BaT project

Chapter 17
Cumulative impacts

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17. Cumulative impacts

17.1 Introduction

The purpose of this chapter is to assess the cumulative impacts on environmental values resulting from the Project. It considers the interaction of various environmental aspects of the Project over time, as well as the interaction of the environmental aspects of the Project with other developments.

This chapter addresses section 6.2 of the Terms of Reference (ToR).

17.1.1 Study area

The study area for the cumulative impact assessment is primarily focussed on the study corridor for the Project, identified in **Chapter 1 – Introduction**. However, the assessment also evaluates the potential for cumulative impacts outside the study corridor where Project activities and the activities of other major infrastructure and urban development projects have the potential to interact (eg along shared haulage routes and spoil placement sites).

17.1.2 Methodology

Cumulative impacts on environmental values resulting from the Project have been considered in relation to:

- the interaction of various environmental aspects of the Project over time during construction and operation
- the combined effect on environmental values arising from the interaction of the environmental aspects of the Project with the environmental aspects of other current or planned infrastructure and urban development projects occurring within the study area and over similar timeframes.

Detailed discussions of the impacts of the Project in relation to specific environmental values and aspects are provided in the respective chapters of the EIS.

The assessment of cumulative impacts arising from the Project as a whole and in conjunction with other Projects, involved the following key tasks:

- review of each environmental aspect of the Project (described in **Chapters 4** to **16**) and assessment of their interactions to determine the overall impact of the Project
- review of various strategic policies, land use plans and project databases applicable to the study area to identify other current or planned infrastructure or urban development projects expected to occur within the same geographic area or timeframe as the Project, including:
    - South East Queensland Regional Plan 2009-2031 (SEQ Regional Plan)
    - Woolloongabba Urban Development Area Development Scheme (April 2011) (applicable to the Woolloongabba Priority Development Area (PDA))
    - Brisbane City Plan 2014 (City Plan)
    - Brisbane City Centre Master Plan 2014
    - Brisbane Long Term Infrastructure Plan 2012-2031
    - Database of current and completed EIS projects evaluated by the Office of the Coordinator-General
    - *Database of referrals under the Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

  - Queensland Transport and Roads Investment Program 2013–14 to 2016–17 (QTRIP)
  - Brisbane City Council's PD Online database of development applications
  - Queensland Heritage Strategy: A Ten Year Plan
- consultation with various planning agencies, including Brisbane City Council, Department of Housing and Public Works (DHPW), the Department of State Development, Infrastructure and Planning (DSDIP), Economic Development Queensland (EDQ), the Department of Science, Information Technology, Innovations and the Arts (DSITIA), Department of Transport and Main Roads (TMR) and Queensland Rail
- identification and evaluation of the interactions between each of the environmental aspects of the Project and of other adjacent developments and landholders to determine the potential for such interactions to either increase or decrease the overall impact of the Project on the environment
- development of mitigation measures to avoid, minimise or mitigate adverse cumulative impacts and maximise beneficial cumulative impacts resulting from the Project.

17.2 Cumulative impacts across the Project

The Project would result in both beneficial and adverse impacts in relation to environmental, social and economic values of the study corridor. As impacts would vary in location, magnitude, duration and timing, the overall cumulative impact of the Project needs to be considered in relation to the whole of Project life.

The following sections describe the key impacts predicted to occur as a result of the Project as identified through detailed impact assessments, provided in **Chapters 4** to **16**.

Impacts have been summarised separately for the design, construction and operation phases of the Project as the nature and magnitude of impacts differs between these phases. The nature and magnitude of impacts also differs between surface and underground components of the Project, and in relation to the effects on local and regional communities. Where appropriate, such differentiation has been described in the following sections.

17.2.1 Design phase

Overarching beneficial impacts relevant to the design of the Project include:

- a high quality, dedicated and direct crossing of the Brisbane River for both bus and rail, improving network function and reliability
- predominantly underground structures, meaning that most impacts for surface infrastructure and socio-economic and biophysical matters are avoided
- interchanges at stations between nodes in the network
- well planned, air-conditioned stations, containing platform screen doors to ensure comfort, safety and crowd control
- opportunities to enhance the non-Indigenous cultural heritage setting of George Street through the sympathetic design of the station and the recognition of the heritage values in the design of Project infrastructure
- enhanced connectivity to the Brisbane CBD from Roma Street Station and George Street Station.

It is noted also that the reference design relies upon the temporary use of State land to establish construction worksites, specifically railway and busway corridor land at Dutton Park, part of the GoPrint site at Woolloongabba, office space at 63 George Street, parkland and open space at Roma Street and part of Victoria Park and the Queensland Health Biomedical Technology Service facility at Spring Hill.

Apart from the volumetric corridor, there would be no acquisition of private land on the surface to facilitate either the design or the construction of the Project.

Broadly, adverse impacts associated with the design of the Project would include:

- possible limitations on the basement depths of future development above and adjacent to the Project's tunnel and station caverns, particularly within the Brisbane CBD and at Woolloongabba
- potential influence on the future development of the northern half of Lot 2 within the Boggo Road Urban Village. The southern half of Lot 2 would not be influenced by the Project
- potential to influence the future development of the Princess Alexandra Hospital (PA Hospital) campus in any westward extension towards or including Kent Street
- demolition of existing office space at 63 George Street and the existing GoPrint building
- relocation of Brisbane City Council's Field Services Group and Queensland Rail facilities at Spring Hill
- loss of some vegetation within Victoria Park
- loss of on-street car parking spaces along Gilchrist Avenue, Herston
- ventilation outlets and plant rooms at stations and portals, impacting on visual values and potentially influencing future development
- impacts to the visual values of Victoria Park from the busway connections to the Northern Busway and to the Inner City Bypass (ICB), continuing a trend of visual change in the locality from the construction of major infrastructure (Northern Busway, Legacy Way). The busway connection to the Northern Busway would also result in a loss of part of the sporting fields at Victoria Park.

17.2.2 Construction phase

Beneficial construction impacts

Overarching beneficial impacts associated with the construction phase of the Project include:

- increased employment and generation of demand for skilled workers and general civil construction labour, with a peak construction workforce of 1,200 people
- direct and indirect economic benefits resulting from expenditure on materials and labour required for construction and on goods and services surrounding construction worksites
- the generation of a range of indirect jobs, such as in the construction, financial and business services, Government services and road transport sectors.

Adverse construction impacts

During the construction phase, local communities near construction worksites would likely experience a number of adverse impacts that could potentially cause moderate to high levels of temporary disruption, and reduced amenity. Some level of impact could be expected to occur in these areas throughout the construction phase, although the occurrence and intensity would fluctuate depending on the nature of construction activities at a particular time. The most intense period of impacts would generally be around two to three years per worksite.

The wider community beyond the construction worksites is likely to experience few discernible impacts if any, either adverse or beneficial, during the construction phase with the exception of residents and commuters along key haulage routes and other roads that immediately surround construction worksites where traffic-related impacts could cause low to moderate disruption. However, the traffic impact assessment (refer to **Chapter 4 – Traffic and transport**) indicates that the capacity and function of each of the proposed haul roads is sufficient for, and appropriate to, the haulage tasks required for construction of the Project. The wider community is also expected to experience some beneficial impacts through either direct or indirect employment on the Project.

If no environmental management or mitigation measures were implemented, potential adverse impacts would include:

- temporary decrease in local amenity around the five construction worksites resulting from increased noise, vibration, dust and visual intrusion, in particular for:
    - buildings nearby to the Dutton Park construction worksite, including the PA Hospital, the residential area south of Peter Doherty Street, and the Boggo Road Urban Village
    - buildings nearby to the Woolloongabba construction worksite, including the Land Centre, Dental Hospital and business and residential uses at Stanley Street and Vulture Street
    - buildings adjacent to the George Street construction worksite, including 41 George Street (Mineral House), adjacent commercial towers, the Rendezvous Studio Hotel, Harris Terrace and the residential tower (Metro21) and café at 21 Mary Street adjacent to the construction worksite
    - buildings and parkland adjacent to the Roma Street construction worksite, including the Central Parklands apartments, the Brisbane Transit Centre and Roma Street Parkland
    - buildings adjacent to the Victoria Park construction worksite, including the Queensland Health Biomedical Technology Service facility and the Centenary Aquatic Centre and tennis courts
- potential impacts from regenerated noise and vibration along the whole of the tunnel alignment during the 5 – 7 day passby of the tunnel boring machine
- temporary increase in traffic on roads near to construction worksites associated with haulage of construction materials and removal of spoil, and construction workforce traffic, resulting in the potential for traffic delays, congestion and decreased on-street car parking availability and decreased amenity
- changes to traffic, pedestrian and cycle access in the vicinity of the George Street construction worksite, the Roma Street construction worksite and the Victoria Park construction worksite
- disturbance of contaminated soil and groundwater, including from asbestos, at all construction worksites, originating mainly, due to both previous and current rail operations
- overland flow flooding risk at the Dutton Park, the Roma Street and the Victoria Park construction worksites
- potential erosion and sedimentation resulting in loss of topsoil and impacts on water quality and waterway systems, particularly downstream of the Roma Street and Victoria Park construction worksites that contain moderate erosion risk at these locations
- potential impact on residual Indigenous cultural heritage items during excavation and earthworks, the effect of new infrastructure on cultural landscapes, particularly in the vicinity of York's Hollow in Victoria Park
- temporary loss of non-Indigenous cultural heritage values at George Street Station through changes in built heritage fabric. This could include the potential disturbance of archaeological listed Early Streets of Brisbane at George Street Station during excavation and earthworks

- possible corrosion of fabric on heritage buildings at George Street Station caused by deposition of dust from construction activities
- temporary loss of approximately 137 car parking spaces for Roma Street Parkland at the ancillary construction worksite on Parkland Crescent and approximately 30 car parking spaces at the car park adjacent to Platform 10 at Roma Street Station
- temporary loss of Outlook Park at the Boggo Road Urban Village to establish the Dutton Park (Southern connection) construction worksite
- temporary loss of part of Victoria Park adjacent to the railway corridor for the establishment of the Victoria Park construction worksite, and the removal of some fig trees, impacting on the social and cultural heritage values of the park.

