The proposed enhancements to the public domain, as presented in the station plan for Rozelle Station, are outlined in Table 6.6.

Table 6.6 Public domain enhancements – Rozelle Station

Issue	Principles	CBD Metro elements	Potential provision by others
Public domain	• Use landscape to emphasis the ridgeline (Darling Street) as main pedestrian connector. • Provide northern station forecourts that relate to paths of movement, integrate with the adjacent churches and school, and are buffered from the noise of Victoria Road. • Improve the quality, safety and attractiveness of the public domain.	• Small station plazas to north of northern entries that 'borrow' from the public domain of the adjacent churches, allow access between bus stops on Victoria Road and Darling Street, and contain trees that enhance the landscape setting of adjacent buildings. • Widened footpaths to northern side by setting back entry building by 1–2 metres. • Paving/crossing treatment on Darling Street on northern side of Victoria Road to emphasise pedestrian priority. • Repaving (and regrading if required) of footpaths adjacent to station entries.	• Street trees, paving, and footpath improvements along Victoria Road and Darling Street. • Future widening of footpaths. • Future pedestrianisation of northern end of Hancock Street to enhance the public domain.

6.5 Rozelle stabling and maintenance depot

CBD Metro trains would be stabled and maintained at a new purpose-built depot at the former Rozelle Marshalling Yard, adjacent to the City West Link. The proposed site is within the area bounded by Victoria Road, Lilyfield Road, Catherine Street and the City West Link. Given the route of the CBD Metro, this site has been determined to be the only practical location for the stabling and maintenance depot (refer Chapter 5 for further detail on the selection of the depot site).

The Rozelle stabling and maintenance depot would cover about 8.6 hectares. Buildings and facilities (not including tracks or access roads) would occupy at least 1.4 hectares of this site. Access would be from the City West Link Road and Gordon Street. An indicative layout of the stabling and maintenance depot is given in Figure 6.23 and Figure 6.24.

The public domain strategy for the Rozelle stabling and maintenance depot aims to link the open spaces of Annandale, Rozelle and Lilyfield. The development of the depot site would be a catalyst for integrating the green networks of this part of Sydney with new and enhanced pedestrian and cycle corridors. Water-sensitive urban design principles would be integrated into the site and landscaping provided to improve water quality and create a more attractive place.

It is proposed to use this site for the stabling and maintenance of additional metro trains when and if the metro network is expanded. Figure 6.25 indicates the extent of the CBD Metro stabling and maintenance depot and how the depot could be extended to accommodate future growth in the metro network. This Environmental Assessment only addresses the requirements of the CBD Metro. Future extensions to the metro network, and the additional stabling and maintenance requirements for them, would need to be assessed as part of those proposed extensions.

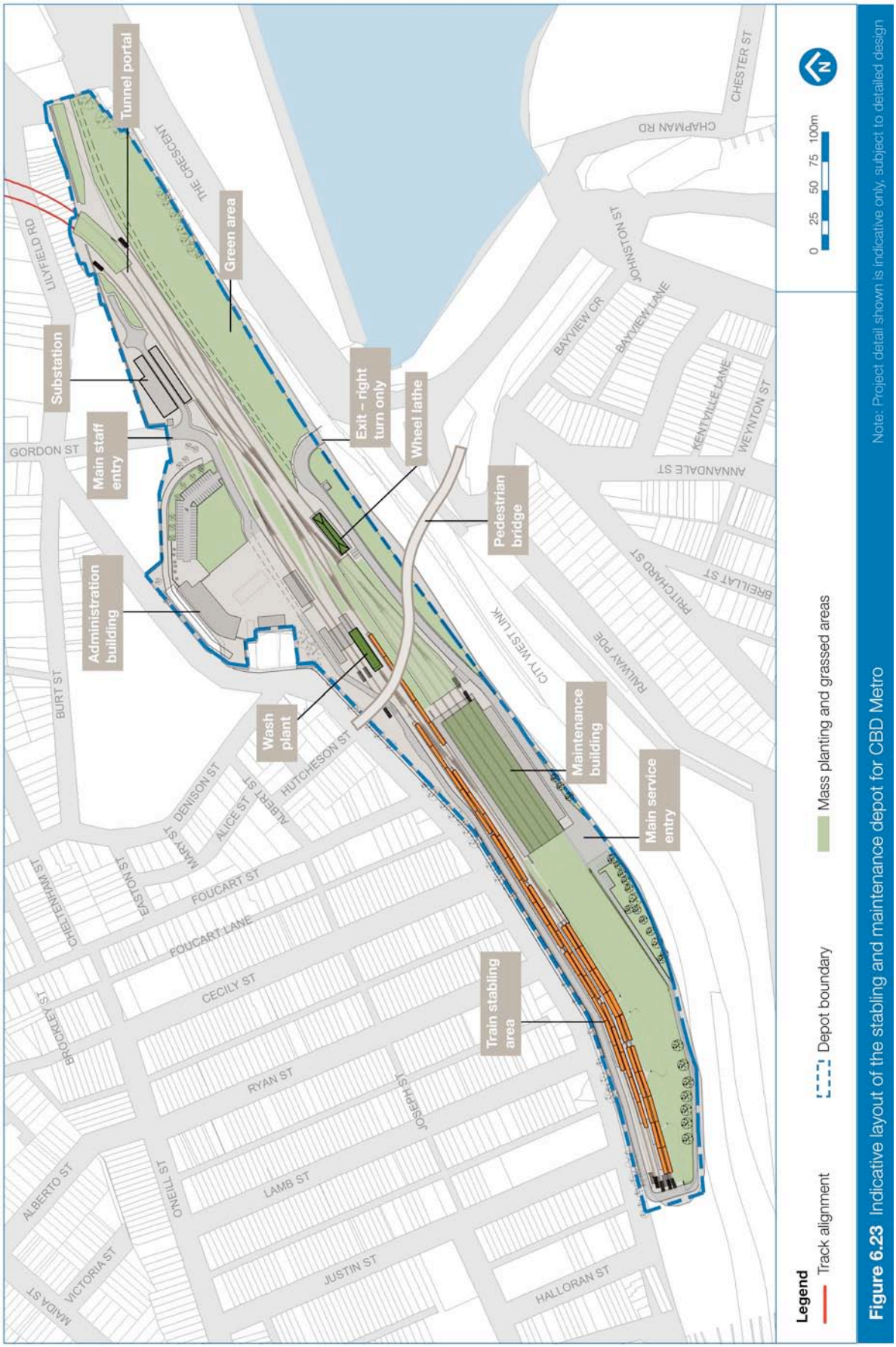


Figure 6.23 Indicative layout of the stabling and maintenance depot for CBD Metro

Figure 6.24 Indicative landscape master plan of the stabling and maintenance depot for CBD Metro

Note: Project detail shown is indicative only, subject to detailed design

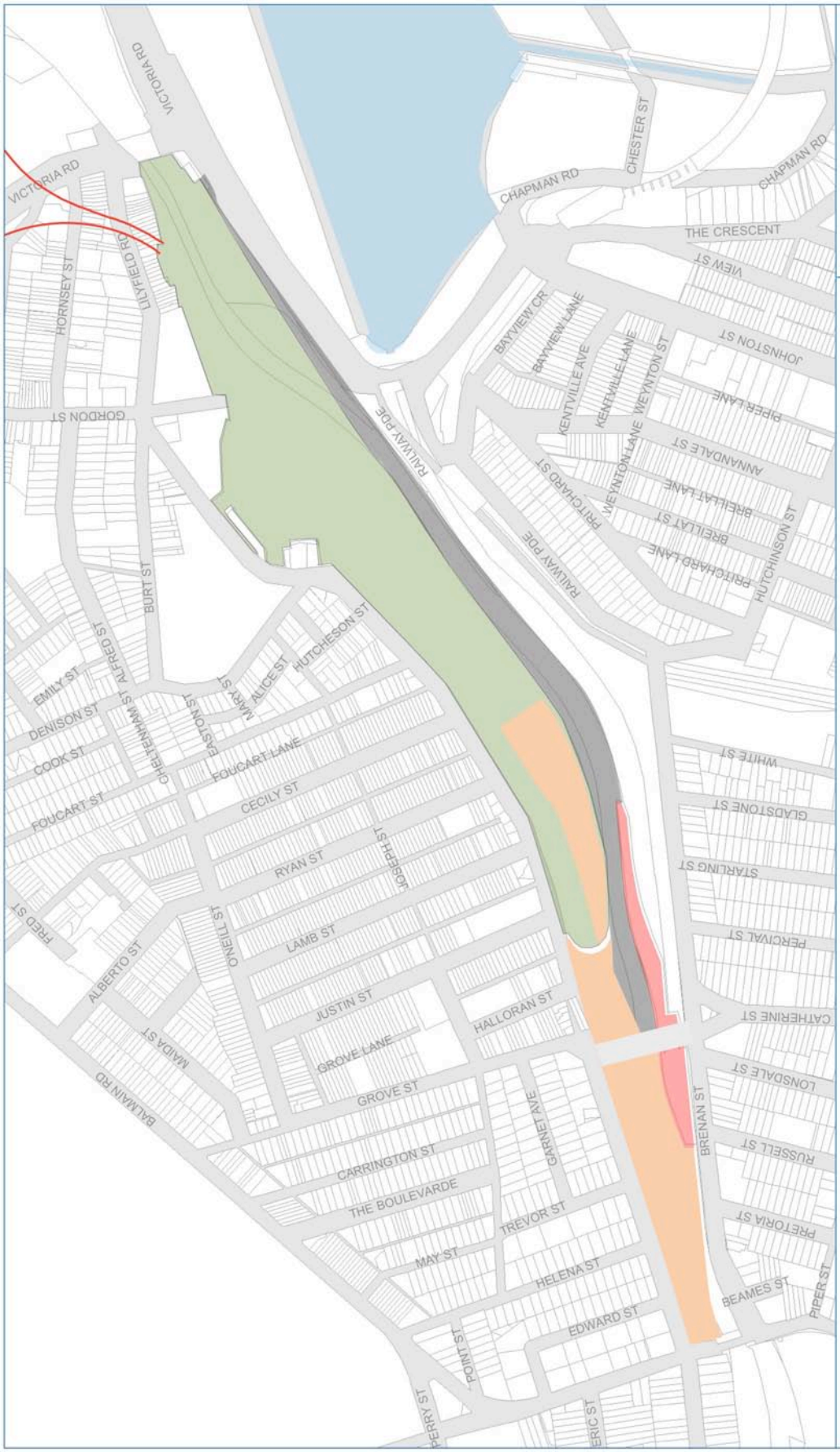


Figure 6.25 Staging of the Rozelle stabling and maintenance depot for the future metro network

An indicative view of the proposed portal entry point is provided in Figure 6.26. Section layouts of the depot are provided in Figure 6.27.

The strategies in the master plan for Rozelle stabling and maintenance depot are outlined in Table 6.7.

Table 6.7 Master planning strategies – Rozelle stabling and maintenance depot

Issue	Strategies
Vehicle access	• Provide access to administration building, infrastructure maintenance facility, wash plant and electrical substations from Gordon Street. • Locate parking behind administration centre away from the view of Lilyfield Road. • Retain access to properties on Lilyfield Road west of the site • Provide access from City West Link to the rolling stock maintenance facility and wheel maintenance facility.
Access safeguards	• Access to White Bay is limited. Safeguard future potential access from City West Link to White Bay.
Pedestrian/bicycle movements	• Improve local and regional pedestrian and bicycle links. • Reconnect residential areas of Lilyfield and Annandale. • Promote alternatives to car use by strengthening existing regional bicycle route along Lilyfield Road. • Reduce conflicts between car and bicycles through separation of modes. • Preserve existing light rail station and lands. • Safeguard future potential pedestrian and bicycle connection to White Bay.
Built form	• Proposed buildings are an opportunity to engage with the surrounding public realm and transport corridors in interesting ways. • High quality materials and finishes to buildings and structures. • Locate buildings to maximise views from Easton Park and Lilyfield Road to Rozelle Bay and the CBD. • Facades on industrial buildings visually engage park visitors. • Demonstration of sustainability design principles and features.
Landscape and public domain	• Link open spaces of Annandale, Rozelle and Lilyfield. • Reintegrate the site with ecological systems and open spaces. • Improve habitat links and quality of water discharged to Rozelle Bay. • Provide new publicly accessible open spaces.

