

CHATSWOOD TO SYDENHAM
**SYDENHAM STATION
AND SYDNEY METRO
TRAINS FACILITY SOUTH
MODIFICATION REPORT**

MAIN REPORT

EXECUTIVE SUMMARY



Executive Summary

Introduction

Sydney Metro City & Southwest has been developed within the framework of the transport and planning strategies identified in State government policies. This includes the 12 NSW Premier priorities (established to grow the economy, deliver infrastructure, and improve health, education and other services across NSW), Sydney's Rail Future: Modernising Sydney's Trains, Draft Metropolitan Strategy for Sydney 2031 and the NSW Long Term Transport Master Plan. The project responds to these challenges delivering a step-change in the capacity of Sydney's rail network by providing a fully automated rail system across Sydney, supporting high demand with a high capacity, turn-up-and-go service.

Sydney Metro City & Southwest was declared by Ministerial Order on 10 December 2015 to be State significant infrastructure and critical State significant infrastructure. The assessment and approval process for a critical State significant infrastructure project is established under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

An Environmental Impact Statement (EIS) for the Chatswood to Sydenham component of Sydney Metro City & Southwest was prepared and exhibited for 48 days from 11 May to 27 June 2016. A subsequent Submissions and Preferred Infrastructure Report was prepared and submitted to the Department of Planning and Environment in October 2016. Planning approval was granted by the Minister for Planning under Part 5.1 of the EP&A Act on 9 January 2017.

Pursuant to section 115ZI of the EP&A Act, Transport for NSW is seeking to modify the State significant infrastructure approval to include the Sydenham Station and Sydney Metro Trains Facility South modification modifications as outlined below. This modification report includes:

- A description of the proposed modification to the approved project
- A justification for the modification
- Options considered for the proposed modification
- An assessment of the environmental and community impacts and benefits of the proposed modification.

Overview of the proposed modification

The proposed modification would involve the addition of the following key features to the project:

- Sydenham Station and precinct works – demolition and reconstruction of platforms 1 and 2 for metro rail operations and a new aerial concourse connecting to new station entries at Railway Parade and Burrows Avenue. Upgrades to transport interchange facilities and provision for active transport would be delivered as part of the station works
- Sydney Metro Trains Facility South – construction and operation of train stabling and maintenance facilities for the overall metro network. The scope includes earthworks, retaining walls, track and rail systems, construction of new buildings, plus operation of trains and maintenance activities within the stabling yard
- Track and rail system facilities – reconfiguration of existing track and rail systems to segregate the T3 Bankstown Line and the Goods Line, installation of metro tracks and rail systems including crossover and turnback facilities
- Adjustments to the Sydenham Pit and Drainage Pumping Station – including a new aqueduct over the pit, new pumping station and new maintenance access ramp
- Ancillary infrastructure and works – including fencing, maintenance access, utilities works, drainage, noise barriers, road and transport network works, bridge works, and temporary facilities to support construction.

Need for the proposed modification

Sydenham Station and Sydney Metro Trains Facility South were considered for inclusion in the scope of works for the Sydenham to Bankstown upgrade project. The application report for that project noted that delivery of works to support the potential phased opening of the Chatswood to Sydenham component through to Sydenham Station could be accelerated under a separate planning approval. To support the delivery of these works, Transport for NSW propose to incorporate Sydenham Station and Sydney Metro Trains Facility South works as part of the Chatswood to Sydenham project.

The proposed extension of the approved project to Sydenham Station would provide the following benefits:

- Customers on the T4 Eastern Suburbs and Illawarra Line and T2 Airport Line would be able to interchange at Sydenham to access metro services to places like Martin Place, Barangaroo, Victoria Cross, Macquarie Park and the Norwest Business Park. Faster and direct access to places like North Sydney and Macquarie University would give customers more choices and better connections to jobs and educational opportunities
- Improved interchange potential at Sydenham would reduce congestion on the T4 Eastern Suburbs and Illawarra Line and T2 Airport Line and reduce interchange movements at other stations, particularly Central Station
- Support the temporary transport strategy for the final shutdown of the T3 Bankstown Line required for the construction of the Sydenham to Bankstown project. The proposed extension would provide frequent turn-up-and-go metro services at Sydenham Station for travel to and from the Sydney CBD and Sydney's northwest to minimise the impact to existing customers who would temporarily need to travel to and from Sydenham Station via rail replacement bus services during this final shutdown

To provide operational efficiency and flexibility, the proposed modification would also involve the conversion of a section of track to the south of Sydenham Station to metro standards, including the addition of another track-crossover.

The Environmental Impact Statement for the approved project also identified that stabling of metro trains would occur at the Sydney Metro Trains Facility in Rouse Hill (approved as part of Sydney Metro Northwest) and that any additional stabling facility required to support operations would be delivered and assessed as part of the Sydenham to Bankstown project. It is now proposed to deliver an additional stabling facility (the Sydney Metro Trains Facility (South)) as part of the Chatswood to Sydenham project.

The provision of the Sydney Metro Trains Facility South as part of the Chatswood to Sydenham project would result in more efficient operations of metro services during the potential phased opening as stabling facilities would be located across the metro line, avoiding the need to run empty metro trains.

Community consultation

Engagement with the community and stakeholders about Sydney Metro City & Southwest began in June 2014 and has continued through the preparation of the Chatswood to Sydenham Environmental Impact Statement (including this modification) and the Sydenham to Bankstown Environmental Impact Statement. Prior to, and on a continuing basis outside of the Environment Impact Statement process, Sydney Metro continues to proactively engage with the community and stakeholders.

Ongoing consultation has been carried out with specific government agency groups, including regular meetings with the Heritage Working Group and Sydney Metro Roads Integration Working Group. Transport for NSW's government agency consultation focussed on cross-agency integration and communication.

Feedback received during ongoing consultation activities will be considered in ongoing development of the works the subject of the proposed modification.

Environmental assessment

Additional environmental impacts would occur as a result of the proposed modification as a result of adding new construction and operational sites to the approved project. Some of the environmental impacts differ from those identified in the approved project due to the nature of Sydenham Station and Sydney Metro Trains Facility South as above-ground developments. The environmental impacts of the proposed modification are as follows:

- Direct and indirect impacts to the State heritage listed Sydenham Station and Sydenham Pit and Drainage Pumping Station
- Some adverse landscape character and visual amenity impacts due to construction works and introduction of an aqueduct over the Sydenham Pit and Drainage Pumping Station
- Permanent changes to the existing stormwater drainage network, including the realignment of the Eastern Channel, modifications at the Sydenham Pit and Drainage Pumping Station, and raising of the Sydney Metro Trains Facility South and tracks to the above the probable maximum flood level
- Additional operational noise impact for receivers around the Sydney Metro Trains Facility South and along some parts of the rail corridor

- Extension of construction noise impacts for some sensitive receivers around the construction sites
- Some short-term construction traffic impacts on local roads
- Additional acquisitions of commercial and industrial properties around the Sydney Metro Trains Facility South and Sydenham Station
- Additional potential interface with areas of contamination
- Additional biodiversity impacts, however these would be limited to the minor impact of clearing exotic and planted native vegetation.

The proposed modification would be constructed in accordance with the Sydney Metro Construction Environmental Management Framework provided as part of the Submissions and Preferred Infrastructure Report for the approved project. While the project-specific mitigation measures identified for the approved project are generally sufficient to address the potential impacts of the proposed modification, some additional measures or changes to measures have been identified to manage specific potential impacts of the proposed modification. The relevant conditions of approval for the approved project would also apply, with some recommendations made in relation to potential modifications to these conditions.

Conclusion

Further details of the proposed modification to the approved project are provided in this report. Overall, the proposed modification is expected to provide substantial benefits to Sydney Metro and Sydney Trains customers at Sydenham Station which are expected to outweigh any potential additional impacts of the proposed modification.

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INTRODUCTION

CHAPTER ONE



1 Introduction

This chapter provides an overview of the proposed modification (Sydenham Station and Sydney Metro Trains Facility South), its need and key features, and the structure of this report.

1.1 Overview

Planning approval for Sydney Metro City & Southwest Chatswood to Sydenham was granted by the Minister for Planning under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 9 January 2017. The works around Sydenham as part of the approved project involve:

- A dive structure (about 400 metres long) and tunnel portal between Sydenham Station and Bedwin Road, Marrickville (the Marrickville dive structure). The dive structure would commence about 400 metres north of Sydenham Station and the Marrickville tunnel portal would be located about 840 metres north of Sydenham Station, to the south of Bedwin Road
- A services facility beside the Marrickville dive structure and tunnel portal, including a tunnel water treatment plant and a substation (for traction power supply)
- Signalisation of the Edinburgh Road / Edgeware Road / Bedwin Road intersection at Marrickville
- The temporary use of a construction site adjacent to the proposed dive structure.

The approved project does not involve any changes to the Sydney Trains tracks in the vicinity of Sydenham or works to support a phased opening of Sydney Metro to Sydenham Station prior to the Sydenham to Bankstown component of Sydney Metro City & Southwest. In addition, the approved project does not provide for additional stabling facilities. The Environmental Impact Statement for the approved project identified that there may be an opportunity to operate the Chatswood to Sydenham component (to Waterloo Station) before completion of the Sydenham to Bankstown component, and that this would require an additional track-turnback to be constructed between the Marrickville dive structure and Sydenham Station. Such work would be subject to separate assessment and approval.

The Sydenham to Bankstown State Significant Infrastructure Application Report noted that delivery of works to support the phased opening of Chatswood to Sydenham through to Sydenham Station could be accelerated under a separate planning approval. To support the delivery of these works, Transport for NSW proposes to include these elements of scope as part of the approved project through a modification application.

It is now proposed to incorporate works at and around Sydenham Station together with works associated with the Sydney Metro Trains Facility South as part of the Chatswood to Sydenham project to provide the ability to open Sydney Metro City & Southwest in two phases. The first phase would involve commencement of services between Chatswood and Sydenham stations, while the second phase would extend Sydney Metro services to Bankstown. Both components are planned to be completed by the end of 2024.

These works, which include the delivery of an upgraded Sydenham Station to meet accessibility requirements and to support metro operations, works to separate the Sydney Trains tracks from Sydney Metro and works associated with Sydney Metro Trains Facility South, are being progressed as a proposed modification to the approved Sydney Metro City & Southwest Chatswood to Sydenham project in accordance with section 115ZI of the EP&A Act. This is one of several modification applications that are likely to occur as the detailed design is developed across the project.

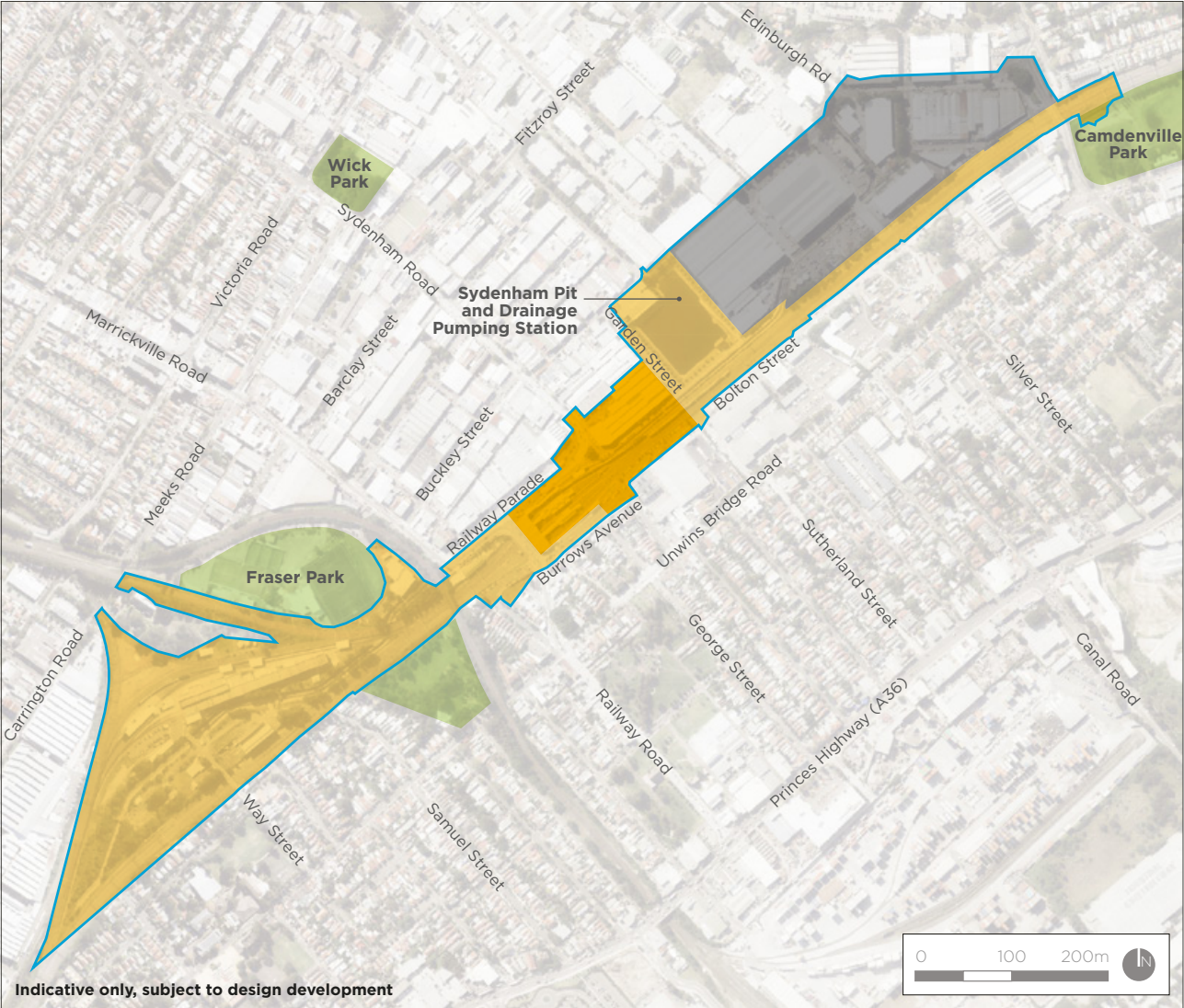
1.2 Overview of the proposed modification

The proposed modification would involve the addition of the following key features (as shown on Figure 6-1) to the project:

- Sydenham Station and precinct works – demolition and reconstruction of platforms 1 and 2 for metro rail operations and a new aerial concourse connecting to new station entries at Railway Parade and Burrows Avenue. Upgrades to transport interchange facilities and provision for active transport would be delivered as part of the station works
- Sydney Metro Trains Facility South – construction and operation of train stabling and maintenance facilities for the overall metro network. The scope includes earthworks, retaining walls, track and rail systems, construction of new buildings, enabling works to support future rail corridor development above the facility, plus operation of trains and maintenance activities within the stabling yard
- Track and rail system facilities – reconfiguration of existing track and rail systems to segregate the T3 Bankstown Line and the Goods Line, installation of metro tracks and rail systems including crossover and turnback facilities
- Adjustments to the Sydenham Pit and Drainage Pumping Station – including a new aqueduct over the pit, new pumping station and new maintenance access ramp
- Ancillary infrastructure and works – including fencing, maintenance access, utilities works, drainage, noise barriers, road and transport network works, bridge works, and temporary facilities to support construction.

The proposed modification is described in more detail in Chapter 6 (Modification description – operation) and Chapter 7 (Modification description – construction).

The proposed modification assessed in this report does not include surveys or investigations to inform the designer or assessment, such as geotechnical investigations, utility surveys and other tests. These would be subject to separate assessment and approval as required.



KEY			
	Proposed modification area		Sydney Metro Trains Facility South
	Other works		Parks and reserves
	Extent of Sydenham Station and precinct works		

Figure 1-1 Proposed modification area

1.3 Need for the modification

Sydenham Station and Sydney Metro Trains Facility South and associated works were considered for inclusion in the scope of works for the Sydenham to Bankstown upgrade project. As noted in the application report for that project, Transport for NSW has been investigating opening Sydney Metro City & Southwest in two phases. Further project planning has now identified that the Chatswood to Sydenham component (Phase 1) could be opened some months in advance of the Sydenham to Bankstown component (Phase 2) and could be extended through to Sydenham Station. A phased opening through to Sydenham Station would provide the opportunity to enable Sydney Metro services at Sydenham during the final shutdown of the T3 Bankstown Line that is required to complete construction of the Sydenham to Bankstown component.

The Sydenham to Bankstown State Significant Infrastructure Application Report noted that delivery of works to support the potential phased opening of Chatswood to Sydenham through to Sydenham Station could be accelerated under a separate planning approval. To provide opportunity for accelerated delivery of these works, Transport for NSW propose to include these elements of scope as part of the approved project through a project modification.