Integration of environmental design requirements described in **Chapter 18 – Draft Outline EMP** into the detailed design of the Project to achieve environmental outcomes and performance criteria, would avoid or reduce these adverse construction impacts. Implementation of the EMP during construction and commissioning phases of the Project would require compliance with environmental outcomes and performance criteria, described in **Chapter 18 – Draft Outline EMP**. If it is predicted that the performance criteria would not be achieved, mitigation measures would be implemented through negotiation with affected parties. This would require an early and ongoing communication process.

17.2.3 Operations phase

Beneficial operational impacts

Overarching long-term beneficial impacts (up to 100 years) associated with operation of the Project include:

- unlocking congestion points in the bus (Victoria Bridge) and rail (Merivale Bridge) networks
- improved public transport capacity, connectivity and accessibility, particularly with respect to servicing a number of major health and education facilities, commercial centres, entertainment precincts and sporting facilities (refer to **Chapter 2 – Project rationale** and **Chapter 4 – Traffic and transport**)
- enhanced integration between transport infrastructure and key urban development projects, such as the Woolloongabba PDA, the Boggo Road Urban Village and developments within the Brisbane CBD, such as Queen's Wharf Brisbane, supporting State, regional and local planning intents by providing critical transport infrastructure necessary to enable revitalisation of these precincts
- enhanced integration between transport infrastructure and the economic and employment hub of the Brisbane CBD facilitating further economic growth and prosperity
- opportunities for new commercial development at 63 George Street, above George Street Station, as well as within the new Roma Street Station
- improved accessibility for neighbourhoods served by the new underground stations and other stations due to consequential increases in the frequency of services
- a more resilient component of the transport network that would remain operational during some flood events and allow faster resumption of transport services following such events without increasing flooding on private property.

Operation of the Project would have long-term beneficial social, community and economic impacts for local, neighbourhood, metropolitan and regional communities through increased public transport accessibility, efficiency and connectivity.

Locally, the Project would lead to an improvement to amenity and pedestrian accessibility for the neighbourhoods served by those stations that form part of the Project and other stations with consequential increased frequency of service. The Project would also be likely to support intensification of land uses around the new stations that are consistent with land zoning and planning intents, stimulating local economic development and improving people's economic and social opportunities.

The Project would provide beneficial impacts to metropolitan and regional communities through improved public transport accessibility to major health and education facilities, such as the PA Hospital and the Queensland University of Technology, economic and employment centres, including the Brisbane CBD and Woolloongabba, and sporting facilities, including the Gabba Stadium. The provision of access to new multi-modal underground stations and enhanced frequency of services for existing surface stations along the study corridor would extend Project benefits across the southern rail network and the northern and western bus network.

Overall, the cumulative impacts resulting from the operation of the Project are expected to be beneficial at the local, neighbourhood, metropolitan and regional levels over the 100 year design life of the Project. The broader relevance and greater longevity of benefits associated with operation of the Project are considered to compensate for and outweigh the construction impacts and surface and volumetric acquisitions that would occur.

Adverse operational impacts

The Project has incorporated environmental design requirements to resolve operational impacts and to achieve environmental outcomes. The design requirements are intended to address potential adverse impacts associated with the operation of the Project, including:

- ground-borne noise and vibration from train movements in sections where the tunnel alignment would be shallow relative to most of the Project, eg north of Park Road Station
- changes to local atmospheric conditions due to warm air flows from the tunnel ventilation systems
- groundwater contamination, potentially influenced by groundwater drawdown, from existing contaminated soil or areas of potential acid sulphate soils
- permanent volumetric acquisitions of land surrounding the tunnel and underground stations along with the appropriate construction of the tunnel and stations, would have nominal or no enduring impacts on any existing or approved buildings or developments. There would be a right to compensation for volumetric acquisitions in accordance with the *Acquisition of Land Act 1967*. Future development of properties affected by volumetric acquisition may be influenced by the Project, although this would depend on the type and scale of proposed developments
- permanent use of State and local government land, including land currently used for open space, offices, transport infrastructure and car parking
- potential impact on non-Indigenous cultural heritage places from possible settlement effects or vibration near the tunnel or station caverns.

With implementation of the environmental design requirements, the residual operational impacts are likely to include:

- volumetric acquisitions of land
- use of State land and local government land.

17.3 Cumulative impacts with other projects

This section discusses infrastructure and urban development projects that are planned, or are currently being constructed that could interact and at a scale that would influence the Project, or result in cumulative construction impacts, including noise, dust and traffic congestion. This includes projects located within, as well as some projects outside, the study corridor (eg along shared haul routes and spoil placement sites).

Detailed discussion of possible interactions of the Project with other transport projects and networks is provided in **Chapter 4 – Traffic and transport**, including an assessment of the cumulative impacts of construction traffic generated from multiple construction projects on the metropolitan road network. Significant urban development projects and their relevance to the Project are described in more detail in **Chapter 5 – Land use and tenure**.

Major infrastructure and urban development activities occurring within the same construction timeframe and study corridor as the Project include:

- One William Street
- Queen's Wharf Brisbane
- Boggo Road Urban Village developments (Lots 2, 5, 6 and 7)
- North Brisbane Bikeway
- 300 George Street.

Major infrastructure and urban development activities occurring outside the study corridor but within the same construction timeframe with the potential to interact with Project activities include:

- Albert Street master plan
- Kangaroo Point pedestrian bridge
- Kingsford Smith Drive upgrade
- Gateway upgrade north (Nudgee to Bracken Ridge)
- RNA Showgrounds redevelopment (within the Bowen Hills PDA).

Construction associated with the major development sites have the potential to contribute to cumulative impacts, where construction timeframes occur concurrently. Specifically, spoil haulage and material delivery would be likely to share the same road network, resulting in potential for cumulative noise impacts and changes to local traffic and access.

The Woolloongabba Station would be located within the Woolloongabba PDA, which encourages higher density transit oriented developments. It is unlikely that any development within the PDA would occur during construction of the Project, although developments proposed during operation of the Project would be influenced by the height of the ventilation outlet.

Other infrastructure and development projects having potential interaction with the Project may also emerge during the detailed design and early construction phase of the Project. Minor infrastructure works undertaken by public utility providers in proximity to construction worksites throughout the construction phase of the Project would be managed through appropriate consultation and coordination with the Proponent.

Table 17-1 outlines the existing or proposed projects that have the potential for overlapping construction timeframes with the Project and are located in areas relevant to the study corridor.

Table 17-1 Indicative construction timeframes for projects and potential for cumulative impacts

Project	2015				2016				2017				2018				2019				2020			
Bus and Train project																								
Urban development projects																								
One William Street																								
Queen's Wharf Brisbane																								
Boggo Road Urban Village developments																								
Albert Street Master Plan																								
300 George Street																								
RNA Showgrounds Redevelopment																								
Transport infrastructure projects																								
North Brisbane Bikeway																								
Kangaroo Point Pedestrian Bridge																								
Kingsford Smith Drive Upgrade																								
Gateway Upgrade North																								

Notes:

	Projects located within the study corridor and likely to have direct interaction with the Project.
	Projects not located within the study corridor but potentially having indirect interaction with the Project due to proximity and overlapping construction periods.

A number of multi-storey development projects ranging from 20 to 88 storeys for which development applications have been lodged or approved, are also identified within or in close proximity to the study corridor. These projects include:

- 9 Hubert Street, Woolloongabba – development application approved, construction timing uncertain (20, 25 and 30 storeys (three towers), 5 basement levels, residential)
- 40 Elizabeth Street, Brisbane – development application approved, construction timing uncertain (27 storeys, 1 basement level, mixed use)
- 131 Mary Street, Brisbane – development application approved, under construction (88 storeys, 8 basement levels, mixed use)
- 140 Alice Street, Brisbane – development application approved, under construction (46 storeys, 6 basement levels, mixed use)
- 151-271 Roma Street, Brisbane – development application approved, construction timing uncertain (33 storeys, above the Brisbane Transit Centre (two towers, commercial).

These developments are discussed further in **section 17.3.3**.

17.3.1 Transport infrastructure projects

This section identifies the transport infrastructure projects in the vicinity of the Project that have the potential to contribute to cumulative impacts with the Project.

It is noted that Legacy Way is scheduled to be complete and operating when construction activities for the Project are expected to commence in 2015. Cumulative impacts from the Project would result in the continuation of construction in the corridor at Victoria Park for an additional five years.

North Brisbane Bikeway

The proposed North Brisbane Bikeway would link Brisbane's CBD to the northern suburbs and would be constructed in a number of stages. Stage 1A, consisting of two sections, comprises construction of a 710m pathway from Victoria Park at Gilchrist Avenue, Herston to O'Connell Terrace, Bowen Hills, via the State heritage listed Victoria Park, RNA Showgrounds and Bowen Park.

Section 1 of Stage 1A will connect with the existing off-road bikeway that runs along Gilchrist Avenue and crosses the Inner City Bypass and the Exhibition/ Normanby railway corridor via the existing land bridge to Gate 6 of the RNA Showgrounds. Section 2 of Stage 1A is from Gate 6 of the RNA Showgrounds to O'Connell Terrace. As such, Section 1 of Stage 1A would traverse the proposed location for the Northern Connection worksite and permanent infrastructure proposed for the Project.

Construction of Section 1 of Stage 1A of the North Brisbane Bikeway is due to be completed in early 2015 and would therefore not overlap with construction of the Project. Section 2 of Stage 1A would be completed in mid to late 2015. Only indirect construction impacts would be experienced.

Potential impacts of the Project on existing and proposed bikeway connections would be managed through internal coordination between the Proponent's Project team and the Brisbane City Council Bikeways Team, including where appropriate, provision for construction of temporary bikeways around construction worksites to maintain connectivity to key community facilities during construction.

Kangaroo Point Pedestrian Bridge

The Brisbane City Centre Master Plan 2014 has identified a new pedestrian and cycle bridge connecting Kangaroo Point to the Brisbane CBD as one of six priority projects identified as key catalysts to drive the revitalisation of the city centre. The Kangaroo Point Pedestrian Bridge is likely to extend generally from the eastern end of Alice Street in the CBD across the Brisbane River to around Thornton Street at Kangaroo Point. The new bridge would be integrated with a new node on the bus network at Kangaroo Point.

Planning and feasibility studies for the Kangaroo Point Bridge project have commenced, with construction anticipated to occur around 2017. Construction could therefore occur concurrently with the Project.