Figure 6.26 Indicative view of the tunnel portal entry point

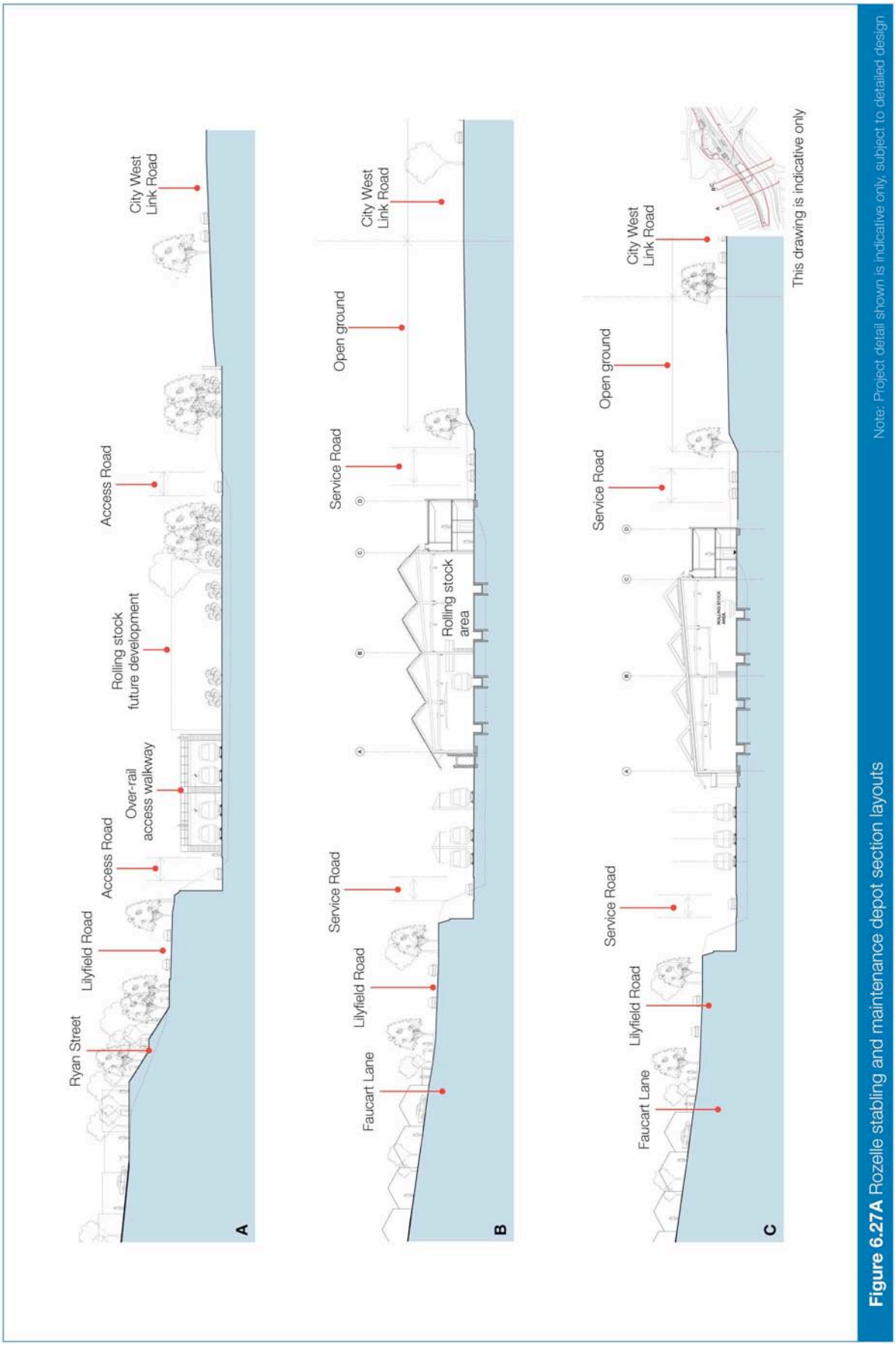


Figure 6.27A Rozelle stabling and maintenance depot section layouts

Note: Project detail shown is indicative only, subject to detailed design

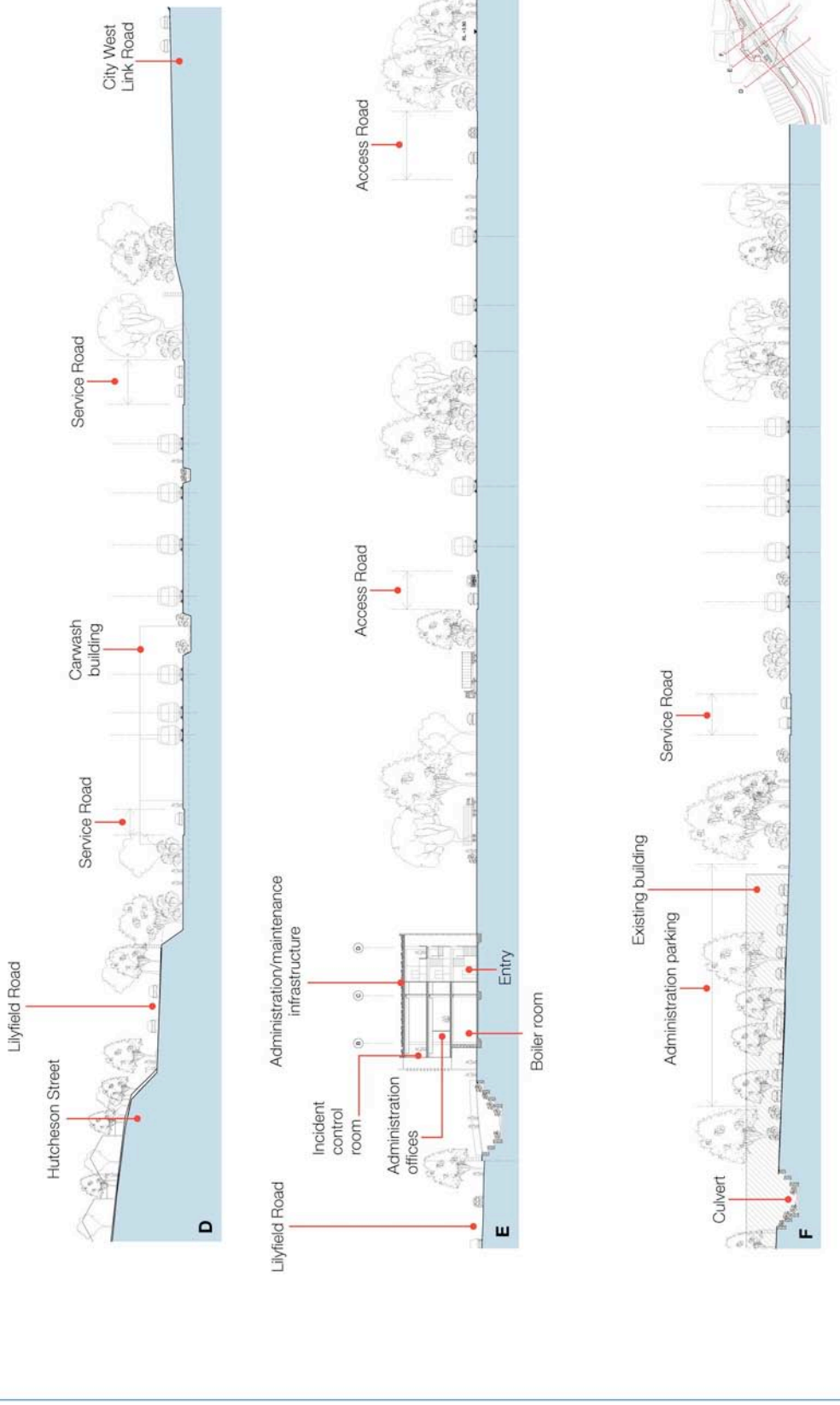


Figure 6.27B Rozelle stabling and maintenance depot section layouts

Note: Project detail shown is indicative only, subject to detailed design

6.5.1 Train stabling area

The train stabling area would be used to stable trains when they are not required for service. As the metro system would be closed for maintenance from approximately midnight to 6.00am, trains would require storage off the running lines. Trains not required during off-peak periods would be accommodated in the stabling area.

Daily internal cleaning of trains would take place in the train stabling area as trains return to the depot after the morning and evening peak periods. Trains returning from service at the end of each day would be cleaned internally prior to entering service the next day. The daily internal clean would involve picking up rubbish; spot cleaning of seats, floors, glass and other interior surfaces; and removal of minor internal graffiti by cleaners. Minor maintenance attention would also be undertaken in the train stabling area, such as replacement of lamps, loose or damaged equipment covers, and minor testing and replacement of control equipment accessible from the interior of the train.

No external work would normally be undertaken on the trains in the train stabling area.

The train stabling area would be located along the north-western boundary of the site, alongside the Lilyfield Road escarpment towards the Catherine Street bridge. The initial rolling stock for the CBD Metro is likely to comprise 13 trains. The initial stabling area would provide space to accommodate 11 five-car trains in four stabling roads, each about 360 metres in length. The two other trains would be stabled at either end of the running tunnels. As the stabling area is located close to the Lilyfield Road escarpment, very little of the stabling area would be visible from the adjacent residences.

While the project would be designed to accommodate six-car trains, it is unlikely that six cars would be required from commissioning in 2015. The number of cars per train would increase to meet rises in passenger demand.

Trains would normally be shut down once they have been stabled but would need to powered up approximately thirty minutes prior to their scheduled departure time, and also for cleaning and minor maintenance. The trains would be equipped with a ‘cleaning mode’ which would be programmed to activate the lights, ventilation fans (but not the air-conditioning) and the cleaning power supply, which would minimise any noise or lighting impacts from these activities. The train doors would normally be closed during internal cleaning operations.

6.5.2 Rolling stock maintenance building

The purpose of the rolling stock maintenance building (refer Figure 6.28) is to provide for the unscheduled, scheduled and heavy maintenance of the trains. Scheduled maintenance includes all maintenance and detailed cleaning activities. Unscheduled activities include train and component failures, rectification of vandal damage and graffiti removal. Heavy maintenance consists of periodic change out of major components.

The rolling stock maintenance building would be located along the south-eastern boundary towards the middle of the site, parallel to the City West Link. It would be about 148 metres long, 34 metres wide and 10 metres high.

All trains would be subject to a detailed clean every 30 days. Routine train maintenance activities would generally also be undertaken on a 30 day cycle.

The primary rolling stock maintenance building would consist of four maintenance roads, one inspection road, one scheduled maintenance and out-of-course road, one lifting road and one presentation road.

There would be approximately twenty staff employed in the rolling stock maintenance building, with the majority of these, approximately fifteen, on day-shift during the week. Scheduled detailed cleaning would normally be undertaken on day-shift between peak periods. Routine train maintenance would also normally be undertaken on day-shift.

All train maintenance activities would be conducted within the building, which would be equipped with end doors on each maintenance road to minimise noise.

The main store, office facilities and component testing and servicing rooms to support the rolling stock maintenance activities for the CBD Metro would be attached to the rolling stock maintenance building, in a two-storey building. Only minor repair of components would be undertaken on-site. All major component repairs and overhauls would be undertaken off-site. The store section of the building would be the full height to allow high pallet racking with a partial mezzanine floor above for small components and tools. Minor workshops would be located on the ground floor, adjacent to the trains being overhauled for minimum transport distance. Offices would be located on the second-storey above the minor workshops.

