5) Mitigation measures should be investigated for receivers that are predicted to experience noise levels above both the RING residential absolute noise trigger level criteria and RING noise level increase trigger level.

In addition, 45 residential receivers in the study area are predicted to exceed the night-time ground-borne noise trigger level of 35 dBA by up to 5 dB (refer to section 6.5 in *Technical Report 2 – Noise and Vibration Impact Assessment*). The triggered receivers are generally within 10 to 20 metres of the rail track or near where the new rail crossovers are proposed to be installed. However, for these receivers, the external airborne noise impacts (as summarised in Table 9.10) are expected to dominate over the ground-borne noise impacts.

Predicted rail noise impacts on other sensitive receivers

Table 9.11 summarises the predicted rail noise levels and noise level increases at 'other sensitive' receivers for the 2034 design year scenario. As discussed in section 9.1.1, hotels have been conservatively assessed under the residential criteria provided in the RING, as they may have areas of permanent residence. However, for other areas of hotels, or hotels without any areas of permanent residence, the RING does not apply.

The locations of the exceedances are shown on Figure 9.8.

The results show the following:

- The noise levels are predicted to exceed the maximum noise trigger levels at all six hotels assessed in the study area, including three hotels in NCA01, one hotel in NCA02 and two hotels in NCA03. However, only areas of permanent residence in hotels require consideration of mitigation (refer to section 3.1.2 in *Technical Report 2 – Noise and Vibration Impact Assessment*).
- The absolute daytime and night-time L_{Aeq} noise levels are predicted to exceed the noise criteria for a number of the hotels (including the future new airport hotel, refer to section 9.3.2).
- Noise levels at the existing Qantas Flight Training Centre in NCA02, which has been assessed as an educational receiver, are predicted to be above the noise trigger levels.

Table 9.11 Predicted noise levels and increases for other sensitive receivers

NCA	RECEIVER	DESIGN YEAR (2034)					
		Predicted noise level[1] (dBA)			Increase in noise level compared to existing noise level (dB)		
		Day	Night	Max	Day	Night	Max
Hotels							
	Criteria[2]	***65***	***60***	***85***	***2.0***	***2.0***	***3.0***
NCA01	Ibis Sydney Airport	57	57	**87**	**2.9**	**3.0**	**6.4**
	Travelodge Sydney Airport	**66**	**63**	**93**	**3.2**	**3.7**	**6.8**
	Stamford Plaza Hotel	**71**	**71**	**107**	**3.0**	**3.1**	**5.1**
NCA02	Mantra Hotel	65	**63**	**87**	1.6	**2.5**	**5.6**
NCA03	Quest Mascot	64	**63**	**86**	1.3	**2.2**	**6.4**
	Felix Hotel	**66**	**66**	**86**	0.9	1.0	**5.4**
Educational							
	Criteria[2]	***55***	***55***	n/a	***2.0***	***2.0***	n/a
NCA02	Qantas Flight Training Centre	**67**	**67**	n/a	**2.1**	1.9	n/a

(1) The results represent the façade of the receiver with the highest noise level increase.
(2) Criteria is the corresponding external level for redeveloped rail projects.
(3) Red text indicates exceedances of the adopted noise level criteria.

Predicted rail noise impacts on future developments

As discussed in section 9.3.2, Qantas is proposing to relocate its existing Qantas Flight Training Centre to King Street in Mascot around 40 metres from the project site. During operation, the new centre could be impacted by wheel squeal and other noise from trains operating on the curves between Lancastrian Road and O'Riordan Street. This could result in daytime and night-time LAeq noise levels of up to around 75 dBA and maximum noise levels of over 100 dBA at the future centre. However, it is expected that the façades of the Qantas Flight Training Centre would be high performing, due to high existing noise levels in the area, which would likely reduce the potential airborne construction noise impacts.

A new hotel on Qantas Drive between Seventh and Ninth Street is proposed around 60 metres to the south of the project site. Operational rail noise impacts on the future hotel would be similar in nature to the nearby Stamford Hotel. Daytime and night-time LAeq noise levels of around 70 dBA, and maximum noise levels of above 100 dBA are predicted at the future building.

