CrossRiver*Rail*

4. Project Description

Cross River Rail

CHAPTER 4
PROJECT DESCRIPTION

JULY 2011

Contents

4 Project description

This chapter addresses Section 1.8 and Section 2 of the ToR. It provides a brief description of the key elements of the Project's construction and operation and provides a summary of major associated infrastructure requirements.

4.1 Overview of the Project

The Queensland Government is planning to transform South East Queensland's rail network, with Cross River Rail as the first step.

Cross River Rail is a new north-south rail line in Brisbane's inner city which features a railway in tunnels under Brisbane's central business district (CBD) and river, and four new underground inner-city railway stations at Roma Street, Albert Street, Woolloongabba and Boggo Road. The total infrastructure cost is estimated to be $6.4 billion (2010 dollars).

The planned underground stations would provide access to:

- key existing and future employment destinations including in the Brisbane CBD and at South Brisbane, Woolloongabba and Bowen Hills
- major event facilities including the Gabba stadium, the redeveloped River Stage in the City Botanic Gardens, the RNA Showgrounds and Suncorp Stadium via Roma Street
- significant hospitals and health infrastructure at the Mater Public and Private hospitals, the new Queensland Children's Hospital, Princess Alexandra Hospital (PA Hospital) and Royal Brisbane and Women's Hospital (RBWH)
- major tertiary education institutions including the Queensland University of Technology (QUT) at Gardens Point and improved access to the University of Queensland (UQ).

The underground system would consist of two single track tunnels of approximately 6 m internal diameter running under the city. Allowance has been made in the design for potential airspace developments directly above the stations at Albert Street, Woolloongabba and Boggo Road and adjacent to Roma Street Station.

A new signalling system for the underground section would allow 24 trains an hour to operate in the peak period on each new track. The new signalling system would also allow train operations to synchronise with the platform screen doors (PSD) in underground stations.

Cross passages between the two tunnels would be provided every 240 m for fire and life safety. A separate ventilation and emergency access building at Fairfield ensures compliance with the egress and fire and life safety requirements in the underground operating environment.

On the surface, new stations would be constructed at the RNA Showgrounds and at Yeerongpilly, and upgrades to existing stations would be provided at Moorooka and Rocklea. The Project also incorporates modifications to the rail infrastructure on the Exhibition Loop, Mayne Rail Yard, Clapham Rail Yard (new stabling facility) and from Moorooka to Salisbury.

Modifications to the road network in areas near the stations and new surface tracks would also be undertaken for the Project. Additionally upgrades and changes to the pedestrian and cycle network near the stations would also occur to provide improved connectivity and access to Cross River Rail.

Upon completion, Cross River Rail would deliver additional passenger rail capacity into central Brisbane. This capacity has been designed to accommodate the forecast demands of Monday to Friday business, special cultural and sporting events and increased patronage requirements over the weekends.

The Project would form part of the South East Queensland passenger rail network which is operated by Queensland Rail. Freight tracks in the study corridor would continue to operate separately. Access would not be provided to Cross River Rail underground infrastructure for freight rail operators.

4.1.1 Operation overview

This section provides an overview of the Project's operation. More detailed information is provided in **Section 4.3**.

The introduction of Cross River Rail is based on separating the current network into sectors. These include:

- north-south Cross River Rail sector, which connects the Beenleigh and Gold Coast lines to the Redcliffe and North Coast/Caboolture lines and allows the transition to nine-car sets on these high growth lines
- east-west sector, which connects the Springfield and Rosewood/Ipswich lines to the Airport and Shorncliffe lines
- Brisbane suburban sector, which connects the Ferny Grove and Doomben lines to Kuraby and Cleveland/Manly lines, which service the current South Bank and South Brisbane stations and uses the Ferny Grove flyover and the suburban platforms in the inner city.

The Project has been designed to accommodate future nine-car train sets which are expected to commence operations prior to 2031. In the interim, the Project would be used by Queensland Rail's existing six-car train sets.

The Project would allow the current number of passenger train services to the city to double (up to 24 nine-car trains per hour in each direction), providing improved public transport access from the northern and southern growth corridors. This increased rail capacity is an essential requirement for future rail network enhancements.

The Project includes a train stabling facility at Clapham Rail Yard which would accommodate 27 six-car trains or 15 nine-car trains.

Queensland Rail is expected to manage and operate the Cross River Rail infrastructure and provide the operating passenger trains in accordance with its current network operations.

4.1.2 Construction overview

The Project would involve both surface and underground construction works and would be undertaken from multiple worksites across the study corridor. Key phases include:

- pre-construction, including demolition and worksite establishment
- construction of surface and underground works
- fit-out of the tunnels and stations
- commissioning, including testing of the surface and underground infrastructure
- construction decommissioning and rehabilitation.

The following provides an overview of the Project's construction, including the construction methodology and program. More detailed information is provided in **Section 4.4**.

Construction methodology

Construction of the tunnels and underground stations for Cross River Rail would involve a combination of cut and cover, cavern, mined excavation and driven tunnel methods.

The tunnels would be constructed primarily by tunnel boring machine (TBM). Four TBMs would be used for construction, with two TBMs launched at Yeerongpilly and travelling to Woolloongabba and two launched at the Woolloongabba worksite and travelling to the northern portal at Victoria Park. Construction of underground stations would generally involve mined cavern and/or cut and cover construction methods.

The surface rail infrastructure works represent approximately 50% of the overall project length. Much of the surface works border the existing Queensland Rail operational network. The southern surface works extend from the southern portal to Musgrave Road at Salisbury. The northern surface works would generally extend from the northern portal at Victoria Park to Enoggera/Breakfast Creek, within Mayne Rail Yard at Bowen Hills.

Works associated with the construction of surface rail infrastructure would generally include:

- demolishing or removing existing buildings, structures and infrastructure
- constructing new surface stations at the RNA Showgrounds and Yeerongpilly
- upgrading existing stations at Rocklea and Moorooka
- constructing new rail bridges and viaducts
- constructing new rail tracks and other infrastructure
- altering or realigning existing rail tracks and other infrastructure
- realigning existing road, pedestrian and cycle networks
- relocating existing public utility plant (PUP).

Construction program

Major construction activities are expected to commence in 2015 with the Project expected to be open to rail passenger transport around 2020.

The design, construction and commissioning works for the Project are expected to take approximately 5.5 years, with key stages of the construction program including:

- detailed design and worksite establishment, which would take approximately 12 months
- major underground construction, which would take approximately 4.5 years
- surface rail infrastructure works, which would take approximately five years
- fit-out of stations and tunnels, which would take approximately two years
- testing and commissioning, which would take approximately six months.

Some works within each stage would be undertaken concurrently with works for other stages, allowing the overall program timeframes to be reduced.

Much of the new surface work in the southern section can be carried out independently of the main line rail operations. However, significant work would be required within the existing rail corridor, associated with:

- relocation of existing tracks
- construction of new tracks, bridge and viaduct structures and track infrastructure such as power and signalling
- station upgrades.

These works would require consideration of Queensland Rail's forward possession planning for the overall South East Queensland network and would need to occur over designated weekends or public holiday periods such as long weekends, Easter and Christmas.

The fit-out of underground stations would commence once the station structural shells are complete and the ongoing TBM operations allow.

The testing and commissioning stage would include testing and training in relation to fire and life safety systems, flood protection systems, day to day operations and general passenger and train control.

3.1 Project location

This section describes the location of the study corridor and major project infrastructure and provides an overview of the regional and local context relevant to the Project, such as key land use and natural features and land tenure.

4.1.3 Study corridor

The study corridor is located in the Brisbane local government area (LGA) within South East Queensland. It is approximately 19 km long and extends from Wooloowin in the north to Salisbury in the south, via the Brisbane CBD and Woolloongabba (refer to **Figure 4-1**).

The northern part of the study corridor generally follows the existing rail corridor from north of Wooloowin Station, south to the existing Exhibition Station at Bowen Hills. From the existing Exhibition Station, the corridor widens to include Spring Hill and the Brisbane CBD, the Woolloongabba urban development area (UDA) and the Boggo Road Urban Village.

South of Boggo Road, the study corridor generally follows the existing rail corridor to Salisbury and includes the existing train stations of Dutton Park, Fairfield, Yeronga, Yeerongpilly, Moorooka, Rocklea and Salisbury. Between Dutton Park and Rocklea, the study corridor is widened towards the west to include Fairfield Road.

4.1.4 Key features of the study corridor

The study corridor includes a number of key land use and natural features.

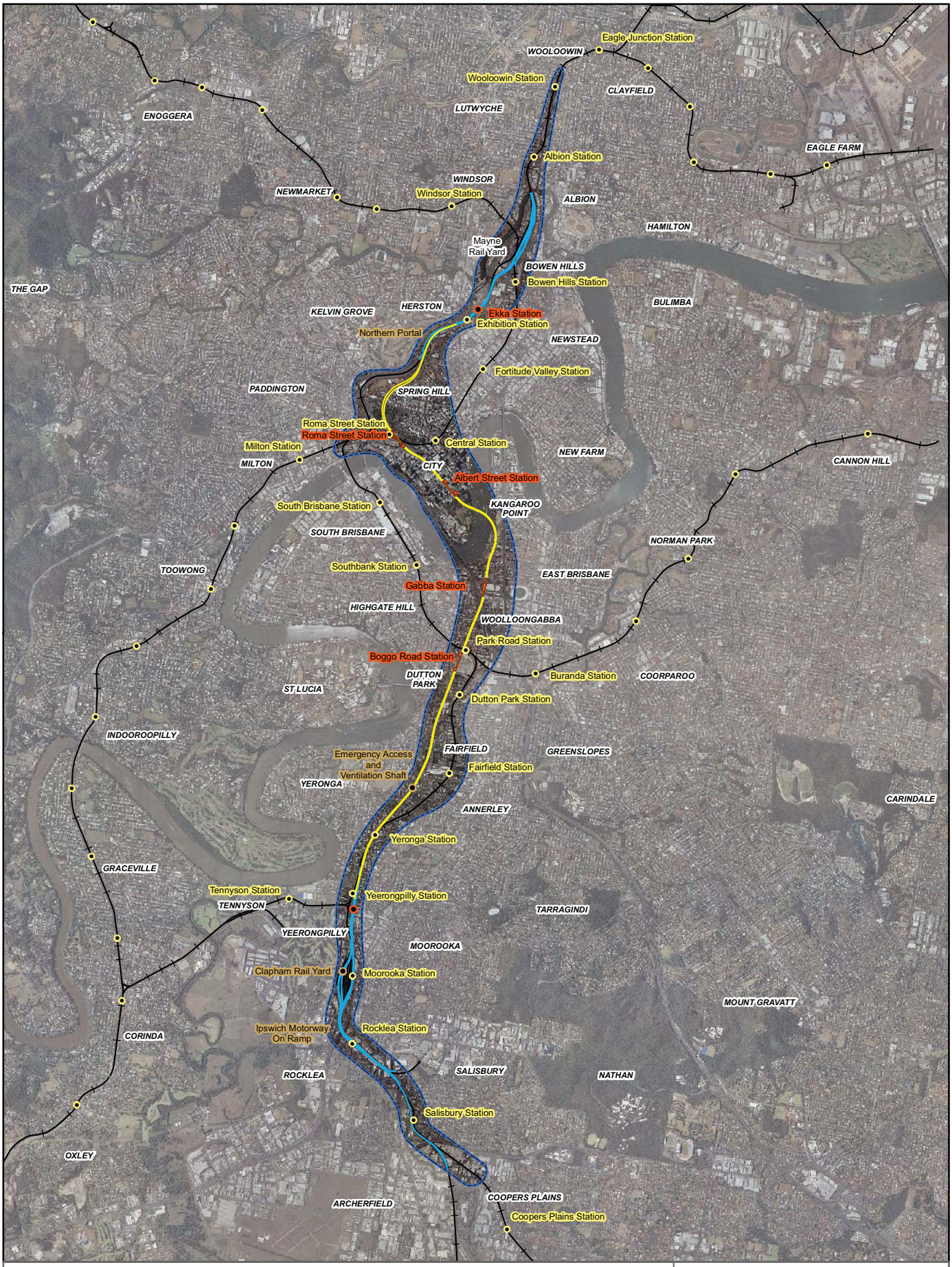
Land use

The study corridor comprises a broad mix of land uses that reflect the inner city and inner suburban location. It includes areas of residential, commercial, community, open space and light industry.

Densities across the study corridor vary, with the highest densities located within the Brisbane CBD. Other areas of higher density development are situated at key employment areas or around key transport nodes.

Residential is the most prominent land use in the study corridor. Residential uses are located across the study corridor, although key residential suburbs include Wooloowin and Albion north of Breakfast Creek, the inner city suburb of Spring Hill, and Fairfield, Yeronga, Yeerongpilly, Moorooka and Salisbury to the south.

Industrial land uses are primarily located at Bowen Hills in the north and at Yeerongpilly, Rocklea and Salisbury in the south. Commercial uses are predominantly located within the Brisbane CBD.



LEGEND

- Study Corridor
- Existing Station
- Track
- New Surface Station
- New Underground Station
- Associated Infrastructure

Alignment

- Above Ground
- Underground

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-1

The Reference Design and Study Corridor

0 1 2 3 4 Km

1:75,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0100_CRR_Reference_Project_A4.mxd 06/07/2011 14:17

The study corridor includes a number of major community uses including the RNA Showgrounds, RBWH, QUT, Mater Hospital, PA Hospital and the Gabba stadium.

Key development areas include the Bowen Hills UDA, the Woolloongabba UDA, the Boggo Road Urban Village, and the Yeerongpilly transit oriented development (TOD).

The study corridor contains a range of significant transport infrastructure, including:

- major road transport, such as the Inner City Bypass (ICB), the Clem Jones tunnel, the Pacific Motorway, Ipswich Road and the Ipswich Motorway
- rail infrastructure, including the North Coast, Beenleigh, Gold Coast, and Cleveland lines and the interstate standard gauge line, as well as Roma Street Transit Centre, Mayne Rail Yard and Clapham Rail Yard
- busways, including the Inner Northern Busway, South East Busway and Eastern Busway
- key pedestrian and cycle networks, including the South East Freeway bikeway, ICB land bridge and Eleanor Schonell Bridge.

Further information on existing land uses and transport infrastructure is provided in **Chapter 9 Land Use and Tenure** and **Chapter 5 Transport** respectively.

Natural features

Natural features in the study corridor are generally limited to waterways and major open space areas. Waterways located within the study corridor include:

- the Brisbane River, which generally extends the length of the study corridor and is traversed by the Project near the Brisbane CBD
- Breakfast/Enoggera Creek, which is located in the northern part of the study corridor
- Oxley Creek and its tributaries of Moolabin Creek, Rock Waterholes Creek and Stable Swamp Creek, which are located in the southern part of the study corridor.

A number of surface water features such as ponds and lakes are also located in the study corridor at the City Botanic Gardens, Roma Street Parkland and York's Hollow at Victoria Park. The study corridor also traverses the catchment boundaries of Kedron Brook in the north and Norman Creek in the south.

Major open space areas located in the study corridor include Victoria Park, Roma Street Parkland, the City Botanic Gardens and the Kangaroo Point Cliffs. A number of smaller open space areas and reserves are also located across the study corridor.

Further information on natural features within the study corridor is in **Chapter 11 Nature Conservation** and **Chapter 13 Surface Water**.

4.1.5 Tenure

Existing rail corridor land generally comprises leasehold land administered by the Department of Environment and Resource Management. The majority of rail corridor land in the study corridor is leased by the Department of Transport and Main Roads, with subleases to Queensland Rail. Following construction, land acquired for the Project and which accommodates project infrastructure, would be held as rail land.

The majority of land in the study corridor is held in freehold tenure. This includes freehold land owned by the:

- Brisbane City Council, such as Victoria Park, South Brisbane Cemetery and Robinson Park
- Queensland Government departments, such as the Department of Public Works (Boggo Road Urban Village and Roma Street Parkland) and the Department of Education and Training
- Commonwealth Government, such as the Commonwealth Law Courts and General Post Office.

Land in the study corridor is also held as reserve, land set aside for community and public purposes, Council land and lands lease, and land primarily established for the existing rail corridors. Further information on existing land tenure in the study corridor is provided in **Chapter 9 Land Use and Tenure**.

4.1.6 Project infrastructure

Key project infrastructure required for Cross River Rail includes:

- tunnel infrastructure, including rail tunnels, tunnel portals and dive structures and the ventilation and emergency access building
- surface rail infrastructure, including bridge structures, viaducts and stabling facilities
- stations, including underground stations, station entrances and surface stations
- associated infrastructure, including feeder stations, road upgrades and pedestrian access.

The location of key project infrastructure is summarised in **Table 4-1** and shown on **Figure 4-1**. Further detail on key project infrastructure is provided in **Section 4.2** and in **Volume 2 Reference design drawings.**

Table 4-1 Key project elements

Project Element	Location
Tunnel infrastructure	
Rail tunnels	Two separate tunnels, including one for northbound and one for southbound tracks, extending from the northern portal at Spring Hill to the southern portal at Yeerongpilly.
Tunnel portals and dive structures	The northern portal is located along the northern edge of Victoria Park, between the ICB land bridge and Bowen Bridge Road. Both southbound and northbound tracks would use the one portal and dive structure. The southern portal and dive structure is located on the eastern side of the existing rail corridor at Yeerongpilly, from just north of Crichton Street to Livingstone Street.
Ventilation and emergency access	The ventilation and emergency access building is located on land owned by Energex and Brisbane City Council at Railway Road, Fairfield, between Sunbeam and Bledisloe streets.
Surface rail infrastructure	
Surface tracks	Additional surface tracks are located: • north of the northern portal, between Victoria Park and Breakfast Creek, within the existing rail corridor for the Exhibition Loop, RNA Showgrounds and Mayne Rail Yard • south of the southern portal, between Yeerongpilly and Salisbury, including narrow guage tracks generally on the eastern side of the study corridor and a dual gauge track on the western side of the corridor.

Project Element	Location
Viaducts	Viaducts would be required to allow the separation of rail movements. These would be located: • within Mayne Rail Yard, adjacent to the ICB • within Clapham Rail Yard, west and south of Moorooka Station
Bridge structures	Two new rail bridges would be required: • over Muriel Avenue at Yeerongpilly • over Moolabin Creek at Yeerongpilly. Road bridges would also be required over the existing rail corridor at O'Connell Terrace, Bowen Hills and under the Ipswich Motorway at Rocklea.
Stabling	New stabling infrastructure would be located at Clapham Rail Yard.
Stations	
Underground stations and station entries	Four underground stations are proposed for Cross River Rail at: • Roma Street, with an entry to the existing underground concourse to allow interchange with existing surface rail and busway networks, and an entry immediately north-west of Emma Miller Place allowing access from Albert and Roma streets. • Albert Street, between Alice and Mary streets, with station entries at the corner of Albert and Mary streets, Albert and Alice streets, and Alice Street adjacent to the City Botanic Gardens. • Woolloongabba, adjacent to Leopard Street within the Woolloongabba UDA, with one entry located immediately east of Leopard Street at the western extend of the existing Goprint site. • Boggo Road, within the Boggo Road Urban Village, with one entry located immediately adjacent to the existing Park Road Station and Boggo Road busway station, and one entry located south east of the Boggo Road Gaol. Further details on the design of stations, including station platforms, access and amenities are outlined in **Section 4.2.2**.
New surface stations	New surface stations are proposed at: • the RNA Showgrounds at Bowen Hills (Ekka Station), with one entry to O'Connell Terrace and a second entry to the RNA Showgrounds • Yeerongpilly, in an industrial area at Station Road, south of the existing station, with access to the realigned Wilkie Street and Station Road.
Existing station upgrades	Upgrades are proposed at the existing Moorooka and Rocklea stations to meet requirements of the Disability Discrimination Act 1992 (DD Act) The existing footbridge at Salisbury Station would also be extended across the widened railway corridor.
Associated infrastructure	
Feeder stations and electrical substations	Three new 25 kV feeder stations are proposed to provide the additional power required for the Cross River Rail traction power system. These would be connected to a 110 kV Energex substation. The feeder stations and substations would be located: • at Mayne Rail Yard, adjacent to the rail corridor and access road • near the northern portal at Victoria Park • adjacent to the widened rail corridor, south of the new Yeerongpilly Station.
Train control	The existing Queensland Rail train control centre at Mayne Rail Yard would be used for Cross River Rail.

Project Element	Location
Road network changes	Changes to the road network would be required for the Project, including: • regrading of O'Connell Terrace at Bowen Hills, to accommodate raising of the bridge across the rail corridor • re-configuration of the Roma Street and George Street intersection, Parkland Boulevard and widening footpaths on the northern side of Roma Street • re-configuration of Albert Street between Charlotte and Alice streets and partial reconfiguring of Mary Street traffic lanes to enable footpath widening • realignment of Wilkie Street and Station Road at Yeerongpilly • re-configuration of the Sherwood Road to Fairfield Road southbound slip lane at Yeerongpilly • reconstruction of the southbound ramp to Ipswich Road at Rocklea • closure of the Beaudesert Road service road open level crossing • reconfiguration of Fairlie Terrace and Railway Parade, and provision of a new signalised intersection at Gladstone Street and Muriel Avenue • reconfiguration of Heaton Street and Dollis Street, and provision of a new signalised intersection at Dolis Street and Beaudesert Road • widening of Tramore Street to allow two way traffic access. Further details about proposed changes to the road network are provided in **Section 4.2**.
Access roads	Access roads for emergency and maintenance access along the corridor would be accommodated where new surface tracks are being provided, except between Bowen Bridge Road and O'Connell Terrace (due to the confined nature of the rail corridor in this location).
Pedestrian rail overbridge	A new pedestrian overbridge would be provided north of Salisbury Station to replace the existing pedestrian crossing at the Beaudesert Road service road open level crossing. The overbridge would connect Heaton Street with Fairlie Terrace. Upgrades to existing pedestrian overbridges would also be made at Yeerongpilly, Moorooka, Rocklea and Salisbury stations. This would involve lengthening of the overbridges across the rail corridor.
Water and waste management structures	Waste management structures are not required for the operation of the Project. Two water treatment plants are proposed at Roma Street Station and the Gabba Station. During construction, temporary water treatment facilities would be provided at the Yeerongpilly, Boggo Road and Woolloongabba construction worksites.

4.1.7 Construction worksites

Construction of Cross River Rail would require a number of construction worksites across the study corridor.

Construction worksites for tunnelling activities would be located at Victoria Park, Woolloongabba and Yeerongpilly. Construction worksites would also be located at each of the proposed underground stations, at proposed surface stations, at Fairfield to support construction of the ventilation and emergency access building and at Mayne Rail Yard and Salisbury to support construction activities associated with surface works.

Table 4-2 provides a summary of the construction worksites proposed for the construction of Cross River Rail. Further details on each of the construction worksites, including area, site layout, access, facilities and main construction activities, and proposed buffers around the construction worksites, are provided in **Section 4.4.3**.

Table 4-2 Location of construction worksites

Worksite	Purpose	Location
Major construction worksites		
Victoria Park, Spring Hill	This site would be used for: • construction of the northern portal, dive structure and cut and cover tunnel sections • retrieval of the TBMs for the tunnels between Woolloongabba and Victoria Park • tunnel fit-out.	Adjacent to the Exhibition Loop, north of Centenary Pool, within Victoria Park, the existing rail corridor and land owned by Brisbane City Council.
Woolloongabba	The site would be used for: • construction of the cut and cover box and station cavern for the Gabba Station • TBM launch site and removal of spoil from construction of the tunnels between Woolloongabba and Victoria Park • retrieval of the TBMs for the tunnels between Yeerongpilly and Woolloongabba.	Goprint site at the Woolloongabba UDA, bounded by the South East Busway, Leopard Street and the South East Freeway off-ramp to Vulture Street.
Yeerongpilly	The site would be used for: • construction of the southern portal and new Yeerongpilly Station • TBM launch site and removal of spoil from the tunnels between Yeerongpilly and Woolloongabba • construction of the extended footbridge to the existing station and the new re-aligned local streets • construction of the feeder station • tunnel fit-out.	Area alongside Wilkie Street and east of the rail corridor and industrial and commercial properties at Station Road.
Other construction worksites		
Bowen Hills		
Mayne Rail Yard	Construction site and material laydown area to support construction of the northern viaduct in Mayne Rail Yard.	Three sites are located in Mayne Rail Yard, including: • northern end of Mayne Rail Yard, north of the Ferny Grove rail line • adjacent to Abbotsford Road, north of the Ferny Grove rail line • southern end of Mayne Rail Yard, adjacent to the ICB and Queensland Rail train control centre.

Worksite	Purpose	Location
Mayne feeder station site	Construction of the Mayne feeder station.	Adjacent to the access road to Mayne Rail Yard and the ICB off-ramp to Clem Jones Tunnel.
O'Connell Terrace	Construction support sites for the regrading of O'Connell Terrace, including road over rail bridge.	Three sites are located on O'Connell Terrace, including between Sneyd Street and the ICB and either side of Tufton Street.
RNA Showgrounds	Worksites at the RNA Showgrounds would be used for construction of a new station and surface tracks and regrading of O'Connell Terrace.	Within the RNA Showgrounds, adjacent to: • O'Connell Terrace, east of the rail corridor • the western side of the rail corridor.
Brisbane CBD		
Roma Street Parkland	Satellite site to support the Roma Street Station construction.	Car park at College Close, located west of Roma Street Station, between the Roma Street Parkland and the rail corridor.
Roma Street Station – north	This site would be used for the construction of the: • northern plant shaft and building for Roma Street Station • relocated toilet facilities.	Luggage handing building adjacent to Platform 10.
Roma Street Station – central	This site would be used for the construction of the: • central shaft for escalators and lift shaft access to the existing station concourse.	Queensland Rail car park adjacent to the heritage listed station building on Platform 3.
Roma Street Station – south	This site would be used for the construction of the: • shaft to accommodate the southern entrance to the station and associated plant • main on-site support for construction of the station cavern.	On Roma Street, between Roma Street and the inner northern busway corridor, either side of the access road to Roma Street Parkland.
Albert Street – north	This site would be used for the construction of the northern station entrance and associated plant.	North east corner of Albert and Mary streets.
Albert Street – south	This site would be used for construction of the: • Albert Street Station cavern • shaft accommodating the southern entrance and associated plant • subway and entrance under Alice Street.	On Albert Street, between Alice and Margaret streets, on the site of the existing Royal on the Park hotel.

Worksite	Purpose	Location
Dutton Park		
Boggo Road Station	This site would be used for the construction of the cut and cover station box, entrance shafts and associated plant.	Adjacent to Annerley Road at the Boggo Road Urban Village, either side of Peter Doherty Street. A second support site is located between Boggo Road and the Boggo Road busway station.
Fairfield		
Ventilation and emergency access building	Construction of ventilation shaft and emergency access building.	On the median between Fairfield Road and Railway Road, south of Bledisloe Street and on Energex land east of Railway Road, between Bledisloe and Sunbeam streets.
Moorooka, **Rocklea and Salisbury**		
Clapham Rail Yard	Material laydown and construction site for surface track work within Clapham Rail Yard.	Western part of Clapham Rail Yard, adjacent to Fairfield Road.
Moorooka	Construction site and stockpiling of materials for the construction of the viaduct.	Two worksites are located in this area, including: • on residential land located between Ipswich Road and the existing rail corridor • on industrial land bounded by Unwin Street, Ipswich Road and the railway corridor, adjacent to Moorooka Station.
Rocklea	Construction of the Muriel Avenue bridge and road works associated with the Ipswich Road on-ramp. Material laydown area for construction of the new surface tracks.	On land currently occupied by a hotel, south of Medway Street, between Fairfield Road and the Ipswich Motorway. On industrial land between Annie Street and the railway corridor, east of Rocklea Station.
Salisbury	These sites would be used for: • storage and material laydown • construction of the new footbridge north of Salisbury Station and extension of the existing footbridge at Salisbury Station • southern surface tracks • road realignments.	Two worksites are located in this area, including: • land bounded by Beaudesert Road, Dollis Street and the railway corridor • land within the rail corridor, adjacent to the track bifurcation, south of Riawena Road.

