Planning & Environment

STATE SIGNIFICANT INFRASTRUCTURE ASSESSMENT:
Sydney Metro City and Southwest - Chatswood to Sydenham
SSI 7400

Environmental Assessment Report under
Section 115ZA of the
Environmental Planning and Assessment Act 1979

December 2016

Cover Photograph: Crows Nest Station Transport for NSW

Published December 2016
NSW Department of Planning & Environment
www.planning.nsw.gov.au

EXECUTIVE SUMMARY

The Proposal

Transport for NSW (the Proponent) proposes to construct the Sydney Metro City and Southwest - Chatswood to Sydenham proposal (the project), which forms part of a future modern high capacity rail network, which also includes Sydney Metro Northwest (currently under construction) and the proposed Sydenham to Bankstown upgrade project.

The project is primarily an underground metro rail line, 16.5 kilometres in length, between Chatswood Station and just north of Sydenham Station. New metro stations would be provided at Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street and Waterloo; and new underground platforms at Central.

The project facilitates and responds to Sydney's forecast population and economic growth and the existing and emerging constraints on the existing rail network. At ultimate capacity, the project would provide additional capacity for more than 40,000 customers per hour through the Sydney CBD in each direction.

Stations would be designed to allow over station development, incorporating structural elements and suitable space. However, this development, including associated future uses, does not form part of this project and would be subject to the relevant assessment pathway prescribed by the *Environmental Planning and Assessment Act.1979.*

Key construction works include enabling works (such as demolition of existing buildings), dive structures and tunnel portals, tunnelling, surface earthworks and structures, bridge works, drainage, the construction of ancillary facilities and finishing works. Construction is expected to start in early 2017 and continue over about six years.

Sydney Metro would deliver the project, on behalf of Transport for NSW, with construction and operation by the private sector. The project has a capital investment value of $9.6 billion, and would provide for up to 2820 construction jobs and 150 operational jobs.

Need and Justification

The key project benefits, in conjunction with the broader Sydney Metro network, include:

- increased rail network capacity by introducing new high-capacity rail connections between the Sydney CBD and other key economic centres in Sydney. It would cater for expected increased demand for rail services and accommodate an extra 100,000 customers per hour across the Sydney CBD rail lines;
- reduced platform crowding at existing Sydney CBD rail stations. The new stations and platforms at Martin Place, Pitt Street, Central and Barangaroo would spread customers across more stations, thereby reducing crowding at Town Hall and Wynyard stations;
- improved travel times for customers; the largest travel time savings would be experienced by customers travelling from new stations (such as Crows Nest), or where the project provides a more direct route of travel (such as Victoria Cross to Martin Place);
- providing a catalyst for urban renewal, social housing and public domain improvement opportunities at and around station sites;
- increased accessibility to the broader transport network by extending the metro network under Sydney Harbour through the Sydney CBD and by increasing the number of Sydney CBD rail stations; and providing extra connectivity and interchange capacity at existing stations; and
- increased transit amenity throughout Sydney, which would facilitate increased economic productivity and land use efficiency. This would provide the opportunity for development adjacent to metro stations within existing centres, activating precincts and providing new communities around metro station locations.

The Proponent states that without the project, insufficient transport capacity would constrain Sydney's economic development and Sydney's transport network would not provide a minimum required level of service.

Assessment and Approvals Process

The proposal is State Significant Infrastructure (SSI) and has also been declared Critical State Significant Infrastructure (CSSI) because it is deemed essential for the State. The Minister for Planning is the approval authority.

The Environmental Impact Statement (EIS) was publicly exhibited from Wednesday 11 May 2016 until Monday 27 June 2016 (47 days). A total of 318 submissions were received. 301 submissions were received from individual submitters, special interest groups and businesses; five submissions from local Councils; and 12 submissions from government agencies.

Key issues raised in the submissions were associated with:

- strategic and project justification;
- traffic and transport impacts;
- noise and vibration impacts;
- non-Aboriginal heritage;
- land use and urban design; and
- social and economic impacts.

Following the exhibition period, the Department of Planning and Environment (the Department) directed the Proponent to prepare a response to the submissions. The Proponent provided a Submissions and Preferred Infrastructure Report that was published on the Department's website.

Key Assessment Issues

Noise and Vibration

Construction noise and vibration impacts reflect the scale of the project and the surrounding densely populated urban environment. Project construction is predicted to generate significant noise and vibration impacts. These impacts would generally be localised around station and ancillary facility sites, with site establishment works (enabling works, demolition and earthworks) making the most noise. To meet construction timeframes, some works would occur over 24 hours, including tunnelling and related activities.

In most locations where construction will occur, there is a range of land uses and there is no single period available that would minimise impacts to all receivers. Significant noise impacts will be experienced, even with standard mitigation applied. Implementation of a comprehensive Community Consultation Strategy would be critical to managing community expectations with regards to impacts to be experienced. Construction planning would include significant community and receiver consultation to optimise construction schedules and mitigation measures. Proposed measures include engaging place managers to provide a single interface between the community and the Project; developing a robust Community Consultation Strategy; and engaging a Community Complaints Commissioner to provide an independent review of complaints that are not resolved to the complainant's satisfaction.

The Department has adopted an innovative and localised approach to construction noise management which differs from the "business as usual", which acknowledges that much of the surface work is located in areas where land use other than residential uses predominate. Notwithstanding there are residences (mostly apartments) in those locations, such as the Sydney and North Sydney CBDs. Nonetheless, apartment buildings in these areas are

expected to have been constructed to a similar standard to commercial buildings. These constructions generally lower internal noise levels due to greater reduction by the façade. Therefore, use of internal noise levels to measure impacts to amenity is considered a more meaning approach in this instance. Extended construction hours have also been recommended in those mixed use zones (*i.e.* not predominantly residential) where higher construction, traffic and late night entertainment and leisure activity and resulting noise environment would reasonably be expected.

The Department also recommends that the Proponent engage an independent acoustic advisor to oversee:

- construction methods as they relate to managing noise and vibration;
- construction noise and vibration planning, management and mitigation;
- construction noise and vibration monitoring and reporting; and
- verification of compliance and auditing of noise and vibration management practices.

This role is considered integral to the success of construction across the Project by providing the community certainty that the issues will be optimised and effective at the local site level and not solely driven by convenience or temporal and cost imperatives.

The implementation of these mitigation measures would be described in a comprehensive noise and vibration construction management plan.

Historic Heritage

The project would have a moderate to major impact on five state listed and 15 locally listed heritage properties and precincts. Key impacts are associated with Central Station, Martin Place, and Barangaroo. The proposed Sydney Yard Access Bridge, located at Central, necessitates the demolition of the Officers' garden, Rolling Stock Officers' Building and Cleaners' Amenities Building, which have moderate to major contributions to the historic and operational workings of the precinct. In addition, the changes to the Sydney Yard would have a major indirect impact on the views, vistas and setting of Mortuary Station, the only extant mortuary rail station in NSW.

In accepting that the Proponent has designed the project to minimise heritage impacts, the Department has recommended a comprehensive suite of management measures, including the implementation of a Construction Heritage Management Plan. To ensure appropriate consideration of design matters related to heritage, the Department recommends membership of the existing Design Review Panel (DRP) be expanded to include representation from the Heritage Council. In relation to Mortuary Station, the Department recommends that the Proponent design the Sydney Yard Access Bridge to minimise its impacts, and that the final design development be considered by the DRP.

Traffic and Transport

High volumes of traffic in an already congested environment are an inevitable consequence of construction on such a large scale as that for Sydney Metro. Vehicle numbers across the various construction phases remain relatively constant, with those generated during station and systems fitout equal to, if not greater than, excavation and tunnelling. Nonetheless, construction traffic during peak periods is not expected to significantly affect existing traffic operations. To limit the construction traffic impacts on local and regional road networks, 24-hour material haulage (to and from the sites) is proposed.

Opportunities to limit trucks in the urban environment will be adopted, including barging from Barangaroo and Blues Point and development of a truck logistics and marshalling area close to the North Sydney and Sydney CBDs. Further measures to use non-road transport for removal and delivery of spoil and materials is also required to be investigated, including the

use of rail to deliver material for systems and station fitout. Traffic management measures would be developed in consultation with relevant road authorities and the RMS, and set out in Construction Traffic Management Plans specific to particular construction sites. These would be endorsed by the Sydney Coordination Office. An advantage of this approach is that the cumulative effect of this project and other significant traffic generating projects in the CBD and beyond would be central to the consideration.

Impacts to pedestrian access levels of service could deteriorate during construction and operation. This would be addressed in site specific Construction Traffic Management Plans, and for operational impacts, in Interchange Access Plans recommended by the Department. Further, the Department has recommended conditions requiring the Proponent investigate several other opportunities to increase active transport options and accessibility to stations with a new lift from High Street Millers Point to Hickson Road and reinstatement of a pedestrian and cycleway bridge connecting Nelson Street Chatswood on either side of the rail line, where the current road bridge would be demolished.

Urban Design and Visual Amenity

Hoardings will be used around sites, particularly station sites during construction to prevent access and provide some noise mitigation at ground level. The Department accepts that these are generally a functional element of construction, but that there is significant opportunity to improve the visual elements at the human level and to use these to engage the community by providing information specific to each site, including descriptions of key elements of construction, heritage interpretation and project milestones. Recommended conditions which reference this issue relate to the Community Communications Strategy and the Heritage Interpretation Plan.

Visual impacts of the project primarily relate to surface infrastructure and in particular station design, and their relationship and interaction with the surrounding public realm. Station design should provide for high quality and integrated places, having regard to local values and opportunities. To ensure design excellence and integration with and the enhancement of the public domain, the Department considers it necessary for the project to be refined in collaboration with design experts and Councils. To ensure this, Councils and other key stakeholders such as Urban Growth NSW would be invited to participate in the DRP meetings.

The Department recommends that detailed design be articulated in a Station Design and Precinct Plan. The Plan would detail the design of the station including but not limited to frontage activation; design and management of the public and private interface; and final appearance of the stations and ancillary facilities.

Land Use, Social and Economic

Construction and operation of the project would require acquisitions of a range of freehold properties. Land acquisition is an unavoidable outcome of linear transport projects in urban environments. However, this impact has been greatly reduced with most of the project being below ground. To assist in the acquisition process the Proponent would implement management measures including:

- dedicated Transport for NSW place managers;
- dedicated transaction managers;
- a help line (1800 number and email address); and
- an independent mediator.

Access to community facilities would be affected during construction of the project. Accordingly, the Department has recommended the Proponent consult with the relevant Council, community groups and key stakeholders to provide alternative access options for impacted community facilities during construction. Once operational, the project would provide

enhanced connectivity and access to services and public spaces along the route, benefiting communities, businesses and residents through improved public transport.

Project objectives adopted by the Proponent address sustainability of the project from design, through construction and ongoing operation. Specific conditions of approval are also recommended which set a performance level which reflects best practice (consistent with recognised sustainability rating tools). How this would be achieved would be set out in a Sustainability Strategy. In addition, conditions requiring opportunities in the project design to minimise operational greenhouse gas emissions are investigated and full offsetting of residual greenhouse gas emissions during operations are proposed.

Other Issues

The assessment concludes that relevant impacts of other issues such as flooding, biodiversity, land contamination, Aboriginal heritage, and air quality can be appropriately managed through the implementation of mitigation measures and safeguards, as proposed in the EIS and as recommended by the Department.

Conclusions and Recommendations

The project is a critical component to achieving the Government's land use and transport policy and objectives and would provide increased rail network capacity, improved travel times for customers, increased accessibility to the broader transport network, and increased transit amenity throughout Sydney.

The potential environmental impacts associated with the construction and operation would be acceptable subject to the implementation of appropriate mitigation measures and the Department's recommended conditions. The project would comply with the objects of the *Environmental Planning and Assessment Act (1979)* and with the principles of Ecologically Sustainable Development.

On balance, the project's benefits outweigh its potential impacts and that any residual impacts can be managed and would not result in any long-term adverse or irreversible effects, subject to the conditions that have been recommended. It is therefore in the public interest that the project proceeds.

ABBREVIATIONS

ANZECC	Australian and New Zealand Environment Conservation Council
ARI	Average Recurrence Interval
CBD	Central Business District
CSSI	Critical State Significant Infrastructure
Department	Department of Planning and Environment
DPI (Water)	Department of Primary Industries – Water
EIS	Environmental Impact Assessment
EPA	Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPL	Environment Protection Licence
ESD	Ecologically Sustainable Development
ICNG	Interim Construction Noise Guideline
INP	NSW Industrial Noise Policy
LGA	Local Government Area
LoS	Level of Service
Minister	Minister for Planning
NCA	Noise Catchment Areas
NML	Noise Management Level
OEH	NSW Office of Environment and Heritage
PMF	Probable Maximum Flood
Proponent	Transport for NSW
RNP	NSW Road Noise Policy
SEARs	Secretary's Environmental Assessment Requirements
Secretary	Secretary of the Department of Planning and Environment
SSI	State Significant Infrastructure
TBM	Tunnel Boring Machine

Table of Contents

1. BACKGROUND

The Sydney Metro City and Southwest - Chatswood to Sydenham proposal (the project) forms part of a modern high capacity rail network, which also includes Sydney Metro Northwest (currently under construction) and the proposed Sydenham to Bankstown upgrade project (**Figure 1**).

The project has been developed within the framework of the transport and planning strategies developed by the State government and provides a critical rail link between the Sydney Central Business District (CBD) and the southwest and northwest suburbs of Sydney.

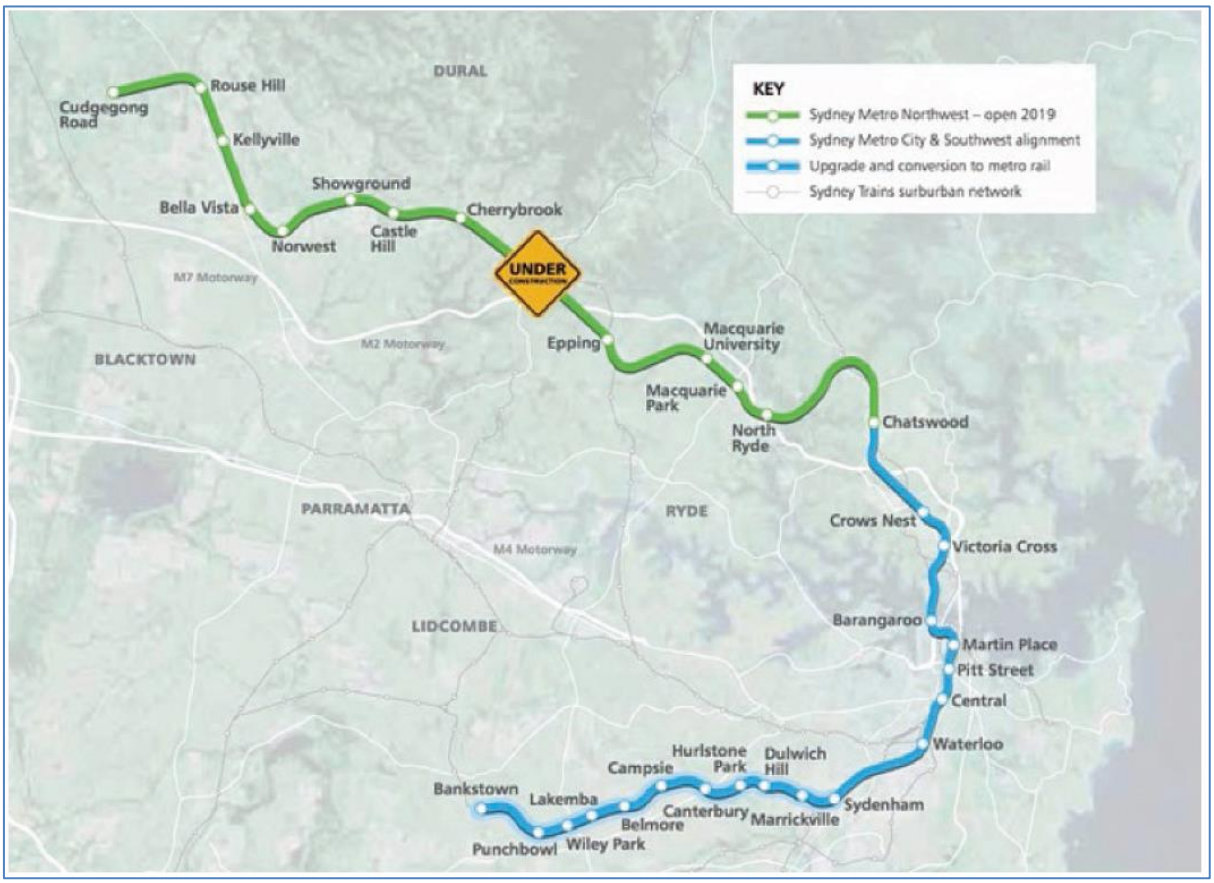

Figure 1 – Sydney Metro Alignment (Source: Sydney Metro, Business Case Summary)

Transport for New South Wales (TfNSW, the Proponent) has proposed the construction and operation of an underground metro rail line, 16.5 kilometres in length, between Chatswood Station and just north of Sydenham Station. New metro stations would be provided at Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street and Waterloo; and new underground platforms at Central.

The route and station locations (and associated construction compounds) are in an urbanised area with diverse land uses along the route alignment, including:

- predominantly residential developments with some commercial and mixed uses in the vicinity of the Chatswood dive site (northern);
- mix of residential and light industrial uses in the vicinity of the Artarmon substation;
- mixed use with some residential and commercial uses in the vicinity of Crows Nest station;

- high density commercial uses at Victoria Cross station;
- Barangaroo station proposed construction site is within the vicinity of commercial, residential and mixed use land uses;
- Martin Place and Pitt Street stations are in the vicinity of commercial land uses;
- predominantly mixed use development and residential uses surround Waterloo station (although this area would be subject to significant proposed urban renewal); and
- industrial land use with some residential uses in the vicinity of Marrickville dive site and southern service facilities.

2. PROPOSED PROJECT

2.1. Project Description

This project involves the construction and operation of a metro rail line, around 16.5 kilometres in length, between Chatswood Station and just north of Sydenham Station. The project is proposed to be integrated with the future Sydenham to Bankstown proposal. If there is a delay in this proposal the Proponent would consider alternate operating scenarios and has committed to undertaking supplementary environmental assessment and consultation; and approvals sought if required.

The proposed alignment, stations and operational ancillary infrastructure are shown in **Figure 2**. Construction of the project is expected to take six years with the project open to passengers in late 2024.

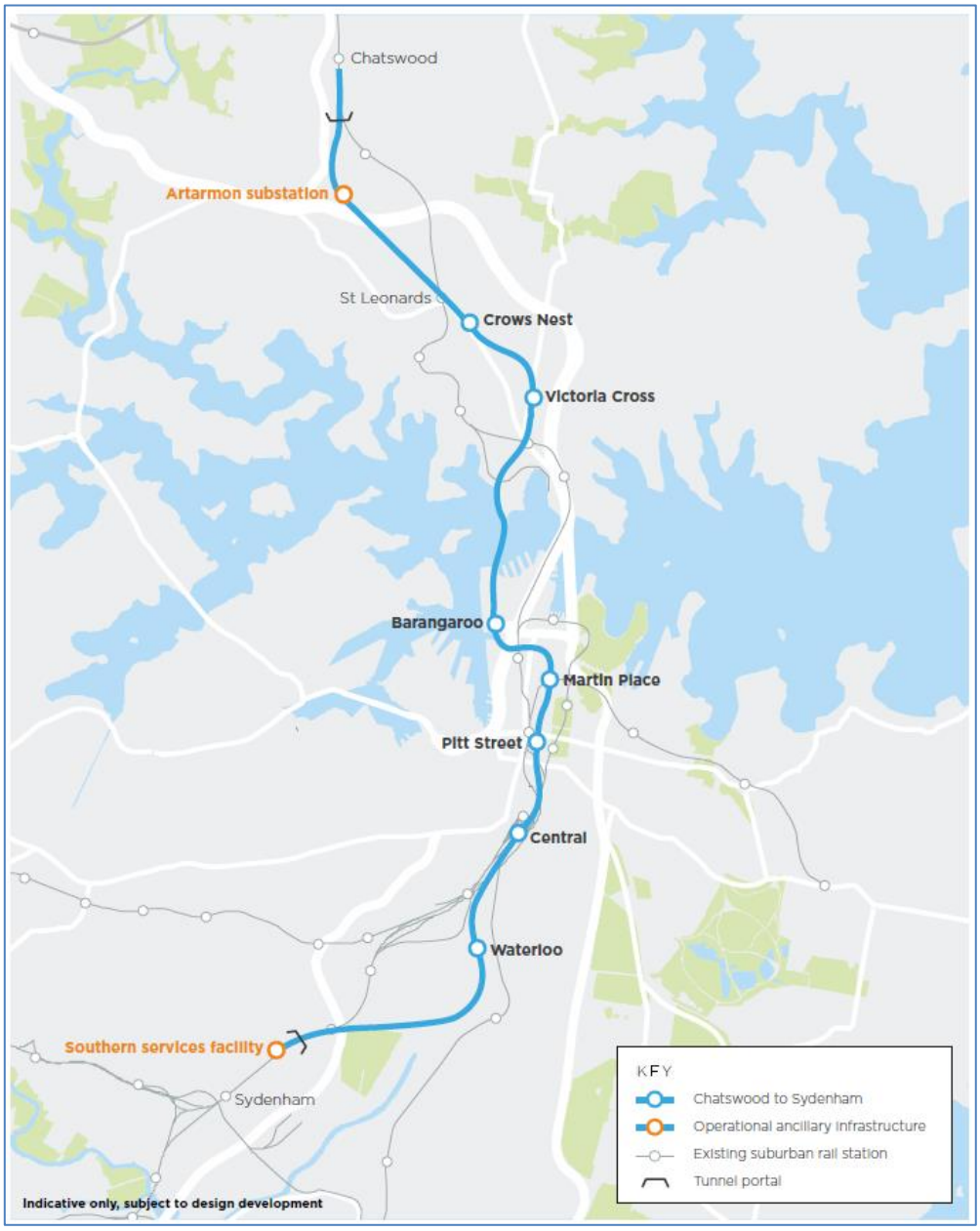

Figure 2 – **The Project** (Source: TfNSW, SPIR)

Key components and operational features of the project are described in **Table 1**.

