

Attachment A15

Rail Impact Assessment



Sydney Metro West

Planning Proposal for Hunter Street Over Station
Development

Rail Impact Assessment

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1 Introduction

1.1 Purpose

The Sydney Metro West Hunter Street Station over station development (OSD) Planning Proposal seeks to amend the maximum building height and maximum floor space ratio permitted for both the Hunter Street Eastern and Hunter Street Western sites under the *Sydney Local Environmental Plan 2012 (SLEP 2012)*. This rail impact assessment report forms part of the planning proposal submitted for the Sydney Metro Hunter Street Station OSD.

This report addresses the following requirements:

- Review the Rail Protection Reserves defined in Section 5 of T HR CI 12051 ST 'Development Near Rail Tunnels' and summarise the Rail Protection Reserves.
- Provide a rail impact assessment to the TfNSW rail network due to the proposed Sydney Metro West Hunter Street Station OSD.

The interaction between the Sydney Metro West and the Sydney Metro City and Southwest has been assessed and considered in a separate Sydney Metro integrated design process and is not covered in this report. The assessment concluded that the interaction can be appropriately managed during detailed design via engineering processes.

1.2 Overview

This Rail Impact Assessment accompanies a planning proposal seeking an amendment to the *Sydney Local Environmental Plan 2012 (SLEP 2012)*. The intended outcome of the proposed amendments to the SLEP 2012 is to facilitate the redevelopment of the site for an integrated station development (ISD) consisting of the new Hunter Street Station and two commercial developments. The proposal aligns with the Central Sydney Strategy to deliver high quality employment generating floor space and contribute towards the establishment of an integrated transport hub within the Sydney CBD.

Hunter Street Station is located in the northern part of Sydney CBD and comprises two sites referred to as Hunter Street Eastern site and Hunter Street Western site. The Eastern site is located on the corner of O'Connell Street, Hunter Street and Bligh Street. The Western site is located on the corner of George and Hunter Street, including De Mestre Place and land predominantly occupied by the existing Hunter Connection retail plaza.

Refer to Figure 1 below which illustrates the location of the Hunter Street Station (Sydney CBD) within its regional context.

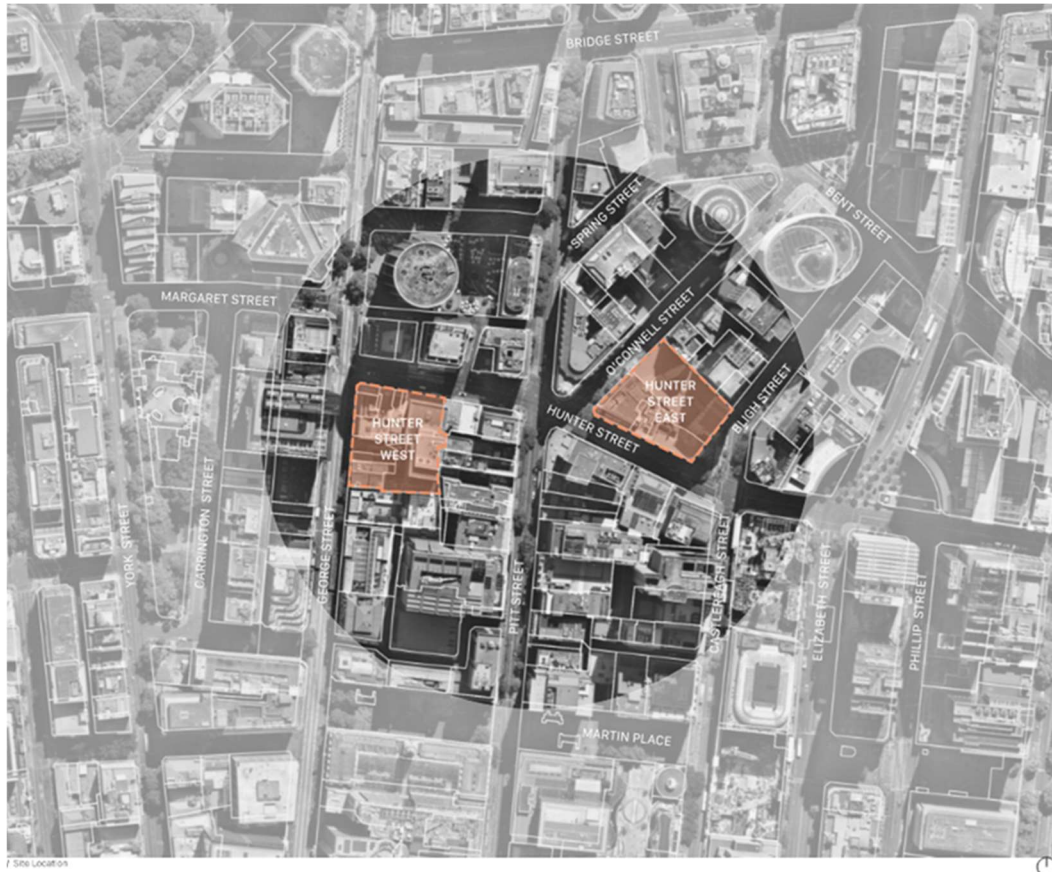


Figure 1 – Location of Hunter Street Station

1.3 Planning process

1.3.1 State Significant Infrastructure

Sydney Metro West was declared as State Significant Infrastructure (SSI) and Critical State Significant Infrastructure (CSSI) under sections 5.12(4) and 5.13 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) respectively on 23 September 2020.