The proposed extension of the approved project to include the delivery of Sydenham Station to support metro operations would provide the following benefits:

- Customers on the T4 Eastern Suburbs and Illawarra Line and T2 Airport Line would be able to interchange at Sydenham to access metro services to places like Martin Place, Barangaroo, Victoria Cross, Macquarie Park and the Norwest Business Park. Faster and direct access to places like North Sydney and Macquarie University would give customers more choices and better connections to jobs and educational opportunities
- Improved interchange potential at Sydenham would reduce congestion on the T4 Eastern Suburbs and Illawarra Line and T2 Airport Line and reduce interchange movements at other stations, particularly Central Station
- Support the temporary transport strategy for the final shutdown of the T3 Bankstown Line required for the construction of the Sydenham to Bankstown project. The proposed extension would provide frequent turn-up-and-go metro services at Sydenham Station for travel to and from the CBD and Sydney's northwest to minimise the impact to existing customers who would temporarily need to travel to and from Sydenham Station via rail replacement bus services during this final shutdown

To provide operational efficiency and flexibility, the proposed modification would also involve the conversion of a section of track to the south of Sydenham Station to metro standards, including the addition of another track-crossover. The T3 Bankstown Line tracks would be realigned to connect to the T2 Airport Line tracks to retain the ability for T3 Bankstown Line services to operation whilst Platforms 1 and 2 are isolated for metro conversion.

The provision of the Sydney Metro Trains Facility South as part of the Chatswood to Sydenham project would result in more efficient operations of metro services during the potential phased opening of Sydney Metro City & Southwest as stabling facilities would be located across the metro line, avoiding the need to run empty metro trains.

1.4 Purpose of this report

This report provides an assessment of the proposed modification in accordance with section 115ZI of the EP&A Act. This modification report includes:

- A description of the proposed modification to the approved project
- A justification for the modification
- Options considered for the proposed modification
- An assessment of the environmental and community impacts and benefits of the proposed modification.

1.5 Structure of this report

The structure and content of this report is outlined in Table 1-1.

Table 1-1 Structure and content of the Modification Report

Chapter	Description
Volume 1 – Main Report	
Chapter 1	Introduction (this chapter) Provides an overview of the proposed modification (Sydenham Station and Sydney Metro Trains Facility South). Outlines the structure and content of this report.
Chapter 2	Strategic justification and need Provides the strategic context and explains the need for the proposed modification.
Chapter 3	Sydenham Station and Sydney Metro Trains Facility South development and alternatives Reviews options that were considered for the proposed modification and describes the design development process.
Chapter 4	Planning and assessment process Provides information on the legislation and environmental planning instruments that would apply to the proposed modification. Outlines the steps involved in the modification assessment and approval process.
Chapter 5	Stakeholder and community engagement Provides an overview of the community consultation and stakeholder engagement processes that have been carried out for Sydenham Station and Sydney Metro Trains Facility South to date. Identifies issues raised during consultation and how these have been addressed.
Chapter 6	Modification description – operation Identifies the physical infrastructure and built form of the proposed modification, including place-making initiatives and specific design guidelines. Describes the functionality and operation of the proposed modification and its relationship to the approved project.
Chapter 7	Modification description – construction Outlines how the proposed modification is likely to be constructed and identifies the location and function of the main construction sites.
Chapter 8	Environmental screening assessment Provides consideration of the potential for the proposed modification to change the impacts described in the Sydney Metro City & Southwest Chatswood to Sydenham planning approval documentation and whether further assessment is required.

Chapter	Description
Chapter 9	Construction traffic and transport Identifies and assesses the potential changes to impacts on the existing road, public transport, pedestrian and cyclist network from the proposed modification construction activities, with a focus on station operations and customers.
Chapter 10	Operational traffic and transport Identifies how the proposed modification would function in relation to transport interchange within and around Sydenham Station and with the phased opening of the Sydney Metro City & Southwest.
Chapter 11	Noise and vibration Assesses the potential changes to construction and operational noise and vibration impacts of the proposed modification, including construction and use of operational facilities.
Chapter 12	Land use and property Assesses the potential changes to property and land use impacts due to the proposed modification including property acquisition, changes to land use and integration with surrounding land use.
Chapter 13	Business impacts Assesses the potential changes to impacts on businesses due to construction and operation of the proposed modification.
Chapter 14	Non-Aboriginal heritage Assesses the potential changes to impacts on non-Aboriginal archaeological and built heritage due to construction and operation of the proposed modification.
Chapter 15	Aboriginal heritage Assesses the potential changes to impacts on Aboriginal heritage due to construction and operation of the proposed modification.
Chapter 16	Landscape character and visual amenity Assesses the potential changes to landscape character impacts from the introduction of the proposed modification including urban design elements, and the potential changes to visual impacts due to construction and operation of the proposed modification.
Chapter 17	Flooding and hydrology Assesses the potential changes to impacts associated with flooding and hydrology due to construction and operation of the proposed modification.
Chapter 18	Contamination Assesses the potential changes to impacts associated with contamination due to construction and operation of the proposed modification.
Chapter 19	Biodiversity Assesses the potential changes to impacts associated with biodiversity due to construction and operation of the proposed modification.
Chapter 20	Cumulative impacts Assesses the potential for changes to cumulative impacts with other construction projects due to the proposed modification.
Chapter 21	Consolidated revised environmental mitigation measures Provides a consolidated list of the revised mitigation measures identified in Chapters 9 to 20.
Chapter 22	Justification and conclusion Confirms the justification for the proposed modification.

Chapter	Description
Volume 2 – Appendices	
Appendix A	Secretary’s environmental assessment requirements Provides a checklist of the proposed modification against the Secretary’s environmental assessment requirements issued for the approved Sydney Metro City & Southwest Chatswood to Sydenham.
Appendix B	Revised Sydney Metro City & Southwest Chatswood to Sydenham Design Guidelines Provides revised design guidelines to incorporate new project elements as part of the proposed modification
Appendix C	Construction traffic and transport technical information Provides technical information to support the construction traffic and transport assessment.
Appendix D	Construction noise and vibration technical information Provides technical information to support the construction noise and vibration assessment.
Appendix E	Non-Aboriginal heritage technical information Provides technical information to support the non-Aboriginal heritage assessment.
Appendix F	Landscape character and visual amenity technical information Provides technical information to support the landscape character and visual amenity assessment.

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STRATEGIC JUSTIFICATION AND NEED

CHAPTER TWO



2 Strategic justification and need

The need and justification for Sydney Metro City & Southwest Chatswood to Sydenham project (the approved project) was provided in the Environmental Impact Statement. This chapter focusses on the justification and need for the proposed modification to include the Sydenham Station and Sydney Metro Trains Facility South works.

2.1 Need and justification for Sydney Metro City & Southwest (Chatswood to Sydenham)

The approved project was developed within the framework of the transport and planning strategies identified in State government policies. In particular this includes the *12 NSW Premier priorities* (established to grow the economy, deliver infrastructure, and improve health, education and other services across NSW), *Sydney's Rail Future: Modernising Sydney's Trains, Draft Metropolitan Strategy for Sydney 2031* and the *NSW Long Term Transport Master Plan*.

These policies indicate a strategic need to:

- Significantly 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
- Effectively develop infrastructure to cement Sydney's position among the world's most liveable cities and Australia's only global city.

The approved project will deliver a step-change in the capacity of Sydney's rail network by providing a fully automated rail system across Sydney, supporting high demand with a high capacity, turn-up-and-go service. It will increase the capacity of the rail network through the Sydney CBD from about 120 per hour during peak periods today, to up to 200 services per hour beyond 2024, including capacity for up to 60 metro trains per hour during peak periods (or 30 trains per hour in each direction). This would equate to an increase of up to 60 per cent capacity across the network. This means that the railway network across greater Sydney would have room for an extra 100,000 train customers per hour in the peak. The fully automated Sydney Metro network would have the ultimate capacity to operate a train every two minutes through the Sydney CBD in each direction. The proposed new stations would alleviate congestion at Wynyard, Town Hall, Central, Redfern and Green Square stations.

It will also deliver a new tier for Sydney's rail network, supporting high demand with a high-capacity, turn-up-and-go service. It is being developed with an emphasis on supporting the needs of customers for 'door to door' journeys from origin to destination.

Other key benefits of the approved project include:

- Doubling the number of train paths available from the north
- Strengthening connections and access across Sydney, particularly within the Global Economic Corridor
- Providing new connections to the rail network – including connections to the T4 Eastern Suburbs Line, and direct connections between the Sydney CBD with the north west
- Improving 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
- Providing the opportunity for urban development opportunities particularly around the new stations at Crows Nest, Victoria Cross, Barangaroo and Waterloo
- Providing the opportunity for the progressive renewal of the ageing Waterloo social housing estate including a mix of private, affordable and social housing
- Improving network resilience through the Sydney CBD and across Sydney Harbour by providing an additional route during planned and unplanned events affecting other Sydney CBD and harbour links.
- Health benefits with the creation of safer and more appealing conditions for pedestrians, cyclists and other transit users in the areas around the stations.

It will also provide important urban renewal and development opportunities through the application of transit oriented development principles that support government objectives to achieve a more sustainable and efficient use of land to meet Sydney's growth.

2.2 Need and justification for the proposed modification

The Environmental Impact Statement for the approved project identified that there may be an opportunity to operate the Chatswood to Sydenham component before completion of the Sydenham to Bankstown project. In this scenario an additional track-turnback would need to be constructed between the Marrickville dive structure and Sydenham Station. The Environmental Impact Statement identified that a supplementary environmental assessment and appropriate community and stakeholder consultation would be carried out and the appropriate approvals obtained prior to this component being constructed.

As noted in the Sydenham to Bankstown State Significant Infrastructure Application Report, Transport for NSW has been investigating opening Sydney Metro City & Southwest in two phases. Further project planning has now identified that the Chatswood to Sydenham component (Phase 1) is likely to be opened some months in advance of the Sydenham to Bankstown component (Phase 2) and could be extended through to Sydenham Station. A phased opening through to Sydenham Station would provide the opportunity to enable Sydney Metro services at Sydenham during the final shutdown of the T3 Bankstown Line that is required to complete construction of the Sydenham to Bankstown component.

Sydenham Station and Sydney Metro Trains Facility South were included in the scope of works for the Sydenham to Bankstown State Significant Infrastructure Application Report. The report noted that delivery of works to support the potential phased opening of Chatswood to Sydenham through to Sydenham Station could be accelerated under a separate planning approval. To support the delivery of these works, Transport for NSW propose to extend the scope of the approved project through a project modification.

The proposed extension of the approved project to Sydenham Station would provide the following benefits:

- Customers on the T4 Eastern Suburbs and Illawarra Line and T2 Airport Line would be able to interchange at Sydenham to access metro services to places like Martin Place, Barangaroo, Victoria Cross, Macquarie Park and the Norwest Business Park. Faster and direct access to places like North Sydney and Macquarie University would give customers more choices and better connections to jobs and educational opportunities
- Improved interchange potential at Sydenham would reduce congestion on the T4 Eastern Suburbs and Illawarra Line and T2 Airport Line and reduce interchange movements at other stations, particularly Central Station
- Support the temporary transport strategy for the final shutdown of the T3 Bankstown Line required for the construction of the Sydenham to Bankstown project. The proposed extension would provide frequent turn-up-and-go metro services at Sydenham Station for travel to and from the CBD and Sydney's northwest to minimise the impact to existing customers who would temporarily need to travel to and from Sydenham Station via rail replacement bus services during this final shutdown

To provide operational efficiency and flexibility, the proposed modification would also involve the conversion of a section of track to the south of Sydenham Station to metro standards, including the addition of another track-crossover. The T3 Bankstown Line tracks would be realigned to connect to the T2 Airport Line tracks to retain the ability for T3 Bankstown Line services to operate whilst Platforms 1 and 2 are isolated for metro conversion.

The Environmental Impact Statement for the approved project also identified that stabling of metro trains would occur at the Sydney Metro Trains Facility in Rouse Hill (approved as part of Sydney Metro Northwest) and that any additional stabling facility required to support operations would be delivered and assessed as part of the Sydenham to Bankstown project. It is now proposed to deliver an additional stabling facility (the Sydney Metro Trains Facility South) as part of the Chatswood to Sydenham project.

The provision of the Sydney Metro Trains Facility South as part of the Chatswood to Sydenham project would result in more efficient operations of metro services during the potential phased opening of Sydney Metro City & Southwest as stabling facilities would be located across the metro line, avoiding the need to run empty metro trains.

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SYDENHAM STATION AND SYDNEY METRO TRAINS FACILITY SOUTH DEVELOPMENT AND ALTERNATIVES

CHAPTER THREE



3 Sydenham Station and Sydney Metro Trains Facility South development and alternatives

This chapter describes the options evaluation process used to determine the preferred option for each element of the proposed modification and describes the design development process for the metro platforms at Sydenham Station.

3.1 Strategic alternatives

The strategic alternatives for the proposed modification are relevant to the metro rail network and were described in the Environmental Impact Statement for the approved project.

3.2 Alignment and station options

The alignment options for the metro network to the north of Sydenham Station were described in the Environmental Impact Statement for the approved project. The alignment of the approved project was influenced by:

- Previous investigations
- Station locations
- Design criteria such as vertical and horizontal alignment requirements
- A decision on a Sydney CBD east or Sydney CBD west alignment
- Avoidance of underground constraints such as deep basements and major utilities.

The alignment options for the metro network to the south of the approved project boundary were originally developed as part of the Sydney Metro City & Southwest Sydenham to Bankstown project. Alignment options for this component were designed to maximise the value of existing rail infrastructure, and included various combinations of full or partial conversion to metro of the following rail lines:

- T2 Airport, Inner West & South Line
- T3 Bankstown Line
- T4 Eastern Suburbs & Illawarra Line
- T5 Cumberland Line.

The assessment concluded that conversion of the T3 Bankstown Line was the preferred option to increase network capacity, support growth and urban renewal, address existing network reliability, demand and accessibility issues on the T3 Bankstown Line, and was the simplest conversion of the options.

3.2.1 Increased capacity

Conversion of the T3 Bankstown line would allow metro services to continue through Sydney's CBD and across Sydney Harbour, facilitating the removal of the T3 Bankstown Line from the City Circle, and from the suburban network between Sydenham and Central stations. This would provide additional capacity for the busy T2 Airport, South and Inner West line, by increasing frequencies on the City Circle to 20 trains per hour in peak periods. This would also significantly reduce platform and train crowding. The new metro services would significantly increase capacity of the Bankstown Line.

3.2.2 Supports growth

Conversion of the T3 Bankstown Line would support growth within the Sydenham to Bankstown urban renewal corridor by providing much needed additional capacity. It would also meet future demand for rail services.

3.2.3 Addresses existing rail network issues

The conversion of the T3 Bankstown Line would address existing rail network issues including:

- Network reliability and capacity constraints and challenges
- Difficulty meeting future demands with current services
- Accessibility issues on the T3 Bankstown Line.

3.2.4 Simpler conversion

The T3 Bankstown Line would be less complex to convert to metro operations and segregate from the existing rail network. Compared to other rail lines, such as the Illawarra Line, it does not share operations with other lines or rail freight for the majority of its length. The conversion of the T3 Bankstown Line would have minimal ancillary infrastructure requirements compared to other lines, which would require additional tunnels and tracks, and significant enabling works.

Sydenham Station was selected as a station location as part of the preferred alignment option to the south of the approved project boundary as it services the T3 Bankstown Line. The option of only upgrading some of the stations on the T3 Bankstown Line was considered but not preferred, as this would limit the benefits of the preferred alignment option and has the potential to isolate customers who currently use train services along the Sydenham to Bankstown corridor to access local centres of employment, living and amenity.

3.3 Stabling facility options

3.3.1 Initial options

The expansion of the Sydney Metro network to the south requires additional stabling for trains to be located along the Sydney Metro City & Southwest corridor. A number of sites for a stabling facility (including sites within the proposed Sydenham to Bankstown component of Sydney Metro City & Southwest) were considered, including:

- Industrial land in Sydenham, on the western side of the rail corridor
- Land within the rail corridor near Punchbowl Station
- The Sydenham Maintenance Centre at Meeks Road
- Bankstown Airport
- Meeks Road industrial area.

The Sydenham Maintenance Centre option was discounted at the time of assessment given its importance to the operations of the NSW Trains regional fleet.

The Bankstown Airport option would only be a viable possibility if extension of Sydney Metro services to Liverpool proceeded, due to the high cost of building it without extension.

The Meeks Road industrial area is not large enough to provide the required stabling capacity.

An analysis was undertaken to compare different options at Punchbowl to determine the most cost effective option that minimises impacts on the local community and environment, and provides for future expansion of the stabling facility. The following options were considered for the use of rail corridor land at Punchbowl:

- Provide a stabling facility at Punchbowl without maintenance facilities
- Provide a stabling facility at Punchbowl and retain some land in Marrickville (at the location of the tunnel dive construction area) for a future facility to allow for future expansion.

While both options would result in some benefits (including potential to return half of the construction site at the tunnel dive structure for future development), the Punchbowl options were not considered suitable for the following reasons:

- The site does not provide an initial optimum stabling solution
- The site would be at capacity at project opening and would not provide future expansion capacity, resulting in the need to build and operate a second facility (and associated costs)
- The site is close to residences with potential for significant amenity impacts
- Vegetation removal would be required, potentially impacting threatened species and / or vegetation communities
- There is no opportunity for provision of maintenance activities, which is an operational risk.