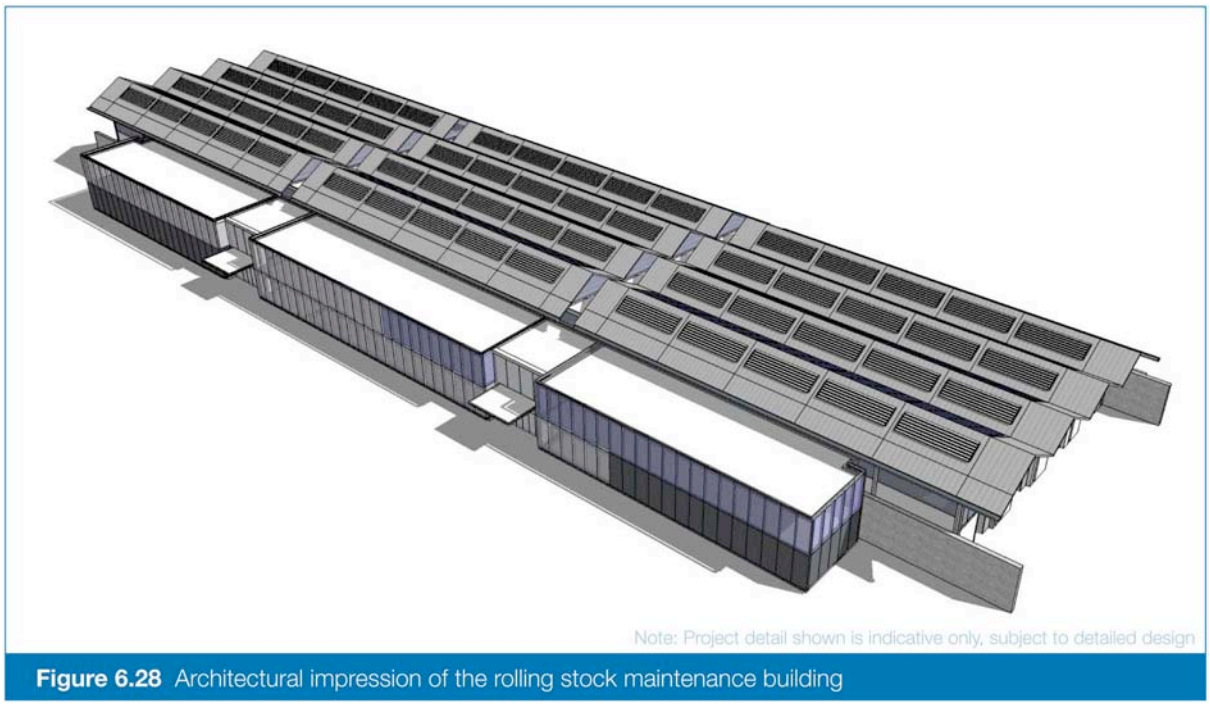


Figure 6.28 Architectural impression of the rolling stock maintenance building

6.5.3 Automated train wash

Trains would be washed externally at least once every three days. Trains would normally be washed as they return from service after the morning and afternoon peak periods. Trains that do not require washing would bypass the train wash plant.

The train wash plant would be located on a section of track leading to the stabling area, ensuring that trains can be washed as they enter the stabling area. The uni-directional plant is about 40 metres long and five metres wide (not including the control room/store/treatment plant). The plant would utilise rainwater collected from the roofs of the depot buildings.

The plant would operate automatically with a service check by a technician once a week. Train speed through the wash plant would be 2.5 kilometres per hour. The throughput would be six trains per hour, as the plant would typically recycle in 10 minutes, to allow collection of water run-off and recovery.

The train wash would recycle up to 95 per cent of the wash water for use in subsequent washes. The wastewater treatment plant would meet Sydney Water requirements. It would separate solid and liquid waste to further reduce the load on the sewer as the solid waste would be dried and disposed of with other waste. Following recycling and treatment of the collected wash water, the remaining 5 per cent of water would be discharged to the sewer. All water discharged to the sewer would comply with Sydney Water requirements. The waste water treatment plant occupies about 200 square metres, including the control room.

The train wash plant would be contained within an acoustic enclosure.

6.5.4 Infrastructure vehicle maintenance facility and marshalling area

The infrastructure vehicle maintenance facility would provide an enclosed space, between the actual train wash plant and the water treatment plant. The infrastructure vehicle maintenance facility, which is incorporated into the train wash building, would be about 14 metre wide and 24 metres long. It would contain two maintenance tracks with pits.

The CBD Metro would be equipped with a small number of rail-bound infrastructure maintenance vehicles equipped to undertake activities such as the repair of track and overhead conductors. Servicing and safety inspections on the rail vehicles would be undertaken in the infrastructure vehicle facility. The facility may also be used as undercover storage for some main vehicles.

There would be no permanent staff located in the infrastructure vehicle maintenance facility. Staff and contractors would conduct maintenance activities in the facility, when required.

The infrastructure maintenance vehicle marshalling area would be used to assemble work trains ready for the commencement of the maintenance operations period. It would also be used to position road and rail vehicles ready to enter the tunnels at the commencement of the maintenance operations period. The marshalling area consists of two parallel rail tracks about 100 metres long, which feed into the infrastructure vehicle maintenance facility.

6.5.5 Train control / administration building

All operations, maintenance and administration for the CBD Metro would be managed in the administration building (refer Figure 6.29). The administration building would house CBD Metro operations control and emergency command rooms where all command, control, system monitoring and communications functions would take place; and office facilities and locker areas for CBD Metro staff.

The proposed administration building would be three-storeys high, about 65 metres long and 22 metres wide, containing a usable interior of 3,500 square metres. The ground floor of the building would house spare infrastructure parts and cleaning supplies.

About 25 staff would be housed in the administration building, and would work on a typical Monday to Friday schedule (excluding holidays) from 8am to 4pm. Another 12 staff, responsible for the actual control and monitoring of real-time metro operations and activities, would also be housed in the operations control centre. They would work in three shifts, 24 hours per day (four staff per shift).

The ground floor of the administration building would also be the operational base for the infrastructure maintenance and train cleaning staff. Infrastructure maintenance of the tunnels and stations would primarily be undertaken between midnight and 6.00am. Cleaning staff would be required to clean trains in the stabling area throughout the day and night, as required. These staff would start and finish their shifts at the administration building.

There would be an access control and security check point at each of the two entrances to the depot. These would provide shelter and a small office with communications capabilities for the security guard on duty. The security guard would monitor and control access into, and egress from, the depot by individuals and vehicles. Each access control and security check point would be one-storey and about three metres wide and five metres long.

The access control and security check point at the Gordon Street entrance would be staffed by one guard on a 24 hour, seven day per week basis. The access control and security check point at the City West Link entrance would be staffed from approximately 8am to 4pm each weekday. The gate would be kept closed and locked at other times.

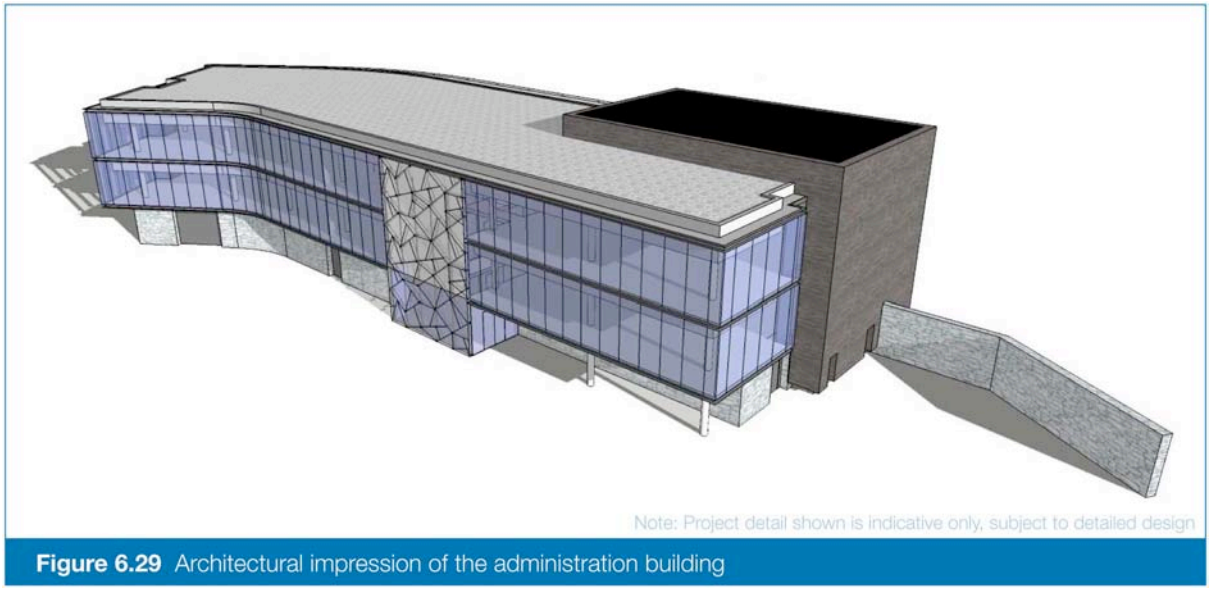


Figure 6.29 Architectural impression of the administration building

6.5.6 Bulk power supply building and traction power substation

The bulk power supply building and the traction power substation would be separated by a maintenance roadway. The bulk power supply building would be the connection point for the incoming supply from EnergyAustralia, where AC power is supplied to the depot, the traction substation and the running tunnels between Rozelle and Pyrmont stations. The adjacent traction power substation would convert the AC supply to 1,500 volts DC, required to power the trains. The traction substation at this location feeds the overhead wiring in the depot and in the running tunnels between Rozelle and Pyrmont.

The bulk power supply building would be a fully enclosed brick building, about 55 metres long and 14 metres wide. The traction power substation would be similar, about 55 metres long and seven metres wide. These two facilities would typically be unattended substation buildings. Staff would only attend to undertake period maintenance or to respond to emergency situations.

6.5.7 Depot connection tunnel portal and dive structure

This would be the location where trains would enter and exit the CBD Metro's tunnels from the depot. The curved 'dive structure' (i.e. the structure where tracks leave the depot to the portal entrance) would be about 40 metres in length. It would have a concrete roof structure, which would be landscaped. A 70 metre long, 2.4 metre high noise barrier extending from the end of the portal structure on the northern side is proposed.

The purpose of the dive structure is to mitigate against potential noise impacts caused by the wheel/track interface associated with the movement of trains, particularly on curved track. The mitigation requirements are discussed in detail in section 15.4. Most train movements in and out of the depot would occur at the start and end of each day's service, with additional movements at the end of the morning peak period and the beginning of the afternoon peak on weekdays.

6.5.8 Wheel maintenance facility

The purpose of the wheel maintenance facility would be to undertake periodic machining of the train wheels without having to remove them from the train. The tread of the train wheels would be worn from normal acceleration, braking and cornering forces. The maintenance of the correct wheel tread profile is essential to maximise wheel life and minimise noise generation. Machining can be undertaken using either an underfloor wheel lathe or milling machine.

The underfloor wheel lathe would be housed in a building approximately 40 metres long and eight metres wide. Insulation of the side walls and roof of the wheel lathe enclosure, and partial doors that close around the rolling stock profile, would be installed to minimise noise breakout.

The wheel maintenance facility track would be of sufficient length to stand a 6-car train either side of the lathe. There would be no permanent staff allocated to the wheel maintenance facility. Trained operators from the rolling stock maintenance facility would attend and operate the facility as required.

For the CBD Metro there may not be sufficient workload to justify the installation of a wheel maintenance facility. However, provision would be made in the depot layout, to allow installation at a later date, as the metro network is extended.

6.5.9 Vehicle parking areas

Vehicle parking areas would be provided for staff and visitors to the Rozelle stabling and maintenance depot. There would be two parking area. The first area, containing space for about 63 vehicles, would be located on the northern side near the operations control centre with access from Gordon Street. The second area, containing space for about 18 vehicles, would be located on the southern side near the rolling stock maintenance facility with access from the City West Link.

Other than the arrival of occasional visitors during the day, most movements in and out of the parking areas would occur during shift changes of the depot staff with peak movements occurring at 8am and 4pm on weekdays. There may be a smaller shift change occurring around midnight. It is currently anticipated that depot staffing levels on weekends would be minimal and, accordingly, there would be very little vehicular movement in or out of the depot on weekends. Adequate off-street parking for depot staff would be provided within the depot. No on-street residential parking would be used.

6.6 Pedestrian links

6.6.1 Barangaroo Pedestrian Link

The CBD Metro project includes the construction of the Barangaroo Pedestrian Link between Barangaroo and Wynyard. The Minister for Planning has made provision of the Link a condition for development and delivery of the planned Barangaroo development. The provision of a grade separated pedestrian link is considered critical in ensuring safe and efficient pedestrian movement and

transport integration between Barangaroo and the transport hub of Wynyard (i.e. future metro, the existing CityRail Wynyard Station, bus services, and light rail links).

The CBD Metro alignment, Barangaroo-Wynyard Station and the Barangaroo Pedestrian Link are all located under the east-west axis of Margaret Street. This provides an opportunity to integrate the design, securing of approvals and construction of the Link by Sydney Metro and its contractors. In April 2009, the NSW Government's Budget Committee requested Sydney Metro take responsibility for planning and delivery of the Link.