Sydney Metro West is being assessed as a staged infrastructure application under Section 5.20 of the EP&A Act. The approved Concept and major civil construction work for Sydney Metro West between Westmead and The Bays (Stage 1 of the planning approval process application number SSI-10038) were approved on 11 March 2021.

Stage 2 of the planning approval process (application number SSI-19238057) includes all major civil construction work, including station excavation and tunnelling, between The Bays and Sydney CBD (an Environmental Impact Statement for this application was exhibited between 3 November and 15 December 2021).

Stage 3 of the planning approval process (application number SSI-22765520, being the application for the tunnel fit-out, construction of stations, ancillary facilities and station precincts, and operation and maintenance of the Sydney Metro West line. This application seeks approval for the construction of the Hunter Street Station, including above and below ground structures, public domain works, and spatial

provisioning and works to facilitate the construction and operation of an OSD above the two station entries which are described further in this report.

1.3.2 Over Station Development

The OSD components of the Hunter Street integrated station development is not declared as SSI or CSSI under *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP). As such, separate development consent is required to be granted for the construction and operation of development above the Hunter Street Station.

The primary land use of the OSD sites is anticipated to be ‘commercial premises’ which has a capital investment value of more than \$30 million, and which are located within a rail corridor and/or are associated with railway infrastructure. Consequently, the future OSD will be classified as State Significant Development. The SLEP 2012 is a relevant environmental planning instrument for the future development, though the Sydney Development Control Plan 2012 (Sydney DCP 2012) will not apply to the OSD sites.

To inform the planning controls relevant for the Hunter Street OSD sites, amendments are proposed to the SLEP 2012 to provide additional Maximum Height of Building and floor space ratio (FSR) controls. Further, as the Sydney DCP 2012 does not apply to the land, Sydney Metro will prepare a design guideline to support the planning proposal to inform the future built form on the site including details such as street frontage heights, setbacks, massing and tapering, development adjacent to heritage items, building exteriors, and managing wind impact.

The inter-relationship of the scope of Sydney Metro EIS2 and EIS 3 (Critical State Significant Infrastructure CSSI) and the Hunter Street planning proposal is illustrated in Figure 2.