3.3.2 The preferred option

The industrial area in Marrickville was identified as the preferred option for the following reasons:

- Maximised efficiency of train operations during a phased opening of the Chatswood to Sydenham component before the Sydenham to Bankstown component
- Ability to provide capacity beyond the requirements of project opening
- Able to support maintenance facilities for efficient maintenance and operations
- Better aligned with surrounding land use with no residential properties directly affected
- Limited potential to impact on threatened species and / or vegetation communities that have the potential to occur in the area
- Limited potential to impact on the community with no residential property acquisition requirements
- The site would predominately be acquired for use during construction of the approved project.

3.4 Sydenham Pit aqueduct

3.4.1 Initial options

The eastern channel is a drainage channel that runs in a north-south direction through the proposed Sydney Metro Trains Facility South site and adjacent to the existing Sydney Trains tracks, outside the rail corridor (see Figure 3-1).

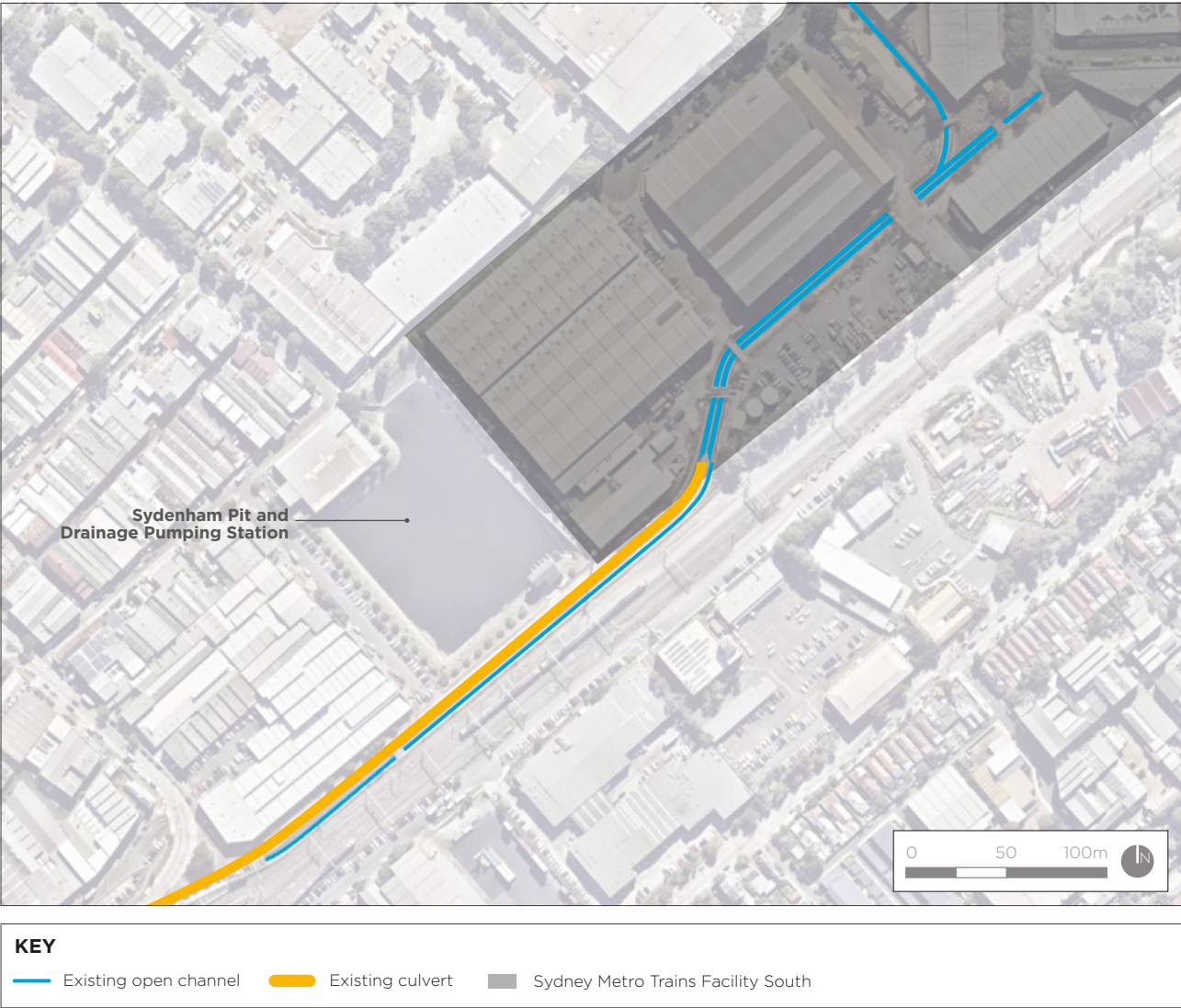


Figure 3-1 Current location of eastern channel

The current alignment of the eastern channel would conflict with the proposed Sydney Metro main tracks and stabling sidings of Sydney Metro Trains Facility South. It is therefore necessary to divert the channel, taking into consideration factors such as hydrology and flooding, operation and maintenance, constructability and program, heritage impact, visual impact and urban design.

Three options were considered for the area between the stabling facility and Sydenham Road. These were:

- Option 1: Aqueduct across the Sydenham Pit and Drainage Pumping Station
- Option 2: Enclosed culverts under the new Sydney Metro tracks between the existing Sydney Trains tracks and Sydenham Pit and Drainage Pumping Station
- Option 3: Open channel along the existing embankment of Sydenham Pit and Drainage Pumping Station adjacent to the new Sydney Metro tracks.

Option 1, when compared with Option 2 and 3, would require the least amount of interface with the existing stormwater system during construction, and maintenance during operation would not impact on Sydney Metro services. The aqueduct would provide a potential future pedestrian connection across Sydenham Pit and Drainage Pumping Station to Sydenham Station and enable vehicular access for maintenance purposes. While the original State heritage listed pumping station would be maintained (non-operational), the viaduct and new access ramp would have moderate adverse visual and moderate-major adverse heritage impacts and minor flooding impacts to properties on Garden Street.

Option 2 would have lower adverse visual and heritage impacts as the level of physical intervention on Sydenham Pit and Drainage Pumping Station would be minimised. The original pumping station would be maintained and supplemented with a new pumping station and there would be no significant flooding impacts on local properties. However, the option poses a construction risk due to impacts on existing flooding channels that would result in a temporary channel capacity loss of 50 per cent. The new culverts have the potential to cause upstream draining issues during operation, are not the preferred option of Sydney Water due to maintenance access and ventilation / emergency egress, and would impact Sydney Metro operations during structural maintenance periods. Option 2 would require land ownership transfer and would impact reliability of the Sydney Metro track cross-over.

Option 3 would provide independent access to new pumping station facilities and to Sydenham Pit and Drainage Pumping Station. Drainage maintenance would not impact on Sydney Metro operations but may result in flooding impacts at Garden Street. Option 3 would result in moderate adverse visual impacts and major adverse heritage impacts, as the existing pumping station would need to be demolished and replaced with a new pumping station. Option 3 would also require extensive demolition of the eastern and southern pit walls and would substantially reduce the original size of the pit.

3.4.2 The preferred option

Option 1 has been selected as the preferred option. The preferred option would not result in maintenance access issues for Sydney Water and Sydney Metro operations and presents a low construction risk as the infrastructure would be built without impacting the existing drainage channels. While the aqueduct would impact on the open character of Sydenham Pit and Drainage Pumping Station, the legibility of the existing pit and pump station would be retained. The existing pump station would be retained as a non-operational feature with opportunities to repurpose the building and provide public access to the heritage site. The aqueduct would also present opportunities for future pedestrian connection to Sydenham Station.

3.5 Design development

3.5.1 Design strategy

Sydenham Station

Transport for NSW is seeking to establish a Sydney Metro network that has a coherent identity to unify the different sections of the line (Sydney Metro Northwest and Sydney Metro City & Southwest), whilst providing sufficient flexibility to address and celebrate the differences in local context and communities, and the engineering and architecture responses to these differences.

Sydenham Station would form the only above-ground station in the approved project as proposed to be modified. As such, the architectural strategy developed for this station differs from the other stations within Chatswood to Sydenham component. The architectural strategy is to introduce elegant, contemporary structures that complement the earlier station buildings, and to ensure that this fourth overlay is clearly distinguishable from the earlier heritage fabric. The key architectural design principles developed for the above-ground stations are illustrated in Figure 3-2.

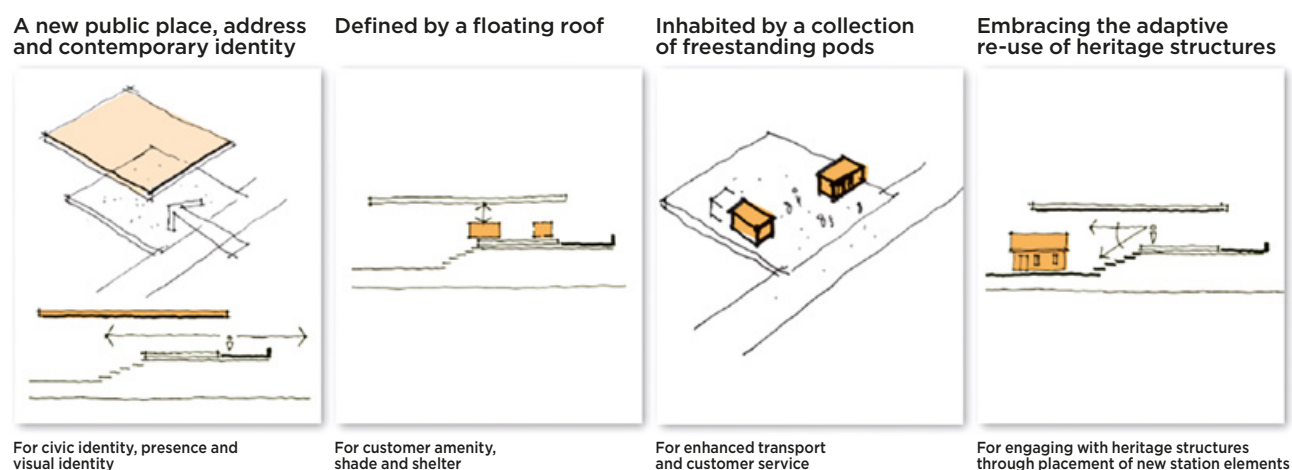


Figure 3-2 Key architectural design principles for Sydenham Station

A modular kit of parts approach has been adopted to implement the architectural principles identified above. Canopies and concourses to suit the specific platform type at Sydenham Station have been developed with a consistent height of the aerial concourse above platforms which means that standard lifts, precast stair elements and cladding panels are able to be used. This modular kit of parts approach has been adopted for the following reasons:

- It is consistent with other sections of Sydney Metro product, including branding, wayfinding, and station identity
- Impacts to the operation of the Sydney Trains lines and ARTC freight line need to be minimised
- It minimises the construction period and associated impact to the communities
- Provides for a high quality of finish via prefabricated modules, as well as ease of replacement (if and when required). Given parts are prefabricated and trucked in, construction related impacts at the site and on the community are minimised
- 'Plug and play' with services pre-assembled minimises time during possessions for services fit-out.

Sydney Metro Trains Facility South

The Sydney Metro Trains Facility south would follow specific design guidelines (Appendix B) in order to provide a stabling facility and adjoining streetscapes that is sensitively integrated with the surrounding commercial and industrial context.

The administration building and paved areas would be consolidated where possible to maximise opportunities for landscaping. Planted areas would improve visual amenity and allow areas for surface water run-off from surrounding hard surfaces. Street trees and landscape verge areas would be included along Sydney Steel Road and Edinburgh Street to assist in visually screening the facility from the street and provide shade to the shared pedestrian and cycle path. The design also allows for potential future rail corridor development above the facility which would provide further visual screening.

The administration building would be designed to maximise sustainability by providing roof-mounted low voltage power regeneration infrastructure, rain water harvesting and reuse facilities, and providing plantings and permeable or reflective surfaces to mitigate heat absorption.

Rail corridor

Work within the rail corridor, including embankments, noise walls, protective screens or fences, would be designed to visually integrate into the existing landscape setting as much as possible and would keep engineered structures and clutter to a minimum. Designs would take into account the connection of the rail corridor to wider open space and recreational areas.

Any bridge works would be integrated with the existing architecture, engineering and rail systems and would be designed to respect any heritage identity of the bridge.

Any vegetation planting would be selected based on minimal water and maintenance requirements beyond the establishment phase, as access for landscape maintenance within the active rail corridor would be limited. Where possible, landscape treatments would be provided to screen the rail corridor from adjacent land uses.

3.5.2 Heritage strategy

Sydenham Station is listed on the State Heritage Register. The introduction of Sydney Metro at Sydenham Station as part of the proposed modification constitutes the fourth major intervention to this existing railway landscape. The design of the station has been undertaken having regard to the heritage values of the station and the wider T3 Bankstown Line overall, and has sought to:

- Recognise and demonstrate the heritage significance of all phases of rail transport development along the Bankstown Railway Line
- Retain and conserve, wherever possible, elements of heritage significance, so that functional relationships can be understood and interpreted
- Remove intrusive station elements that detract from the core heritage values
- Adaptively reuse the retained and conserved heritage buildings for station and related functions
- Carefully and clearly express the presence of Sydney Metro with new high quality design elements
- Deliver a functionally viable line, stations, and precincts, while enhancing the legibility of key heritage values.

The design approach adopted to meet the operational requirements of the Sydney Metro system, whilst minimising impacts on heritage, involves the following:

- On platform 2, the new platform canopy would maintain a separation from the heritage listed platform building to maintain the heritage integrity of the building. All new platform canopies would be offset from the end of heritage canopies. This would create a two to three metre weather protection gap that is considered acceptable given the positive outcome for the heritage building fabric
- The design of the concourse would accommodate the minimum depth and area required for gates and customer requirements at the concourse level
- The new aerial concourse and station entries would be located away from their traditional location on the adjacent road overbridge to retain existing heritage platform buildings. The aerial concourse would be designed to complement the earlier station buildings while ensuring the structure is clearly distinguishable from the earlier heritage fabric
- The aerial concourse and new station entries are located to directly service the Metro platforms as well as interchange movements between transport modes. The new infrastructure would increase the capacity of connections to platforms at Sydenham to meet the forecast interchange demands
- Platforms 1 and 2 would be straightened and lengthened at the northern end to cater to the length of Metro trains. The existing platforms would not be able to service the full length of a metro train in their current state.

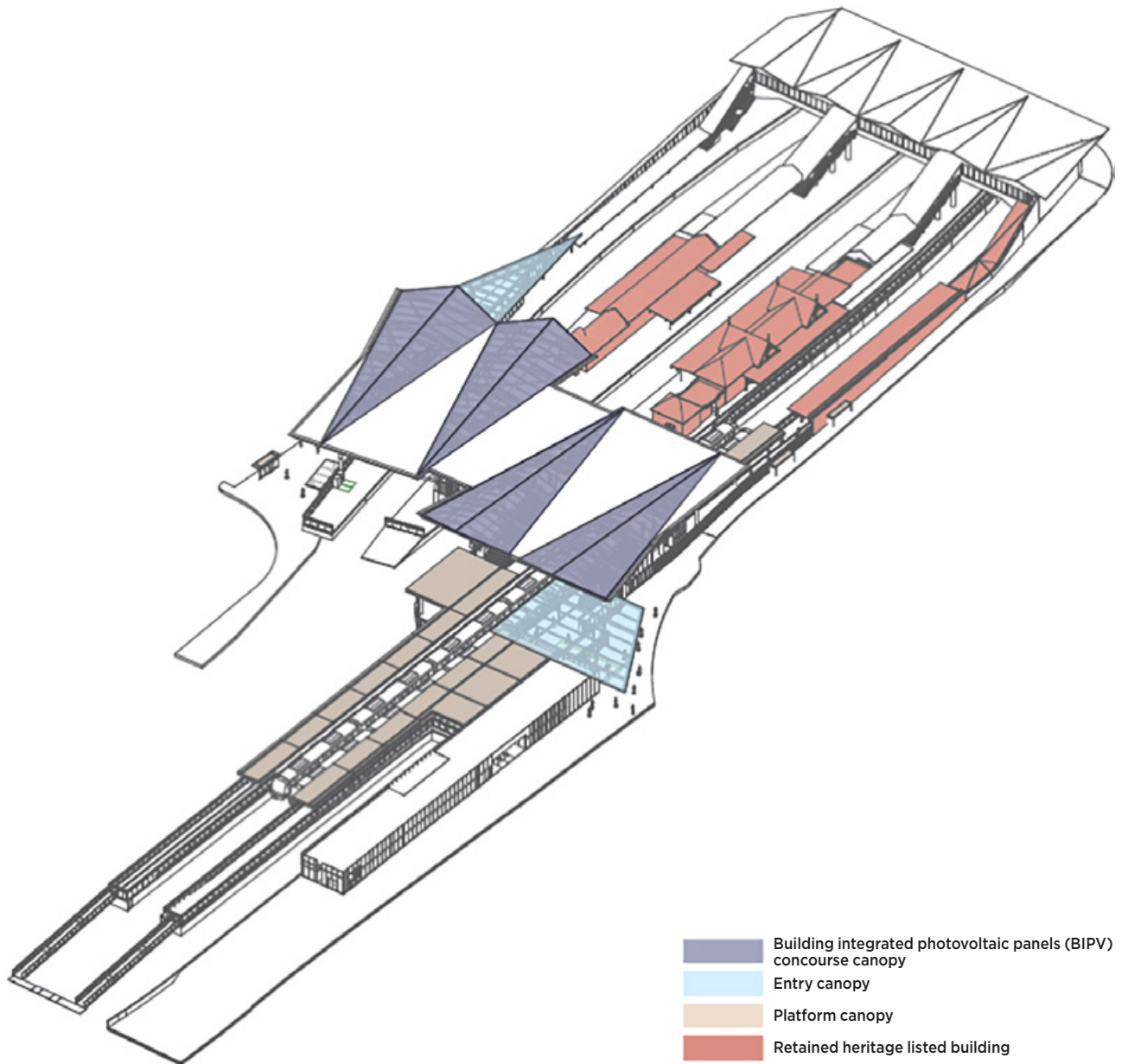


Figure 3-4 Approach to canopies at Sydenham Station

Through the design of the above-ground stations to date, significant work has been undertaken to reduce heritage impacts.