4.2 Project design

This section provides a description of the Project, including the design of stations and tunnels, and associated infrastructure.

4.2.1 Design standards and criteria

The Project has been developed to meet the requirements of an Output Specification developed for the Project (AECOM, 2011c) based on current design standards and engineering principles. Project development was supplemented by feedback received during consultation with key stakeholders and the community.

The Output Specification sets out the general characteristics of the system, service outcomes and technical parameters required to achieve delivery and operation of the Project. It supports the higher level objectives of the Project as well as the more detailed service requirements developed in line with the transport goals of the draft *Connecting SEQ 2031: an Integrated Regional Transport Plan for South East Queensland* (Connecting SEQ 2031).

Rollingstock

The Project has been designed to accommodate rollingstock that is generally compatible with requirements to operate on the Queensland Rail Citytrain network in South East Queensland, relating to clearances, signalling and communications, traction power, track guage and car configuration.

Station platforms have also been designed to cater for the new generation rollingstock, including nine-car train sets, proposed to be introduced onto the South East Queensland rail network by 2031. In the interim, the existing train sets would operate on the Project infrastructure.

Design life

The Project has been designed to provide a minimum design life of 100 years for the tunnel lining and project structures and 40 years for fixtures and fittings. Relevant design requirements for each project element are identified in the following sections.

4.2.2 Station design

The stations are the key element of the Project, generally determining the horizontal and vertical alignment of the tunnel and providing the boarding and alighting facilities for passengers.

Station design requirements

The Cross River Rail stations have been designed to comply with relevant legislation, standards and policies including:

- *Disability Discrimination Act 1992 (DD Act)*
- Building Code of Australia
- Disability Standards for Accessible Public Transport (DSAPT)
- Queensland Rail Station Design Guide
- Queensland Rail Accessibility Signage Manual
- TransLink Station Signage Manual.

Key aspects of the Cross River Rail stations include:

- All station areas and facilities are designed to enable the vertical circulation of the forecast passengers to/from the underground platforms in the morning and afternoon peak periods.
- The stations have been designed to achieve a general functionality at peak times that is no worse than 1.54 passengers/m² of station floor space for standing, ie level of service C, under normal commuter operating conditions.
- The stations have been designed to provide sufficient capacity for the fire and life safety evacuation requirements[1] for the station and tunnel system, as outlined in the Output Specification.
- The ventilation systems for the stations and tunnels have been designed as separate systems to allow the platform space to be air-conditioned.
- The platform faces at each station include automatic, full height PSD.
- Each station incorporates fully automated passenger information systems, including
  - active train information at station entry and platform levels
  - public address system throughout the station
  - station information and help points.
- The stations are designed to enable a safe and friendly environment for passengers in all public areas of the station, and would incorporate lighting and security surveillance systems.

A typical cross section of an underground station cavern is shown in **Figure 4-2**. Cross sections and long sections of each station are also provided in **Volume 2 Reference design drawings**.

Station design capacity

Cross River Rail stations have been designed to meet the projected peak passenger loading at each station based on the two hour morning and two hour afternoon peak travel periods in 2031.

Mechanical and electrical services

Underground stations would be provided with mechanical cooling to the platform level to improve passenger amenity and comfort. This would be achieved through the provision of mechanical plant located at each end of the station and a sub-floor displacement system along the length of the centre platform. It is proposed to maintain temperatures of 26°C at the platform level in the vicinity of the PSD during the hotter months.

Acoustics noise and vibration

Station acoustics would be managed through surface finishes and treatments to control reflective surfaces. Train noise in stations would be controlled through the use of PSD. Train vibration control would occur through resilient fastenings or vibration-isolated tracks.

[1] The fire and life safety design shall generally be in accordance with the widely recognised American guideline – NFPA 130 with additional reference to the European standard : EU TSI for Safety in Rail Tunnels.

1. 21 Person Lift
2. Custom Feature Suspended Ceiling
3. GRFC (Glass Reinforced Fibre Cement) Feature Panels
4. GRFC Standard Wall Panel – Neutral Colour
5. 1200mm High Toughened Glass Stainless Steel Balustrade
6. Reconstituted Stone Epoxy Floor Tile on Screed
7. Aluminium Blade Ceiling System with Integrated Linear Slot Diffusers
8. Aluminium Framed Platform Screen Door
9. 800mm Glazed Smoke Baffle
10. Stainless Steel Smoke Grill Exhaust
11. Automated Dampers
12. Fire Escape Door
13. Class 1 Steel Form Concrete Finish Sealed
14. Over Track Exhaust
15. Smoke Duct
16. Continues Indirect Light

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-2

Typical cavern section

CrossRiverRail

SKM aurecon

CRR JOINT VENTURE

Station planning and design

The stations, surface structures and public domain areas have been designed to provide a clear Cross River Rail identity that connects with existing and proposed surrounding urban development.

The station design and location of station entries have been informed by the vision and city building outcomes identified for each station location. These are described in **Chapter 10 Visual Amenity and Lighting** along with the goals and objectives and key design principles identified to guide the design of project infrastructure.

The stations have also been designed to reflect the city's sub-tropical environment and incorporate elements of sub-tropical design principles. These include:

- maximising access to natural light and ventilation for passenger amenity and comfort
- providing shade and shelter at station entrances
- providing sub-tropical landscaping
- encouraging active streetscapes around stations
- ensuring the design of stations reflect the character of the local area.

The planning and design of stations also considered transit oriented development principles as identified in the Transit Oriented Development Guide (DIP, 2010a). In particular, the stations have been planned and designed to:

- integrate with existing and future growth areas, such as the Bowen Hills and Woolloongabba UDAs, Boggo Road Urban Village and Yeerongpilly TOD
- support increased public transport use and facilitate a high level of intermodal connection
- provide a high-quality public realm and incorporate sub-tropical design features that maximise amenity, street activity and pedestrian connectivity
- provide a high sense of personal and community safety.

Cross River Rail stations have also been designed to:

- respond to the unique character of Brisbane
- provide a clear architectural identity for Cross River Rail and clearly identify Cross River Rail within the urban context
- promote passenger experience and comfort
- be functional buildings that promote efficiency of passenger movement
- seamlessly integrate with the existing context and future precinct plans
- incorporate a high level of standardisation in planning and built elements to facilitate expedient construction
- incorporate high quality and durable materials selected for life cycle performance, maintenance, sustainability performance and cost.

Key principles guiding the station design are described in **Table 4-3**.

Table 4-3 Station design – key principles

Element	Details
Public domain	• Emphasise access for pedestrians, cyclists and other public transport, providing new connections and reinforcing existing connections. • Deliver sufficient capacity to ensure distribution of pedestrians into the community at peak times within desirable levels of service. • Facilitate safety in design, particularly to bus stops and waiting areas. • Provide shade and shelter at entries and at key pedestrian collection points. • Provide opportunity for retail and other activation of the ground plane in the vicinity of the station entry to improve passenger service/comfort and passive surveillance. • Protect and enhance view lines to reinforce the character of existing streets and buildings. • Use durable and distinctive materials to increase sense of place and differentiate station locations.
Station entry	• Create a highly visible station entry providing a recognisable destination from different view points. • Utilise the station design as part of establishing a brand for Cross River Rail. • Create a suite of structures which are identifiable and give identity to the Cross River Rail line to assist in legibility of the broader system.
Station planning	• Connect the perception of public space from the entry level to the platform. • Optimise passenger convenience, safety and comfort. • Provide an intuitive journey from surface to platform with a minimum number of decision points. • Allow for incorporation of future commercial development opportunities in key strategic locations. • Meet functional requirements for anticipated station capacities in 2031, including clear passenger flows, access to ticket lines, ticketing, station, toilet, retail and other facilities. • Provide for platforms with PSD. • Provide for staff facilities in line with Queensland Rail operational guidelines. • Comply with relevant Queensland Rail and national rail standards. • Provide equitable access for staff and passengers.

Crime prevention through environmental design

- Commuter safety and security is a key driver for the station design. Crime prevention through environmental design (CPTED) principles have been considered in the development of the station designs. These include:
- ensuring clear sight lines on approach to station
- locating station entry points and staff entries in areas activated by other uses, such as retail, or within sight lines of adjoining residential or commercial tenancies
- minimising dead spaces behind columns or other barriers
- providing public toilets within the paid concourse entrance, visible from staff positions, well lit and monitored
- designing stations with a central platform to avoid the isolation of passengers
- provision of PSD to avoid accidental access to the rail line
- ensuring that station entries are able to be closed during non-operational hours
- integrating security bollards where vehicular access/approach to the station is available.

In addition, each station would also incorporate:

- good levels of lighting in and about the station entry points
- closed circuit television monitoring, including to the entire platform
- intrusion detection and monitoring
- easily located help points
- a full-time staff member located on platforms during operational hours.

Environmental design features

A range of environmental design features have been incorporated into the station design for both underground and surface rail stations. These include:

- water sensitive urban design (WSUD) measures to manage storm water run-off
- provision of planting for visual amenity and improvement of micro-climates
- the use of natural light where possible
- ventilation used to manage station temperature and air flow
- natural and manmade canopies to shade and provide amenity
- vegetation to form natural barriers along the rail corridor.

The design of the stations has also considered the environmental context of the local and regional areas.

Asset protection from flooding

A range of flood protection measures are incorporated into the reference design to provide flood immunity to the underground system in either a local flood event, intermediate flood event, i.e. 1 in 500 year to 1 in 1,000 year flood events, or extreme flood event, i.e. one in 10,000 year flood event.

All stations incorporate raised entrances to protect them against local flash flooding events and potential problems with the local storm water network. The entrances to Boggo Road, Gabba and Roma Street stations are all above the one in 10,000 year river flood level. As such, no further flood protection measures have been included at these locations.

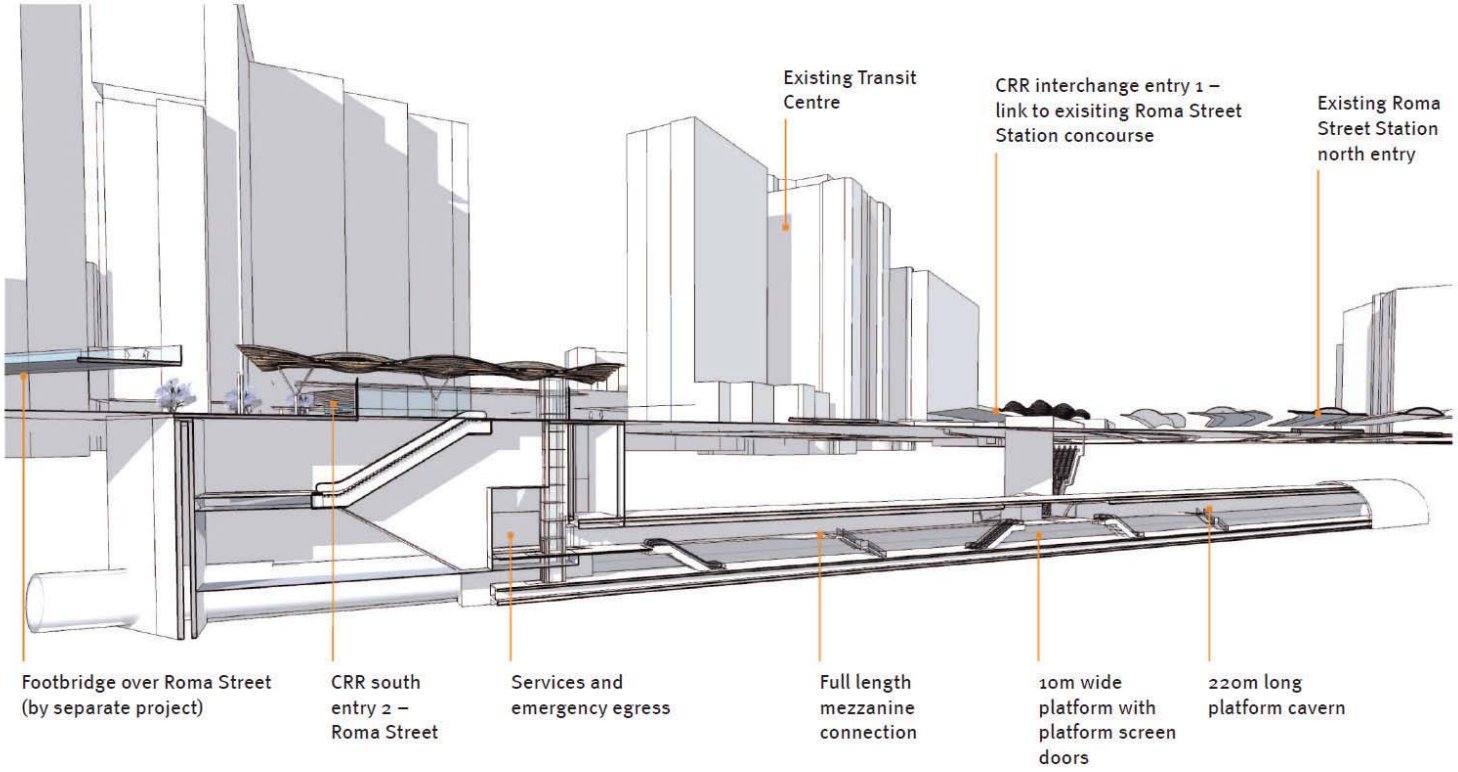
Albert Street Station entrances are protected by both floodboards and floodgates, while the southern portal is also protected by floodgates integrated with the southern portal structure. Floodboards can be quickly and easily installed in case of intermediate flood events and provide up to one metre of additional protection above the raised entrances. The floodgates provide protection up to a one in 10,000 year flood event.

4.2.3 Roma Street Station

The Roma Street Station is a single span cavern incorporating a central island platform (refer to **Figure 4-3** and **Figure 4-4**). The cavern is approximately 25 m deep from surface to platform level. The station has been oriented to avoid subsurface obstructions and allow the running tunnels to achieve suitable operational requirements.

The station design provides two entry points to the Cross River Rail platforms. One entry connects with the existing underground concourse, which links with the existing surface rail and busway networks. The existing underground concourse also provides access to Roma Street Parkland and to upper Albert Street and Spring Hill. The second (southern) entry is positioned in the north-west of Emma Miller Place and provides a new entry from Albert and Roma streets.

Roma Street
Longitudinal section

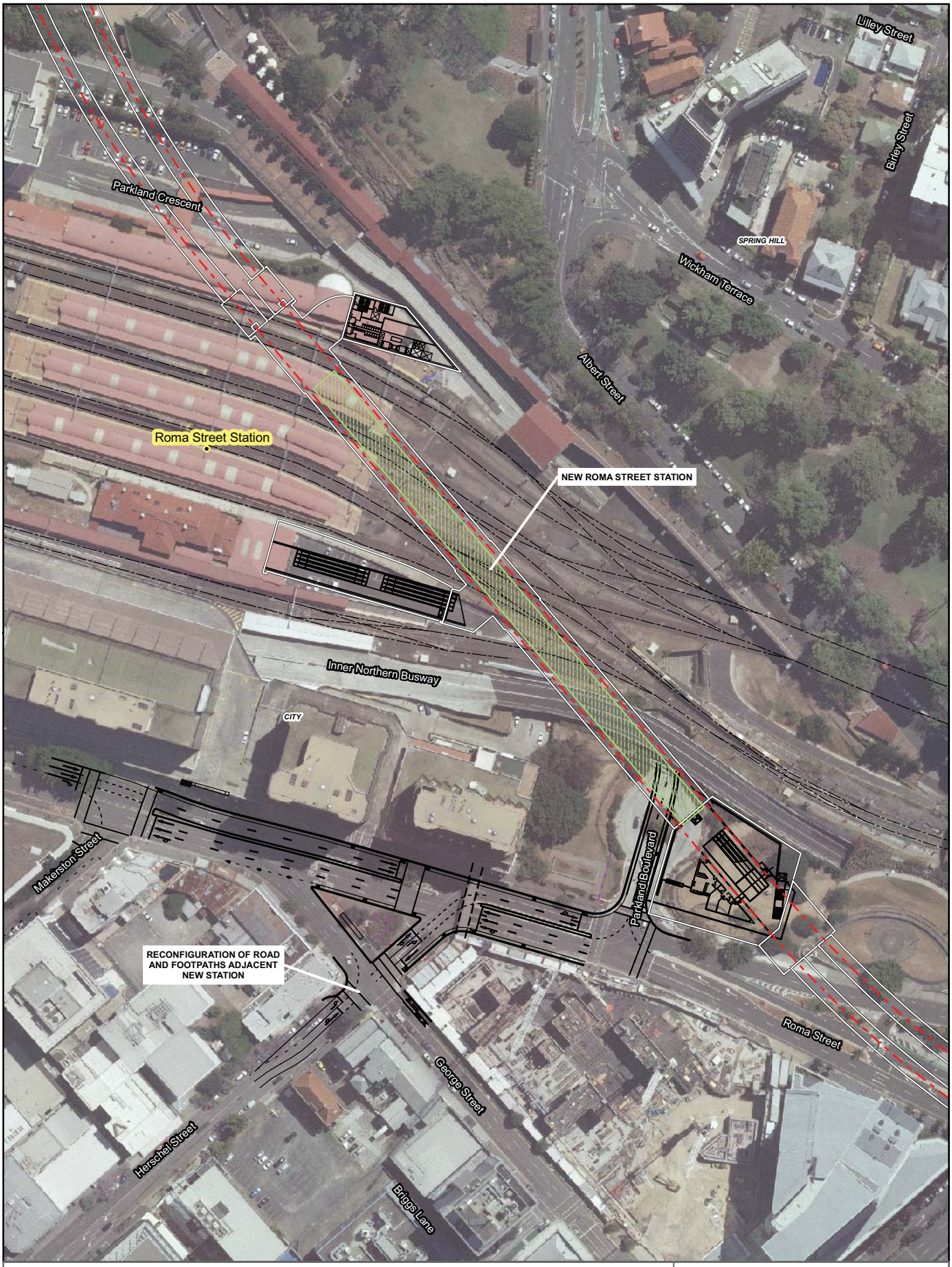


CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-3
Roma Street Station Cross Section

CrossRiverRail

SKM aurecon
CRR JOINT VENTURE



LEGEND

- Study Corridor
- Tunnel and Station Structure
- Existing Track
- Proposed Platform
- Proposed Track

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-4

Roma Street Station Surface Works

0 25 50 75 100 Meters

1:2,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0101_CRR_Roma_St_Surface_Works_A4.mxd 06/07/2011 14:20

The station provides escalators, lifts and stairs to a mezzanine level approximately 20 m below ground. The mezzanine level acts as a longitudinal passenger circulation level for passengers entering from the southern Roma Street Station entry or transferring from the existing surface platforms. The station mezzanine is continuous between the southern entry at Roma Street and the centrally located connection to the existing underground concourse.

Emergency egress from the station to the surface is provided at either end of the platforms, along with emergency services.

Surface works adjoining the station identified to support the Project include:

- improving and widening footpaths on the northern side of Roma Street
- improving street crossing opportunities from the CBD across Roma Street to address pedestrian safety risks
- reconfiguring the intersection of Roma and George streets to provide enhanced pedestrian capacity and to improve pedestrian safety
- reconfiguring of Parkland Boulevard to enable the delivery of the southern Cross River Rail entry and public plaza.

4.2.4 Albert Street Station

The Albert Street Station would be situated approximately 31 m below Albert Street in the Brisbane CBD. The station comprises a single span cavern with central platform (refer to **Figure 4-5** and **Figure 4-6**), extending from Alice Street to just west of Mary Street. The cavern incorporates a 220 m long platform. The station is generally located within the road reserve to minimise impacts on adjacent property development and existing buildings.

The station includes two main entry points. One entry is located near the intersection of Albert and Mary streets, with this providing the primary access to the station and supporting the highest volume of passenger loadings. The station entry is positioned to provide convenient access to the Eagle Street business district, the government precinct on lower George Street and the Queen Street Mall.

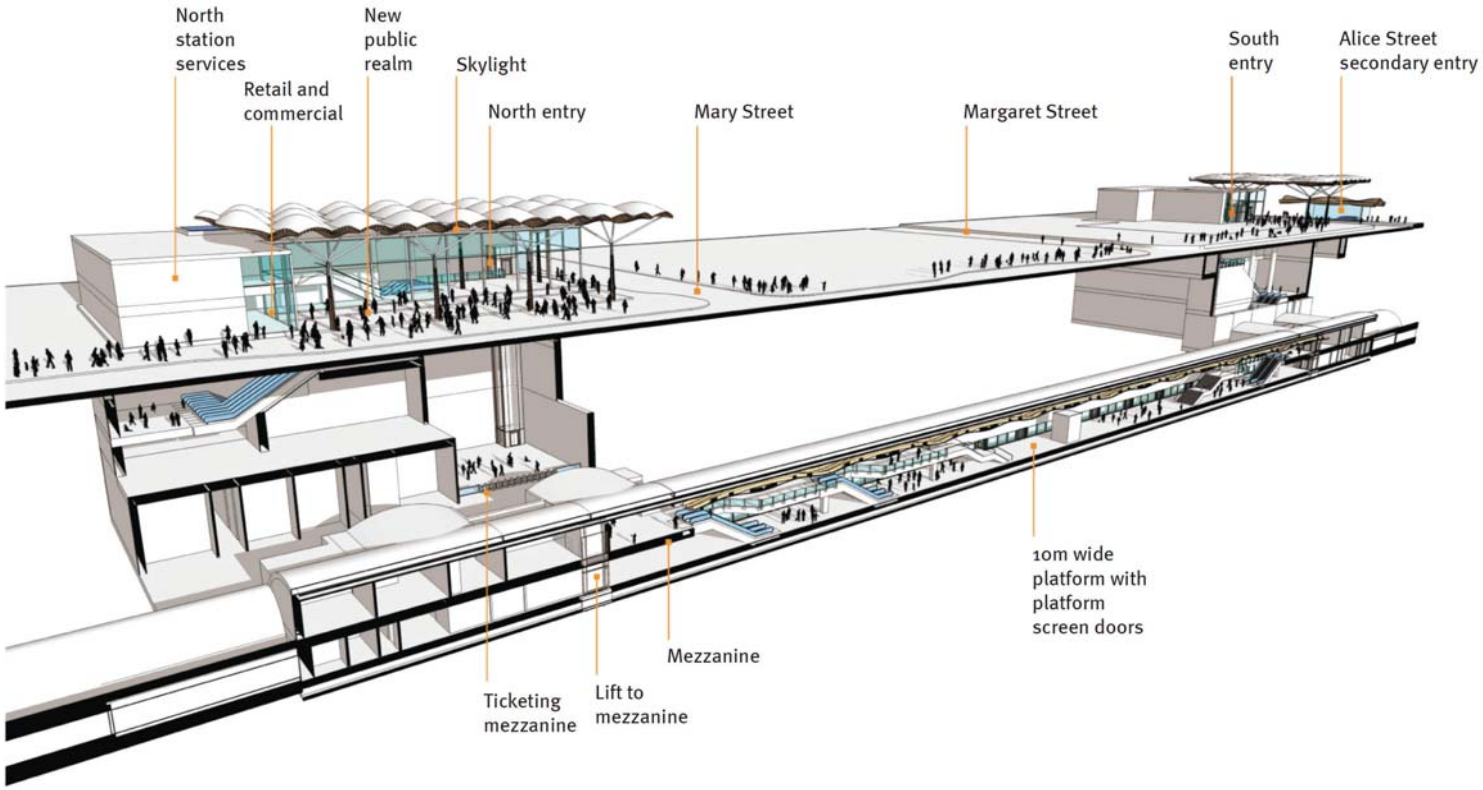
The second entry is positioned at the southern end of Albert Street. This provides two surface access points, including one at the north-east corner of Albert and Alice streets and one adjacent to the Albert Street entrance to the City Botanic Gardens, via a subway under Alice Street. This entry provides direct access to the City Botanic Gardens and supports convenient access to QUT, the River Stage and the riverside pedestrian and cycle links.

The Albert Street Station incorporates floodgates and floodboards at each of the major entry points to protect against a one in 10,000 year flood event. The floodgates are positioned at street level to provide protection to the main entrance shafts, accommodation, station and underground system. A separate floodgate would also be provided at the concourse level of the southern tunnel entrance from the City Botanic Gardens entry. Flood events of one in 100 years or greater would result in the lift and stairs/escalators between the street and concourse level to be flooded.

The Albert Street Station has been designed to carry loads associated with an 80 storey building above or around the station. The design also allows for basement excavation up to the proposed volumetric resumption boundary.

Albert Street Station has four below ground levels, including a concourse level at the southern entry, “mid-level”, mezzanine and platform. The design of the station allows for retail uses at the first concourse level at the Alice Street end of the station. An allowance has also been made in the Project design for a future development at the southern end of the station up to 80 storeys. This development would be delivered separately to the Project and would be subject to a separate planning and assessment process.

Albert Street
Longitudinal section



CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-5
Albert Street Station Cross Section

CrossRiverRail

SKM aurecon
CRR JOINT VENTURE

LEGEND

- Study Corridor
- Tunnel and Station Structure
- Existing Track
- Proposed Platform
- Proposed Track

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-6

Albert Street Station Location and Surface Works

0 25 50 75 100 Meters

N

1:2,000 at A4

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0102_CRR_Albert_St_Surface_Works_A4.mxd 06/07/2011 14:21

The surface works adjoining the station proposed as part of the Project include:

- reconfiguring Albert Street between Charlotte and Alice streets to enable footpath widening
- reconfiguring Albert Street between Charlotte and Elizabeth streets to enable more efficient use of space for pedestrians
- partially reconfiguring traffic lanes on Mary Street to enable footpath widening on the western side
- providing a large covered forecourt and public space at Mary Street with associated retail
- footpath widening on Albert Street crossings to increase pedestrian waiting capacity at signals during peak periods
- reallocating kerb space to provide for new taxi ranks, drop off, bus stop relocation and reconfiguration of loading bays.

4.2.5 Gabba Station

The Gabba Station is designed to provide daily commuter access to the Woolloongabba UDA, interchanges with the existing and future busway station and passenger access during major events at the Gabba stadium. The station is located within the Woolloongabba UDA west of the existing Goprint site, east of Leopard Street (refer to **Figure 4-7** and **Figure 4-8**).

The station comprises a combination of cut and cover box and single span cavern with a central island platform. The cavern sections are extensions of the main station box. The northern cavern extends beneath Vulture Street, while to the southern cavern extends beneath Stanley Street and properties fronting the southern side of Stanley Street.

The station platforms are approximately 28 m below surface level. The ticketing and staff facilities are located at ground level.

A particular feature of the station includes a symmetrical arrangement of escalators running through all station levels, which aids passenger flows during events. The escalators are arranged into two groups, each with four escalators between the surface level and the mezzanine level. Between the mezzanine and platform levels, the escalators are arranged into four lots of two escalators to allow the effective distribution of passengers onto the platform.