Table 1: Key project components

Aspect	Description
Tunnels	• About 15.5 kilometres of twin rail tunnels (that is, two tunnels located side-by-side) between Mowbray Road, Chatswood and Bedwin Road, Marrickville. The tunnel corridor would extend about 30 metres either side of each tunnel centre line and around all stations
Surface Tracks	• About 250 metres of aboveground metro tracks between Chatswood Station and the northern dive structure • Realignment of T1 North Shore Line surface track within the existing rail corridor between Chatswood Station and Brand Street, Artarmon, including a new rail bridge for a section of the 'down' (northbound) track to pass over the proposed northern dive structure • Installation and modification of existing Sydney Trains rail systems including overhead wiring, signalling, access tracks / paths, rail corridor fencing and noise walls, within surface sections at the northern end of the project at Chatswood
Metro Stations	• New stations at Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street and Waterloo, new underground platforms at Central Station • Underground pedestrian links and connections to other modes of transport (such as the existing suburban rail network) and surrounding land uses
Dive structures	• A northern dive structure (about 400 metres in length) and tunnel portal south of Chatswood Station and north of Mowbray Road, Chatswood • A southern dive structure (about 400 metres in length) and tunnel portal north of Sydenham Station and south of Bedwin Road, Marrickville
Ancillary Infrastructure	• Services within each of the stations, including mechanical and fresh air ventilation equipment and electrical power substations • A permanent power supply from Pyrmont or Surry Hills to Pitt Street Station • A substation (for traction power supply) at Artarmon • A services facility (for traction power supply and an operational water treatment plant) adjacent to the southern dive structure
Bridges and Roads	• Sydney Yard Access Bridge • Permanent closure and demolition of the Nelson Street road bridge, Chatswood • Signalisation of the Mowbray Road / Hampden Road intersection at Chatswood • Modification (including protection) of the road bridge on Mowbray Road, Chatswood to accommodate the reconfigured T1 North Shore Line track • Alterations to pedestrian and traffic arrangements and public transport infrastructure around the new stations and surrounding Central Station • Signalisation of the Edinburgh Road / Edgeware Road / Bedwin Road intersection at Marrickville • Removal of the existing Sydney Trains maintenance access point from Hopetoun Avenue, Chatswood and modifications to the existing access point from Drake Street, Artarmon • Provision of a maintenance access point from Brand Street, Artarmon on the 'down' (western) side of the T1 North Shore Line • Provision of maintenance access stairs from Albert Avenue, Chatswood

A stabling facility is not proposed for this stage and the project would utilise the Rapid Transit Rail Facility being constructed at Rouse Hill. However, it is expected the Sydenham to Bankstown stage would incorporate a stabling facility. Stations would be designed to allow for over station development, including the inclusion of structural elements and suitable space (**Figure 3**). However, this development (excluding subdivision), does not form part of this project and would be subject to the relevant assessment pathway prescribed by the *Environmental Planning and Assessment Act,1979*.

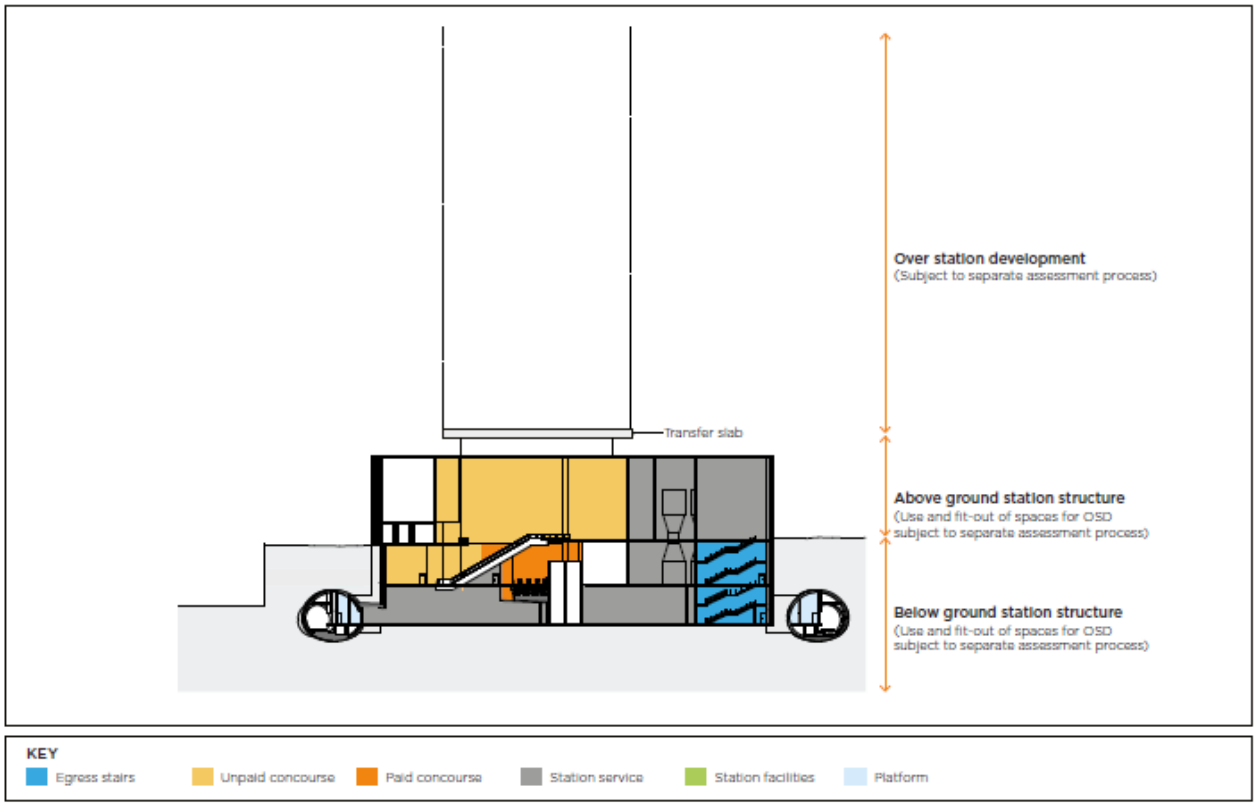

Figure 3 – Typical over station development interface (Source: TfNSW, SPIR)

2.2. Operations

Once operational the Metro would be a fully automated network with driverless single deck trains. Automated station platform screen doors along the length of the platforms would open in conjunction with the train doors increasing passenger access/egress and safety. The Metro is design to operate as a high-demand turn-up-and-go service. The trains and stations would be fully accessible, with level platforms and reduced gaps between the platforms and trains. Three Metro stations, Chatswood, Martin Place and Central have been designed to integrate with the existing heavy rail network; allowing passengers to change transport modes and connect with other public transport services.

2.3. Construction Works

A number of construction sites would be required to construct the project (**Figure 4**). These include locations for tunnel equipment and support, stations, surface tracks and ancillary features. Key construction works include enabling works (such as demolition of existing buildings), dive

structures and tunnel portals, tunnelling, surface earthworks and structures, bridge works, drainage, the construction of ancillary facilities and finishing works.

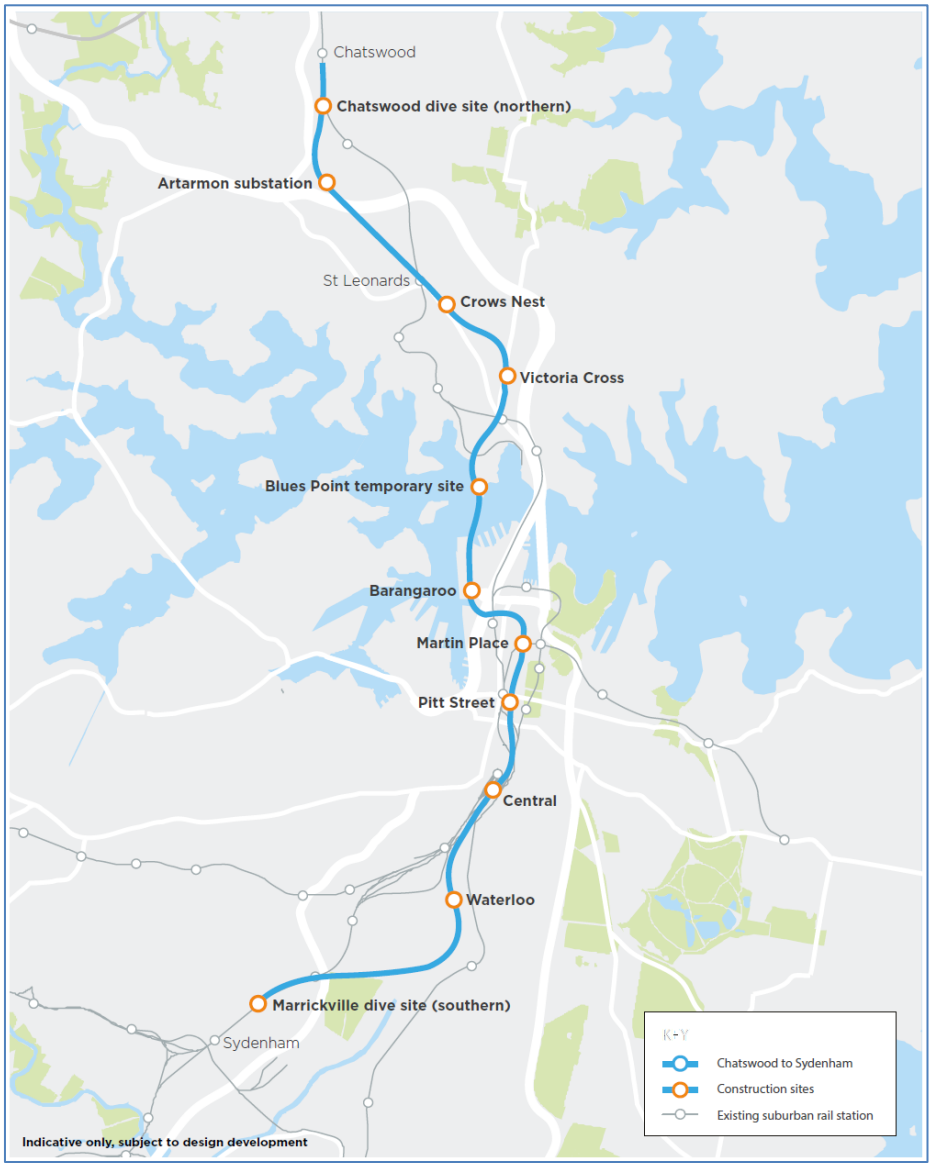

Figure 4 – Construction Sites (Source: TfNSW, EIS)

Subject to approval, construction is expected to start in early 2017 and continue over about six years. This would be followed by testing, commissioning and preparation for operation. An indicative construction program is shown in **Figure 5**.

Tunnel boring machines would be used to excavate twin tunnels about 15.5 kilometres long. The depth of the tunnels would vary from about 20 metres to 60 metres deep, due to changes in the topography and the need to cross Sydney Harbour. The shallower tunnel sections would generally be near each tunnel portal and near the cut-and-cover stations. Roadheaders would be used to excavate irregular shaped tunnels such as stub tunnels, niches and cross-passages. Roadheaders would also be used to excavate mined station caverns, underground pedestrian connections and adits.

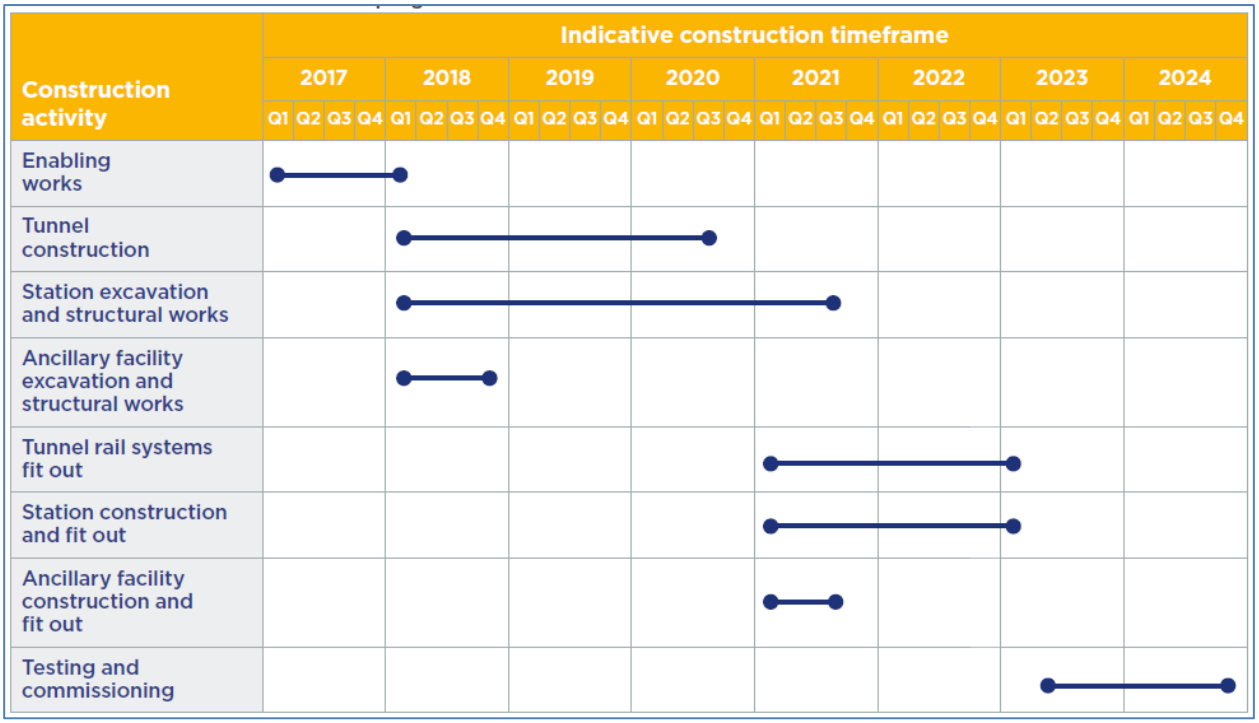

Figure 5 – Indicative construction program (Source: TfNSW, EIS)

It is anticipated that tunnelling would occur from three tunnel boring machine launch and support sites:

- at Chatswood (south of Chatswood Station and north of Mowbray Road), referred to as the Chatswood dive site (northern);
- at Marrickville (north of Sydenham Station and south of Bedwin Road), referred to as the Marrickville dive site (southern); and
- at the proposed Barangaroo Station for the crossing of Sydney Harbour (Barangaroo Station construction site).

A temporary site would also be established at Blues Point for the retrieval of the cutter head and shields of the tunnel boring machine driven from the Chatswood dive site and the Barangaroo Station construction site.

Tunnelling from the tunnel boring machine launch sites would occur concurrently, with the use of five tunnel boring machines. The tunnelling sequence is shown in **Figure 6**.

Due the expected ground conditions underneath Sydney Harbour, ground improvement work is likely to be required prior to excavation of the tunnels. Ground improvement work is likely to be carried out at the rock-sediment transition zones to reduce construction risks and allow for maintenance of the tunnel boring machine cutters prior to driving through the rock-sediment transition zones.

The preferred method of ground improvement is through jet grouting (**Figure 7**), although alternative approaches such as ground freezing may be considered during detailed design. Jet grouting involves injecting a cement grout from barges via a crane and drilling lead. Three barges would be used for these works. One barge would be used to carry out the grout works which would generally remain in the harbour for the duration of the works. The other two barges would be used to transport grout to and spoil from the works area to an on-shore facility. Tug boats would move the barges and small boats would transport construction workers. Open shipping channels would be maintained during ground improvement work, in consultation with the Port Authority of NSW, Roads and Maritime Services and Sydney Ferries.

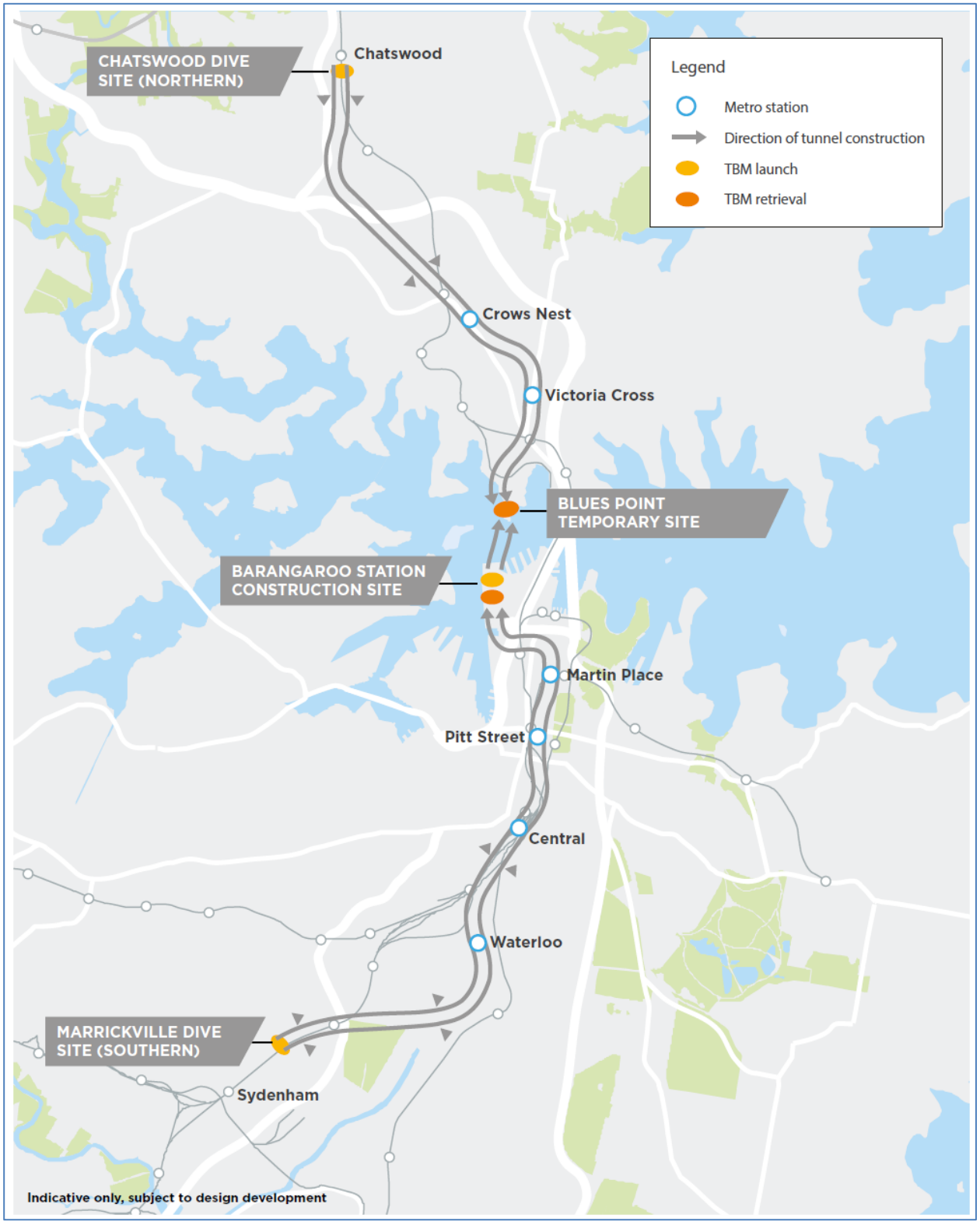

Figure 6 – Indicative tunnelling sequence (Source: TfNSW, EIS)

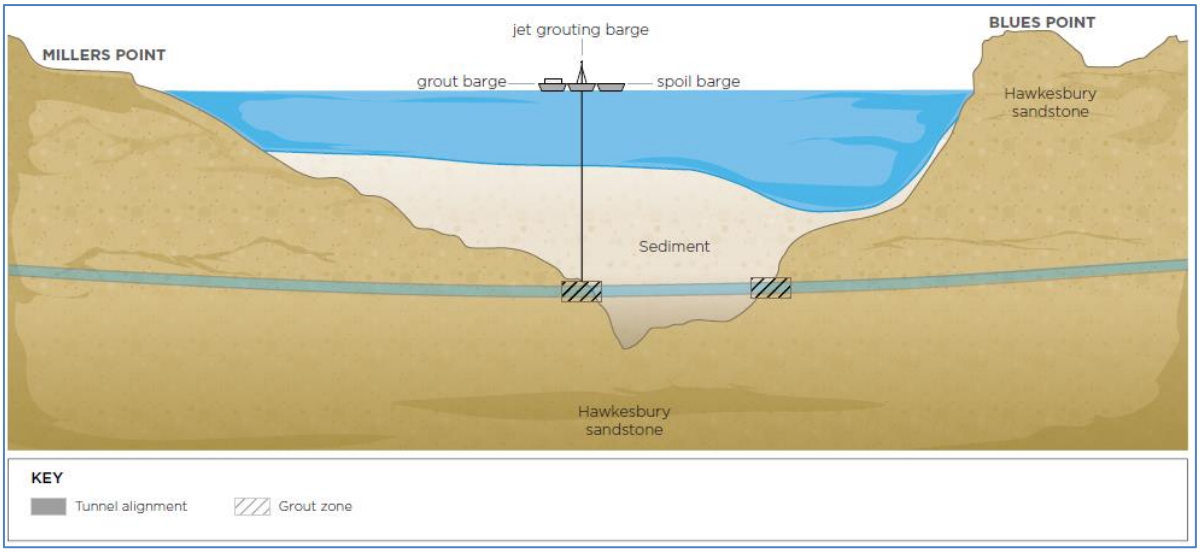

Figure 7 – Ground improvement work process (Source: TfNSW, EIS)

Based on the concept design, it is envisaged that excavation would generate about 2.4 million cubic metres of spoil. The expected volumes for each construction site are shown in **Figure 8**. This spoil is proposed to be moved by truck; however, the Proponent is further investigating barge options from Barangaroo.

2.4. Project Need and Justification

The project facilitates and responds to Sydney's forecast population and economic growth and the existing and emerging constraints on the existing rail network. At ultimate capacity, the project would provide additional capacity for more than 40,000 customers per hour through the Sydney CBD in each direction. The project would also improve the capacity, reliability and efficiency of the existing transport system, by relieving the pressure on existing rail lines, Sydney CBD train stations, Sydney CBD, North Sydney and Sydney South bus routes, and the Sydney CBD road network.

The project has been endorsed by the NSW Government by being a key component of the *Sydney's Rail Future: Modernising Sydney's Trains*. This plan facilitates the transformation and modernisation of Sydney's rail network based on a three tier system, of which this project is a Tier 1 - Metro: 'turn up and go service' service with single deck metro trains. The Department notes that the project forms part of the integrated transport plan presented in the *NSW Long Term Transport Master Plan.*

The project is consistent with NSW strategic planning policy and framework, including:

- *A Plan for Growing Sydney;*
- *Rebuilding NSW: State Infrastructure Strategy 2014*; and
- A range of priorities identified in the draft District Plans (Central and North).