A new hotel is also currently being constructed on Sarah Street in Mascot. The potential operational rail noise impacts at this new hotel would be comparable to the impacts predicted for the Quest Mascot, meaning areas of permanent residence in the hotel would likely require consideration of noise mitigation.

Noise from idling locomotives

Freight trains typically leave their engines idling while waiting to be passed, resulting in the generation of noise from the stationary locomotive. The project involves the duplication of an existing rail line, which minimises the need for trains to stop and idle while other trains use the existing single-track section of the Botany Line within the project site.

9.4.2 Operational vibration assessment

Figure 9.9 presents a summary of the predicted vibration dose values for residential receivers within the study area in the 2034 scenario. The results show that the vibration levels predicted from the project are not expected to exceed the adopted daytime or night-time criteria for cosmetic damage. As a result, no cosmetic damage or human comfort vibration related impacts are expected and consideration of specific vibration mitigation measures for the project is not required.

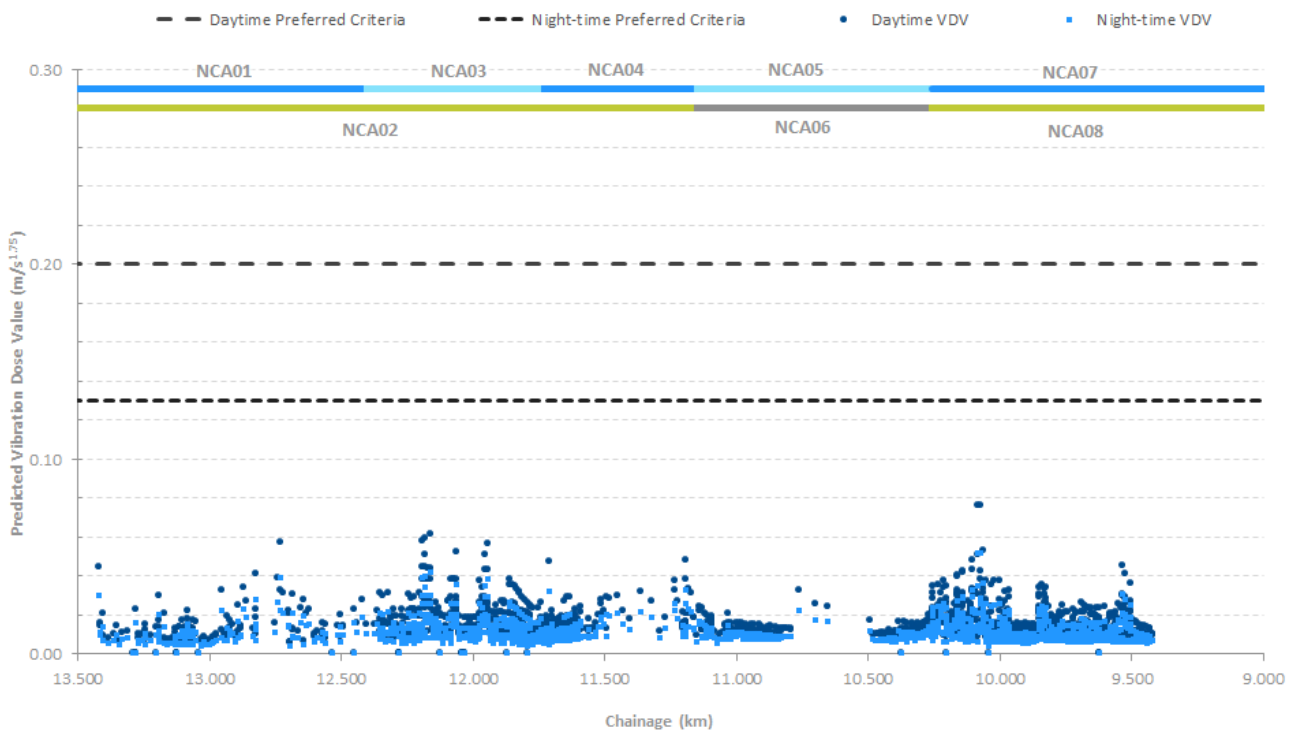

Figure 9.9 Predicted vibration dose values for residential receivers

9.5 Cumulative impacts

9.5.1 Overview

The methodology of the cumulative impact assessment and details of other projects considered are detailed in Chapter 24. A summary of the predicted cumulative impacts which relate to noise and vibration are described below.