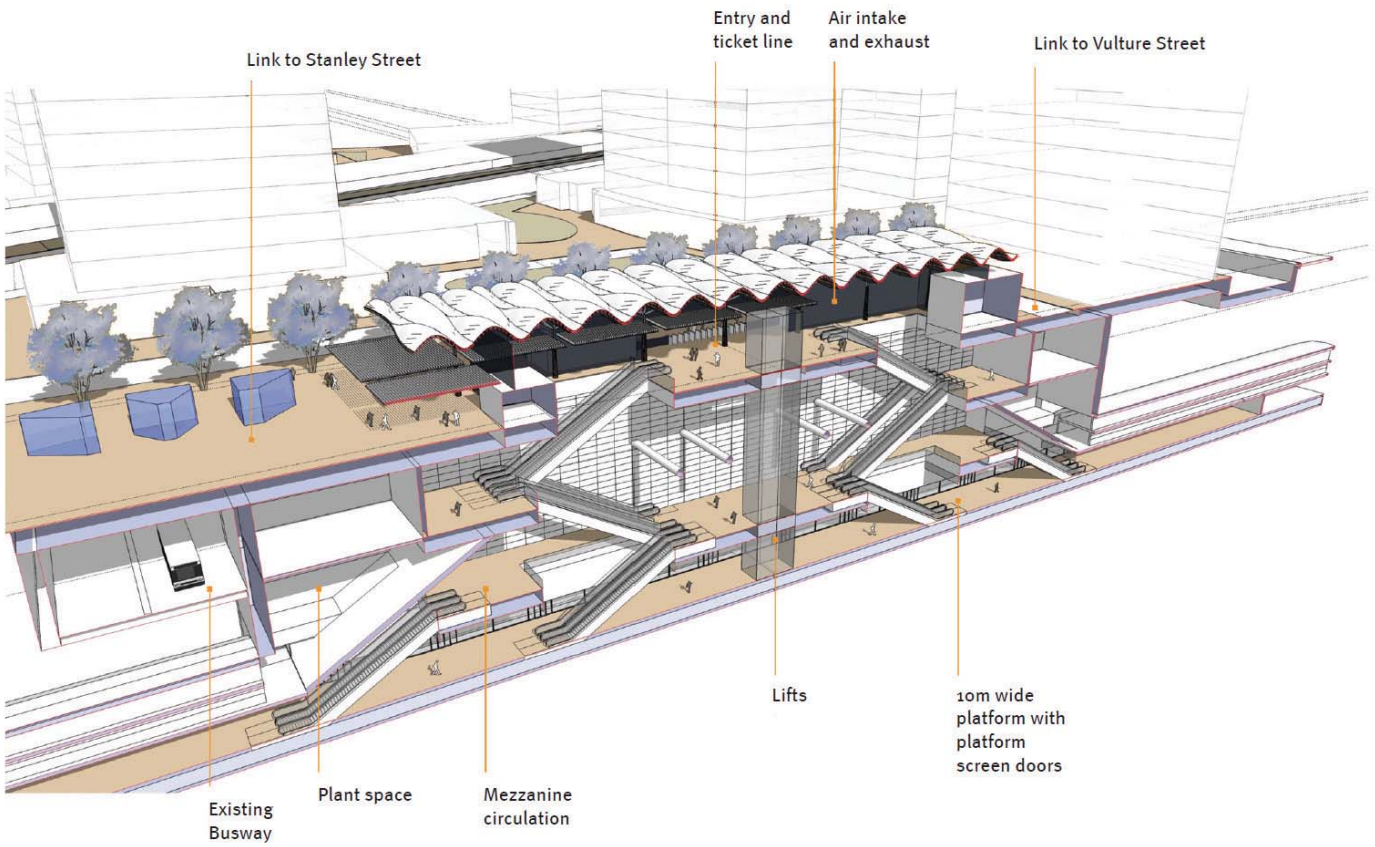
The central section of the station is to be open to natural light and ventilation and covered with a full length canopy. There is one entry point for the station to enable effective crowd management for major events and to serve the local catchment. The entry is positioned east of Leopard Street, west of the existing Goprint site. The entry would be visible from Stanley Street and the structure planning for the Woolloongabba UDA would preserve a direct line of sight between the station and the stadium. The position of the station several hundred metres away from the Gabba stadium would help to disperse crowds during events and provide effective station access.

The station design allows for future high-rise development to occur over the northern half of the station. This development would be coordinated between the Urban Land Development Authority (ULDA) and the Department of Transport and Main Roads as part of a separate planning process to the Project.

Surface works to be undertaken in this area as part of the Project include:

- the provision of a station forecourt/plaza over the existing busway cutting, to the station entry and the creation of surface pedestrian connections to the existing busway station
- clear pedestrian through movement to accommodate game day crowd movements from the Gabba stadium to the station entry
- the creation of cycle parking facilities in public area outside the station.

Woolloongabba
Longitudinal section



CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-7
Woolloongabba Station Cross Section

CrossRiverRail

SKM aurecon
CRR JOINT VENTURE

LEGEND

- Study Corridor
- Tunnel and Station Structure
- Proposed Platform
- Proposed Track

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-8

Woolloongabba Station Location and Surface Works

0 25 50 75 100 Meters

N

1:2,000 at A4

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0103_CRR_Woolloongabba_Surface_Works_A4.mxd 06/07/2011 14:21

4.2.6 Boggo Road Station

Boggo Road Station is an important interchange between the Project and the existing Park Road Station and the Boggo Road busway station. The station would support the development of the Boggo Road Urban Village and provide enhanced access to the UQ via the Eleanor Schonell Bridge and the PA Hospital.

The station is located between the Ecosciences Precinct and the Boggo Road Gaol and extends from Peter Doherty Drive to the Boggo Road busway station (refer to **Figure 4-9** and **Figure 4-10**).The station comprises a cut and cover box, with a central island platform.

The station platform is located approximately 25 m below surface level. The station design provides two main below ground levels, being a mezzanine level and a platform level, although a mid-landing level is also provided for the escalators between the surface and mezzanine levels.

Two entry points are provided to maximise the stations walk up catchment and to allow interchange with existing bus and rail facilities. Entry one is located north of Boggo Road, adjacent to the existing Park Road Station and Boggo Road busway station. The three stations would be linked via an existing pedestrian footbridge. The second entry is located at the southern end of the station, adjacent to Peter Doherty Drive. The entry is located west of the central spine between the Boggo Road Gaol and the Ecosciences Precinct.

Each end of the station is provided with three sets of escalators, stairs and lifts. Station services, including mechanical ventilation and plant would also be located at either end of the station. Provision has been allowed in the station design for the space above the station box to be used for future development. This would be provided as part of the Department of Public Work's proposed redevelopment for the site.

The surface works identified for this area to be provided as part of the Project include:

- improving and widening a section of footpath on the western side of Annerley Road
- the reallocation of kerb space to provide drop-off facilities and turning facility at Quarry Street
- the provision of zebra crossings of Boggo Road and Peter Doherty Street adjacent to the station's northern and southern entrances (respectively)
- creating kiss 'n' ride facilities and local surface bus stops to integrate with station's northern and southern entrances
- the provision of cycle parking facilities outside the station entries.

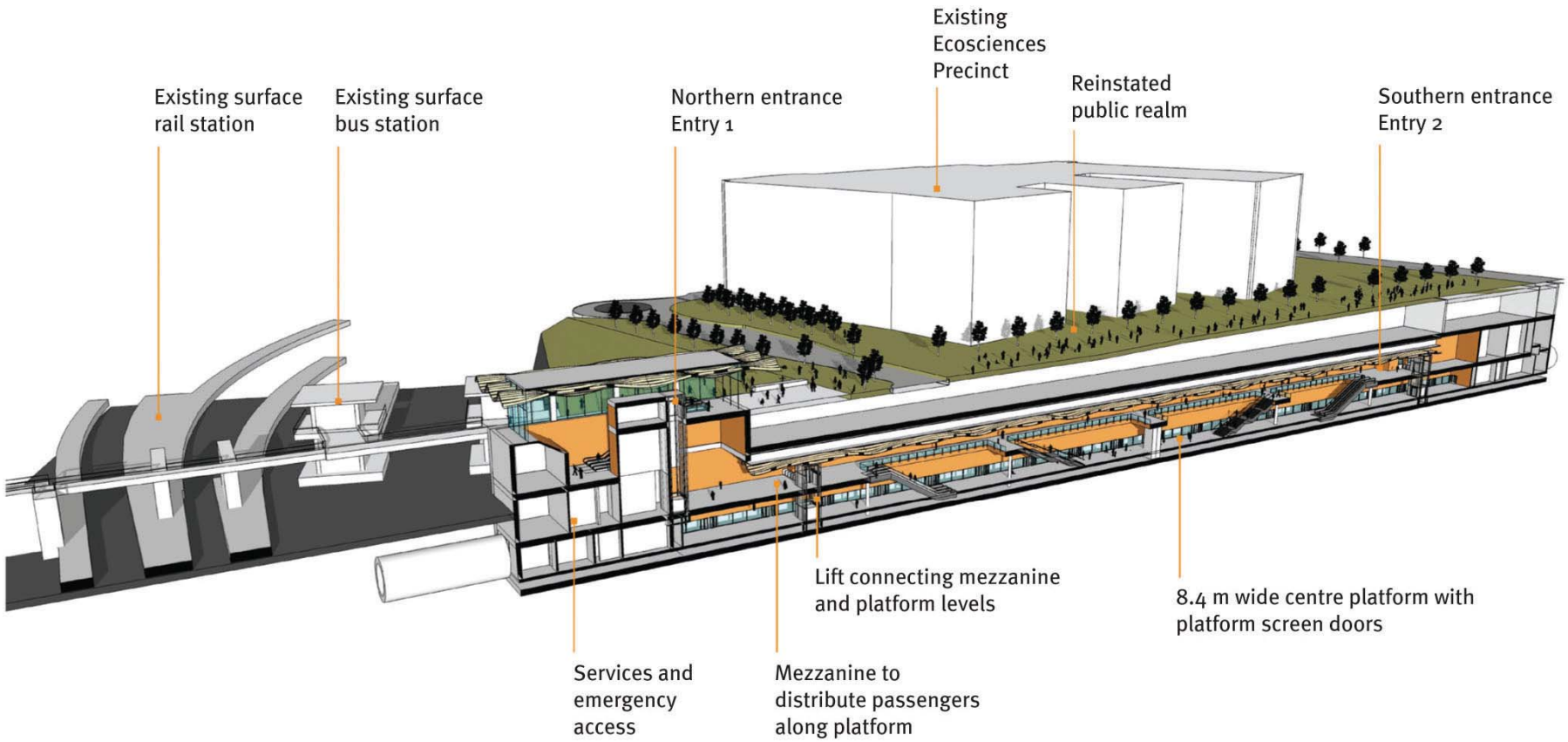
4.2.7 Ekka Station (surface)

A new surface station is proposed to replace the existing Exhibition Station. The new Ekka Station would include a raised island platform extending south of O'Connell Terrace along the existing rail corridor (refer to **Figure 4-11** and **Figure 4-12**). The station would be designed for normal commuter services as well as passenger numbers associated with major events at the RNA Showgrounds.

The new station would replace the existing Exhibition Station. It would include high level platforms approximately 220 m long and 12 m wide. The new track and station is approximately five to six metres above ground level. The existing subway under the viaduct would be widened and heightened to allow greater passenger flows during events.

Two entries are proposed to maximise the station's walk up catchment and provide direct access to the range of local destinations. One entry is located at the O'Connell Terrace frontage of the RNA Showgrounds. This would provide access to the Bowen Hills UDA, planned developments on O'Connell Terrace and to the RBWH. The entry would also allow passengers to interchange with local bus services and kiss 'n' ride facilities.

Boggo Road Section

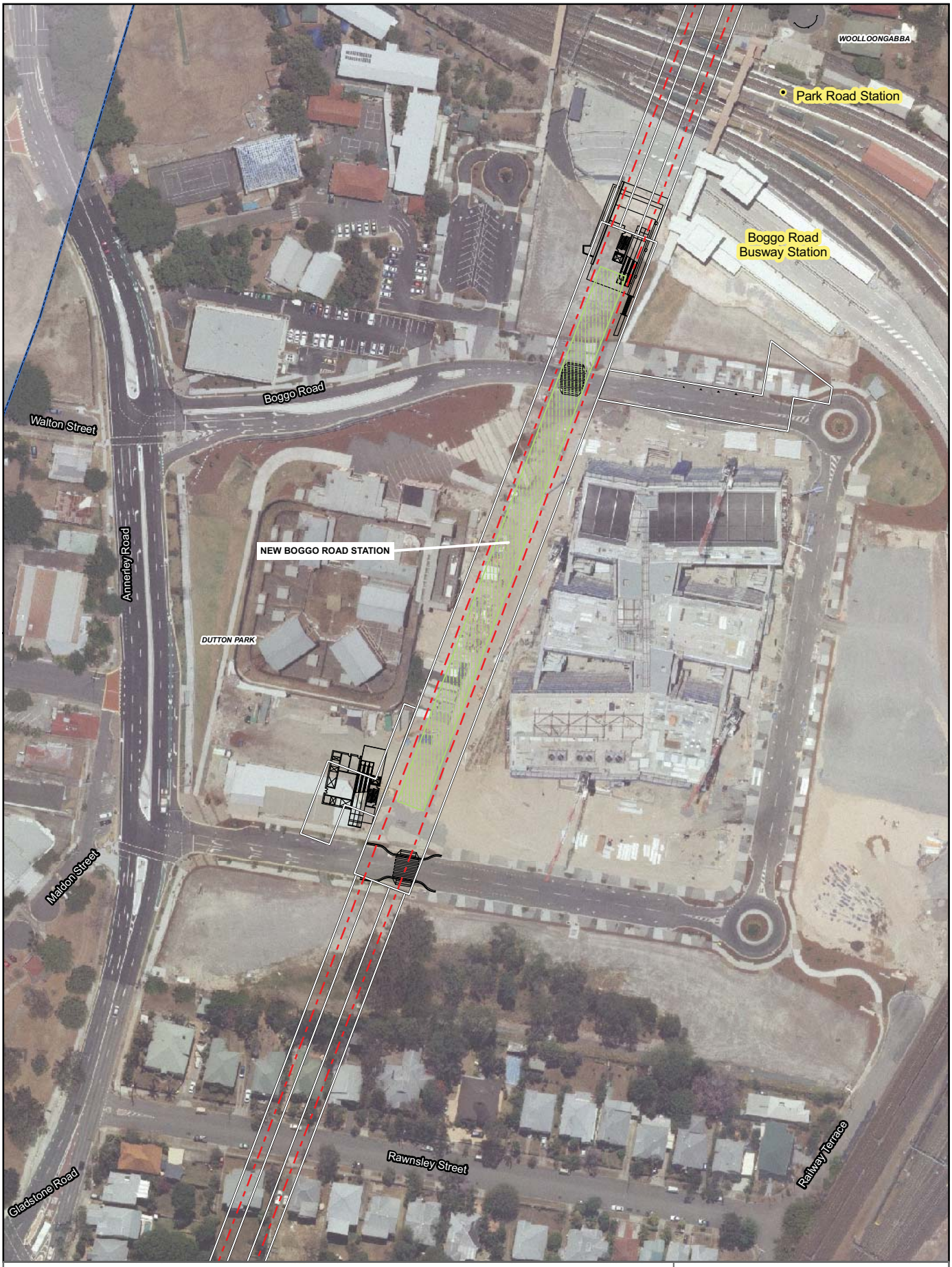


CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-9
Boggo Road Station Cross Section

CrossRiverRail

SKM aurecon
CRR JOINT VENTURE



LEGEND

- Study Corridor
- Tunnel and Station Structure
- Proposed Platform
- Proposed Track

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-10

Boggo Road Station Surface Works

0 25 50 75 100 Meters

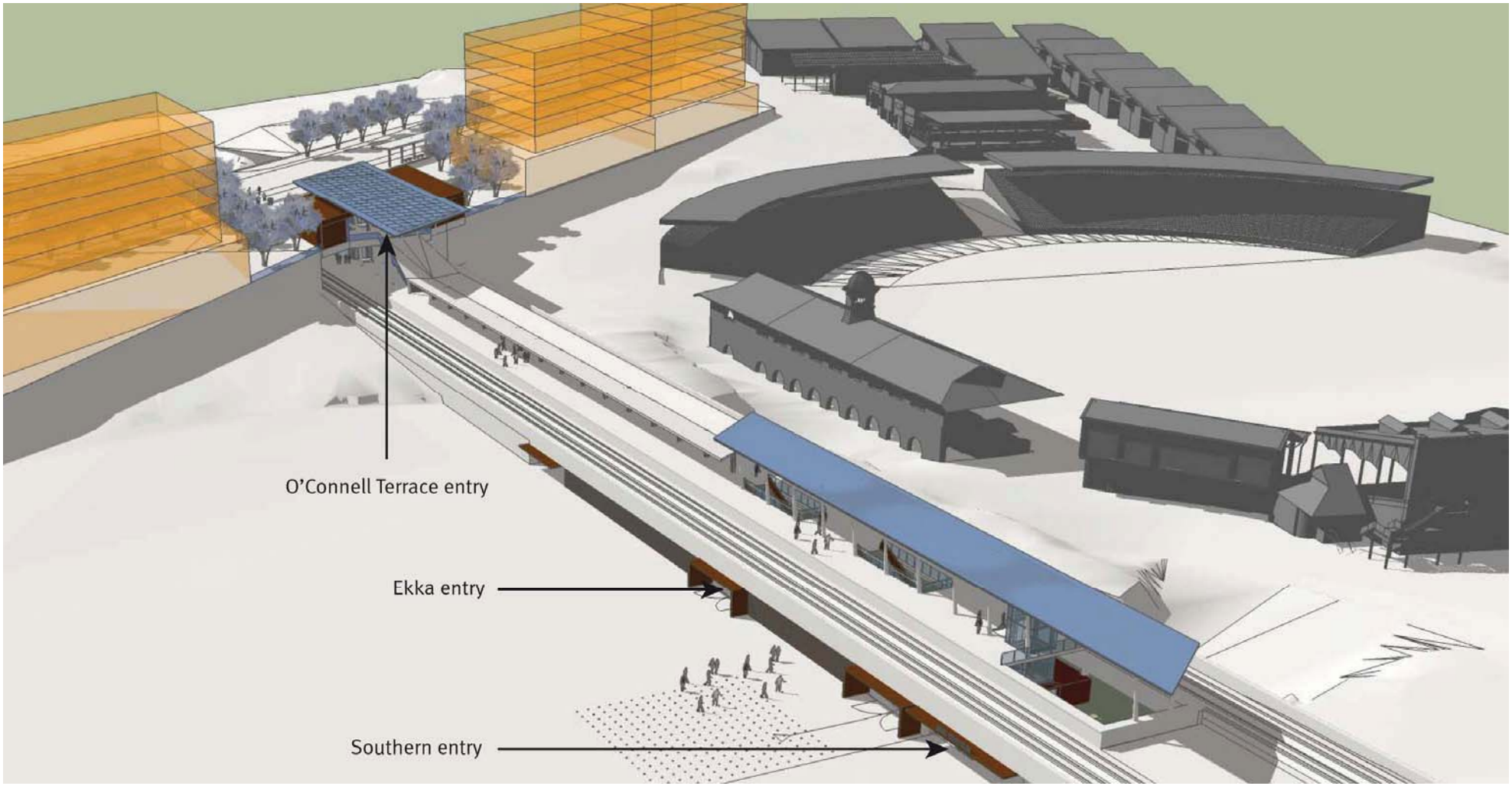
1:2,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0104_CRR_Boggo_Rd_Surface_Works_A4.mxd 06/07/2011 14:22



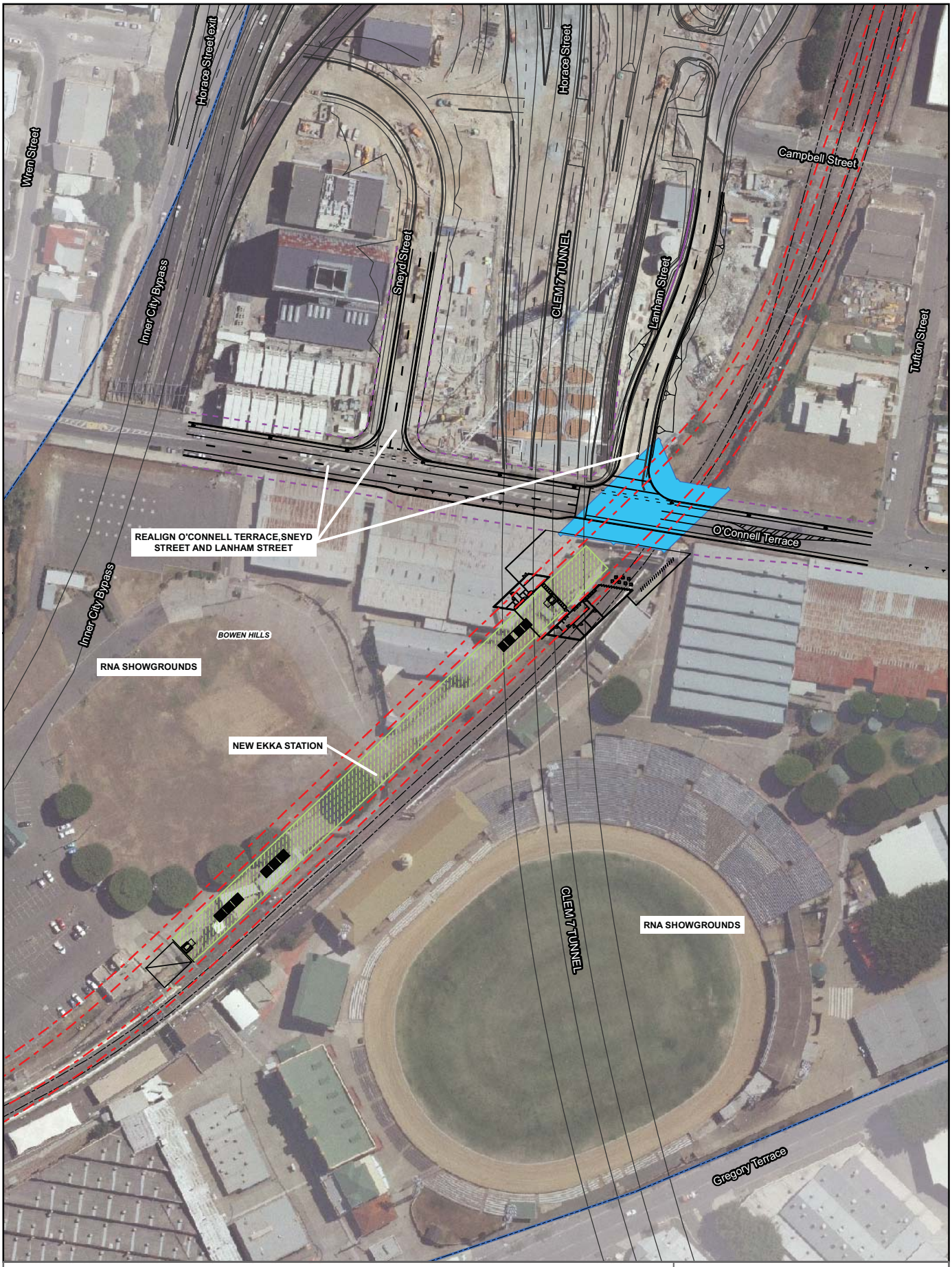
CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-11

Exhibition Station

CrossRiverRail

SKM aurecon
CRR JOINT VENTURE



LEGEND

- Study Corridor
- Tunnel and Station Structure
- Existing Track
- Proposed Platform
- Proposed Track
- Bridge Structure

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-12

Ekka Station Location and Surface Works

0 25 50 75 100 Meters

1:2,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0105_CRR_Exhibition_Surface_Works_A4.mxd 06/07/2011 14:23

The second entry would connect with the north-south pedestrian spine through the RNA Showgrounds, to the RBWH, commercial development planned for the northern areas of Fortitude Valley and to the commercial development and convention centre proposed as part of the RNA redevelopment.

Ticketing gates would be located at each end of the station, and ticket offices and staff facilities would be located on O'Connell Terrace, at the northern end of the station. The station design also makes provision for a second staff facility and ticket office at the southern end adjacent to the proposed "Ekka Plaza", to allow day to day access as the RNA precinct develops.

The surface works identified as part of the Project in this area include:

- reconfiguration of the O'Connell Terrace rail bridge and associated regrading of O'Connell Terrace to accommodate widening of the rail corridor
- the provision of a new southern station concourse and regrading of the rail underpass to interface with the RNA Showgrounds
- the development of a plaza forecourt for the station on O'Connell Terrace
- the provision of a signalised pedestrian crossing at O'Connell Terrace
- the provision of taxi and passenger loading bays on O'Connell Terrace, adjacent to the northern station concourse
- the provision of cycle parking facilities outside the station.

4.2.8 Yeerongpilly Station (surface)

A new surface station is proposed at Yeerongpilly. The station comprises two side platforms and one island platform linked by a pedestrian overpass (refer to **Figure 4-13, Figure 4-14** and **Figure 4-15**). The station is located in the industrial area at Station Road, south of the existing Yeerongpilly Station.

The station would operate three platforms, including two six metre wide side platforms and one 12 m wide island platform. The western platforms would be for Cross River Rail services and would be 220 m long. The eastern platform would be for suburban train services and would be 175 m long. Canopies would be provided for over 70% of the platform length to provide weather protection for passengers.

The new platform arrangements enable freight trains to be separated from the new passenger platforms minimising conflicts between passenger and freight traffic and providing greater passenger amenity.

The new Yeerongpilly Station would be accessed from Wilkie Street via a new station plaza. A covered walkway would be provided along the realigned Wilkie Street, from the existing pedestrian overpass over Fairfield Road and the rail corridor. New public bus stops and kiss 'n' ride facilities would be established at Wilkie Street, near the station entry.

Ticketing and staff facilities would be located on the edge of the station plaza with a paid concourse located centrally over the platforms, connecting to the platforms by stairs and lifts.

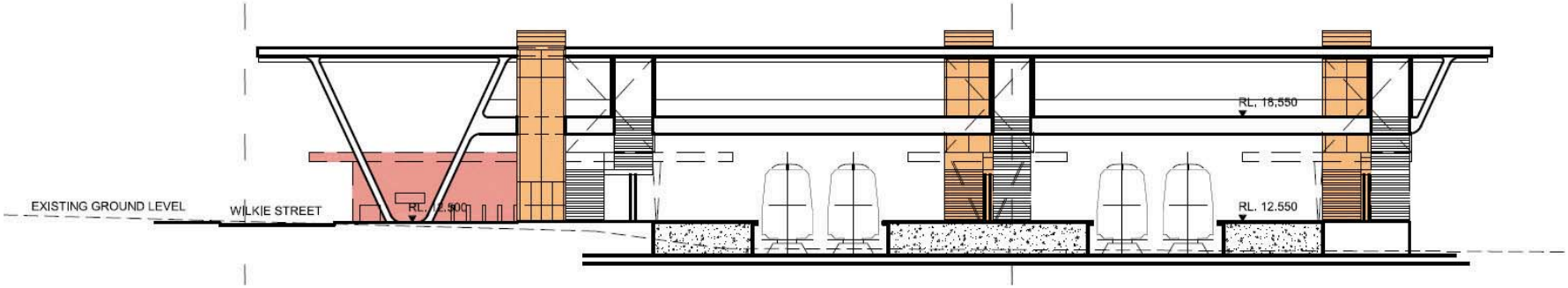


Figure 4-13 Yeerongpilly Station cross section

Source: Hassell, 2011

Figure 4-14 Yeerongpilly Station indicative perspective view

Source: Hassell, 2011

LEGEND

- Study Corridor
- Tunnel and Station Structure
- Existing Track
- Existing Platform
- Proposed Platform
- Proposed Track

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-15

Yeerongpilly Station Surface Works

0 25 50 75 100 Meters

1:2,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0106_CRR_Yeerongpilly_Surface_Works_A4.mxd 06/07/2011 14:24

Park 'n' ride facilities have not be provided in the station design at Yeerongpilly. This is in line with current TransLink policy for stations within 10 km of the Brisbane CBD, which aims to encourage kiss 'n' ride and 'walk-up' patronage. Surface works to be provided as part of the Project in this area include:

- a new station plaza, comprising local retail outlets, paving and seating, landscaping, canopy structure and cycle parking
- realignment of Wilkie Street south of the Cardross Street rail overpass bridge, including tree avenue planting to both sides of the street
- realignment of Station Road between the station plaza and Ipswich Road, including landscaping, on-street parking and street furniture
- kiss 'n' ride, bus stop and taxi facilities on Wilkie Street, adjacent to the station plaza
- extending the existing pedestrian overpass over the rail corridor and Fairfield Road to connect to the realigned Wilkie Street
- a covered pedestrian link along the realigned Wilkie Street between the station entry and the pedestrian bridge link to the western side of Fairfield Road.