The Barangaroo Pedestrian Link is shown in Figure 6.30, Figure 6.31 and Figure 6.32. Key elements of the Barangaroo Pedestrian Link include:

- A surface pedestrian link from the Barangaroo waterfront to Sussex Street (about 200 metres long). The surface link would be a paved boulevard including landscaping and interchange with metro services, future ferry and possible light rail services.
- A bridge link over Sussex Street into a public pedestrian plaza area located adjacent to Moreton's Hotel and known as the Napoleon Node. The bridge would be about 50 metres long and 4.5 metres wide, and would have a minimum clearance height of 5.5 metres. The bridge would be a visually light and elegant structure and would be accessed via escalators and a 27 person lift. The lift accessing the bridge would be glass enclosed. The bridge would also provide a grade-separated connection to the Westpac Forecourt Park on Kent Street. At a later date a second bridge over Sussex Street would be provided. This bridge would be aesthetically and structurally similar to the first bridge and would cross Sussex Street from just north of the metro entry at Barangaroo to the northern side of Moreton's Hotel, connecting with the Napoleon Node.
- A public pedestrian plaza that would be paved and provide a well-proportioned public space and discharge/entry to the tunnel. The area would also link the City of Sydney street garden on Sussex Street with the Westpac Forecourt Park. From the Napoleon Node the Barangaroo Pedestrian Link would enter the tunnel portal.
- A tunnel connection providing a grade-separated link from the Napoleon Node, under Margaret Street (between Kent and Clarence streets) to the Barangaroo-Wynyard Station shaft at Clarence Street. The tunnel would be about nine metres wide and up to three metres high. The section beneath Margaret Street would be about 100 metres long, and the section beneath Clarence Street would be about 35 metres long. Breakthrough panels would be included to allow integrated pedestrian links to be developed in the future. Apart from the Napoleon Node, surface access points to the tunnel would be provided by escalators and lifts on the western and eastern sides of Clarence Street, as well as the western side of York Street through Transport House.
- A one metre stub tunnel would be provided to allow further extension east under Margaret Street to the western side of George Street. Preliminary investigations have scoped the possibility of building this second stage of the pedestrian link – the George Street Pedestrian Link, however this second link does not form part of the CBD Metro project that Sydney Metro seeks approval for in this Environmental Assessment.

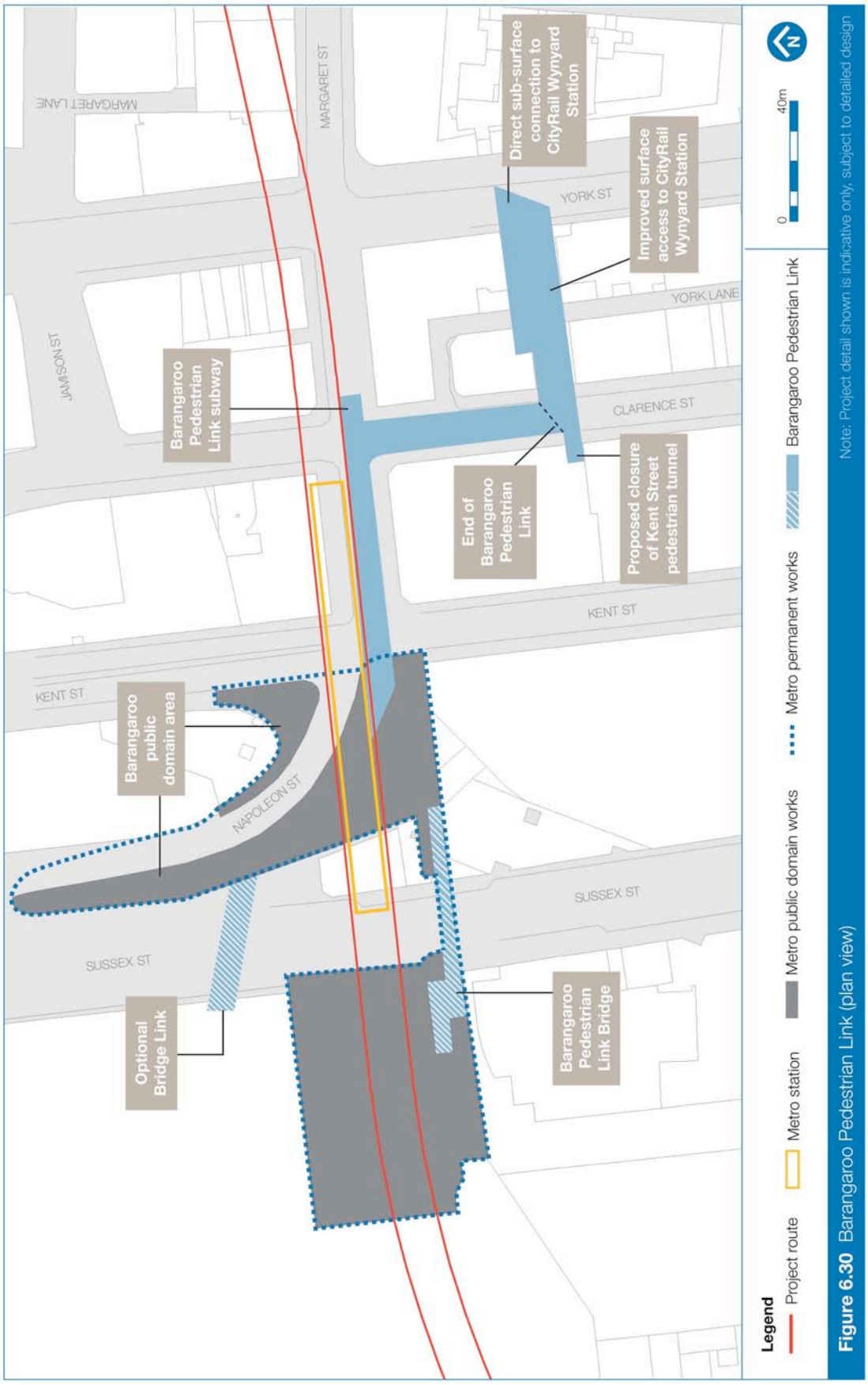
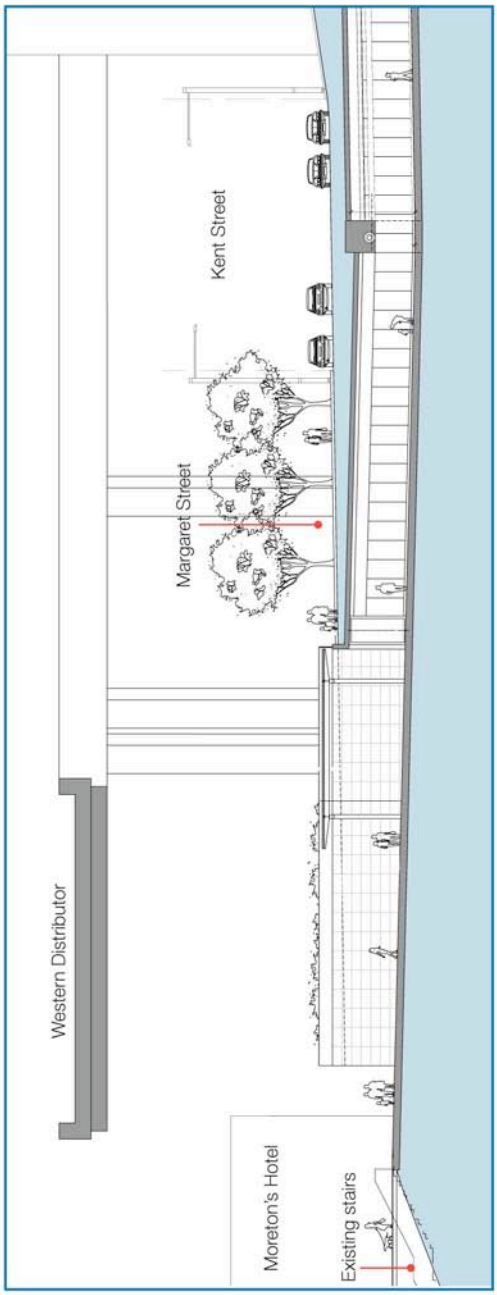


Figure 6.30 Barangaroo Pedestrian Link (plan view)



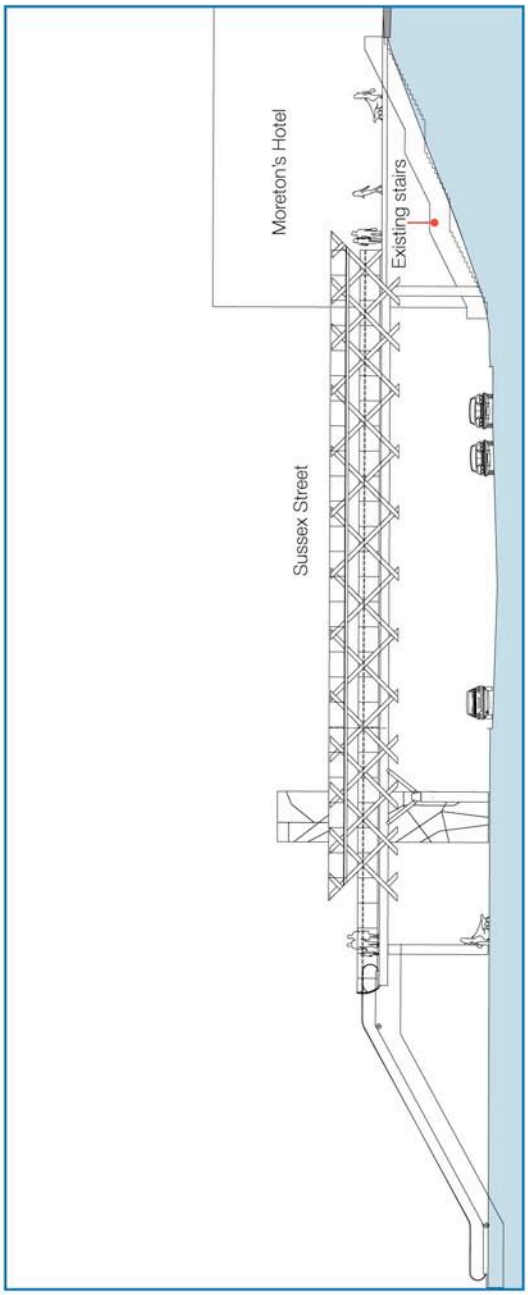


Figure 6.31 Indicative section through Barangaroo Pedestrian Link (long view)