The footprint of the Kangaroo Point Pedestrian Bridge is not located within the study corridor. However, should the construction phase of these projects occur concurrently, potential exists for minor cumulative impacts to occur along possible shared construction traffic routes, such as Main Street, Stanley Street and Vulture Street at Woolloongabba and Alice Street in the Brisbane CBD. Impacts may relate to possible traffic congestion, noise and dust, but are expected to be minor as the Kangaroo Point Pedestrian Bridge is not in close proximity to the Project and outside of the study corridor. Alternative options for construction traffic routes to those of the Project's would also exist.

Cumulative impacts associated with concurrent operation of the Project and the Kangaroo Point Pedestrian Bridge would be largely beneficial. Benefits would include improved pedestrian and cycle connectivity to the inner city provided by the new bridge, and the improved efficiency of inner city bus and rail travel provided by the Project and potential opportunities for integration between the two.

Kingsford Smith Drive Upgrade

Kingsford Smith Drive is undergoing a process of staged planning and upgrading to reduce traffic congestion and to improve safety. The project involves widening Kingsford Smith Drive from four to six lanes from Harvey Street to Breakfast Creek Road. Stage one of the upgrade, between Harvey Street and Theodore Street, is complete. It is expected that by late 2014, a design and construction method for the remainder of the upgrade, from Theodore Street to Breakfast Creek Road will be completed by Brisbane City Council. This study phase is expected to be completed in late 2014. The proposed commencement of construction activities for the next stage of the Kingsford Smith Drive upgrade is expected to commence in 2015, therefore is likely to overlap with the construction activities for the Project.

Detailed assessments of haul route options for the Project determined that the use of the ICB, including Kingsford Smith Drive, to haul spoil from the northern worksites to Brisbane Airport or the Port of Brisbane was not viable on a number of grounds, including cumulative impacts. Haulage of spoil from the northern connection to Brisbane Airport would utilise Airport Link, avoiding Kingsford Smith Drive. A detailed assessment of the viability of the haul routes is provided in **Chapter 4 – Traffic and transport**.

Gateway Upgrade North (Nudgee to Bracken Ridge)

The Gateway Upgrade North project involves the upgrade of the Gateway Motorway between Nudgee and Bracken Ridge in order to reduce congestion and improve traffic safety and efficiency on the motorway. Works include widening 11.3km of the motorway from 4 to 6 lanes from Nudgee to Bracken Ridge, reconfiguring the Nudgee interchange, widening the Deagon Deviation, modifications to the Bicentennial Road interchange, construction of off-road cycle/pedestrian facilities and installation of Intelligent Transport Systems.

The first stage of the Gateway Upgrade North project is scheduled to commence in late 2014 and continue through to completion in late 2018. Although the timing of construction activities for the Project would overlap with the Gateway Upgrade North project, it is unlikely that the proposed haul routes would utilise parts of the Gateway Motorway containing construction activities. Proposed haul routes for the Project are detailed in **Chapter 4 – Traffic and transport**.

17.3.2 Urban development projects

Boggo Road Urban Village developments

The Boggo Road Urban Village is located approximately five kilometres south of Brisbane CBD, covering an area of 9.5 hectares. The Urban Village is anchored by the Ecosciences Precinct, occupying Lot 3, next to the heritage listed Boggo Road Gaol, occupying Lot 4, and also contains the Leukaemia Foundation ESA Village (ESA Village). Development within the Urban Village is ongoing with Stage 1 of the Ecosciences Precinct completed.

Stage 2 of the Ecosciences Precinct includes the development of a Centre of Environmental Services on Lot 2 at the Boggo Road Urban Village. Concept designs included in the preliminary approval and master plan for Stage 2 allow for building heights of six storeys and footprints ranging from 1,000m^2 to 3,000m^2. Investigations of the options for development of Lot 2 are ongoing.

Construction activities on Lot 2 are unlikely to overlap with construction of the Project. Should the tunnel boring machine (TBM) be launched from the Southern Connection (preferred construction method), it would be possible for development of the southern half of Lot 2 to commence in mid-2018. The Project's most intensive construction activities and busway connection would be finished by this time. Should the TBM be launched from the Northern Connection, development of the southern half of Lot 2 may not be possible until completion of the Project in 2020.

Development on the northern half of Lot 2 would need to consider the subsurface elements of the Project and the ventilation outlet and fan room. The Proponent's preferred option would be to integrate the ventilation outlet and fan room into building design and development on Lot 2. Early and ongoing negotiations would need to occur between the Proponent, DHPW, DSITIA and Commonwealth Scientific and Industrial Research Organisation (CSIRO) to coordinate suitable development possibilities and designs for this option. If the ventilation outlet and fan room is not integrated into building designs, development of Lot 2 would need to be designed appropriately to avoid impacts from the ventilation outlet.

The following developments have recently been approved within the Urban Village and are expected to commence construction in 2014:

- five storey commercial office building on the southern corner of Annerley Road and Peter Doherty Street (Lot 5)
- six storey residential building comprising approximately 64 units, on the southern side of Peter Doherty Street (Lot 6)
- six storey residential building comprising approximately 84 units, on the southern side of Peter Doherty Street (Lot 7).

The Project's construction may have a short overlap with the construction of these three sites. This may result in increased access and amenity issues to nearby properties, such as the ESA Village, the Ecosciences building and residential land in Rawnsley Street. Following the construction of these developments, residents and occupants of the new buildings may experience impacts to access and amenity from the construction of the Project if not managed effectively. Construction planning for the Project has been modified to address potential impacts on these new developments. For example, construction traffic flows on Peter Doherty Street would flow one way (east bound) to access the Boggo Road construction worksite and leave the construction worksite via Boggo Road only. These new developments would also aid in further screening of construction noise generated by the worksite for residential properties at Rawnsley Street.

Long-term benefits for the Boggo Road Urban Village would be experienced through access to a higher frequency of rail services at Dutton Park Station within 400m, upgrade to the station, as well as the new shared-path bridge on Annerley Road.

Woolloongabba Priority Development Area

The Woolloongabba PDA (formerly the Woolloongabba Urban Development Area) is located approximately 2km south-east of Brisbane CBD. The PDA, administered by DSDIP, through EDQ, is situated on approximately 10 hectares of land bounded by Vulture Street to the north, Stanley Street to the south, Allen Street to the west and Main Street to the east. The site currently contains the Queensland Government Landcentre and GoPrint sites, Woolloongabba Busway Station, South Brisbane Dental Hospital and the Morrison Hotel.

The Woolloongabba PDA, through the Woolloongabba Development Scheme, provides the planning framework that establishes development potential for the site. The site has been earmarked as a future urban transit oriented development (TOD), containing a mix of residential, community, recreation and commercial uses.

Development within the PDA includes plans for a major public transport interchange incorporating the existing Woolloongabba Busway Station and a 20-30 storey development located in areas with easy access to the Woolloongabba Busway Station to support the investment in public transport infrastructure. Development applications would be required prior to any development occurring on the site.

The Woolloongabba Station would be located in the heart of the PDA, occupying part of the existing GoPrint site and surrounded by planned future high density mixed use development. Woolloongabba Station would be integrated with the existing Woolloongabba Busway. The Woolloongabba Station would provide a high quality, multi-modal transport service to the major employment centre at the Mater Hospital and to the international sporting venue at the Gabba Stadium. The PDA, hospital campus and sporting venue would become more accessible to the population of South East Queensland.

There is the potential for development within the Woolloongabba PDA to occur during construction activities for the Project, although the timing of future development is still to be determined. The Proponent would continue to work with EDQ, to coordinate design and development activities in this precinct to determine an efficient delivery and staging strategy, including any necessary amendments to the Woolloongabba Development Scheme. This would require the consideration of:

- the height of the Project's ventilation outlet in determining the suitable design height, orientation and siting of tall buildings within the PDA
- the integration of development within the PDA and the Woolloongabba Station to maximise connectivity to the surrounding health, entertainment and sporting precincts.

Queen's Wharf Brisbane

The Queen's Wharf Brisbane project is proposed for State land encompassing the area from George Street to the Brisbane River and from Alice Street to Queen Street. The precinct is intended to deliver an integrated resort development, including a range of mixed uses, major public realm and may also include a casino. The area contains heritage buildings, a number of government buildings and riverfront land under the Riverside Expressway.

Development on the Queen's Wharf Brisbane site is the subject of a procurement process involving expressions of interest (2014) and tenders (announcement in 2015). Consequently, there is no detailed planning or design information for Queen's Wharf Brisbane available to inform a cumulative impact assessment with the Project.

It is anticipated that the redevelopment of the precinct would be managed by declaring the site a PDA under the *Economic Development Act 2012* to establish the relevant planning framework. This process would involve the preparation of a development scheme, which must undergo public consultation and be approved under regulation.

The George Street Station would interface with the Queen's Wharf Brisbane development area on the opposite (western) side of George Street. The projects would be complementary, creating a highly accessible CBD destination. Announcement of the successful proponent for Queen's Wharf Brisbane is expected to occur in early 2015, with construction anticipated to commence in 2017, by which time Project works are anticipated to be well advanced, specifically excavation works for George Street Station. There is potential for cumulative construction impacts resulting from these developments.

Cumulative adverse impacts would relate to the combined effects on the amenity of surrounding land uses arising from construction traffic and parking, noise, vibration and dust generated by these projects. Construction traffic for both projects would likely utilise similar haulage routes (i.e. George Street, Riverside Expressway) resulting in potential for cumulative impacts on traffic flow, including buses, along these routes. Queen's Wharf Brisbane would have alternative options for construction traffic routes as access to the precinct is possible from Margaret Street and William Street, whereas access to George Street Station during construction is more constrained.

There is a need for a working group comprising the Queensland Government, represented by DTMR and DSDIP, and the Brisbane City Council, to prepare and implement a CBD Construction Traffic Management Plan for that area bounded by Elizabeth Street, Albert Street, Alice Street and William Street. The CBD CTMP would provide measures to manage overlapping construction traffic associated with these projects.

Pedestrian and cycle movements and traffic flows in George Street, including buses, would be constrained by the combined construction of the projects. Pedestrian and cycle modelling conducted for the Project incorporated an assumed level of pedestrian activity relating to Queen's Wharf Brisbane as information on specific infrastructure or pedestrian demands was not available at the time of this assessment. It is recommended that when appropriate information is available, a specific pedestrian and cycle assessment relating to all construction activities occurring within the George Street precinct is undertaken to determine suitable mitigation measures for implementation by relevant proponents. Coordinated management of pedestrian, cycle and traffic flows would be required to achieve safety requirements and to reduce disruptions to the functioning of the Brisbane CBD.