9.5.2 Cumulative construction impacts

Cumulative construction noise impacts may occur if construction on the project occurs at the same time as construction on other nearby projects. Figure 9.10 shows the location of nearby projects which may result in cumulative noise impacts. Table 9.12 summarises the potential cumulative construction noise impacts identified for major projects close to the project site. These projects are described in Chapter 24.

Table 9.12 Summary of cumulative construction impacts

PROJECT	POTENTIAL CUMULATIVE CONSTRUCTION NOISE IMPACTS
Sydney Gateway road project	The study area for the Sydney Gateway road project overlaps with the western section of the Botany Rail Duplication study area. If the Sydney Gateway road project is constructed at the same time as this project, receivers in NCA01, NCA02 and NCA03 may experience an additional increase in noise levels of up to 3 dB. In addition, construction of the two projects is likely to increase the duration of the noise impacts experienced by receivers in NCA01, NCA02 and NCA03.
WestConnex – New M5	Residential apartments are located between both projects in the area of Kent Road in NCA01. However, as these receivers are over 400 metres from the project and 600 metres from the new M4, and the existing noise levels are high in this area, the potential for cumulative noise impacts from concurrent construction of the two projects is low.

PROJECT	POTENTIAL CUMULATIVE CONSTRUCTION NOISE IMPACTS
Qantas Flight Training Centre Relocation	The sensitive receivers near the new Qantas Flight Training Centre are generally commercial, however Travelodge Hotel and King Apartments (an approved residential development but not built yet) are nearby. The new Qantas Flight Training Centre would be much closer to these receivers than the project, meaning that if concurrent construction were to occur on both projects, the noise levels from construction of the new Qantas Flight Training Centre would likely be dominant over the noise levels from the Botany Rail Duplication. Therefore, the cumulative impact is expected to be managed by the mitigation measures used to control the impacts from the Qantas Flight Training Centre Project.
Airport North	The Airport North study area overlaps the western section of the project in NCA01, NCA02 and NCA03, near the Sydney Airport Terminal 2/3 entrance. While NCA01 is generally commercial, the Airport North works would likely affect residential receivers and hotels near O'Riordan Street, Baxter Road and Joyce Drive. However, the Airport North works are likely to be completed prior to Botany Rail Duplication works starting and therefore no cumulative impacts are expected.
Airport East	The Airport East study area overlaps the central section of the project in NCA02, NCA03 and NCA04, along General Holmes Drive. However, the Airport East works are likely to be completed prior to project works starting and therefore no cumulative impacts are expected.
F6 Extension – Stage 1	No cumulative impacts are expected if the F6 Extension is built concurrently with the project given the large distance between the two projects.

Overall, the cumulative construction noise impacts are expected to be relatively minor, with a low likelihood of worst-case noise levels being generated by two different projects at the same time.

The main cumulative impact would likely be associated with a potential increase in the duration of the noise impacts, rather than a cumulative increase in the noise levels themselves. If more than one project occurs in the same area consecutively, there may be a combined effect from the increased duration of impacts on nearby receivers and the associated reduced respite period between consecutive construction works. This effect is termed 'construction fatigue'. There is potential for construction fatigue for receivers near the Joyce Drive and O'Riordan Street intersection, including several hotels in NCA01 and NCA02, residential receivers on Baxter Road in NCA03 and residential receivers on Botany Road and McBurney Avenue in NCA04. This is due to several consecutive projects in the area including Airport East, Airport North, Sydney Gateway road project, Qantas Flight Training Centre and this project.

9.5.3 Cumulative operational impacts

During operation, receivers near the Joyce Drive and O'Riordan Street intersection would potentially be affected by operational noise from both the Botany Rail Duplication and Sydney Gateway road project, associated with a greater number of trains and cars using the area. However, operational noise from different types of transportation (ie road and rail) have different characteristics and result in different annoyance responses from affected communities. Therefore, a quantitative cumulative assessment of the combined operational noise impacts from the two projects is not possible, as the criteria for road and rail noise impacts are different.