Note: Project detail shown is indicative only, subject to detailed design

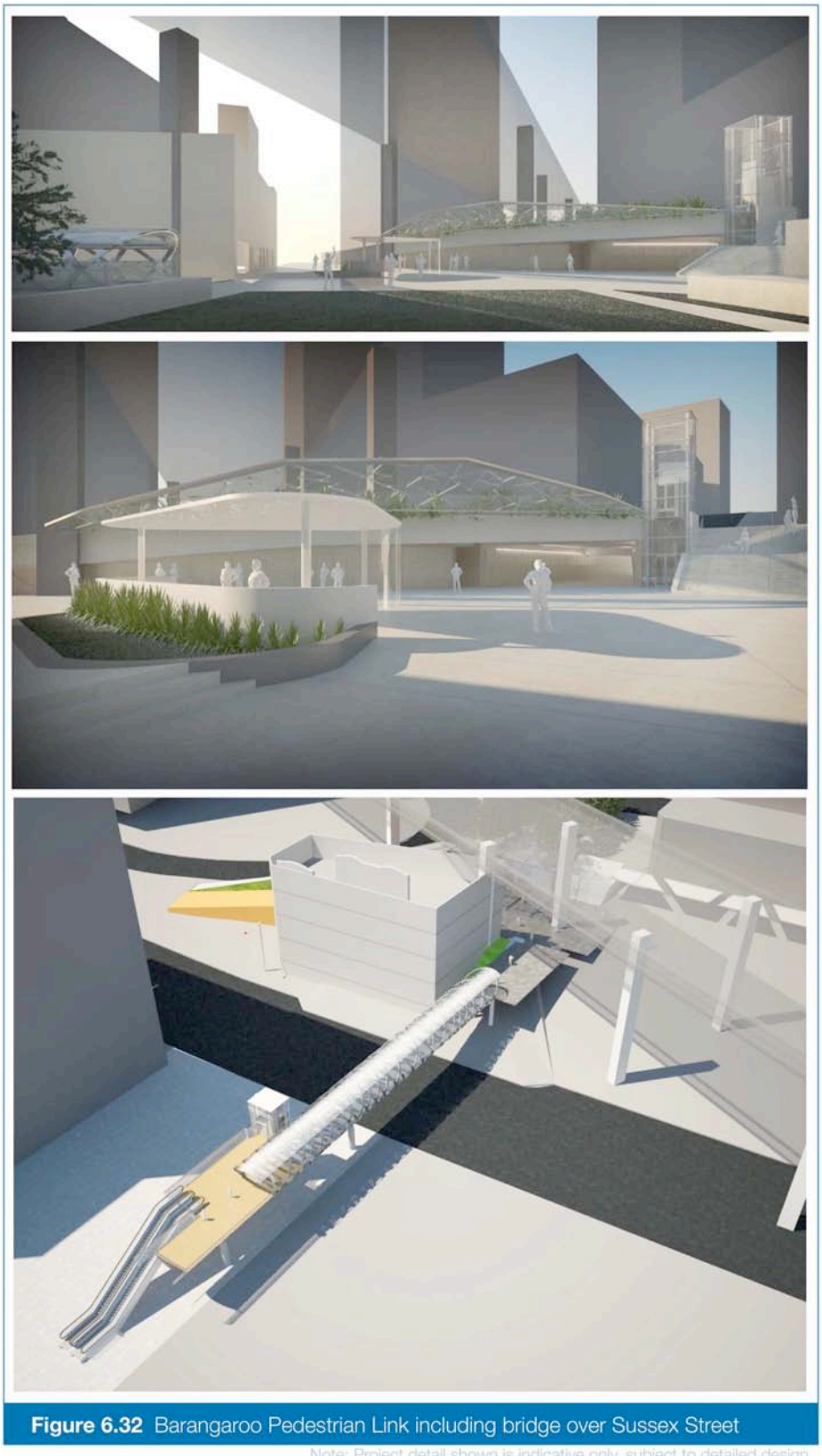


Figure 6.32 Barangaroo Pedestrian Link including bridge over Sussex Street

Note: Project detail shown is indicative only, subject to detailed design

6.6.2 Lilyfield Pedestrian Link

The pedestrian/bicycle bridge link would be provided from the Lilyfield Road side on the north, to the Annandale light rail station area on the south to facilitate access over the depot and the City West Link as part of the maintenance and stabling depot (refer Figure 6.33).

The link would provide access between Lilyfield/Rozelle and Annandale, and improved access to Rozelle Bay, Glebe foreshore and Annandale light rail station. The bridge would span the metro train stabling areas, the City West Link and Whites Creek, and include a mid-landing point to provide pedestrian and bicycle access through open space in the east of the site to the existing Anzac Bridge northern pedestrian/cycle path. The bridge would be approximately 230 metres long and four metres wide.

The bridge detailed design would be seek to maximise viewing opportunities to Rozelle Bay and the city. The bridge design, including the grade and handrails, would ensure easy access for bicycles, wheelchairs and prams. At the eastern end of the bridge on Lilyfield Road, a new paved and landscaped seating area would provide opportunities for passive recreation and views over the train stabling areas and harbour. The bridge would be well-lit, monitored through the CCTVs, and cleaned of rubbish and debris on a regular basis.

Figure 6.33 Artist's impression of Lilyfield Bridge Link at the depot (view from Lilyfield Road)

6.7 Ancillary features

6.7.1 Signalling, train control and communications

Efficient signalling, communications and train control facilities are required for the safe operation of the CBD Metro system. Trains would be automatic and driverless and controlled using an Automatic Train Control (ATC) system with associated signalling equipment. The signal system design would provide performance levels of up to 30 trains per hour. Under normal operations, trains would use Automatic Train Operation (ATO) and Automatic Train Protection (ATP) systems, which are systems that supervise and control the trains. The ATP system would keep trains within a safe braking distance of the train ahead. As a train approaches a station, the ATO system would automate the driving function. It would also control the train stopping at stations, ensure trains stop in line with platform edge doors, control speed between stations, ensure that only the doors on the correct side can be opened at each station, and initiate door closing.

The train controller (operating from the Rozelle stabling and maintenance depot) may intervene and operate the train movements in the event of emergencies. The train lines would be bi-directionally signalled to allow for the continued operation of train services during disrupted operations (for example, if a tunnel is blocked due to a train failure).

The integrated information control system would allow communication with passengers or any staff member via audio and visual links at the station or on a train. The various systems that would be used include:

- Radio communications systems for operator and emergency services.
- Passenger mobile telephone.
- Backbone data transmission.
- Passenger information and public address.
- Closed circuit television.
- Telephone and personnel wireless terminal.
- Automatic fare collection.
- Station and tunnel control.

6.7.2 Power supply

Electrical power would be required for the electrical and mechanical systems for the stations and tunnels. Power supply would also be required for lighting, ventilation, hydraulic services, tunnel ventilation, and fire services.

The operational power system would be made up of the following key components:

- Bulk supply point – This is the electrical supply point from EnergyAustralia that would feed the CBD Metro's high voltage reticulation system. This would in turn feed the traction supply as well as the station and depot supply systems. Bulk electrical supply would be from EnergyAustralia's network and is likely to comprise the following:
  - Two off 33kV feeders from EnergyAustralia's existing Rozelle sub-transmission sub-station (STS), which would be reticulated to a sub-station in the Rozelle stabling and maintenance

depot. The proposed route for the feeders would be trenched within the road easement through Rozelle via Moodie, Oxford, Denison, Burt and Gordon streets.

  - Two off 33kV feeders from EnergyAustralia's Surry Hills STS, which would be reticulated to a sub-station within Central Station. The proposed route for the feeders would be trenched within the road easement through Surry Hills via Smith, Reservoir, Mary, Albion and Elizabeth streets and Eddy Avenue.

  - Two off 11kV feeders from EnergyAustralia's Campbell Street, Surry Hills STS, which would be reticulated to a sub-station within Central Station. The proposed route for the feeders would be trenched within the road easement through Surry Hills via Campbell and Smith streets, then the same route trench as the 33kV feeders to Central Station.

- High voltage (HV) reticulation – The HV reticulation system would transfer and control the supply of power throughout the CBD Metro infrastructure. The most likely system would be 33kV and 11kV ring networks with controlling switchgear at each station and the stabling and maintenance depot.

- Traction supplies – Traction supply sub-stations would take power from the SM HV ring and provide electrical power to the overhead wire system (OWS). The traction supply sub-stations would probably be installed at Central Station and Barangaroo-Wynyard Station, and at the Rozelle stabling and maintenance depot.

- Station and depot supplies – Station and depot supply sub-stations would be used to provide electrical power to the station and depot buildings. These sub-stations would be contained within station or depot buildings.

6.7.3 Tunnel and station support systems

Emergency egress

Emergency egress would be provided at each station site. The stations would allow access for emergency services and provide emergency egress from tunnel sections. They would consist of sub-surface lift facilities with minimal surface level access structures. The stations would provide the following features:

- Main entry and fire stairs to serve as emergency egress points to be used by the emergency services to access the tunnels. A room with fire control services equipment would be provided at, or one level below, the surface level. The depot portal would also serve as a fire-fighter access point.

- Emergency egress facilities, consisting of lifts, escalators and stairs to allow for passenger evacuation, with a place of safety provided at the surface.

Station ventilation

Ventilation systems would be provided in the tunnels to allow effective natural ventilation and supplementary mechanical ventilation. These facilities would supply fresh air to stations and tunnels and discharge air from the tunnels and station environment. The locations of these ventilation shafts are shown on each station diagram.

The ventilation systems would be designed to meet the criteria for normal, congested and emergency scenarios. The systems would also provide ventilation in the event of fire to ensure suitable conditions in the tunnel for safe egress of passengers and access for the emergency services. In the event of fire, smoke-laden air would be discharged to the atmosphere.

The tunnel and trackway ventilation system would be designed to prevent smoke from entering the station or recirculating through ventilation shafts or tunnel portals. Only in the event of a fire would the ventilation shafts be used for smoke exhaust.

Emergency and incident management

One of the key objectives of the CBD Metro project is to provide a safe and reliable transportation system. The project includes specific features for safe operation, including its signalling and communication systems, described above. It also includes features within the design of its tunnels, shafts and stations to aid efficient emergency access and escape, also described above.

Major hazards and risks associated with metro operations have been considered during design development to either eliminate the hazards or adequately mitigate or control the associated risk. Measures incorporated into the design and operation of the tunnels to manage accidents and hazardous incidents during metro operations are outlined below.

Communications and control systems

The primary means of emergency management would be via the operations control centre (OCC). Emergency services would communicate with the OCC to coordinate their response during an emergency. The stations would also provide emergency management, including control of ventilation systems, monitoring of CCTV and communication facilities. The OCC would be able to communicate to occupants on trains, at cross-passages and at stations.

Fire and life safety

A rigorous fire engineering process has been undertaken as part of the design process for the project in close consultation with the NSW Fire Brigades. A key aspect of this has been the development of fire and life safety objectives which achieve a level of safety that meet performance requirements of international guidelines for metros and Australian standards such as the Building Code of Australia.

The risk due to train fires is very low. On the CBD Metro, the risk would be further mitigated through the following means:

- Rolling stock would have materials with low combustibility, flame spread and smoke-production properties.
- Rolling stock would have systems to minimise the likelihood and potential impact of fire incidents. These would include emergency warning and alarm systems to provide warning and direction to occupants, and advanced fire detection systems.
- The tunnel structure would be designed to withstand fire events. Fire separation would be provided between tunnels and at cross-passages to separate the incident tunnel from the non-incident tunnel. Advanced fire detection systems would be installed in tunnel cross-passages.
- Help points would be provided at cross-passages to permit two-way communication with occupants and emergency services.
- Each running tunnel would have a dedicated walkway between the rails so that passengers could proceed to an emergency egress at stations. A range of occupant mobilities and capabilities has been considered within design development.
- In addition to a walkway between the rails, derailment containment provided on both sides of the tunnel is to have a level walking surface so that fire fighters can pass a train carriage on at least one side along all points of the tunnel.
- Fire-fighting equipment, including fire hydrants, would be provided within tunnels for use by emergency services. Hydrant boosters would be provided at each station.
- Egress from the stations is to be intuitively clear to passengers by utilising normal access routes as the preferred egress route for emergencies. Redundancy in the egress system would be provided through the use of fire-isolated stairs located so that at least two independent egress routes are provided for all public areas. The exit design and associated measures, such as occupant warning

systems, would aim to minimise queuing time for evacuating occupants in order to reduce the likelihood of crushing at exits, anxiety and impatience. Sufficient egress capacity is to be provided so that the time needed to evacuate each of the station areas is much less than the time for untenable conditions to develop for the expected fire scenarios.

- Fire safety for the depot would be based on the requirements of the Building Code of Australia for buildings, and international codes where relevant.

6.7.4 Trackform

The trackform refers to the track system, consisting of the rail and its supports. The CBD Metro, including the Rozelle stabling and maintenance depot, would be completely separate from other rail and train trackform on other networks. The trackform for the metro would consist of a ballastless, concrete slab trackbed.

The tunnel trackform would be designed to mitigate potential adverse impacts of vibration and ground-borne noise. It would comprise:

- A continuously welded rail.
- A resilient booted-sleeper design. This involves providing a rubber ‘boot’ around the sides and bottom of the sleeper where the track is fastened, to reduce the transfer of noise and vibration into the surrounding ground and building structures above the tunnels. Acoustic modelling indicates that this would satisfy noise and vibration constraints at ground level receivers.

Where the tunnels are bored close to particularly sensitive receptors, such as residential buildings, medical facilities or places of worship, higher attenuation trackform may be provided, where reasonable and feasible, to further mitigate ground-borne noise. Noise and vibration issues are addressed in further detail in Chapter 11.

6.8 Project operations

The following sections provide a description of how the CBD Metro would operate at maximum capacity. It is expected that some elements of the project, such as the number of cars per train, would be introduced in proportion to the growth in passenger demand. Potential staging options are discussed further in section 6.8.8.

6.8.1 Transport integration and interchange

Convenient access, integration and interchange with other transport modes are key objectives of the CBD Metro as part of the broader strategy to provide an integrated transport network for Sydney.

Each station is being designed to allow easy access for pedestrians with efficient and legible interchange to rail, bus, light rail, footpaths and cycleways and/or ferries, and there would be appropriate bicycle storage for cyclists. Stations are also being designed to provide full access for mobility- and sensory-impaired customers and those with other specific accessibility needs. Interchanges between the CBD Metro and other public transport services across the network are shown in Figure 6.34.