The effects of concurrent construction would also need to be considered in relation to potential impacts on buildings and places of heritage value during activities involving excavation and earthworks. This would include potential disturbance of heritage listed Early Streets of Brisbane, temporary changes in built heritage fabric and possible corrosion of fabric on heritage buildings caused by deposition of dust from construction activities. Excavation works associated with both projects also have the potential to cause groundwater movement and ground settlement.

While the overlapping construction timeframes could contribute to a prolongation of these impacts, construction of multiple high-rise developments often occurs within the Brisbane CBD simultaneously, with associated construction traffic sharing CBD roads. Overlapping construction timeframes would also reduce the overall duration of construction relative to end to end construction of these two major projects.

Once operational, the George Street Station and Queen's Wharf Brisbane would increase pedestrian activity in the locality, requiring further planning of the CBD street movement system. Detailed design of the Project would incorporate improved pedestrian infrastructure to cater for predicted increases in pedestrian traffic and maintain pedestrian safety, including consideration of a subterranean pedestrian link between the two projects.

Improved public transport accessibility from George Street Station would contribute to a reduced need for private transport, with reduced potential for traffic and pedestrian conflicts. Reduced surface bus movements in George Street would also reduce the potential for vehicle and pedestrian conflicts.

Opportunities to enhance the non-Indigenous cultural heritage setting of the George Street precinct would also exist, through the sympathetic design of the two projects and the recognition and incorporation of the heritage values of the area in the design of the projects.

Overall, the Project is anticipated to result in beneficial cumulative impacts during the operational phase due to the improved accessibility to the city centre, Queen's Wharf Brisbane, and the Queensland University of Technology.

At the time of writing, the Queen's Wharf Brisbane team in DSDIP is working with the Project Proponent to establish protocol agreements to manage the integration of the two projects to ensure complementary benefits are captured and potential construction impacts are managed and coordinated appropriately. Collaborative interaction would also need to occur between the Proponent and the successful proponent of Queen's Wharf Brisbane.

One William Street

The One William Street office tower is being constructed on land bound by William Street, Margaret Street, Alice Street and the Riverside Expressway. Once completed, One William Street would accommodate an estimated 4,000 employees. The site of the One William Street office tower occupies an area of approximately 7,000m^2. The building comprises 43 storeys plus three basement levels and has a total gross floor area of approximately 120,000m^2.

Construction works on One William Street commenced in 2013 and are due to be completed in late-2016. Excavation, piling works and construction of the basement levels is to be completed by late-2014 and would not overlap with construction of the Project. Construction of the tower structure, and building fit-out would occur from late-2014 or early-2015 through to late-2016 and would likely overlap with the construction phase of the Project.

With the separation of the One William Street development from the George Street Station (250m by road), there is some potential for cumulative impacts in relation to increased construction traffic on local roads and the Riverside Expressway. Any cumulative impacts are expected to be relatively minor due to the advanced stage of construction of One William Street when Project construction commences and the relatively short overlap in construction activities. Although, the locality would experience prolonged cumulative construction impacts between One William Street, Queen's Wharf Brisbane and the Project. Construction traffic management would be addressed by the CBD CTMP referred to above in relation to Queen's Wharf Brisbane.

Like Queen's Wharf Brisbane, the effects of concurrent construction activities involving excavation and earthworks have the potential to impact on buildings and places of heritage significance. However, there is opportunity to enhance the non-Indigenous cultural heritage values of the George Street precinct through the sympathetic design and the recognition of heritage values of the area in the design of the Project. This would also be achieved through the integration of the Project with Queen's Wharf Brisbane.

300 George Street

The 300 George Street development is located on the former Queensland Law Courts site, bounded by George Street, Adelaide Street, Ann Street and North Quay within the Brisbane CBD. The development comprises three multi-story towers and six basement levels, including an 82 storey apartment tower, a 32 storey accommodation tower on the corner of Ann Street and North Quay and a 39 storey office tower on the corner of George Street and Ann Street. The development would also incorporate a retail and dining precinct.

The Reference Design has made allowance for the basement depths and structural loading requirements of 300 George Street. Construction of 300 George Street commenced in 2014 through the demolition of the Queensland Law Courts. It is expected that the development would be complete by 2017. Construction of the Project's tunnel under George Street within the Brisbane CBD and the George Street Station would overlap with construction activities for 300 George Street.

With the separation of the 300 George Street development to the George Street Station (approximately 500m by road), there is minor potential for cumulative impacts in relation to increased construction traffic on local roads within the Brisbane CBD and pedestrian movements along George Street. There is some potential for tunnelling works for the Project and excavation of the basement levels for 300 George Street to cause groundwater movement and ground settlement. Cumulative impacts relating to vibration and regenerated noise caused by excavation works for the projects are unlikely as excavation works for 300 George Street would be complete prior to TBM pass by.

Any cumulative impacts are expected to be relatively minor due to the low potential for excavation works for the projects to overlap and the distance between the projects.

Albert Street Master Plan

Brisbane City Council is proposing to pedestrianise Albert Street to improve the connection between the City Botanic Gardens and Roma Street Parkland, creating a 'green spine'. The planned 'subtropical corridor' would also include Wickham Park and King George Square, creating a focal point for pedestrians, outdoor dining and activity. The revitalisation of Albert Street is identified in the Brisbane City Centre Master Plan 2014. The Master Plan identifies a number of different streetscape options, some including a reduction in traffic lanes and another involving closure to all vehicular traffic.

The redevelopment of Albert Street is to be divided into a number of stages. Stage 1 of the redevelopment between Charlotte Street and Mary Street is intended to be completed within the next five years and would therefore overlap with construction of the Project. During construction activities on Albert Street, pedestrian access may be diverted to George Street in proximity to the George Street Station construction worksite. Pedestrian movement between Alice Street (the City Botanic Gardens, Queensland University of Technology) and the Queen Street precinct would therefore be constrained by the two projects, as well as by construction activities for Queen's Wharf Brisbane. An on-going need for pedestrian and traffic management in this part of the Brisbane CBD would be required.

Once the two projects are operational, there would be beneficial impacts as the Project would provide key public transport to support the range of pedestrian oriented activities proposed for Albert Street.

RNA Showgrounds Redevelopment (Bowen Hills Priority Development Area)

The Bowen Hills PDA contains the RNA Showgrounds, which are currently undergoing redevelopment in accordance with the Brisbane Showgrounds Master Plan that was approved by the former Urban Land Development Authority (ULDA) in November 2010. The Master Plan provides for the upgrade of the RNA Showgrounds including the new Royal International Convention Centre, the Plaza and Porte-Cochere, together with 5.5 hectares of new development comprising of The Green residential apartments, Kings Gate commercial precinct and the creation of King Street.

The 22 hectare redevelopment site would create 340,000m^2 of new residential, commercial and retail buildings along with an additional 76,000m^2 of new development on RNA retained land. Stage 1 of the redevelopment was completed in 2013, including the Royal International Convention Centre and Plaza and Porte-Cochere. Stage 2 works have commenced with construction on The Green residential apartments and the first tower in the Kings Gate commercial precinct. Construction works associated with implementation of the RNA Showgrounds Master Plan are expected to continue through to at least 2020.

Although the RNA Showgrounds is not located within the study corridor, there would be the potential for cumulative impacts to arise due to its proximity and overlapping construction timeframes, including:

- increased pressures on local on-street car parking

- changes to vehicle, pedestrian and cycle access to key facilities, including the Brisbane Grammar School, Brisbane Girls Grammar School and St Joseph's College Gregory Terrace, Victoria Park, Royal Brisbane and Women's Hospital (RBWH) and RNA Showgrounds
- reduced amenity from construction noise and dust.

Consultation and coordination with EDQ would be required with respect to construction timeframes, construction worksites, spoil removal and construction material haulage in order to minimise potential cumulative impacts on car parking, access, traffic, noise and dust.

Completion of the Project in conjunction with other recently completed and near completed transport infrastructure projects such as Northern Busway, Airport Link and Legacy Way, would result in beneficial cumulative impacts during operation by enhancing the accessibility of the RNA Showgrounds, RBWH and new residential and commercial developments within the Bowen Hills PDA.

Once operational, the cumulative impact of Bowen Hills PDA (including RNA Showgrounds) and the Project would have a long-term positive impact on the local and broader community, through provision of accessible and robust public transport systems that are integrated with urban development and community facilities. The Project facilitates development in these locations and would help to deliver a planned and coordinated integrated transport framework.

17.3.3 Other approved and proposed developments

Table 17-2 provides an overview multi-storey development projects planned within the study corridor, as identified by Brisbane City Council.

Table 17-2 Multi-storey development projects planned within study corridor

Address	Lot and plan	Summary of proposed development	Development application status
9 Hubert Street, Woolloongabba	Lots 18, 22, 26, 30, 34, 38, 42, 46, 50 and 54 RP11205, Lot 5 RP11205, Lot 1 RP11210, Lot 1 and 2 RP74662, Lot 7 and 8 RP11205, Lot 3 and 9 RP838591	Chalk Hotel Redevelopment. Three towers (30, 25 and 20 storeys) comprising a total of 502 residential units, 5 basement levels	Approved, timing uncertain
40 Elizabeth Street, Brisbane	Lot 1 RP883066	27 storey, 300 room hotel, restaurant and convention centre, 1 basement level	Approved, timing uncertain
131 Mary Street, Brisbane	Lots 1, 2, 3, 4, 5 and 6 RP123433	88 storey mixed use tower including 47,000m² commercial office space, 380 hotel rooms and 870 residential units, 8 basement levels	Approved, under construction
151-271 Roma Street, Brisbane	Lot 35 SP207219	Two 33 storey towers for commercial occupying 6,000m², above the Brisbane Transit Centre	Approved, timing uncertain
140 Alice Street, Brisbane	Lot 1 RP40587, Lot 12 SP231766	46 storey tower, containing 223 residential units, a café and bar, 6 basement levels	Approved, under construction

Cumulative adverse impacts between these projects and the Project would relate to construction related impacts including noise, vibration, dust and construction traffic impacts, such as congestion and on-street parking availability around construction worksites. Numerous developments occurring within the Brisbane CBD in close proximity to each other have the potential to influence monitoring results of the Project during construction activities. It is important that the extent of the impacts from various construction activities being carried out within close proximity to each other are clearly understood to delineate accurate monitoring results.