Where elements of both projects occur in the same location, there is potential for operational mitigation measures to be required for both projects at the same receivers. The final operational mitigation strategy for each project would consider the impacts from both the Botany Rail Duplication and Sydney Gateway road project with the aim of maximising the benefit provided to receivers by the mitigation in a practical way.

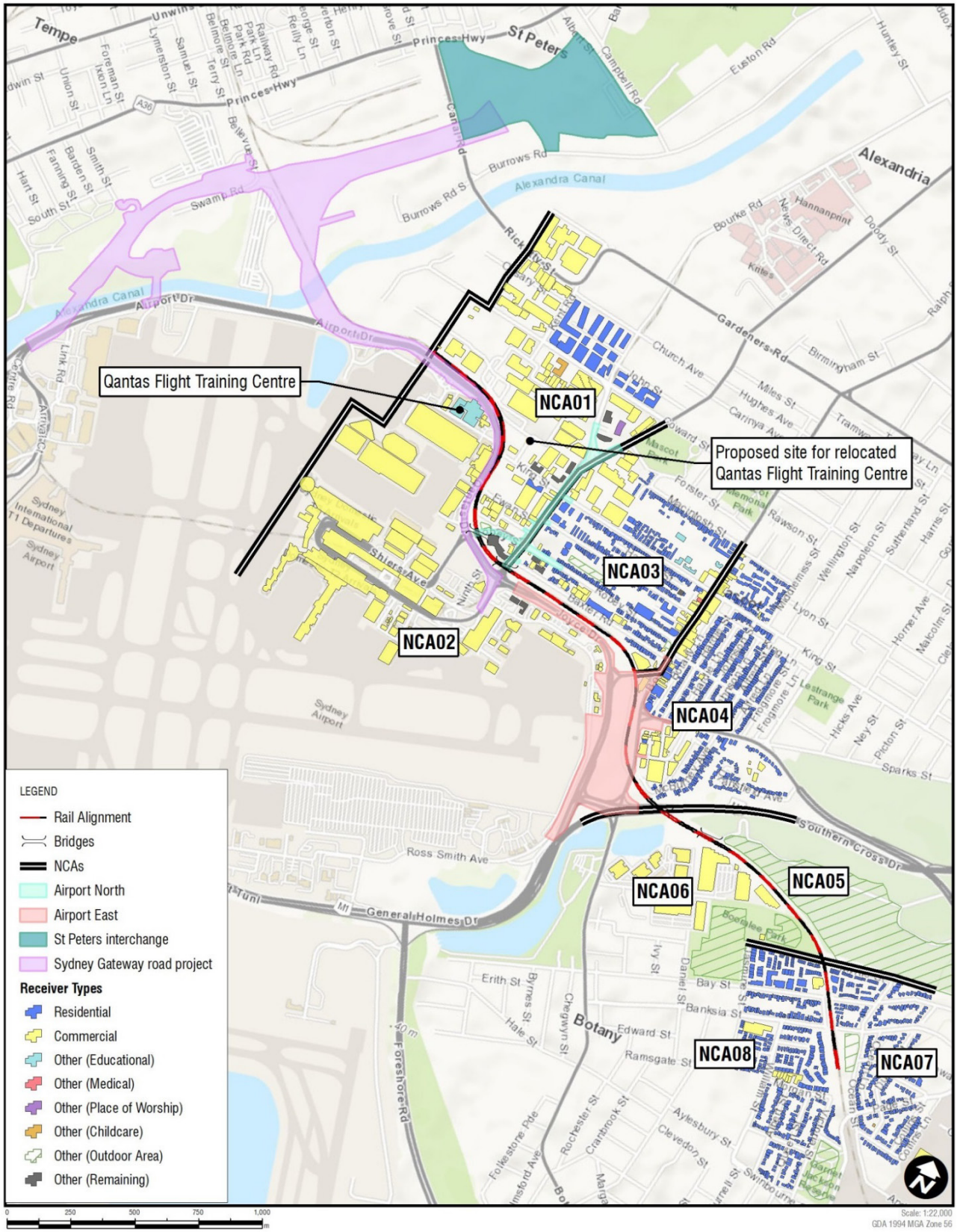

Figure 9.10 Location of nearby projects considered in cumulative construction noise assessment

9.6 Management of impacts

9.6.1 Approach

ARTC is committed to minimising the environmental impact of the project and is investigating opportunities to reduce actual impact areas where practicable. As discussed in section 9.1.4, ARTC has, where possible, altered the project to avoid and minimise noise and vibration impacts in the project planning stage (see section 9.1.4). This includes construction planning and proposing a lubrication procedure to reduce high frequency wheel squeal from operational trains. Further refinement will be made during detailed design, where possible, to minimise noise and vibration impacts.