4.2.9 Surface station upgrades

Upgrades to the existing surface stations at Moorooka and Rocklea would also be undertaken as part of the Project. Works would also be undertaken at Salisbury Station to extend the existing pedestrian overpass over the widened rail corridor. The following provides an overview of the proposed works involved with each of these stations.

Moorooka and Rocklea stations

The works at Moorooka and Rocklea stations comprise construction of new footbridges and station upgrades to meet DD Act requirements (refer to **Figure 4-16** and **Figure 4-17**). The proposed works include:

- a new covered pedestrian overpass
- new canopies over 70% of the platform length to provide weather protection for passengers
- new lifts at each entry point and platform, designed for 21 passenger capacity and to allow stretcher access
- upgraded disabled passenger path of travel from the platform lift entry point to the nominated boarding point at the centre of the platform
- new six metre wide disabled passenger boarding point, located approximately 77 m from each end of station
- extension of the platform at one end to accommodate future seven car trains
- upgrading the existing low level platforms to high level platforms (approximately 1,050 mm), including regrading of the platform to fall to centre of station including upgraded stormwater system
- upgrading coping and tactile for the raised platform and directional tactile at disabled passenger zone
- upgrading the existing station building to include new disabled toilet, new ticket window and counter, and upgrade staff areas to be compliant with Australian Standard AS 1428.2
- upgrading general signage to be compliant with the TransLink Signage Manual
- general repainting of existing surfaces and replacement of damaged materials
- general replacement of damaged services including lighting, audio visual and passenger information display screens.

In addition, the following works are proposed to the area surrounding the stations to support new station infrastructure and comply with DD Act requirements include:

- upgrading park 'n' ride, disabled parking bays and access pathways to the station entry point
- upgrading pedestrian paths from bus set down to station entry point to be DD Act compliant
- a new pedestrian protection canopy, nine metres long and 2.5 m wide adjacent to the bus set down area.

Salisbury Station

Widening of the rail corridor in this location would require the existing footbridge to be extended to the west. Other works associated with the redevelopment of Salisbury Station are being considered separately to the Project, and would be undertaken as part of the Salisbury to Beaudesert rail project.

4.2.10 Tunnel design

The tunnel design has been defined by operational, engineering, construction and cost effectiveness requirements. The following describes the key tunnel design requirements, tunnel alignment, surface connections and tunnel infrastructure.

Design requirements

Twin single track tunnels are proposed due to operational, design, risk, constructability and whole of life cost criteria. Key considerations for the design of the tunnels include:

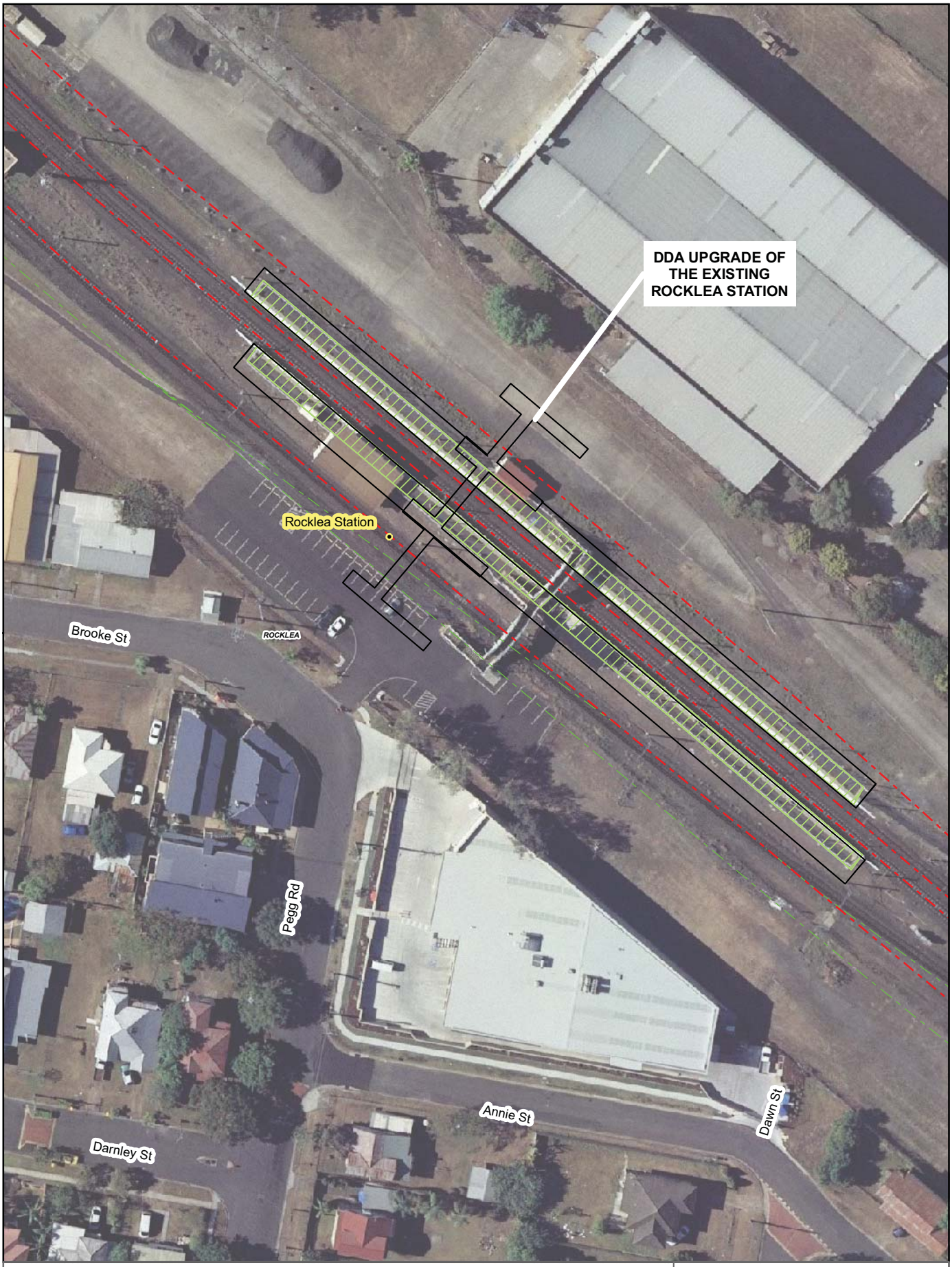
- a tunnel diameter that provided for the required track form, overhead line arrangements, the rollingstock and clearances, walkway access and vehicle envelope
- arrangement of underground spaces and tunnels to minimise potential impacts on existing buildings, structures and utilities
- accommodation of future development loads of buildings above the tunnels, as appropriate, such as current development horizons in the CBD, current plans at Woolloongabba, and nominal loads elsewhere
- the majority of the tunnel length to comprise parallel single-track running tunnels, with mined cross passages
- tunnel track centres to match track centres through the island platform stations
- the need for a maintenance walkway to be provided in each tunnel.

Tunnel alignment and design

The Project has been designed to maintain the majority of the tunnels in rock.

The standard tunnel configuration consists of two single track tunnels separated by a central rock pillar and connected at regular intervals by mined cross-passages. The cross-passages between the tunnels are supported by a permanent concrete lining connected to both running tunnels.

The western tunnel would carry northbound trains and the eastern tunnel would carry southbound trains



LEGEND

- Study Corridor
- Existing Platform

Alignment

- Dual Gauge
- Narrow Gauge
- Train Storage
- Yard Tracks

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-16

Rocklea Station Upgrades

0 10 20 30 40 50 Meters

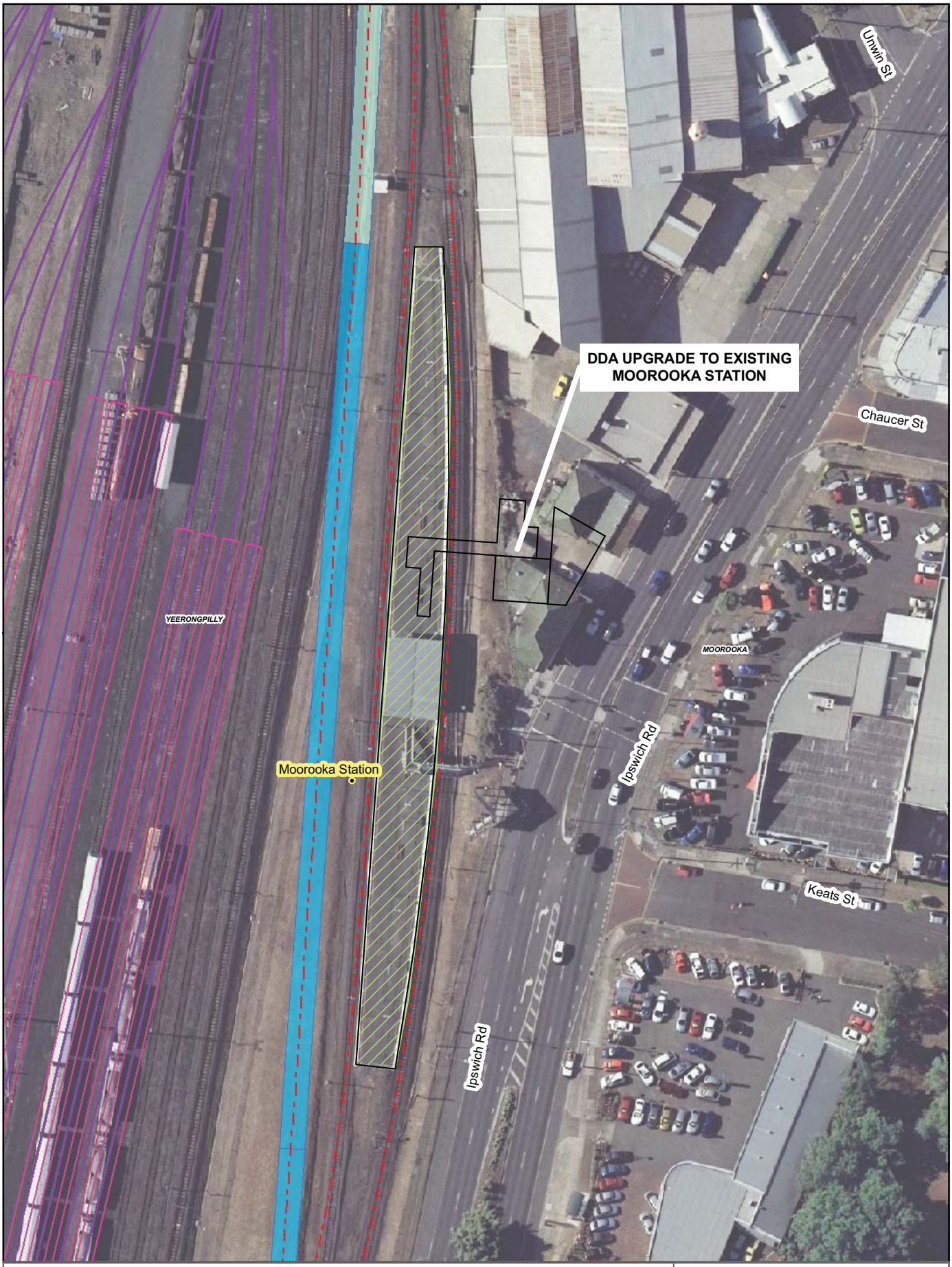
1:1,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0144_CRR_Rocklea_upgrades_A4.mxd 06/07/2011 14:26



LEGEND

- Study Corridor
- Existing Platform
- Embankment / RSS Structure
- Viaduct / Bridge Structure

Alignment

- Dual Gauge
- Narrow Gauge
- Train Storage
- Yard Tracks

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-17

Moorooka Station Upgrades

0 10 20 30 40 50 Meters

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CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0143_CRR_Moorooka_upgrades_A4.mxd 06/07/2011 14:25

The tunnels would have a bored diameter of approximately seven metres and a finished internal diameter of approximately six metres to accommodate narrow gauge rollingstock (refer to **Figure 4-18**). Each tunnel would include rail tracks, emergency systems and services such as communication and overhead lines.

The tunnels are designed to accommodate narrow gauge rollingstock approximately 2.7 m wide by 4.4 m high. The track separation for the two running tunnels would be 13.7 m to generally match the track centres through the stations.

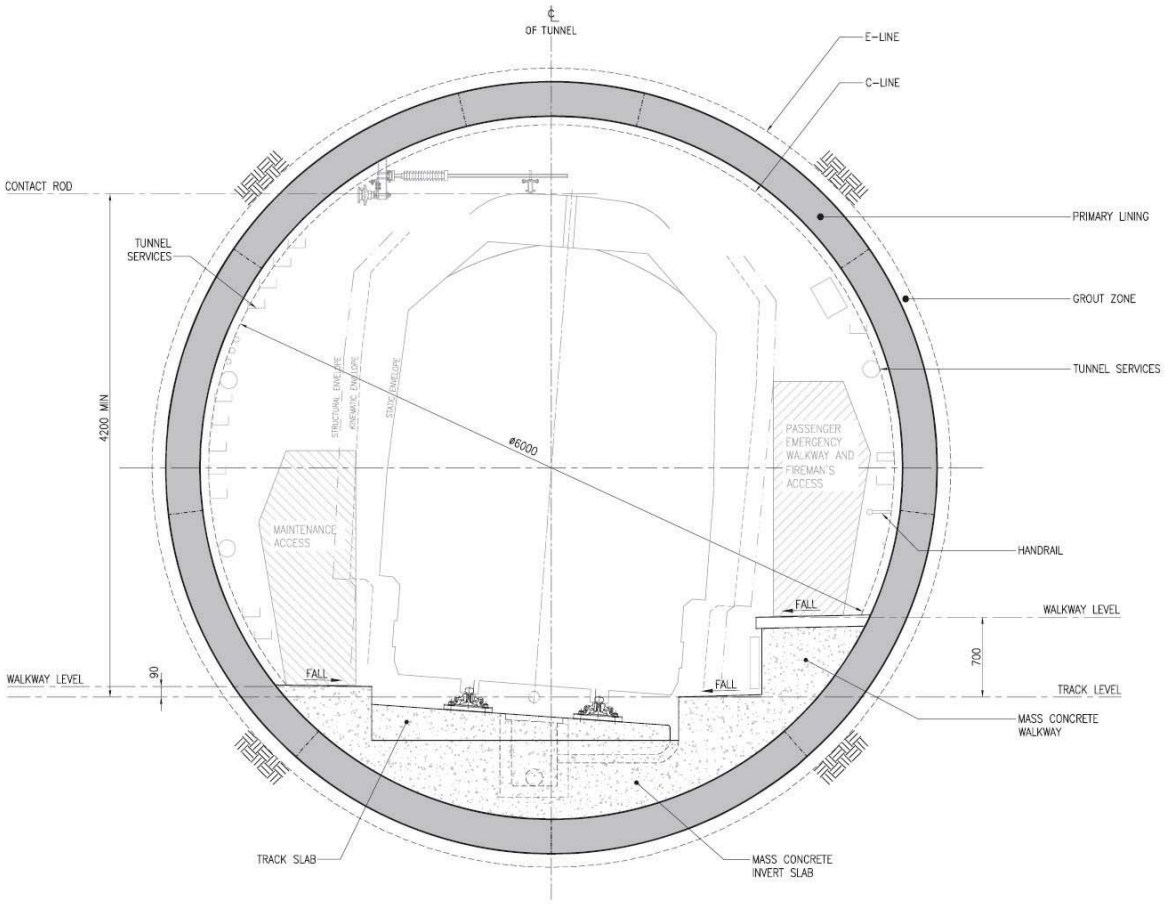

Figure 4-18 Typical tunnel cross section

The vertical alignment of the tunnels has been defined by the geology and general topography, the location of stations and the requirements to connect with the surface network. Along the length of the tunnel there are two low points, under the Brisbane River and at the location of the ventilation and emergency services shaft at Fairfield.

In the north, the tunnel would surface in Victoria Park at Spring Hill, immediately east of the existing rail corridor, while in the south, the tunnel would surface between Crichton and Stamford streets at Yeerongpilly.

The tunnels generally run in parallel under the suburbs of Spring Hill, Brisbane City, Kangaroo Point, Woolloongabba, Dutton Park, Fairfield and Yeronga. Where possible, the tunnel alignment follows existing rail and road corridors to minimise property impacts, and avoids passing beneath sensitive uses such as hospitals. The tunnel is at its deepest points below Spring Hill (over 50 m) and the Kangaroo Point Cliffs (55 m) (refer to **Figure 4-19**). The depth of the river crossing would suit conventional TBM construction and achieves approximately one tunnel diameter of rock cover.

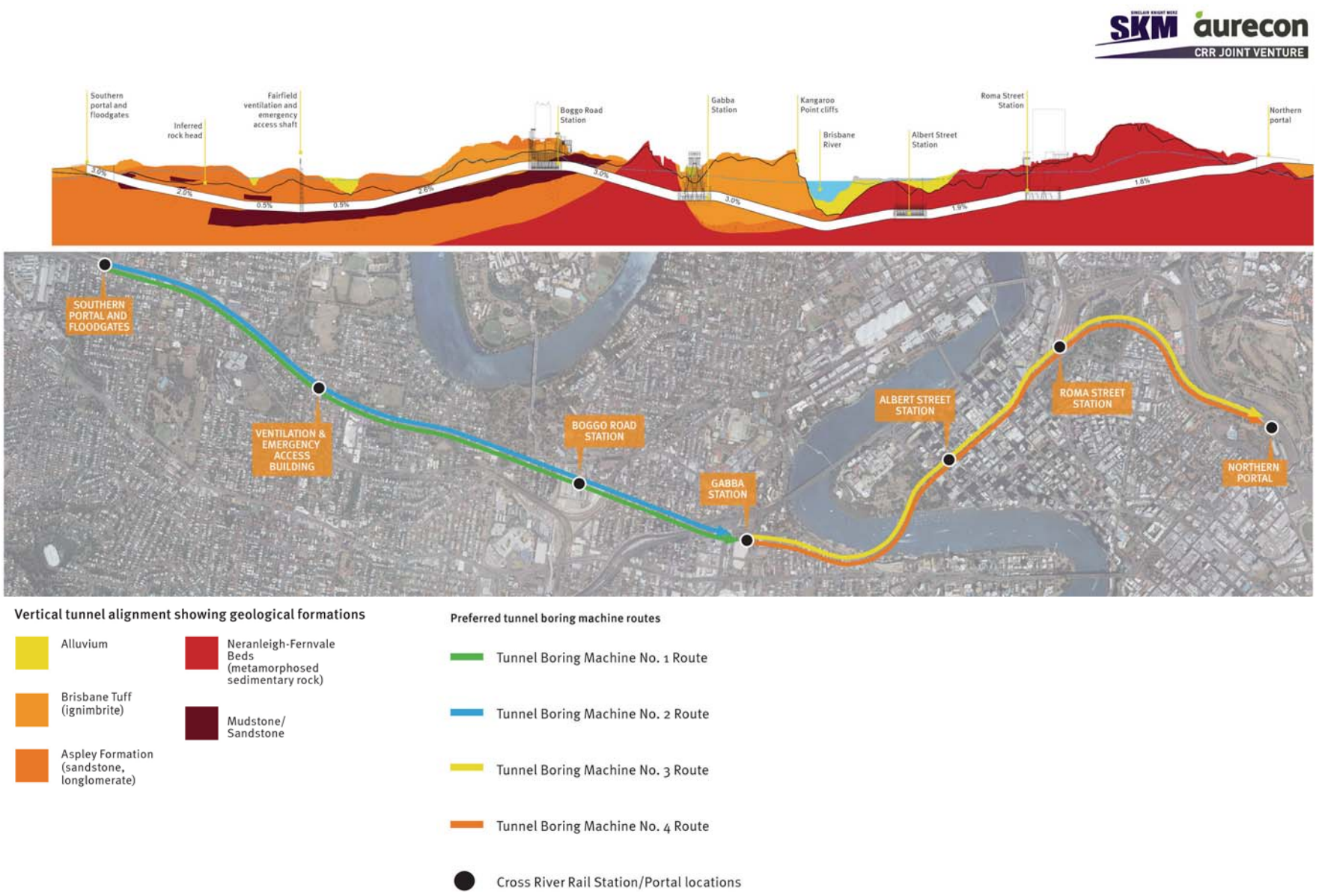

Figure 4-19 Tunnel alignment (vertical and horizontal)

Alignment description

The tunnel alignment generally follows Queensland Rail's design standards, although some variations were established through the development of the reference design in consultation with Queensland Rail. These predominately relate to an increase in the maximum vertical grade to 3% where required for passenger tracks and reduction of vertical curve lengths based on passenger comfort levels.

The tracks are level through Yeerongpilly Station and then descend at the maximum grade of 3% for approximately 550 m. The tracks then flatten out to a 2% down grade for approximately 800 m and then to a 0.5% grade for approximately 500 m to reach the lowest point of the southern section of tunnel. This is the location of the ventilation and emergency access shaft as well as the pumping station for the southern section of the tunnel. The horizontal alignment in this area is relatively straight, and generally follows the Fairfield Road alignment with minimum radius curves of 1,225 m. The maximum train speed achievable in this section of alignment, after the vertical curve at the end of Yeerongpilly Station, is 130 km per hour. Through the station and on the vertical curve the maximum speed is 80 km per hour.

After the southern low point, the tracks rise at a grade of 0.5% for approximately 600 m followed by nearly 3% for approximately 1,100 m to Boggo Road Station where the tracks are level through the station. The horizontal alignment remains relatively straight with minimum radius curves of 1,225 m as it travels under Fairfield Road, before straightening to approach Boggo Road Station. Based on the alignment within this area the maximum speed achievable is 130 km per hour except for the curve on approach to Boggo Road Station, which has a maximum speed of 80 km per hour.

North of Boggo Road Station the tracks descend under the existing Boggo Road busway station and Park Road Station at a 3% grade for approximately 800 m. The tracks then dive down to the Gabba Station where they are level through the station. North of the Gabba Station, the tracks descend at a curve compensated grade of 3% for approximately 900 m to the low point of the northern section of the tunnel under the Brisbane River.

The horizontal alignment between Boggo Road Station and Gabba Station is relatively straight with a set of reverse curves to position the tracks entering Gabba Station with minimum curve radius of 600 m. From Gabba Station to under the river, a set of reverse curves with radius of 400 m is required to extend the length of track to retain the maximum 3% grade. Subject to a review of the cant (elevation of the rails relative to each other) this alignment would allow speeds up to 80 km per hour with at least a 60 km per hour minimum speed.

From the Brisbane River to Albert Street Station, the tracks rise at an approximate 2% grade for approximately 500 m, flattening to be level through the station. After the station, the track rises again to under the S1 sewer with a grade of 1.9% for approximately 600 m before steepening to a grade of 3% for 140 m to Roma Street Station. The horizontal alignment in this section after travelling under the City Botanic Gardens from the river follows Albert Street with minimum radius curves of 400 m. Subject to a review of the cant this alignment may allow speeds up to 80 km per hour with at least a 60 km per hour maximum speed.

North of Roma Street Station, the vertical alignment rises at a grade of 1.8% for approximately 1,100 m to the northern portal. Through the portal structure there is a length of level track to assist with construction prior to climbing for approximately 400 m at a 3% grade to interface with the existing surface tracks on the Exhibition Loop. In this area the horizontal alignment of the tracks is not parallel to allow the tunnels to merge into the portal structure. The minimum curve radius in this section is 400 m. Subject to a review of the cant this alignment may allow speeds up to 80 km per hour with at least a 60 km per hour minimum speed.

Surface connections

The portals and dive structures comprise a combination of retaining walls, open cut box, covered box and mined structures, depending on the topography and ground conditions at each site. Dive structures have generally been located to run into the side of a hill, to minimise the length of the dive structure:

- The northern portal and dive structure would be located partly within the existing rail corridor, within Victoria Park and on land adjacent to Victoria Park occupied by Brisbane City Council (refer to **Figure 4-20**). The portal is located along the northern edge of Victoria Park, between the ICB land bridge and Bowen Bridge Road. Both southbound and northbound tracks would use the one portal and dive structure. The design of the portal makes allowance for the possible connection to a future North West Transport Corridor (NWTC).
- The southern portal and dive structure would be located east of the existing rail corridor, south of Cardross Street at Yeerongpilly (refer to **Figure 4-21**). The southern portal is located on the eastern side of the existing rail corridor between Crichton and Stamford streets, generally within the road reserve for the existing Wilkie Street. The dive structure would generally extend from Stamford to Livingstone streets. The dive structure would provide for both northbound and southbound tracks. A floodgate would be incorporated into the southern portal. The floodgate would comprise a hinged tilting gate operated by hydraulic rams. The hydraulic rams and motor room would be located adjacent to the tunnel portal.

LEGEND

- Study Corridor
- Existing Track
- Proposed Platform

Alignment

- Dual Gauge
- Narrow Gauge
- Train Storage
- Yard Tracks

Structure Type

- Cut and Cover Structure
- Dive / Transition Structure
- Road Header Tunnel
- TBM Tunnel
- Cross Passage

0 50 100 150 200 Meters

1:4,000 at A4

N

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-20

Northern Portal

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0145_CRR_Northern_Portal_A4.mxd 06/07/2011 14:27

LEGEND

- Study Corridor
- Existing Track
- Proposed Platform

Alignment

- Dual Gauge
- Narrow Gauge
- Train Storage
- Yard Tracks

Structure Type

- Cut and Cover Structure
- Dive / Transition Structure
- Road Header Tunnel
- TBM Tunnel
- Cross Passage
- Floodgate

0 50 100 150 200 Meters

1:4,000 at A4

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CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-21

Southern Portal

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0146_CRR_Southern_Portal_A4.mxd 06/07/2011 14:28

Ventilation and emergency access building

Due to the length of the tunnels between the southern portal at Yeerongpilly and Boggo Road Station, a ventilation and emergency access shaft and building is required to ensure the safety of trains and passengers in the event of an emergency.

This would be located at Railway Road, Fairfield, between Bledisloe and Sunbeam streets. The site includes part of the existing landscaped median between Fairfield Road and Railway Road and land partly used for an existing Energex substation. Construction of the shaft and building would require the permanent realignment of that part of Railway Road between Bledisloe and Sunbeam streets.

The structure would accommodate an exhaust and air supply duct for the tunnels, emergency equipment and control panels, access shafts and an emergency escape stair. The ventilation equipment is designed for emergency use and may occasionally be used to remove excess heat from the tunnels.

The ventilation building would have a footprint of approximately 24 m x 7 m x 5 m high. An outlet, approximately 8.5 m high would also be required to protect the ventilation ducts in a one in 10,000 year flood event.

An indicative view of the ventilation and emergency access building from Fairfield Road is shown in **Figure 4-22**.

Figure 4-22 Ventilation and emergency access building (indicative view from Fairfield Road)

4.2.11 Surface rail works

Surface works are required to connect the underground component of the Project to the existing rail network to the north and south. Additional surface rail tracks are also required to accommodate the increased rail passenger services facilitated by the Project and to separate freight services, all stop passenger services and Cross River Rail express services.

In the north, the surface works extend from Normanby Rail Yard on the Exhibition Loop to Breakfast Creek. In the south, the surface rail works extend from Cardross Street at Yeerongpilly through to Musgrave Road at Salisbury.

The surface rail works include new passenger track works and modified track works to accommodate Cross River Rail as well as new freight track works.