Within this context a range of alignment and station locations were considered, including stations at the University of Sydney and at Waterloo. The Department acknowledges the land use, network, engineering, and environmental attributes and constraints associated with these issues and has considered the implications of these constraints in its assessment of the project. This includes the consideration of an additional station between Waterloo and St Peters.

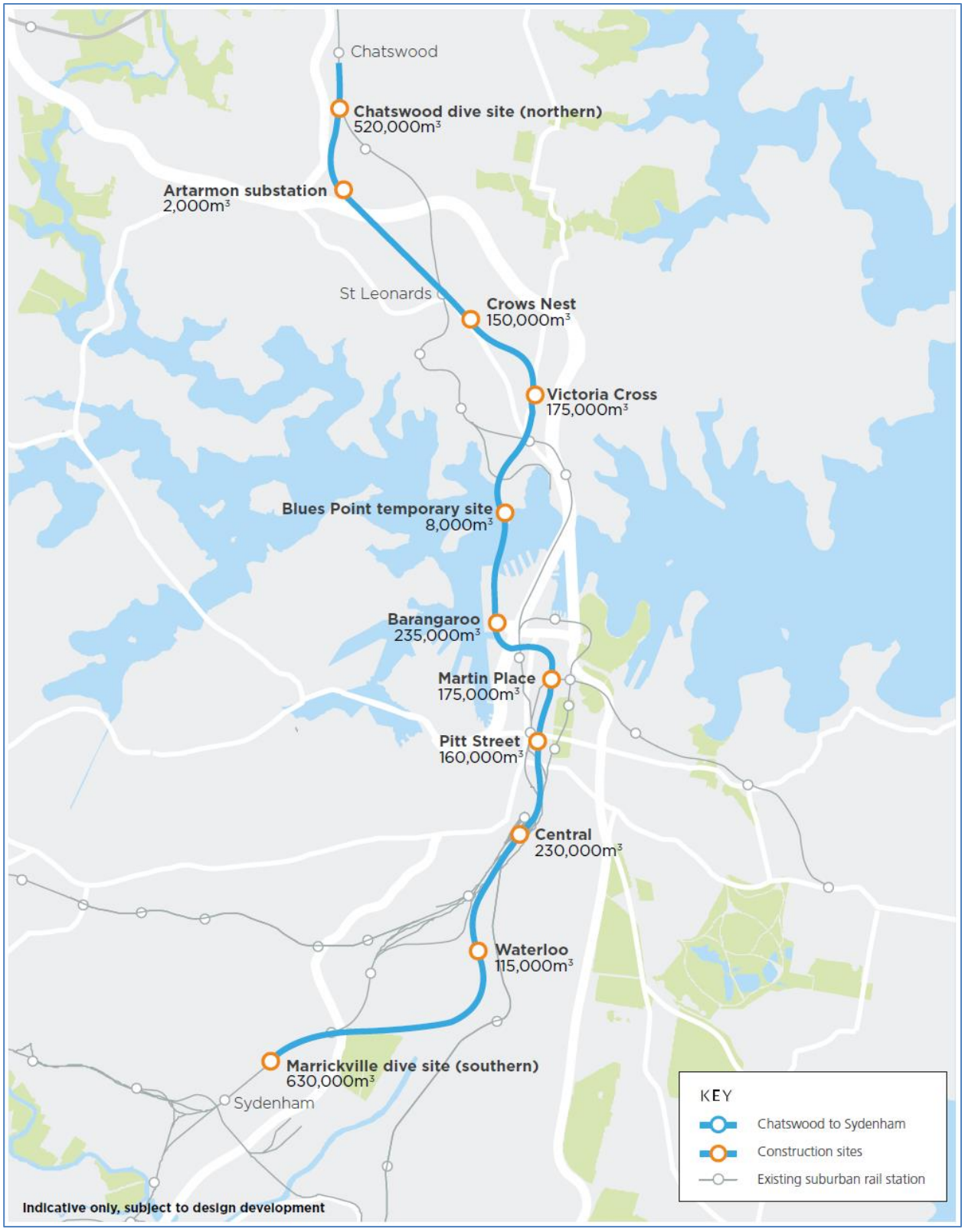

Figure 8 – Indicative spoil generation volumes (Source: TfNSW, EIS)

The key project benefits, in conjunction with the broader Sydney Metro network, include:

- increased rail network capacity by introducing new high-capacity rail connections between the Sydney CBD and other key economic centres in Sydney. It would cater for expected increased demand for rail services and accommodate an extra 80,000 customers per hour across the Sydney CBD rail lines;
- reduced platform crowding at existing Sydney CBD rail stations. The new stations and platforms at Martin Place, Pitt Street, Central and Barangaroo would spread customers across more stations, thereby reducing crowding at Town Hall and Wynyard stations;
- improved travel times for customers; the largest travel time savings would be experienced by customers travelling from new stations (such as Crows Nest), or where the project provides a more direct route of travel (such as Victoria Cross to Martin Place);
- providing a catalyst for urban renewal, social housing and public domain improvement opportunities at and around station sites;
- increased accessibility to the broader transport network by extending the metro network under Sydney Harbour through the Sydney CBD and by increasing the number of Sydney CBD rail stations; and providing extra connectivity and interchange capacity at existing stations; and
- increased transit amenity throughout Sydney, which would facilitate increased economic productivity and land use efficiency. This would provide the opportunity for development adjacent to metro stations within existing centres, activating precincts and providing new communities around metro station locations.

The Proponent states that without the project, insufficient transport capacity would constrain Sydney's economic development and Sydney's transport network would not provide a minimum required level of service.

As noted, the project forms part of the broader Sydney Metro network and the identified benefits would be maximised with the implementation of this network. Whilst the Sydenham to Bankstown application has not been received or assessed, the Department is satisfied that the Chatswood to Sydenham project could operate independently with the inclusion of an additional track-turnback between the Marrickville dive structure and Sydenham Station. In this event, the Proponent has committed to undertaking supplementary environmental assessment and consultation. Relevant approvals would be sought, where required, before this component being constructed. This assessment does not pre-empt the Department's consideration of any future application for Sydenham to Bankstown.

3. STATUTORY CONTEXT

3.1. State Significant Infrastructure

The project is Critical State significant infrastructure (SSI) pursuant to section 115V of the *Environmental Planning and Assessment Act, 1979* (EP&A Act). The Minister for Planning is the approval authority for the project.

3.2. Permissibility

The proposal is for the purpose of a rail infrastructure facility and is characterised as development permitted without consent, in accordance with clause 79 of *State Environmental Planning Policy (Infrastructure) 2007*.

3.3. Environmental Planning Instruments

In accordance with Section 115ZF(2) of the EP&A Act, the only environmental planning instruments that apply to the proposal are *State Environmental Planning Policy (Infrastructure) 2007* (insofar as it relates to the declaration of development that does not require consent) and *State Environmental Planning Policy (State and Regional Development) 2011* (as it pertains to the declaration of infrastructure as SSI. There are no other environmental planning instruments that substantially govern the carrying out of the project.

3.4. Objects of the Environmental Planning and Assessment Act 1979

The determination must have regard to the objects of the EP&A Act, as set out in **Section 5**. The Department has given consideration to the objects of the EP&A Act including:

- how the proposal would impact on the management, development and conservation of the area, including in relation to heritage, traffic, noise and vibration, water hydrology, biodiversity, urban design, amenity and socioeconomic issues (see **Section 5** and **6**);
- the justification of the proposal in terms of the orderly and economic use and development of land, and how it would affect traffic and access (see **Section 5**);
- protection of the environment by assessing the effectiveness of proposed environmental management and mitigation measures (see **Sections 5** and **6**);
- the principles of ecologically sustainable development (see **Section 3.5**); and
- public involvement and participation in the assessment of the proposal (see **Section 4**).

3.5. Ecologically Sustainable Development (ESD)

The EP&A Act adopts the definition of ESD found in the *Protection of the Environment Administration Act 1991*. Section 6(2) of that Act states that ESD requires the effective integration of economic and environmental consideration in decision-making process and that ESD be achieved through the implementation of:

a) the precautionary principle;
b) inter-generational equity;
c) conservation of biological diversity and ecological integrity; and
d) improved valuation, pricing and incentive mechanisms.

Project objectives which guide the delivery and operation of the proposal would contribute to the sustainability of the project and the meeting of ESD principles. In addition to the objectives, the Proponent has addressed the above principles directly in the EIS and has identified a broad range of mitigation measures to manage impacts associated with these issues.

The Department has also recommended conditions of approval requiring:

- the Project achieve a best practice level of performance for the CSSI using market leading sustainability ratings tools, such as ISCA and Greenstar;
- the preparation of a Sustainability Strategy that will be implemented throughout the design, construction and operation of the project. The Strategy will identify opportunities to reduce operational greenhouse emissions and other sustainability initiatives;
- the Proponent to fully offset greenhouse gas emissions associated with the consumption of electricity during operation of the project.

The precautionary principle is applied throughout the EIS and the Department considers the assessment and the range of mitigation measures adequately adopt the principle. The Department is also satisfied that the valuation and pricing of the environmental resources associated with the project have been adequately undertaken and internalised through the project design and mitigation measures.

4. CONSULTATION AND SUBMISSIONS

4.1 Exhibition

Under Section 115Z(3) of the EP&A Act, the Department is required to make the EIS publicly available for a minimum period of 30 days. The Department exhibited the EIS (**Appendix A**) from Wednesday 11 May 2016 until Monday 27 June 2016 (a total of 41 days). The EIS was published on the Department's website, and also made available for viewing at the following locations:

- Department of Planning & Environment, Information Centre, Sydney;
- Willoughby Council: Council Chambers, Level 4, 31 Victor Street Chatswood;
- Chatswood Library: Lower Ground, The Concourse, 409 Victoria Avenue, Chatswood;
- Artarmon Library: 139 Artarmon Road, Artarmon;
- Lane Cove Council: Council Civic Centre, 48 Longueville Rd, Lane Cove;
- North Sydney Council: 200 Miller Street, North Sydney;
- Stanton Library: 234 Miller Street, North Sydney;
- Crows Nest Centre: 2 Ernest Place, Crows Nest;
- City of Sydney: Council Chambers, Town Hall House, Level 2, 456 Kent Street, Sydney;
- State Library: Macquarie Street, Sydney;
- Haymarket Library: 744 George Street, Sydney;
- Waterloo Library: Waterloo Town Hall, 770 Elizabeth Street, Waterloo;
- the then Marrickville Council: Administrative Centre, 2 Fisher Street, Petersham;
- Marrickville Library: Marrickville Town Hall, Corner Marrickville and Petersham Roads, Marrickville; and
- Nature Conservation Council of NSW: Level 2, 5 Wilson Street, Newtown.

The Department advertised the public exhibition in the Sydney Morning Herald, Daily Telegraph, The Australian, Inner West Courier, Central Sydney, North Shore Times and the Mosman Daily. The Department also notified State and relevant local government authorities of the exhibition in writing.

A total of 318 submissions were received. 301 submissions were received from individual submitters, special interest groups and businesses; five submissions from local Councils; and 12 submissions from government agencies. A summary of the key issues raised in the submissions follows. A full copy of all submissions can be found at **Appendix C**.

4.2 Submissions from the Public and Special Interest Groups

There was a diverse range of issues raised from members of the public, businesses operating in the local area, and special interest groups. The main issues raised in the submissions are summarised below. Key issues raised are further assessed in **Chapter 5.**

<u>Strategic</u>

- There is a lack of consideration of alternatives;
- Concern that the claimed increases in capacity won't eventuate and that the metro would negatively affect the services on other lines;
- The metro should integrate with the current heavy rail network with tracks built on the Western and Illawarra lines;
- Requests for additional stations including new stations at Gore Hill, Lane Cove, Sydney Opera House, between Central and Sydenham, Danks Street and Crystal Street Waterloo, Alexandria and St Peters and on the airport line;
- The alignment should include a route through to Sydney University, and that stations at Crows Nest and Waterloo should be relocated;

- The substation at Artarmon should be moved to an industrial area;
- A different dive option at Chatswood should be pursued;
- The location of maintenance facilities has not been provided; and
- Concerns about driverless trains and seating arrangements.

Traffic and Transport

- Objection and comment on the modification to the Mowbray Road and Pacific Highway intersection, new traffic lights at Hampden Road and Mowbray Road and the removal of Nelson Street Bridge;
- Concern about construction traffic impacts including cumulative construction traffic impacts and the preference for the use of barges over trucks;
- Concern about the loss of parking, impacts to pedestrian and bicycle connectivity and changes to bus stops;
- Concern that congestion at Sydenham station would be exacerbated;
- Concern that the transport modelling is inadequate;
- Requests for a separated bike path connecting the stations and bike parking;
- Comments on connectivity of stations and underground tunnels; and
- Concern about impacts to other rail services including those at Erskineville and St Peters.

Noise and Vibration Impacts

- Concern about construction and operation noise and vibration impacts to sensitive receivers including educational facilities, recording studios, theatres and residents and construction traffic;
- Concern about the proposed construction hours and duration of construction;
- Alternative alignments of the tunnel should be considered to reduce construction and operation noise and vibration impacts to receivers above the tunnel;
- Concern that construction could cause structural damage and requests for building surveys prior to construction;
- Comments on noise attenuation proposed including requests for architectural treatment.

Land use, social and economic considerations

- Concerns about impacts to property values and rental incomes;
- Requests for buildings to be leased or acquired;
- Concern about impacts to sensitive businesses from construction including recording studios, medical and educational facilities, food preparation businesses and hotels;
- Incorrect identification of sensitive receivers in the EIS;
- Concern about impacts from the removal of local businesses including Crows Nest Post Office;
- Concern about impacts from rezoning of land and future over station development; and
- Requests for further information and concern about restrictions to basement excavations for properties located above the Project.

Urban Design

- Objection to the removal of buildings around Martin Place and concern that the proposed building is not in keeping with the architectural period of other buildings in this area;
- Concern about tree removal;
- Comments about landscaping options, impacts to the Tom Bass Sculpture, the park at Blues Point and noise barriers.

Heritage

- Concern about impacts to and removal of heritage listed buildings and archaeology;
- Request for heritage buildings to be relocated;

- Request for the Mowbray Road heritage precinct to be protected;
- Objection to the proposed bridge into Sydney yard; and
- Comment that new stations should incorporate Aboriginal and non- Aboriginal heritage.

Other issues raised include flooding, biodiversity, air pollution, consultation and concerns about conflicts of interest with developers.

4.3 State Government Agency Submissions

The following summarises the key issues raised in the State government agency submissions.

The **Environment Protection Authority's** (EPA) submission addressed issues relating to construction noise, vibration, blasting criteria, alternative work methods and groundwater. The Authority noted that the project can be built to comply with operational noise criteria and recommended conditions of approval for consideration.

Land and Housing Corporation and **UrbanGrowth NSW's** submission addressed issues relating to construction noise impacts as a concern for residents of the Waterloo social housing estate, planning around Waterloo Station and coordination of construction staging with their rehousing strategy to minimise potential impacts to residents.

The **Heritage Council of NSW's** submission agreed with the merits of the proposal and its public transport benefit. The Council raised concerns about the level of information provided in the EIS, how impacts would be mitigated and commented on the archaeological assessment.

The **Port Authority of NSW's** submission addressed issues relating to impacts to shipping channels in Sydney Harbour, construction traffic and noise and vibration impacts and commented on the Harbour Master approvals required.

The **Office of Environment and Heritage** commented on floodplain management at Marrickville, biodiversity and Aboriginal cultural heritage.

Fire and Rescue NSW commented on the emergency support services, the design of the rolling stock and compliance of Stations and ancillary buildings with the National Construction Code.

Sydney Harbour Foreshore Authority commented on the need for ongoing consultation with stakeholders affected during construction.

Sydney Water commented on the need to protect and monitor Sydney Water assets during construction and operation and on the requirements under the Protection of the Environment Operations Act 1997.

Department of Primary Industries' submission addressed issues related to water quality, activities on waterfront land, groundwater and consultation.

4.4 Local Government Submissions

The **City of Sydney** broadly supports the Project and recommended the inclusion of an additional station between Waterloo and Sydenham and noted its interest in ensuring a superior transport and connectivity outcome with superior public domain and social outcomes. The City also commented on stakeholder and community engagement, construction traffic, noise and vibration, land use, public domain, property and business impacts, heritage, landscape and visual impacts,

groundwater and geology, soils and contamination, biodiversity, flooding, air quality, hazard and risk, waste management, sustainability, cumulative impacts and environmental mitigation measures and performance outcomes.

The **Inner West Council** supports the Project and commented on the strategic context including the coordination of the Project with the NSW Government's Sydenham to Bankstown Urban Renewal Corridor Strategy, zoning of the Marrickville dive site and recommends an additional station between Waterloo and Sydenham. The Council also commented on the cumulative impacts, heritage, flooding, traffic and transport and construction impacts.

Lane Cove Council commented on the Pacific Highway and Mowbray Road intersection and the new Crows Nest Station. Council also commented on cumulative construction and traffic impacts and recognised the opportunity for better integration with Council's planning for St Leonards.

North Sydney Council commented on pedestrian safety, amenity and access, active and public transport, traffic, construction impacts, over station development, land use, property and business impacts. Council also requested ongoing consultation and community engagement.

Willoughby City Council supports the Project and commented on stakeholder engagement, adjustments to the T1 North Shore Line, construction impacts, widening of the Pacific Highway, closure of Nelson Street bridge, noise walls, Artarmon substation, track maintenance access points and the weekend closure of Frank Channon Walkway.

4.5 Proponent's Response to Submissions

Following completion of the formal exhibition period, the Department directed the Proponent to prepare a response to the submissions received. The Proponent's consideration of submissions led to a number of changes to the Project. Consequently, a Preferred Infrastructure Report was prepared and included with the Submissions Report (refer **Appendix C**). The changes to the project design included:

- changes to the construction methodology for the retaining wall beside the track at Chatswood resulting in Frank Channon Walk being reconstructed and closed for a longer period of time;
- removal of the intersection works at Mowbray Road and the Pacific Highway from the Project;
- design changes at Central Station including the:
    - removal of the proposed temporary pedestrian bridge;
    - an additional construction site to support the construction of the Sydney Yard Access Bridge within the Sydney Yard area just beyond the Regent Street access;
    - changes to improve pedestrian circulation at the northern concourse resulting in platforms 9 to 14 being lengthened;
    - consolidation of operational metro infrastructure from the Eddy Avenue forecourt to the southern side of the Central Electric Building;
- removal of rock breaking at night, except at Central.

The Proponent also provided further detail on the following aspects of the project including:

- the track cross-over located north of Barangaroo Station;
- consideration of barging of spoil from Barangaroo;
- the potential for an underground pedestrian link between Martin Place Station and O'Connell Street;
- revised footprint at Waterloo station;
- additional heritage investigations;
- refinement of the operational maintenance access at Chatswood;

- consideration of barging of tunnel boring machine components from Blues Point;
- additional information on the over station development and its relationship with this project;
- design principles for the Sydney Yard Access Bridge; and
- clarification of noise receiver types.

Four State government agencies and three local government councils provided comments on the Submissions and Preferred Infrastructure Report. The State Government agencies and councils reiterated a number of the issues raised in their original submissions as well as recommending conditions should the project be approved. The residual issues raised by the State Government agencies have been considered by the Department in its assessment and are addressed in **Chapter 5** and the recommendations integrated into the recommended instrument of approval, as appropriate. The new or residual issues raised by agencies and councils include the following:

The **Office of Environment and Heritage** noted the changes to flood risk management at the Marrickville tunnel portal.

The **Heritage Council of NSW** requested to be involved in minimising the heritage impacts and raised concern that comments raised in their previous submission were not fully considered or resolved. The Council provided further detailed comments on the heritage impacts including concern at:

- the significant work required to mitigate heritage impacts particularly at Martin Place, Barangaroo and the Central Railway heritage precinct;
- the lack of detailed design figures and sketches to illustrate new station and platform designs;
- the accuracy of the archaeological heritage assessment; and
- the scale of intervention at Central, specifically in regard to the Sydney Yard Access Bridge.

The Heritage Council also expressed a view that the Barangaroo station and ancillary components should be housed within the Barangaroo developments in order to minimise visual impacts on the Hungry Mile that forms a significant part of the Millers Point and Dawes Point Village Precinct. The Council also provided recommended conditions of approval to manage heritage impacts.

The **Environment Protection Authority** provided further detailed comments on noise and vibration, water and air quality impacts. The Authority noted the need for effective communication with the affected community, clear justification for works outside of standard construction hours, early erection of temporary and operational noise barriers, minimisation of traffic movements particularly at night time and the need to assess the potential noise and vibration impacts from blasting. The Authority recommended conditions of approval.

The **Department of Primary Industries** requested to be consulted and provided further comment on geotechnical/groundwater modelling, water licencing and activities on waterfront land.

The **City of Sydney Council** reiterated its support for the Project, its desire to work collaboratively and key issues raised in its previous submission. The Council recommended a number of conditions to address areas of concern including lack of Council's representation on the Design Review Panel, consideration of Council's Plans and an additional station between Waterloo and Sydenham, pedestrian movements, station entrances, cycleways, and heritage impacts.

Inner West Council reiterated concern and provided further comment on flooding impacts of the project at Marrickville. The Council also commented on cumulative impacts of construction traffic, a new Station at Alexandria, future services at St Peters and Erskineville Stations and heritage impacts to the Sydenham Drainage Pit and Pumping Station. The Council also requested to be invited to be on the Design Review Panel.

North Sydney Council provided further comment on the use of barges, traffic and transport including integration with other transport projects, heritage impacts to Crows Nest Post Office, acquisition of 105 Miller Street, the optimal timing for blasting and over station development. The Council requests that conditions include continued consultation with Council as relevant.

In finalising its assessment, the Department offered to meet with agencies and councils and those parties that made representations on the Preferred Infrastructure Report. As part of this process the Department met with:

- City of Sydney Council,
- North Sydney Council,
- Roads and Maritime Services, and
- Environment Protection Authority.

The Department has considered the issues raised in all submissions in its assessment of the project as detailed in **Chapter 5.**

5. ASSESSMENT

5.1. Noise and Vibration

Issue

The existing noise environment varies with land use along the project corridor and includes contributions from road traffic, suburban rail line and stations, industrial activities, maritime traffic, aircraft noise and other construction activities.