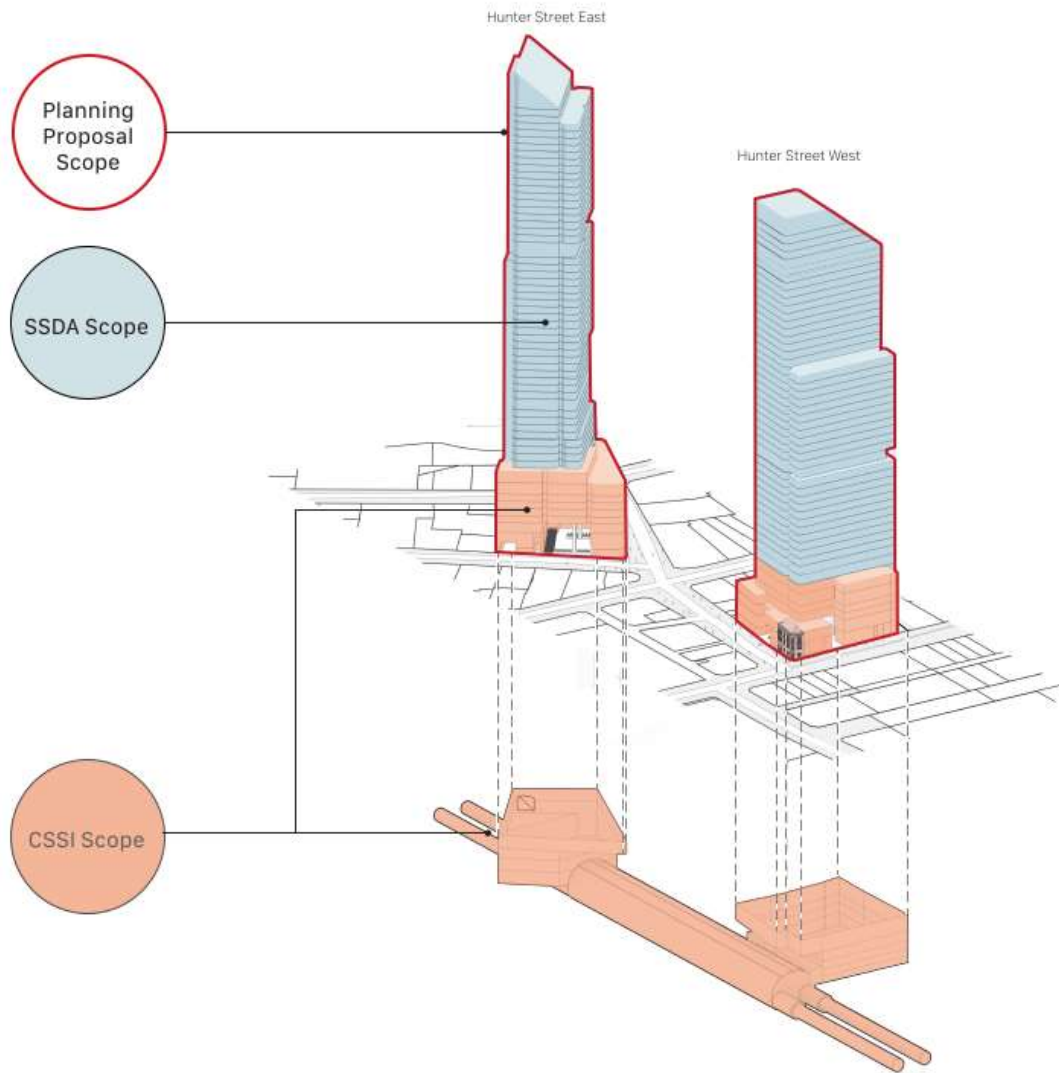


Figure 2 – Hunter Street Station and proposed OSD

Consideration of existing, future and interim rail corridors is an integral factor to the alignment and design of the Sydney Metro West project. The design of the tunnel and stations are subject to a rigorous design and engineering process, which includes engagement with Transport for NSW and the Department of Planning and Environment.

Transport for NSW (TfNSW) is defined as a *rail authority* under Section 2.90 of the *State Environmental Planning Policy (Transport and Infrastructure) 2021* and will be notified by the consent authority of any development which triggers legislation within or adjacent to an interim rail corridor or rail corridor. Sydney Metro and TfNSW have been involved in the development and design of Hunter Street Station and tunnel alignment.

2 Site description

2.1 Site description

The existing condition of the Hunter Street Station site is described as follows:

The eastern site:

- The Eastern site is partially occupied for the Sydney Metro City and South West construction site. The remainder of the site is currently occupied by existing commercial office buildings with a range of ground floor businesses, retail and food & drink premises.
- The Eastern site slopes steeply from east down to west along Hunter Street. There is approximately an 8m level difference between Bligh Street and O'Connell Street. The lowest point of the site is RL 11.31 m at the corner of O'Connell and Hunter Street. The highest point is RL 17.04 m at the northeast corner.

The western site:

- The Western site is occupied by commercial office buildings, restaurants, retail and business premises. The site also includes the State heritage listed 'former Skinners Family Hotel including interiors' at 296 George Street.
- The Western site has a moderate slope from west down to east along Hunter Street. There is approximately a 3.4m level difference between George Street and the north-eastern corner of the site at Hunter Street.

2.2 Soil landscape

As part of the *Sydney Metro West – major civil construction between The Bays and Sydney CBD* (SSI-19238057) a soils assessment was undertaken for the proposed Hunter Street (Sydney CBD) construction sites. The study area was defined as a 500m buffer surrounding the site as shown in Figure 3. The following soil landscape types were identified within the soils study area:

- Residual soils associated with the Gymea and Lucas Heights soil landscapes. These are derived from weathered siltstone and sandstone rock, except where formed by erosion. The residual soils derived from shale typically comprise stiff to hard clay of medium to high plasticity, gravelly clay, sandy clay and silt. The residual soils derived from sandstone typically comprise thin (less than 1.5 metres thick) medium plasticity silty clay to sandy clay
- Alluvial/fluvial soils associated with the Deep Creek soil landscape
- Disturbed terrain.