The ICNG acknowledges that construction noise impacts cannot always be avoided where construction activities are required near sensitive receivers. However, the construction strategy for the project would need to take into account the communities' willingness to tolerate the level of construction noise predicted. Potential noise and vibration related issues raised during stakeholder and community consultation activities have been considered as a part of this noise and vibration assessment, to help identify appropriate mitigation strategies to minimise potential impacts such as respite periods. The approach to construction management would be managed through development of relevant environmental management plans, including site environmental management plans (site EMPs) during enabling works and a construction noise and vibration management plan (CNVMP) during main construction works. Monitoring will be carried out at the start of noise and vibration intensive activities near receivers, to confirm the effectiveness of the noise and vibration mitigation measures implemented.

Operational noise impacts can be controlled in a variety of ways. The RING requires that preference is given to source control measures, as they offer the greatest benefit to the largest number of receivers when compared to more localised mitigation options. Path control measures are considered next, with receiver controls being the final approach. Where exceedances of the RING trigger levels are predicted for hotels, at-property treatment would only need to be considered for areas of permanent residence within the hotels (if any). An Operational Noise and Vibration Review (ONVR) would be prepared to confirm the noise and vibration impacts from the project (based on the final detailed design) and define the operational mitigation measures that would be implemented. This would ensure that the operational mitigation measures would be suitable to effectively control operational noise and vibration impacts.

ARTC have experience in managing potential noise and vibration impacts as a result of developments of similar scale and scope to this project. As such, based on prior experience, the measures proposed to avoid noise and vibration impacts during construction and operation are expected to be effective in managing potential impacts from noise and vibration.

Further details on the approach to management is provided in Chapter 24.

9.6.2 List of mitigation measures

The mitigation measures that would be implemented to address potential noise and vibration impacts are listed in Table 9.13. This table also outlines which mitigation measures (during the construction stage) would be implemented during the enabling works and main construction works.

Table 9.13 Mitigation measures

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
Design	Sleep disturbance from consecutive night-time works	The need for consecutive night-time works and likelihood for sleep disturbance impacts will be reviewed during detailed design. Where impacts are considered likely, appropriate noise mitigation will be developed which takes into consideration factors such as the existing facade performance of affected residential receivers. Appropriate respite will be provided to affected receivers to limit impacts from night-time works in the same location, as required by the conditions of approval.	N/A – Design phase	N/A – Design phase
	Potential noise impacts on hotels	Further investigation will be completed during detailed design to determine appropriate criteria which takes into account the existing facade performance of the affected hotels, noting that most of the hotels are of recent construction and are likely to have high performance facades. Prior to construction, all hotels within 50 metres of the project site will be consulted and assessed to determine their sensitivity to airborne and ground-borne noise impacts, existing facade performance, areas of permanent residence (if any) and to allow appropriate criteria and mitigation to be determined.	N/A – Design phase	N/A – Design phase
	Potential vibration impacts on pipeline assets	The project has the potential to impact a number of pipeline assets during construction. An assessment will be completed in detailed design which will: • calculate the actual distance of the works from the structure • assess ground conditions and the effect this would have on vibration. Where impacts are considered likely, the susceptibility of the various assets to vibration levels and appropriate monitoring and management protocols will be developed in consultation with the relevant owners. Condition surveys will be completed before and after the works where appropriate.	N/A – Design phase	N/A – Design phase