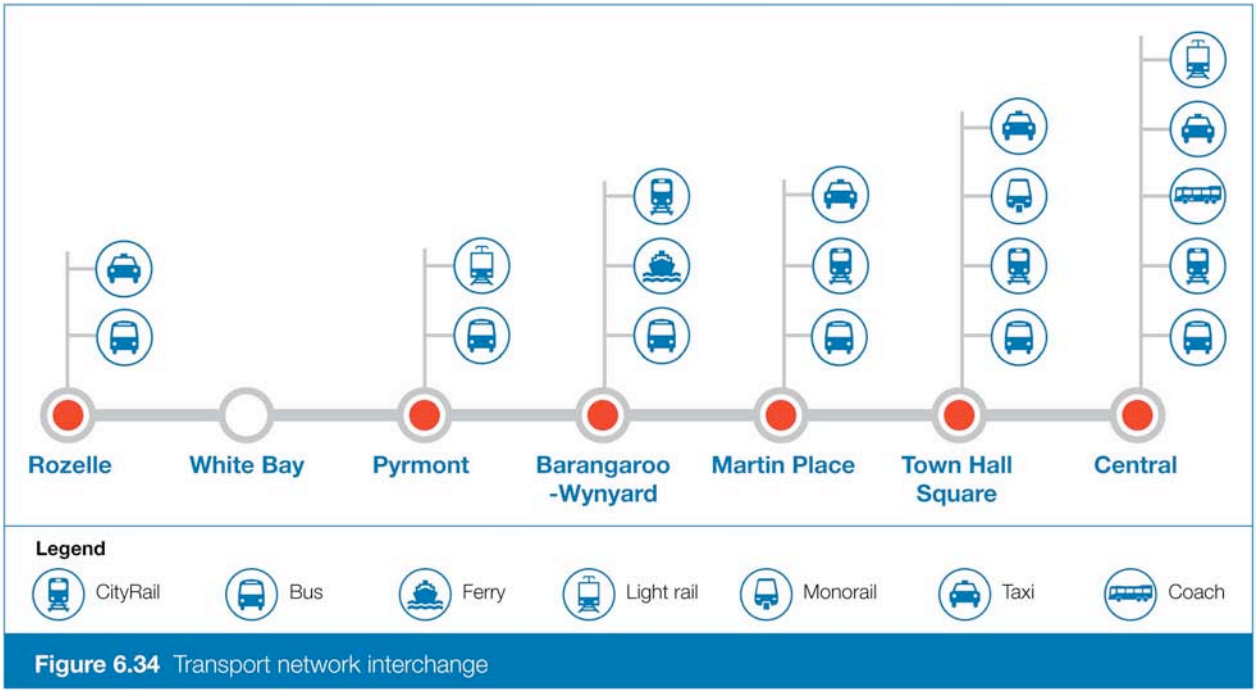


Figure 6.34 Transport network interchange

Key CityRail stations within the Sydney CBD would be linked with CBD Metro stations to allow increased capacity and facilitate quick interchange. Pedestrian and cycle access to stations has been a key driver of the location and design of stations. Passengers would be able to conveniently transfer to and from the metro to other modes of transport within minutes.

Central Station would be a key station for passenger interchange as passengers on CityRail intercity and suburban train services terminating at CityRail's Central Station would have the opportunity to interchange with the CBD Metro. Significant interchange of passengers between CityRail's Wynyard Station and Barangaroo-Wynyard Station is also anticipated with passengers travelling on rail to and from the south and the North Shore and to the Inner West. It is anticipated that up to half the existing bus passengers on Victoria Road at Rozelle could interchange to the CBD Metro rather than stay on buses to the CBD (see Figure 6.35). The CBD Metro would offer transport choice at Rozelle and a

quicker journey time than buses to destinations near Pyrmont, Barangaroo-Wynyard and Martin Place stations. Further detail regarding transport modal interchange and access is given in Chapter 14.

Figure 6.35 Artist's impression of Rozelle bus transfer station (outbound from City)

6.8.2 Rolling stock specification

The CBD Metro would use single-deck trains, each with five cars. Each car would be about 22 metres long, (each five-car train would be about 113 metres long) with a body width of about 3.2 metres and a height of about 3.7 metres.

The trains would be air-conditioned and draw power from overhead wire systems. An indicative impression of the likely metro cars is shown in Figure 6.36. Allowance would be made during station/platform construction to allow the future operation of six-car train.

Figure 6.36 Typical Metro train car (exterior)

The layout of each car would be designed to assist rapid boarding and alighting at stations in order to minimise dwell times. Each car would have at least three bi-parting doors per side, two-by-two transverse seating, a wide centre aisle, two wheelchair spaces and an open full-width gangway (with no inter-car doors) to assist passenger movement and provide a clean, open environment.

Each five-car train could hold 965 passengers. While this is less than an eight-car CityRail double-deck train (1,200 passengers), the metro system capacity is greater overall due to the higher frequency. The interior of a typical metro car is shown in Figure 6.37.

Figure 6.37 Typical Metro train car (interior)

6.8.3 The metro service

The CBD Metro would provide a service between Rozelle and Central with a travel time of about 10 minutes. The peak frequency of services is anticipated to be 22 trains per hour in the year 2016 (that is, a train every 2.73 minutes), moving to 24 trains per hour from 2031. During off-peak periods the metro would operate with a reduced number of trains per hour, with a daytime minimum of 12 trains per hour (that is, a train every five minutes) in each direction.

The CBD Metro is currently proposed to operate at the following times:

- Monday to Thursday – from 5.30am (first train from Rozelle) to midnight (last train from Central).
- Friday and Saturday – from 5.30am to 1.00am.
- Sunday – from 6.00am to midnight.

These operating hours can be adjusted to cater for special events and potential capacity would even remain for 24-hour operation if ever required (subject to maintenance requirements).

The expected travel time between Central and Rozelle would not be more than 10 minutes. Dwell times (the time allowed for passengers to alight and board trains) of 40 seconds are proposed at each station, with the exception of Pyrmont Station and Rozelle Station where the dwell times are estimated at 30 seconds.

It is likely that one train would be stabled overnight within the tunnel at Central Station and one stabled at Rozelle Station for early morning start-up operations. All remaining trains would be stabled within the Rozelle stabling and maintenance depot. Generally, all underground track maintenance activities would be undertaken during the night-time when trains are not operating (that is, between 1.00–5.30am).

On a typical operational day, trains would depart the depot from about 5.30am to 6.30am. About half of the train fleet would return to the stabling area after the morning peak (about 9.00am). These trains would depart again for the afternoon peak and return to the depot at about 7.00pm. The remaining trains would return to stabling around midnight or 1.00am on Fridays and Saturdays, when the infrastructure maintenance period would commence. Infrastructure maintenance trains (which are used to undertake maintenance on the metro network) would leave the depot around midnight and return before operation recommences in the morning.

6.8.4 Ticketing system

The CBD Metro ticketing system would use the latest automatic fare collection (AFC) technology, and would be a fully gated and paperless. Automatic fare collection gates, with locally controlled directional settings, would be provided to allow safe and smooth passenger movement between paid and unpaid station areas, as shown in Figure 6.38. Passengers would swipe in on entry and swipe out on exit. Passengers who use the metro infrequently would be able to buy tickets at the stations. Frequent users would be able to buy and top up Smart Cards. It is intended that the ticketing system would be part of an integrated electronic ticketing system for Sydney and would be interoperable with other transport modes (that is, there would be one single, integrated ticketing system for all of Sydney's public transport). If the fully-integrated system is not available at the time, an automatic fare collection system would be installed and operated with a possible interface to other Sydney public transport operations. Fares would be comparable to other public transport systems at the time of opening.

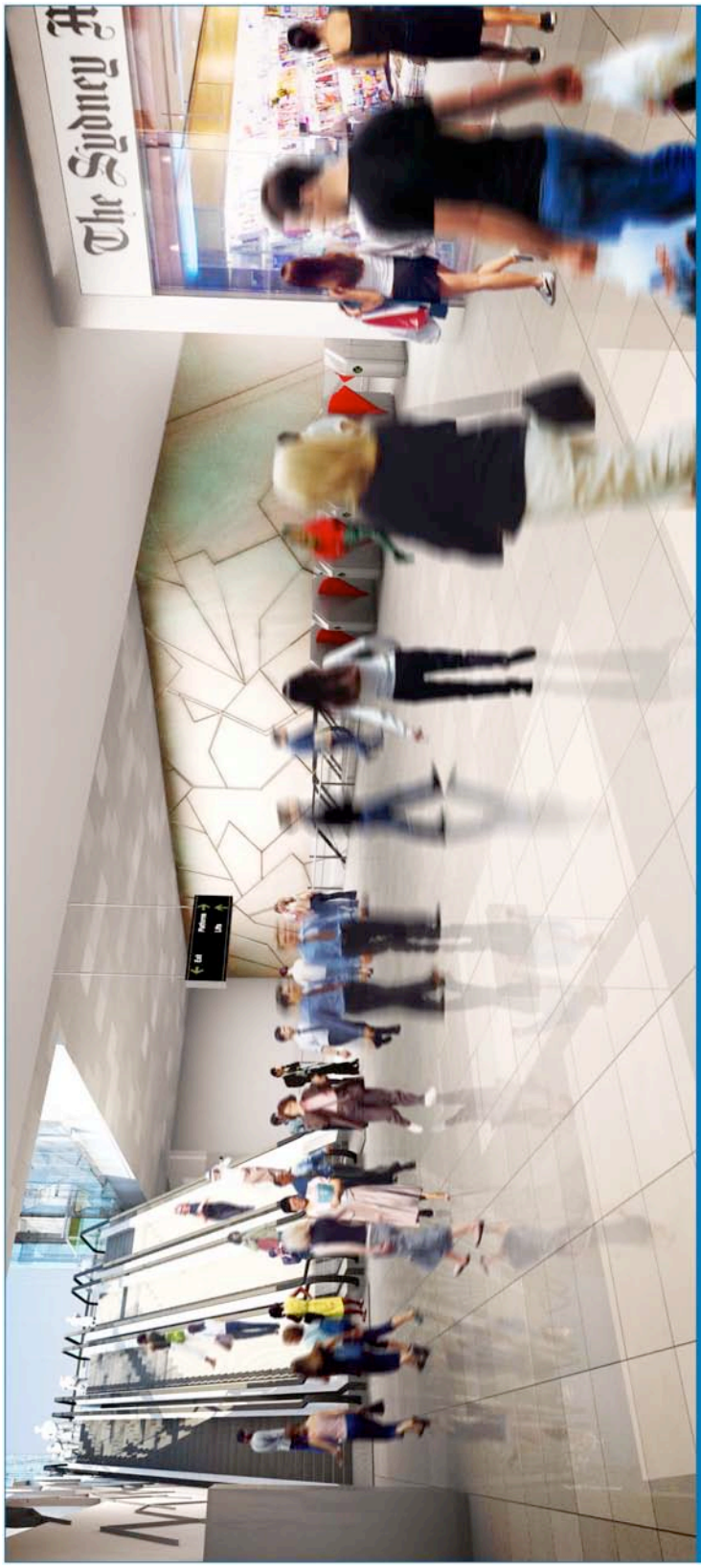


Figure 6.38 Indicative illustration of concourse and ticket areas

6.8.5 Interfaces to other services

The CBD Metro would interface with Sydney's public transport network, including CityRail trains, buses, light rail, monorail and ferries. This would ensure timely connectivity to destinations not serviced by the CBD Metro. This interface would require development and agreement of service plans between Sydney Metro and other modal operators to ensure full integration of services. Further discussion of how the different transport services would interface, and any potential changes that may occur, is provided in Chapter 14.

6.8.6 Operational staff

Up to 275 full-time equivalent jobs would be required in order to operate and maintain the CBD Metro network, rolling stock, stations and tracks. It is expected that this number of staff would remain constant for the CBD Metro from 2015 onwards. The range of skills employed would include customer service staff at stations and on trains, head office functions, and maintenance staff at the depot.

6.8.7 Rozelle stabling and maintenance depot operations

Commencement of daily and afternoon operations
For a typical weekday, metro operations are scheduled to commence at 5.30am with the first train departing from Rozelle. The trains would have been positioned in the stabling area at the end of the previous day's operations, cleaned and put into stabled mode (i.e. all systems shut down and powered off).