The Project would provide beneficial impacts to these development through providing greater access to public transport services. More specifically:

- 9 Hubert Street, Woolloongabba would be supported by high quality bus and train services at the Woolloongabba Station, within 100m of the development
- 40 Elizabeth Street, Brisbane would be supported by high quality bus and train services at the George Street Station, within 300m of the development
- 131 Mary Street, Brisbane would be supported by high quality bus and train services at the George Street Station, within 400m of the development
- 140 Alice Street, Brisbane would be supported by high quality bus and train services at the George Street Station, within 200m of the development
- 151-271 Roma Street, Brisbane would experience direct benefits from the Roma Street Station due to its location above the Brisbane Transit Centre.

There is a need for volumetric acquisitions for underground components of the Project. The volumetric acquisitions would include a 10m wide envelope surrounding the tunnel and station caverns, except at George Street Station where a 12m wide envelope is proposed. These envelope widths are estimated as suitable to preserve the structural integrity of the Project structures and of the buildings above and adjacent to it.

During the planning and construction of the Project, any development applications lodged over land within the study corridor prior to any approval of the Project would trigger a referral to the State Assessment and Referral Agency within DSDIP for assessment of State transport matters. This would be required as the whole of the study corridor has been defined as a State interest for development assessment purposes, being ‘future public passenger transport corridor’. The referral area for application assessments is to be refined to a ‘State controlled transport tunnel’ and public passenger transport corridor following the construction of the Project.

17.3.4 Future bus and rail upgrade projects

A number of key future bus and rail related projects have been identified that could have an interaction with the Project. These include the Queensland Rail Upgrade Program and upgrade of the South East Busway portal at South Brisbane.

South East Busway tunnel portal widening

Brisbane City Council has identified the need to upgrade the South East Busway’s portal connecting to Melbourne Street in South Brisbane. It has been determined that the portal is too narrow for the number of bus movements that have increased since the busway’s operation commenced in 2001. Buses often strike the side of the portal when entering or exiting the busway, resulting in them being removed from service for repairs. The works would involve the widening of the tunnel portal to improve access and the safety for buses entering and exiting the busway.

The widening of this portal would have indirect benefits for the Project as the reliability of bus services on the network would be improved.

Queensland Rail Upgrade Program

The Queensland Rail Upgrade Program involves the upgrade of South East Queensland's rail stations, required to meet the needs of the 65 million passengers Queensland Rail carries each year. The station upgrades are proposed to deliver increased levels of safety, security, accessibility and comfort for customers.

The upgrades would vary depending on the requirements at each station, but would include:

- new lifts or elevators and access improvements to meet disability standards
- new platforms, raising to train level, refurbishments and new ticket offices
- restoration of historic buildings
- amenity and safety upgrades, including toilets, lighting and security cameras.

Queensland Rail are currently restoring the heritage listed station building on platform three at Roma Street Station as part of the program. The Project's tunnel passes directly beneath the State heritage listed station building. However, ground-borne vibration levels are within the cosmetic damage vibration goal and the building would not be affected. There are no other upgrade works currently proposed under the Queensland Rail Upgrade Program that are within the study corridor. The upgrade of Dutton Park Station would be undertaken as part of the Project and not as part of the Queensland Rail Upgrade Program.

17.4 Management of cumulative impacts

Integration of environmental design requirements described in **Chapter 18 – Draft Outline EMP** into the detailed design of the Project to achieve environmental outcomes and performance criteria would avoid or reduce the adverse construction impacts. Implementation of the EMP during construction and commissioning phases of the Project would require compliance with environmental outcomes and performance criteria. If it is predicted that the performance criteria would not be achieved, mitigation measures would be implemented through negotiation with affected parties. This would require an early and ongoing communication and consultation process. Specific measures to manage the cumulative impacts associated with interaction of the Project with other major developments within the study corridor are outlined in **Table 17-3**.

Table 17-3 Management of cumulative impacts with other major developments

Impact	Project phase	Management measure
Interaction with other major projects occurring within the study corridor over similar construction timeframes or requiring design coordination	Detailed design, Construction	Undertake early and ongoing consultation with relevant agencies and project proponents including: • DHPW, DSITIA and CSIRO (future development of Lot 2 at the Boggo Road Urban Village) • EDQ (future development at the Woolloongabba PDA and coordination of construction activities of the Project and the RNA Showgrounds Redevelopment) • Queen's Wharf Brisbane (DSDIP) (integration of the designs of Queen's Wharf Brisbane and the Project and coordinated management of construction impacts) • Brisbane City Council (coordinated management of construction impacts associated with multiple storey developments close to Project works)

Impact	Project phase	Management measure
Disruptions to pedestrian, cycle and traffic flows within the George Street precinct	Construction	• A working group comprising the Queensland Government and the Brisbane City Council to be established to prepare and implement a CBD Construction Traffic Management Plan, with input from relevant stakeholders • Undertake a pedestrian and cycle assessment of the George Street precinct to determine suitable mitigation measures for implementation by relevant proponents during detailed design
Unforeseen future developments within the study corridor	Construction	• Undertake regular reviews during construction to identify other projects with potential for cumulative impacts

17.5 Summary

17.5.1 Cumulative impacts across the Project

During construction of the Project, local communities surrounding each of the construction worksites would experience impacts as a result of construction activities. The magnitude and severity of impacts would fluctuate based on the effectiveness and capacity of implemented mitigation measures and the type of construction activities occurring at any one time. The combined effects of construction (eg noise, vibration, dust, traffic) would be likely to cause disruption, nuisance and loss of amenity within these local communities. These impacts would be localised in extent and limited in duration to the construction phase.

The wider community would experience minor impacts during construction, relating to commuters along haulage routes used by construction traffic. However, these haulage movements would occur outside of commuter peak periods. Economic benefits experienced during construction of the Project would include increased employment opportunities for multiple construction related sectors supplying materials and labour to the Project, heightened economic activity around construction worksites due to increased demand for goods and services, and industry innovation through enhanced construction techniques.

Through adoption and implementation of the measures proposed in **Chapter 18 – Draft Outline EMP** and constructed in accordance with an approved EMP, a reasonable environment for living and working would be achieved for local communities surrounding construction worksites, while permitting the Project to be constructed efficiently and economically.

Overall, the cumulative impacts of the Project during operation are predicted to be beneficial at the local, neighbourhood, metropolitan and regional levels over the long-term. Relatively short-term impacts to local communities during construction of the Project would be offset by the long-term city-wide benefits operation of the Project would offer to communities over its 100 year life. The Project would provide long-term city-wide benefits, including more equitable public transport access for commuters and improved connections to where people live, work and play, reductions in traffic congestion on main roads, and reductions in air and noise emissions due to increased public transport usage.

Locally, the Project would lead to an improvement to amenity and pedestrian accessibility for the neighbourhoods served by those stations that form part of the Project and other stations with consequential increased frequency of service. The Project would also support intensification and revitalisation of land uses around the new stations, stimulating local development and creating economic and social benefits for the local population, including employment and housing choice.

The provision of new stations also allows for a greater level of integration of stations with surrounding land uses, such as commercial, retail and green open space areas, improving people's economic and social opportunities.

Metropolitan and regional communities to the south of the Brisbane CBD would benefit from operation of the Project through increased accessibility and connectivity on the southern rail network. Benefits for communities to the north and west of the Brisbane CBD would also experience improved bus accessibility. The Project would improve the quality, frequency and access for these communities to the Brisbane CBD, strategic development nodes, existing employment centres, major health, research and education facilities and international sporting venues. Improved public transport capacity, connectivity and accessibility would also relieve congestion on the existing bus and rail networks, particularly to the south, and facilitate increased productivity and subsequent long-term benefits for the wider economy.

17.5.2 Cumulative impacts with other projects

Construction of the Project is likely to occur concurrently with construction of a number of projects, most notably, Queen's Wharf Brisbane, One William Street and 300 George Street and urban developments within the Boggo Road Urban Village. Construction of multiple major projects at the same time and within similar geographic areas has the potential to increase cumulative impacts relating to disruption, nuisance and loss of amenity. However, construction of multiple major projects within proximity to each other is not uncommon, particularly within the Brisbane CBD.

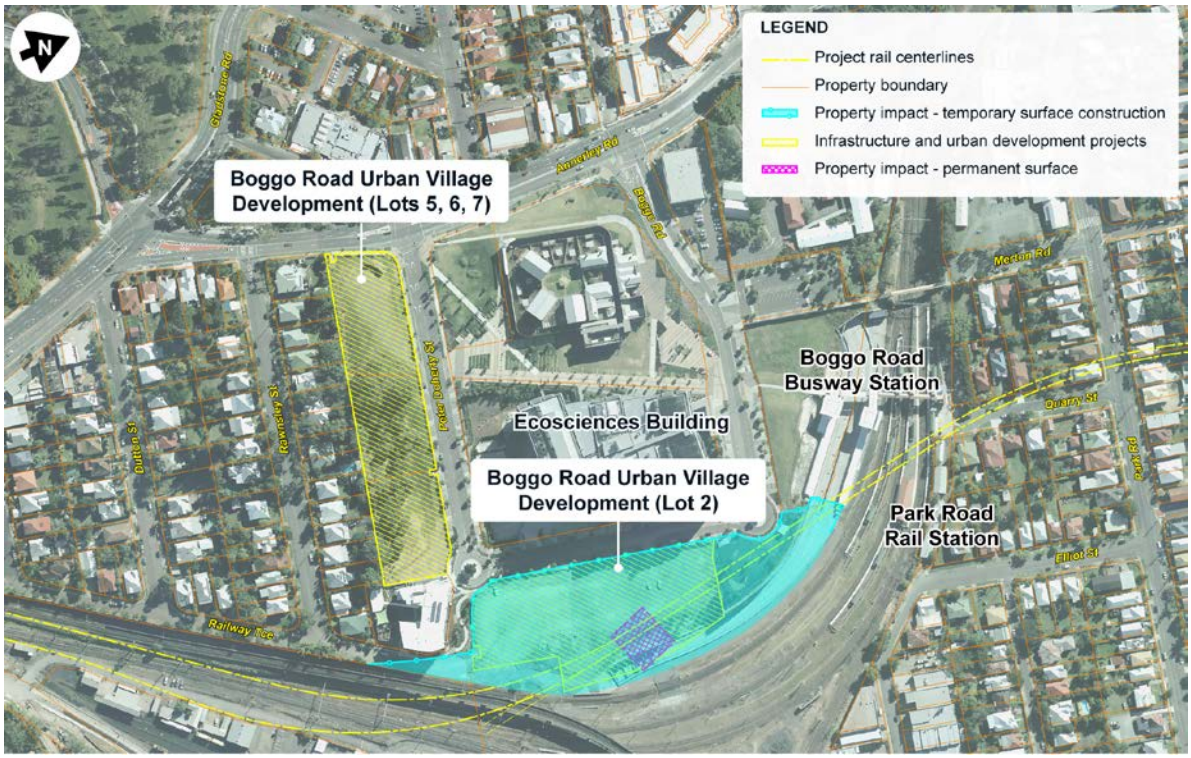
During detailed design, the Proponent would consult with the Coordinator-General, Brisbane City Council and the various entities responsible for these projects in order to better integrate connectivity and functionality between these developments so as to fully realise their significant economic and social benefits. It is recommended that early and ongoing negotiation occurs between the Proponent, HPW and CSIRO to discuss the influence of the Project on the future development of Lot 2 within the Boggo Road Urban Village. It is also recommended that negotiation occurs between the Proponent and the successful proponent of Queen's Wharf Brisbane when possible to integrate design of the two projects where appropriate.