Key surface rail design requirements

The track design generally conforms with Queensland Rail design standards relevant to the existing network. Specific design requirements for the Project include:

- tracks are designed to provide for 20 tonne axle load for passenger and maintenance traffic
- surface tracks are designed in accordance with Queensland Rail standards for track structure
- tunnel tracks comprise a track slab with 60 kg rail and resilient fastenings
- track centres from existing to new surface tracks are generally 6.5 m, with a minimum track centre of 4.0 m
- track centres for the tunnel section are a minimum of 6.5 m.

Northern track and structures

The northern surface works extend along the existing rail corridor, from Normanby Rail Yard on the Exhibition Loop, through the RNA Showgrounds to Mayne Rail Yard to Breakfast Creek (refer to **Figure 4-23** and **Figure 4-24**). The track alignment is divided into three inter-related components, being new Cross River Rail tracks; modifications and extensions of the Exhibition Loop tracks; and modifications to the mains and suburban tracks.

Cross River Rail tracks

The Cross River Rail tracks merge into the rail corridor for the Exhibition Loop west of Bowen Bridge Road. The tracks follow the existing corridor to the north through the RNA Showgrounds and new Ekka Station. The Cross River Rail tracks face the station platforms with the freight tracks located on the outside of the corridor.

From the RNA Showgrounds, the Cross River Rail tracks pass under a new O'Connell Terrace road bridge. New junction works would be provided between tracks for Cross River Rail, the Exhibition Loop and shunting movements into Mayne Rail Yard, between O'Connell Terrace and the ICB.

Between the northern portal and the ICB, the tracks follow a similar vertical grade to the existing tracks.

North of the ICB, the Cross River Rail northbound and southbound tracks continue on a viaduct over the existing main and suburban lines, and realigned Exhibition tracks. The viaduct is located at the eastern edge of the Mayne Rail Yard, west of the Mayne Control Centre and immediately west and parallel to the ICB. North of the Ferny Grove flyover, the tracks again cross the main and suburban lines (on viaduct) and tie into the existing rail tracks at the Breakfast Creek rail bridge.

The viaduct is approximately 1,050 m in length and up to approximately 9.5 m above the existing ground level. It comprises a combination of embankment and elevated viaduct on piers. The embankment extends approximately 225 m at the southern end and approximately 230 m at the northern end, with the elevated viaduct extending for approximately 865 m.

The minimum radius curve for this area is 160 m under the ICB, to match existing alignments where the maximum speed would be 40 km per hour. After this curve, the minimum curve radius is 400 m resulting in a maximum speed of 60 km per hour.

LEGEND

- Study Corridor
- Existing Track

Alignment

- Dual Gauge
- Narrow Gauge
- Train Storage
- Proposed Platform

- Embankment / RSS Structure
- Viaduct / Bridge Structure

Tunnel Structure Type

- Cut and Cover Structure
- Dive / Transition Structure
- Road Header Tunnel
- Station Cavern
- TBM Tunnel
- Cross Passage

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-23

Northern Surface Rail Works
Northern Portal

0 50 100 150 200 250 Meters

N

1:7,000 at A4

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0139_CRR_NR_Surface_Works_Northern_P_A4.mxd 06/07/2011 14:28

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-24

Northern Surface Rail Works
Mayne Rail Yard

CrossRiverRail

SKM aurecon
CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0140_CRR_NR_Surface_Works_Mayne_RY_A4.mxd 06/07/2011 14:29

Exhibition line tracks

The Exhibition Loop tracks would be modified to facilitate the provision of the two Cross River Rail tracks. The tracks move the connection point between the Exhibition Loop and the main lines past the junction of main and suburban lines, north of the Ferny Grove flyover.

At the northern portal, the southbound Exhibition track is realigned to travel south of the portal and across the cut and cover section of tunnel to tie into the existing alignment at the ICB land bridge. This allows the Cross River Rail tracks to align between the Exhibition tracks. Minor realignment of the northbound Exhibition track would also be required to allow four tracks to pass under Bowen Bridge Road. Through the RNA Showgrounds, the tracks are positioned at the outside of the Cross River Rail tracks. No platforms are provided for the Exhibition tracks, which would be used for freight.

From the RNA Showgrounds, the Cross River Rail tracks pass under a new O'Connell Terrace road bridge. New junction works would be provided between tracks for Cross River Rail, the Exhibition Loop and shunting movements into Mayne Rail Yard, between O'Connell Terrace and the ICB.

North of the ICB, the tracks remain at surface level with the northbound Exhibition track located west of the proposed Cross River Rail viaduct. The southbound Exhibition track is realigned east of the proposed viaduct, adjacent to the Mayne control centre, before continuing under the proposed viaduct. Through this section, the radii of the curves are a minimum of 140 m due to existing constraints at the ICB and limited space to pass under the proposed viaduct. The maximum achievable speed in this area is 40 km per hour.

After passing under the proposed viaduct, the Exhibition tracks are positioned between Mayne Rail Yard and the main lines. A junction is required to allow trains to connect to Mayne Rail Yard from the Exhibition and main lines. The Exhibition tracks continue north under the Ferny Grove flyover where the southbound Exhibition track crosses the northbound main track to connect to the southbound main track. The northbound Exhibition track connects to the northbound main approximately 300 m north of the Ferny Grove flyover. The maximum speed through this area is 80 km per hour. The track connection between the main lines and the Exhibition Loop at the Bowen Hills Station would be removed.

Main and suburban tracks

Realignment of existing main and suburban tracks located clear of the ICB and Breakfast Creek, is required. This would allow the grade separated Cross River Rail tracks and Exhibition tracks to fit in this constrained section of corridor. The vertical alignment of the realigned tracks is retained at similar grades to the current arrangement.

The southbound suburban track currently runs adjacent to the ICB. This track would be realigned to allow construction of the proposed viaduct. Realignment also allows the existing junction between the main lines and suburban lines, located north of the Ferny Grove flyover, to be moved approximately 200 m north. The northbound suburban, and southbound and northbound main tracks would require slews adjacent to Mayne Rail Yard to allow the extension of the Exhibition tracks.

North of the Ferny Grove flyover, the main and suburban lines would be realigned to allow connection of the Exhibition tracks and Cross River Rail tracks to the main lines. This includes relocation of the junction between the main and suburban lines 200 m south, to allow these operational moves to still occur. The northbound main track would be moved west, allowing the proposed viaduct to land between the main lines. This would reduce the number of at grade train movement conflicts adjacent to Breakfast Creek.

Southern track and structures

Surface rail works in the southern part of the study corridor include upgrade and modification to the freight and passenger rail tracks. The following describes the key works to be undertaken in this section of the study corridor (refer to **Figure 4-25** and **Figure 4-26**).

Passenger track works

A new narrow gauge passenger track would be provided on the eastern side of the corridor, extending from the existing tracks south of Rocklea Station into the southern portal at Yeerongpilly. This track would be used by Cross River Rail southbound trains. From the south, the track travels on the existing eastern rail bridge over Muriel Avenue. The track then travels on a new single track viaduct on the eastern side of Clapham Rail Yard, west of Moorooka Station, and across Moolabin Creek on a new rail bridge. The track then travels through the new Yeerongpilly Station, adjacent to the western side of the central platform.

The viaduct is approximately 710 m in length and approximately nine metres above ground level. It comprises a combination of embankment and elevated viaduct on piers. The embankment extends approximately 250 m at the southern end and approximately 90 m at the northern end, with the elevated viaduct extending for approximately 370 m.

New main line passenger tracks would be provided either side of the new passenger stabling facilities within Clapham Rail Yard. These lines would merge with the existing dual gauge track north of Muriel Avenue, separate around the stabling yard and then run parallel between Clapham Rail Yard and Yeerongpilly Station. The eastern track would connect to the southbound Cross River Rail track, while the western track is the northbound Cross River Rail track.

Modifications to the existing tracks would occur between Beaudesert Road at Salisbury and School Road at Yeerongpilly. The modifications between Beaudesert Road and Rocklea Station include:

- minor track slews to allow new junction works to be installed
- major track realignment and associated road works from Rocklea Station to Moorooka Station to allow all tracks to pass under the existing Ipswich Motorway road over rail bridge and to create a new two track rail over road bridge to the west of the existing rail bridges over Muriel Avenue
- major track realignments of the existing suburban passenger tracks between Moorooka Station and Cardross Street, to the east of the southern portal and aligning tracks to serve the suburban train platforms at the new Yeerongpilly Station
- a new crossover between the existing eastern tracks near Christensen Street to allow realigned suburban tracks to tie in to their existing alignment near Cardross Street.

New platforms for all trains using Yeerongpilly Station would provide high level straight platforms for all tracks, remove freight and coal trains operating on tracks adjacent to the platforms, and allow Queensland Rail the opportunity to reconfigure Tennyson Junction to improve the operation of services through the junction.

Freight track works

A new dual gauge (narrow gauge and standard gauge) freight track is to be provided on the western side of the surface corridor from Musgrave Road at Salisbury along the interstate corridor for approximately 550 m. The track then runs along the western boundary of the combined passenger/freight corridor from Salisbury junction through to just south of the Tennyson Loop junction with a track length of approximately 4,000 m.

Two freight passing loops are provided within Clapham Rail Yard, approximately 500 m and 1,000 m in length. The minimum curve radius of the freight line is 260 m, adjacent to the existing tracks south of Salisbury Station with a maximum vertical grade of 1.8% from Ipswich Motorway to Muriel Avenue, Rocklea to allow the bridge clearance to be raised.

LEGEND

- Study Corridor
- Existing Track

Alignment

- Dual Gauge
- Narrow Gauge
- Train Storage
- Proposed Platform

- Embankment / RSS Structure
- Viaduct / Bridge Structure

Tunnel Structure Type

- Cut and Cover Structure
- Dive / Transition Structure
- Road Header Tunnel
- Station Cavern
- TBM Tunnel
- Cross Passage

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-25

Southern Surface Rail Works
Southern Rail Extent

0 50 100 150 200 250 Meters

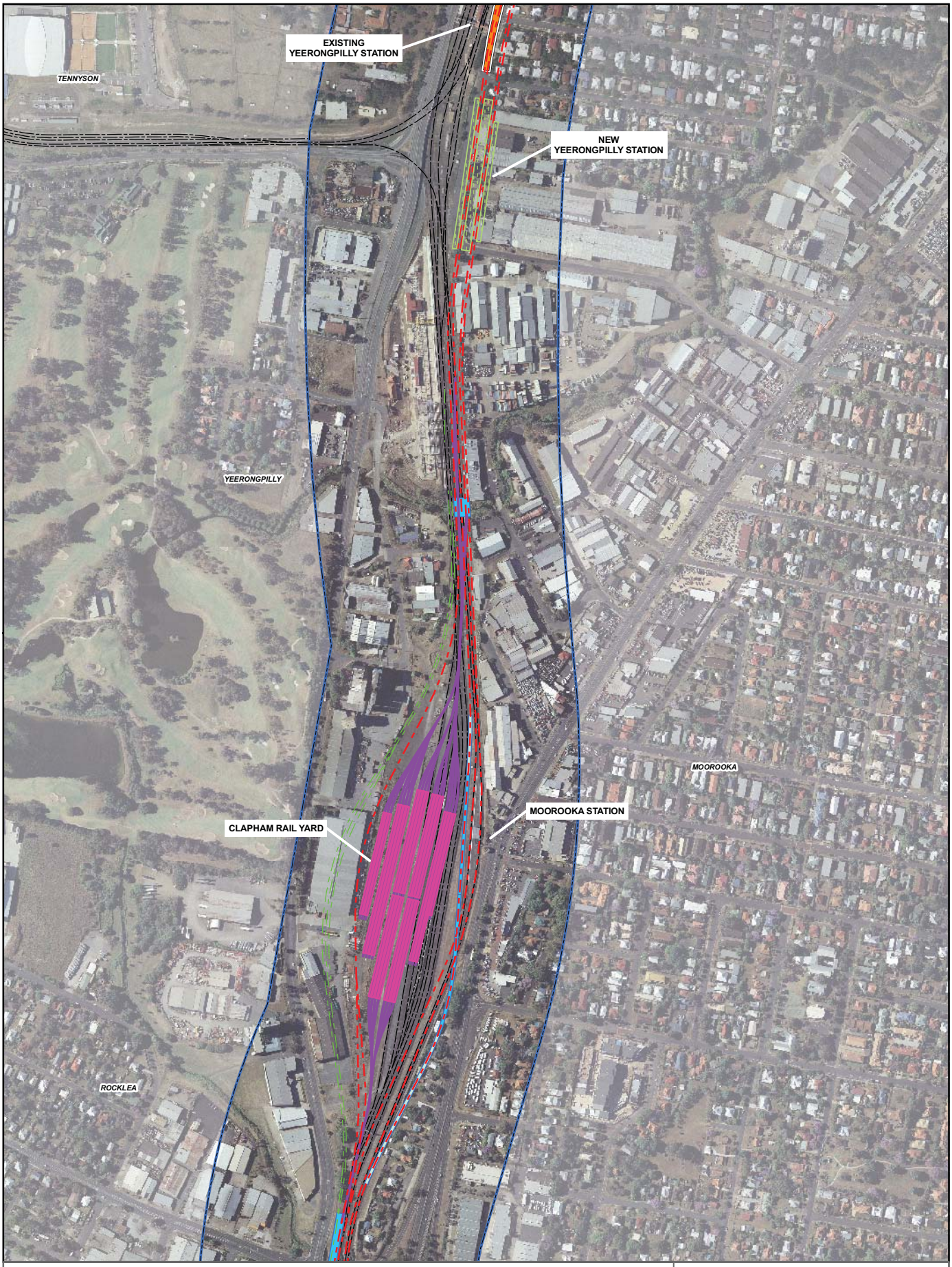
N

1:7,500 at A4

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0141_CRR_SR_Surface_Works_South_RE_A4.mxd 06/07/2011 14:30



LEGEND

- Study Corridor
- Existing Track

Alignment

- Dual Gauge
- Narrow Gauge
- Train Storage
- Yard Tracks
- Proposed Platform

- Embankment / RSS Structure
- Viaduct / Bridge Structure

Tunnel Structure Type

- Cut and Cover Structure
- Dive / Transition Structure
- Road Header Tunnel
- Station Cavern
- TBM Tunnel
- Cross Passage

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-26

Southern Surface Rail Works
Southern Portal

0 50 100 150 200 250 Meters

N

1:7,500 at A4

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0142_CRR_SR_Surface_Works_South_Portal_A4.mxd 06/07/2011 14:32

Stabling facility

A stabling facility accommodating 27 six-car trains or 15 nine-car trains would be provided at Clapham Rail Yard for Cross River Rail trains. The stabling layout would have 4.5 m track centres, with access between every fourth track in a configuration suitable for stabling of trains and cleaning of trains on some tracks.

Pedestrian footbridges would be required to provide access for staff into the yard. Vehicle access would be through the use of maintenance level crossings. Crew facilities and administration buildings would also be provided as required.

4.2.12 Associated non-rail surface works

To accommodate the widening of the surface rail corridor for the additional rail tracks in the southern section of the corridor, changes are required to some adjoining local roads. These road changes are described in more detail in **Chapter 5 Transport** and include:

- cul-de-sacs at Unwin Road and Evesham Road to accommodate the widening of the railway corridor
- reconfiguring the Sherwood Road to Fairfield Road southbound slip lane to accommodate a new rail over road bridge west of the existing bridge
- reconstructing the southbound on-ramp to the Ipswich Motorway by creating a new underpass under the motorway
- reconfiguring the Station Street link under the Ipswich Motorway bridge to accommodate an additional rail line
- reconfiguring the intersection of Railway Parade/Railway Terrace/Fairlie Terrace and the intersection of Fairlie Terrace/Beaudesert Road (service road) as well as realigning Fairlie Terrace
- signalising the intersection of Gladstone Street and Muriel Avenue
- closing the Beaudesert Road (service road) open level crossing and realigning the Beaudesert Road (service road), including providing an emergency access to Beaudesert Road for major flood events
- realigning the Heaton Street/Beaudesert Road (service road) intersection
- widening Tramore Street, to provide two way access and signalising the existing intersection of Beaudesert Road, Tramore Street and Lillian Avenue
- realigning Dollis Street to the west to accommodate an additional rail line within a widened rail corridor.

4.2.13 Project systems

The main rail systems for the Project comprise traction power, overhead electrification, signalling, communications and train control. The following provides an overview of the design requirements for each of these systems. Details relating to the relocation of services and utilities are provided in **Section 4.4.1**

Traction power

Three new 25 kV feeder stations would be located near the northern portal at Victoria Park, at Mayne Rail Yard (to replace an existing feeder facility) and near the new station at Yeerongpilly. The feeder stations would provide the additional power required for the Cross River Rail traction power system and would be connected to adjacent Energex main supply points. The new traction power supply would feed through the tunnel system and have an independent supply in the event of a localised power failure.

Overhead wiring

The overhead wiring system would consist of two components:

- surface works from the northern portal through to the north coast line at Breakfast Creek
- surface works from Salisbury through to the southern portal.

This system would consist of conventional overhead mast supports and a conventional catenary support system, similar to the existing Queensland Rail system. All surface passenger tracks would be electrified, while surface tracks that only carry freight would be non-electrified.

In the tunnel section, the overhead wiring system would consist of a single solid conductor and be supported by special fixings to the tunnel soffit.

Signalling

The signalling infrastructure would consist of new line-side signalling works to suit the new surface track arrangements between Salisbury and the southern portal at Yeerongpilly and the northern portal at Victoria Park and the North Coast Line at Breakfast Creek. No explicit signalling rearrangements have been allowed for at the existing Mayne Rail Yard.

Within the tunnels, a new automatic train protection (ATP) system would be provided, comprising a signalling and train control system based on the European train control system. This system enables new trains to operate efficiently at close headways and to interface with the automated PSD at underground stations.

Interfaces between the existing Queensland Rail signalling system and the new ATP system would be further developed during detailed design for the Project. Construction, testing and commissioning strategies would also be developed during the detailed design. This would allow effective continuation of existing operations during implementation.

Communications

A train communication system would be provided throughout the tunnel, station and above ground network to facilitate train services.

Train control

The existing Queensland Rail train control centre located at Mayne Rail Yard would be used for Cross River Rail. The central communications room manages communications across the South East Queensland rail network. Changes to the existing building footprint are not proposed as part of works for the Project.

Electricity

The electrification system proposed for the Project is compatible with the existing Queensland Rail system, and includes a 25 kV alternating current (AC) system with overhead wiring. However, a simple return conductor system is proposed for the Project, rather than the 25 kV AC booster transformer system currently used for the Brisbane suburban electrification. There are no obstacles to the integration of the existing booster transformer system with the simple return conductor system proposed for the Project.

Upgrade of the existing power supply would be undertaken to meet the new system needs.

The main power supply for the new stations would include a dual ring main arrangement along each track/tunnel. Power would be supplied from a pair of 110 kV bulk power supplies located at each end of the proposed rail works. Each of these would have the capacity to supply the complete system.

Separate independent power supplies would also be provided at some station locations, to provide additional capacity as required.

Underground stations would be provided with an uninterruptible power supply to service critical elements of plant, such as central communications and signalling equipment. These would be located at each end of the station.

Fire service systems

The provision for fire and life safety includes a tunnel and ventilation system that allows for normal operations as well as emergency fire conditions. The system has been designed to cope with a train fire of 20 MW, at a station platform and in tunnel.

Table 4-4 provides an overview of the fire services systems proposed for the Project.

Table 4-4 Fire service systems

System	Details
Fire hydrant and hose reel system	The fire hydrant system would be connected from the town main through a fire hydrant booster cupboard and connected to a diesel engine driven fire hydrant pump. Fire hydrant outlets would be located within the public and back of house areas of each station. The fire hydrant system would extend into the tunnels with hydrants located along the tunnel. Fire hose reels would be connected directly from the town main water supply. Hose reels would be located in the public and back of house areas of the station.
Fire sprinkler system	A fire sprinkler system would connect from the town main to an electric driven sprinkler water pump. Sprinklers would be provided to general non-critical back of house areas.
Gas suppression system	Underground stations would be provided with a gas fire suppression system at each end of the station. Each suppression system would be common for all areas that require gas suppression.
Fire detection and alarm system	A smoke detection and fire alarm system would be provided for the public and back of house areas of each station. The detection system would activate the fire alarm and initiate the evacuation process. For the tunnel, smoke detectors would be located in the ventilation shafts.

Ventilation

Cooling would be provided to the platform area of underground stations. This would be achieved by providing a supply air handling unit at each end of the station. Air would be reticulated to the platform area via an under platform supply air duct.

The air would be supplied to the platform zone via diffusers located along the centre of each platform under escalator and stair rises. The return air would be extracted at high level in the mezzanine area just below the cavern ceiling using the smoke exhaust duct connected to the tunnel ventilation/over track exhaust. The return air would be recirculated back to the inlet of the supply air handling unit to maximise energy recovery. The supply air handling unit and return air fan are located in the public area ventilation plant room.

Temperatures would be maintained at 26 C$^{\circ}$ at the platform level in the vicinity of the PSD.

Fresh air supply and exhaust air ventilation would be provided to back of house equipment, staff and plant room areas at each end of each station. These are required for the removal of heat and to provide fresh air. Supply and exhaust fans would be located within the ventilation plant room at each end of the stations.

Pairs of tunnel ventilation fans would be installed at either end of the stations to provide forced ventilation when required. The fans would be connected to either tunnel and would supply from, or exhaust to, the surface via a shaft. The primary reason for these fans is to provide supply and exhaust to the tunnels when congestion occurs and to provide smoke exhaust and fresh air supply during an emergency. Under hot ambient conditions the fans could also be used to supply outside air to the tunnels to allow tunnel and station areas to achieve design criteria temperature levels.

A ventilation and emergency access building is required at Fairfield due to the length of the tunnel between the Boggo Road Station and southern portal at Yeerongpilly. Further information on this building is provided in **Section 4.2.10**.

Drainage

An ingress/wastewater sump and pump system would be provided at:

- both ends of each underground station
- each of the two dive structures
- the ventilation and emergency access shaft
- the low point where the tunnel passes beneath the Brisbane River.

Each sump would be located at the lowest point when located in tunnels and would gather ingress water through drainage channels in the tunnel. Collected water would be pumped through the tunnel to the nearest station and to ground level where it would be discharged into the local sewer system. If required, collected water would be treated prior to discharge.

Groundwater in the vicinity of Roma Street and Gabba stations has the potential to be contaminated. This may require the ingress water collected from the tunnels and stations in these locations to be treated. An allowance has been made in the reference design for two water treatment plants, one at each of these two locations. The discharge from the water treatment plants would be discharged to the stormwater drainage system.

Lighting

Lighting would be provided to public and back of house areas of stations. In addition lighting would be required to entrances as well as in the tunnels. Emergency lighting would be provided throughout the public, back of house and tunnel areas. Lighting types proposed for the various areas of the Project include:

- public platform, mezzanine, concourse and entrance areas - mixture of linear, compact fluorescent or LED lighting with zone control
- back of house areas - linear fluorescent or possibly LED lighting
- external lighting adjacent to station entrances - feature lighting to complement the architectural intent
- tunnel lighting – linear fluorescent or possibly LED lighting.

4.3 Project operation

This section provides an overview of the Project operations, including the operational benefits and operational arrangements.

4.3.1 Operational overview

Cross River Rail is a key component of implementing the rail network and rail operating strategies identified in the draft Connecting SEQ 2031. The rail network would support sectorised operations enabling the introduction of UrbanLink (all stops), ExpressLink (metropolitan express) and CoastLink services (coast express).

The provision of additional rail tracks through the inner city would allow the separation of the different rail operations, ie freight, express passenger and all stops passenger. In general this would allow passenger services to increase in frequency and minimise surface conflicts between passenger and freight movements.

Yeerongpilly, Boggo Road, Woolloongabba, Albert Street, Roma Street and Ekka stations would provide new nine-car platforms for Cross River Rail services, improving accessibility to the South East Queensland rail network. In particular, this would benefit journey to work (and return) trips for existing and future employment hubs including in the CBD and at the RNA Showgrounds, Woolloongabba UDA and Boggo Road Urban Village.

The Project would free up capacity at existing bottlenecks such as the Park Road junction and Merivale Bridge, enabling an additional four services from the Gold Coast, Beenleigh and Cleveland corridors in 2021.

Queensland Rail is currently undergoing a process to procure additional rollingstock to meet growing passenger demand. New generation rollingstock, including nine-car train sets, would be introduced onto the South East Queensland rail network through this process. While existing train sets would initially operate on the Cross River Rail infrastructure, it is anticipated that they would be replaced by 2031 with the new rollingstock. Queensland Rail would also be upgrading stations north of Petrie and south of Kuraby in the future, separate to Cross River Rail, to accommodate longer trains.

This new rollingstock would need to be stabled across the Brisbane metropolitan network, ideally in locations that minimise dead running, either at the beginning or end of services or at maintenance facilities. With this in mind, access to stabling and maintenance has been considered important in design development of the northern and southern approaches to enable access to Mayne Rail Yard and Clapham Rail Yard.

Chapter 5 Transport provides a detailed discussion on operations and rail patronage.

4.3.2 Operational arrangements

Queensland Rail would be responsible for the development of operational and functional requirements for the Project's rail infrastructure and rail systems. In particular, as the designated rail transport operator under the *Transport (Rail Safety) Act 2010* (Rail Safety Act) Queensland Rail would be responsible for:

- development of the rail safety case for the Project
- obtaining approval for the rail safety case from the Rail Safety Regulator
- providing approval (rail safety) of the construction of rail infrastructure
- operating and maintaining the rail corridor and rail systems.

Queensland Rail would become the operator of the rail infrastructure on commencement of the Project operations. Except for the legislative safety requirements identified under the Rail Safety Act, the operations of the Project would be primarily guided by the internal processes and standards developed by Queensland Rail for their rail infrastructure.

Transport (Rail Safety) Act 2010

The Rail Safety Act replaced the rail safety provisions contained within the *Transport Infrastructure Act 1994*. It addresses:

- accreditation/registration
- compliance/enforcement
- interface agreements
- relationship between WH&S legislation and rail safety legislation
- rail safety duties.

Transport Security (Counter-Terrorism) Act 2008

An agreement has been established between the Commonwealth Government and state and territory governments for a coordinated approach to protecting surface transport systems from potential terrorist attacks or unlawful activities. In Queensland, the *Transport Security (Counter-Terrorism) Act 2008* establishes procedures for any transport system identified as a Security-Identified Surface Transport Operation.

In the event that the Project is declared a Security-Identified Surface Transport Operation, a management plan (Surface Transport Security Plan) must be prepared and issued to the Chief Executive, Transport and Main Roads, which outlines a systematic and consistent approach to responding to counter terrorist attacks and to minimising the effects of such attacks.

Regulator

Rail safety in Queensland is regulated by the Department of Transport and Main Roads. The Regulator under the Rail Safety Act is the Chief Executive, Transport and Main Roads, as advised by Rail Safety Regulation Branch.

The Chief Executive, Transport and Main Roads is also responsible for accreditation of ‘rail transport operators’. All railway managers and railway operators within Queensland are required to be accredited in accordance with the Rail Safety Act.

The role of Transport and Main Roads in rail safety is:

- to regulate rail safety
- to accredit and approve the safety systems of rail operators and managers operating in Queensland
- to implement and manage safety accreditation schemes
- to audit the implementation of rail safety management systems.

Audit and inspection programmes are designed and implemented to ensure that rail transport operators and contractors working on rail infrastructure are complying with the requirements of the Rail Safety Act.

Accreditation

In order for the Project to be operational, the management of rail infrastructure and rollingstock would need to be by an accredited rail transport operator. Railway operations for which accreditation is required include:

- construction of a railway, railway tracks and associated track structures
- management, commissioning, maintenance, repair, modification, installation, operation or decommissioning of rail infrastructure.