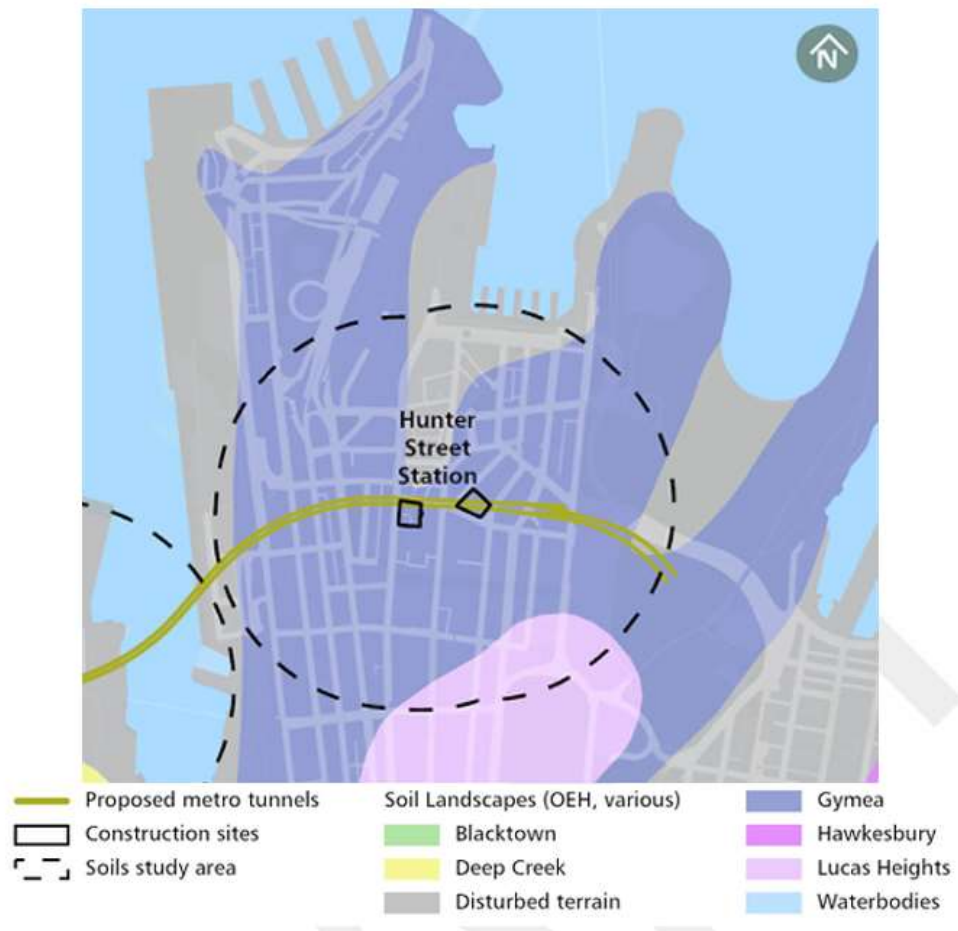


Figure 3 – Soil landscape underlying Hunter Street Station

The major soil type identified at Hunter Street Station and the surrounding tunnel alignment was the Gymea soil landscape, which is described as follows:

- Landscape: found on undulating to rolling rises and low hills on Hawkesbury Sandstone, with slopes between 10 per cent and 25 per cent and local relief up to 80 metres
- Soils: shallow to moderately deep (30 centimetres to 100 centimetres)
- Limitations: localised steep slopes, high soil erosion hazards, shallow highly permeable soil and very low soil fertility

A detailed analysis of geotechnical conditions was carried out during the options analysis to assess the suitability of the site for construction as part of the CSSI scope.

2.3 Topography and Hunter Street Station details

The proposed Hunter Street OSD is located in the heart of Sydney CBD and approximately 500m from the Sydney Harbour. The surrounding land is highly

urbanised with typical ground surface elevations between about RL 10m AHD and 15m AHD.

2.3.1 Western shaft

The western shaft is approximately rectangular in shape and excludes the heritage building (Skinners Hotel) located at the corner of George and Hunter streets which is to be maintained. The site has a total perimeter length of about 228m measured at ground level. Existing ground surface levels across the site are approximately RL+9.0m AHD (Australian Height Datum) to +13.0m AHD. These levels are to be confirmed through a detailed site survey and may be affected by any existing building basements. The proposed excavation level of the shaft is approximately RL-18.2m AHD.

2.3.2 Eastern shaft

The eastern shaft has an unconventional polygon shape. The site has a total perimeter length of approximately 245m measured at ground level. Existing ground surface levels across the site range between RL+12.0 to RL+16.0m AHD with higher elevation towards the east. These levels are to be confirmed through a detailed site survey and may be affected by any existing building basements. The proposed excavation level of the shaft is approximately RL-19.4m AHD.

The features of Hunter Street Station are still being developed at the time of writing of this assessment report.

2.4 Geology

The Hunter Street Station has a relatively thin cover of anthropogenic ground (filling) which overly a relatively thin layer of residual soils derived from the Hawkesbury Sandstone unit. The underlying bedrock is Hawkesbury Sandstone. The Hawkesbury Sandstone is described as medium to coarse-grained quartz-rich sandstone with occasional shale lenses.

The Martin Place Joint Swarm is expected to intersect the station and tunnel alignment. The joint swarm has been intersected in previous major tunnel projects, excavations and boreholes between Ultimo and Martin Place Railway Station. The presence of the joint swarm results in increased fracturing of the sandstone which can increase the movement due to excavation.

A summary of the indicative subsurface profile in the vicinity of station is presented in Table 2-1. The unit depths, thicknesses and material properties presented in Table 2-1 should not be assumed to represent the maximum or minimum values within the Hunter Street Station. Actual unit boundaries and material properties can be highly variable, particularly for fill.

Table 2-1: Indicative subsurface profile

Geotechnical Unit	Description	Depth to Top of Unit (m)	Unit Thickness (m)
Fill	Existing, with variable material type and consistency	Ground Surface	Up to 3.5m

Geotechnical Unit	Description	Depth to Top of Unit (m)	Unit Thickness (m)
<i>Residual Soil</i>	<i>Typically Sandy Clay or Clayey Sand</i>	<i>1.0 to 3.5m</i>	<i>1.3 to 2.1m</i>
<i>Hawkesbury Sandstone</i>	<i>Sandstone, highly weathered to fresh, low to very high rock strength</i>	<i>2.5 to 5.0m</i>	<i>Bedrock</i>

2.5 Groundwater

Available groundwater monitoring data around the Hunter Street Station site indicates groundwater levels before the tunnelling and excavation activities is between -2.0 m AHD to -6.9 m AHD and is within the Hawkesbury Sandstone.