Platforms at Sydenham Station would need to be reconstructed to address existing accessibility issues and to meet operational requirements, including provision of platform edge barriers for safety. This results in an unavoidable impact to platforms 1 and 2 at Sydenham Station.

The approach to the remaining heritage listed elements at Sydenham Station has been to retain, where possible, existing significant items and / or elements, with particular focus given to those items listed on the State Heritage Register. As part of this process, Transport for NSW has ensured that retained heritage elements have a suitable station or operational purpose, and that their retention does not compromise the integrity of the station design and layout, or safety and customer requirements. In particular, the design of the upgrades to Sydenham Station has minimised impacts on the heritage walls around the station and resulted in the retention of a number of significant heritage buildings within the station.

Table 3-1 summarises the justification for those impacts on heritage items which are proposed to be removed as part of the proposed modification. Further information on the potential heritage impacts of the project are provided in Chapter 14 (Non-Aboriginal heritage).

Table 3-1 Justification of heritage impacts

Location	Heritage elements directly impacted	Comment / justification
Sydenham Pit and Drainage Pumping Station	Pumping station Pit wall Maintenance access	Works, including the new pumping station, are required to address existing drainage issues and potential impacts, with regard to local flooding conditions tied to ageing infrastructure. A number of options were considered, some of which had greater impacts on the heritage elements of the Sydenham Pit and Drainage Pumping Station. From those options that also meet the drainage needs, the proposed works have the least heritage impact, with the existing pumping station retained in its current position, and a new aqueduct proposed to be constructed across the pit at a suitable distance from the pumping station. The new aqueduct would be designed to contrast with, and minimise impact on, existing views to the pumping station. The new pumping station would be built with a modern design so it reads as a new element within this infrastructure asset. The design has evolved to ensure minimal impact on the existing wall and floor of the pit. Where materials need to be disturbed or impacted, they would be reused wherever possible. An access ramp would be positioned and designed to minimise its visual impact.
Sydenham Station	Platform Building 1 Platform Building 6 Part brick perimeter walls	Widening of the corridor is required to accommodate the reconfigured tracks and provide access to the station from the north, and access to Sydney Metro Trains Facility South. This widening would result in unavoidable impacts on Platform Building 1 and the brick perimeter walls. The impact on Platform Building 6 is associated with the limited space between Burrows Avenue and the platform building. Space is needed to accommodate the concourse and accessibility requirements. Brick perimeter walls would be rebuilt at a different location in a similar form to mitigate the impact.

3.5.3 Accessibility and safety requirements

Sydenham Station was upgraded in 2011 as part of the Transport Access Program. This upgrade included a new elevated concourse and station entrance with new ticketing facilities, retail space, a staff office and public and family accessible toilets; four new lifts to the platform and concourse, expansion of the station forecourt area to include new bicycle storage facilities and new staircases to access platforms.

Notwithstanding, accessibility issues still exist at Sydenham Station including curved platforms which create larger gaps between the train and platform compared to straight platforms and a barrier to movement. This large gap makes access for customers, particularly the disabled, elderly and those travelling with children in prams, very difficult. Accessibility issues extend beyond the station into the surrounding precinct, presenting accessibility challenges for interchange with other modes of transport.

The platform buildings are generally in good condition. Unfortunately, many of the platform buildings are not accessible, and due to security and operational considerations, now sit locked and vacant.

A key element of the design is to upgrade Sydenham Station to allow better access through a new concourse, level platforms and provision of additional lifts. Improvements would also be undertaken within the immediate precinct surrounding the station to deliver accessible interchange with other forms of transport.

Station and interchange designs and layouts were developed in accordance with relevant accessibility legislation and guidelines, including the Disability Discrimination Act 1992 (DDA) and Disability Standards for Accessible Public Transport (DSAPT). An outline of the options considered to meet these requirements for Sydenham Station is provided below.

Platform geometry and platform edge barriers

Platform edge barriers are required to be constructed on the Sydney Metro system to meet train loading and safety requirements. The existing brick faced platforms cannot accommodate the necessary footings for platform edge barriers. Examples of platform edge barriers are provided in Figure 3-5.



Platform Screen door at Åkeshov station Stockholm tunnelbana 2015

Figure 3-5 Examples of platform edge barriers (doors)

To address accessibility issues and to meet metro standards, the proposed modification would include modification of platforms 1 and 2 at Sydenham Station to allow installation of platform edge barriers, and reduce the gap and elevation difference between the train and the platform. The curved geometry of the existing platforms does not allow a consistent, DDA (and DSAPT) compliant gap (vertical and horizontal) between train and platform. Two options were considered to meet DDA and DSAPT requirements:

- Straightening of platforms (demolition and rebuild as required)
- Use of mechanical gap fillers (mechanisms that automatically narrow the gap between the platform and the train when the train arrives at the platform).

During assessment of these options, consideration was given provision of an accessible, safe, reliable and maintainable transport system; place making and urban design outcomes; heritage and property impacts; relationship with, and implications on road and rail bridges; and the rail geometry required to support operations and constructability.

Straightening of platforms was identified as the best option to meet accessibility, operational performance and safety requirements.

PLANNING AND ASSESSMENT PROCESS

CHAPTER FOUR



4 Planning and assessment process

This chapter describes the statutory planning process for the proposed modification.

4.1 NSW environmental planning approvals

Sydney Metro City & Southwest was declared by Ministerial Order on 10 December 2015 to be State significant infrastructure and critical State significant infrastructure. The assessment and approval process for a critical State significant infrastructure project is established under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). An Environmental Impact Statement for the Chatswood to Sydenham component of Sydney Metro City & Southwest was prepared and exhibited for 48 days from 11 May to 27 June 2016. A subsequent Submissions and Preferred Infrastructure Report was prepared and submitted to the Department of Planning and Environment in October 2016. Planning approval was granted by the Minister for Planning under Part 5.1 of the EP&A Act on 9 January 2017.

Pursuant to section 115ZI of the EP&A Act, Transport for NSW is seeking to modify the State significant infrastructure approval to include the works associated with Sydenham Station and Sydney Metro Trains Facility South. These works would fall within the definition of the critical State significant infrastructure declaration.

Appendix A provides consideration of the Secretary's environmental assessment requirements issued for the Environmental Impact Statement for Sydney Metro City & Southwest Chatswood to Sydenham, including the relevance of each assessment requirement to the proposed modification and, for the relevant requirements, where they have been addressed in this report. As the proposed modification was included in the original scope of work and State Significant Infrastructure Application Report for the Sydenham to Bankstown component, the Secretary's environmental assessment requirements issued for the Environmental Impact Statement for Sydney Metro City & Southwest Sydenham to Bankstown project were also considered where relevant.

4.2 NSW legislation that may still be applicable

The Environmental Impact Statement for the approved project considered other NSW legislation that may be applicable to the project. Table 4-1 provides further consideration of this legislation in relation to the proposed modification.

Table 4-1 Environmental related legislation of potential relevance to the proposed modification

Legislation	Requirement	Where addressed
<i>Aboriginal Land Rights Act 1983</i>	The <i>NSW Aboriginal Land Rights Act 1983</i> applies to Crown lands that are not lawfully needed for an essential public purpose; referred to as claimable Crown land. No claimable Crown lands would be affected by the proposed modification.	Aboriginal heritage impacts are assessed in Chapter 15 Property impacts are assessed in Chapter 12
<i>Contaminated Land Management Act 1997</i>	This Act outlines the circumstances in which notification of the Environment Protection Authority (EPA) is required in relation to the contamination of land. This may become relevant during construction and / or operation of the proposed modification.	Chapter 18
<i>Crown Lands Act 1989</i>	Ministerial approval is required to grant a 'relevant interest' (ie a lease, licence, permit, easement or right of way) over a Crown Reserve if required. The proposed modification would not be carried out on Crown land.	Chapter 12

Legislation	Requirement	Where addressed
<i>Greater Sydney Commission Act 2015</i>	This Act establishes the Greater Sydney Commission which has a principal objective of leading metropolitan planning for the Greater Sydney Region. The core functions of the Greater Sydney Commission are to provide advice to Government and assist local Councils plans or proposals relating to development in the Greater Sydney Region. The Greater Sydney Commission would not have a formal statutory role for the proposed modification but would be consulted with respect to its core functions if required.	Chapter 12
<i>Heritage Act 1977 (Section 146)</i>	The Heritage Council must be notified of a relic that is uncovered during construction and if it is reasonable to believe that the Heritage Council is unaware of the location of the relic.	Chapter 14
<i>Land Acquisition (Just Terms Compensation) Act 1991</i>	This Act would apply to the acquisition of land required for the proposed modification. However the provisions of the <i>Transport Administration Act 1988</i> have the effect that for underground stratum acquisition compensation is not payable except in certain circumstances.	Chapter 12
<i>Native Title (New South Wales) Act 1994</i>	This Act provides for native title in relation to land or waters. The proposed modification would not affect land subject to native title or to which an Indigenous Land Use Agreement applies.	Aboriginal heritage impacts are assessed in Chapter 15 Property impacts are assessed in Chapter 12
<i>Water Management Act 2000</i>	The <i>NSW Aquifer Interference Policy</i> (Department of Primary Industries, 2012) documents the NSW Government's intention to implement the requirement for approval of 'aquifer interference activities' under the <i>Water Management Act 2000</i> . The requirement for aquifer interference approvals has not yet commenced.	Chapter 17

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) prescribes the Commonwealth's role in environmental assessment, biodiversity conservation and the management of protected areas.

The Environmental Impact Statement for the approved project did not identify any impacts to matters of national environmental significance. As such, the project was not referred to the Commonwealth Department of the Environment.

With respect to matters of national environmental significance, the assessment carried out for the proposed modification did not identify any changes to the impacts as assessed for the approved project. That is, the assessment for the proposed modification did not identify any potential impacts to matters of national environmental significance. Similarly, the proposed modification would not involve any actions on Commonwealth land. As such, a referral to the Commonwealth Department of the Environment for the proposed modification is not considered necessary.

4.3.2 Native Title Act 1993

The main objective of the Commonwealth Native Title Act 1993 is to recognise and protect native title. Section 8 states that the Native Title Act is not intended to affect the operation of any law of a State or a Territory that is capable of operating concurrently with the Act. Searches of the register maintained by the National Native Title Tribunal indicate there are no native title claims registered with respect to land within the area of the proposed modification. The proposed modification would not directly affect any Crown land that is currently the subject of a native title claim.

4.3.3 Disability Discrimination Act 1992

The *Disability Discrimination Act 1992* aims to eliminate as far as possible discrimination against persons on the ground of disability in areas including access to premises and the provision of facilities, services and land. The upgraded elements of Sydenham Station would be designed to be independently accessible and in compliance with the objectives and requirements of the *Disability Discrimination Act 1992*.

4.3.4 Disability Standards for Accessible Public Transport 2002

Section 33.1 of the *Disability Standards for Accessible Public Transport 2002* requires all new public transport premises, infrastructure and conveyances to be compliant with the requirements of the standard and referenced to the Australian Standards and Design Rules therein, unless unjustifiable hardship is incurred by implementation. The proposed modification would be designed to be compliant with the requirements of the *Disability Standards for Accessible Public Transport 2002*.

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STAKEHOLDER AND COMMUNITY ENGAGEMENT

CHAPTER FIVE



5 Stakeholder and community engagement

5.1 Overview

Engagement with the community and stakeholders about Sydney Metro City & Southwest began in June 2014 and has continued through the preparation of the Chatswood to Sydenham planning approval process (including this modification) and the Sydenham to Bankstown planning approval process. Prior to, and on a continuing basis outside of the planning approval process, Sydney Metro continues to proactively engage with the community and stakeholders.

Key stakeholders relevant to the proposed modification include (but are not limited to):

- State agencies (eg Department of Planning and Environment, Transport for NSW (including Roads and Maritime Services, Sydney Trains, NSW Trains, NSW TrainLink, Transport Coordination, Environment Protection Authority, NSW Office of Water, Sydney Water and Office of Environment and Heritage)
- Local government (Inner West Council)
- Public utility providers, business and industry groups near the project
- Directly impacted communities
- The broader community.

This chapter provides an overview of the consultation activities to date. Consultation activities during construction would be consistent with the approach for the approved project.

5.2 Consultation and engagement activities to date

As detailed in the Chatswood to Sydenham Environmental Impact Statement, consultation and engagement activities for Sydney Metro City & Southwest have included:

- Stakeholder consultation following the announcement of Sydney Rapid Transit in June 2014
- Project scope consultation and engagement following the announcement of Sydney Metro City & Southwest in June 2015
- Industry consultation in June and December 2015, April and September 2016 and April 2017
- Engagement following the project update announcement in November 2015
- Engagement following the announcement of the Waterloo Station location in February 2016
- Engagement regarding the Blues Point temporary site in February 2016
- Consultation during the preparation and exhibition of the Chatswood to Sydenham Environmental Impact Statement in May-June 2016.

Since June 2016, consultation and engagement activities have included:

- Consultation during the preparation of the Sydenham to Bankstown Environmental Impact Statement (which initially included Sydenham Station and the Sydney Metro Trains Facility South) in 2016 and 2017
- Mobile community information centre display at local markets, events and shopping centres along the Sydenham to Bankstown project corridor, including at Marrickville Metro
- Consultation during the preparation of this modification.

Consultation and engagement since June 2016 is discussed further in the following sections.

5.2.1 Public information and engagement

Table 5-1 identifies the activities used to provide up-to-date information to the community and stakeholders.

Table 5-1 Public information and engagement

Activity	Date	Detail
Community information line	Existing	1800 171 386
Community email address	Existing	sydneymetro@transport.nsw.gov.au
Website	Existing	www.sydneymetro.info
Postal address	Existing	Sydney Metro City & Southwest PO Box K659, Haymarket, NSW 1240
Place Managers	Existing	Dedicated community relations specialists who act as the single, direct contact between directly affected members of the community and the project team
Project update	Commenced 16 February 2017	Delivered to 70,000 properties in the vicinity of the rail corridor from Sydenham to Bankstown and made available on the Sydney Metro website. Copies were distributed to ethnic community organisations and translated into several different languages.
Mobile Community Information Centre	22 – 28 May 2017	Marrickville Metro
Media release	16 February 2017	'More trains, faster services, better connections: Metro heads south west'
Advertisements in local and community language newspapers	16 February – 10 March 2017	The Australian Sydney Morning Herald Daily Telegraph Inner West Courier Canterbury Bankstown Express Bankstown Torch Greek Herald Korea Community Magazine Chieu Duong Australian Chinese Daily Indian Link
Email alert	16 February 2017	Sent to over 3,200 community members registered in the Sydney Metro City & Southwest database.
Printed materials	16 February 2017	'Sydenham to Bankstown SSIAR Summary Booklet' – provided at meetings and on request, and on the Sydney Metro website
Doorknocks	16 February 2017	Property owners and / or tenants affected by property acquisition.
Industry consultation	Since June 2015	Four industry briefings, each attended by over 450 industry representatives from Australian and international firms. Attendees receive a <i>Sydney Metro, City & Southwest Industry Briefing</i> booklet.

5.2.2 Stakeholder consultation

Key stakeholders (including local government, NSW and Australian Government departments, peak bodies and industry associations) were briefed via meetings, presentations and phone calls. The briefings were designed to ensure stakeholders were adequately informed of the project; to ensure issues and concerns were understood, captured and addressed in the planning process; and to receive feedback.

5.2.3 Government agency consultation

Ongoing consultation has been carried out with specific groups, including regular meetings with:

- **Heritage Working Group:** This group was consulted on the non-Aboriginal heritage assessment, the potential impacts and management strategies. The group includes heritage specialists and representatives from the Department of Planning and Environment, Transport for NSW, Sydney Trains Environment and Office of Environment and Heritage
- **Sydney Metro Roads Integration Working Group:** This group was consulted on the traffic and transport assessment, the potential impacts and management strategies. The group includes Transport Coordination and Roads and Maritime Services.

Transport for NSW's government agency consultation focussed on cross-agency integration and communication. Regular meetings were held with a variety of government stakeholders to ensure key issues were appropriately addressed, including (but not limited to):

- Department of Planning and Environment
- Transport Coordination
- Inner West Council
- Environment Protection Authority
- Heritage Council of NSW
- Greater Sydney Commission
- Department of Premier and Cabinet
- Infrastructure NSW
- NSW Trains
- Office of Environment and Heritage
- Roads and Maritime Services
- Sydney Trains
- UrbanGrowth NSW.