In order to meet the 5.30am commencement of operations the system would need to sequentially 'wake up' trains from 5.00am onwards. The trains would be automatically powered up and the lighting, ventilation and air-conditioning systems activated. Time would be allowed for the air-conditioning system to bring the internal train temperature to the desired level, particularly when there is a significant difference to the ambient temperature. Concurrently, the on-board control systems would commence a series of self-checks to ensure that all vehicle systems are operating correctly.

Once these activities have been completed, and at the programmed times, the individual trains would be dispatched towards Rozelle station to form the morning peak service.

At the commencement of afternoon operations, trains would be automatically 'started' and prepared for service. At the appropriate times, they would be inserted back into service to increase the number of trains in service required for the afternoon peak.

Post-morning and post afternoon peak periods
At the completion of the morning and afternoon peak periods, half of the trains in service (five out of ten) would be returned to the depot and stabled. As they enter the depot from the portal, trains scheduled for external wash would be routed through the automated train wash facility and into the stabling area. Trains not requiring washing would proceed directly to the stabling area.

Once in the stabling area, the trains would be internally cleaned (undertaken daily) and any minor maintenance work would be performed. Upon completion of the cleaning and minor maintenance activities, the trains would be shut down and put into stabled mode until they need to be put back in to service.

Cessation of daily operations
At the completion of the day's operations, the remaining trains in service would be returned to the depot and stabled. The last train would return to the depot at approximately 12.15am (1.15am on Friday and Saturday). Again, once in the stabling area, the trains would be internally cleaned and any

minor maintenance work would be performed. The trains would be shut down and put into stabled mode overnight until they need to be 'woken up' and put back in to service the next day.

Rolling stock maintenance activities
Sufficient spare trains would be acquired to allow for routine cleaning and maintenance activities without impacting service delivery.

Trains would be placed in the stabling area, upon completion of the required maintenance activities, to form part of the pool of trains available for the next day's operations. Trains scheduled for maintenance would be directed to the maintenance area and placed in the rolling stock maintenance facility or the wheel maintenance facility, as required, ready for the next day's maintenance activities. Routine cleaning, maintenance and wheel machining will normally be undertaken during day shift (about 8.00am to 4.00pm).

Infrastructure maintenance activities
The maintenance operations period would commence once passenger services have ceased for the day, and all trains have been stabled. As most maintenance activities would be programmed, the necessary vehicles and materials can be assembled during the day and a work train marshalled ready for the commencement of the maintenance period.

The work train would proceed through tunnels and to the work site(s), once approved by the control centre. Individual road/rail inspection vehicles may also be programmed to undertake inspection work on the system. Work trains and maintenance vehicles will depart from the depot at approximately 12.30 am (1.30am on Friday and Saturday) and return by 5.00am.

Any infrastructure maintenance activities required within the Rozelle depot itself would normally be undertaken during the day.

6.8.8 Project staging

This chapter has described the built form and operational requirements of the CBD Metro at full capacity. As patronage for the CBD Metro is expected to be at its lowest in the first year of operation, it is likely that some elements of the project would be staged.

For example, while the project would be designed to accommodate six-car train sets, it is unlikely that six cars would be required upon commissioning. The number of cars per train would increase as demand for the CBD Metro increases.

Opening of the future station at White Bay would be staged with the future development of this site.

6.9 Station precincts and end state

At each station, access to the CBD Metro would be via entrances that are integrated with the existing and planned urban environment, including other transport modes. Minor changes to footpaths, bus stops and roads are expected, as described in station plans being developed for each station. Changes that would be constructed as part of the CBD Metro project are considered in this Environmental Assessment as required.

Station precincts would also comprise commercial and/or retail activities, open space and public domain improvements. Commercial and/or retail activities within the station complex would be constructed and operated as part of the CBD Metro project. Other development, for example on surplus construction sites or above service facilities, would be viable at some locations. Such development would be subject to relevant planning approvals. The CBD Metro project would be

designed and constructed to accommodate future development (by providing structural support, servicing and access).

Potential future uses on land acquired for the CBD Metro project have been identified as described in Table 6.8. The indicative future end state of the services and station buildings is shown in the following figures. Artist's impressions of some services buildings and stations are also provided. A more detailed consideration of the visual impacts of the project is provided in section 19.1. Further station master planning would be undertaken through the process described in section 2.6.

Table 6.8 Potential future uses on land acquired for the project

Station	Site	Potential future land use
Town Hall Square Station		
Town Hall Square	TH1	City of Sydney Council's vision for Town Hall Square. Opportunity to establish community facilities.
Bathurst Street	TH2	Property acquired for construction site and services building. Services building accommodates interim retail with building designed to permit future development above. Residual development would be subject to a separate planning approval.
Martin Place Station		
Between Castlereagh and Elizabeth streets	MP2	Property acquired for construction site and services building. Services building accommodates interim retail with building designed to permit future development above. Residual development would be subject to a separate planning approval.
Barangaroo-Wynyard Station		
Wynyard East Construction site	W1	Property acquired for construction, services and station entry. Building above to occur in conjunction with construction of Metro.
Barangaroo		Future associated with Barangaroo.
Pyrmont Station		
Union and Pyrmont streets (Alternative 1 only)	P1	Station entry with retail.
Mount and Miller streets	P2	Station entry, services, retail/commercial at ground level.
White Bay Station		
		Station box provided. Future uses linked to future proposals for Bays Precinct
Rozelle Station		
North-west corner of the intersection of Victoria Road and Darling Street, Rozelle	R1	Station entry and services. Retail consistent with current forms of retailing.
Balmain Leagues Club site		Bus transfer facility on Victoria Road and services building on part of site
North-east entrance	R2	Station entry with retail at ground level
South-east entrance	R3	Station entry with retail at ground level

6.9.2 Residual development

At a limited number of sites, including Bathurst Street (TH2) and Castlereagh construction site (MP2), there would be the potential for development to occur after construction has finished and the service facilities have been constructed. At these locations the Metro facilities would be designed to allow future development by other parties. These future developments are not directly related to the project and separate planning approvals would need to be sought. Relevant planning controls, including relevant LEPs and DCPs (e.g. floor space ratios (FSR), height and setback controls) would apply.

6.9.3 Barangaroo-Wynyard East construction site

This site (30 and 36-38 Clarence Street), which would be required for construction of the station and to provide services and a station entry, is currently occupied by commercial buildings. To enable the construction of a similar type of building, the new structure would need to be designed and constructed as part of the project in conjunction with the Metro station complex. The new building would be designed consistent with relevant planning controls, including relevant LEPs and DCPs (e.g. FSR, height and setback controls). Further approval for this development would be sought from the appropriate approval authority.

6.9.4 Interim uses on Metro acquired properties

Sydney Metro would manage land not required as part of the Metro station complex on sites that have the potential for residual development. Interim land uses, such as retail or commercial, would be implemented to ensure active street frontages pending residual development occurring. This would occur in consultation with local councils.

Further details on the station planning process and potential land use impacts are described in section 2.6 and Chapter 17 *Land use implications*.

6.9.5 Central Station

No development sites are identified at Central Station following construction of the project. However, within the metro station complex, some retail or commercial opportunities would be created to activate the non-paid areas, including the Pitt Street frontage.

6.9.6 Town Hall Square Station

Two sites have been identified for acquisition and possible redevelopment at Town Hall Square Station:

- The Town Hall Square site including the Woolworths building (TH1) (Figure 6.39 and Figure 6.40). The development of the metro at Town Hall Square increases the possibility for the realisation of Town Hall Square – a long-term aspiration of City of Sydney Council. Following construction of the metro station at Town Hall Square, the City of Sydney would build and manage the square when the site becomes available after construction. The design of the station allows for a future building by City of Sydney Council for office or community facilities. This development would be subject to master planning by the City of Sydney Council.
- A smaller site on Bathurst Street for services (TH2) (Figure 6.41 and Figure 6.42) has been designed to allow future development by others within permitted height controls. Interim uses would ensure street frontages are active prior to any future development.

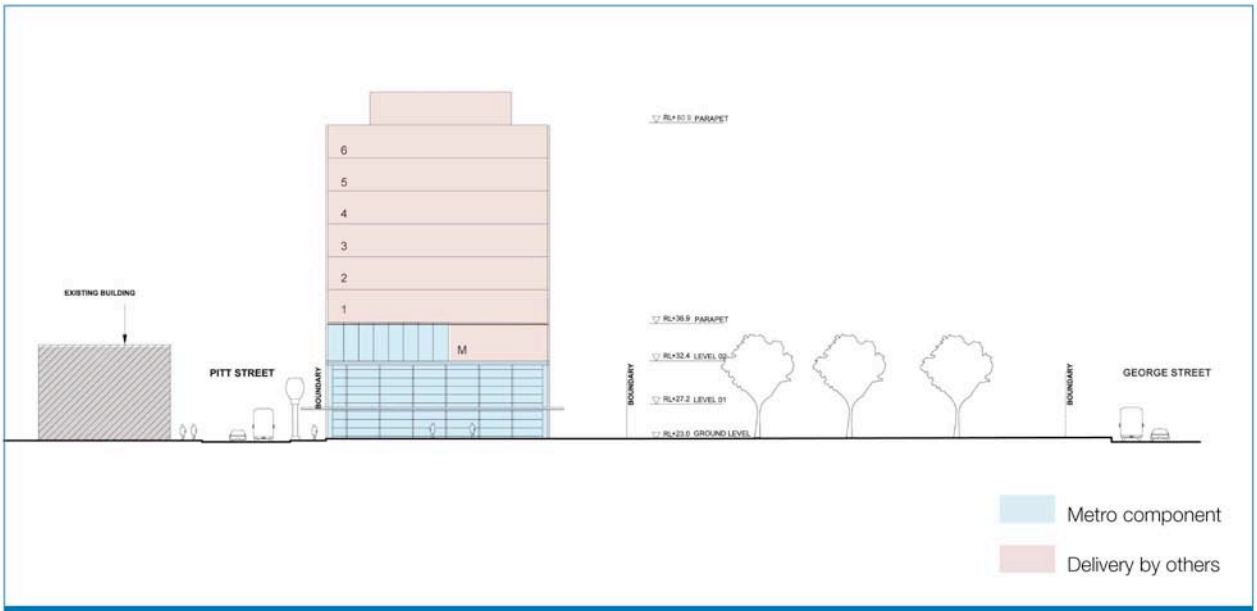


Figure 6.39 Indicative future end state at Town Hall Square Station (TH1)

Note: Project detail shown is indicative only, subject to detailed design

Figure 6.40 Artist's impression of the main entrance building to Town Hall Square Station (Park Street view)