During the tunnelling and major civil construction work between The Bays and the Sydney CBD, SSI EIS 2 estimated groundwater level drawdown from construction at two years post-excavation.

During the operation of Hunter Street Station, the groundwater flows into the tanked cavern would be minimal. The groundwater inflows into the drained shafts would continue throughout the operation. In the long term, the tanked cavern station would promote the reduction in drawdown until a new groundwater level is achieved around the station.

3 Sydney Metro West – Sydney CBD to The Bays

The Sydney Metro West (SMW) alignment is all underground and will be comprised of twin underground metro rail tunnels that are approximately 24 kilometres in length from Westmead to Hunter Street.

The proposed major civil construction work between The Bays and Sydney CBD, which is currently under assessment (SSI-19238057) will include the following:

- Enabling work such as demolition, utility supply to construction sites, utility adjustments, and modifications to the existing transport network
- Tunnel excavation including tunnel support activities
- Station excavation for new metro stations at Pyrmont and Hunter Street in the Sydney CBD.

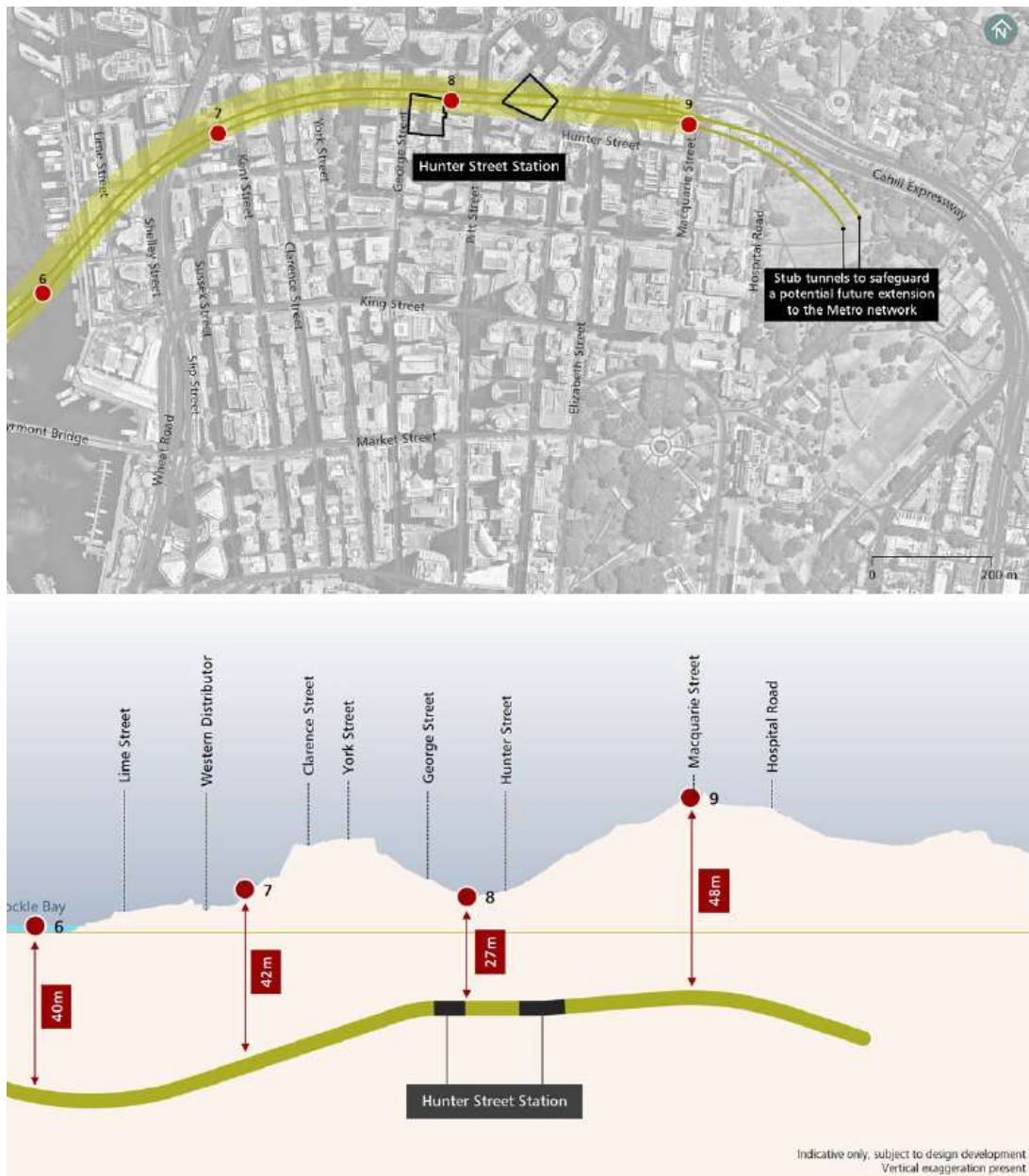


Figure 4 – Indicative alignment plan and long section

Key factors that influenced the Hunter Street Station construction site include:

- Mined double height cavern
- Construction site required to accommodate tunnel boring machine extraction
- Allowance for protection of the State significant listed heritage item Skinners Family Hotel (corner of George Street and Hunter Street) within the construction site and minimisation of construction impacts on nearby State significant heritage items including the Tank Stream
- Construction site required to accommodate spoil extraction from station cavern and turnback cavern / tunnels
- Avoiding existing buildings, basements, foundations, utilities and infrastructure
- Location of existing City & Southwest mined cavern excavation facility

The SMW rail tunnels are a circular shape and are approximately 6m in diameter as shown in Figure 5. The tunnels have been designed with regards to the protection reserves of any proximate rail tunnels.

Protection reserves define the extent of zones that have been established to protect existing metro infrastructure and protect the feasibility of planned metro infrastructure from adjacent proposed development.

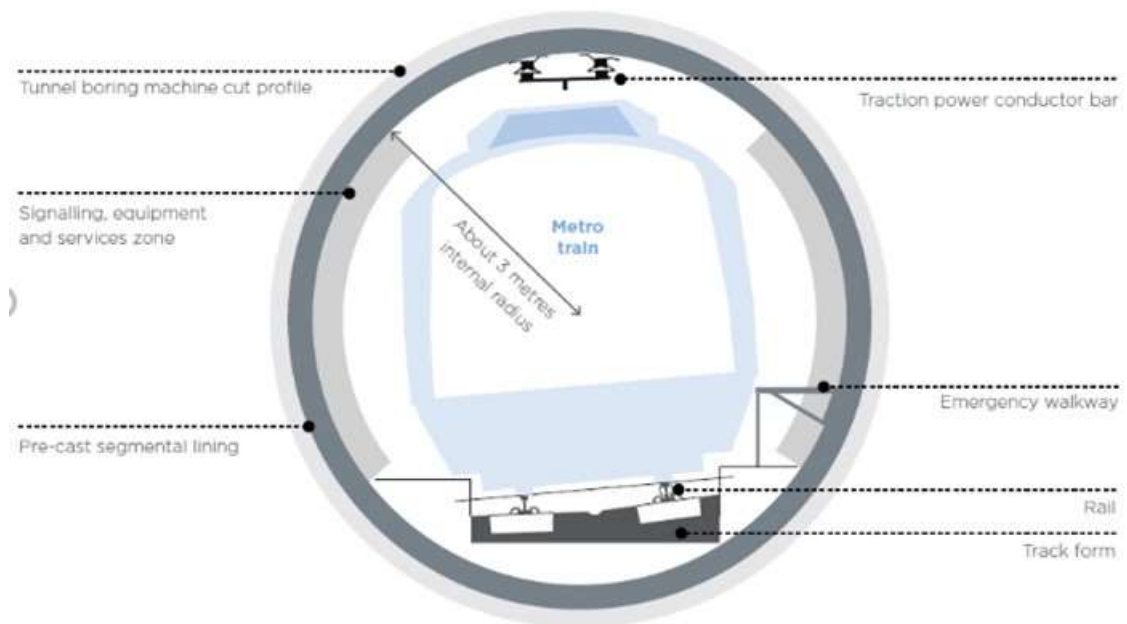


Figure 5 – Indicative cross-section of a metro tunnel

4 Interface with rail tunnels and corridors

The proposed Hunter Street Station Western Site interfaces with the existing Wynyard Station Precinct and the existing Hunter Tunnel (also known as the George Street Subway). Figure 6 below, highlights the location of these two interfaces with respect to Hunter Street Station.