5.3 Feedback

The community contact and information tools established for Sydney Metro City & Southwest as outlined in Section 5.2 were available during the planning and approval process.

A summary of the issues raised that are relevant to the proposed modification, and an outline of the response to feedback received, is provided in Table 5-2.

Table 5-2 Response to community and stakeholder feedback received

Feedback received	Response
Temporary transport plans – customers use Tempe Station when trains are not running at Marrickville Station. However, Tempe Station is at capacity and does not have sufficient parking. If this station is considered as an alternative, more parking is needed	Preliminary information regarding the Temporary Transport Strategy required for the Sydenham to Bankstown upgrade project is provided in Chapter 7 of this report. A review of existing facilities and commuter parking at stations on other rail lines would be carried out during the development of specific temporary transport plans for each major rail possession. Further information regarding the Temporary Transport Strategy will be provided in the Environmental Impact Statement for the Sydenham to Bankstown upgrade project.
Concern about vibration from operating trains	Potential vibration impacts from the operation of trains around Sydenham is considered in Chapter 11 of this report. This assessment identified that all receivers around the proposed modification are predicted to comply with the applicable ground-borne vibration criteria.
Construction timing – when will work start on Sydenham Station, when will construction works be complete	Works at and around Sydenham Station are anticipated to commence in 2018 and would take around four years to complete.
Desire to keep the ‘grunge’ vibe in Sydenham (eg street art)	The presence of existing street art in the area around Sydenham Station is acknowledged in the landscape character and visual amenity assessment. Mitigation measure LV17 (as part of the approved project) commits to investigating opportunities to provide a permanent wall for street art near the Marrickville dive site in consultation with the local council.
Request for further information on rail shutdown period(s)	Preliminary information regarding rail shutdown periods required for the proposed modification is provided in Chapter 7 of this report. The exact nature of rail shutdown would be determined based on more detailed construction planning. Information would be provided to the community prior to any rail shutdown required for the project.
Is there going to be a station at the dive site?	The future use of the Marrickville dive site would be as a stabling facility for metro trains (the Sydney Metro Trains Facility South). Sydenham Station in close proximity to the dive site would be upgraded to include metro services.

5.4 Public exhibition of modification report

The Department of Planning and Environment will place this report on public exhibition. During the exhibition period, government agencies, project stakeholders and the community will be able to review the modification report and will have an opportunity to make a written submission to the Department of Planning and Environment for consideration in its assessment of the proposed modification.

Advertisements will be placed in newspapers to advise of the public exhibition period, where the modification report can be viewed, and to invite the public to community information sessions where they can meet representatives from the project team.

Consultation activities during the public exhibition of the modification report will include:

- Contact points (ie Community Information Line and email address)
- Media releases
- Community information sessions
- Newsletter letterbox drops
- Doorknocks with neighbouring properties
- Project website
- Local business engagement
- Government stakeholder engagement
- Newspaper advertising
- Displays at local councils
- Stakeholder briefings.

5.4.1 Submissions report

At the completion of the public exhibition period for the modification report, the Department of Planning and Environment will collate and provide Transport for NSW with a copy of all submissions received. After reviewing the submissions, Transport for NSW will prepare a submissions report that responds to the relevant issues raised. The submissions report will be made publicly available on the Department of Planning and Environment website. Anyone making a public submission will receive a letter notifying them of the publication of the submissions report on the Department of Planning and Environment website.

5.4.2 Future consultation and engagement

Should the proposed modification be approved, the project team would continue to consult with the community and key stakeholders during the planning and construction of the project. In general, this consultation would involve:

- Ongoing consultation with key stakeholders, local council and other government agencies
- Provision of regular updates to commuters and the nearby community
- Development and implementation of a Community Communications Strategy.

Further details regarding stakeholder and community involvement requirements during project delivery are outlined in the Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report for the approved project). Transport for NSW would also specifically consult with stakeholders to fulfil mitigation measures outlined in this modification report. These consultation activities are identified in the relevant mitigation measures in Chapter 21 (Consolidated revised environmental mitigation measures).

MODIFICATION DESCRIPTION - OPERATION

CHAPTER SIX



6 Modification description – operation

This chapter identifies the physical infrastructure and built form, and describes the functionality and operation of the proposed modification.

6.1 Approved Sydney Metro works at Sydenham

The Sydney Metro City & Southwest Chatswood to Sydenham project was approved by the Minister for Planning on 9 January 2017. In the area around Sydenham, the approved project works include:

- A dive structure (about 400 metres long) and tunnel portal between Sydenham Station and Bedwin Road, Marrickville (the Marrickville dive structure). The dive structure would commence about 400 metres north of Sydenham Station and the Marrickville tunnel portal would be located about 840 metres north of Sydenham Station, to the south of Bedwin Road
- A services facility beside the Marrickville dive structure and tunnel portal, including a tunnel water treatment plant and a substation (for traction power supply)
- Signalisation of the Edinburgh Road / Edgeware Road / Bedwin Road intersection at Marrickville.

The approved project does not involve any changes to the Sydney Trains tracks in the vicinity of Sydenham or the phased opening of Sydney Metro to Sydenham Station prior to the Sydenham to Bankstown component of Sydney Metro City & Southwest. The Environmental Impact Statement for the approved project identified that there may be an opportunity to operate the Chatswood to Sydenham component (to Waterloo Station) before completion of the Sydenham to Bankstown component, and that this would require an additional track-turnback to be constructed between the Marrickville dive structure and Sydenham Station. Such work would be subject to separate assessment and approval.

6.2 Proposed modification

The proposed modification would involve the addition of the following key features to the project:

- Sydenham Station and precinct works
- Sydney Metro Trains Facility South
- Track and rail system facilities
- Adjustments to the Sydenham Pit and Drainage Pumping Station
- Ancillary infrastructure and works.

These features are described in more detail in the following sections.

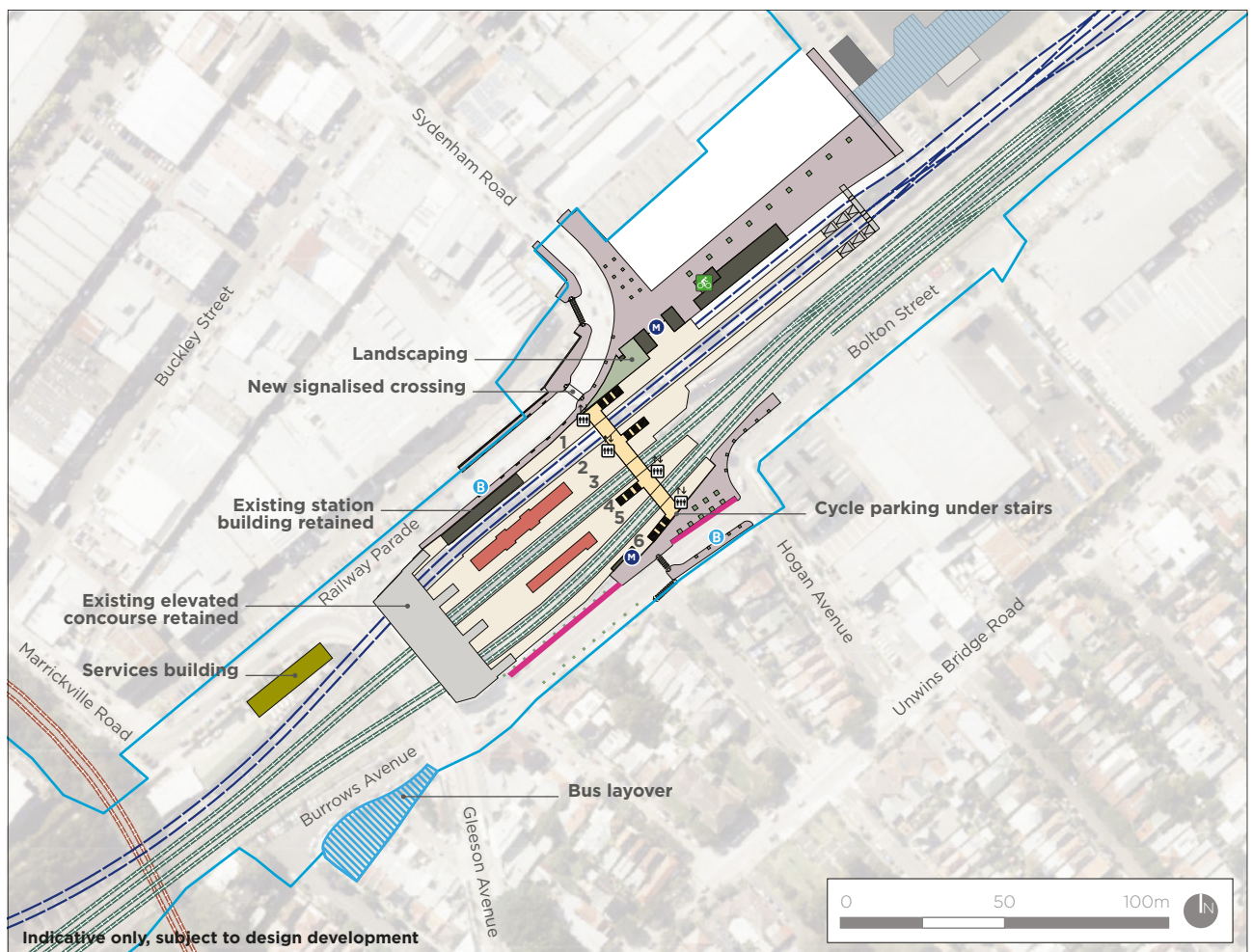
6.3 Sydenham Station and precinct

Sydenham Station and precinct would be upgraded to improve accessibility and meet metro operational requirements. In particular platforms 1 and 2 would be remodelled and metro operational facilities provided as described in Table 6-1 and shown in Figure 6-1. An indicative artist's impression of the upgrade of Sydenham Station is provided as Plate 6-1.

Table 6-1 Sydenham Station precinct design elements

Feature	Description
Station elements	
Station entry / exit	- Retention of existing Sydney Trains station entry on Gleeson Avenue at southern end of station - A new aerial concourse at the northern end of the existing platforms accessed from new station entrances located at Railway Parade and Burrows Avenue. The new concourse would provide access to both Sydney Metro and Sydney Trains platforms - Signage and wayfinding within the station.
Platform details	- Platforms 1 and 2 would be operated by Sydney Metro. The platforms would be extended north and modified to meet accessibility requirements and to support metro and would be connected by the new aerial concourse - Platforms 3, 4, 5 and 6 would also be connected to the new concourse and would continue to be operated by Sydney Trains and temporarily include T3 Bankstown Line services - Platform works would be undertaken to meet accessibility requirements and platform screen doors would be installed to support metro operations. Platform screen doors would open with the train doors once an arriving train has stopped, and close simultaneously with the train doors.
Station buildings	- The heritage listed Parcels Office on platform 1 and heritage listed buildings on platform 6 would be removed due to the construction of the new aerial concourse (outlined above). All other existing station buildings (including other heritage buildings) would be retained - A new services building within the rail corridor south-west of the Gleeson Avenue overbridge - New station buildings located at the new Railway Parade station entrance.
Precinct elements	
Public transport integration	- Relocated bus stops on Railway Parade would be modified to become accessible - A new accessible bus stop would be provided on Burrows Avenue to service northbound bus services - A new permanent bus layover facility would be provided on the vacant site at 117 Railway Road to the south of the station. This facility is required to accommodate rail replacement buses that currently use Burrows Avenue north of Gleeson Avenue which would no longer be available due to the new station forecourt.
Access and precinct	- Regraded Railway Parade in parts to accommodate new drainage - A new pedestrian crossing facility would be provided across Georges Street and Burrows Avenue to the east of George Street to provide access to the new Burrows Avenue station entry - Pedestrian crossing facilities would be provided on Railway Parade near the new station entrance and a secondary zebra crossing on Lower Railway Parade - Potential for cycle routes along Railway Parade and Gleeson Avenue to be provided by Inner West Council - Installation of signage and wayfinding within the precinct - Pedestrian and cycling infrastructure within the station precinct to support the active transport corridor between Sydenham and Bankstown. Other parts of the active transport corridor beyond the Sydenham Station precinct may be staged as funding becomes available, following agreement on land acquisition and maintenance provision and consultation with the relevant local council.

Feature	Description
Kerbside uses / parking	- The existing car share and designated accessible parking bays on Burrows Avenue would be retained - Existing kerbside facilities (kiss-and-ride) would be maintained west of the new station entrance and new kerbside facilities (taxi and kiss-and-ride bays) would be provided further east on Burrows Avenue adjacent to the new station entry - Existing bike parking facilities at the Gleeson Avenue station entrance would be retained - Bike parking is proposed near the new station entries on Railway Parade and Burrows Avenue - Thirty-six car parking spaces would be removed to allow for the new station pedestrian plaza and active transport facilities.

**KEY**

Proposed modification area	Platform	Paid concourse	New pavement	Station buildings
Heritage buildings to be retained	Metro station entry	Proposed lifts	Stairs	Proposed cycle parking
Kerbside facilities (Taxis and Kiss & Ride)	Sydney Metro tracks	Sydney Trains tracks	ARTC tracks	Proposed bus stop

Figure 6-1 Sydenham Station – indicative plan view



Plate 6-1 Sydenham Station – artist's impression

Metro platforms at Sydenham Station would be fitted with platform screen doors similar to those fitted at the underground stations for the approved project (Plate 6-1 provides an indicative view of platforms screen doors). These operate like lift doors, in that they only open (with the train doors) once an arriving train has stopped, and close simultaneously with the train doors. Platform screen doors provide an enhanced level of customer safety, as they prevent access to the track.

6.3.1 Place-making

Place-making has a pivotal role in creating a successful transport interchange, including improving the quality of customer experience, encouraging public transport use, establishing connections to local destinations and stimulating appropriate urban development. Transport interchanges can reinforce the sense of place by responding to local contexts and communities through place legibility, landscape quality and amenity, heritage elements, and public lighting, furniture and art. The following sections outline the local context that has been considered during the development of the proposed modification at Sydenham Station and identifies urban design strategies to enhance place-making opportunities.

Context

Location and urban context

Sydenham Station is located about six kilometres south of the Sydney CBD. Sydenham falls within the Inner West local government area and is bounded by St Peters to the east, Marrickville to the west, Enmore to the north and Tempe to the south. The station fronts Gleeson Avenue, which functions as the commercial centre of Sydenham and contains shops, restaurants, offices and 'shop top' housing extending south from the station.

Railway Parade and Gleeson Avenue border the station to the north and west. These roads form an important north-south connection across the rail corridor between the Princes Highway and the inner west area for general traffic, heavy vehicles and buses. Burrows Avenue borders the southern edge of the station is a busy local road. There are three parks within walking distance of Sydenham Station: Fraser Park, Sydenham Green and Tillman Park.

Sydenham Pit and Drainage Pumping Station is located to the north of the station and is listed on the State Heritage Register as a Great Depression-era public works project. The infrastructure forms part of the Cooks River flood defence system as a storm water retention reservoir.

Heritage and land use

Sydenham Station is a late nineteenth century train station listed on the State Heritage Register, RailCorp Section 170 Heritage and Conservation Register and the Marrickville Local Environmental Plan. Significant items within the station include platform buildings and awnings, the parcels office, platforms, waiting sheds, steel overbridge structure and brick perimeter walls. The station is characterised by a variety of platform buildings that show the evolution of railway infrastructure through to the end of the twentieth century. Heritage values of Sydenham Station and the surrounding area are discussed further in Chapter 14 (Non-Aboriginal heritage).

Land use around the station is mixed, with low density residential as well as commercial and industrial areas to the south that generally date from the late 19th century and early 20th century, and later industrial areas to the north. A small retail centre is located on Unwins Bridge Road and Railway Road to the south of the Sydenham Station. Aircraft noise is a dominant noise source in the area along with rail and road traffic noise, as Sydenham is two kilometres from Kingsford-Smith Airport and lies directly under the flight path of the third runway. Land use around Sydenham Station is discussed further in Chapter 12 (Land use and property).

Landscape and urban fabric

The character of the area surrounding the station is strongly influenced by its industrial history and the transport network, including rail, busy main roads and Sydney Airport. Areas to the north and west of the station are predominantly single and double storey industrial buildings. The Goods Line to Port Botany crosses the commuter rail corridor via a Pratt truss bridge to the immediate south-west of the station. Residential areas are largely occupied by single semi-detached and detached houses on relatively compact lots dating from around the early twentieth century.

The topography of the area is gently undulating and rises to the west of the station at Gleeson Avenue, providing city views to the east. Landscape character around Sydenham Station is discussed further in Chapter 16 (Landscape character and visual amenity).

Station area place-making and community enhancement

Urban design strategies have been developed for the proposed modification to enhance place-making opportunities around Sydenham Station, including address and legibility, public space, precinct connectivity and accessible interchange. These strategies have been developed in conjunction with the design guidelines described in Section 6.9 and the heritage strategy described in Chapter 3 (Development and alternatives). Integration with State and local land use planning strategies (described in Chapter 12 (Land use and property)) and local traffic and transport integration (described in Chapter 10 (Operational traffic and transport)) have also been considered. The following sections describe how place-making strategies have been incorporated into the initial design of Sydenham Station.