Construction would be extensive and long-term, offset by most of the impacts being localised around key above ground construction sites. Receivers near surface construction sites would experience:

- air borne noise that exceed noise management level goals up to and in excess of 20 dB during the day (up to and exceeding 95 dBA) and night (up to and exceeding 72 dBA), for extended periods of time;
- ground-borne noise levels greater than 75 dBA during the day that would exceed the human comfort vibration criteria; and
- vibration that exceeds the criteria for minor cosmetic damage at 21 buildings.

Receivers would experience ground-borne noise levels greater than 35 dBA from tunnel construction at various distances depending on the machinery in use.

5.1.1 Construction hours

Underground construction and support activities, listed in **Table 2**, would occur up to 24 hours a day, seven days a week. Other activities generally defined as surface works including demolition, site establishment, surface construction, track works and tunnel borer retrieval events at Blues Point would occur during standard construction hours (Monday to Friday 7 am to 6 pm and Saturday 8 am to 1 pm).

Table 2: Out of hours works

Construction hours	Activity
24 hours per day, seven days per week	• Tunnelling • Activities supporting tunnelling • Underground excavation at station and ancillary sites • Tunnel and station fit out (underground) • Above ground activities that support underground construction • Construction traffic for material supply to, and spoil removal from, tunnelling and underground excavation (station and ancillary facility sites) including night time barge movements for spoil removal and deliveries
7am – 10pm 24 hours per day, seven days per week unless no exceedance of the Noise Management Level	• Rock hammering and road headers within the tunnel
Saturday 1pm – 5pm Sunday 8am – 5pm	• Non-disruptive preparatory work, repairs or maintenance

Construction hours	Activity
Carried out during periods anticipated to have the least impact on receivers, when required	• Drilling and blasting
Carried out when required up to 24 hours per day, seven days per week	• Activities requiring temporary possession of roads or rail or to accommodate road and rail network requirements. • Work determined to comply with the relevant noise management level at the nearest sensitive receiver • The delivery of materials outside approved hours as required by the NSW Police or other authorities (including Roads and Maritime) for safety reasons • Emergency situations where it is required to avoid the loss of lives and property and / or to prevent environmental harm • Situations where agreement is reached with affected receivers.

5.1.2 Airborne noise

Noise Management Levels (NMLs) were calculated in accordance with the *Interim Construction Noise Guideline* (ICNG, Department of Environment and Climate Change, 2009). Residential receivers and other sensitive receivers have been grouped together into receiver areas or 'catchments', which comprise those receivers which would experience a similar level of construction noise. Each receiver area includes multiple receiver categories including residential, commercial, recreational, religious, educational and industrial receivers. There are 68 receiver areas across the project.

Construction NMLs would be exceeded during a worst case day and night time construction scenario at many receiver areas. **Table 3** shows the number of receiver categories that will exceed the predicted NML across the project for any given activity and time period. While some exceedances are considered minor (less than 10 dB above the NML) others are up to and in excess of 20 dB of the NML during the day and night time.

Table 3: Number of receiver category1 with exceedance of the NML

Activity	Estimated duration of activity at any construction site	Total number of Receiver Categories[1] with exceedances of the NML	
		Day[2]	Out of Standard working hours[3]
Enabling Works /Demolition	1 month - 1.5 years	114	-
Earthworks	1 - 12 months	101	-
Acoustic Shed construction	1 month	37	-
Excavation (within acoustic shed), or tunnelling	12 months - 3.5 years	36	24
Construction and/or fit out	12 months - 1.5 years	65	14
Surface Track works	1 - 4.5 years	14	-
Site reinstatement	6 months	6	-
Grout barge	1 year	-	1

1 For each construction site, each receiver category the noise levels are predicted at the most noise-exposed location, which would usually be the closest receiver.
2 Day – Standard construction hours (Monday to Friday 7am to 6pm and Saturday 8am to 1pm)
3 OOH – Out of Hours – all other times.

5.1.3 Construction traffic noise and sleep disturbance

Traffic noise increases more than 2 dB above the existing road traffic noise are anticipated as follows:

- a 2.4 dB increase during the night time period at May St, Marrickville;
- a 3.8 dB increase during the night time period at O'Connell Street, Martin Place; and
- a 2.9 dB increase during the day and a 7.9dB increase during the night time period Wellington Street, Waterloo.

Exceedances due to night-time construction traffic would be addressed at Chatswood, Crows Nest and Victoria Cross by adopting alternative routes to avoid residential areas. The sleep disturbance impacts predicted near the O'Connell Street would be similar to levels currently experienced when heavy vehicles use the street.

Exceedance of the sleep disturbance management level (greater than 65dB) by up to 10 dB from construction and/or construction traffic is predicted at receiver areas in Chatswood, Crows Nest, Martin Place, Central and Waterloo even with an acoustic shed. The proposed management response is through implementation of mitigation measures such as avoiding the simultaneous use of multiple noisy plant and scheduling noisy activities for less sensitive time periods.

5.1.4 Ground-borne noise – excluding tunnelling and within tunnel construction

Day time ground borne noise levels are predicted to exceed the NMLs up to and in excess of 25 dB at 131 receivers with 65 of these locations being residential.

Ground-borne noise levels adjacent to construction sites at Pitt Street, Martin Place, Barangaroo, Victoria Cross, Crows Nest and Central are predicted to be in excess of 75 dB for a range of residential, commercial and educational facilities during daytime construction activities such as rock breaking and piling.

5.1.5 Ground-borne (regenerated) noise – from tunnelling only

Ground-borne noise from tunnelling would vary with tunnel depth to the receiver (between approximately 20 to 60 metres deep) and the progress rate (approximately 20 metres per day). Worst case noise impacts are expected at any receiver for up to four days as the tunnel boring machine (TBM) passes.

Exceedances of the Night time NML are not expected for residential receivers at a slant distance (see **Figure 9**) greater than 50 metres from the tunnel.

5.1.6 Construction vibration

The screening criterion for cosmetic damage would be exceeded at 21 buildings (residential, commercial, educational and heritage listed), two station platforms at Central and a heritage listed bus stop at Blues Point which are predicted to exceed the cosmetic damage screening criteria.

The screening criterion is set at 50 per cent of the level at which cosmetic damage may occur. The Proponent has committed to vibration monitoring to measure actual impacts and to inform the need to implement any measures to avoid impact to structures.

5.1.7 Operational noise and vibration

Operational noise design objectives are derived from the *Rail Infrastructure Noise Guideline* (NSW Environment Protection Authority, 2013) and the *Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects* (Department of Environment and Climate Change, 2007). Ground-borne vibration design objectives were based on guidelines for human comfort or amenity from the *Assessing Vibration – a technical guideline* (Department of Environment and Conservation, 2006a).

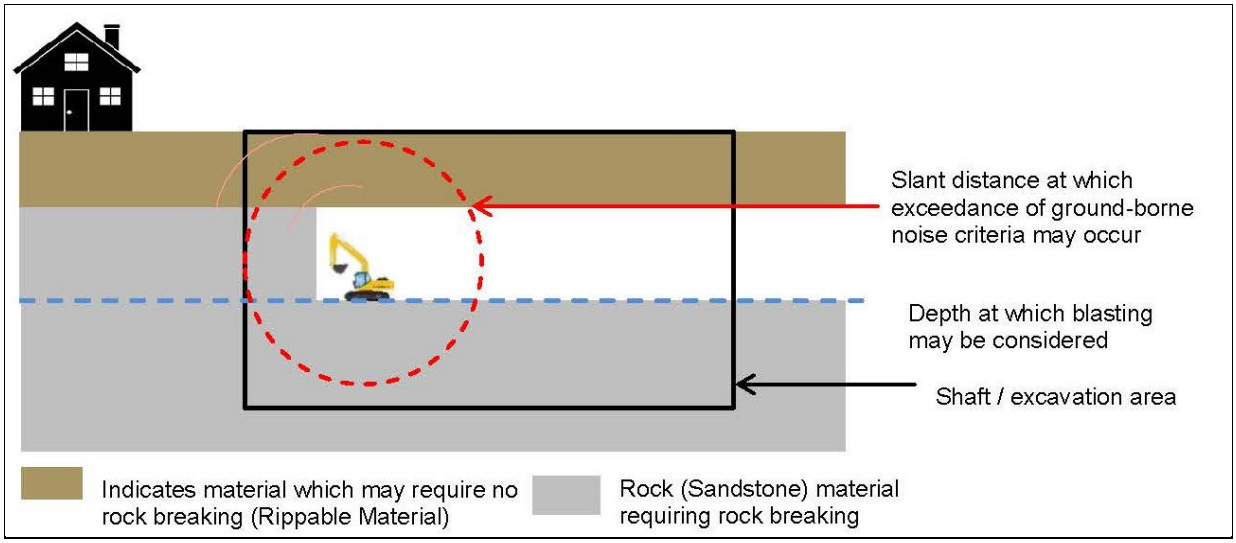

Figure 9 - Slant distance defined by red dashed circle (not to scale) (Source: TfNSW, EIS)

An increase in noise above the *Rail Infrastructure Noise Guideline* noise trigger level is expected at one multi storey apartment building at Chatswood, predominantly due to its unobstructed view of the tracks. At-property treatment would be considered for this property as noise walls are not generally effective for multi storey buildings.

Noise from services at stations and ancillary facilities would be designed and mitigated in order to ensure compliance with the applicable amenity and intrusive noise criteria from the *Industrial Noise Policy* (EPA,2000) (INP).

The operation of the Project is predicted to comply with ground-borne noise and ground-borne vibration design objectives.

Submissions

Key issues raised by the community included:

- quality of the noise and vibration assessment;
- construction noise and vibration impacts on sensitive receivers including cumulative impacts, duration of impacts and out-of-hours works;
- structural damage from surface and tunnelling works, including blasting;
- the need for noise management and monitoring, including provision of noise barriers, acoustic enclosures and at-property acoustic treatment;
- operational noise and vibration impacts on sensitive and vulnerable receivers; and
- the type and provision of noise mitigation.

Agencies and Councils raised similar issues. The EPA raised concerns about construction noise, vibration, working hours and blasting criteria, alternative work methods, consultation and submitted draft recommended conditions of approval for consideration. The EPA noted that the project can be built to comply with operational noise criteria.

Consideration

The Department notes the concerns raised by the community about the quality of the noise and vibration assessment, including incorrect classification of properties in the assessment, which have been considered in the response to submissions. The Department also acknowledges that

the assessment would be refined during detailed design. Notwithstanding, construction noise and vibration impacts from a project of this scale and in this environment are significant and unavoidable and even with the proposed mitigation measures would still impact a large number of sensitive receivers over an extended period of time.

To address this issue, the Department, has recommended an innovative approach to managing noise be adopted. This approach reflects the significant diversity of land use around construction sites, and provides the flexibility required to enable the project to be built as quickly as possible without unacceptable impacts on amenity. It is recognised that in mixed land use areas, as most of the surface construction locations are, there is no time period which will not inconvenience a group of receivers, whether they are residential, commercial or otherwise. The proposed approach and recommended conditions provide a realistic localised management regime that is achievable given the scale of construction required.

The Department considers that construction activities must aim to minimise the impacts to all sensitive receivers and has recommended conditions to ensure this is achieved.

Avoid, minimise and manage

The Department supports the Proponent's commitments to minimise noise and vibration impacts, including:

- implementing Sydney Metro's Construction Noise and Vibration Strategy which sets out what standard and additional mitigation measures could be used;
- avoiding rock breaking during out of standard construction hours at all locations except at Central Station;
- restricting surface construction works to day time standard construction hours only;
- considering alternative demolition and excavation techniques during detailed construction planning;
- reducing the number of days sensitive receivers exceed the NML by considering blasting instead of rock breaking at some locations; and
- engaging an independent acoustics advisor to oversee noise management across the project.

Despite these measures there are a range of sensitive receivers and facilities that would experience noise impacts greater than 20 dB above NMLs and perceptible levels of vibration.

Construction noise and vibration strategy

The Department considers that the proposed *Sydney Metro City and Southwest Construction Noise and Vibration Strategy* (Sydney Metro, 2016) and construction hours are appropriate in circumstances where the impact would occur over a relatively short time period and in predominantly residential areas. The Department supports the proposed method for determining mitigation including clearly identifying mitigation measures and when respite offers and alternative accommodation would be offered.

However, the Department does not consider the strategy to be appropriate in circumstances where high noise and vibration impacts are expected and where impacts take place over an extended period of time as these situations are more akin to long term operational impacts. The Department considers that long term construction impacts be considered as more than temporary and a more flexible approach to mitigation adopted which reflects the duration. Further, the Department considers it is appropriate for the *Sydney Metro City and Southwest Construction Noise and Vibration Strategy* (Sydney Metro, 2016) be updated to include additional mitigation measures including at property or architectural treatment, respite and relocation where necessary to achieve this outcome.

Providing property and architectural treatment to address construction impacts is a significant shift from the standard approach as these are normally only considered for operational impacts. This recognises that construction is clearly where the most significant noise and vibration generating activities will occur and that as this activity may continue for up to six years it is not temporary.

Construction hours

The Department supports restricting predominantly surface works to day time standard construction hours, however, some construction activities would occur up to 24 hours per day, seven days per week including tunnelling, excavation within an acoustic enclosure (apart from Central), station fit out, haulage and supporting works.

Scheduling the noisiest demolition and construction activities during standard construction hours is not likely to avoid impacts to sensitive receivers or result in reducing noise and vibration impacts in locations where non-residential land use predominates (such as commercial and industrial areas). Stations at Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street and Central are located within business areas with many types of sensitive receivers affected by demolition and construction at all times.

These areas pose significant challenges when considering construction noise and vibration as it is difficult to establish standard management and mitigation measures in areas with a diverse range of receivers. The Department also notes that, typically, commercial buildings within the CBD are constructed to a high standard with modern air conditioning and glazing which can give a façade transmission loss of around 30 dB(A) to airborne noise. Residential apartments in the CBD should also have been designed to meet an appropriate CBD amenity that includes regular and consistent noise sources consistent with a CBD environment.

The Department also considers that comprehensive and meaningful consultation with affected receivers is vital to understanding how demolition and construction would affect their ability to continue to operate and to identify specific mitigation measures to minimise disruption.

To address this issue, the Department recommends conditions requiring:

- consultation with affected receivers to identify specific additional mitigation measures to be included in Construction Noise Impact Statements before construction affecting that receiver, to document specific mitigation to be implemented to address impacts in a particular location or those resulting from individual activity across the project (*e.g.* rock-breaking);
- the application of internal noise levels rather than external noise levels to calculate receiver impacts during construction;
- consultation with affected sensitive receivers at Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street and Central to determine times for scheduling noisy works; and
- restricting night time noise impacts at residential receivers (*i.e.* to reflect that residential uses are permissible in a range of land use zones, not just residential zones). Where this cannot be achieved offers of additional mitigation are required including at property or architectural treatment, respite and alternative accommodation in accordance with the revised *Construction Noise and Vibration Strategy*.

This approach would allow flexibility to schedule noisy activities at times when it least affects the surrounding receivers.

The Department acknowledges that there are commercial and other noise and vibration sensitive receivers that would be impacted by construction works between 9 pm and 7 am that require further investigation. To address this the following conditions are recommended:

- identifying all receivers and specific mitigation measures through consultation with sensitive receivers and preparation of Construction Noise and Vibration Impact Statements; and
- timetabling noise and vibration generating construction activities outside of sensitive periods unless other arrangements are made with the sensitive noise and vibration receiver (and at no cost to that receiver).

Construction noise could reach levels equivalent to the maximum adopted by the *National Standard for exposure to noise in the occupational environment* for exposure over an eight hour period. While it is acknowledged that construction activities would vary throughout the day resulting in noise levels lower than the maximum predicted, the Department, recommends a condition to ensure that the noise levels attributable to the Project do not exceed this level for any employee of a nearby business at any time.

Demolition and excavation

The Proponent has committed to demolition only occurring during standard construction hours and considering alternative demolition techniques as part of the detailed construction planning to minimise impacts from the demolition of 79 buildings and other structures. Considerations would include:

- limiting the use of hydraulic hammers and rock breakers;
- using hydraulic concrete shears;
- demolition sequencing to shield noise sensitive neighbours;
- respite periods; and
- installing sound barrier screening to scaffolding.

The Department supports the commitment to consider alternative demolition and excavation techniques, but also recognises that prescribing a particular method across the project would limit flexibility and innovation to adopt the most appropriate method in a given location. Accordingly the Department recommends conditions that require the Proponent to identify and adopt industry best practice, effective consultation and notification to ensure that noise and vibration takes into account community values in reducing impacts to surrounding receivers. The Proponent's commitment to using acoustic sheds at Chatswood, Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street and Waterloo to minimise noise impacts during excavation is supported and would contribute towards achieving best practice.

The Department considers the potential for significant construction noise and vibration impacts remain unresolved to the unique multi-use theatre and music space at Monte Sant' Angelo Mercy College adjacent to the ventilation and services facility on Miller Street. TfNSW has advised that it is currently investigating alternative locations for this facility. The Department supports this approach and recommends a condition requiring a rigorous options analysis of alternative sites including consideration of constructability, operational efficiency and comparative impacts. Where a better option is identified, this option must be selected.

Blasting

Blasting was considered as an alternative to rock-breaking to reduce the number of working days where construction noise above the NMLs is expected (see **Figure 10**). A reduction in the number of days exceeding the NML could be achieved at all locations where blasting is proposed.

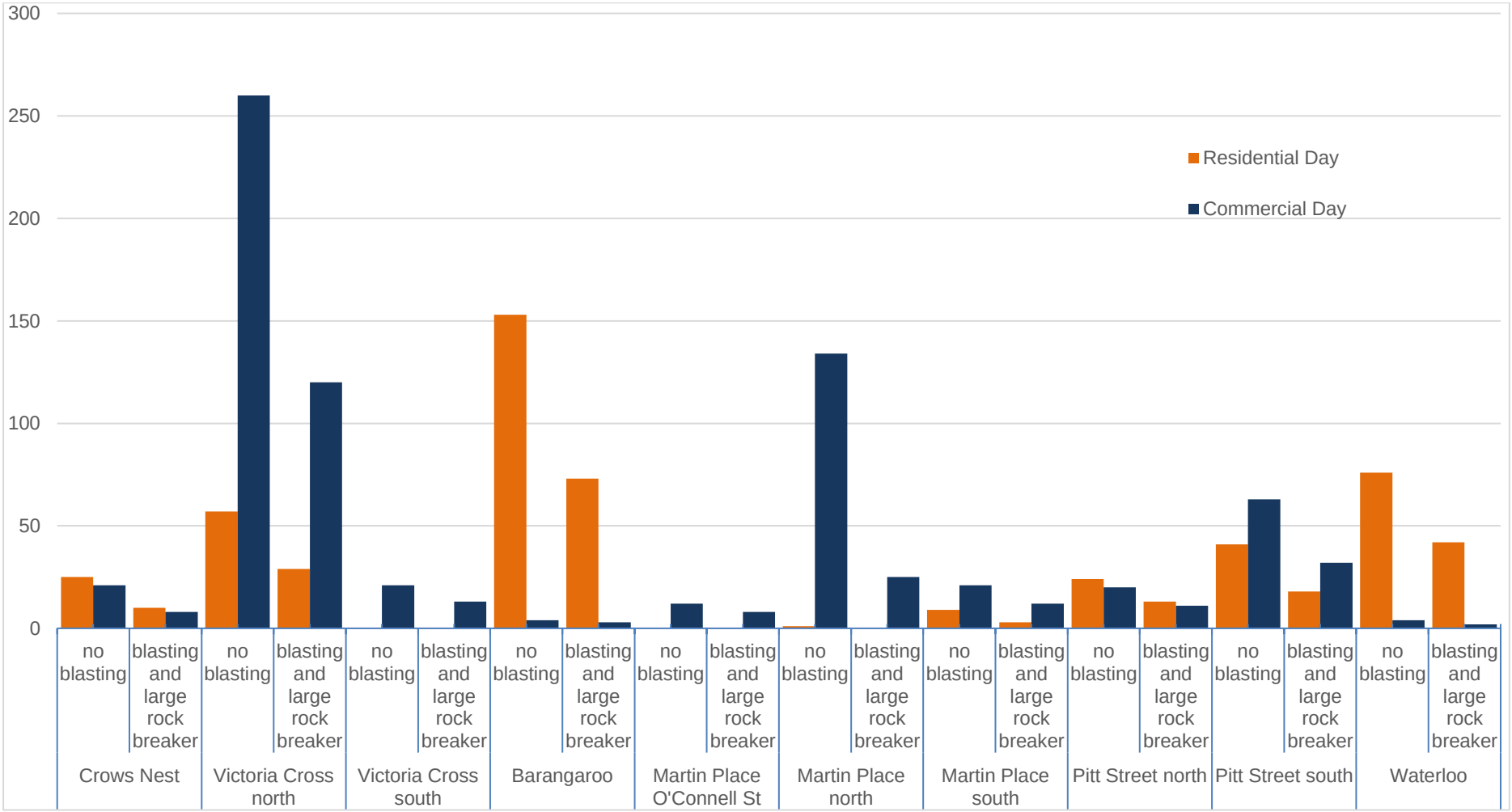

Figure 10 - Number of days exceeding the NML with and without blasting (Source: derived from EIS and SPIR)

Alternatives to rock breaking and blasting, such as using diamond impregnated wire saws, bursting and splitting, were investigated but discounted due to their potential limited application, which would require a mix of techniques and plant extending the duration of works.

The time and noise benefits of blasting over rock breakers are recognised, but it is also noted that rock breaking or similar would still be required for initial excavation until an appropriate blasting depth (*i.e.* until rock is reach with an appropriate safety buffer) is reached and during daytime construction in addition to blasting.

The Proponent has committed to:

- a blasting regime of no more than one blast per day, but more likely 2-3 times per week, once an appropriate blasting depth (when rock is reached between four metres to 25 metres deep depending on the location) is reached; and
- blasting criteria of:
  - vibration (PPV): 25 mm/s or 7.5 mm/s for heritage structures
  - overpressure: 125 dBL; and
- scheduling blasting at times that minimise impacts to the affected receivers.

The Department considers that detailed construction planning for excavation should consider all available methods to minimise noise and vibration impacts to receivers, before committing to any particular method.