During construction of the Project, the Proponent would engage in early and ongoing consultation with entities responsible for other projects having overlapping construction periods in order to coordinate construction activities as far as practicable through an integrated approach to reduce cumulative impacts. Consideration of construction programmes, traffic management measures, pedestrian and cycle movements and environmental management plans for other nearby projects as part of construction planning for the Project would be required. There is also a need for a CBD Construction Traffic Management Plan to be prepared and implemented by a working group comprising the Queensland Government, represented by TMR and DSDIP, and the Brisbane City Council, to manage overlapping construction traffic associated with projects located within the George Street area of the Brisbane CBD.

Procedures would also be established to ensure regular reviews throughout the construction process to identify new major projects with potential to exacerbate construction impacts associated with the Project.

A summary of the overarching beneficial and adverse impacts across the Project are provided in **Table 17-4** to **Table 17-11**.

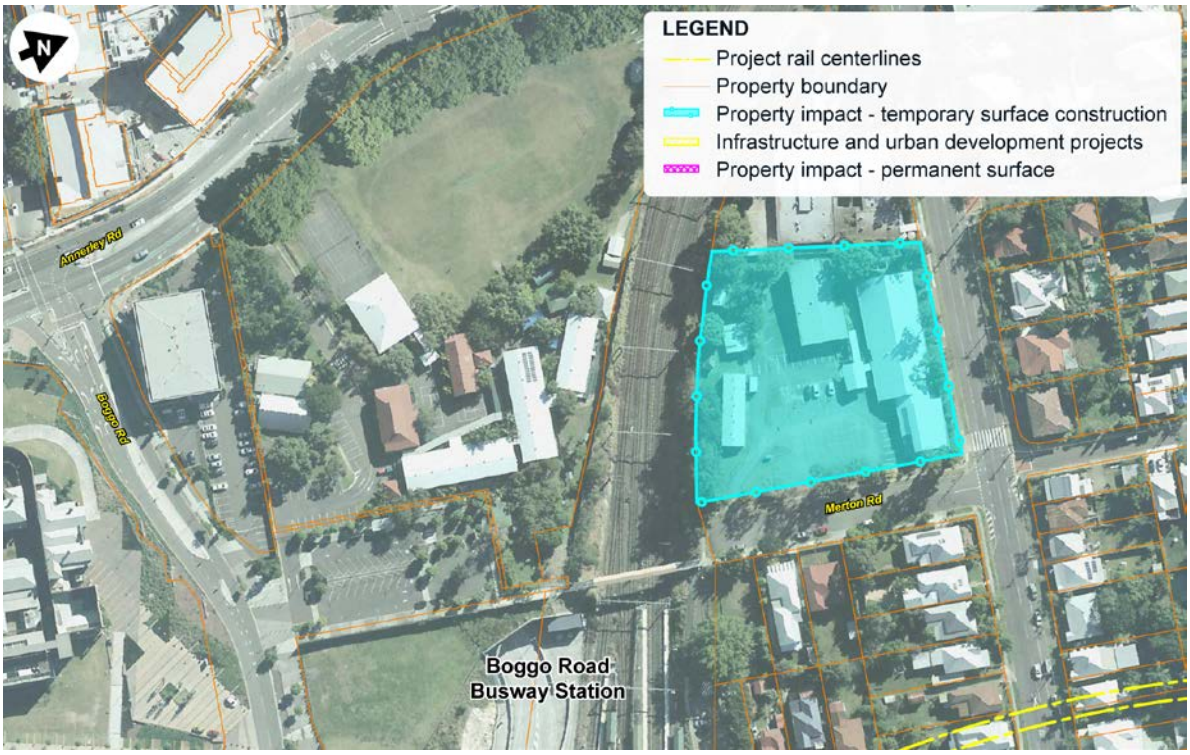
Table 17-4 Southern Connection – Dutton Park construction worksite



Construction impacts	Design	Construction 2015 – 2020						Operation impacts 2021 – 2121	
		'15	'16	'17	'18	'19	'20		
Air quality (dust): Sensitive receivers at Boggo Road Urban Village and Rawnsley Street	n/a								**Air quality:** Emissions from ventilation outlet
Noise and vibration: Sensitive receivers at Boggo Road Urban Village and Rawnsley Street	n/a								**Noise and vibration:** Noise and vibration from rail and busway corridor operation
Land use: Development of Lot 2 (Boggo Road Urban Village) influenced by Project sub-surface elements		n/a	n/a	n/a	n/a	n/a	n/a		**Land use:** Continued development of Boggo Road Urban Village (key Regional Activity Centre)
Transport: Construction traffic on Peter Doherty Street, Boggo Road	n/a								**Transport:** Support the public transport needs of Boggo Road Urban Village and PA Hospital precinct

High potential adverse impact (if no mitigation)	*High beneficial impact*
Moderate potential adverse impact (if no mitigation)	*Moderate beneficial impact*
Low potential adverse impact (if no mitigation)	*Low beneficial impact*
Negligible potential adverse impact	*Negligible*

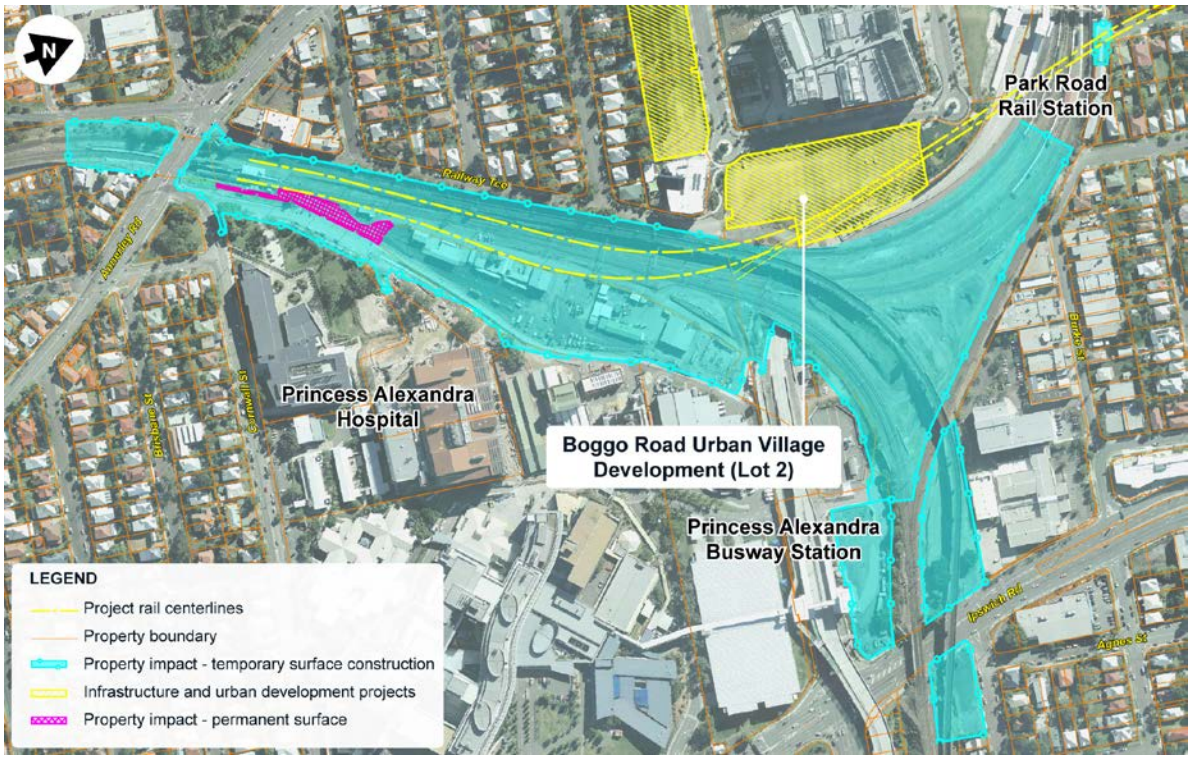
Table 17-5 Southern Connection – Dutton Park construction worksite car park



Construction impacts	Design	Construction 2015 – 2020						Operation impacts 2021 – 2121	
		'15	'16	'17	'18	'19	'20		
Noise and vibration: Noise impacts to residential sensitive receivers from workforce traffic	n/a								**Land use:** Opportunity for redevelopment following construction
Transport: Pedestrian safety impacted by workforce traffic	n/a								

	High potential adverse impact (if no mitigation)		*High beneficial impact*
	Moderate potential adverse impact (if no mitigation)		*Moderate beneficial impact*
	Low potential adverse impact (if no mitigation)		*Low beneficial impact*
	Negligible potential adverse impact		*Negligible*