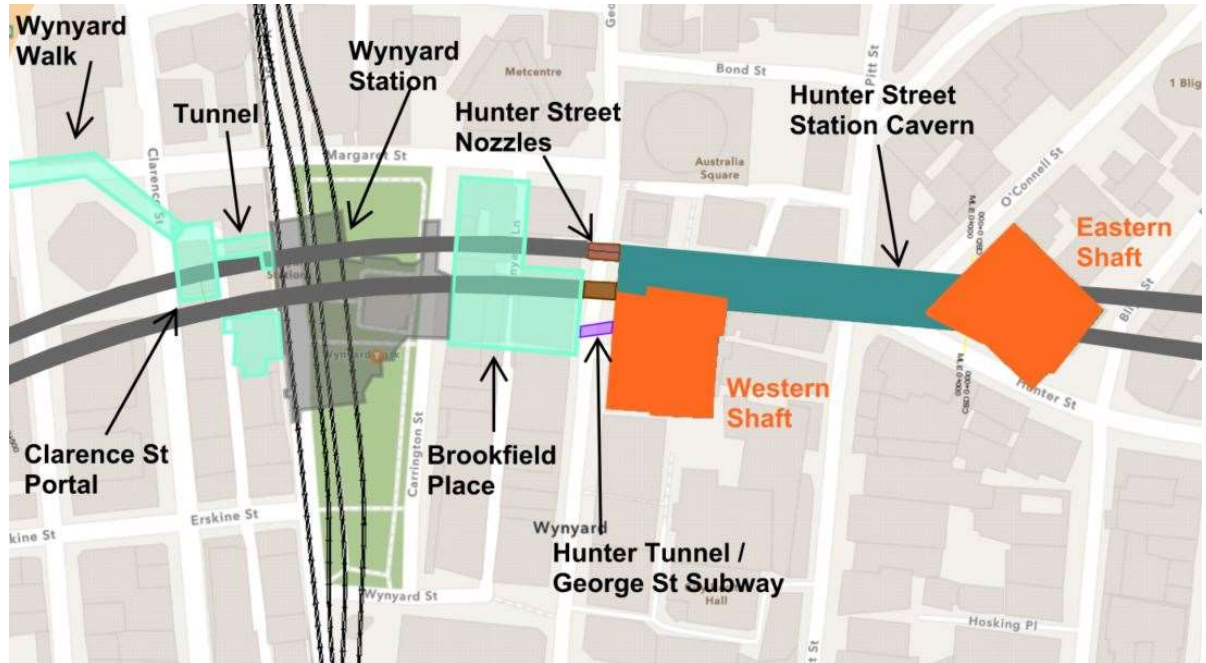


Figure 6 – Hunter Street Station Interfaces – showing Wynyard Station Precinct and the Hunter Tunnel (also known as the George Street Subway).

The following sections describe the rail protection reserves and the interfaces of the various Sydney trains assets with Hunter Station Planning Proposal.

4.1 Rail protection reserves

Section 5 of T HR CI 12051 ST ‘Development Near Rail Tunnels’ is the source document and Standard used to define the Protection Reserve Zones around existing rail tunnels. It is noted

“For the purpose of assessing the effects of adjacent developments, the rail tunnels include the main tunnel and the associated structures such as station caverns, cross passages, egress passages, refuges, adits, cut and cover tunnels, short and long underpasses and walkways, dive and portal structures, and underground electrical substations.”

The CCI tunnels and ESR tunnels did not have clearly defined protection reserves. Tunnel easement details for CCL tunnels and ESR tunnels are registered on land titles for individual lots located near rail tunnels.”

[Source: Section 5 of T HR CI 12051 ST – Version 2.0 Nov. 2018]

The rail protection reserves are categorised into first and second reserves and are in place to protect the existing tunnels and infrastructure from future development activities.

Reserve zones are typically measured orthogonal to the primary orientation of the existing tunnel, resulting in a series of 2D slices for the given length of tunnel.

The first reserve zone comprises the immediate surrounds of the tunnel, comprising dimensions A, B and C of Figure 7 below. These limits are based on general tunnel design, construction, and support methods. The second reserve zone is a simple arithmetic extension of the first reserve zone, comprising the dimensions X, Y and Z. These limits are founded on known areas of stress change, reflected in displacements that may occur when intruding into this second reserve zone.