The Proponent has suggested blasting criteria that exceed those in the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990) as blasting in close proximity to sensitive receivers would make compliance with the criteria difficult. The suggested criteria would provide for protection of structures from cosmetic damage rather than human comfort (amenity) and is consistent with the overpressure criteria for occupied non-sensitive sites in the *Australian Standard 2187.2 Explosives – Storage and Use. Part 2: Use of Explosives*. The Department has considered the proposed blasting criteria against the benefit that could result in less rock hammering being required. The biggest benefit will be realised at Victoria Cross north where there is an approximate 50 per cent reduction in days the noise management levels will be exceeded. This is considered a positive benefit and the Department has therefore recommended the proposed criteria be accepted subject to conditions.

With respect to the timing of blasting it is noted that prescribing a time for blasting without appropriate consultation, due to the mix of commercial, residential and other sensitive receivers in close proximity to the sites, would be difficult. While the Department does not generally support high noise generating activities such as blasting or rock breaking during out of standard construction hours it does support alternative timing for blasting if the performance criteria can be met, support by a substantial majority of receivers can be demonstrated and it would result in reduced impacts to those sensitive receivers. Therefore conditions to this effect have been recommended.

<u>Independent Acoustic Advisor</u>

The Proponent proposes engaging an Independent Acoustic Advisor to oversee:

- construction methods as they relate to managing noise and vibration;
- construction noise and vibration planning, management and mitigation;
- construction noise and vibration monitoring and reporting; and
- verification of compliance and auditing of noise and vibration management practices.

The Department is supportive of this approach and recommends a condition that the Acoustic Advisor be approved by the Secretary and to expand the role to include review of all Construction Noise and Vibration Impact Statements, out of hours works requests and recommend best practice measures to improve demolition and construction performance.

The Department considers the Acoustic Advisor is vital to ensuring the localised approach to construction noise and vibration impacts operates as intended. Further, the Department has recommended a condition for a Community Complaints Commissioner to assist in resolving any outstanding concerns that individuals or businesses may have.

Tunnelling

Some works, predominantly underground excavation and construction are proposed to occur 24 hours a day, seven days per week. The Department recognises that 24 hour a day, seven days per week construction activities could result in a shorter construction timeframe than if the project was only permitted to construct during standard construction hours. The longest time any receiver would experience regenerated noise during tunnel boring machine tunnelling for is up to four days for each tunnel. Excavation of cross passages and the track cross over using road headers and rock breakers would be limited to 7 am-10 pm because it could take between two and a half to three months to complete. The Department supports this approach provided appropriate, consultation, management and mitigation measures are implemented as outlined in the Department's recommended conditions, including consideration of impacts to residential receivers after 8 pm including offers of respite and alternative accommodation.

Sleep disturbance

The Department supports the commitment to minimise sleep disturbance impacts by measures such as the use of alternative construction traffic routes. Measures such as construction scheduling must be considered to avoid impacts that would result in sleep disturbance. Where it cannot be avoided, additional mitigation measures including at property or architectural treatment, respite periods and alternative accommodation must be considered in accordance with Sydney Metro's *Construction Noise and Vibration Strategy*.

Construction vibration impacts

The assessment identified 21 buildings that are predicted to exceed the cosmetic damage screening criterion. The screening criterion is set at 50 per cent of the level at which cosmetic damage is likely. For these structures, further detailed assessment and attended vibration monitoring is proposed by the Proponent to ensure vibration levels remain below the appropriate limit for each structure.

The Department supports the Proponent's proposal to undertake further detailed assessment and attended vibration monitoring to ensure that vibration levels remain below the appropriate limit for each of the structures identified as being at risk of vibration levels exceeding the cosmetic damage screening criterion. In addition, the Department has recommended conditions of approval requiring:

- properties be notified of this risk and for those properties to be incorporated into a Construction Noise and Vibration Management Sub Plan to detail how the performance outcomes, commitments and mitigation measures committed to will be achieved;
- vibration levels to remain below the vibration limits set out in the *British Standard BS 7385-2:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration* (for structural damage); and
- real time vibration monitoring.

Operation ground-borne noise and vibration

The Project has been designed to meet the ground-borne noise design objectives derived from the *Rail Infrastructure Noise Guideline* (NSW Environment Protection Authority, 2013) and the *Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects* (Department of Environment and Climate Change, 2007) by incorporating track attenuation in areas where noise would exceed the design objectives. The Department considers that

adopting specific design criteria is appropriate and is satisfied that, based on other operational rail tunnels that this is achievable.

However, the Department is concerned:

- that the assumptions used to predict ground-borne noise were based on theoretical and not actual geological conditions along the alignment; and
- the design objectives adopted for some sensitive receivers may not be appropriate. For example, it may be more appropriate that particularly sensitive receivers such as religious buildings, surgeries and acoustically designed halls and studios have more stringent design objectives than proposed.

The Department has therefore recommended an independent review of the proposed ground-borne design (noise) objectives and the ground-borne noise and vibration model to ensure that appropriate Project design objectives identified will be met with appropriate track attenuation.

Conclusion

Demolition and construction noise and vibration would result in exceedances of the NML and perceptible levels of vibration at sensitive receivers even with mitigation. The Department's recommended conditions require a best practice approach to the management of demolition and construction noise and vibration to ensure an appropriate level of amenity for sensitive receivers while balancing the needs of construction. This approach is reinforced through a recommended comprehensive community consultation process, which includes the engagement of a Community Complaints Commissioner.

Operational noise and vibration can be largely managed through the design process and the application of standard mitigation measures. Recommended conditions relating to operational noise are focused on ensuring appropriate design criteria and confirmation that noise and vibration objectives have been met following operation.

5.2. Non-Aboriginal Heritage

Issue

The EIS states that the locations and design of stations and station infrastructure were chosen with the objective of minimising impacts to heritage as one of the primary project considerations. Notwithstanding, impacts to built heritage and heritage conservation areas would occur through demolition and modification of locally and State Heritage Register-listed items and indirectly through impacts to views and vistas. The risks and potential impacts to heritage from vibration caused by excavation and demolition of adjacent structures during construction were also considered.

The project would have a moderate to major impact on five state listed and 15 locally listed heritage properties and precincts. State Heritage properties, including Sydney Terminal and Central Railway Stations group and Martin Place Railway Station, would undergo extensive interventions to accommodate Metro stations and station infrastructure. Heritage impacts at Crows Nest and Waterloo station locations are largely restricted to views, vistas and settings. Material impact to heritage items have largely been avoided at Pitt Street and Victoria Cross stations and are considered minor.

Impacts due to future over station development are subject to separate development approvals processes and are not considered here. Nonetheless, the Proponent's assessment considers the heritage implications of new stations; the impact stations would have on surrounding heritage precincts; and provides measures to ensure permanent and adverse heritage impacts are minimised.

CBD stations sites and the Blues Point tunnel boring machine (TBM) retrieval site are expected to yield potentially significant historical archaeology. Trenching for the Metro power supply cables may also impact on significant subsurface items such as the Bennelong Sewer channel and Tank Stream.

Central Station

The Sydney Terminal and Central Railway Station group (**Figure 11**) is a heritage precinct of state significance for its historical, aesthetic, technical values and for its research potential.

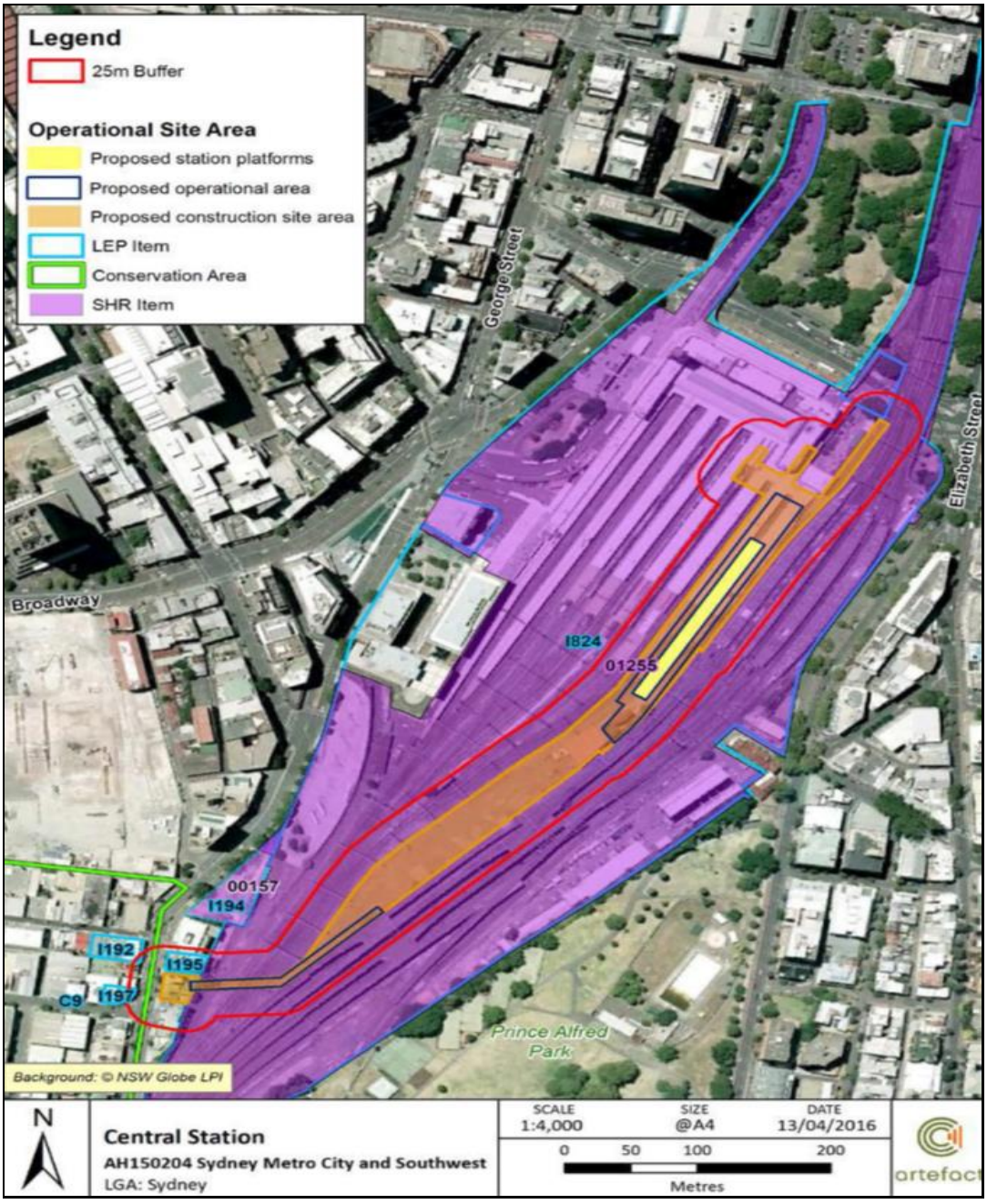

Figure 11 - Central Precinct with heritage items and indicative Metro footprint (Source: TfNSW, EIS)

The precinct demonstrates a high level of historic significance associated with its early government and institutional uses, as well as being the site of Sydney's second major burial

ground, the Devonshire Street cemetery. Archaeological evidence of government and institutional uses is rare and as such, where present, has high research potential and heritage significance.

The precinct would undergo substantial modification in order to accommodate Metro platforms, services and maintenance infrastructure. Extensive excavation is required to accommodate the "station box" and Metro concourse located beneath the current platforms 12 to 15, necessitating their demolition and removal. The associated canopy structures are generally intact, contain elements of high heritage significance and are considered rare in the local context.

During construction, alternative access to platforms would be required, as the station box would inhibit pedestrian access through the Eddy Avenue Northern concourse and would sever underground pedestrian egress at the heritage listed Devonshire Street Tunnel, directly impacting on the fabric of the item.

Construction of the CBD Light Rail and the Sydney Metro would permanently sever access to the Sydney Yards from Eddy Avenue, the main construction site for Metro construction. A permanent road access bridge crossing the intercity rail lines into the Sydney Yard from Regent Street is proposed to provide ongoing unrestricted construction and operational maintenance access. A moderate impact to the Chippendale Conservation Area streetscape is expected as a result of the construction and operation of the bridge, largely confined to the views and vistas of contributory heritage items. The Sydney Yard Access Bridge (**Figure 12**) would also require demolition of the Officers' garden, Rolling Stock Officers' Building and Cleaners' Amenities Building, which have moderate to major contributions to the historic and operational workings of the precinct.

Overall, the changes to the Sydney Yard would have a major indirect impact on the views, vistas and setting of Mortuary Station, the only extant mortuary rail station in NSW.

Martin Place Station

The Martin Place heritage item and Martin Place Railway Station Precinct would also undergo substantial modification, resulting in moderate to major impacts to the item. A moderate direct impact on the heritage significance of the Martin Place Railway Station would occur due to impacts to the Martin Place Railway and associated fabric and removal and modification of Eastern Suburbs Railway fittings (red tiles, circular seats, terrazzo panels).

Existing surface station entrance points in the middle of Martin Place would be removed to consolidate surface access to the new and existing station, which impacts on the curtilage of the item. Potential vibration impacts are predicted to the Commonwealth Bank building, from the demolition of adjoining buildings and excavation under the heritage item during construction. The locally heritage listed "flat building" at 7 Elizabeth Street would be demolished to accommodate entrance and surface facilities for the northern section of the Martin Place Station.

Direct, indirect and archaeological impacts would be largely neutral to minor in scale. Views, vistas and settings would be moderately yet permanently impacted from the new metro station structure and temporarily from demolition and construction works.

Potential heritage impacts were also identified to the views and vistas of surrounding buildings, including the Commonwealth Bank building, AFT building, Former City Mutual Life Assurance building, and Former Qantas House, mainly due to the proximity of three large construction sites operating adjacent to the items. Whilst temporary in nature, moderate to major visual impacts are expected to these items, and to Martin Place itself.

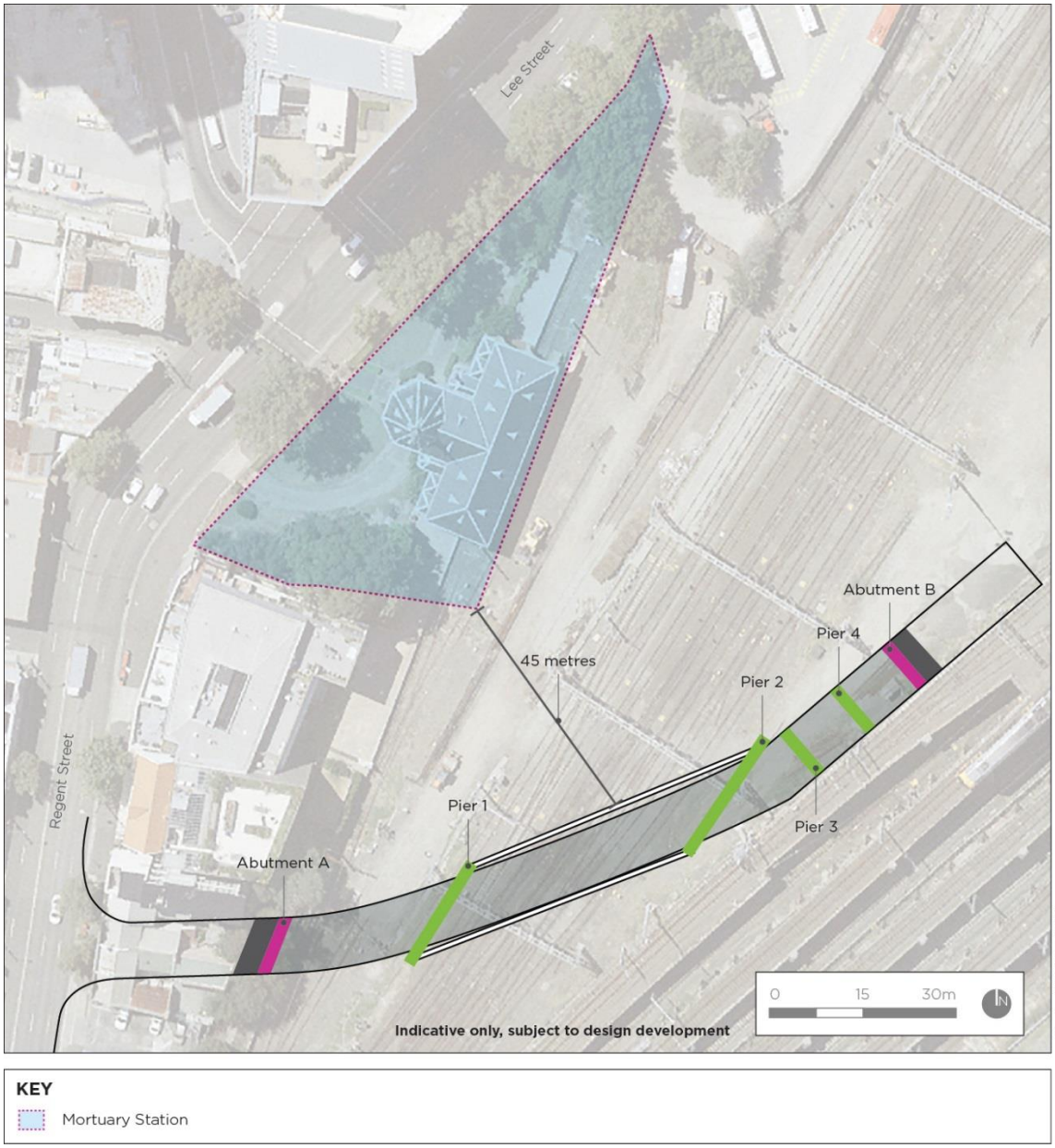

Figure 12 - Sydney Yard Access Bridge indicative layout within Sydney Yard (Source: TfNSW 2016)

Barangaroo

The Millers Point and Dawes Point Village Precinct and Millers Point Conservation Area are State Heritage Register-listed items located adjacent to the station. Ancillary infrastructure, such as ventilation risers and skylights would be located against the Hickson Road wall, which is the boundary of the Conservation Area and represents the "Hungry Mile". Permanent minor to moderate impacts to views, vistas and to the setting of the precinct would occur. During construction, excavation of the Hickson Road corridor required for station construction would result in direct impacts to the fabric of the items, although these are considered minor in the context of the precinct. There is also high potential for local and state significant archaeological remains, representing various phases of European occupation of the site.

Submissions

Community submissions raised concerns on the detail of information regarding impacts to listed built heritage items and how they would be mitigated and managed during construction.

Concerns were also raised about the preservation and integration of built heritage with the introduction of new elements such as the stations, the Sydney Yard Access Bridge and over station development. Community submissions also urged protection of Heritage Conservation Areas to be potentially impacted by the project.

The City of Sydney is generally supportive of the project overall, but does not consider the demolition of 7 Elizabeth Street, a locally listed item, has been justified and that construction and other related infrastructure could be housed adjacent to the heritage item.

The Heritage Council expressed concern at:

- the significant work required to mitigate heritage impacts particularly at Martin Place, Barangaroo and the Central Railway Group;
- the lack of detailed design figures and sketches to illustrate new station and platform designs;
- the accuracy of the archaeological heritage assessment; and
- the scale of intervention at Central, specifically in regard to the Sydney Yard Access Bridge.

On this basis, the Heritage Council has requested representation on the Design Review Panel in order to provide technical expertise in heritage design.

The Heritage Council, along with the City of Sydney, also expressed a view that the Barangaroo station and ancillary components should be housed within the Barangaroo developments in order to minimise visual impacts on the Hungry Mile that forms a significant part of the Millers Point and Dawes Point Village Precinct.

Consideration

General

A number of locally-listed heritage buildings would be demolished or directly impacted to accommodate new stations or station extensions and include:

- the “Flat” Building on 7 Elizabeth Street;
- a shop at 187 Miller Street North Sydney;
- relocation of listed North Sydney bus stops; and
- alterations to the curtilage of Mowbray House (Chatswood Dive and Waterloo Congregational Church (Waterloo Station) with demolition of associated buildings in both instances.

The Department acknowledges community concerns about the need to avoid heritage impacts and the Proponent’s objectives to do so. However, the Department accepts that within an established urban environment, the ability to avoid all heritage impacts is not possible due to inherent project design requirements and competing environmental demands. Notwithstanding, it is considered important that interpretation of heritage values that would be lost or modified due to the project are appropriately documented and celebrated. In this regard, the Department agrees with the Proponent’s commitments to archival and photographic recording.

The Department recommends that affected items are collated within a Heritage Archival Recording Report. In addition, the Department has recommended the preparation of a Heritage Interpretation Plan, to identify and interpret the values and stories of heritage items and heritage conservation areas impacted by the project. The Heritage Interpretation Plan would also inform the Station Design and Precinct Plan, and be prepared in accordance with current heritage guidelines.

To ensure appropriate consideration of design matters related to items listed on the State Heritage Register, the Department recommends membership of the Design Review Panel be expanded to include representation from the Heritage Council. It is also noted that the Panel includes representation from the NSW Government Architects Office.

The Department notes the uncertainty around station designs in heritage sensitive areas such as Martin Place and Pitt Street, and shares concerns regarding integration of these elements with the heritage settings of station precincts. The Department supports the updated design guidelines for the project, including design requirements for aboveground station buildings (not over station development) and other elements that more effectively consider adjacent heritage items and setting.

Concern remains over the location of ancillary station infrastructure such as traction and power supply stations, ventilation systems and emergency access and egress points, which can add considerable bulk and scale to station developments. The Department considers it appropriate that design collaboration continues with key stakeholders such as City of Sydney Council, the Heritage Council of NSW and the Barangaroo Delivery Authority to ensure heritage values continue to be considered in resolving outstanding design challenges.

In regards to Barangaroo, the Department considers that an additional safeguard is required to ensure that all opportunities to house station ancillary components (i.e. traction substation, ventilation risers and skylights) associated with the station within the Barangaroo development complex are fully explored. Should an integrated outcome for ancillary components not be achieved, the location and design outcome must be consistent with design objectives and endorsed by the Design Review Panel.

The Department considers that whilst there would be impacts to historic and archaeological heritage, the project would be the catalyst for positive change to the urban fabric, and would provide a positive public transport benefit to the city. In this context, impacts to built and archaeological heritage are outweighed by the potential benefits of the project.

Central

The Department acknowledges that the Central Station precinct has evolved to reflect the transport needs of a growing city. The works at Central would represent a new phase in this development process and the Proponent argues that it should be visible as the third key phase and intervention.