Constraints and opportunities

The Sydney Airport flight paths and local flood-prone areas restrict land use on both sides of Sydenham Station, while rail freight and heavy road traffic detract from the urban amenity of the area. Precinct intervention is limited by the Marrickville Development Control Plan 2011, which promotes that retention of the existing low-density, single-storey streetscapes.

However, proposed changes by the Inner West Council would allow additional land uses in the industrial area to the north of Sydenham Station to diversify activity in the area and promote a night-time economy. Proposed uses include creative uses, small bars, cafes and restaurants. The potential for an increase in the creative industry sector is also noted in the Department of Planning and Environment Urban Renewal Corridor Strategy. The proximity of Sydenham to Sydney Airport and Sydney CBD provide an advantage for developing new land uses, including possible mixed-use or residential development.

Place-making characteristics

Address and legibility

- Sydenham Station suffers from poor physical and visual connections to the north and south. Blank walls and facades and generally limited visibility restrict legibility of the station from adjacent areas
- A second station entry and distinctive metro canopy would open the station up and make it clearly visible from Sydenham Road in the north and local streets to the south.



Public space

- Proposed plazas would widen the public domain at station entries and generally improve pedestrian amenity and safety
- New street trees, interchange shelters and furniture would enhance the customer arrival and interchange experience.



Precinct connectivity

- The station concourse at the eastern end of the station would provide an important cross-corridor link between Sydenham Road to the north and neighbourhood streets and Sydenham Green in the south.



Accessible interchange

- Modifications to Railway Parade including a pedestrian crossing would provide a safe and accessible bus stop adjacent to the northern station entry for southbound bus services
- An interchange zone on Burrows Avenue would serve northbound bus services and taxi and kiss-and-ride requirements
- Secure and sheltered bicycle parking would be located in the north and south station plazas.



Entry plaza accessibility and design principles

The proposed entry plazas on Burrows Avenue and Railway Parade would create new public space around Sydenham Station by widening the public domain. The entry plazas would be designed to improve accessibility at Sydenham Station as a key transport interchange south of Central Station. The southern entry plaza would include an interchange zone on Burrows Avenue, providing footpaths, accessible bus stops and travel paths, taxi, kiss-and-ride facilities and sheltered bicycle parking. The northern entry plaza would include an accessible bus stop, pedestrian crossing, footpaths and sheltered bicycle parking to facilitate interchange between transport modes.

The entry plazas would be designed to enhance the physical presence of Sydenham Station as a key transport interchange destination by improving physical and visual connections to the north and south of the station. The new station entry on Railway Parade, including a distinctive metro canopy, would make the station clearly visible to the north of the station and would remove existing blank walls that restrict the legibility of the station from adjacent areas. The addition of street trees, transport interchange shelters and furniture in the plazas would enhance customer experience when accessing the station and interchanging between transport modes and improve amenity at Sydenham Station. Future opportunities would also be created for improved connectivity and public plaza space to the station from the north connecting through to Garden Street and through to the Sydenham Pit and Drainage Pumping Station and Sydney Steel Road. Wayfinding signage and information within and around the station would provide intuitive and clear navigation during customer interchange.

Planting concepts

Planting around Sydenham Station would be designed to be appropriate for local conditions and would suit the scale of the public domain without compromising pedestrian capacity and circulation. Tree species would respond to local council policies and guidelines and be selected to provide shade during the summer months and solar access during winter months. Plants would be low maintenance and have minimal water requirements following establishment. All landscape treatments would address safety-in-design issues by maintaining clear sight lines at road intersections and be offset from rail infrastructure,

Platform elements

Platforms 1 and 2 would be straightened and extended towards the Sydney CBD to meet accessibility requirements and accommodate the metro train design. Platforms would be fitted with platform screen doors. New canopies would maintain a distance of around two metres from heritage buildings to maintain the integrity of the heritage item.

New stairs and lifts would be installed on all platforms to connect to the new aerial concourse. Services rooms may be located under the stairs to minimise additional station buildings.

Concourse concepts

The new aerial concourse at the eastern end of the station would provide an additional pedestrian link across the rail corridor between Sydenham Road in the north and Burrows Avenue in the south. The concourse would connect to all heavy rail and metro platforms within Sydenham Station and link to the new pedestrian plazas and footpaths on both sides of the station. The aerial concourse would connect to the proposed new northern station entry on Railway Parade to improve connectivity across the station and precinct, which is currently limited to the road bridge and footpaths on Gleeson Avenue and Railway Road.

A single canopy would span over the aerial concourse to provide weather protection. The canopy would be designed to provide a contemporary station identity with minimal columns to maintain clear sightlines from the concourse to heritage listed buildings on the platforms. The canopy design references the existing heritage listed platform building roofs as well as the more recent upgrade to the Gleeson Avenue concourse.

The placement of stairs and lifts between the concourse and platforms would be prioritised for the most efficient and direct means of customer interchange. Lifts would be glazed to ensure visibility, safety and security for customers.

Heritage elements

The introduction of Sydney Metro infrastructure at Sydenham Station would constitute the fourth major intervention to the existing railway landscape. The proposed modification would be designed to balance the need for updated infrastructure with the need to retain heritage fabric to meaningfully convey the heritage values of the station. The proposed modification would respond to the existing station layout in a contemporary style to readily distinguish the ‘fourth phase’ of transport development at Sydenham.

Sustainability elements

Climate change resilience measures would be embedded in the design of proposed works at Sydenham Station. Shading of station concourses for both summer and winter weather conditions would be provided. Large concourse canopies would include photovoltaic systems to produce renewable energy at the station. Rain water would also be harvested from canopies for reuse in bathrooms and in the landscape around the station. High efficiency fixtures and fittings would also be included and sustainable materials used for construction where feasible and reasonable.

6.4 Sydney Metro Trains Facility South

The Sydney Metro Trains Facility at Rouse Hill is proposed to be the primary stabling facility for the overall metro network as it would contain the heavy maintenance facilities required to manage the system. This facility was approved and is being constructed as part of Sydney Metro Northwest.

The Sydney Metro Trains Facility South (the stabling facility) would be located about 750 metres north-east of the existing Sydenham Station, bounded by Sydney Steel Road to the north, Edinburgh Road to the east, Sydney Trains rail corridor to the south and the existing Sydenham Pit and Drainage Pumping Station (water detention basin) to the west.

The stabling facility would provide for overnight stabling of Sydney Metro trains and light maintenance activities to minimise the requirement to send trains to the Sydney Metro Trains Facility at Rouse Hill. The Sydney Metro Trains Facility South site would occupy an overall area of about nine hectares and would mainly consist of low-rise, single storey development. The stabling facility would be rained from existing ground levels with a series of retaining walls up to 3.5 metres high) and structures around the site.

Provision for screening development along the north-western end of the stabling facility, including above the stabling tracks, has been made in the design. The inclusion of this development would screen the stabling facility from surrounding land uses located to the north-west. Although, approval for this development would be subject to a separate process and is not included in the proposed modification, the preparation works (eg structural foundations, supports and columns) would be included as part of the proposed modification to ensure development of this precinct could occur in the future.

The design of the facility would be refined during the detailed design stage. An indicative layout of the facility is shown in Figure 6-2.

Works to adjust drainage in the vicinity of the stabling facility are also included in the proposed modification (refer to Figure 6-2). The proposed modification includes realigning and enclosing the existing open channels to facilitate construction of new tracks and the Sydney Metro Trains Facility South. Works at this location would involve:

- Realignment and enclosure of existing open channels through the Sydney Metro Trains Facility South site
- Construction of a new aqueduct structure over the existing Sydenham Pit and Drainage Pumping Station to the north of existing Pumping Station No. 1
- Provision of a new Sydney Water pumping station adjacent to Garden Street
- Adjustment to the access ramp to the Sydenham Pit and Drainage Pumping Station
- A new buried cross-drainage structure with large capacity inlet pits to carry water from the southern side of the rail corridor within Bolton Street to the existing Sydenham Pit and Drainage Pumping Station.

The key features of the Sydney Metro Trains Facility South are described below.

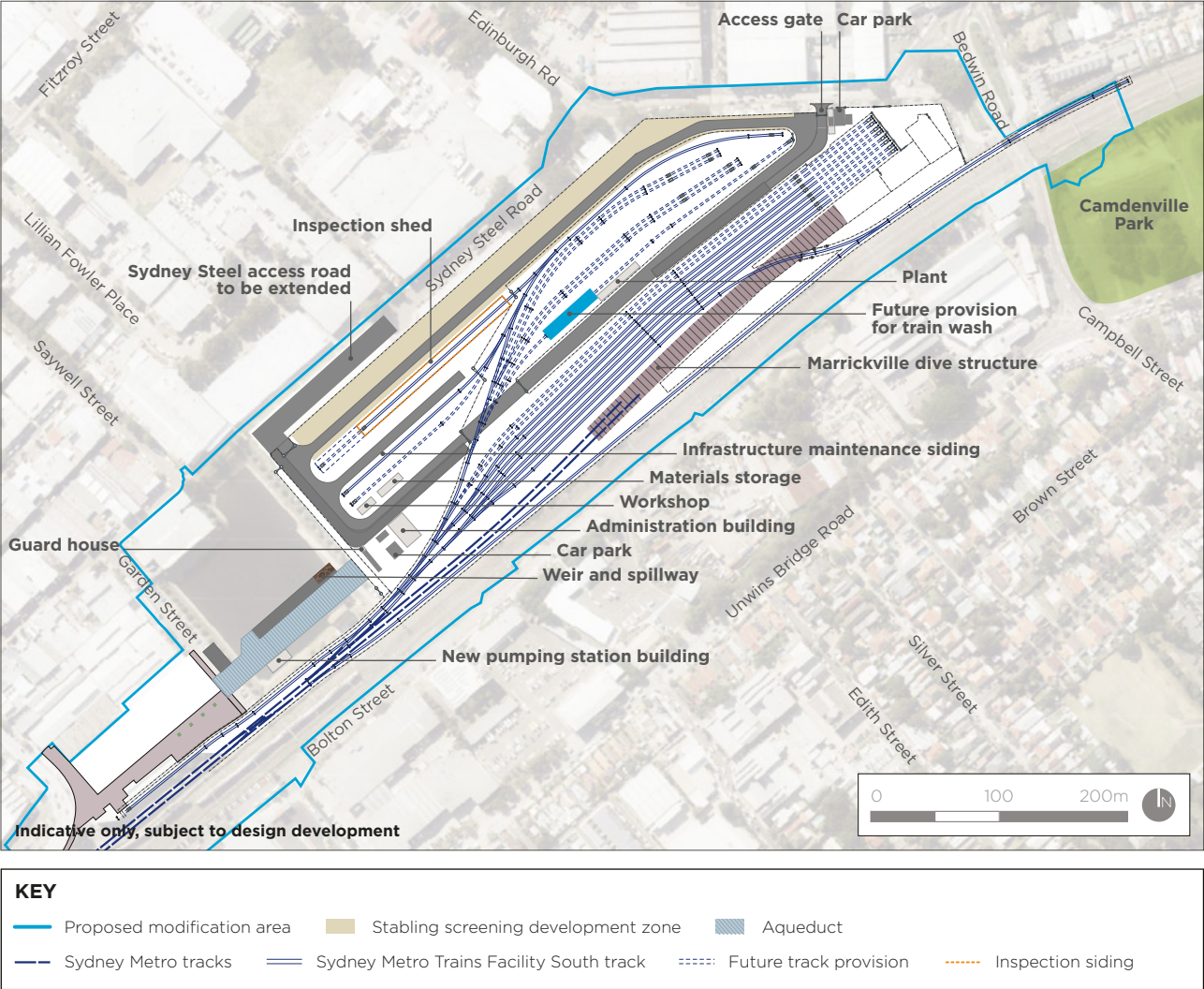


Figure 6-2 Sydney Metro Trains Facility South

6.4.1 Train stabling area

The train stabling area would initially accommodate 12 six-car trains, with the capacity to accommodate 20 eight-car trains. The arrangement of the stabling area is shown in Figure 6-2 and would comprise an eastern and a western stabling area, with buffer stops at each end.

The train stabling area would be raised from existing ground levels to be above flood levels and a series of retaining walls and structures would be built.

The stabling area would consist of tracks fixed to concrete sleepers supported on ballast. Platform access would be provided at train ends to allow access to trains for internal cleaning. These platforms would be able to be relocated where required.

Three turnouts from the main operational line would provide routes into and out of the facility, two of which would be on the north side, and one on south side of the line.

6.4.2 Train maintenance area

A covered train maintenance area would be located to the south-west of the stabling area.

The maintenance area would consist of a single siding about 180 metres long, and would have the capacity for a single six-car train. The siding could be lengthened for use by eight-car trains. Part of the siding would be covered with a clad shed of about 210 metres in length. A train inspection pit would be located within the maintenance shed to provide access to the underside of trains during inspection and light maintenance activities.

A train wash facility would also be provided within the stabling facility to clean the exterior of the trains. The location of this facility is shown on Figure 6-2.

6.4.3 Infrastructure maintenance area

An infrastructure maintenance siding would be located to the west of the train maintenance area on the western side of the stabling area (adjacent to the administration building) as shown on Figure 6-2. The maintenance siding would consist of a single covered siding used for the storage of track mounted and road / rail maintenance equipment and plant.

6.4.4 Other facilities

Administration building

An administration building would be provided to house facilities such as workstations, office space, a security staff office and toilets.

Car parking

Off-street car parking for about 50 cars would be provided within the stabling facility. On-street parking is not expected to be required.

Site security and access

The stabling facility would be accessed by metro trains from the rail corridor via turnout locations to the south of the facility. Vehicular and pedestrian access would be via new access points on an extended Sydney Steel Road and Edinburgh Road. The location of these access points access would be confirmed during the detailed design phase. Maintenance access to the enclosed Sydney Water assets (Sydenham Pit and Drainage Pumping Station) would be provided from both Sydney Steel Road and Edinburgh Road.

The stabling and maintenance facility would be surrounded by a security fence, and be gated at all entrance and exit points. A landscape zone (around 2.5 metres wide) with grass planting and street trees would create shade for the street and provide screening of the stabling facility on the boundary with Sydney Steel Road and Edinburgh Road.

The stabling facility would operate 24 hours per day and therefore require suitable lighting across the whole site and within sheds. Light installations would be installed in accordance with the *Australian Standard 4282:1997 Controlling the Obtrusive Effects of Outdoor Lighting*, and avoid light spill to nearby road corridor and residential areas.

6.4.5 Operation

Operational hours

To meet the operational and timetabling requirements of the Sydney Metro network the stabling and maintenance facility would be required to operate 24 hours per day and seven days per week.

Operational staff

About 150 full time equivalent staff would work in shifts at Sydney Metro Trains Facility South, with about 110 staff working on any one day.

Operational activities

Train stabling

Trains would need to be stored at the Sydney Metro Trains Facility South outside peak periods and between the last service and the first service commencing the following day. When a train enters the facility, the parking brake is applied and the trains would enter cleaning mode with lighting and air-conditioning on for up to an hour while train interiors are cleaned.

After cleaning, trains would be stabled with all auxiliary equipment shut down. Trains would need to be powered up around 15 minutes prior to their scheduled departure time. Safety checks are undertaken prior to the train entering service the following morning.

Train horn testing would not be required within the stabling facility. The water used for cleaning would be collected on-site in a rainwater harvesting tank and treated for reuse.

Train maintenance

The train maintenance area of the Sydney Metro Trains Facility South would not be used for heavy maintenance activities. Activities undertaken in the train maintenance area would include:

- Rolling stock (train carriages) inspections
- Minor repairs using a mobile maintenance crew
- Inspection of wheels, bogie and the underbody
- Train washing.

Infrastructure maintenance

Infrastructure maintenance would be coordinated from the Sydney Metro Trains Facility South. The maintenance activities would be both routine and major periodic maintenance of infrastructure with a view to maximising service availability and minimising impacts on customers.

Maintenance activities may include:

- Routine inspections and repairs
- Emergency repairs to address those unexpected defects (such as vandalism)
- Replacement and testing of project infrastructure.

Major periodic maintenance activities would be undertaken on an infrequent basis, likely to be on weekends or during the anticipated shutdown period each night.

The infrastructure maintenance areas within the facility would support the following maintenance activities:

- Parking of plant and equipment including track maintenance vehicles
- Loading of materials for transportation to site
- Rail handling and welding of rail into longer length
- Rail replacement and renewal
- Electrical, signalling and communication systems renewals
- Maintenance of civil infrastructure; footpaths, internal roads, fences, buildings
- Maintenance of on-site water systems
- Vegetation management
- Inspections and minor repairs of infrastructure.

6.5 Tracks and rail system facilities

6.5.1 Metro tracks and changes to track alignment

Changes to the track alignment would be carried out around Sydenham Station to facilitate the separation of the metro tracks from the existing rail network. This would involve the installation of rails, sleepers, fastenings and ballast between the Marrickville dive structure and the proposed modification boundary to the south-west of Sydenham Station (as shown on Figure 1-1).

Adjustments to existing track alignment would meet the operational requirements of Sydney Metro, Sydney Trains, NSW Trains and freight operators.