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
	Noise impacts on the community	In locations where 'moderate' or 'high' noise impacts are predicted, engagement with the affected communities will be outlined in the community and stakeholder engagement plan and undertaken during detailed design to determine their preference for mitigation and management measures.	N/A – Design phase	N/A – Design phase
	Operational noise impacts	Investigate operational noise and vibration mitigation options during detailed design, including source control measures, path control measures and receiver controls as per the RING. This will include a review of the: • use of track lubrication as the primary source of noise control for operation noise impacts • feasibility and reasonableness of using noise barriers to provide path control mitigation to nearby receivers, noting the specific constraints that are applicable to this project • need for at-property treatment to be used to mitigate residual impacts at receivers which require consideration of mitigation after the use of source of path control measures. The potential operational noise and vibration mitigation options to be investigated are discussed further in section 8.3 in *Technical Report 2 – Noise and Vibration Impact Assessment*.	N/A – Design phase	N/A – Design phase
	Operational ground-borne noise impacts	Potential ground-borne noise impacts will be investigated further during detailed design when the extent of airborne rail noise mitigation, train speeds, and the position of track turnouts are confirmed.	N/A – Design phase	N/A – Design phase

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
Construction	Noise generated from enabling activities including billboard removal, utilities relocation and vegetation clearing and property adjustments	Site EMPs will be prepared before any enabling works begin. Specific to the activities proposed, these plans will include: • identification of nearby sensitive receivers • description of works, construction equipment and hours of work • mitigation measures that apply to the works proposed • criteria for the project and relevant licence and approval conditions • requirements for noise and vibration monitoring • details of how community consultation would be completed in accordance with the Community and Stakeholder Engagement Plan • details of how respite would be applied where ongoing high impacts are seen at certain receivers. The requirement for enabling works out of hours will be described in the site EMPs to be approved by the independent Environmental Representative (ER). The Site EMPs will detail: • the proposed activities and predict the potential noise impact against the relevant noise and vibration criteria • the relevant mitigation measures including consideration of sleep disturbance and respite periods • the required community notification specific to the activities proposed.	✓	

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
	Noise generated from main construction activities	A CNVMP will be prepared as a sub plan to the CEMP before any main construction works begin. This will include: • identification of nearby sensitive receivers • description of works, construction equipment and hours of work • criteria for the project and relevant licence and approval conditions • requirements for noise and vibration monitoring • details of how community consultation and notification would be completed • procedures for handling complaints • details on how respite would be applied where ongoing high impacts are seen at certain receivers. The CNVMP will also consider cumulative construction impacts and the likelihood for 'construction fatigue' from consecutive projects in the area and define a suitable management approach. Quantitative road traffic noise impacts from temporary detours during construction would also be evaluated, especially for local roads with low existing volumes.		✓
		Community consultation measures will be included in the CNVMP and community and stakeholder engagement plan, including periodic notification (monthly letterbox drop or equivalent) detailing all upcoming construction activities delivered to impacted sensitive receivers at least 14 days prior to commencement of relevant works.	✓	✓

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
	Noise generated from out-of-hours work	Unless subject to an Environment Protection License, an Out-of-Hours Work Protocol will be prepared and included as part of the CNVMP for main construction works. It would identify a process for the consideration, management and approval of works which are outside standard hours. The protocol will be prepared in consultation with the EPA and approved by the independent ER before the commencement of main construction works. The Protocol will include processes for: • the consideration of out of hours work against the relevant noise and vibration criteria • the identification of mitigation measures for residual impacts, including respite periods in consultation with the community at affected locations • consideration of the risk of activities, proposed mitigation, management and coordination for works outside of standard hours to be approved by the independent ER.		✓
		Where feasible and reasonable, construction will be carried out during Standard Construction Hours. If it is not possible to restrict the works to daytime, then they would be scheduled so noise intensive equipment is not used after 11:00 pm, where possible, noting that there is a requirement for many of the works to be completed during possessions, and restrictions on working hours during these periods are generally not feasible.	✓	✓
	Noise generated from use of noise intensive equipment	Where noise intensive equipment is to be used near sensitive receivers, the works will be scheduled for Standard Construction Hours, where possible. If it is not possible to restrict the works to daytime then they would be scheduled so noise intensive equipment is not used after 11:00 pm, where feasible.	✓	✓
		Monitoring will be carried out at the start of noise and vibration intensive activities which are near to receivers to confirm that actual levels are consistent with the predictions. Where mitigation measures have been specified, the monitoring results will confirm their effectiveness.	✓	✓