The key design challenge for the new development phase is to “celebrate” this intervention while seeking to achieve sympathetic integration with the existing phases, as well as protecting the existing heritage setting. While an alternative location may have less impact on heritage items, the central location of the metro platforms provides efficient interchange between transport modes and connectivity within the precinct. The Department also acknowledges that the heritage values of the precinct are derived from its ability to adapt with growth and technology and to maintain its efficient operational use as the primary public transport hub for NSW. Therefore, the Department considers that the metro station location within the Central precinct optimises the functional and operational requirements with heritage outcomes.

Construction and operational access to the Metro platforms would be constrained by changes to Eddy Avenue and Chalmers Street for the CBD and South East Light Rail and operation of the project, which would permanently remove the current maintenance vehicle access to the Sydney Yard. A range of options was considered, including a new access through Prince Alfred Park and access from the existing Sydney Buses layover. These options were discounted due to impacts to the operation of these facilities. Tunnel options were also ruled out due to geographical constraints which prevented the ability to get under the operational lines. A conveyor across the suburban lines was also considered for spoil removal but

discounted for safety and operational reasons. This option would also not provide long term access to Sydney Yards, which will continue its current functions of servicing Central station.

The most feasible option is to provide a permanent road access bridge from Regent Street into Sydney Yard to allow 24/7 access. The bulk and length of the proposed bridge would not directly impact Mortuary Station but would impact a number of key sightlines to Mortuary Station and its surrounds. To address this, the Proponent has developed specific design objectives and principles to guide the design of the bridge to minimise impacts to the precinct.

The Department is satisfied that alternative access arrangements were properly considered and that the proposed Sydney Yard Access Bridge is, on balance, an appropriate outcome as it serves both the construction requirements of Sydney Metro and long term operational requirements of the broader Central precinct and can feasibly be constructed. None of the other options considered can meet these requirements.

Nonetheless, the assessment predicts that impacts could only be partially mitigated through design due to the prominent location of the bridge and the obligatory engineering standards. The Department therefore requires that the Proponent design and construct the Sydney Yard Access Bridge to minimise its impact on the heritage values of Mortuary Station. The agreed design objectives for the bridge require the bridge to integrate with its industrial surrounds, be visually unobtrusive and must respect the heritage sensitivities of the Mortuary Station setting. The design must also be developed in consultation with the Design Review Panel.

Martin Place

The Department acknowledges the site constraints at Martin Place, which include underground basements, utilities and services which govern the layout and siting of the Metro station. The design avoids direct impacts to significant State Heritage Register-listed items, such as the Commonwealth Bank building, and minimises impacts to the existing Martin Place station. The site location provides additional design opportunities, including integration of the streetscape as detailed by the City of Sydney's *Martin Place Urban Design Study*, and through the preservation of public realm within Martin Place itself. The Department further acknowledges that heritage impacts have been minimised through project design and accepts that the residual impacts to the heritage fabric of Martin Place are unavoidable.

Notwithstanding, the Department recommends that the final design and access to the Martin Place Railway Station must minimise the removal of identified heritage fabric. Any removed items should be salvaged and reused where applicable within the new station concourse, and documented as required by the Heritage Interpretation Plan.

Archaeology

A number of concerns were raised in submissions in regards to the Proponent's archaeological assessment and archaeological research designs, largely in regards to the accuracy of the plans. The Department considers that the archaeological research designs therefore require revision, to account for comments provided by the Department and the Heritage Council, prior to commencement of excavation works. In addition to detailed archaeological research designs, the Proponent must prepare an Exhumation Management Plan, to provide a framework for unexpected human remains to be potentially encountered in the area of the former Devonshire Street Cemetery at Central, and for the recovery of unexpected human remains elsewhere throughout the project.

In addition, the Proponent must provide an Archaeological Relics Management Plan, to account for the identification and management of state significant relics, and provide measures to be implemented to avoid and/or minimise harm to these relics. The plan must be prepared in consultation with the Heritage Council and be provided to the Secretary for information. The Department is satisfied that potential impacts to historical archaeology can be managed

through the Proponent's proposed heritage management measures and the Department's recommended conditions of approval.

Conclusion

The key heritage objective of the project is to facilitate, to the greatest extent possible the long term protection, conservation and management of identified heritage items along and adjacent to the project. The Department acknowledges the constraints and opportunities presented to preserve the integrity of Sydney's heritage, and the challenges presented by undertaking the project within a constrained environment. The Department has mandated the protection of heritage items through a suite of management and mitigation measures.

Whilst it is acknowledged that the direct impacts of the project cannot be wholly offset or mitigated, the Department considers such impacts to be acceptable when considered in the context of the broader project benefits and public transport needs to support a growing population. There are many other beneficial heritage outcomes from this project, including the integration of heritage items into modern public transport infrastructure which would elevate its visibility, protection and management for future generations.

5.3. Traffic and Transport

Construction Traffic
Construction would generate significant traffic movements at surface construction locations for spoil removal, material delivery and, to a lesser extent, employee and contractor vehicles arriving and leaving sites at the start and end of shifts.

Construction traffic would be generated for each site, however some sites have greater potential for cumulative impacts due to their locations, in particular the CBD (including Barangaroo), North Sydney and Sydenham.

The Proponent has considered indicative haulage routes for spoil removal which minimises the use of residential streets, particularly in more suburban locations such as Crows Nest, Waterloo and Sydenham/Marrickville, and which avoid passing through or beneath the Sydney CBD.

Potential opportunities have also been identified to remove spoil from some locations by rail or barge, such as Barangaroo Station. However, this would require complex scheduling arrangements and therefore the assessment has considered a worst case scenario of all spoil removal occurring by road.

There is a number of construction projects located along the length of the project alignment, which may coincide with Sydney Metro. These are concentrated in the Sydney CBD, however construction at dive sites are likely to interact to some degree with construction of the New M5 (WestConnex) and North West Metro.

These may have a range of cumulative impacts with the project, including traffic, pedestrian access, visual impacts and construction noise. Due to the use of regional and local roads to transport spoil, a range of road regulatory authorities would be instrumental in managing traffic so as to minimise impacts to road network operation.

Nelson Street Bridge Removal
Construction of the Chatswood dive and the northern surface works would necessitate demolition, without reinstatement, of the Nelson Street bridge which spans the rail corridor at Chatswood between Orchard Road and the Pacific Highway. Its primary function is to provide

westbound access to Mowbray Road for vehicles heading south on the Pacific Highway. To continue to provide for this key movement, a two lane, all vehicle right turn from the Pacific Highway to Mowbray Road westbound was proposed.

Further consultation with RMS has indicated that this is no longer a desirable option and a more strategic response to the intersection as a whole is preferred. Further the RMS has indicated that it would prefer any upgrades at one time to avoid multiple traffic disruptions. A solution has not been identified and may not be determined ahead of the proposed closure of the Nelson Street bridge.

Parking and Vehicular Access

Public car parking would be removed from locations near a number of construction locations. Approximately 300 spaces each would be provided at the Chatswood and Sydenham dive sites for construction personnel, however most sites, particularly in the CBD would be constrained and parking limited to four to ten spaces. The Chatswood and Sydenham sites may be used to provide worker parking and shuttle bus transfers to other nearby construction sites.

Around 125 on-street car parking spaces on Hickson Road would be removed during construction. The current users of these spaces are predominantly construction workers at Barangaroo, although some spaces may be used by local residents and visitors.

Whilst it is expected that many construction workers would utilise public transport to access sites, the proponent has committed to considering remote car parking in existing under-used car parks such as at The Domain, Goulburn Street and Darling Harbour, and shuttle bus transfers to the construction sites.

Pedestrian Access

Pedestrian access during construction would be affected, particularly around the North Sydney and Sydney CBD stations. Footpaths would be reduced in many locations during construction which would reduce the efficiency/level of service of pedestrian links. To maintain a safe path width, some street furniture would be relocated temporarily. Key pedestrian locations that would be affected by construction are:

- Frank Channon Walk, Chatswood including access across the rail line;
- around the commercial core of North Sydney; including key pedestrian desire lines and the pedestrian bridge across Denison Street;
- Martin Place, particularly its total closure for six months, between Elizabeth and Castlereagh streets including the underground pedestrian concourse;
- Pitt and Park streets intersection; and
- Devonshire Street pedestrian tunnel.

In general, pedestrian links and routes to key destinations from metro stations achieve a level of service during operation equivalent to that prior to construction. However there is some deterioration in some locations even with all mitigation measures applied, including Victoria Cross and on Hunter Street for pedestrians heading northward from Martin Place station.

Submissions

Community submissions raised a number of concerns regarding traffic and active transport during both construction and operation. These are summarised briefly below:

- cumulative impacts during construction, with particular reference to WestConnex at St Peters/Sydenham;
- further consideration of alternative spoil transport options, including barging and rail;
- construction worker parking and loss of parking generally;

- impacts to pedestrian routes, including alternatives to Frank Channon Walk, during closure period;
- pedestrian, cyclist and traffic safety from construction traffic, potential disruption to emergency services and impacts during special events;
- safety and performance of pedestrian access at Martin Place during construction;
- impacts to traffic, pedestrian and cycle access closure of Nelson Street bridge;
- future of heavy rail services to St Peters and Erskineville;
- pedestrian impacts during operation at Martin Place and Pitt Street;
- potential for underground pedestrian links at Martin Place, Pitt Street and Crows Nest and consideration of additional access on southern side of Waterloo Station; and
- provision for bicycle integration.

Agency and Council submissions raised similar issues.

Port Authority NSW is concerned about: impacts on shipping channels to Gore Bay, Glebe Island, White Bay and Darling Harbour; construction impacts on Hickson Road and access to the Overseas Passenger Terminal; impacts of tunnelling impacts beneath and spoil disposal from Moores Wharf.

Willoughby Council the Mowbray Road/Pacific Highway intersection; Council supports the double right turns from the Pacific Highway (southbound) into Mowbray Road west (westbound); a grade separated Nelson Street crossing following construction is required; signalisation of the Hampden Road / Mowbray Road intersection.

Lane Cove Council raised matters concerning reconfiguration of Pacific Highway and Mowbray Road; traffic impacts at the Pacific Highway/Oxley Street intersection; cumulative construction impacts; pedestrian links between St Leonards Station and Crows Nest; and safeguarding an underground pedestrian link to the western side of the Pacific Highway at Crows Nest.

North Sydney Council raised issues related to prioritising active transport to access Victoria Cross, including re-allocation of road space; pedestrianisation of Oxley Street near the Crows Nest station entrance and shared zones on Clarke Street; efficiency of walking infrastructure must be maintained and preferably improved; delivery requirements; simplifying the intersection of Pacific Highway/Falcon Street/Shirley Street; closure of Miller Street between Pacific Highway and Berry Street and road space changes to improve public domain; does not support kiss and ride on Berry Street;; and exploration and implementation of public realm improvement opportunities beyond the immediate curtilage of metro stations.

City of Sydney raised concern on impacts of the Martin Place closure; construction worker access to sites; compliance with City of Sydney policies and procedures during construction; implementation of bus priority measures around Waterloo and Green Square; regional cycle network omissions; an additional station between Waterloo and Sydenham; bicycle parking; provision of cycle routes at various locations; removal of street furniture; safeguarding of underground connections at Bligh/O'Connell Street and Pitt Street/Town Hall.

Inner West Council encourages addition of an extra station between Waterloo and Sydenham Stations; upgrade of Edinburgh/Bedwin Road/Edgeware Road intersection and bridge (particularly pedestrian and cycle routes) does not reflect previous advice or improve pedestrian priority; provision of off-road cycle way connecting Edgeware Road to Sydenham; and concerns around traffic generation at Sydenham dive site.

Consideration

Construction Traffic

Approximately 2.4 million cubic metres of earth would be generated by the project, including mainline tunnelling and station excavations or about 56,000 truck movements. Avoiding truck movements during the morning and afternoon peak commuter periods is proposed to minimise impacts in periods already subject to high traffic volumes on key commuter routes such as the Pacific Highway and in the CBD. While tunnelling and station excavation would likely generate the most traffic, vehicle movements would continue to be generated for materials delivery for track laying, systems installation and station fitout.

Up to 30 heavy vehicles per hour (between 10 am and 4 pm) would be generated at Sydenham (during excavation) and Chatswood (during tunnel excavation and fitout) dive sites. Heavy vehicle numbers reduce at all locations outside of these core hours. Light vehicle movements would also be highest at most locations between these hours but generally no more than 10 vehicles per hour would be generated.

The Department acknowledges that tunnelling and spoil removal inevitably generates a significant amount of traffic. Alternative options include barging and removal by rail have been identified. However where sites are located distant from port and rail siding facilities, as well as final disposal destinations near respective commensurate facilities, the benefits are substantially diminished if transfer to road vehicles is required as part of this process.

The Proponent has not identified disposal locations for spoil at this time and therefore it is not known whether barge or rail transport is possible or likely. Nonetheless, the Department recognises the potential relief that these options would provide in the key areas of Barangaroo, Sydenham and Blues Point to a lesser extent, if available. The Department supports the commitment to include further investigation of barging from Barangaroo and investigation of rail transport and barging from Sydenham and Blues Point respectively. This is reflected in the recommended conditions which require the Proponent to investigate opportunities to maximise spoil removal by non-road methods.

Heavy vehicle generation for station and tunnel fitout is expected to be generally the same as that for tunnel and station excavation. With up to 30 vehicles per hours during the 10 am to 4 pm period at some locations. Station construction and tunnel fitout would take less time to complete than excavation (3.5 years vs 2 years). The traffic generated would be dominated by delivery of materials to site. Operation of the tunnel boring machine is such that the tunnel is constructed as it is excavated.

The Department is of the opinion that, while there may be some complexities around scheduling of subsequent construction activities in the tunnel, there are opportunities to reduce the impacts of materials delivery by scheduling track laying as soon as possible following excavation completion to enable the opportunity for materials to be delivered to the various worksites by rail. To reinforce this, the Department has recommended the Proponent to schedule final track laying as soon as practicable to enable materials transportation by rail and minimise truck movements.

Despite the above considerations, the Department agrees that construction traffic impacts can be managed to acceptable levels through the application of management measures including but not limited to:

- development of a construction management sub-plan to address matters including site access, parking, heavy vehicle metering and use of remote holding locations, bus re-routing; special event management, emergency and property access and incident response planning;

- prohibiting use of local roads except where no feasible alternative is available, to be determined during preparation of Construction Traffic Management Plans;
- safety audits for permanent road works; and
- establishment of a Traffic and Transport Liaison Group to inform traffic management for construction and operation with representatives from the relevant road authorities including Councils, the Sydney Coordination Office, Roads and Maritime Services, Barangaroo Development Authority and other key stakeholders.

The Department remains concerned that the implications of cumulative traffic impacts of high traffic generating construction projects in close proximity has not been better resolved, particularly where these are interactions between large government infrastructure projects. The volume and scale of construction in the CBD and in constrained and congested streets provides challenges for traffic management and congestion. However, interfaces such as that with construction of the New M5 (WestConnex) around Sydenham and St Peters, CBD and South East Light Rail and Barangaroo in the CBD is less predictable and more complex.

The Department therefore considers that further analysis of the potential impacts of these interactions on local access and networks must be considered in more detail and measures to minimise and consolidate impacts identified. This should inform the development of measures to be included in the Construction Traffic Management Framework which sets the suite of measures and issues to be considered in developing subordinate documents to manage access to and around sites by both construction traffic as well as local traffic as appropriate.

The proponent has committed to liaising closely with the Sydney Coordination Office during detailed construction planning and throughout construction to minimise the potential construction traffic impacts within the Sydney CBD, including potential cumulative impacts with other projects or special events. The Sydney Coordination Office has been established to oversee all traffic and transport in the Sydney CBD including decisions, directions and approvals affecting all road and traffic arrangements in the Sydney CBD, including buses and taxis. The Department supports this approach.

Parking

Employee parking and the potential impacts on surrounding local roads was raised in numerous submissions. Limited parking in the CBD would naturally limit the ability of construction workers to drive to these sites and park nearby. It is anticipated that most would use existing public transport to access Central, Pitt Street, Martin Place, Barangaroo and Victoria Cross. Parking for up to 300 vehicles would be provided at each of the dive sites (Chatswood and Sydenham). Shuttle services would run from these locations to intermediate worksites such as the Artarmon substation, Crows Nest and Waterloo.

Notwithstanding these commitments by the Proponent, the Department notes that there would be significant pressure on parking at these sites. It is stated that there would be a 480 construction workforce at Chatswood. If it is assumed that all workers drive and that there are equal workers per shift, there would be a shortfall in spaces for the changeover period. Natural limits on parking availability, particularly around Chatswood is likely to limit any spill into local streets to some extent; however, the onus would be on the Proponent to ensure that this does not occur. Management of construction parking is required to be considered in the Construction Traffic Management Plan, the preparation of which is a recommended condition of approval and a commitment of the Construction Traffic Framework Plan.

Approximately 125 on street parking spaces would be removed from Hickson Road for construction of the Barangaroo station. The Proponent advises that these spaces are mainly used by Barangaroo construction workers though some may be used by residents and visitors

and has committed to identifying alternative parking locations or strategies to reduce demand in this location.

The Department considers that loss of parking for construction or use of on-street parking by construction employees at all other locations can be appropriately managed by implementation of management measures to be outlined in the Construction Traffic Management Sub Plans.

Nelson Street Bridge Demolition

Construction of the Chatswood Dive and tunnel excavation requires that the Nelson Street vehicle overbridge be demolished and is not proposed to be reinstated. Nelson Street currently provides a key movement for vehicles:

- driving southbound on the Pacific Highway wanting to access Mowbray Road westbound; and
- heading eastbound on Mowbray Road (west) wanting to turn southbound onto the Pacific Highway.

These movements would no longer be possible with the demolition of the Nelson Street bridge. The Department accepts that this would have no effect on construction haulage routes or its impacts. However, alternatives may result in a slight deterioration in level of service of some local intersections, but these would still operate with acceptable delays (LoS C) during construction.

Alternative routes are available for local traffic redistribution to allow these movements to occur. The alternate route for the Mowbray Road westbound movements uses Albert Avenue, Chatswood to cross the rail line and Orchard Road to access Mowbray Road.

Two route options using Mowbray Road and Hampden Road provide for the Pacific Highway southbound from Mowbray Road eastbound movement; however, the more direct route would use local streets which is not desirable. The Department recommends that the Proponent consult with Willoughby Council with a view to developing an appropriate short term traffic route, signage and diversion measures to encourage use of regional roads for vehicles wanting to travel southbound on the Pacific Highway from Mowbray Road eastbound.

Harbour Construction

Approximately 550 metres of the twin underground rail tunnels are required to pass beneath Sydney Harbour between Blues Point and Millers Point (at Barangaroo). Prior to any excavation of these tunnel sections, ground improvement works (undertaken via jet grouting through the use of three barges on the surface of Sydney Harbour) may be required to solidify sediments and other non-rock material at the two locations the tunnel would pass through the rock-sediment transition zones.

The physical presence of the barges (inclusive of their movements between the work zone within the harbour and on-shore facility) has the potential to impact on commercial, recreational and transport related maritime users of the existing shipping channels.

The Department notes that Sydney Ports Harbour Master, Sydney Ferries and Roads and Maritime Services do not object to the project. The Department further notes that the Proponent would require the approval of the Harbour Master under clause 67 of the *Management of Waters and Waterside Lands Regulations NSW* for any disturbance of the bed of Sydney Harbour. This process includes measures such as the preparation of a Marine Traffic Management Plan (MTMP), establishment of a marine consultation group, and the identification of the barges via the use of an Automatic Identification System (including flashing yellow lights to warn of a 25m exclusion zone).

The Department is satisfied this existing approval process with the Harbour Master and associated MTMP would ensure any marine traffic risks associated with the ground improvement works are suitably managed.

Construction Pedestrian and Cycle Routes

Construction in an urban environment, particularly in the CBD, would inevitably cause disruption to pedestrians and cyclists. Footpaths would need to be narrowed in some locations to enable construction to proceed. Key areas identified include Martin Place and Pitt Street in the CBD; and at Victoria Cross. The proponent has committed to ensuring that minimum performance levels as set out in relevant standards and policies are maintained to ensure public safety. These matters and management measures would need to be considered in the relevant specific Construction Traffic Management Plans required as a recommended condition of approval.

Frank Channon Walk is a shared pedestrian/cyclist facility that provides off road connections from Albert Avenue to Nelson Street Chatswood, with an underpass to Chatswood Oval. Construction of the northern dive structure and associated relocation of the T1 North Shore Line require it to be temporarily closed for periods during construction. Alternative pedestrian/cyclist facilities are available along the Pacific Highway to the west and via Orchard Street on the eastern side of the rail line.

The walk would be closed for approximately nine months in two stages in an effort to provide continued pedestrian/cyclist access. The underpass connecting Frank Channon Walk and Chatswood Oval would be closed during Stage 1 (for a period of up to three months). The Proponent has committed to reopening the underpass to maintain the east-west connection when Stage 1 works are complete.

While closure of Frank Channon Walk during construction would affect north-south pedestrian/cyclist connectivity; alternate pathways are available along the Pacific Highway and along Orchard Road. The Department acknowledges this temporary loss of access but for safety reasons accepts the need for the closure.

To increase the overall pedestrian/cyclist north-south connectivity, the Frank Channon Walk would be extended from Nelson Street to Mowbray Road once construction is completed. Mowbray Road would provide east-west connectivity across the T1 North Shore Line, in lieu of Nelson Street. The extension of the Frank Channon Walk to Mowbray Road in the longer term, would enhance the north-south connection. However, the removal of the Nelson Street overbridge would affect east-west connectivity across the rail line. Therefore the Department recommends a condition that requires the proponent to investigate the actual foot and bicycle traffic that uses this pathway and where demand warrants it, provide an additional pedestrian and bicycle overbridge.

Pedestrian access to and through Martin Place will be affected during construction. Martin Place between Elizabeth and Castlereagh streets will be closed for six months during cut and cover activities. An alternative route during is proposed during this period to the south of the demolished building.

Access to the existing station via the underground concourse between Castlereagh and Elizabeth will also be closed however access will be retained east of Elizabeth and east of Phillip streets with exception of that adjacent to 60 Phillip Street which will be closed for three years for construction of a separate project.

The changes will likely result in additional pedestrian crossings of Elizabeth and Castlereagh streets. These crossings run a significant width of Martin Place and are considered to have sufficient storage capacity to absorb the increases during construction. Despite this, the level

of service at all remaining pedestrian access points will deteriorate during AM and PM peaks during the six month closure, some to as low as LoS F in the peak minute. The Proponent has committed to use of marshalls during peak periods to maintain pedestrian flows and direct pedestrians to access and egress points. The Department acknowledges that this is a short term impact which will likely be alleviated once cut and cover activities are complete and Martin Place is reopened. This and any other measures to be adopted to minimise the impacts of construction on this busy commuter and tourist station will need to be addressed in the Construction Traffic Management Framework and subsequent Construction Traffic Management Plans.