While the design of railway infrastructure does not require accreditation under the Rail Safety Act, activities such as construction and commissioning of rail infrastructure must be undertaken by an accredited entity.

Responsibilities

The Rail Safety Act requires the accredited rail transport operator to prepare and implement Safety Management Systems in accordance with Schedule 1 of the *Transport (Rail Safety) Regulation 2010.* This includes a safety management plan, an emergency management plan, health and fitness management program, alcohol and drug management program and fatigue management plan for all works under their management. This safety management system would establish the framework for the safe operation of the Project infrastructure.

The rail transport operator is required to prepare and issue a safety performance report to the Chief Executive, Transport and Main Roads. The report describes and assesses the safety performance, comments on any deficiencies or irregularities, and identifies any initiatives undertaken for the rail operations carried out by the rail transport operator. The Chief Executive, Transport and Main Roads may audit the rail operations of the rail transport operators on a yearly basis.

Change management

Queensland Rail, as the designated rail transport operator for the South East Queensland rail network that interfaces with the Project, must notify the Regulator of changes which impact on their existing network. Queensland Rail is required to develop a safety case under their current accreditation for the inclusion of Cross River Rail in the South East Queensland rail network.

The safety case must provide a detailed assessment of the incremental impact on the rail safety of the network relating to the rail infrastructure and rail operations associated with the Project. A rigorous assessment of operational safety risks would be reflected in the rail safety compliance process. This includes a rail safety assessment of the new rail infrastructure and systems including signalling, as well as the integration of the new infrastructure and systems with the existing infrastructure and systems.

In preparing the change management safety case, Queensland Rail would be required to certify that it accepts the rail infrastructure constructed as part of Cross River Rail before it becomes operational.

Rail safety in Queensland –interface agreements

A memorandum of understanding (MOU) was finalised and endorsed in early 2010 by Queensland Government agencies that have responsibility for safety in the rail industry, including:

- Transport and Main Roads, through the Rail Safety Regulation Branch
- Department of Justice and Attorney-General, through the agencies of Workplace Health and Safety Queensland, and the Electrical Safety Office.

The purpose of the MOU is to establish collaborative arrangements between the relevant agencies with responsibility for safety in the rail industry and communicate the collaborative arrangements to the Queensland rail industry to ensure understanding of the whole of Queensland Government approach to safety in the rail industry.

The scope of the MOU applies to all rail operations covered by the:

- *Transport Infrastructure Act 1994*
- *Workplace Health and Safety Act 1995*
- *Electrical Safety Act 2002*
- *Dangerous Goods Safety Management Act 2001*
- Rail Safety Act.

The rail safety MOU provides a basis and precedent on which to develop interface agreements between Cross River Rail and Queensland Government agencies in relation to rail safety, workplace health and safety, and fire and life safety (with the Queensland Fire and Rescue Service). For Cross River Rail, interface agreements would be developed and finalised with the key government agencies.

4.3.3 Passenger rail operations at commencement of Project

Six-car electric trains consistent with those currently operating on the Queensland Rail network would operate on Cross River Rail at the commencement of operations.

In 2021 with the introduction of the Project, the rail network would operate in three distinct sectors as shown in **Figure 4-27**.These include:

- north-south Cross River Rail sector (blue line), which connects the Beenleigh and Gold Coast lines to the Redcliffe and North Coast/Caboolture lines and allows the transition to nine-car sets on these high growth lines
- east-west sector (pink lines), which connects the Springfield and Rosewood/Ipswich lines to the Airport and Shorncliffe lines. Airport services would no longer be connected to Gold Coast services
- Brisbane suburban sector (green lines), which connects the Ferny Grove and Doomben lines to Kuraby and Cleveland/Manly lines. These lines service the current South Bank and South Brisbane stations and use the Ferny Grove flyover and the suburban platforms in the inner city.

The Project allows for a fundamental transformation in rail capacity to and through the Brisbane CBD. The Cross River Rail tunnels would allow up to an additional 48 trains per hour (two way) through the Brisbane CBD. This would result in a combined total throughput of 132 trains per hour, an increase of 57% compared to the current infrastructure's maximum capacity of 84 trains per hour. This would free up surface rail paths at existing bottlenecks such as the Merivale Bridge, enabling additional passenger and freight services to be provided.

Table 4-5 shows the peak hour train frequencies at Brisbane CBD stations achievable for the morning peak period with the Project.

Table 4-5 Forecast morning peak train numbers at CBD stations, 2021

Scenario	Trains from the south/west to CBD	Trains from the north to CBD	Total two-way through CBD
2009	30	27	57
2021 with Project	49	39	88

Source: Systemwide, December 2010

In 2021 the Project would allow a significant increase in services within the newly created inter-city/outer suburban sector along the Gold Coast/Beenleigh corridor. A total of 39 services would approach the Brisbane CBD from the north during the one hour morning peak, while 19 services would approach the city from the west, and 30 services would approach the Brisbane CBD from the south. Of the 30 services that approach the Brisbane CBD from the south, 14 services would travel via the Cross River Rail tunnel and a further 16 services would travel via the Merivale Bridge.

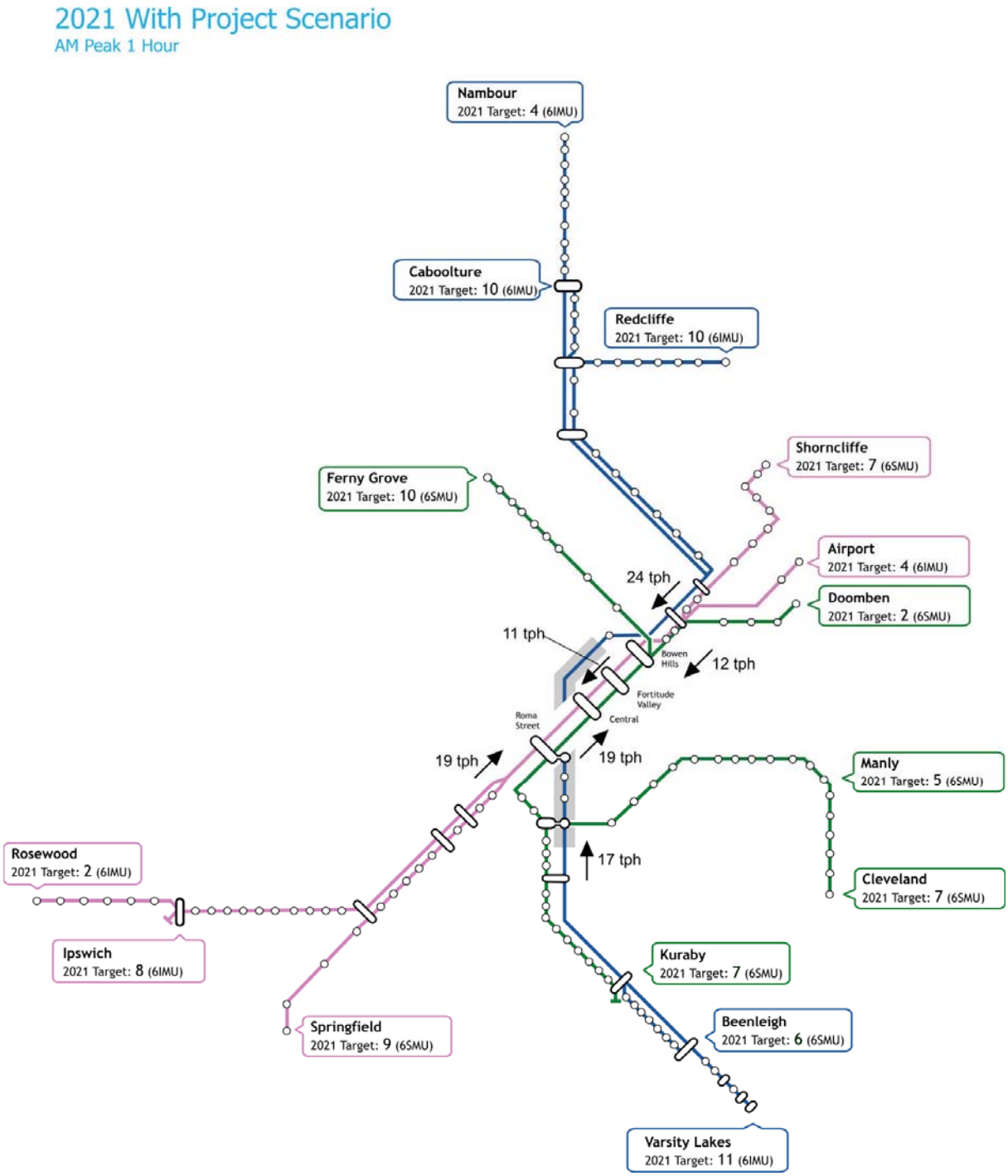


Figure 4-27 2021 Service plan with the Project (morning one hour peak)

Note: provided by Systemwide, June 2011

During the morning peak one hour, 14 services from the Gold Coast and Beenleigh would operate on the Project, providing a service approximately every five minutes. At the same time, 19 services would operate from Caboolture and the Sunshine Coast, providing a service approximately every three minutes. During the off peak, Gold Coast and Beenleigh trains would operate through the Project approximately every 10 minutes, while trains from the Sunshine Coast or Caboolture would operate approximately every nine minutes.

Figure 4-28 shows the changes in station boardings and alightings from 2009 to 2021 and 2031. In 2021, key stations include Roma Street, Central and Albert Street stations. These stations would each have around 90,000 boardings and alightings daily.

Further detail is provided in **Chapter 5 Transport** about patronage at each station.

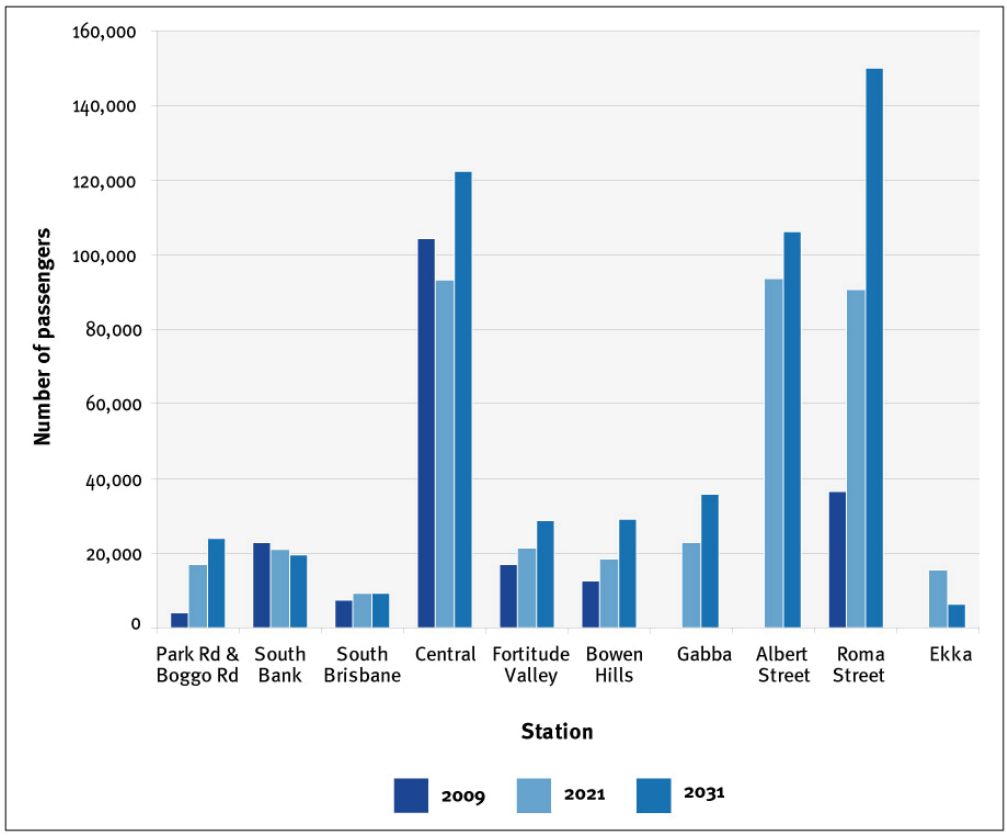


Figure 4-28 Station boarding and alightings (including transfers)

4.3.4 Future passenger rail operations with Project (at 2031)

The 2031 operating strategy is expected to result in a significant increase in the number of rail services that can be operated through the Brisbane CBD, a significant improvement in travel times and reliability, and facilitate increased train frequencies on the network.

It is assumed that by 2031, the NWTC would be operating, providing a new rail line from Strathpine to the city via Alderley. This would be used by ExpressLink and Coastlink services from the Sunshine Coast and Caboolture lines. It is also assumed that some additional branch lines and extensions would also be operating, allowing more services to be added to the South East Queensland rail network, especially from new regional centres such as Strathpine, Caloundra and Redcliffe from the north and Ripley, Flagstone Creek and Elanora from the south.

During the morning one hour peak, 22 services from the Gold Coast, Beenleigh and Hillcrest would operate on the Project, providing a service every three minutes. From the north, 23 services would operate from the North Coast and Caboolture, providing a service every two to three minutes. In the off peak, trains would operate in both directions approximately every five minutes.

Roma Street, Central and Albert Street stations would continue to be the primary stations. However, growth is expected across all Cross River Rail stations, apart from Ekka Station, which would be bypassed by Cross River Rail services.

The 2031 operating strategy is shown on **Figure 4-29**.

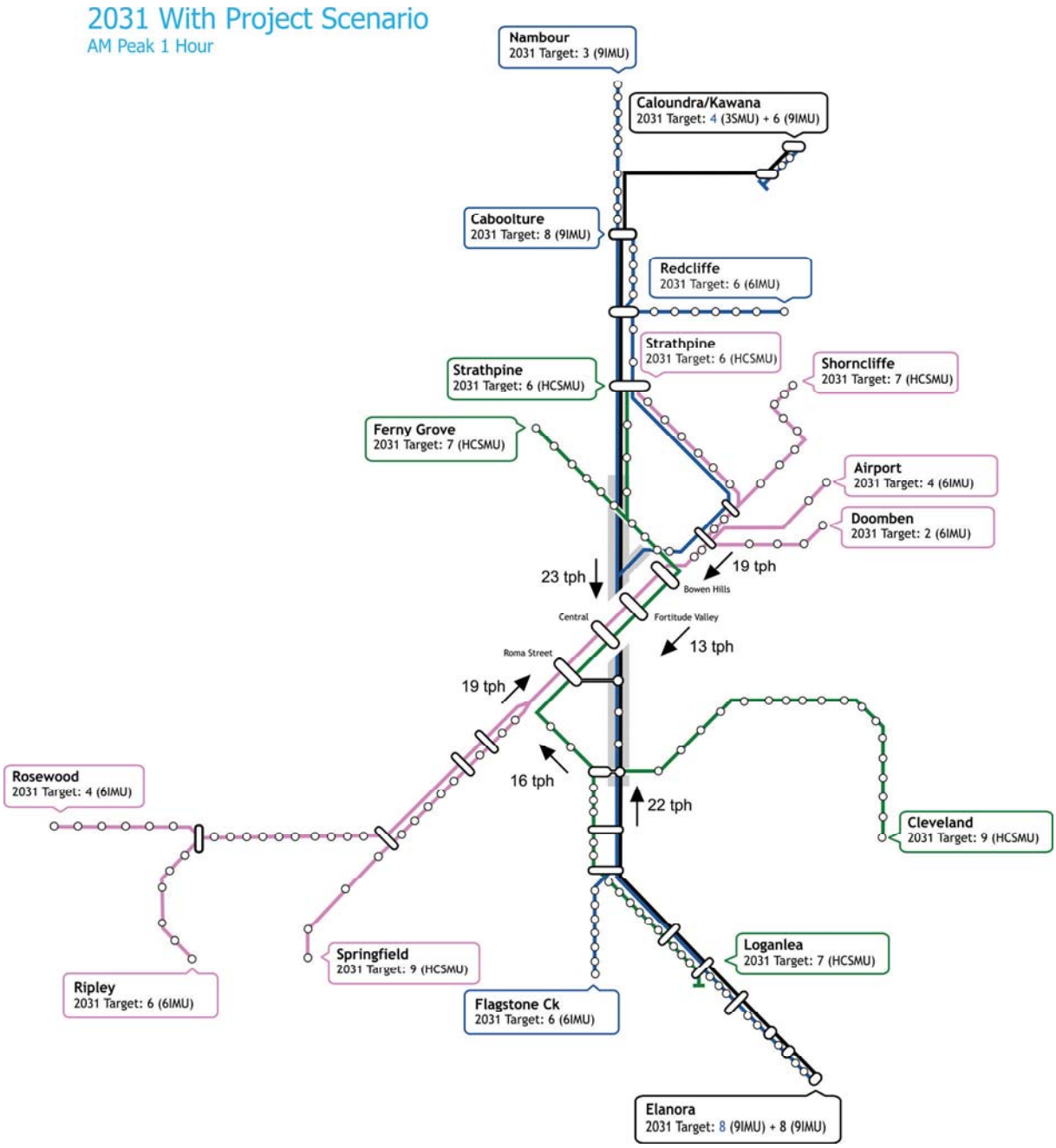


Figure 4-29 2031 Service plan with Cross River Rail (morning one hour peak)

Source: Systemwide, December 2010

4.3.5 Other train services

On the commissioning of the Project and in 2031, interstate and inter-regional services, ie Travel Train and Tilt Train, would continue to operate in a similar manner to current operations.

There would be approximately 104 freight trains operating within the study corridor on an average day in 2031, including services travelling from interstate, western and north coast lines to the Port of Brisbane and Acacia Ridge. This would consist of coal (29 services), container/intermodal/Travel Train (72 services) and standard gauge freight (three services).

Freight services are expected to grow over time in accordance with growth in economic development and freight goods in South East Queensland.

Cross River Rail infrastructure would facilitate additional freight trains on the rail network by removing conflicts between passenger and freight services. Further discussion of the Project's benefits and impacts for freight operations is provided in **Section 5.6.8**.

4.3.6 Stabling

Queensland Rail is currently undergoing a process to procure additional rollingstock to meet growing passenger demand. This new rollingstock would need to be stabled at a range of locations across the South East Queensland rail network, and ideally would be stabled in locations that minimise dead running, either at the beginning or end of services, or at maintenance facilities. With this in mind, access to stabling and maintenance has been considered important in design development of the northern and southern approaches of the Project, to enable access to Mayne Rail Yard and Clapham Rail Yard.

A stabling facility catering for up to 27 six-car trains or 15 nine-car trains is provided at Clapham Rail Yard. Due to the close proximity of the Cross River Rail tunnel portal, this stabling supports efficient rail operations by minimising empty running for terminating services.

The stabling layout has 4.5 m track centres with access between every fourth track in a configuration suitable for stabling of trains and cleaning of trains on some tracks. Until the exact maintenance requirements, if any, for trains stabled at this location is confirmed by Queensland Rail, the final layout of the stabling cannot be confirmed.

Future stabling needs to accommodate non-Cross River Rail services is beyond the scope of the Project and this EIS.

4.3.7 Rail maintenance

Maintenance would be undertaken by Queensland Rail in accordance with existing and future rail maintenance strategies.

Rail tracks within the tunnel are proposed to be a minimum of 60 kg continuously welded rail. These would be constructed using flash butt welds to reduce the amount of ongoing repair required on the rail.

Access roads for emergency and maintenance access along the corridor would be provided near new surface tracks, apart from that section between Bowen Bridge Road and O'Connell Terrace due to the confined nature of the corridor in this location and the majority of the track being on elevated structure.

Existing access points for maintenance access to the corridor would continue to be used. Additional access points would also be provided adjacent to the feeder station at Victoria Park and to Clapham Rail Yard from Fairfield Road.

The tunnels have been designed to allow access by:

- diesel powered maintenance vehicles
- maintenance material freight wagons
- diesel locomotives for engineering trains and/or recovery of stranded trains.

A maintenance walkway would also be provided in the tunnels to provide access for maintenance staff.

Track access points used for road/rail vehicles to access the tracks would be positioned at each end of the tunnel. The ramps would be positioned to allow easy road access and close to the portals for both maintenance and emergency use. The proposed locations are to the south of the new Yeerongpilly Station for the southern portal and west of Bowen Bridge Road for the northern portal.

Emergency access is provided at each station and portal as well as at the ventilation and emergency access building at Fairfield.

4.3.8 Operations workforce

During operations, it is estimated that the Project would require a total of approximately 230 staff, including for the operation of new stations and train services and for ongoing infrastructure maintenance.

Approximately 14 staff would be required at each of the new stations at Roma Street, Albert Street and Boggo Road. Approximately 10 staff would be required for the day-to-day operations at Gabba Station, with an additional staff required during major events at the Gabba stadium. It is expected that approximately 4-6 staff would also be required at each of the new Ekka and Yeerongpilly stations, depending on demand at the commencement of Project operations.

Additional services provided by the Project are also expected to require approximately 50 new train drivers.

It is estimated that approximately 120 workers would be required for the ongoing maintenance of project infrastructure.

The actual workforce numbers required for the operation of the Project would be determined by Queensland Rail, in the context of its broader workforce planning at the time the Project commences operation.

4.4 Construction

Construction of the Project would involve both major surface and underground works, including approximately 10 km of tunnelling, four new underground stations, two new surface stations and associated surface works.

The design, construction and commissioning works for the Project are expected to take approximately 5.5 years and would generally involve

- detailed design and worksite establishment
- major underground construction, including tunnelling and station construction
- surface rail infrastructure works
- fit-out of stations and tunnels
- testing and commissioning.

Construction worksites would be required to support tunnelling activities, station construction, surface works and construction of the ventilation and emergency access building.

TBMs are proposed to be used for the majority of tunnelling, with short sections of mined or cut and cover tunnel near either end of the tunnels and mined station caverns. Shafts and cut and cover construction would also be required for some stations, station entries and plant space. Surface works would occur at the northern and southern parts of the study corridor where the Project interfaces with the existing rail network.

Construction hours for above ground works would vary depending on the location of the worksite and/or construction works. Hours of spoil haulage and delivery of materials and equipment would also vary across the study corridor, depending on the location of the worksite. Information on construction work hours, including hours of materials delivery and spoil haulage, is provided in **Section 4.4.4**.

The maximum number of workers required for the construction of the Project is anticipated to be approximately 2,200 people with a maximum shift of approximately 1,325 people. Workers would be required for tunnelling works, station construction, surface works and project management and design. A breakdown of workforce requirements is provided in **Section 4.4.6**.

Tunnel and station excavation would require the removal of approximately 1.4 million m^3 of insitu material, or approximately 3.4 million tonnes of spoil. The majority of spoil would be generated from the TBM running tunnel sites at Woolloongabba and Yeerongpilly. However, the northern portal and station locations would also generate significant volumes of spoil. Further information on spoil haulage is provided in **Section 4.4.7**.

The peak construction and haulage periods varies between worksites and the stage of activities being undertaken at each worksite.

4.4.1 Pre-construction phase

A number of pre-construction activities are required prior to the commencement of major construction works. These would include activities such as land acquisitions, fencing, site clearing and demolition, access arrangements, relocation of public utilities and other infrastructure, and relevant construction approvals.

A range of project approvals would also be required prior to construction of the Project, including for construction related activities such as site preparation and establishment, transport of materials and temporary works such as road and utilities. Approvals for the Project are discussed in **Section 4.5**.

Works undertaken during the pre-construction phase would involve:

- property acquisition and enabling works such as relocation or alteration to public utility and road infrastructure and worksite establishment
- detailed possession planning for works within the existing rail corridor to ensure operational capability of the network is maintained during construction.

Relocation of utilities and services would be undertaken in consultation with the infrastructure owners, and would include the relocation of shallow pipelines and utilities, particularly at the locations where:

- tunnel construction is by ‘cut and cover‘ method
- surface tracks are relocated
- new surface tracks are constructed
- surface level entry points are to be constructed for underground stations
- improvements to the public realm, eg roads, footpaths etc, are undertaken.

The Project is not expected to require the relocation of utilities in those sections of the tunnels proposed to be constructed by either road-header or TBM, due to the depth of the tunnelling in these locations. However, the Brisbane CBD is traversed by two large sewers, being the S1 Sewer and S1 Interceptor, which pass deep under George, Albert and Edward streets. The vertical and horizontal alignment of the tunnels has been designed to avoid these major utilities.

Further information on potential impacts on utilities and infrastructure is contained in **Chapter 9 Land Use and Tenure**.

4.4.2 Construction phase

Underground

The underground sections of the Project, between the southern portal at Yeerongpilly and the northern portal at Victoria Park, are complex and comprise a range of structural forms.

The running tunnels and station caverns have been designed to lie below the inferred rockhead levels, making initial excavations self supporting. The tunnels would predominantly be constructed by TBMs with pre-cast concrete segmental linings erected behind a mechanised shield. However, some sections of the tunnels and station caverns would also be constructed using a combination of roadheader and drill and blast methods.

The station caverns and mined tunnels would be drained structures while the sections of the tunnels constructed by TBM would be undrained. Full groundwater cut-off to rock has been provided at specific locations to address anticipated groundwater inflows.

Some stations, station entries and plant space would require shafts and cut-and-cover elements. These would generally comprise reinforced concrete structures, predominantly cast insitu, although specific pre-cast elements may also be required. Perimeter walls would extend to rock, with excavations continuing below as vertical rock cuts to depth. The majority of piled walls would be drained soldier piles with shotcrete lagging.

Fit-out of the track and rail systems in the tunnels is proposed to be undertaken from a number of worksites to minimise the time required for tunnel fit-out. These include worksites at Yeerongpilly, Woolloongabba and Victoria Park.

Table 4-6 provides an overview of the key underground construction activities.

Table 4-6 Underground construction activities

Element	Description	Technique
Southern portal and dive structure	• Dive structure immediately to east of existing rail corridor. • Short length of mined tunnel followed by driven tunnels to the north.	• Reinforced concrete retaining wall. • Soldier pile wall at immediate portal retaining re-aligned Wilkie Street. • Elsewhere reinforced ie soil nails or un-reinforced cuttings. • Cut and cover tunnel, north of Stamford Street to just north of Crichton Street.
Tunnels between Yeerongpilly to the northern portal	Two single track running tunnels with cross passages at approximately 240 m centres.	• TBM tunnels in rock with pre-cast concrete lining. • Mined cross passages with cast insitu concrete or shotcrete linings.

Element	Description	Technique
Ventilation and emergency access building	• Tunnel supply and ventilation, emergency egress stairs, tunnel sump. • Surface structure includes ventilation outlet to above flood levels.	• Secant pile walls with cast reinforced concrete skin. • Cast insitu reinforced concrete internal structure.
Boggo Road Station	Cut and cover station box, entrances and tunnel ventilation at each end of the station.	• Soldier pile wall or similar retaining structures. • Capping beam on piles at top-slab level. • Pre-cast beams and cast insitu top slab. • Conventional reinforced concrete slabs and skin-wall at depth. • Top-down construction to minimize surface impacts.
Gabba Station	• Cut and cover station box in central section of site south of South East Freeway off-ramp. • Cavern profiles at each end. • Tunnel ventilation reticulated back into box from station ends.	• Secant pile walls with cast reinforced concrete skin. • Number of piles taken to depth to carry future development loads.
Albert Street Station	• Station cavern approximately 250 m long. • Entrances and tunnel ventilation in off-line shafts at each end. • Two shaft-cavern connecting adits at each end-one passenger, one ventilation/services/egress.	• Mined station cavern with a minimum of two top-headings, potentially full-width bench. • Southern shaft – temporary walls retaining soil near-surface, cast insitu walls (shallow rock anticipated). • Secant pile wall for northern shaft (deeper to rock).
Roma Street Station	• Station cavern approximately 250 m long. • Entrance and tunnel ventilation in on-line shaft at south end. • Entrance in shaft providing connection to existing subway towards centre of station. • Ventilation and egress shaft beyond northern end of station.	• Mined station cavern with possibly two top-headings, potentially full-width bench. • Shafts – temporary walls retaining soil near-surface, cast insitu walls (shallow rock anticipated).
North portal and dive structure	• Shallow tunnels transition to cut and cover and then trough structures for north-bound and south-bound tracks. • Provision for the future NWTC line (tunnel stubs, provision for future ventilation facility).	Temporary walls retaining soil near-surface, cast insitu walls.