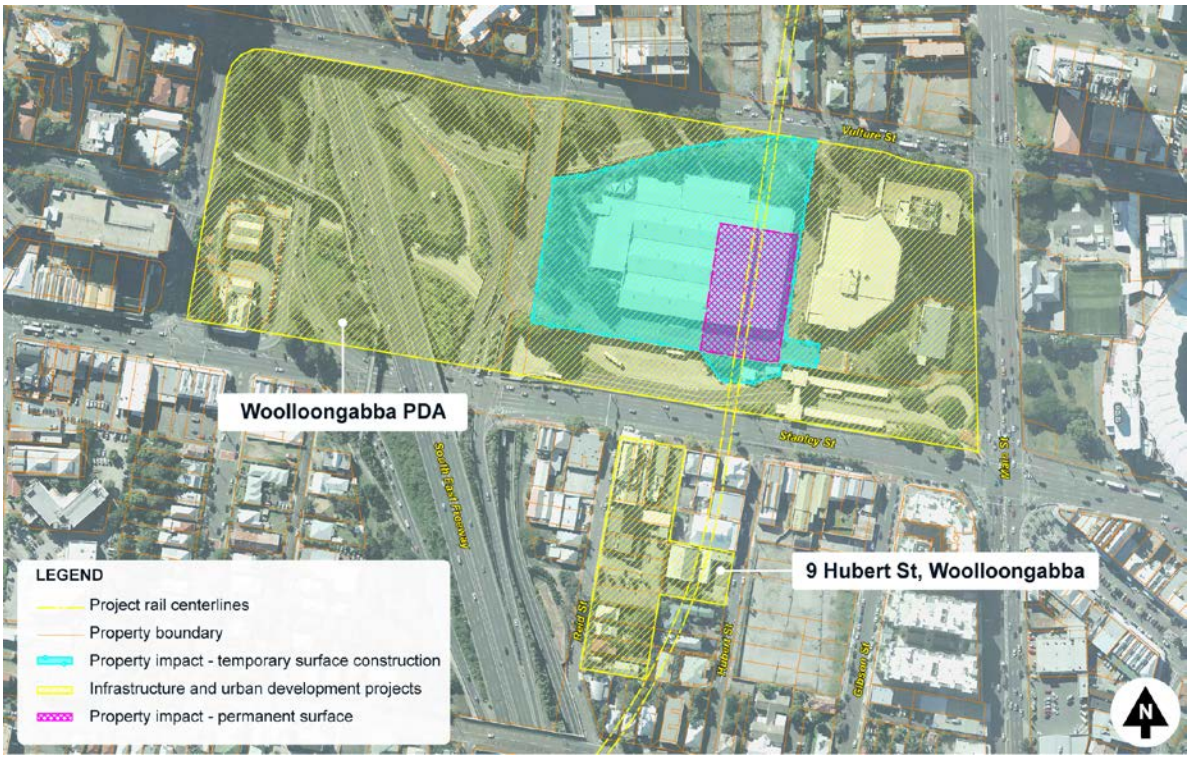
Table 17-6 Southern Connection – Woolloongabba construction worksite



Construction impacts	Design	Construction 2015 – 2020						Operation impacts 2021 – 2121	
		'15	'16	'17	'18	'19	'20		
Air quality (dust): Sensitive receivers at PA Hospital, PACE, laundry and Dutton Park residential area	n/a								**Noise and vibration:** Noise and vibration from railway and busway corridor operation
Noise and vibration: Sensitive receivers at PA Hospital, child care centre and Dutton Park residential area	n/a								**Transport:** Project would improve public transport accessibility to the PA Hospital precinct
Contaminated land: Contaminated soil within railway corridor	n/a								
Transport: Traffic disruptions caused by spoil haulage and workforce traffic	n/a								

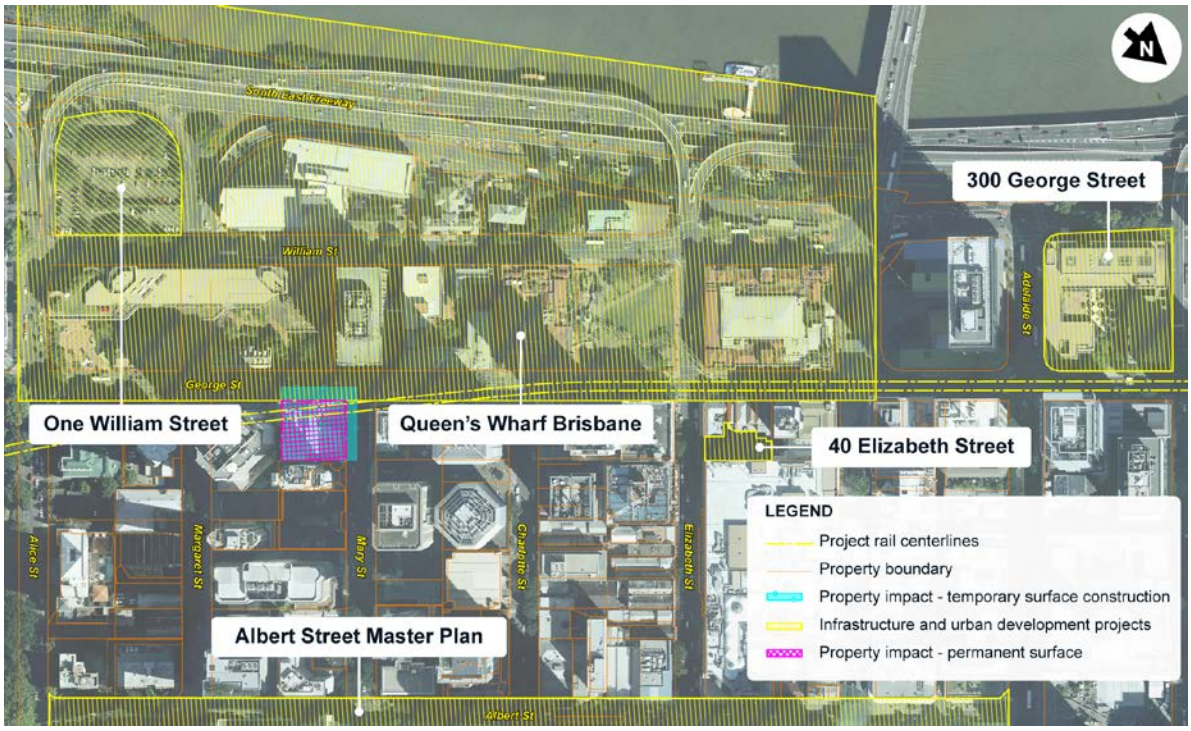
	High potential adverse impact (if no mitigation)		*High beneficial impact*
	Moderate potential adverse impact (if no mitigation)		*Moderate beneficial impact*
	Low potential adverse impact (if no mitigation)		*Low beneficial impact*
	Negligible potential adverse impact		*Negligible*

Table 17-7 Woolloongabba Station construction worksite



Construction impacts	Design	Construction 2015 – 2020						Operation impacts 2021 – 2121	
		'15	'16	'17	'18	'19	'20		
Noise and vibration: Sensitive receivers at Stanley Street and Vulture Street	n/a								**Air quality:** Emissions from ventilation outlet
Contaminated land: Contaminated soil within former railway corridor, asbestos at existing GoPrint site	n/a								**Noise and vibration:** Noise and vibration from rail and busway corridor operation
Land use: Demolition of existing GoPrint building and impact on Land Centre									**Land use:** Implementation of Woolloongabba PDA and integration of station
Transport: Traffic disruptions and congestion due to construction traffic	n/a								**Transport:** Improved public transport accessibility in a key activity and sporting precinct
High potential adverse impact (if no mitigation)									*High beneficial impact*
Moderate potential adverse impact (if no mitigation)									*Moderate beneficial impact*
Low potential adverse impact (if no mitigation)									*Low beneficial impact*
Negligible potential adverse impact									*Negligible*

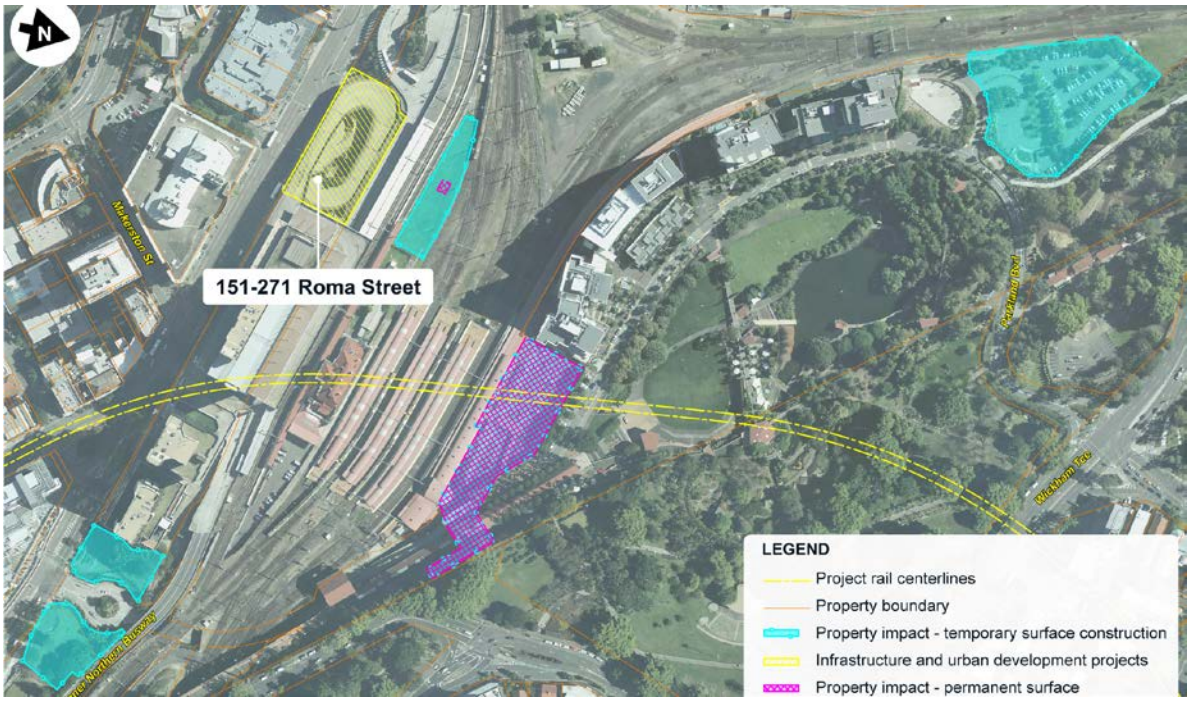
Table 17-8 George Street Station construction worksite