Reduced footpath widths on Castlereagh and Elizabeth streets are not expected to have a significant effect pedestrian movements along these corridors, though some street furniture may need to be temporarily relocated. These matters will be considered in the relevant Construction Traffic Management Plan.

Operational Traffic

The Department notes that generally there are few proposed changes to the road network that would result in change to existing traffic movements once the project commences operation. Almost all intersections would retain the existing, pre-construction level of service at that time. The Proponent has identified that very few passengers are likely to arrive at metro stations by car. It is unlikely passengers would park and ride at any station and kiss and ride passengers are only likely at those more suburban stations such as Crows Nest and Waterloo. Up to six per cent of passengers in the busiest hour in the morning peak are expected to arrive at Victoria Cross by kiss and ride.

The Proponent proposes including kiss and ride facilities on the southern side of Berry Street. North Sydney Council has stated that these should not be prioritised ahead of active transport facilities such as walking and cycle paths and considers the proposed location unsafe. The Department agrees with this but notes that the Proponent has prepared the design taking into account a transport access hierarchy which prioritises walking and cycling, as well as committing to further consultation with council and RMS to finalise an appropriate location.

The Department accepts the proposed approach, however consideration of any facilities, including park and ride, cycleways and footpaths should not be undertaken in isolation as means of accessing any of the stations but one which also considers integration with the wider community and the public realm surrounding each station. The recommended condition requiring preparation of Station Access, Urban Design and Landscape Plans is an appropriate place to consider this within a broad context and range of issues. These plans would be prepared in consultation with the Precinct Design Working Group(s) which includes council representation.

Pedestrian and Cycle Connectivity

A number of submissions raised suggestions to improve connectivity to stations and in particular pedestrian connectivity. The Department supports the maintenance of existing active transport connections to and from stations and, where there is a clear benefit and nexus to the project, to facilitate opportunities to complete active transport connectivity. In this respect the Department recommends that the Proponent maintain or enhance pedestrian levels of service within the walking catchments of any station including consideration of connections which extend beyond the station boundary.

A number of Councils have identified “missing links” within existing networks which would service the metro. The Department considers that the Proponent should work with the relevant stakeholders to maximise the benefits of the project which includes ensuring easy and safe access to stations. It is considered that these concerns can be largely addressed through the recommended Interchange Access Plans and the station specific designs.

City of Sydney Council identified that access to the proposed Barangaroo Station caters well to workers, visitors and future residents of the Barangaroo South and Central developments, but did not provide any advantage to existing residents of Millers Point. Council recommended that the Proponent be required to provide a lift access from High Street to Hickson Road to cater for less mobile Millers Point residents. The Department notes that there is an existing set of stairs in this location that leads from the end of High Street down the heritage cliff face to Hickson Road. Notwithstanding, it is recognised that an accessible option is not available in this area, therefore the Department recommends that the Proponent be required to investigate the demand and opportunity for such a facility with any findings to be included in the relevant Interchange Access Plan.

The Proponent's plans to include parking for bicycles is critical to ensuring adequate integration of transport modes at interchange points. North Sydney and the City of Sydney councils raised concerns that the bicycle parking facilities would not meet the needs of those seeking to use these facilities. Additionally the Department considers that deferring bicycle parking facilities to over-station development does not adequately address cyclist needs. To address these concerns the Department has recommended operational reviews of bicycle parking at stations to establish demand and the need to provide additional facilities. Further, station access and public realm design should accommodate space to provide additional facilities to cater for future demand and the Department has recommended a condition to this effect.

Concerns have been raised regarding deterioration of the level of service and increased congestion for pedestrian access at key locations once the metro commences operation. This includes passengers exiting the following stations in the AM peak:

- Victoria Cross heading in a south easterly direction towards Denison Street where a shared zone with vehicles accessing basement carparks in adjacent buildings is proposed;
- Martin Place heading in a northerly direction across Hunter Street; and
- Pitt Street on Park and Bathurst streets in a westerly direction towards George Street and Town Hall.

Each of these areas are key destination locations for users of the metro. The Department considers that failure to ensure easy and convenient access to and from these stations could have significant consequences for the project. A potential future underground access from the Martin Place station to O'Connell or Bligh streets is flagged in the Preferred Infrastructure Report. The proponent has indicated that a stub tunnel to O'Connell Street would be created during construction but that any future connection to the station would be part of any future development application/applicant for this site. Various submissions also identified potential opportunities for underground pedestrian links in the following locations:

- Crows Nest near Oxley Street beneath the Pacific Highway;
- Victoria Cross; and
- Pitt Street connecting to the existing Town Hall station.

The Department accepts that these are not currently considered within the scope of the project; however as stated, it is considered that every opportunity should be explored with a view to ensure that stations are as accessible as possible. Irrespective, the Department considers that the station design and precinct planning should not preclude future underground access and connectivity where it can be demonstrated to benefit accessibility of the station.

For each of these locations, the Department acknowledges that there are major opportunities for, and that the respective councils have major plans to, create major civic places. It is considered that Station Design and Precinct Plans must integrate with any proposals to

develop these civic spaces in the longer term, but must also ensure that congestion and deterioration of pedestrian levels of service does not eventuate in the shorter term. Conditions of approval are recommended which require the Proponent to not worsen the pre-construction level of pedestrian service as well as to ensure that future plans for the stations, including accessibility and connectivity to major nearby civic places are taken into account in developing the Station Design and Precinct Plans.

Additional Station at Alexandria

The Proponent evaluated a range of station locations in the South Sydney area and undertook further analysis of an additional metro station near the junction of McEvoy Street and Euston Road, Alexandria. The evaluation did not identify a need for the station, as represented in **Figure 13**. Of particular note is that the station would have overlapping catchments, with Green Square, Erskineville and Waterloo stations; and the new catchment was relatively small and contained limited potential for employment and population growth. Accordingly, the Department accepts that a new station would not provide sufficient benefits to justify the cost of its construction.

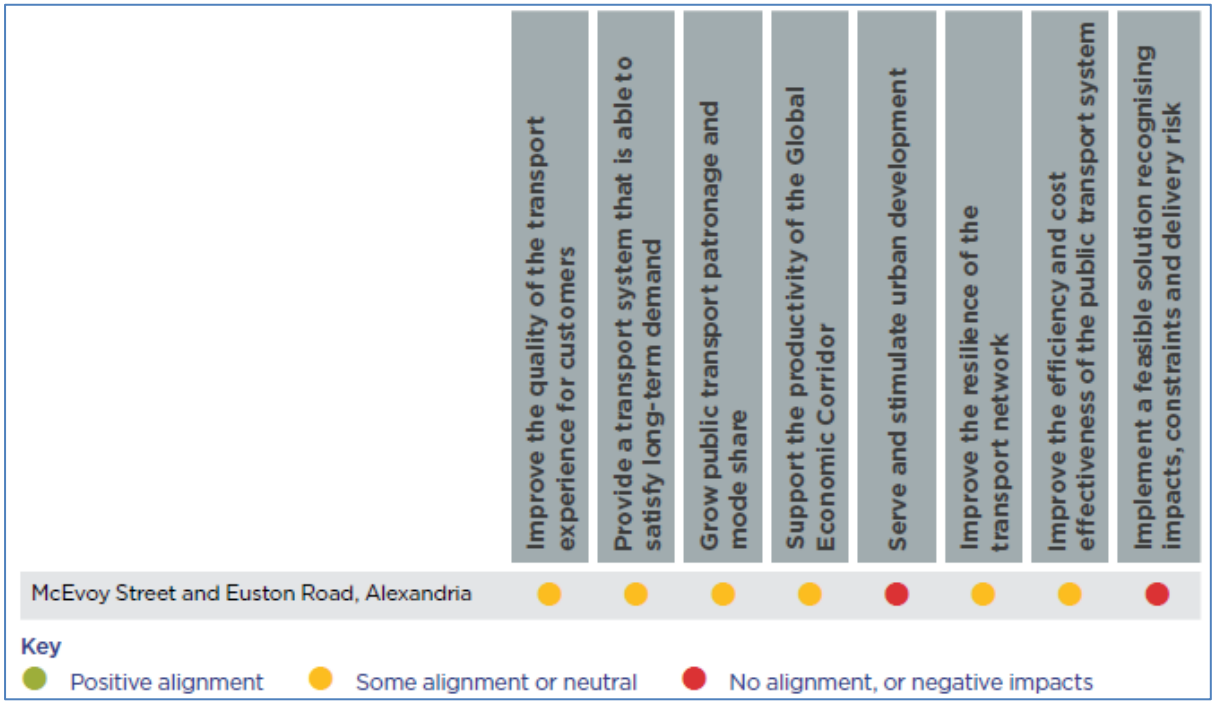

Figure 13 – Performance of a potential station at Alexandria (Source: TfNSW, RTS)

Heavy Rail Services to Erskineville and St Peters

A number of submissions raised concerns regarding future heavy rail services to these stations as they are currently serviced by the Bankstown Line. Once metro operations commence, Bankstown Line services would cease and these stations are removed from proposed metro stations. The Proponent has stated that these stations would continue to be serviced by heavy rail on either the East Hills or Eastern Suburbs and Illawarra lines. This would be taken into consideration with the review of the rail services timetable at the appropriate time. The Department is satisfied that this is an appropriate response at this time that would be addressed by existing operational processes for Sydney Trains and that no conditions are required.

5.4. Visual Amenity, Urban Design and Landscape

Issue

Whilst the majority of the project is underground, therefore reducing the landscape and visual impacts, there are proposed surface facilities that impact on the urban domain. These surface facilities would require the removal of substantial buildings and public domain elements such as street furniture, street trees, footpaths, stairwells, and public art.

Construction would have the greatest impacts to the landscape character from building and structure demolition and construction hoarding and site facilities. Areas with a greater than minor adverse impact are the:

- Chatswood dive site, due to the impact to the Frank Channon Walk, from the loss of trees;
- Victoria Cross Station, due to demolition of buildings and hoarding erection around the sit and removal of the Harbour cycles sculpture;
- Blues Point due to reduced public access to the foreshore area and harbour views;
- Martin Place, due to demolition of buildings and hoarding erection on the public space of Martin Place, pedestrian connectivity and landscape quality;
- Pitt Street, due to demolition of buildings and hoarding erection around the site, construction within the public realm for power supply; and
- Central Station, due to pedestrian connectivity impacts and activation of the northern concourse.

Once the Metro is operational, the visual impacts decrease to negligible in most areas. A moderate benefit is expected for Victoria Cross and Barangaroo Stations; while Martin Place is expected to result in a high benefit. However minor adverse impacts are expected on the Frank Channon Walk from the removal of trees during construction. Notwithstanding station design, their relationship and interaction with the surrounding public realm, and the opportunities to improve urban design are the key issues requiring assessment.

Submissions

Community submissions raised a number of concerns in relation to the visual impacts of construction and operations including impacts at Blues Point; changes to areas from property acquisition and removal of local businesses and residences; the construction of the Sydney Yard Access Bridge; station design and over-station development; tree removal; noise walls and impacts to the Tom Bass Sculpture at 55 Hunter Street (P&O Fountain).

The councils along the route raised similar concerns, including:

- ongoing consultation regarding integration with public domain strategies, plans, policies and codes, and works within the public realm, during construction and operation;
- the retention of trees;
- the achievement of design excellence; and
- the design of stations and their interface with the public domain and the retention of views, landscapes and streetscapes.

In addition the City of Sydney does not support the proposed northern station exit at Barangaroo or the location of ventilation shafts and sky lights on the eastern footpath of Hickson Road.

Consideration

The Department considers the design of the above ground elements to be critical to the attractiveness and user-experience for potential customers. The project also presents significant opportunities to contribute to the legacy and iconic nature of transport infrastructure, and the history of an evolving city. Notwithstanding, and in considering the submissions received, there are a range of issues that require further refinements.

Construction ancillary facilities

The Department notes that there would be a range of adverse visual impacts at construction and ancillary facility sites. Whilst the Department accepts that such impacts are an inevitable consequence of construction, the long duration of construction coupled with the industrial nature of construction sites within urban areas, requires that these visual impacts, including way finding, be effectively managed.

The Department considers that hoardings should be used as an opportunity for the project to convey relevant information to the public and not viewed simply as a boundary control and safety measure. The Department has therefore recommended that they interpret the heritage significance of sites and be used to inform the public of construction works occurring and the timeline for works. Hoardings, should be dynamic and updated as construction progresses.

Of particular concern to the Department and other agencies is the management of conflicting uses at Blues Point Reserve especially during major events such as New Year's Eve and the Vivid Light Festival. During construction there would be a temporary loss of 2,100 m^2 of open space. The Proponent has committed to avoiding works at the site during key harbour viewing events, and maintaining access to Sydney Harbour for small watercraft by establishing a 5 metre zone of the foreshore and along the eastern side of the site from Henry Lawson Drive to the foreshore. The Department has reinforced this commitment by requiring that the Proponent work collaboratively with Events NSW and other key government organisations to identify key viewing events and to avoid work during these events. In addition, special event management must also be included in the Construction Traffic Management Framework that will provide a consistent guide for developing Construction Traffic Management Plans for each construction site.

Station design and place integration

Whilst the Department acknowledges that detailed design is an iterative and ongoing process and has not progressed to the point where active frontages within the operational footprint have been determined, the issue is important to the integration of station facilities with surrounding contexts. **Figure 14** shows the conceptual entrance to the Barangaroo Metro Station. North Sydney and the City of Sydney Councils raised the issue that station frontages should be designed for retail, commercial and community opportunities.

The Department considers that station design should provide for high quality and integrated places, having regard to local values and opportunities. Whilst the Department acknowledges that the *Chatswood to Sydenham Design Guidelines* provide a solid basis for detailed design, to ensure design excellence and integration with the public domain, the Department considers it necessary for the project to be refined in collaboration with design experts and the relevant Councils. To achieve this, the Department recommends that the Design Review Panel (DRP), established during preparation of the EIS, continues to guide high quality design outcomes. To ensure applicability of design review outcomes at the local context, relevant council(s) and other key stakeholders such as Urban Growth NSW would be invited to participate in the DRP meetings as appropriate.

Detailed design would be articulated in a Station Design and Precinct Plans (SDPP), which would be prepared in consultation with the relevant council(s). The SDPP would detail the

design of the station including but not limited to frontage activation; design and management of the public and private interface; final appearance of the stations (where there may be a lag between station operation and the commencement of over-station development) and adherence to *Crime Prevention through Environmental Design* (CPTED) principles. This SDPP would be approved by the Secretary.

Figure 14 – Indicative Barangaroo Station Entrance (Source: TfNSW, EIS)

The Department considers that the incorporation of salvaged historic and artistic elements into the project design is key and should include but not limited to the Tom Bass P&O fountain, Bass Relief and the Douglas Annand glass screen and has recommended a condition to this effect.

The Proponent has committed to consulting with the Design Review Panel in developing over-station development proposal(s). This would ensure that any design aligns with the design principles established for the project; key infrastructure built into the station that would integrate with the over station development (utilities and plant rooms and lift access shafts) and structure of the transition slab; that the proposed over-station development would not have a negative impact on the function or accessibility of the stations and provide for generous and attractive public domain areas. The Department supports this approach and notes that these matters would be considered in the development of the SDPP.

To further address the communities concern about the visual impacts of the project, the Department has recommended that the Proponent to facilitate a “Minor Benefit” visual impact rating for all design elements of the project.

<u>Street trees and landscaping</u>
Expected impacts to street trees will occur at the Chatswood dive site; Artarmon substation; Blues Point temporary site; Barangaroo Station site and Marrickville dive site.

The Proponent has committed to retaining the large fig tree at the eastern end of Blues Point Reserve. The Department is aware of the importance with which the community applies to this tree and fig trees more broadly and has recommended a condition to highlight the importance placed on retaining the tree, but which allows for pruning on the recommendation of an arborist including an assessment of impact to its long term viability.

Willoughby Council raised concerns in its submission that clearing of trees from alongside the Frank Channon Walk, would result in a loss of shade and visual amenity and result in heat gains. To reduce this impact, the Department considers that clearing of established and mature vegetation should be minimised and staged where possible. Revegetation should occur as soon as practicable as the works progress along and adjacent to the Frank Channon Walk and at the end of Gordon Avenue.

The Department notes the Proponent has assumed a worst-case scenario in relation to vegetation removal. To ensure that as many trees are retained as possible, the Department recommends that before construction the Proponent assesses and reports on those trees in and adjacent to construction sites, including along the utilities routes, that can be retained and identify appropriate protection measures. A robust process must be developed and implemented before determining that a tree must be removed which ensures that all possible options to retain it have been considered. A report of this assessment (tree report) must be provided to the Secretary for approval.

Conclusion

The Department acknowledges the work done by the Proponent to date to facilitate high quality urban design and public domain. Notwithstanding, the Department is aware that this project does not start and end at the boundaries of the station sites and that the project must integrate with its surrounding environment. Accordingly, the Department has recommended that the Proponent employ significant design expertise to guide this and to collaborate with councils, their local communities and visions for place making around the stations. The Department has also recommended a suite of urban design conditions forming a coherent and comprehensive urban design management framework for the project.

5.5. Land Use, Social and Economic Considerations

Issue

The project area comprises a range of socio-economic environments including residential, industrial and commercial. A summary of the key socio-economic impacts is presented in **Table 4**. Submissions and impacts associated from noise and vibration, traffic and transport and air quality further discussed in sections 5.1, 5.3 and 5.6.

Table 4: **Summary of Potential Social, Economic and Land Use Impacts during Construction and Operation of the Project**

Issue	Construction impact	Operation impact
Noise and vibration	• The proximity of residential and other sensitive receivers during construction will likely result in high noise impacts • Indirect impacts from underground tunnelling • Detail provided in section 5.1	• Indirect impacts from underground metro trains • Detail provided in section 5.1

Issue	Construction impact	Operation impact
Access and traffic	• Temporary road closures surrounding construction sites affecting road users, businesses, loading zones, residents and customers • Parking spaces will be removed along some roadways affecting road users, businesses and residents • Detail provided in section 5.3	• Parking spaces will be removed along some roadways causing disruption in the short-term • Detail provided in section 5.3
Air quality	• The proximity of residential and other sensitive receivers during construction may result impacts on air quality • Detail provided in section 5.6	• No impacts during operation
Property acquisition	• Land acquisition of 204 freehold interests (3 hotels, 11 development sites, 88 residential, 91 commercial, 6 office towers and 5 government) • Transfer or cessation of a number of leases	• Opportunities to return residual land in the future • Opportunities for future over station development (subject to separate assessment process) • Improvements to public domain and open space
Access to Public Spaces and Community Facilities	• Construction vehicles may present a safety risk to parents and children utilising child care centres, schools and sporting centres and ovals • Potential impacts to park users and water users at Blue Point Reserve and McMahons Point Wharf. • Martin Place will be closed at the new station location • Restrictions to pedestrian and cyclist access around surface works	• Blues Point construction site will be rehabilitated to its original use • Martin Place will be opened with greater underground connectivity and improvements at the surface • Improvements to public domain around new stations
Retail and Business	• Alterations to business access, deliveries and servicing as a result of road and access reconfigurations are likely to cause disruption • Removal of street-level parking in retail areas may impact on access and customer passage • The cumulative effects of the construction phase have the potential to impact the trading of businesses • Increase in workers associated with the project will benefit some food and outlets	• Enhanced access to customers will be provided to businesses along the route • Rail users will benefit from more convenient access to businesses and retail premises • Businesses and retail services will be accessible to a potentially wider range of customers
Employment	• There is potential for noise to impact upon workers and workplace ambience along the route • Jobs will be created during the construction period	• Approximately 150 jobs will be created during operation • Over station development may allow for new business and employment opportunities

The project is predicted to generate approximately 2,820 full-time equivalent jobs during construction and approximately 150 full-time equivalent jobs during operation of the project. Further jobs would also be indirectly created by the project.

The project would boost local economic activity by approximately $5 billion per year.

Submissions

The community raised a number of concerns, the key concerns relating to:

- property acquisition, including substratum acquisition, loss of businesses, sensitivity of acquisition processes and loss of community infrastructure;
- impacts at Waterloo, including those associated with the areas broader development and its impacts on affordable housing, business, community and residents
- land use impacts, land use integration and over station development;
- lack of consultation;
- amenity impacts to residential and business premises, including impacts on customer experience and access; and
- impact on property values and loss of business.

These issues were also raised in Government agency and Council submissions. Other issues raised by these stakeholders are as follows.

Willoughby Council raised issues on community engagement and a potential land use conflict through the identification of the Artarmon Substation site for the purposes of affordable housing.

Lane Cove Council raised issues with Council's recent land use planning (particularly around Crows Nest/St Leonards).

North Sydney Council raised issues around future land uses and community engagement.

City of Sydney raised concerns regarding the capacity of the Metro to meet future demands, scheduling of CBD events, Metro running hours to service late-night economy, land use and property.

Inner West Council raised concerns regarding the acquisition of industrial lots and impacts on local businesses.

Greens NSW Transport Spokesperson raised concerns regarding the acquisition of properties and requirement to undertake this process sensitively. The Greens NSW State member for Newtown raised concerns regarding the residential and public amenity in Waterloo, public housing impacts at Waterloo and the compulsory acquisition process.

Consideration

The Department acknowledges that a project of this scale would result in changes to the existing socio-economic environment. However, as the project would be largely below ground, social and land use impacts are limited to surface works locations and their surrounds.

<u>Residential and business acquisition</u>
Approximately 204 freehold interests (3 hotels, 11 development sites, 88 residential properties, 91 commercial properties, 6 office towers and 5 government properties) would be acquired, including managing the transfer or breaking of leases in buildings subject to acquisition. The process to acquire the necessary properties is ongoing.

All acquisition would be managed in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*. It would also be necessary to acquire stratum for the tunnel below the surface of properties under the *Transport Administration Act 1988*. The Proponent would enter into agreements with relevant Government departments for the permanent or temporary use of Government-owned land.

The Department accepts that land acquisition is an unavoidable outcome of linear transport projects in urban environments, and acknowledges that this impact has been greatly reduced with most of the project being below ground. Regardless, it is acknowledged that anxiety, stress and other effects on social wellbeing may arise during the acquisition process.