Track works would also involve:

- Adjustments to the Sydenham Maintenance Centre entry tracks (to the south of Sydenham Station)
- Adjustments to the Goods Line
- Connections to the proposed Sydney Metro Trains Facility South
- Connections to the approved Marrickville dive structure.

6.5.2 Crossover facilities

Crossover facilities allow a metro train on one track to cross over to the other. Installation of these features would facilitate train movement within the rail corridor.

New crossover facilities would be provided at the following locations:

- North of Sydenham Station platforms to service platforms 3 and 4
- South-west of Sydenham Station
- To connect to the Sydney Metro Trains Facility South

6.5.3 Rail systems facilities

The proposed modification would involve the installation of new Sydney Metro rail system facilities and adjustments to the existing Sydney Trains and ARTC rail system facilities and services. The rail systems at Sydenham Station include utilities, overhead wiring, signalling, electrical, radio and communications systems, masts, cable containment systems, equipment and services buildings and electrical transformers.

In addition, telecommunications masts would be positioned along the rail corridor at Sydenham Station Junction at about 250 metre intervals and would include:

- Radio antennae
- CCTV cameras
- Security devices
- Telecommunication cabling
- Equipment enclosures.

The height of each mast would vary between three to six metres in height and would be either a concrete or steel pole or a square steel pole.

6.6 Ancillary infrastructure and works

Permanent ancillary infrastructure to support the proposed modification would include:

- Fencing and trackside intruder detection system
- Maintenance access
- Noise barriers
- Drainage.

6.6.1 Fencing and trackside intruder detection system

Security and segregation fencing is proposed to be installed as part of the proposed modification. This would comprise a new fence along both sides of the rail corridor and between Sydney Metro tracks and the existing rail network.

Fencing would be a minimum of two metres above ground level and would be constructed from palisade or close spaced welded mesh. Access points would be provided at appropriate locations.

The design and type of fence would be confirmed during detailed design and in consideration of Asset Standards Authority standards and other security measures including the trackside intruder detection system.

A trackside intruder detection system would be installed, consisting of non-mechanical protection measures to supplement the fencing. Closed circuit television would also form part of the system, which would monitor all automatic control areas, including the station, stabling yards and the maintenance facility.

6.6.2 Maintenance access

Maintenance access to the rail corridor would be via existing access gates wherever possible. These access points currently consist of a mixture of pedestrian and vehicular gates. There is also potential for new access gates along the corridor to provide the required access during operation for the following:

- Changes in existing access due to the proposed modification resulting in an existing access being no longer available
- Need to access new key infrastructure such as turnouts or station services buildings
- Change of access type for existing gates, in particular the change of pedestrian access gates to vehicular access gates and vice versa
- Additional emergency access / egress points.

Some access points would include provision for access by rail-mounted vehicles.

The provision of any new access points would be considered further during detailed design.

6.6.3 Noise barriers

Noise barriers would be required to mitigate potential airborne noise impacts following the opening of Sydney Metro. Noise modelling undertaken for the proposed modification has identified potential locations of noise barriers along the rail corridor, based on the level of exceedances. The final location of noise barriers would be confirmed during detailed design.

6.6.4 Drainage works

The proposed modification would include drainage works to ensure that stormwater is managed appropriately within the rail corridor. The works would include new and modified drainage infrastructure, consisting of trunk stormwater conveyance and intertrack drainage.

New track drainage would be provided within the proposed modification area where:

- Existing overland flooding issues are present and not adequately addressed by existing drainage infrastructure
- Proposed changes to the track alignment require new track drainage infrastructure.

Modification of cross drainage infrastructure would be required at nine locations (six upgraded crossings and three new crossings). This would generally involve:

- The extension of cross drainage infrastructure to ensure that it is clear of the proposed construction work
- Augmentation of some cross track drainage systems to improve existing capacity issues
- Full removal and replacement.

- In addition to the drainage works proposed within the rail corridor, new drainage infrastructure would be constructed outside the rail corridor in the following locations:
- Realignment and enclosure of existing open channels through the Sydney Metro Trains Facility South site
 - Bolton Street at Sydenham – pits in Bolton Street and an underbore to the existing Sydenham Pit and Drainage Pumping Station
 - Edinburgh Road and Sydney Steel Road at Sydenham – large kerb inlet structures and buried stormwater culvert system
 - Sydenham Pit and Drainage Pumping Station – elevated aqueduct structure to convey stormwater from the east side of the detention basin to the west side and in to the eastern channel, and provision of a new pumping station adjacent to Garden Street.

6.7 Future rail corridor development

Rail corridor development is one potential use for residual land. This could involve development integrated with stations, adjacent to stations, over or adjacent to the rail corridor, where existing in-corridor development is to be removed, or where suitable residual land is identified.

The proposed modification would include enabling works at the Sydney Metro Trains Facility South site for future rail corridor development, including:

- Civil works for a screening development
- Structural works including piles, columns and a deck over the stabling facility.

The inclusion of these elements as part of the proposed modification is necessary to enable the future development. Delivery of these elements in the future, once the stabling facility is operational, would be impractical and would result in unnecessary operational impacts to the stabling facility. Figure 6-3 provides a cross-section of the typical interface between the Sydney Metro Trains Facility South and future rail corridor development above the facility. All other rail corridor development does not form part of the project and would be subject to a separate approval process.

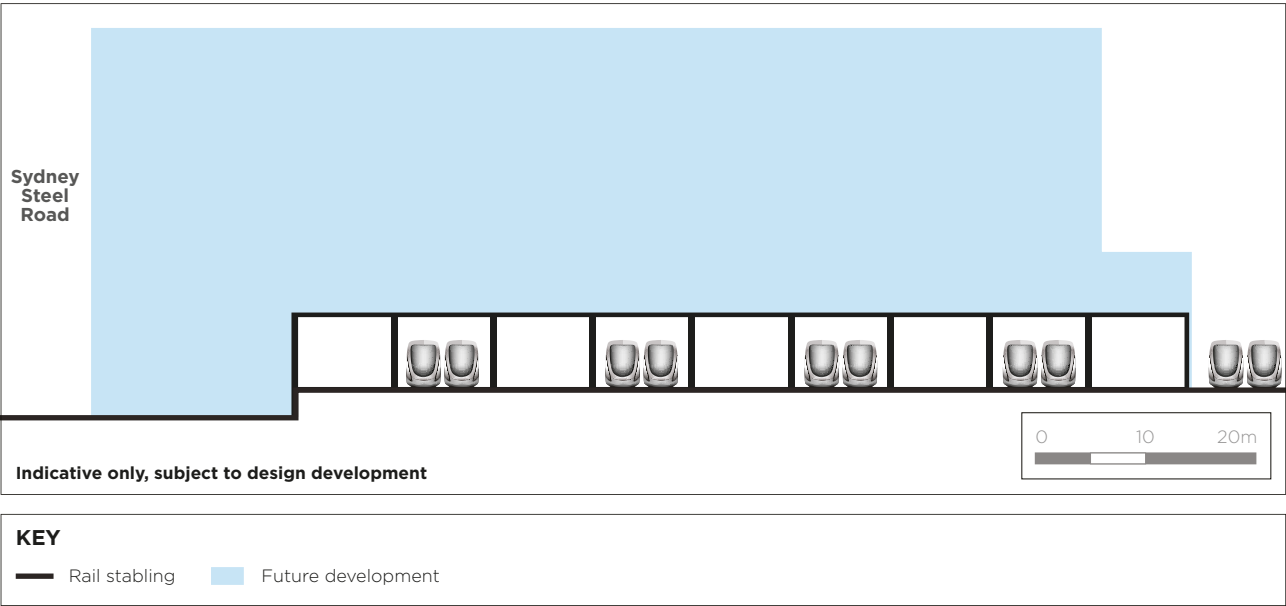


Figure 6-3 Future rail corridor development interface

6.8 Design guidelines

Sydney Metro has developed design guidelines to guide the design development process and establish the aesthetic standards for the project. The Chatswood to Sydenham design guidelines were provided as part of the approved Sydney Metro City & Southwest Chatswood to Sydenham Environmental Impact Statement and revised as part of the Submissions and Preferred Infrastructure Report. A further revision of the design guidelines is included with this modification (Appendix B) to include specific design guidelines for the Sydney Metro Trains Facility South and the upgrade of Sydenham Station.

6.9 Metro operations

Sydney Metro operations were described as part of the assessment of the approved project. Prior to the full opening of Sydney Metro City & Southwest, phased opening of the line between Chatswood to Sydenham may occur. A phased opening would necessitate changes to the existing operations at Sydenham Station to allow the existing Sydney Trains lines (including the T3 Bankstown Line) to continue to operate during this phased opening.

Sydenham Station currently operates as follows, with all platforms operated by Sydney Trains:

- Platforms 1 and 2: T3 Bankstown Line
- Platforms 3 and 4: T2 Airport Line
- Platforms 5 and 6: T4 Illawarra Line.

To support a phased opening of the Chatswood to Sydenham component of Sydney Metro City & Southwest, temporary arrangement to operations at Sydenham Station would include:

- Platforms 1 and 2: Sydney Metro: Cudgegong Road Station to Sydenham Station
- Platforms 3 and 4: T2 Airport Line and T3 Bankstown Line
- Platforms 5 and 6: T4 Illawarra Line.

Sydney Metro would be responsible for the operation of platforms 1 and 2, and Sydney Trains would retain operational responsibility for platforms 3-6.

Following completion of the Sydenham to Bankstown component of Sydney Metro City & Southwest, Sydenham Station would operate as follows:

- Platforms 1 and 2: Sydney Metro: Cudgegong Road Station to Bankstown Station
- Platforms 3 and 4: T2 Airport Line
- Platforms 5 and 6: T4 Illawarra Line.

In addition, the Goods Line and existing shunt movement from the Sydenham Maintenance Centre and the Goods Line to platform 2 of Sydenham Station would be relocated to platforms 3 and 4.

The operational configurations of Sydenham Station during each of these phases are shown in Figure 6-4a-c.

The temporary operation of Sydenham Station to support the potential phased opening of the Chatswood to Sydenham component of Sydney Metro City & Southwest would result in a temporary increase in rail traffic through platforms 3 and 4 of Sydenham Station. This increased rail traffic would be factored into the future timetable for both the T3 Bankstown Line and T2 Airport Line. Further information on the interim operational arrangements and potential impacts to existing services at Sydenham Station are provided in Chapter 10 (Operational traffic and transport).

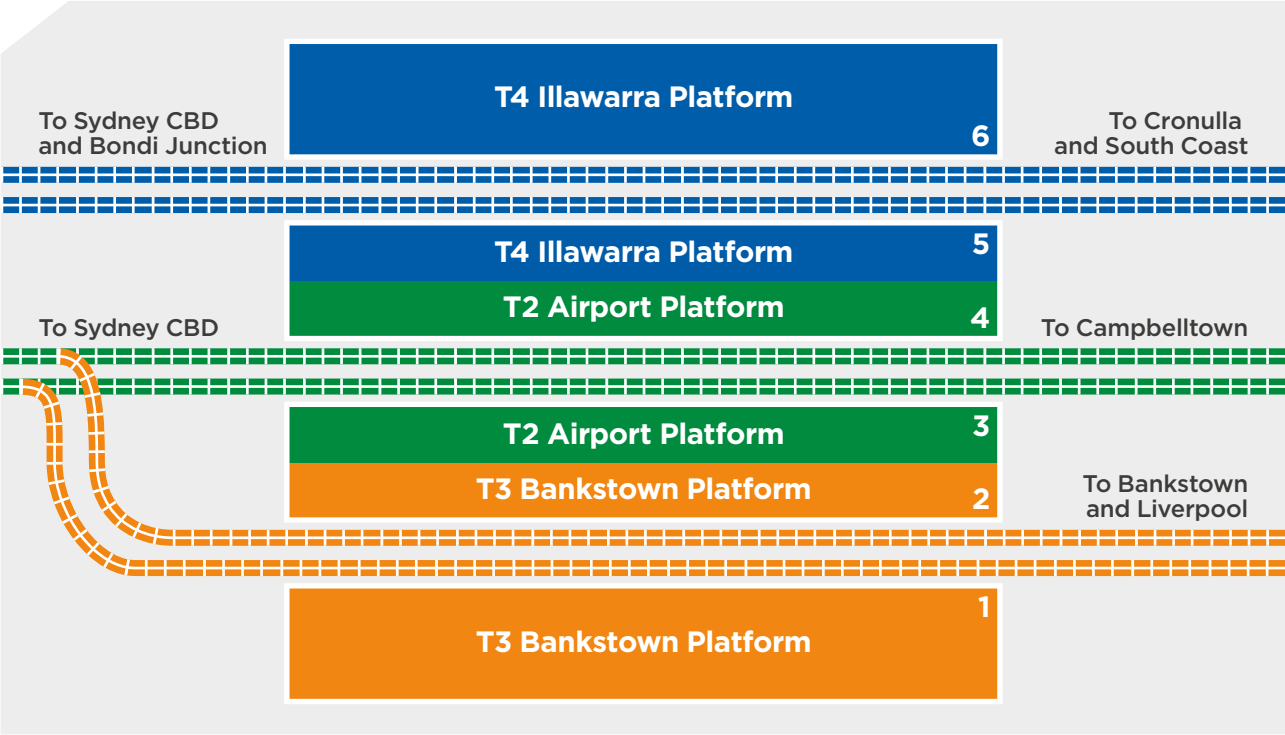


Figure 6-4a Operational configuration at Sydenham Station– existing

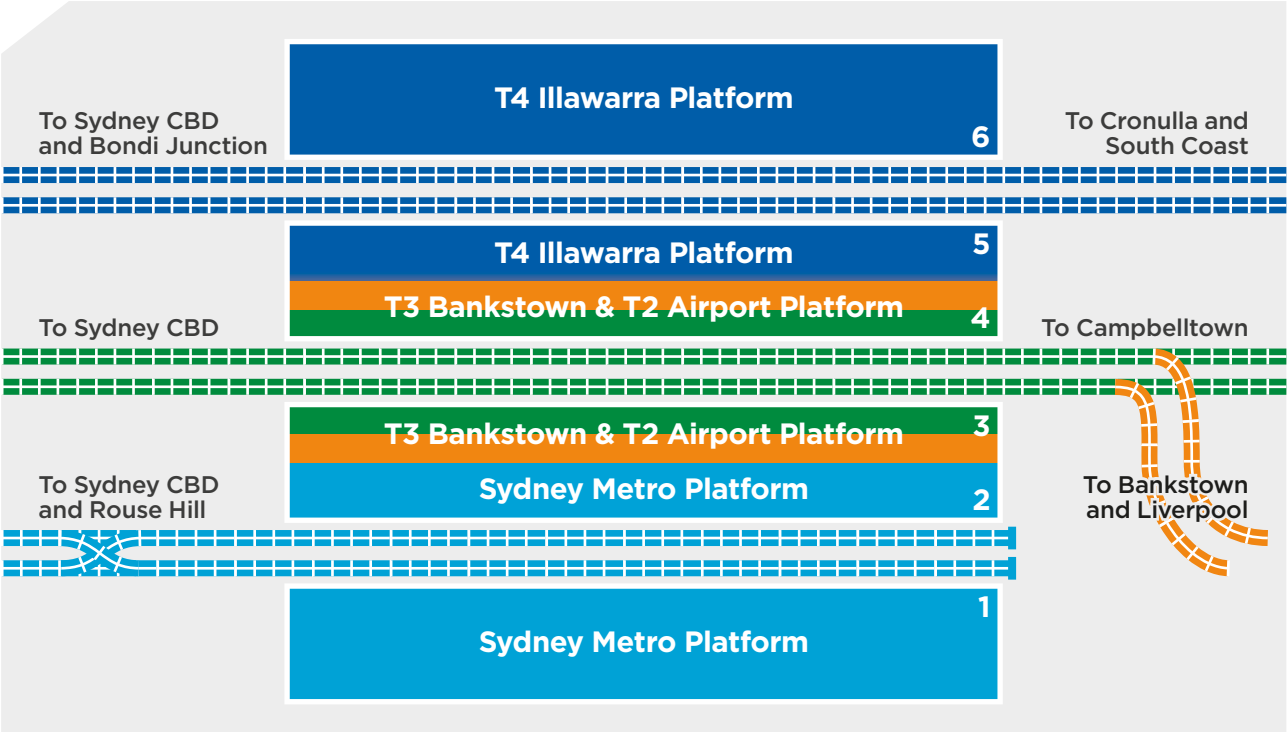


Figure 6-4b Operational configuration at Sydenham Station– phased opening of Sydney Metro City & Southwest