Construction impacts	Design	Construction 2015 – 2020						Operation impacts 2021 – 2121	
		'15	'16	'17	'18	'19	'20		
Air quality (dust): Commercial and residential sensitive receivers adjacent worksite	n/a								**Air quality:** Emissions from ventilation outlet
Noise and vibration: Commercial and residential sensitive receivers adjacent construction worksite	n/a								**Land use:** Improved land use and transport integration at a key activity centre, including Queen's Wharf Brisbane
Land use: Demolition of office space at 63 George Street, Brisbane; temporary use of State land									**Economic:** Connectivity and accessibility to the CBD and opportunity for commercial development at 63 George Street
Transport: Changes to traffic and pedestrian access in vicinity of construction worksite	n/a								**Transport:** Supports the public transport needs of the Brisbane CBD, a high trip generating locality
Heritage: Proximity to State heritage listed places, excavation of heritage structures									**Heritage:** Operation of tunnel

	High potential adverse impact (if no mitigation)		*High beneficial impact*
	Moderate potential adverse impact (if no mitigation)		*Moderate beneficial impact*
	Low potential adverse impact (if no mitigation)		*Low beneficial impact*
	Negligible potential adverse impact		*Negligible*

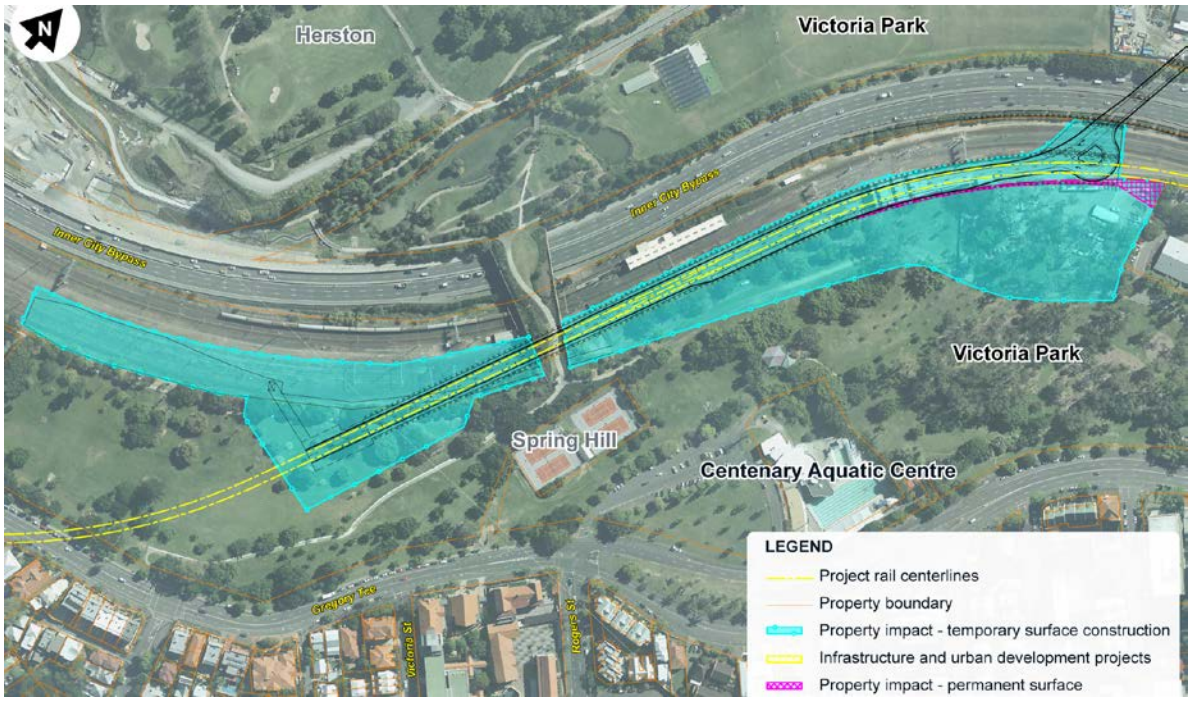
Table 17-9 Roma Street Station construction worksites



Construction impacts	Design	Construction 2015 – 2020						Operation impacts 2021 – 2121	
		'15	'16	'17	'18	'19	'20		
Air quality (dust): Central Parkland apartments, Brisbane Transit Centre and Roma Street Parkland adjacent construction worksite	n/a								**Air quality:** Emissions from ventilation outlet
Noise and vibration: Central Parkland apartments, Brisbane Transit Centre and Roma Street Parkland adjacent construction worksite	n/a								**Economic:** Connectivity and accessibility to the Brisbane CBD and opportunities for commercial development at Roma Street Station
Land use: Use of parkland areas for construction worksite	n/a								**Land use:** Parkland areas rehabilitated to pre-construction conditions
Transport: Temporary loss of car parking and changes to traffic and pedestrian access within Roma Street Parkland	n/a								**Transport:** Enhanced connectivity to the Brisbane CBD from Roma Street Station
Contaminated land: Contaminated soil within former rail yards	n/a								

	High potential adverse impact (if no mitigation)		*High beneficial impact*
	Moderate potential adverse impact (if no mitigation)		*Moderate beneficial impact*
	Low potential adverse impact (if no mitigation)		*Low beneficial impact*
	Negligible potential adverse impact		*Negligible*

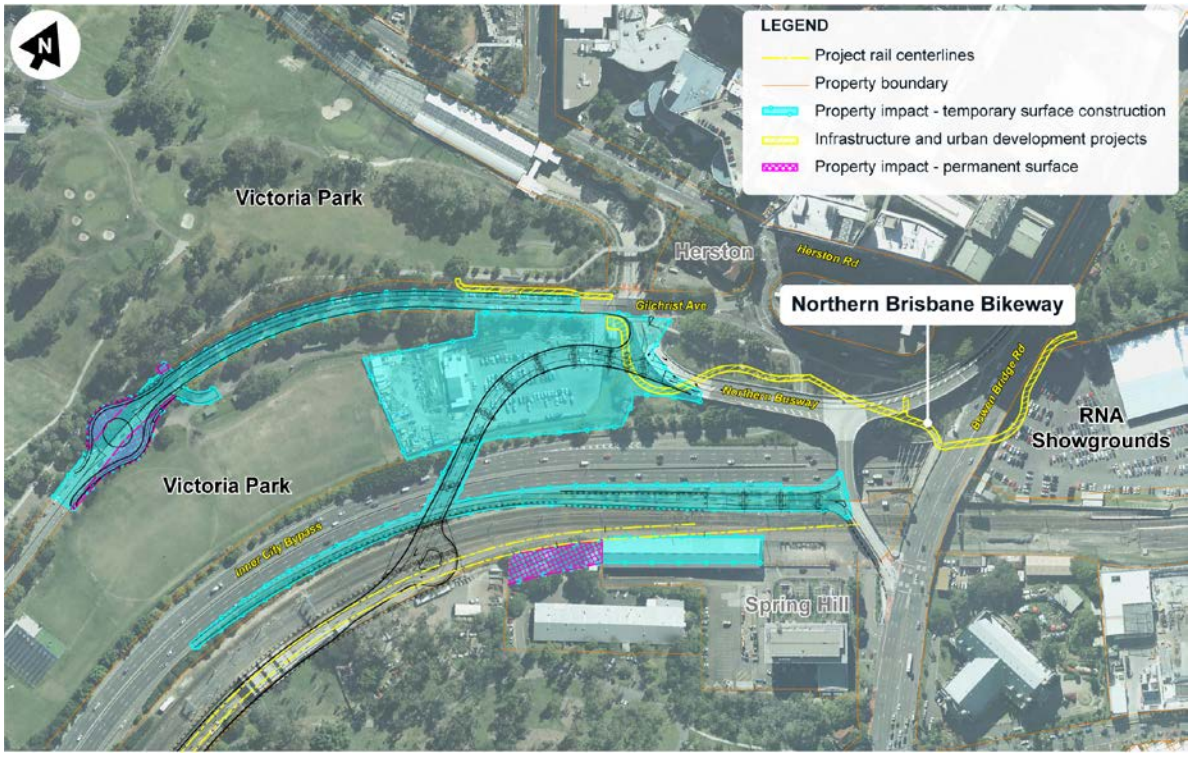
Table 17-10 Northern Connection – Spring Hill construction worksite



Construction impacts	Design	Construction 2015 – 2020 '15	'16	'17	'18	'19	'20	Operation impacts 2021 – 2121	
Transport: Disruption of access road and bikeway to Gregory Terrace within Victoria Park	n/a								**Transport:** Pedestrian and vehicular access reinstated following construction
Air quality (dust): Queensland Health Biomedical Technology Services and Centenary Aquatic Centre	n/a								**Noise and vibration:** Noise and vibration from rail and busway corridor operation
Landscape and visual: Ventilation outlet, feeder station and transition structure and construction worksite									**Landscape and visual:** Visual impact from feeder station and ventilation outlet
Social/ Cultural heritage: Establishment of worksite within Victoria Park, loss of mature vegetation									**Social/ Cultural heritage:** Victoria Park rehabilitated in accordance with a master plan prepared in consultation with the local community, Traditional Owners and Brisbane City Council
Land use: Relocation of Brisbane City Council's Field Services Group and temporary use of part of Victoria Park									

	High potential adverse impact (if no mitigation)		*High beneficial impact*
	Moderate potential adverse impact (if no mitigation)		*Moderate beneficial impact*
	Low potential adverse impact (if no mitigation)		*Low beneficial impact*
	Negligible potential adverse impact		*Negligible*

Table 17-11 Northern Connection – Herston construction worksite and car park



Construction impacts	Design	Construction 2015 – 2020						Operation impacts 2021 – 2121	
		'15	'16	'17	'18	'19	'20		
Transport: Construction traffic and decreased on street car parking availability	n/a								**Noise and vibration:** Noise and vibration from railway and busway corridors operation
Landscape and visual: Busway connection structures to Northern Busway and ICB		n/a	n/a	n/a	n/a	n/a	n/a		**Landscape and visual:** Busway connection structures (to Northern Busway and ICB) would be a dominant feature within visual environment
Contaminated land: Contaminated soil within railway corridor	n/a								**Air quality:** Emissions from ventilation outlet
Social: Loss of part of Victoria Park north of the ICB for workforce car parking									**Landscape and visual:** Victoria Park comprehensively rehabilitated following construction, including Legacy Way car park

	High potential adverse impact (if no mitigation)		*High beneficial impact*
	Moderate potential adverse impact (if no mitigation)		*Moderate beneficial impact*
	Low potential adverse impact (if no mitigation)		*Low beneficial impact*
	Negligible potential adverse impact		*Negligible*