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
	Use of construction compounds	Hoardings, or other shielding structures, will be used where receivers are near compounds or worksites with long-term works. To provide effective noise mitigation, the hoarding would break the line-of-sight from the nearest receivers to the works, where possible, and be of solid construction with minimal gaps. Hoarding for construction sites is typically around three metres in height.		✓
		Noise generating activities in compounds will be positioned away from receivers where possible. Items such as sheds can also be used to shield receivers from noise generated in other parts of the compound.		✓
		Noise impacts are predicted for the compound between Banksia Street and Stephen Road due to the proximity of the nearest receivers. The use of this compound site during out of hours works associated with the road closures at Robey Street and O'Riordan Street will be avoided as far as practicable.	✓	✓
	Vibration impacts from use of vibration intensive equipment	Where works are required within the minimum working distances and considered likely to exceed the cosmetic damage criteria: • different construction methods with lower source vibration levels will be investigated and implemented, where feasible • attended vibration measurements will be undertaken at the start of the works to determine actual vibration levels at the item. Works will be ceased if the monitoring indicates vibration levels are likely to, or do, exceed the relevant criteria.	✓	✓
		Building condition surveys will be completed before and after the works where buildings or structures, including heritage items, are within the minimum working distances and considered likely to exceed the cosmetic damage criteria during the use of vibration intensive equipment. Appropriate criteria will be confirmed for each item before the works begin, based on the surveys.	✓	✓
		The potential human comfort impacts and requirement for vibration intensive works would be reviewed as the project progresses. Where receivers are within the human comfort minimum working distances, the impacts will be managed with the procedures defined in the CNVMP.	✓	✓

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
		The requirement for vibration intensive works near heritage items will be reviewed during detailed construction planning. Where heritage items are considered potentially sensitive to vibration impacts, the more stringent DIN 4150 Group 3 guideline values will be applied and monitoring will be completed when vibration intensive works are in close proximity. Condition surveys will be completed before and after the works where heritage items are within the minimum working distances and considered likely to exceed the cosmetic damage criteria.	✓	✓
	Cumulative construction noise impacts	The likelihood of cumulative or consecutive construction noise impacts will be reviewed during detailed design when detailed construction schedules are available. Coordination will occur between the various projects to minimise concurrent works (particularly concurrent OOHW) in the same areas, where possible. Specific additional management and mitigation measures designed to address potential consecutive impacts will be developed and used to minimise the impacts as far as practicable, in consultation with the affected community.	✓	✓
	Noise generated from construction workers	All employees, contractors and subcontractors would receive an environmental induction. The induction will at least include: • all relevant project specific and standard noise and vibration mitigation measures • relevant licence and approval conditions • permissible hours of work • any limitations on noise generating activities with special audible characteristics • location of nearest sensitive receivers • construction employee parking areas • designated loading/unloading areas and procedures • site opening/closing times (including deliveries) • environmental incident procedures.	✓	✓
		No swearing or unnecessary shouting or loud stereos/radios/phone calls on speaker on site. No dropping of materials from height, throwing of metal items and slamming of doors. No unnecessary idling of vehicles near to receivers.	✓	✓

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
	General construction noise generation	Use quieter and less vibration emitting construction methods where feasible and reasonable. For example, when piling is required, bored pile rather than impact-driven piles will minimise noise and vibration impacts.	✓	✓
		Simultaneous operation of noisy plant within discernible range of a sensitive receiver will be avoided. The offset distance between noisy plant and adjacent sensitive receivers will be maximised. Plant used intermittently will be throttled down or shut down. Noise-emitting plant will be directed away from sensitive receivers, where possible.	✓	✓
		Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.	✓	✓
		Non-tonal reversing beepers (or an equivalent mechanism) will be fitted and used on all construction vehicles and mobile plant regularly used on site as well as any out of hours work.	✓	✓
		Loading and unloading of materials/deliveries would occur as far as possible from sensitive receivers. Site access points and roads will be selected as far as possible away from sensitive receivers. Dedicated loading/unloading areas will be shielded if close to sensitive receivers.	✓	✓
		Where possible, noise from mobile plant will be reduced through additional: • residential grade mufflers • damped hammers such as 'City' Model Rammer Hammers • Air Parking brake engagement is silenced.	✓	✓
		Stationary noise sources will be enclosed or shielded while ensuring that the occupational health and safety of workers is maintained. Appendix F of AS 2436: 1981 lists materials suitable for shielding.	✓	✓