The Proponent has advised that every effort would be made to acquire properties via negotiated purchase, including compensation for legal costs, valuations, relocation and removal expenses and mortgage costs. Assistance would also be provided to businesses in finding new premises. A number of management measures would also be implemented to facilitate this process such as:

- dedicated Transport for NSW place managers;
- dedicated transaction managers;
- a help line (1800 number and email address): and
- an independent mediator.

The Department supports these measures, and is satisfied that the processes in place would adequately mitigate social and economic impacts resulting from property acquisitions.

Land use

Approximately 1,189 m^2 of residential land, 10,561 m^2 of commercial/retail land, 24,343 m^2 of mixed use land and 90,777 m^2 of land zoned industrial (126,870 m^2 in total) would be acquired for construction of the project.

There is likely to be approximately 78,000 m^2 (19,000 m^2 at Chatswood and 59,000 m^2 at Marrickville) of residual land (land required for construction that is not required for operation of the project) at the Chatswood and Marrickville dive sites.

Approximately 60 per cent of the land required for construction is expected to become available for future development. This would help offset the loss of any land to project infrastructure. In this respect, the Department supports the Proponent's intention to review opportunities for the appropriate reuse of residual land in consultation with the relevant council.

Over station development may occur in the future which would further mitigate the loss of land to the project. The Proponent has identified that the proposed Crows Nest, Victoria Cross (southern site only), Martin Place (northern and southern sites), Pitt Street (northern and southern sites) and Waterloo stations have potential for development. As indicated elsewhere, over station development would be subject to a separate approval process which will ensure suitable development can be integrated with the metro stations.

The Waterloo station is within the Redfern-Waterloo Growth Centre area, a priority area for UrbanGrowth NSW. UrbanGrowth is working to ensure the ageing Waterloo social housing estate is progressively renewed to create a vibrant and sustainable community with a mix of private, affordable and social housing. Initial reduction in mixed use land would likely be offset following completion of construction with opportunities to redevelop a significant proportion of the land acquired. The type and form of that development is a matter for resolution in consultation with City of Sydney.

Industrial and employment lands, particularly in inner urban areas, are increasingly under threat from residential re-zoning which attracts higher land values. Approximately 84 per cent

of the land acquired for the Sydenham dive and tunnel segment pre-cast facility would remain for industrial and or transport related uses.

The Department acknowledges the dislocation and change to the areas surrounding the project, however this is being managed through a separate process. Overall the Department does not consider that the project itself results in significant land use change, but rather it would support long term opportunities though the renewal and initiatives of government, particularly in relation to the Redfern-Waterloo Growth Centre.

Business impacts

There would be economic benefits that flow from the project, including additional access and enhanced connections between important business and employment areas (see Traffic and Transport - section 5.3). It is, however, accepted that the local community may lose access to a limited range of goods and services during construction. Given the project's route through established areas on Sydney's North Shore and CBD, the loss of these businesses is unlikely to have a significant impact on the communities' access to similar services in proximity to construction works.

In this respect, the Proponent advises numerous businesses would exist which offer the same or similar services in these localities. For example, while there may be a localised impact associated with the closure of some furniture stores along the Pacific Highway at Crows Nest as a result of acquisition, a considerable number of furniture retailers have moved from the area to the Artarmon Home HQ Homemaker Centre, which provides alternative options for the customer.

Major commercial and retail areas also exist near the Victoria Cross Station such as the North Street Plaza, Berry Square and Greenwood Plaza. Loss of services associated with acquisition and closure of the underground concourse at Martin Place and at Pitt Street should be accommodated within the surrounding business and retail precinct.

At the Waterloo Station site, a number of premises to be acquired include commercial/retail (such as the convenience store, newsagent, bakery, laundry, lighting stores and medical centre) and industrial/warehouse (such as the factory outlet, footwear, clothing and automotive services). Commensurate businesses exist within the locality and the Proponent advises that the majority of these businesses would be readily relocated within the surrounding Waterloo/Botany Road precinct.

Premises to be acquired for the Sydenham dive site include freight and logistics, light industrial and manufacturing, all of which are adequately accommodated in the surrounding Marrickville/Sydenham area. In particular, it is noted that Marrickville contains a large number of automotive repair businesses catering to the local population.

The Department also acknowledges the concerns raised in public and Council submissions regarding impacts on amenity during the construction of the project. Specific amenity impacts (such as noise, air quality and traffic) are addressed in the relevant section of the Department's assessment report. In addition to this, the Proponent has also included a commitment to develop a business risk register to minimise disruptions and develop measures to manage specific construction impacts for individual businesses. This includes consultation with businesses potentially impacted during construction (particularly in keeping affected property owners informed of the project and any associated implications).

The reinforce this, the Department has recommended the Proponent develop a Business Management Plan to minimise impacts on businesses adjacent to major construction sites. This includes implementing a Business Consultation forum (linked into an overall Community Consultation Strategy for the Project) identifying Business Management Strategies for each

construction site (to identify affected businesses and associated management strategies), the implementation of a Small Business Owners' Support Program, and to develop a monitoring program to assess the effectiveness of the identified measures.

To further minimise any potential economic impacts of the construction works to businesses, the Department has recommended that measures be implemented to maintain pedestrian and vehicular access to, and parking in the vicinity of, businesses and affected properties. Where disruption cannot be avoided, alternative pedestrian and vehicular access, and parking arrangements must be developed in consultation with affected businesses and implemented before the disruption. Adequate signage and directions to businesses must be provided before and for the duration of any disruption.

Community infrastructure impacts

Once operational, the project would provide enhanced connectivity and access to services and public spaces along the route, benefiting communities, businesses and residents through improved public transport. However the Department acknowledges the community and local council concerns regarding amenity impacts and accessibility of community facilities during construction.

A number of community facilities are located within or in close proximity to the construction footprint. These facilities may experience amenity impacts (in particular noise impacts) during construction, and connectivity in and around some community facilities would also be temporarily altered. Some facilities would also be acquired and cease to operate. This includes the Crows Nest and Pitt Street post offices, Martin Place early learning centre, and Waterloo medical centres.

With regards to interruptions to existing access and connectivity, the Proponent has committed to maintaining pedestrian and cyclist access at Crows Nest during the temporary closure of Hume Street, and at Martin Place during its temporary closure.

With regards to the temporary loss of 2,100 m^2 open space area associated with the works at Blues Point Reserve, the Department has required the Proponent to develop and adopt specific management controls for construction during harbour related events to ensure the safety of visitors and Metro construction personnel.

With regards to the acquisition and relocation of facilities, the Proponent has also advised:

- it is assisting the remaining facilities (such as the post offices, early learning centre and holistic medical centre) with the relocation process (where required), with consultation indicating these facilities may be relocated in the local vicinity of the existing properties; and
- it is to consult with UrbanGrowth NSW to determine the potential to integrate the Waterloo bilingual medical centre (utilised by residents of the nearby Waterloo estate) into the future development of the Waterloo precinct.

The Department supports these initiatives and has recommended the Proponent determine viable alternative options for impacted community facilities during the construction phase in consultation with the relevant Council, community groups and key stakeholders.

The Department is also satisfied the recommended construction management plans and strategies (detailed within the specific topic areas contained within this assessment report) would provide adequate processes and safeguards to effectively manage indirect impacts on the amenity and accessibility of community facilities (such as schools, fire stations, institutes, churches, medical centres, libraries, theatres, childcare centres) within proximity to construction works.

Property values
The Department acknowledges the issue raised in public submissions regarding the risk to property values as a result of the project. However, with the ongoing refinement of the project design combined with committed and recommended management and mitigation measures, construction related residual impacts would be minimised and in locations that have improved public transport access, it is anticipated that there would be a positive effect on land value in the longer term.

Conclusion

The Department acknowledges that the project is likely to result in changes for the local community that would result in social and economic impacts, particularly through residential property acquisitions, relocation of businesses and short-term amenity impacts during its construction.

Although the social and economic impacts cannot be offset entirely, the Department considers the recommended conditions of approval, in conjunction with the Proponent's proposed environmental management measures, would mitigate the level of impact to acceptable levels. In this respect, the Department is satisfied the processes in place would adequately mitigate impacts resulting from property acquisitions, and the services lost as a result of the project would be adequately accommodated in the surrounding areas.

The Department is also satisfied that the recommended Business Management Plan and Construction Management Sub Plans would effectively mitigate indirect amenity and accessibility impacts to individual businesses and the community to an acceptable level.

While the Department acknowledges the issues raised by local communities, it is mindful that decisions must be made to ensure access to public transport is maintained or improved through a variety of transport solutions. As Sydney's population increases there is a need to maintain ease of movement for all members of the community. While the project would undoubtedly have social and economic impacts to communities adjacent to the surface infrastructure, the consequences of not improving network capacity would be greater and affect the broader Sydney population.

On balance the Department considers the network upgrades and reliability across the rail network would provide significant benefits to the local community and help continue the growth and development of the Greater Sydney Region, and are therefore acceptable.

5.6. Other Issues

5.6.1 Water Resources

Surface water catchments
Surface elements of the project are located in eight sub-catchments in the Sydney Harbour, Middle Harbour and Botany Bay catchments. No natural drainage lines are intersected by the project and most areas (except the T1 North Shore line widening, Artarmon substation and Blues Point sites) are impervious to rainfall infiltration.

The Proponent has committed to:
- implementing erosion and sediment control measures;
- implementing a procedure for identifying and managing potential acid sulphate soils;
- capturing and treating stormwater prior to discharge, to be regulated by an Environment Protection Licence; and
- installing a silt curtain grout stabilising is required in Sydney Harbour.

These measures would be described in a construction water quality management plan to be prepared in consultation with EPA and the relevant Councils.

All water inflows during operation would be directed to a water treatment plant at Marrickville for treatment prior to discharge to stormwater.

Flooding

Flooding may occur near six surface sites. Station sites at Barangaroo, Martin Place and Waterloo, and the Marrickville Dive site currently experience flooding in events greater than a 20 year ARI. Increased flood levels of between 20 mm and 600 mm are predicted around the Marrickville Dive Site during a range of modelled flooding scenarios, with the greatest increase occurring in the existing rail corridor.

Submissions from OEH, City of Sydney Council, Inner West Council, North Sydney Council, a business in the Marrickville industrial area and three community submissions raised flooding impacts as an issue. The Proponent has committed to:

- design the surface elements at stations to be at least 0.5 m above the 100 year ARI flood level, where possible, or consider using drainage, collection and pump-out systems to prevent and/or manage inflows; and
- consult with the key stakeholder agencies including OEH, Councils, Sydney Trains, and the State Emergency Service during detailed design to ensure flooding is not worsened by the project and to inform the development of floodplain management plans.

The Department notes flooding impacts are primarily localised and located within or adjoining the project. Notwithstanding, the Department has recommended conditions requiring the development of the flood mitigation and design in consultation with affected properties and businesses in addition to the relevant agencies, Councils and emergency services.

Because of these measures the Department is satisfied the potential flooding impacts can be managed through design and/or management during operation of the project.

Groundwater

Underlying geology along the project alignment is Hawkesbury Sandstone, though areas of Ashfield Shale and Mittagong Formation may be encountered.

Surface sites would be located in areas of fill, soils and alluvium. The project alignment would also pass within or beneath the bed of Sydney Harbour and the Quaternary Alluvium geology associated with the Botany Sands Aquifer.

The project would be designed so the majority of underground structures are ‘tanked,’ where the inflow of groundwater is minimised by use of concrete lining and/or membranes to effectively seal the structures. Crows Nest and Central stations and shafts to the Victoria Cross and Martin Place stations would be unsealed (or ‘drained’), which would allow groundwater seepage into the structures. Collected groundwater would be pumped to the project water treatment plant at Marrickville during operation.

The project is unlikely to lower the water table at surrounding bores by more than the 2 m minimal harm criterion established under the *Water Management Act 2000*, and the Proponent would set this threshold as a design objective. Consequently, the project is unlikely to significantly impact surrounding groundwater users and would comply with the applicable rules under the *Water Sharing Plan for the Greater Metropolitan Groundwater Sources 2011*.

The Proponent would update its groundwater model during detailed design and monitor impacts in areas where the modelling suggests impacts greater than the target levels.

Consequently, the Department has recommended the development of a groundwater management plan for construction and operation, in consultation with DPI Water. These plans would include an updated groundwater model and design refinements to minimise groundwater drawdown including during construction.

5.6.2 Aboriginal Heritage

Only one recorded Aboriginal heritage site is known along the alignment. This is a sub-surface archaeological deposit occurring within 75 meters of Martin Place Station at Angel Place. A number of previously recorded Aboriginal heritage sites were identified within the broader project locality, although at distances greater than 100 metres from the project.

Sites near the dive locations and station excavation areas are considered to either have high archaeological potential, on the basis of site disturbance history or high archaeological significance, due to the rarity of previous finds. The integrity of archaeological deposits is expected to vary and be site specific, with archaeological significance and research potential of deposits highest in the CBD.

The likelihood of encountering deposits is considered high despite the disturbance history and urbanisation of the alignment since European settlement. It has been demonstrated in the Sydney CBD that building footings preserve Aboriginal heritage sub-surface sites despite demolition and subsequent construction. Significant deposits of Aboriginal objects may be encountered given intact remnant “A” soil horizons (alluvial topsoil) and sands are known beneath dwellings identified for removal. However, locations where extensive excavation for basements or car parks has occurred are expected to substantially lower the likelihood that intact archaeological deposits have survived.

The Department is satisfied that the Aboriginal Cultural Heritage Assessment Report, submitted with the EIS, provides an adequate framework for the management of Aboriginal cultural heritage expected during site excavations. The Department is also satisfied with the Proponent’s proposed measure to implement an unexpected finds procedure, and other measures to avoid or minimise impacts to objects should they be uncovered during construction of the project.

5.6.3 Soils and Contamination

Sixteen locations along the project corridor have known or potential contamination. The former Caltex service station at the Chatswood dive site and former gas works at Barangaroo have a high likelihood of contamination and both are currently regulated under the *Contaminated Land Management Act 1997*.

Potential contaminants include hydrocarbons and heavy metals associated with the former gas works and leaks from fuel storage tanks, along with fill containing asbestos, heavy metals pesticides and gasworks waste.

Further assessment would be made of the sites with potential or known contamination prior to construction. Where required, the Proponent would need to develop a Remediation Action Plan in accordance with *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998) and engage a site auditor to verify the remediation works.

This approach is reasonable for the likely contamination to be encountered during construction of the project and would adequately manage risks associated with soil contamination.

5.6.4 Biodiversity

Construction of the project would result in minimal vegetation loss, comprising mainly of planted trees and shrubs and occasional scattered regeneration of common native plant species. Construction in Sydney Harbour may also impact aquatic species, through disturbance of the harbour bed, noise and vibration and water quality impacts.

Although there is minimal vegetation to be impacted, clearing vegetation at the construction sites would result in the potential threat to foraging habitat for three threatened fauna species: the Grey-headed Flying Fox, Eastern Freetail Bat and Eastern Bentwing Bat. The vegetation does not comprise habitat for 'species' credits and, as such, the *Framework for Biodiversity Assessment* is not applicable and offsets were not calculated.

An assessment of significance was undertaken as part of the EIS and concluded that the project is unlikely to have a significant impact on any of the threatened fauna species. In addition, the risk of impacts to aquatic species and groundwater dependent ecosystems is considered low and as any drawdown would be temporary.

The Department accepts that the likely impacts on fauna are low and that proposed biodiversity management and mitigation measures proposed are adequate.

5.6.5 Air Quality

During construction, particulate matter would be mostly generated by demolition and excavation works, materials handling and material storage, along with the operation of on-site machinery. The tunnel boring machine is powered by electricity thus minimising tunnel exhaust emissions. Air quality impacts would be managed through maintenance of vehicles and equipment and monitoring unsurfaced haul routes, stockpiles, and all vehicles carrying loose or dusty material to minimise dust generation.

With the implementation of standard dust control measures and vehicle maintenance, the project would have a minor impact on local air quality during construction, and that the effects on human health across the community would be minor and acceptable. The Department has recommended the preparation of a construction air quality management plan to ensure the potential impacts are minimised.

During operation, minor particulate matter emissions would be generated by the entrainment (lift off) of surface particles along the metro corridor, wheel and rail wear and traction sanding. The tunnel and underground structures would be ventilated, with fresh air to be drawn in and circulated through the project and ventilation outlets to discharge the circulated air to the atmosphere. The concentration of pollutants in exhaust emissions would be very low given the project would be powered by electricity.

As a result, the Department considers that the proposed operational and construction air quality outcomes are acceptable, with the implementation of the Proponents recommended mitigation and management measures.

5.6.6 Fire Hazards and Risk

A qualitative assessment of hazards associated with the construction of the project was undertaken, with primary hazards and safety issues identified being:

- hazards resulting from accidental releases, underground ruptures, or improper handling and storage of dangerous goods and hazardous substances;
- hazards resulting from releases of hazardous substances from vehicles transporting dangerous goods and hazardous substances to and from the site; and

- hazards due to ground movement and geotechnical uncertainty.

The EIS predicts that the levels are dangerous and hazardous substances to be transported and stored as part of the proposal remains within the limits of *State Environmental Policy No. 33 – Hazardous and Offensive Development* (SEPP 33). The Department is satisfied that the implementation of the Construction Environmental Management Plan would minimise the risks associated with dangerous and hazardous substances.

5.6.7 Waste Management

Several types of waste are likely to be generated during major civil construction works. The quantity and type of waste material would be site specific, but the majority of waste is expected to consist of general solid waste, including approximately 2.4 million cubic metres of spoil. Potential waste management impacts associated with the project include:

- large volumes of demolition waste;
- dust impacts from the incorrect storage, handling and disposal of spoil;
- contamination of soil, surface or groundwater; and
- an increase in vermin from the incorrect storage, handling and disposal of waste.

Waste management activities associated with the construction works are not considered to pose a significant risk to the environment given that standard measures are available to address waste generation, storage, disposal and re-use in order to reduce impacts. The Proponent has identified mitigation measures to manage waste in accordance with the principles of resource management hierarchy embodied in the *Waste Avoidance and Resource Recovery Act 2001*.

Demolition waste would be segregated and stockpiled on site, with spoil to be reused where it meets the relevant standards for reuse, to be described in a spoil management strategy. Any spoil classified as contaminated would be directed to a waste management facility lawfully permitted to accept the waste.

Overall, the Department is generally satisfied that the Proponent has provided a suitable framework, including the requirement to prepare a Waste Management and Recycling Plan, to ensure construction of the project is undertaken to avoid, reduce and manage identified waste impacts.

6. CONCLUSIONS AND RECOMMENDATIONS

Need and Justification

Sydney is a growing international city with population expected to increase from 4.4 million in 2006 to 6.4 million in 2036. The heavy rail network is already under considerable pressure with some lines at or nearing capacity. Sydney Metro would deliver a step-change in the capacity of Sydney's rail network providing a new high demand, high capacity, turn up and go system which is independent of but integrated with, the existing suburban rail system.

Together with upgrades to signalling and infrastructure across the heavy rail network, Sydney Metro would increase the capacity of the rail network through the Sydney CBD from about 120 services per hour during peak periods today, to up to 200 services per hour beyond 2024. This would increase capacity across the rail network by up to 100,000 customers per hour in the peak.

The project is consistent with transport and planning strategies and State government policies. In particular this includes the *Sydney's Rail Future: Modernising Sydney's Trains, Draft Metropolitan Strategy for Sydney 2031;* and *the NSW Long Term Transport Master Plan* which indicate a strategic need to:

- increase transport capacity in key parts of the network, especially to the Sydney CBD and the Global Economic Corridor;
- drive productivity through integrated transport and land use planning to realise the productivity benefits of having businesses close together enabling increased interaction, knowledge sharing and collaboration; and
- effectively develop infrastructure to cement Sydney's position among the world's most liveable cities and Australia's only global city.

Key Considerations

Key impacts of the proposal include noise and vibration, heritage, traffic and transport, urban design and social and economic.

The Department has assessed the merits of the proposal taking into consideration the issues raised in all submissions and is satisfied that the impacts have been satisfactorily addressed in the Proponent's EIS, Submissions and Preferred Infrastructure Report and the Department's recommended conditions of approval. A new, world class transport initiative which relieves the existing public transport system is a positive planning outcome that provides equity of access, reduces land use conflicts and the benefits of which would be shared by the broader population.

A project of this scale would inevitably have residual impacts, the Department has recommended conditions that balance community amenity with the needs of construction including:

- the employment of a Community Complaints Commissioner to assist in addressing community concerns;
- significant community and receiver consultation through implementation of a comprehensive noise and vibration construction management plan;
- ability to implement a controlled blasting strategy to reduce construction timeframes and limit the need to use high noise generating equipment such as rock breakers;
- respite periods to be developed in consultation with sensitive receivers;
- broadening of the Design Review Panel membership to include a Heritage Council representative;
- archival recording of all buildings and structures to be demolished;

- salvage of important heritage fabric for re-use;
- ability to manage spoil haulage and material delivery over 24 hours to reduce impacts to the local and regional traffic routes (subject to meeting specific noise limits);
- investigation of alternatives to road-based transport for haulage and delivery of materials;
- establishment of a truck marshalling and logistics centre to provide just-in-time delivery of trucks to construction sites;
- involvement of relevant councils in developing Station Design and Precinct Plans which consider connectivity and access to ensure local values and visions are core to place-making and public domain; and
- independent mediators for property impacts and unsatisfactorily resolved complaints.

The potential environmental impacts of construction and operation of the proposal would be acceptable subject to implementation of commitments in the Proponent's EIS and PIR and the Department's recommended conditions of approval. The proposal would comply with the objects of the *Environmental Planning and Assessment Act (1979)* and with the principles of Ecologically Sustainable Development.

Recommendation

On balance, it is concluded that the proposal's benefits outweigh its potential impacts and that any residual impacts can be managed and would not, subject to conditions, result in any long term adverse or irreversible effects. It is therefore in the public interest that the project proceeds and it is recommended that the project be approved subject to the Department's recommended conditions of approval

David Gainsford 20/12/16
Executive Director
Priority Projects Assessments

Marcus Ray
Deputy Secretary
Planning Services 20/12/2016

APPENDIX A ENVIRONMENTAL IMPACT STATEMENT

See the Department's website at
http://www.majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=7400

APPENDIX B SUBMISSIONS

See the Department's website at
http://www.majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=7400

APPENDIX C PROPONENT'S SUBMISSIONS AND PREFERRED INFRASTRUCTURE REPORT

See the Department's website at
http://www.majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=7400