Portals

The design of the northern portal at Victoria Park comprises

- open dive structure, approximately 300 m in length, which includes both the northbound and southbound tracks
- cut and cover tunnel, approximately 200 m in length extending north of the land bridge, and including provision for northbound and southbound tracks and connection to future NWTC
- mined tunnel for northbound and southbound tracks, using road headers, south of the land bridge, for a length of approximately 175 m.

The northern side of the cut and cover excavation would be constructed to rock-head with a piled wall, tied back with soil nails, then rock bolts with shotcrete below rock-head. This cutting would be located adjacent to the existing rail line and would need to provide adequate clearance to ensure rail operations are not interrupted.

On the southern side, the excavation would be constructed to rock-head with batter stabilisation, such as soil nailing and shotcrete. Below rock-head, rock bolts with shotcrete would be used.

The design of the southern portal at Yeerongpilly comprises:

- open dive structure, approximately 200 m in length, which accommodates both the northbound and southbound tracks, with batter stabilisation such as soil nailing and shotcrete
- cut and cover tunnel, approximately 100 m in length, extending from north of Stamford Street to just north of Crichton Street, including provision for both northbound and southbound tracks.

Surface works

The surface rail infrastructure works represent approximately 50% of the overall project length at the northern and southern ends of the Project. Surface works would include:

- demolishing or removing existing buildings, structures and infrastructure
- widening of the existing rail corridor boundaries
- altering or relocating road, pedestrian and public utility plant and infrastructure
- constructing new road and rail bridges, including at Mayne Rail Yard, O'Connell Terrace, Moolabin Creek, Clapham Rail Yard and Muriel Avenue
- upgrading existing stations at Moorooka and Rocklea
- constructing new stations at RNA Showgrounds and Yeerongpilly
- constructing new rail infrastructure
- altering or relocating existing rail infrastructure.

Earth works would be required within Clapham Rail Yard to allow the stabling tracks to have a maximum grade of 0.5% and to improve the flood immunity of the stabling facility. The rail yard would need to be raised an average of two metres, requiring approximately 240,000 m^3 of bulk fill material. This fill material may be sourced in part from the station excavations at Boggo Road and Woolloongabba.

Much of the new surface work in the southern corridor section can be carried out independently of the main line rail operations. However, significant work would be required within the existing rail corridor, such as relocation of existing tracks, construction of new bridge and viaduct structures, track infrastructure and station upgrades. These works would require consideration of Queensland Rail's forward possession planning for the overall South East Queensland network and would need to occur over designated weekends or public holiday periods such as long weekends, Easter and Christmas.

The timing of the surface works construction would be managed to minimise impacts on the current and future operational capacity of the rail network, and to ensure the safety requirements of the rail manager are met.

Whole corridor works – track and rail systems

Track and rail systems would generally be constructed as end to end installations. The activities would be planned to avoid construction conflicts, although the assumed sequence of works includes:

- the track formation and tunnel track slabs
- sleepers and rails
- overhead masts and overhead electrical assemblies
- traction power supply and connection
- line-side signalling system installation and communications.

Stations

Fit out of the stations would be undertaken following construction of the station caverns. Due to the complexity of the fit-out process, these works would commence as soon as the station structural shells are complete and the ongoing TBM operations allow. Significant mechanical and electrical, control and ventilation systems would also be required in addition to the normal station facility fit-out and finishes. Installation of the PSD would be synchronised with the new signalling and train control system.

4.4.3 Construction worksites

Construction of the Project would require a number of construction worksites across the study corridor. The location of worksites for major tunnelling and underground station works are shown in **Figure 4-30** to **Figure 4-32.** Further detail is also provided in **Volume 2 Reference design drawings**

Construction worksites for tunnelling activities would be located at Victoria Park, Woolloongabba and Yeerongpilly. Construction worksites would also be located at each of the proposed underground stations, at proposed surface stations, at Fairfield to support construction of the ventilation and emergency access building, and at Mayne Rail Yard and Salisbury to support construction activities associated with surface works. An overview of each construction worksite, including purpose and location, is provided in **Table 4-2**.

Construction worksites would vary in size and scale depending on the requirements for the site. Construction worksites for major tunnelling activities would have a minimum site area of approximately 20,000 m², to support driven tunnelling and cut and cover tunnel activities as well as provide supporting construction requirements such as office, worker car parking, access and storage.

Other construction worksites would generally be about 5,000 m² to 6,000 m², to allow sufficient area for surface construction works and basic construction support facilities such as offices, worker car parking, access and storage.

Public access to work areas and construction worksites would be restricted. Appropriate fencing and screening would be provided for safety and to minimise visual impact and nuisance such as noise and dust for nearby communities. The provision of buffers between worksites and residential areas are not anticipated to be required.

Worker and visitor parking would be provided at most construction worksites to meet the parking demands of the respective worksite. At the construction worksites in Albert Street, on-site parking would generally be limited to visitor parking, with workers required to use commercial off street parking and/or public transport.

LEGEND

- Study Corridor
- Tunnel Structure
- Existing Track
- Worksite Extent

Alignment

- Dual Gauge
- Narrow Gauge
- Train Storage
- Yard Tracks

Worksite

- Acoustic Shed
- Existing Structure
- General Site Area
- Office; Ancillary Plant
- Station Structure
- Project Infrastructure

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-30

The Project Worksites
Victoria Park

0 25 50 75 100 125 Meters

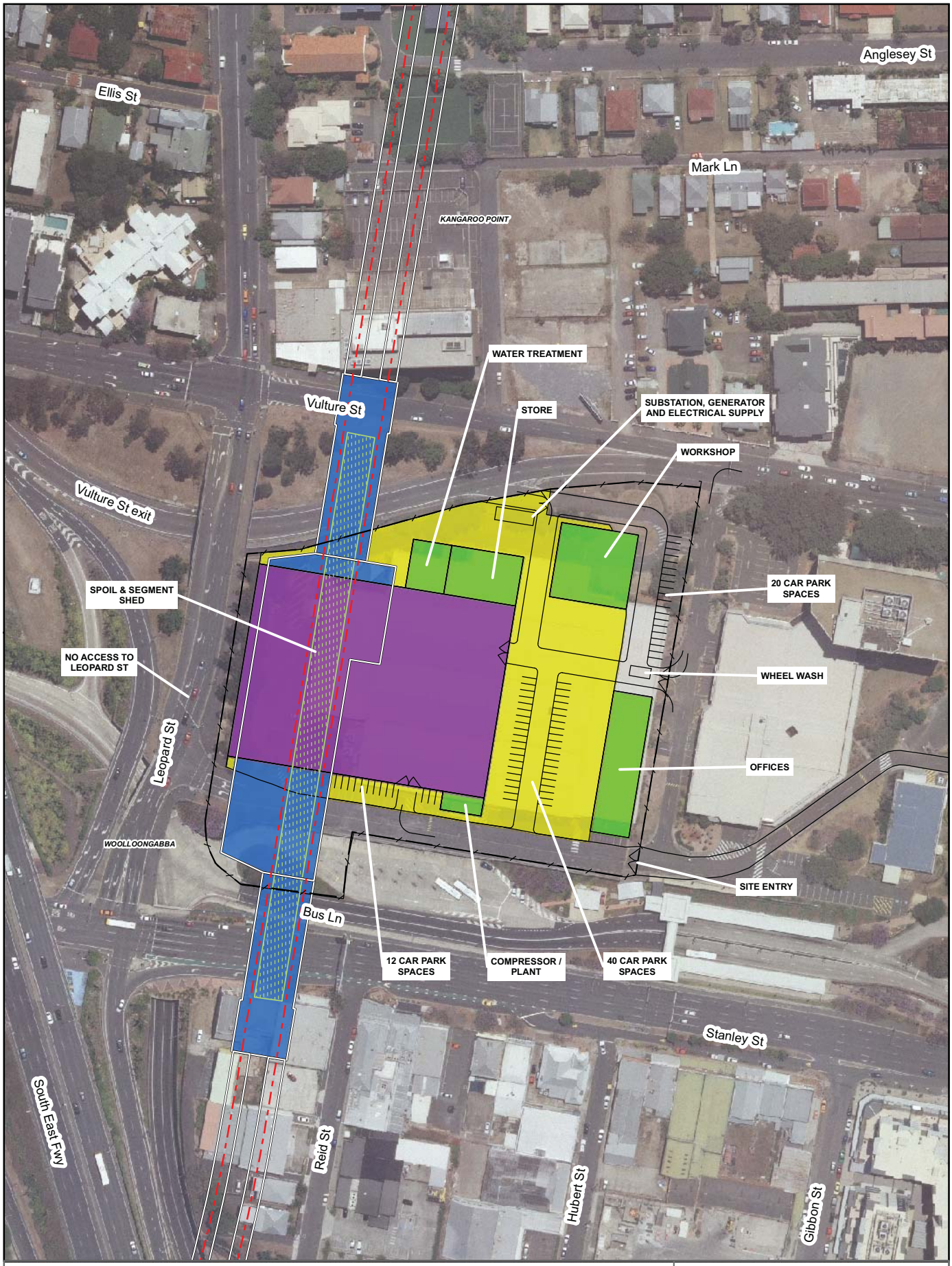
1:3,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0129_CRR_Project_Worksites_Victoria_Park_A4.mxd 06/07/2011 14:34



LEGEND

- Study Corridor
- Tunnel Structure
- Proposed Platform

Alignment

- Dual Gauge
- Narrow Gauge
- Train Storage
- Yard Tracks
- Worksite Extent

Worksite

- Acoustic Shed
- Existing Structure
- General Site Area
- Office; Ancillary Plant
- Station Structure
- Project Infrastructure

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-31

Construction Worksites Woolloongabba

0 20 40 60 80 Meters

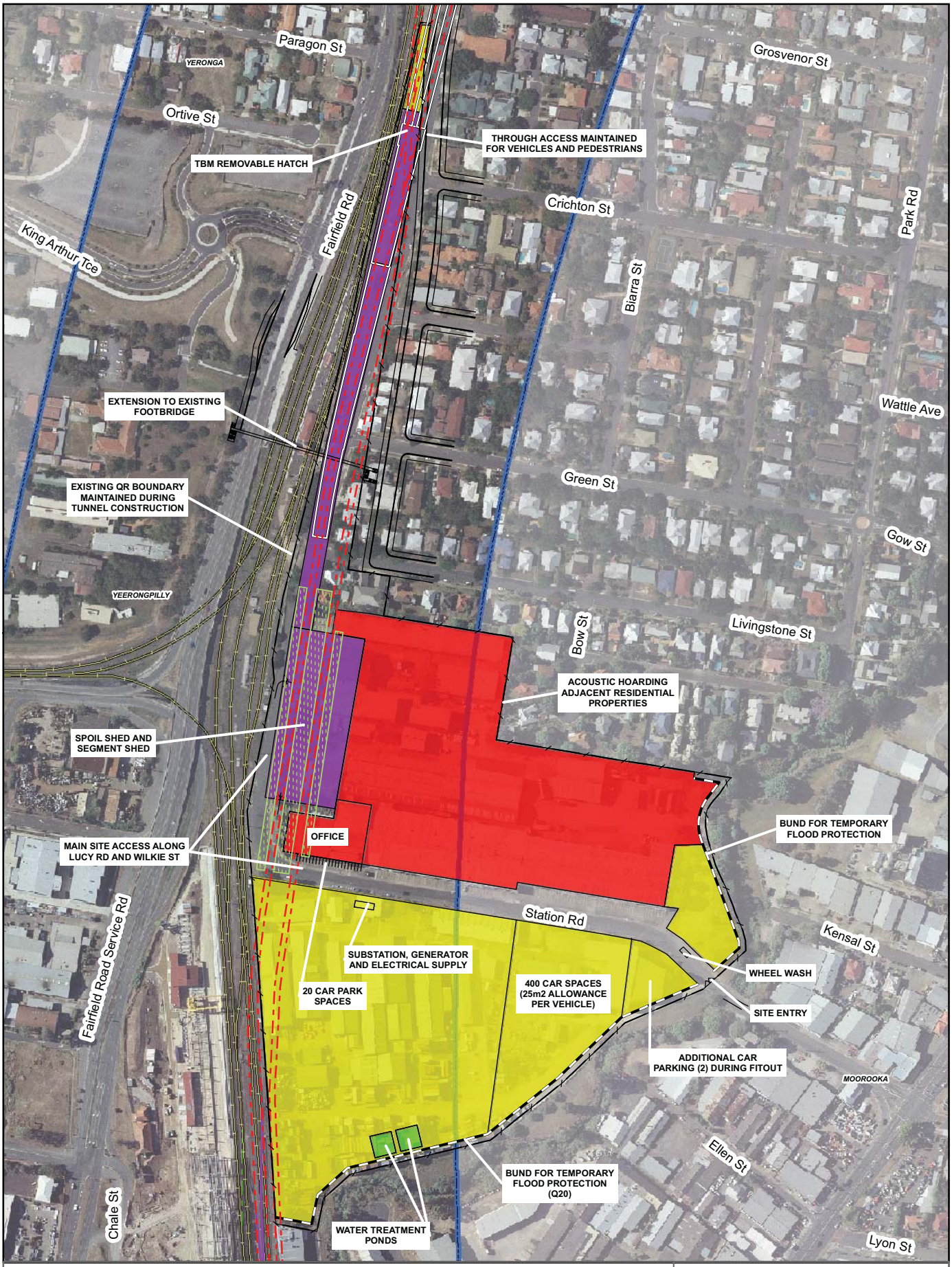
1:2,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0132_CRR_Project_Worksites_Gabba_A4.mxd 06/07/2011 14:37



LEGEND

- Study Corridor
- Tunnel Structure
- Existing Track
- Proposed Platform

Alignment

- Dual Gauge
- Narrow Gauge
- Train Storage
- Yard Tracks
- Worksite Extent

Worksite

- Acoustic Shed
- Existing Structure
- General Site Area
- Office; Ancillary Plant
- Station Structure
- Project Infrastructure

CROSS RIVER RAIL
ENVIRONMENTAL IMPACT STATEMENT

Figure 4-32

The Project Worksites
Yeerongpilly

0 25 50 75 100 125 150 Meters

1:4,000 at A4

N

CrossRiverRail

SKM aurecon CRR JOINT VENTURE

Map by: MJS K:\Cross River Rail\600 Environment\619 GIS\Aurecon\205555_CRR\G0136_CRR_Project_Worksites_Yeerongpilly_A4.mxd 06/07/2011 14:39

Table 4-7 provides an overview of parking provided at each worksite. Impacts of worker parking and proposed management measures are addressed in **Chapter 5 Transport**.

Table 4-7 Worker and visitor parking at construction worksites

Worksite	Number of car parking spaces
Salisbury (Dollis Street)	40 spaces
Clapham Rail Yard	50 spaces
Yeerongpilly	420 spaces
Ventilation and emergency access building	14 spaces
Boggo Road	30 spaces
Woolloongabba	72 spaces
Roma Street	40 spaces
Victoria Park	80 spaces
RNA Showgrounds	45 spaces
Mayne Rail Yard	50 spaces

Water treatment ponds would be provided at Yeerongpilly, Boggo Road and Woolloongabba. Containment bunds and wheel wash facilities would also be provided at worksites, where required. A bund would be constructed at the Yeerongpilly worksite, adjacent to Moolabin Creek to provide flood protection during a one in 20 year flood event. Diversion of watercourses would not be required for the Project. Potential impacts on flooding and surface water are discussed in **Chapter 14 Flood Management** and **Chapter 13 Surface Water** respectively.

The level of construction activity at each of the construction worksites would vary across the construction period. In addition, the duration of construction activities at each worksite would vary. **Table 4-8** provides an overview of the duration of activity expected to occur at each worksite.

Table 4-8 Level and duration of construction activity at each worksite

Worksite	2015				2016				2017				2018				2019				2020			
Major construction sites																								
Victoria Park																								
Woolloongabba																								
Yeerongpilly																								
Other construction sites																								
Mayne Rail Yard																								
Mayne feeder station site																								
O'Connell Terrace																								
RNA Showgrounds																								
Roma Street Station (all)																								
Albert Street Station (all)																								
Boggo Road Station																								
Ventilation & emergency access building																								
Clapham Rail Yard																								
Moorooka (all worksites)																								
Rocklea (all worksites)																								
Salisbury (Dollis Street)																								
Salisbury Station																								

4.4.4 Hours of work

Construction hours would vary depending on the location of the works and whether the works occur above ground, underground or within an acoustic lined shed. **Table 4-9** provides an overview of hours of work for each of the construction worksites.

Table 4-9 Hours of work

Worksite	Surface works – standard hours	Works conducted underground or within an acoustic enclosure, providing the environmental objectives are achieved	Spoil haulage and materials/equipment delivery, providing the environmental objectives are achieved
Northern Portal (Victoria Park), Boggo Road	• 6.30 am – 6.30 pm, Monday to Saturday • no work on Sunday or public holidays	• 24 hours, 7 days	• 6.30 am Monday – 6.30 pm Saturday • no work Sunday or public holidays
Yeerongpilly Clapham Rail Yard Woolloongabba Mayne Rail Yard	• 6.30 am – 6.30 pm, Monday to Saturday • no work on Sunday or public holidays	• 24 hours, 7 days	• 24 hours, 7 days
Roma Street, Albert Street	• 6.30 am – 6.30 pm, Monday to Saturday • 6.30 pm – 10.00 pm Monday to Friday • no work on Sunday or public holidays	• 24 hours, 7 days	• 6.30 am-10.00 pm, Monday to Friday, • 6.30 am-6.30 pm Saturday, • no haulage on Sundays or public holidays
Surface roadworks at O'Connell Terrace Rocklea (Ipswich Motorway)	• 6.30 am Monday – 6.30 pm Saturday • 6.30 pm – 10.00 pm Monday to Friday • no work Sunday or public holidays	n/a	• 6.30 am Monday – 6.30 pm Saturday • 6.30 pm – 10.00 pm Monday to Friday • no work Sunday or public holidays
Other worksites,: • Fairfield ventilation and emergency services building • Salisbury, Rocklea station, Moorooka station • RNA Showgrounds and Ekka Station	• 6.30 am-6.30 pm, Monday to Saturday • no work on Sunday or public holidays	• 24 hours, 7 days	• 6.30 am – 6.30 pm, Monday to Saturday • no haulage on Sundays or public holidays

Works would be undertaken outside of the hours outlined in **Table 4-9**, including at night-time or on public holidays, particularly in the following special circumstances:

- works undertaken within the road corridor of a designated arterial road that cannot be undertaken reasonably nor practicably during daylight hours due to potential disruptions to peak traffic flows.
- works undertaken within the rail corridor that can not be undertaken reasonably nor practicably during daylight hours due to potential for disruption to rail services.
- works involving the transport, assembly or decommissioning of oversized plant, equipment, components or structures.
- emergency works to avoid the loss of lives, damage to property or to prevent environmental harm.

4.4.5 Construction program

The design, construction and commissioning works for the Project are expected to take approximately 5.5 years. This allows for detailed design and set-up of underground operations in the first three months, a core period of approximately five years for major underground construction and station fit-out and a final period of approximately six months for completion of rail infrastructure works, testing and commissioning.

Some of the major timelines for the underground sections of the Project include:

- the tunnelling equipment procurement phase, being 12 months for the TBMs
- TBM launch drive and retrievals
- running tunnel construction
- construction of the Roma Street, Gabba and Albert Street Station caverns.

For the tunnelling sections, construction of the station caverns and ventilation and emergency access building would need to be constructed prior to the TBM tunnelling passing at these locations.

Track laying and fit-out of the tunnels and stations could not commence until the TBMs and associated infrastructure has been removed. Due to requiring rail possessions, the surface works would take a similar time period to tunnelling and fit-out.

Table 4-10 provides an overview of the construction program.

Table 4-10 Construction program

Activity	2015				2016				2017				2018				2019				2020			
Northern portal to Exhibition																								
Southern portal to Yeerongpilly																								
Station construction																								
Tunnel construction																								
Tunnel fit-out																								
Surface works (south to tunnel portal)																								
Station fit-out																								
Surface works (north to tunnel portal)																								
Testing and commissioning																								

4.4.6 Construction workforce

It is expected that up to about 2,200 workers would be required for the construction of the Project with a maximum shift of approximately 1,325 workers. Workers would be required for tunnelling works, station construction, surface works and project management and design.

A breakdown of workforce requirements for each worksite is provided in **Table 4-11**.

Table 4-11 Breakdown of Construction Workforce

Worksite	Shaft/surface construction	Tunnel construction	Total workforce	Peak workforce	Peak (single shift)	Peak (single shift – allow for remote staff)
Southern surface works	200		200	320	200	156
Southern portal (Yeerongpilly worksite)	125	100	225	200	125	98
Ventilation and emergency access shaft/building	50		50	80	50	39
Boggo Road Station	175		175	280	175	137
Gabba Station	175	100	275	280	175	137
Albert Street Station	175		175	280	175	137
Roma Street Station	175		175	280	175	137
Northern portal	50	50	100	160	50	39
Northern surface works	200		200	320	200	50
Total	1,325	250	1,575	2,200	1,325	930

4.4.7 Spoil haulage and placement

Tunnel and station excavation would require the removal of approximately 1.4 million m^3 of insitu material, or approximately 3.4 million tonnes of spoil. The majority of spoil would be generated from the TBM running tunnel sites at Woolloongabba and Yeerongpilly. However, the northern portal and station locations would also generate large volumes of spoil.

The major spoil removal facilities would be located inside acoustic sheds to minimise noise and dust impacts. Spoil removal is projected to occur over approximately 3.5 years, with major excavations occurring over a three year period.

It is proposed that spoil would be removed by road. Spoil haulage is proposed to occur 24 hours a day, seven days a week from those sites with direct access to arterial roads ie Woolloongabba, and Yeerongpilly. For other sites, spoil haulage would generally occur between 6.30am Monday and 6.30 pm Saturday, apart from the Brisbane CBD where haulage may occur up to 10.00pm on Monday to Friday. Consideration would be given to peak traffic periods in the spoil haulage planning. Spoil haulage hours for each worksite are provided in **Table 4-9**.

It is anticipated that an average of about 86 trucks per day would be required for spoil haulage from both the Yeerongpilly and Woolloongabba worksites. At the peak spoil generation, approximately 214 trucks a day would be required at each worksite for spoil removal. Removal of spoil from the construction of underground stations at Boggo Road, Albert Street and Roma Street would require approximately 89 trucks, 80 trucks and 103 trucks per day during the peak excavation periods for each of the stations respectively.

Some spoil from Woolloongabba and Boggo Road will potentially be used as fill for Clapham Rail Yard. However, the tunnel spoil is generally not considered viable for reuse without additional processing, due to the material properties of the spoil. Remaining spoil would be transported to Swanbank for placement.

Spoil from each of the worksites would be transported by road to the nominated placement site at Swanbank. For the worksites situated north of the Brisbane River, the key haulage route would include the ICB for some sites, linking with Milton Road, the Western Freeway/Centenary Motorway on the Ipswich Motorway, the Cunningham Highway and Redbank Plains Road to Swanbank. Access to Swanbank would be via the Swanbank Coal Road.

For the worksites situated south of the Brisbane River, the key haulage route would include Ipswich Road, the Ipswich Motorway and the Cunningham Highway and Redbank Plains Road to Swanbank. The longest trip would be from the Woolloongabba worksite and would involve a return journey of approximately 70 km.

For some of the southern worksites, such as the Boggo Road Station and Fairfield ventilation and emergency access building, spoil would be transported on Fairfield Road. Material to be placed at the future stabling area at Clapham Rail Yard would include the use of Fairfield Road south to Venner Road. Fairfield Road south of the Venner Road intersection is an existing designated freight route.

An assessment of potential impacts of spoil haulage is provided in **Chapter 5 Transport**.

Expected spoil volumes from each worksite, along with the anticipated truck movements, are identified in **Table 4-12**.

Table 4-12 Spoil quantities and haulage

Location	Spoil quantities and generation			Spoil haulage	
	Volume (m^3)	Average rate (m^3/wk)	Peak rate (m^3/week)	Average rate (trucks/ day**)	Peak rate (trucks/day)
Southern portal (Yeerongpilly worksite)	375,000	7,500	18,750	86	214
Ventilation and emergency access shaft/building	11,500	1,000	2,500	12	29
Boggo Road Station	155,000	3,125	7,813	36	89
Gabba Station	437,000	7,500	18,750	86	214
Albert Street Station north	60,000	800	2,000	9	23
Albert Street Station south	130,000	2,000	5,000	23	57
Roma Street Station south	125,000	2,000	5,000	23	57
Roma Street Station central	15,000	800	2,000	9	23
Roma Street Station north	21,000	800	2,000	9	23
Northern portal	96,000	2,625	6,563	30	75
Total insitu m^3	1.4 million m^3				
Total tonnes*	3.4 million t				

Notes:
** estimated density of insitu material is 2.4 tonnes/m^3*
*** this relates to one way trips*

4.4.8 Material haulage

In addition to spoil haulage, delivery of materials to construction worksites would also be required. Order of magnitude estimates have been undertaken to determine likely material haulage.

An average of 23 trucks per day would be required for material deliveries to the major tunnelling worksites at Yeerongpilly and Woolloongabba. Construction of other underground stations would require an average of 10-12 trucks per day for materials delivery.

The order of magnitude estimate of truck movements with respect to deliveries is provided in **Table 4-13.**

Table 4-13 Materials deliveries by road

Element	Average Rate (trucks/day)	Peak rate (trucks/day)
Southern portal (Yeerongpilly worksite)	23	57
Ventilation and emergency access shaft/building	2	4
Boggo Road Station	10	24
Gabba Station	23	57
Albert Street Station north	3	6
Albert Street Station south	12	30
Roma Street Station south	12	30
Roma Street Station central	3	6
Roma Street Station north	3	6
Northern portal	8	20

4.4.9 Property acquisition

Given the scale and scope of the Project, the number and types of private property acquisition and associated impacts are significantly less than would have occurred for a comparable surface rail or road project. Some key factors influencing the estimates of property acquisition and the compensation/acquisition requirements are:

- three underground stations being positioned within existing Queensland Government owned sites (Roma Street, Woolloongabba and Boggo Road)
- Ekka Station and tracks to the north being partially within existing rail corridor
- tunnels and station cavern in the Brisbane CBD (Albert Street) being situated predominantly within existing road corridor, and would be constructed to allow direct loading over them for up to an approximately 80 storey development
- new passenger car stabling being situated at Clapham Rail Yard within the existing rail corridor and adjoining Queensland Rail properties.

Cross River Rail is estimated to require a total of approximately 411 property acquisitions, comprising 108 surface and 303 volumetric property requirements. Of these properties, approximately 377 properties are privately owned sites and the balance (34 sites) are held by government (state and council).

The proposed surface property acquisitions comprise a mix of residential, mixed (commercial, industrial and other) use sites, and open space. These properties are located at the proposed portals, the stations, and surface works between Yeerongpilly and Salisbury.

The volumetric acquisition requirements have been applied around the Project's tunnel and station alignment to ensure that the underground land required for construction and the long term integrity of the tunnels and stations can be guaranteed and protected from future development. To ensure this, a perimeter of seven metre around the tunnels and 10 m around the station caverns would be volumetrically acquired for the Project (refer to **Figure 4-33** and **Figure 4-34**).