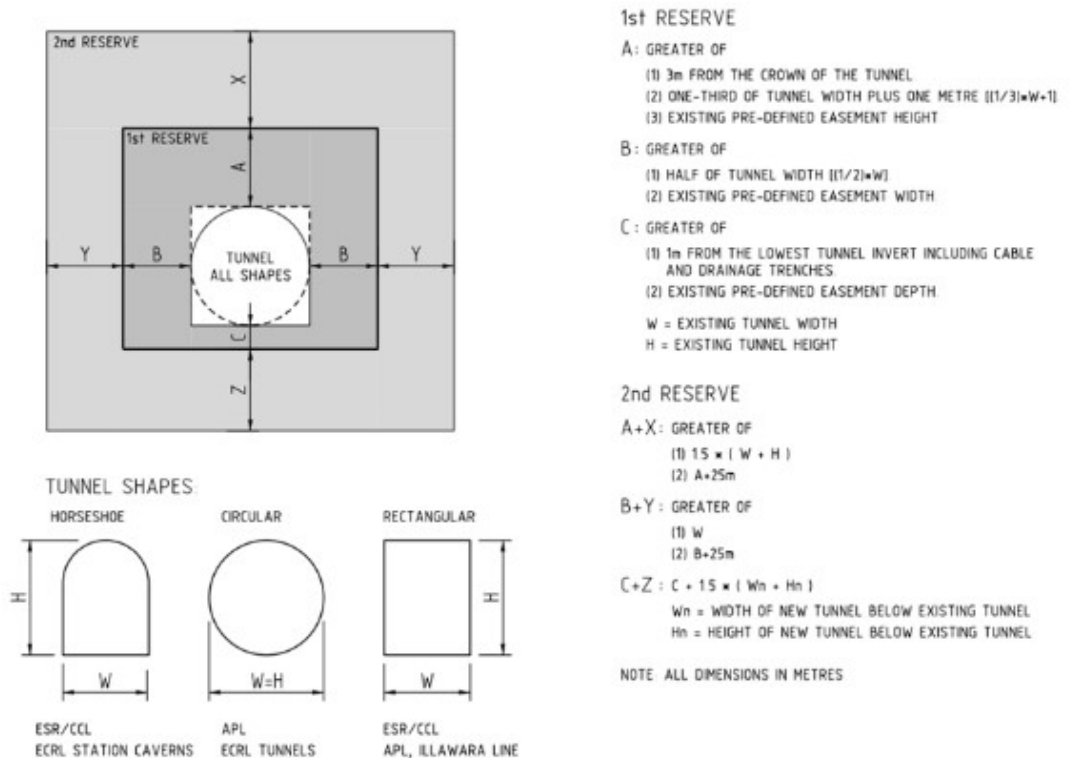


Figure 7 – Rail Protection Reserve

Refer to section 5.2 and 5.3 of T HR CI 12051 ST for more information regarding the characteristics determining first and second reserve zone limits.

Construction restrictions apply to each reserve zone and are outlined in Table 3 of T HR CI 12051 ST. It states that construction within the first reserve is prohibited, while construction within the second reserve is permitted subject to assessment.

4.2 Wynyard Station precinct

The extreme width of Wynyard Station is measured to be approximately 84 m. The first reserve to the East of Wynyard Station is calculated to be 42 m, with the second reserve located a further 25 m.

The Hunter Street Station Cavern and Western Shaft are both located outside of the second reserve and subsequently, none of the construction restrictions outlined in T HR CI 12051 ST apply.

4.3 Hunter tunnel

The Hunter Tunnel (George Street Subway) was built circa 1930 to serve as a subway between George Street and Hunter Street, with the primary orientation of the tunnel being East-West

Considering that the existing Hunter Tunnel directly interfaces with the western face of the proposed Hunter Street Western Shaft, the reserve zone assessment is perhaps less consequential than other requirements set out in T HR CI 12051 ST, particularly Section 7 which references groundwater drawdown and vibration affects. Notably, these affects impact the ISD and not the OSD, as discussed in Sections 4.4 of this report.

The first and second reserve extents of the existing Hunter Tunnel with respect to the defining dimensions outlined above in Figure 7 are as follows:

- First Reserve
 - A = 3.1 m
 - B = 1.6 m
 - C = 1.0 m
- Second Reserve
 - X = 25
 - Y = 25
 - Z = 31.7

4.4 Impacts on Sydney Rail tunnels

The construction of the OSD will take place after the major civil excavation activities and the construction of the station structure. Most of the ground movement will occur during the excavation of the station cavern and access shafts and has been investigated as part of SSI EIS 2. The residual movement due to the construction of the Hunter Street Station OSD is small and will have negligible impact on the Rail Tunnels due to:

- The existing Wynyard Station rail tunnels is located outside the rail protection second reserve defined in ASA standard T HR CI 12051 ST. The second reserve defined in the ASA standard has been defined considering zone of negligible changes in ground stress, shear displacement, groundwater drawdown etc.
- The OSD footprint is limited to the Hunter Street Station sites. The Hunter Street Station shafts are at least 100m from the existing Wynyard Station rail tunnels.
- The station is proposed to be excavated to about RL -18.2m AHD at the western shaft and RL -19.4m AHD at the eastern shaft. The foundation of the OSD is expected to be founded in high strength Class I/II Sandstone which will support the OSD. The high/very high strength sandstone is suitable to support the Hunter Street Station ISD and OSD loading. In addition, geotechnical mapping is expected to be undertaken during the

station excavation and the mapped rock face will be used to develop a suitable OSD foundation to support the integrated station development's foundations, structure and core.

The Hunter Tunnel is connected to the existing building basement contained within the future Hunter Street Station western shaft. The existing building basement will be demolished, and the Hunter Connection will be closed during the Hunter Street Station excavation work. The impact due to the OSD on the Hunter Connection is negligible. Some movement will occur during the demolition and excavation work and the impact will be managed by the CSSI work design and construction stages.

The ground impacts due to the OSD construction is negligible due to no change in the groundwater from the proposed OSD construction.

5 Conclusion

This rail impact assessment report forms part of the planning proposal submitted for the Sydney Metro Hunter Street Station OSD. This assessment has been undertaken to:

- Review the Rail Protection Reserves defined in Section 5 of T HR CI 12051 ST 'Development Near Rail Tunnels' and summarise the Rail Protection Reserves.
- Provide a rail impact assessment to the TfNSW rail network due to the proposed Sydney Metro West Hunter Street Station OSD.

The assessment has found that changes to the Sydney LEP to facilitate a future Hunter Street Station OSD will have negligible impact on the Rail Tunnels due to:

- The future OSD being located above (and integrated with) the Hunter Street Station, and requiring compliance with stringent engineering and design requirements of the rail infrastructure below.
- The construction of the OSD occurring after completion of the major civil excavation activities and construction of the station structure.
- The OSD footprint being limited to the Hunter Street Station sites. The existing Wynyard Station rail tunnels are located outside the rail protection second reserve defined in ASA standard T HR CI 12051 ST.
- The foundation of the OSD being founded within high strength Class I/II Sandstone. The foundation load will not impact on the existing Wynyard Station rail tunnels located over 100m away.