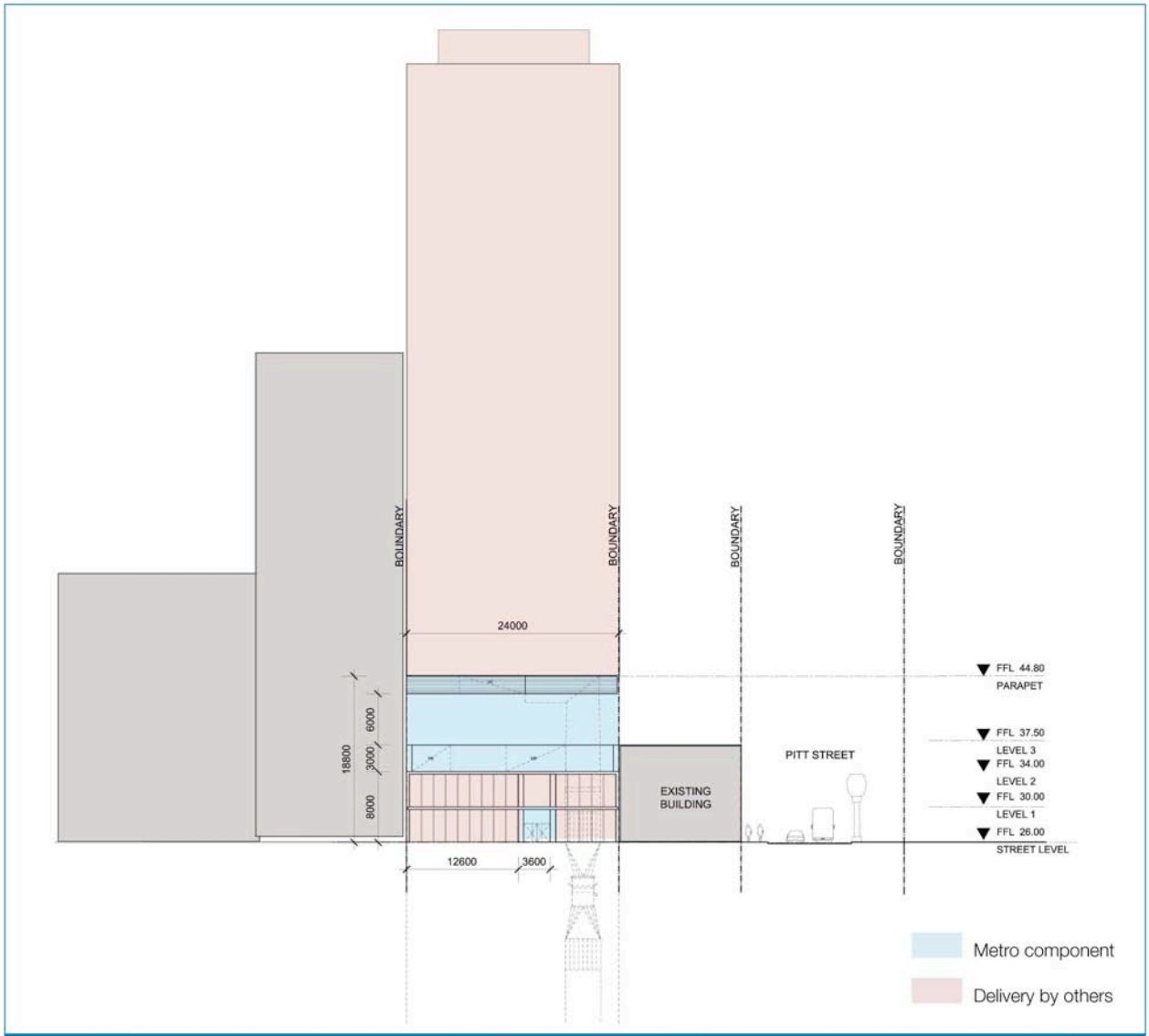


Figure 6.41 Indicative future end state at Bathurst Street Development Site (TH2)

Note: Project detail shown is indicative only, subject to detailed design

Figure 6.42 Artist's impression of the Town Hall Square Station service building at Bathurst Street

6.9.7 Martin Place Station

This site (MP2) (Figure 6.43 and Figure 6.44) lies between Castlereagh and Elizabeth streets, south of Hunter Street. When construction has been completed, there would be the potential for a future development to occur by others above the services building. This site would be subject to applicable planning controls and planning approvals. To ensure an active street frontage, interim uses would occur on the land.

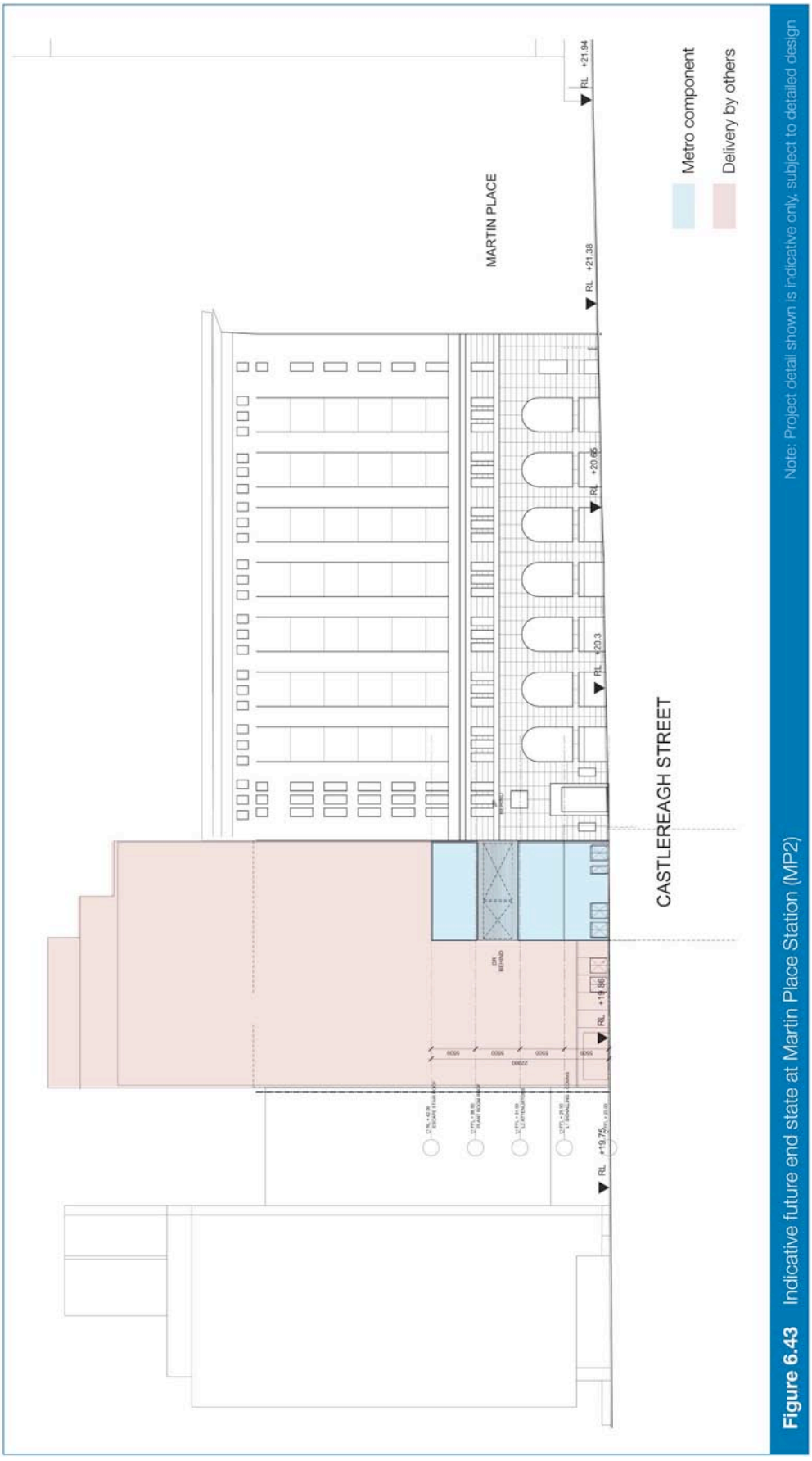


Figure 6.43 Indicative future end state at Martin Place Station (MP2)

Figure 6.44 Artist's impression of the services building on Castlereagh Street (facing north)

6.9.8 Barangaroo-Wynyard Station

Numbers 30 and 36-38 Clarence Street would be required for construction of the station and to provide services and a station entry. This site is located between York Lane and Clarence Street, adjacent to the entries into CityRail's Wynyard Station (refer Figure 6.45). To enable a similar type of commercial building, the new structure would need to be designed and constructed as part of the project in conjunction with the Metro station complex. The new building would be designed consistent with relevant planning controls, including relevant LEPs and DCPs (e.g. FSR, height and setback controls). Further approval for this development would be sought from the appropriate approval authority.

Barangaroo is a 22-hectare redevelopment site (formerly known as East Darling Harbour) located on the western apron of the CBD and close to the proposed Barangaroo-Wynyard Station. At the Barangaroo site, a direct link would be provided to the metro station. In addition, the Barangaroo Pedestrian Link would connect to the site via a bridge over Sussex Street. Development within the Barangaroo site is being coordinated by the Barangaroo Delivery Authority.

Figure 6.45 Artist's impression of the entrance to Barangaroo-Wynyard Station on Clarence Street

6.9.9 Pyrmont Station

Two sites have been identified at Pyrmont Station.

At Union Street, the development of the site would depend upon whether Alternative 1 or Alternative 2 is selected. Alternative 1 (Figure 6.46) would require the replacement of the four existing buildings, which are generally late 19th century terrace buildings, with a new building providing the station entrance and retail uses at ground level. The proposed development would be required to reflect the existing scale and definition of the streetscape heritage character, including the masonry character of Union Street and the Union Square Heritage Conservation Area. This would include the selection of materials and detailing.

Under Alternative 2, the front of the existing buildings would be maintained and these buildings would be made available for retail uses as existed before construction of the metro (refer Figure 6.47 and Figure 6.48).

The land at Mount and Miller streets, would be designed in accordance with existing planning controls and would be similar in scale and form to existing buildings in this location.

Figure 6.46 Artist's impression of the entrance to Pyrmont Station at Union Square (view of Union Square from Pyrmont Street) (Alternative 1)

Figure 6.47 Artist's impression of the entrance to Pyrmont Station at Union Square (view of Union Square from Pyrmont Street) (Alternative 2) with contemporary designed corner building

Figure 6.48 Artist's impression of the entrance to Pyrmont Station at Union Square (view of Union Square from Pyrmont Street) (Alternative 2) with historic designed corner building

6.9.10 White Bay Station

The Sydney Harbour Foreshore Authority, NSW Ports Authority and NSW Maritime have significant land holdings at White Bay, the Rozelle Rail Yards and at Rozelle Bay on James Craig Road. These holdings are collectively known as the Bays Precinct.

The NSW Government has committed to preparing a master plan for the future use of the Bays Precinct with particular emphasis on the renewal of White Bay and the former Rozelle Marshalling Yards.

Preliminary discussions have been held with the Sydney Harbour Foreshore Authority and NSW Ports Authority regarding the possible future uses of the Bays Precinct and potential impacts of the proposed metro alignment and location of a station within the precinct.

Permanent facilities associated with the CBD Metro would be designed and constructed to minimise impact on the Bays Precinct and any plans that may be developed in the future.

6.9.11 Rozelle Station

The station entry at Rozelle (R1) (Figure 6.49) is part of the Darling Street retail zone that is defined by a series of two-storey retail and mixed-use buildings.

The introduction of the metro entry into the street would respond to the urban form and activity that typifies this part of Rozelle. Active retail uses would be incorporated into the station complex on the north-west corner of Victoria Road and Darling Street, which would comprise a two-storey development consistent with the existing streetscape.

The site lies to the south of the Balmain Leagues Club. Future development of the Balmain Leagues Club site after construction of the CBD Metro would be the responsibility of the Club and subject to planning controls and local council processes.

The station entry sites R2 and R3, on the northern side of Victoria Road, would comprise small-scale retail at street level, adjacent to each station entrance. Artist's impressions of these entrance sites are provided in Chapter 19.

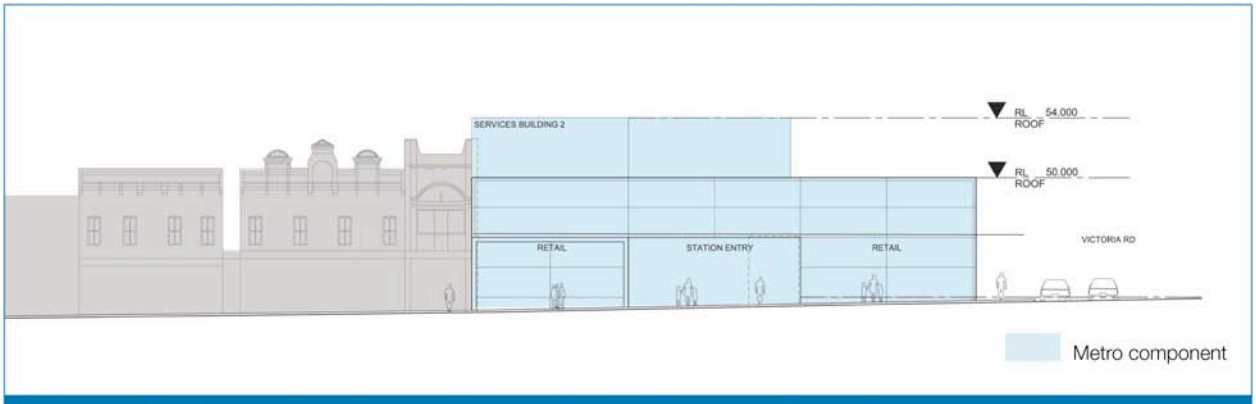


Figure 6.49 Indicative future end state at Rozelle Station (R1), corner of Darling Street and Victoria Road - view west

Note: Project detail shown is indicative only, subject to detailed design

Figure 6.1 Indicative future end state at Rozelle Station (R1), corner of Darling Street and Victoria Road – view west