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
		A CTTAMP will be prepared for the project to manage the haul routes and vehicle movements. Where construction routes are along local roads there is potential for impacts at the adjacent residential receivers, depending on the volume of construction traffic. The potential impacts will be managed using the following approaches: • vehicle movements will be away from sensitive receivers and during less sensitive times, where possible • the speed of vehicles will be limited and avoid the use of engine compression brakes • on-site storage capacity will be maximised to reduce the need for truck movements during sensitive times • heavy vehicles would be restricted from idling near residential receivers.		✓
		Structures, such as site sheds, will be used to shield residential receivers from noise (where practicable), noting that upper floors of multi-storey buildings would be unlikely to benefit.	✓	✓
	Detours during construction	The assessment indicates there is potential for noticeable increases in road traffic noise for some receivers along the detours routes, such as Robey Street. Detours using this road are planned for up to 10 weekends (for closures to either Robey Street or O'Riordan Street) during construction of the project. The potential impacts would be reviewed as the project progresses using detailed traffic volume data Where residential receivers are expected to be subject to a >2.0 dB night-time increase during detours, the project would: • consider the use of different detour routes that do not put traffic during the night-time on roads with low existing volumes. Where this is not possible, the project would: • apply appropriate mitigation measures to the affected residential receivers, as agreed with the independent Environmental Representative (ER), based on the expected magnitude of the exceedance and the total duration of night-time impacts from all detours during construction of the project.	✓	✓

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
Operation	Operational noise impacts	An Operational Noise and Vibration Review (ONVR) will be prepared to confirm the noise and vibration impacts from the project and define the mitigation measures used to control the impacts. The ONVR will be prepared in consultation with affected stakeholders and the community. It will: • be based on the operational noise and vibration objectives identified in *Technical Report 2 – Noise and Vibration Impact Assessment* • confirm the predicted operational noise and vibration impacts at the surrounding receivers based on the final design • review the suitability of the operational noise mitigation measures identified below and any other measures which may be considered appropriate to manage additional impacts identified as a result of design changes and include the timing of implementation • include a consultation strategy to seek feedback from directly affected landowners on the noise and vibration mitigation measures outline how complaints will be managed in accordance with ARTC's existing complaints handling service (Enviroline).The ONVR will be prepared with reference to the *ARTC Noise Prediction and Mitigation Guideline* (ARTC, 2018) and will be made publicly available once complete.	N/A – Operation	N/A – Operation
		Implement noise and mitigation source controls, path controls and receiver controls where feasible and reasonable as determined during detailed design. These mitigation measures will be included in the ONVR, with the identified measures being managed through ARTC's environmental management system for operation of the project.	N/A – Operation	N/A – Operation

9.6.3 Consideration of the interaction between measures

In addition to the measures for noise and vibration described above, there are interactions between the mitigation measures for traffic and transport (Chapter 8) and the community and stakeholder consultation approach, which would help manage and mitigate potential noise and vibration impacts. All mitigation measures for the project are consolidated in Chapter 24 to ensure consistency in implementation.

9.6.4 Managing residual impacts

A residual risk analysis was undertaken taking into account the impact assessment summarised in this chapter and implementation of the mitigation measures as recommended in section 9.6.2. Residual risks with an assessed level of medium or above are summarised below:

- High:
    - noise impacts on local residents and sensitive receivers from out-of-hours construction activities.
- Medium:
    - noise impacts on local residents and sensitive receivers from construction activities within standard work hours
    - noise impacts on local residents and sensitive receivers from out-of-hours construction traffic
    - noise impacts on local residents and sensitive receivers from construction traffic during the day
    - noise impacts on local residents and sensitive receivers from the operation of trains.

The reduction in risk levels assumes effective implementation of several mitigation and management measures (as recommended in section 9.6.2) including implementation of noise and vibration management plans and appropriate construction scheduling and planning, vibration monitoring and inclusion of source, path and/or receiver controls in the design to minimise operational noise.