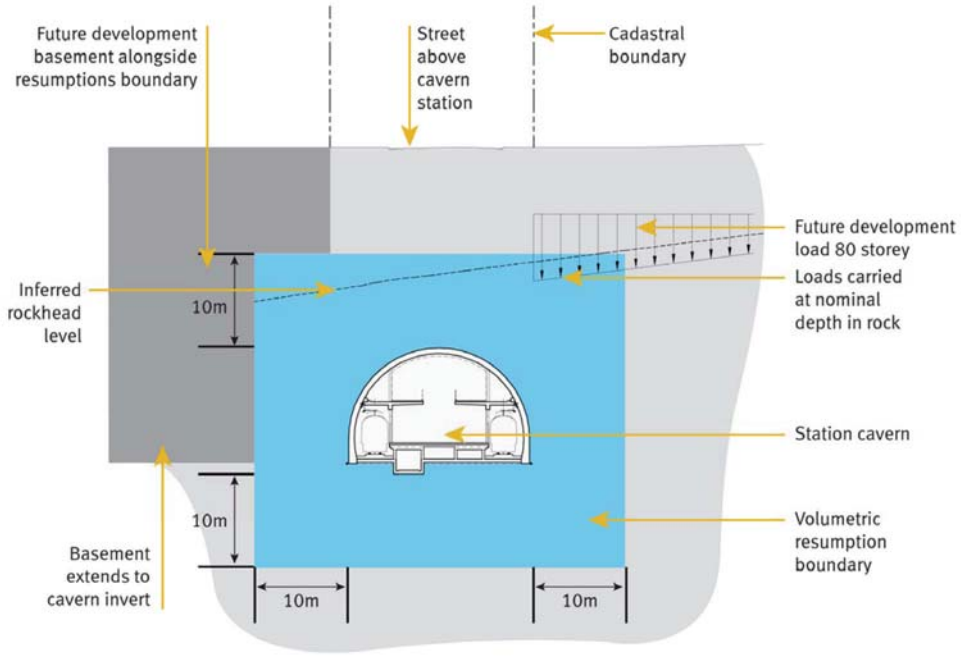


Figure 4-33 Volumetric acquisition – station cavern

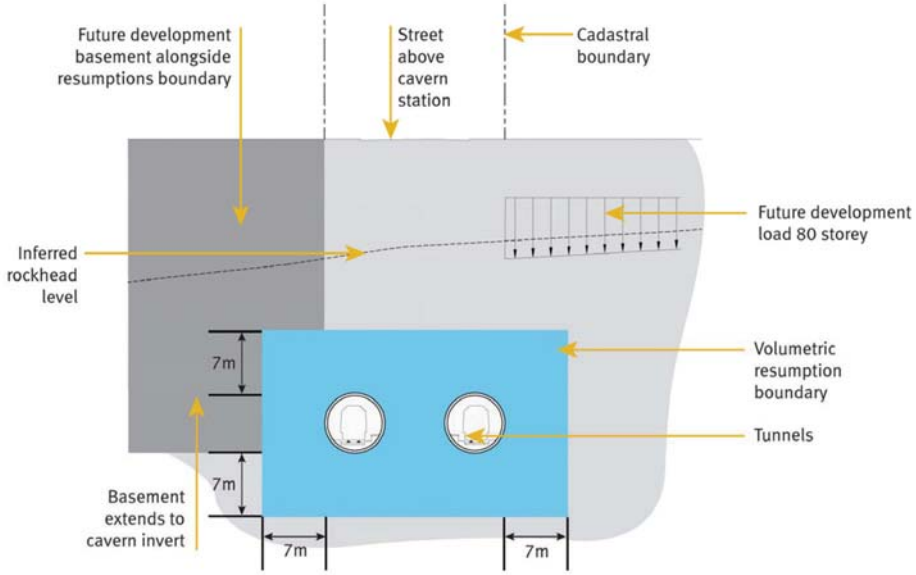


Figure 4-34 Volumetric acquisition – tunnels

In the event that existing structures are located within the proposed volumetric acquisition area, a reduced volumetric acquisition may be able to be applied and the construction methodology maybe altered to ensure that the tunnel or station integrity is retained within this lesser acquisition.

Any development applications approved for new developments prior to final approval for the Project would also be considered and a similar approach of a reduced volumetric area may be applied. Each case would be considered in regards to the relevance to the Project, proposed development and their timings. Developments not approved prior to the approval of the Project would have the full proposed volumetric acquisition applied.

Once the Project has been constructed it may be possible in some instances that the volumetric property surrounding the tunnel and station caverns could be encroached upon by a future development. This would require further extensive engineering investigations relevant to the particular development application to determine the practicality of the proposed encroachment.

To ensure that the Project's structures are not compromised by new development, the acquired properties (volumetric and surface) would be identified as 'railway corridor land' under the *Transport Infrastructure Act 1994* (Queensland). Certain development applications for land nearby would require a concurrence referral response from Transport and Main Roads. This referral would ensure that the Project's structures are considered in the design of any new developments. Transport and Main Roads is currently a concurrence agency for the Cross River Rail future public transport corridor.

Additional information relating to property acquisition is provided in **Chapter 9 Land Use and Tenure**.

4.4.10 Commissioning

Extensive project commissioning plans would be developed for all underground built infrastructure and systems, associated surface works and emergency response/retrieval of trains. They would be developed in subsequent phases of the Project. A draft outline environmental management plan (EMP) has been developed for the Project (**Chapter 24 Draft Outline EMP**).

Key elements of the commissioning of underground rail stations include full testing and training in relation to station fire and life safety systems, day to day operations and general passenger and train control. Due to the significance of the cut-in of the new Cross River Rail, it is anticipated that the final rail systems and rail infrastructure commissioning would need to take place over a major shut-down period such as Christmas or Easter. A period of three to six months could be expected for the appropriate training of station staff after completion of essential works.

Project approvals relevant to the Project commissioning are outlined in **Section 4.5**.

Driver training

Driver training is an essential part of commissioning activities. The Project would require extra training due to the substantially different nature of driver environment compared with the existing Queensland Rail suburban network, which is predominantly a surface network.

Signalling

Testing of the surface signalling system and the new ATP system for the Cross River Rail trains would form one of the most significant commissioning processes due to project risk and timeframe, in particular the effective interfacing of the two systems. The commissioning of new signalling systems is one of the program risk areas. A duration of approximately six to nine months could be expected to trial, test and adjust new systems prior to operations.

Stations

Particular commissioning activities for underground stations include:

- sign-off of the internal tunnel installation arrangements prior to operation and sign-off of the adequacy of all key station facilities including the fit-out of the ticket office, the station master's office and the access requirements to all equipment rooms
- signalling and train control, driver and underground station staff training and station facility testing such as gate-lines and PSD
- passenger information and security systems
- fire and life safety protocols for the new underground stations and tunnel system, including activities such as mock emergency evacuations and fire and life safety system operation
- station training activities such as capacity management strategies for station staff in the case of overload, ie event loading
- reliability testing of PSD on the underground stations as well as station staff training in relation to any disruption to the PSD system
- specific anti-terrorist training involving staff training for surveillance activities in and around the stations
- progressive commissioning of electrical and mechanical services such as lifts and escalators
- passenger interface equipment such as electronic passenger information devices, electronic ticket gates, Public Announcement (PA) systems and Closed Circuit Television (CCTV) cameras.

Ventilation

Commissioning activities required for the ventilation, include testing of the ventilation system operation and smoke testing, prior to commissioning.

Track and tunnel

Commissioning activities for the rail tunnels include:

- fire and life system training for the tunnel system
- driver training in underground operation, new route and particular station interfaces
- mock evacuation of a train in a mid-tunnel section
- operational testing and commissioning of floodgate structures
- trialling of the flood protection system at Albert Street Station.

Rail systems

The commissioning of the majority of the rail systems cannot be completed until the end to end project has been fitted out progressively with trackwork, power supply, overhead electrification, signalling and communications. Each rail system would have its own individual commissioning plan.

4.4.11 Construction decommissioning and rehabilitation

Rehabilitation strategy

Following completion of construction activities, land occupied by work sites not required for the operation of the Project would be available for redevelopment opportunities. Land not utilised by the Project would be able to be redeveloped in accordance with the relevant planning instrument (ie City Plan or UDA development scheme. The Project would not undertake redevelopment of these sites but would undertake works to ensure they were suitable for handover.

Future use of construction sites include:

- RNA Showgrounds and Woolloongabba worksites would be used in accordance with the UDA development schemes and RNA Masterplan
- Victoria Park would be reinstated in line with the "Community Use" area classification of this land
- Albert Street would have a large area of surplus land. Redevelopment could occur in line with the Brisbane City Council City Plan
- Boggo Road work site would be redeveloped in accordance with planning for the Boggo Road Urban Village precinct
- Yeerongpilly worksite is zoned for industrial use under the Brisbane City Council City Plan. The State Government and/or Brisbane City Council may undertake planning investigations to determine an appropriate future use other than industrial.

Worksites within the rail corridor would be maintained for rail purposes. Additional information regarding potential future development of worksites is included within **Chapter 9 Land Use and Tenure**.

4.5 Project approvals

The project has been considered against Commonwealth and State legislation, and local laws to determine the approvals required. This section identifies the legislation and policies most relevant to the planning, approval, construction and operation of the Project.

A detailed list of the potential approvals required for the construction and operation of Cross River Rail are provided in **Appendix D**.

4.5.1 *State Development and Public Works Organisation Act 1971*

The Coordinator General of Queensland (CG) declared Cross River Rail to be a Significant Project for which an EIS is required under Section 26(1)(a) of the *State Development and Public Works Organisation Act 1971* (SDPWO Act). Significant Project declaration was made on 26 March, 2010.

Under Section 26(1)(a) of the SDPWO Act an EIS is required to be prepared for consideration by the Coordinator General to ensure that the environmental and social values of the study corridor are recognised and any project related impacts are identified and managed appropriately.

This EIS provides an assessment of the Project as described in this chapter. During the procurement phase, changes to the Project may be proposed that require further assessment by the CG. In accordance with Section 35B of the SDPWO Act, the proponent may apply to the CG to evaluate the environmental effects of any proposed changes to the Project.

4.5.2 Commonwealth legislation

Relevant Commonwealth legislation includes:

- *Environment Protection and Biodiversity Conservation Act 1999*
- *Native Title Act 1993*
- *Energy Efficiency Opportunities Act 2006*
- *National Greenhouse and Energy Reporting Act 2007*
- *Disability Discrimination Act 1992*.

A referral was made to the Commonwealth Minister for the Sustainability, Environment, Water, Population and Communities under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) to determine whether the Project and its associated works are a 'controlled action' under the Act. The Delegate of the Commonwealth Minister for the Sustainability, Environment, Water, Population and Communities determined that the Project (EBPC 2010/5427) does not constitute a controlled action pursuant to Section 75 of the EPBC Act on 28 July, 2010 subject to the Project being undertaken in a particular manner to avoid significant impacts on Commonwealth Land and Wetlands of International Importance. It was identified that this would be achieved through undertaking the following measures:

- the tunnel alignment being located not closer than 200 m from Commonwealth heritage and land (Commonwealth Law Courts)
- spoil disposal being undertaken at Swanbank.

Opportunities have been identified for the potential reuse of some spoil as fill material for the raising of Clapham Rail Yards rather than taking it to Swanbank (refer to **Section 4.4.7**). If the reuse of spoil for use at Clapham Rail Yards is to be investigated further in detailed design, consultation with the Commonwealth Minister for the Sustainability, Environment, Water, Population and Communities would be required.

There are two registered native title claims under the *Native Title Act 1993*(Cth) (NT Act). These claims have been made by the Jagera and Turrbal People. To the extent that Native Title exists in relation to any land affected by construction or long term operations of the Project, the mechanisms under Section 24KA of the NT Act would be applied. Under Section 24KA of the NT Act, facilities for service to the community, such as Cross River Rail, can be established without the need for the extinguishment or suppression of Native Title. While this process enables the non-extinguishment of the native title rights and interests affected by the proposed future activity, they have no effect on the construction, operation, use, maintenance or repair of the facility.

The *Energy Efficiency Opportunities Act 2006* (Cth) (EEO Act) establishes the national framework that encourages large corporations to improve their energy efficiency. It does this by requiring corporations that use more than 0.5 petajoules of energy per year to identify, evaluate and report publicly on cost effective energy saving opportunities. Under the requirements of the EEO Act, it is mandatory for Queensland Rail to participate in Energy Efficiency Opportunities. Once Cross River Rail is operational, it is likely that Queensland Rail would be required to incorporate the additional activities of the Project into its reporting.

The *National Greenhouse and Energy Reporting Act 2007* (Cth) (NGER Act) establishes a national framework for Australian corporations to report greenhouse gas (GHG) emissions, reductions, removals and offsets and energy consumption and production. The purpose of the NGER Act is to provide for a single, national system for the reporting of GHG emissions, abatement and energy consumption and production activities by corporations.

The NGER Act applies to corporation activities from 1 July 2008. Any activities being undertaken within or after 2010-2011 are required to report if they exceed annual production of 50 kilotonnes in CO^2 equivalent of GHG emitted or if they consume or produce 200 terajoules of energy. Under the requirements of the NGER Act, Queensland Rail is currently required to report on the activities it undertakes. Once Cross River Rail is operational, it is likely that Queensland Rail would be required to incorporate the additional activities of the Project into its annual reporting.

The *Disability Discrimination Act 1992* (DD Act) requires that all publicly accessible buildings be designed and constructed to comply with the Disability (Access to Premises – Buildings) Standards and the Disability Standards for Accessible Public Transport 2002 (DSAPT). The publically accessible components of the Project, such as the paid and unpaid sections of the rail stations, have been designed to comply with these standards.

4.5.3 State legislation

A range of Queensland legislation is relevant to the statutory approval of the Project. The approvals pathway for the Project primarily involves a combination of the SDPWO Act and the *Sustainable Planning Act 2009* (SP Act). The SDPWO Act defines the process to be followed for a significant project for which development approvals are required under the SP Act. The SP Act establishes an "integrated development assessment system" (IDAS) that recognises the roles and responsibilities of development control under local government planning schemes and also the statutory approval.

The declaration by the CG of the Project as a significant project under the SDPWO Act sets the statutory framework for the EIS to be prepared for the Project. In particular the Coordinator-General's report may:

- state conditions that must apply to a development approval under the SP Act
- recommend requirements for inclusion in a community infrastructure designation under the SP Act
- make recommendations for other approvals
- impose conditions.

Sustainable Planning Act 2009

The SP Act regulates development and provides the definition of what is considered as development. Under the SP Act development is considered as any of the following:

- carrying out building work
- carrying out plumbing or drainage work
- carrying out operational work
- reconfiguring a lot
- making a material change of use of premises.

As SP Act regulates development, the legislative requirements triggered under the SP Act are typically required prior to the commencement of the relevant construction activity. Schedule 3 of the *Sustainable Planning Regulation 2009* (SP Reg) outlines development that is considered as assessable under the SP Act. Legislation that is addressed under this Schedule that is relevant to the Project includes:

- *Building Act 1976*
- *Coastal Protection and Management Act 1995*
- *Dangerous Goods Safety Management Act 2001*
- *Environmental Protection Act 1994*
- *Fisheries Act 1994*
- *Land Act 1994*
- *Local Government Act 2009*
- *Plumbing and Drainage Act 2002*
- *Queensland Heritage Act 1992*
- *Transport Infrastructure Act 1994*
- *Vegetation Management Act 1999*
- *Water Act 2000*.

Development permits triggered through the mechanisms of the SP Act would be required to proceed through the IDAS. The IDAS establishes the framework for development application assessment. The IDAS framework consists of a number of stages that, depending on the type of development, may be required for the assessment process.

The stages include:

- application stage
- information and referral stage
- notification stage
- decision stage
- compliance stage.

In the event that the EIS is approved and further development applications to be assessed through IDAS are identified, the EIS and the CG's EIS assessment report would form part of the supporting documentation for the development applications. As a result, the information and notification stages would not be required.

The following section outlines the development applications that would be triggered for the Project and would be subject to the requirements of the IDAS process.

Schedule 4 of the SP Reg outlines development that cannot be declared development of a particular type against a local government planning instrument and is exempt from assessment against local government planning instruments.

The types of development that may be relevant to the Project that are exempt from assessment against the local planning instruments are outlined in **Table 4-14**. Development identified in activities listed under Schedule 4 are only exempt from assessment against local government planning instruments and may still be subject to Commonwealth or State requirements.

Table 4-14 Relevant development identified under Schedule 4 of the SP Regulation

Reference within Schedule 4	Relevant type of development and activity	Relevant component of project
Table 3, Item 2	Reconfiguring a lot under the *Land Title Act 1994*, if the plan of subdivision necessary for the reconfiguration – (e) is in relation to the acquisition, including by agreement, under the *Acquisition of Land Act 1967* (AL Act) or otherwise, of land by a constructing authority, as defined under that Act, for a purpose set out in parts 1 to 13 (other than part 10, second dot point), of the schedule to that Act. (f) is for land held by the State, or a statutory body representing the State, and the land is being subdivided for a purpose set out in the AL Act, schedule, parts 1 to 13 (other than part 10, second dot point), whether or not the land relates to an acquisition	All reconfiguration works for the Project within land held by the State or a statutory body representing the State.
Table 4, Item 1	Operational work or plumbing or drainage work (including maintenance and repair work) if the work is carried out by or on behalf of a public sector entity authorised under a State law to carry out the work.	All operational work for the Project that is authorised under State law.
Table 4, Item 4	Operational work performed by a railway manager, within the meaning of the *Transport Infrastructure Act 1994* (TI Act), under section 260 of that Act.	All operational work undertaken by a railway manager for existing railways as described under section 260 of the TI Act.
Table 4, Item 5	Operational work carried out under a rail feasibility investigator's authority granted under the TI Act.	All operational work undertaken under the authority of a rail feasibility investigator.
Table 4, Item 11	Operational work that is the removal, destruction or damage of a marine plant.	Any operational work for the Project that would impact on marine plants.
Table 5, Item 8	All aspects of development for the maintenance, repair, upgrading, augmentation or duplication of – (a) rail transport infrastructure	All aspects of the Project that involve the maintenance, repair, upgrading, augmentation or duplication of rail transport infrastructure.

Assessable Development under Schedule 3 of the SP Regulation

Building works

The Project would require the construction of a number of buildings including:

- station buildings
- worksite sheds, fences and amenity buildings
- ventilation outlets
- substation facilities.

Building work being undertaken for the Project would be subject to the approval requirements of the *Building Act 1976.*

Operational works

Development approvals for the operational works are required prior to the commencement of any works where such development is assessable development under the SP Act.

Assessable development for operational works includes any kind of work that allows the taking of, or the interfering with, water from a watercourse would likely require a development permit under the *Water Act 2000* (Water Act). Under the Water Act, a watercourse is defined as a non-tidal body of water with a downstream limit at the point to which the high spring tide ordinarily flows and reflows or to an artificial barrier. The assessment requirements of the Water Act only apply to works within non-tidal bodies of water. Works assessable under this Act include the excavation and placement of fill within a watercourse, diverting the flow of a watercourse and the removal of vegetation from a watercourse.

Assessable development includes any kind of work that is undertaken within a tidal waterway and would likely require a prescribed tidal works development permit under the *Coastal Protection and Management Act 2005*.

Assessable development includes any kind of work that is undertaken within a tidal or non-tidal watercourse that may impact on the movements or the habitats of fish species and would likely require a development permit under the *Fisheries Act 1994*. Works assessable under this Act include the establishment of a waterway barrier in tidal and non-tidal water bodies that will impede the upstream and downstream movement of fish species and the damage, destruction or removal of marine plants.

Reconfiguration of a Lot

Reconfiguration to create a lot for the rail tunnel is exempt development under the SP Act where either the land is not under the *Land Act 1994* or where acquired pursuant to the *Acquisition of Land Act 1967*.

Material Change of Use of Premises for an Environmentally Relevant Activity

The *Environmental Protection Act 1994* (EP Act) provides for the protection and management of Queensland's environment while allowing for development that improves the total quality of life, both now and in the future. This is achieved through the adoption of an integrated management program that is consistent with the principles of ecologically sustainable development.

In addition to the general environmental principles and responsibilities set out in the EP Act, it also provides for the development approval requirements for specific activities of environmental relevance.

Environmentally Relevant Activities (ERA) relevant to the Project include:

- 8: Chemical Storage

  ERA 8 is the storage of chemicals and dangerous goods of varying amounts and classes. If chemicals or dangerous goods are proposed to be stored on site, an approval for a material change of use of premises may be required. Due to the highly urbanised nature of the surrounding environment and the proximity of sensitive receptors, the storage of chemicals or dangerous goods in large quantities is not preferred.

- 21: Motor Vehicle Workshop Operation

  ERA 21 for the purpose of the Project consists of operating a motorway vehicle workshop for the ongoing maintenance, spray painting or detailing and washing of motor vehicles. The relevant activity includes carrying out a commercial or non-commercial enterprise by, or for, a State or local government entity.

- 38: Surface Coating

  ERA 38 consists of using 1t or more in a year of surface coating materials for anodising, electroplating, enamelling, galvanising or coating, painting or powder coating. In the event that Project surfaces, such as station buildings or tunnel walls, require painting or the application of protective coatings, ERA 38 may be required.

- 43: Concrete Batching

  ERA 43 consists of producing more than 200t or more of concrete or concrete products in a year, by mixing cement with sand, rock, aggregate or other similar materials.

- 63: Sewage Treatment

  ERA 63 includes the onsite treatment for release of sewage for a facility with a peak design capacity greater than 21 Equivalent Persons (EP). In the event that a sewage treatment facility with a peak design capacity of 21 EP is to operate on the Project site, an approval for a material change of use of premises would be required.

- 64: Water Treatment

  ERA 64 is the onsite daily treatment of water that would be released into the environment. This includes 0.5 megalites or more through desalination, treatment of 10 mL of raw water or carrying out advanced treatment of 5 megalitres or more. In the event that water treatment is required, an approval for a material change of use of premises for an environmentally relevant activity would be required.

Material Change of Use of Premises on the EMR or CLR

A development approval for a material change of use for land on the Environmental Management Register (EMR) or Contaminated Land Register (CLR) is required under the SP Act, where the land does not have an approved site management plan. Land that is listed on the EMR or CLR that would be impacted by the Project is identified in **Chapter 8 Land Contamination**.

A strategic-level investigation of the study corridor has identified a number of sites which contain potentially contaminated soils as a consequence of previous activities, eg service stations, car repair stations, and which could be intercepted by construction of the Project. A number of these sites are covered by site management plans prepared in accordance with the EP Act.

The construction of the Project would need to comply with the conditions applying to the existing site management plans for each of the contaminated sites under or through which it passes.

Various Aspects of Development

All aspects of development within a place listed on the Queensland Heritage Register are typically considered assessable against the *Queensland Heritage Act 1992*. However, as the Project would be undertaken by the State, it would be exempt from requiring approval for works carried out within any of the Queensland Heritage Listed Places. For any works by the State within a Queensland Heritage Place, the Heritage Council must be advised and recommendations from the Director General of Department of Environment and Resource Management (DERM).

A list of potential approvals required for the construction and operation of Cross River Rail under the SP Act have been outlined in **Appendix D**.

4.5.4 Other approvals, licences, certifications, notifications and authorities

In addition to the legislation that is recognised under the SP Act, other legislation that may be relevant to the Project includes:

- *Aboriginal Cultural Heritage Act 2003*
- *Acquisition of Land Act 1967*
- *Electricity Act 1994*
- *Explosives Act 1999*
- *Fire and Rescue Service Act 1990*
- *Food Act 2006*
- *Forestry Act 1995*
- *Land Protection (Pest and Stock Route Management) Act 2002*
- *Plant Protection Act 2002*
- *Survey and Mapping Infrastructure Act 2003*
- *Transport Infrastructure Act 1994*
- *Transport Operations (Road Use Management) Act 1995*
- *Transport Operations (Marine Safety) Act 1994*
- *Transport Planning and Coordination Act 1994*
- Rail Safety Act
- *Transport Security (Counter Terrorism) Act 2008*
- *Urban Land Development Authority Act 2007*
- *Workplace Health and Safety Act 1995.*

An overview of the key approvals, licences, certifications, notification and authorities are outlined as follows. Major potential approval requirements for the construction and operation of Cross River Rail are detailed in **Appendix D.**

Registration Certificate

All operators of environmentally relevant activities (other than mining or petroleum activities) – known as Chapter 4 activities-must be 'registered operators'. This means operators of all Chapter 4 activities listed in schedule 2 of the *Environmental Protection Regulation 2008*.

In addition all operators must have either:

- a development approval for the activity; or
- operate under a code of environmental compliance for Chapter 4 activities.

Operators apply to the administering authority (DERM, DEEDI or local government) to be registered. An application for registration must be submitted with the prescribed fee. Registration authorises the registered operator to carry out the activities at the places stated in the certificate.

Registration certificates may be issued for multiple activities and sites where it is considered that the activities are part of a 'single integrated operation'. An annual fee for registration applies for all Chapter 4 activities.

Cultural Heritage

Under the *Aboriginal Cultural Heritage Act 2003,* a cultural heritage management plan is needed where an EIS is required. A cultural heritage survey has been undertaken to identify the locality of places of cultural heritage significance. Any works affecting a place of indigenous cultural heritage significance may require a permit to remove or relocate artefacts or other evidence of indigenous cultural heritage.

Land Resumption

The *Acquisition of Land Act 1967* (AL Act) provides the mechanisms to acquire land. Under the AL Act, the Chief Executive of Transport and Main Roads may, for the State, acquire property (including by resumption) for transport purposes.

In order to undertake the resumption, a Notice of Intention to Resume must be provided to the relevant person with interest in the land and the compensation process must be undertaken.

Land Tenure Arrangements

The TI Act provides the legislative framework for the tenure arrangements for a railway corridor. Land to be used for railway purposes is owned by the State and sub-leased under s.240 of the TI Act to a railway manager. If the State resumes land for use by a railway manager, then the State is required to lease the land to the railway manager. Further information on tenure is provided in **Chapter 9 Land Use and Tenure**.

Works that Interfere with a Railway

The approval of Queensland Rail as the railway manager is required under the TI Act if works are to be undertaken that would interfere with a railway.

Works on a State Controlled Road

The approval of the Chief Executive of the Transport and Main Roads is required under the TI Act if works are to be undertaken on a State controlled road or would otherwise have an impact on a State controlled road.

Acid Sulfate Soils

In the event that construction activities would disturb potential acid sulfate soils (PASS) or acid sulfate soils (ASS), the preparation of an ASS Environmental Management Plan would be required. The plan would need to be prepared in accordance with the relevant guidelines and approved by the DERM.

Contaminated Land

A disposal permit would be required under the EP Act for removal of contaminated soil during construction for land on the EMR or CLR. Land that is listed on the EMR or CLR that would be impacted by the Project is identified in **Chapter 8 Land Contamination**.

Management of Pests

The approval of a Biosecurity Queensland inspector (Department of Employment, Economic Development and Innovation (DEEDI)) is required under the *Plant Protection Act 2002* if works are being undertaken that involve the disturbance of soil or other high risk items that may contain fire ants. In addition to a pre-disturbance assessment, a Fire Ant Risk Management Plan must be prepared for works within restricted areas with high risk items.

Plumbing and Drainage

A compliance permit would be required from Brisbane City Council for the installation of any permanent facilities that would be connected to local plumbing and drainage services.

4.5.5 Local laws

Administered under the *Local Government Act 2009*, local laws provide local governments with the ability to establish permit or licence regimes for activities they want to regulate, to create offences for unacceptable behaviour and to allow for the issue of compliance or abatement notices.

Approvals from the Brisbane City Council under relevant local laws or provisions of the *Local Government Act 2009* may be required prior to the commencement of such activities. Permanent road closures would be required and applied for under the *Land Act 1994*.

As a component of the Project would involve the removal of spoil to land within the Ipswich local government area, the Ipswich City Council local laws of relevance to the Project have also been reviewed.