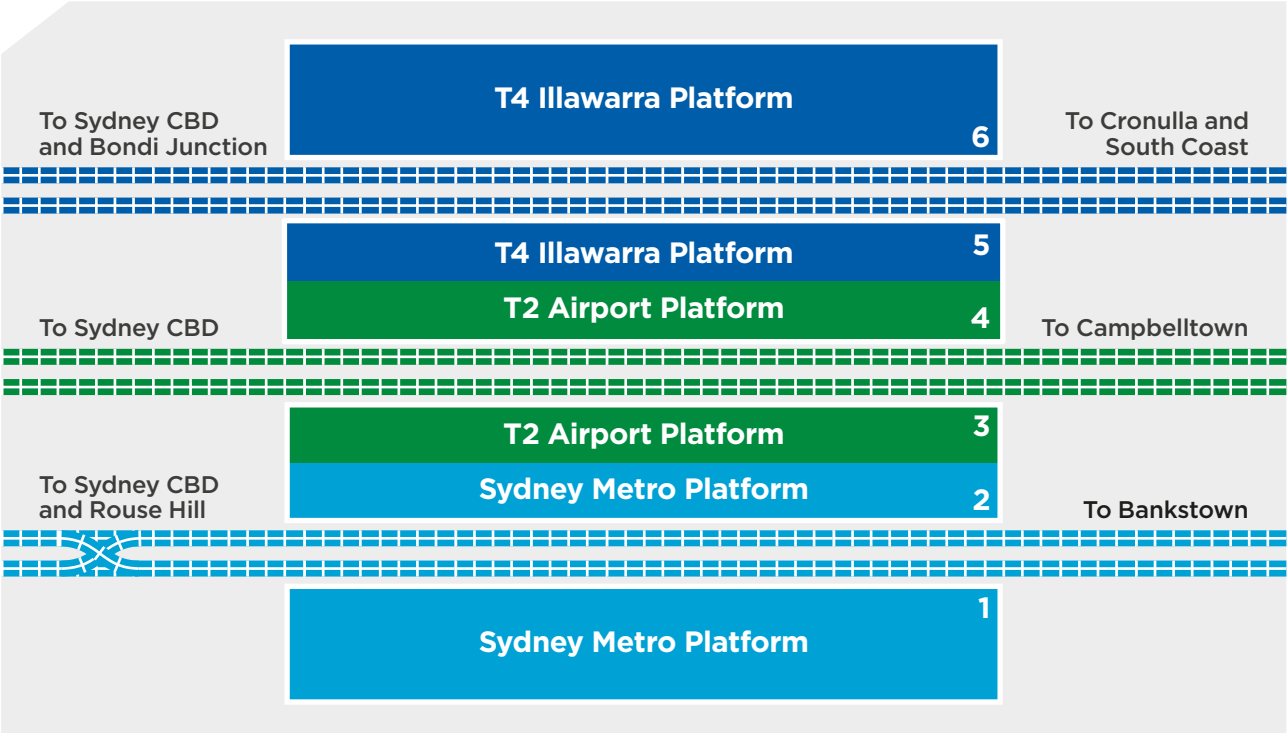


Figure 6-4c Operational configuration at Sydenham Station during– full Sydney Metro City & Southwest operations

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MODIFICATION DESCRIPTION – CONSTRUCTION

CHAPTER SEVEN



7 Modification description – construction

This chapter describes the likely key construction activities for the proposed modification and identifies the construction sites required. A description of the proposed modification once operational is provided in Chapter 6 (Modification description – operation).

7.1 Approved Sydney Metro works at Sydenham

The key construction activities as part of the approved project around Sydenham include:

- Excavation and construction of the Marrickville dive structure and tunnel portal
- Launch and support of two tunnel boring machines for the drive to Barangaroo
- Manufacture and storage of the pre-cast concrete tunnel lining segments
- Fit-out of the tunnel rail systems
- Construction of the southern services facility.

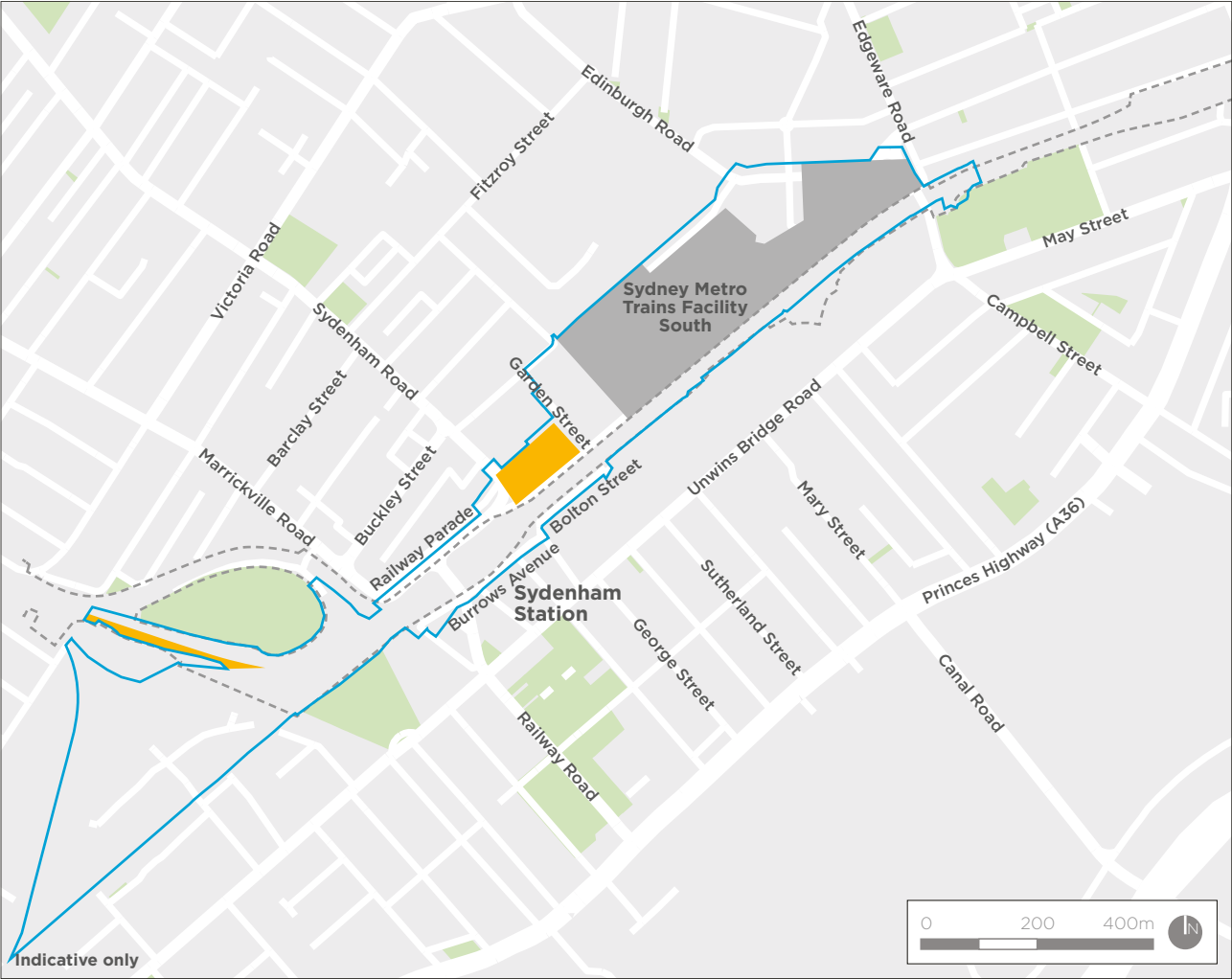
These works would be supported by a construction site located adjacent to the dive structure in Marrickville (referred to as the Marrickville dive site (southern)).

7.2 Overview of the proposed modification

The additional construction activities associated with the proposed modification are described in this chapter. These activities would involve:

- Adjustments to the existing rail network to separate it from the proposed metro tracks and platforms
- Demolition and reconstruction of Sydenham Station platforms 1 and 2 for metro services
- Construction of a new aerial concourse across all platforms
- Construction of station facilities buildings, station forecourts and a station services building
- Construction of Sydney Metro Trains Facility South
- Installation and fit-out of metro tracks and operational infrastructure around Sydenham Station
- Completion of ancillary infrastructure and works, including bridge works and road and transport works
- Testing and commissioning of infrastructure.

Construction activities would be undertaken throughout the proposed modification area, supported by key additional construction locations. Key additional construction locations are shown in Figure 7-1.



KEY		
	Proposed modification area	 Indicative ancillary construction sites
	Approved construction site	 Existing rail corridor boundary

Figure 7-1 Construction sites

7.3 Sydenham Station and precinct

7.3.1 Enabling works

The following works would be undertaken during this phase:

- Site establishment works:
 - ◆ Heritage investigations, protection and archival recordings
 - ◆ Installation of site environment management and traffic controls
 - ◆ Establishment of construction sites
 - ◆ Installation of power supply, water and other utilities to construction sites and other areas within the construction work area (whether temporary or permanent supplies)
 - ◆ Adjustment, modification and protection of utilities and services
 - ◆ Adjustment or removal of existing rail infrastructure (tracks, signalling, communication routes etc) within the rail corridor
 - ◆ Vegetation clearance as required
 - ◆ Minor piling works on platforms to assist with later concourse works.
- Works to facilitate ongoing transport interchange during construction at and around Sydenham Station
- Reconstruction of Sydney Water drainage channels near the western side of Sydenham Station
- Demolition of buildings on platforms 1 and 6 of Sydenham Station.

7.3.2 Station construction

The following works would be undertaken during this phase:

- Demolition and reconstruction of platforms 1 and 2 to support metro operations
- Construction of a new concourse across all platforms including access to each platform
- Construction of new station buildings at the new Railway Parade station entry
- Installation of new station canopies over platforms 1 and 2 and the new concourse
- Construction of a new station services building to south-west of station.

7.3.3 Track installation and infrastructure commissioning

The following works would be undertaken during this phase:

- Installation of Sydney Metro tracks through the station
- Installation of fencing between Sydney Metro and Sydney Train tracks
- Demobilisation of construction sites around station
- Installation of infrastructure to allow operation of Sydney Metro trains between Chatswood and Sydenham stations
- Finishing, testing and commissioning of station infrastructure.

7.4 Sydney Metro Trains Facility South

7.4.1 Facility construction

Construction of the Sydney Metro Trains Facility South would commence following the use of the site to support tunnelling and tunnel fit-out activities as part of the approved project.

The following works would be undertaken during this phase:

- Demolition of properties at 102 to 112 Edinburgh Road (the Marrickville Business Park)
- Site establishment
- Installation of environmental controls
- Completion of stormwater drainage channel diversion / protection works
- Provision of flood mitigation measures to manage overland flows from the north towards the existing channel
- Provision of new access to the base of the Sydenham Pit and Drainage Pumping Station basin which is currently accessed from the southern end
- Construction of sidings in the eastern stabling area
- Construction of sidings in the western stabling area
- Construction of six-car inspection road and building
- Construction of permanent way siding and open building
- Construction of administration building and permanent site amenities
- Construction of security building and site entrance off Edinburgh Road roundabout
- Construction of stabling yard maintenance vehicle road
- Installation of entry and egress turnouts of the north-bound Sydney Metro track
- Installation of inter-yard turnouts at throat of stabling yard
- Installation of overhead wiring and associated rail systems
- Construction of car park adjacent to the Edinburgh Road site entrance
- Facility commissioning.

This phase of works is estimated to be complete by late 2022.

7.4.2 Facility extensions

The second phase of works would be undertaken when required to support the ultimate capacity and involve the following:

- Lengthen the sidings in the eastern stabling area to cater for eight-car trains
- Lengthen the sidings in the western stabling area to cater for eight-car trains and construct additional eight-car sidings
- Extend inspection road to cater for an eight-car train set
- Extend maintenance siding to cater for an eight-car train set
- Install additional overhead wiring and supporting rail systems for the facility.

7.5 Track works and rail system facilities

Track works would involve provision of metro tracks and associated rail systems between the Marrickville dive structure (part of the approved project) and the southern boundary of the proposed modification site. The scope of civil works associated with the track works would include:

- Earthworks and track formation
- Retaining walls
- Stormwater drainage
- New overhead wiring structures.
- Fit-out would involve:
 - Removal of existing fastenings, rail and sleepers
 - Placement of ballast (consisting of either recycled or new ballast) and sleepers on the formation
 - Tamping and profiling of ballast around the sleepers and line to a smooth alignment
 - Installation, fixing, and welding of the rails to the sleepers
 - Installation of cable and equipment, including signalling, communications and electrical systems
 - Installation of overhead wiring for rolling stock
 - Installation of fire and life safety systems (including walkways connecting to emergency egress and fire hydrant systems)
 - Installation of track drainage.

A number of crossover facilities would be installed as part of the track work (as described in Chapter 6 Modification description – operation).

7.5.1 Sydenham crossover, Goods Line and Sydenham Maintenance Centre entry modifications

As the Sydenham crossover and the Sydenham Maintenance Centre entry adjustments (described in Chapter 6 Modification description – operation) are both located in a similar location within the rail corridor, they have been considered as a single construction area. Works to construct the Sydenham crossover, and modify the Goods Line and entry to the Sydenham Maintenance Centre would involve:

- Enabling works (as described in Section 7.3.1)
- Utilities protection, including protection of drainage infrastructure crossing the corridor east of the Victoria Road underbridge
- Widening of the bridge east of the Victoria Road underbridge
- Installation of a retaining wall at the pumping station within the Meeks Road triangle
- Widening of the existing rail embankment on the south-bound side
- Construction of a new section of metro track on south-bound side of existing tracks
- Installation of a new turnout and crossover
- Installation of new overhead wiring structures and removal of redundant infrastructure
- Relocation of existing power feeders
- Installation of overhead wiring
- Relocation of signalling
- Finishing, testing and commissioning of infrastructure.

At this location, works would be undertaken over a period of around two years.

7.6 Ancillary infrastructure and works

7.6.1 Bridge works

Works to three overbridges and one pedestrian footbridge would be required a part of the proposed modification. This would involve:

- Protection and maintenance works to Bedwin Road overbridge, St Peters, Gleeson Avenue overbridge, Sydenham and the Freight line overpass, Sydenham
- Removal of the Sydenham Maintenance Centre access footbridge.

Protection and maintenance works to bridges would include:

- Works to bridge piers to protect against the impacts of increased frequency of the metro operations
- Installation of vehicle collision protection and throw screens to overbridge parapets
- Re-painting of steel elements
- Where appropriate, raking out and re-pointing of masonry and waterproofing works to bridge decks.

7.6.2 Road and transport network works

To facilitate construction, the following road and transport network adjustments would be required:

- Adjustments to some roads around Sydenham Station, including adjustments to some taxi ranks and kiss-and-ride stopping areas
- Road upgrades may be required to facilitate movement of construction vehicles
- Adjustments to bus services and stops near Sydenham Station, including provision of the bus layover on Railway Road / Burrows Avenue
- Adjustments to pedestrian and cyclist networks, including footpaths and crossings around Sydenham Station and Sydney Metro Trains Facility South
- Adjustments to car parking in the vicinity of Sydenham Station and Sydney Metro Trains Facility South.

These adjustments, and their potential impacts on traffic, transport and access, are considered in Chapter 9 (Construction traffic and transport).

7.7 Construction sites

Construction sites would be required to support construction activities and other associated works for the proposed modification. It is assumed that construction activities would occur along the length of the rail corridor within the proposed modification area.

Additional construction sites (as shown on Figure 7-1) would be required at:

- 11 Sydenham Road, Sydenham. This site is currently zoned and used for private industrial purposes. The use of this site would require demolition of the existing buildings. The construction site would include site offices, worker amenities (such as toilets, change rooms, meal rooms, shower facilities and first aid facilities), workshops, material storage and lay down areas (including dangerous goods storage), plant and vehicle parking, and spoil lay down, loading and removal areas, and site security facilities
- Meeks Road Triangle, Marrickville. This site is currently part of the Sydney Water pumping station site and would be used for the construction of noise barriers, drainage works and works related to the rail systems facilities and services.

Additional construction sites would be required within the rail corridor to support the works at Sydenham Station. The Sydney Metro Trains Facility South would also be a construction site.

Construction areas would be generally accessed via existing corridor gates along the rail corridor. In some locations new gates would also be installed.

7.8 Other construction elements

7.8.1 Construction program

Construction works for the proposed modification would commence in 2018 and would involve pre-construction and enabling works. Following these enabling works, major construction works would commence and take around four years to complete, followed by overall testing and commissioning as part of the Chatswood to Sydenham project. The station upgrade works at Sydenham would take about two years within the overall four year construction period.

Sydney Trains services would continue to operate at Sydenham Station throughout the construction period (excluding during possessions or any other closure periods). Following the separation of the proposed metro tracks and platforms from the existing rail network, Sydney Trains services would continue to only operate on platforms 3-6 of Sydenham Station.

Some construction works would need to be undertaken during rail possession periods (when trains are not running) to remove the risk of affecting operations, and risks to rail worker safety. Works that would need to be undertaken during possession periods include:

- Major station works
- Rail systems works at and around Sydenham Station
- Track works
- Activities requiring the temporary possession of roads or to accommodate road network requirements (including bridge works) to minimise safety impacts and inconvenience to commuters
- Other activities which cannot be undertaken during operation of the network.

Construction of the proposed modification would require rail possessions of multiple tracks and lines through Sydenham Station. These possessions would affect train operations on the T2 Airport Line, T3 Bankstown Line and T4 Illawarra Line. The timing of these possessions would need to be determined based on the alternative configuration required to operate the rail and bus networks and the ability to provide alternative travel options for the customers of these lines.

7.8.2 Construction hours

Construction hours for the proposed modification have been determined based on a balanced consideration of the construction program and the need to minimise noise and traffic related impacts.

Where possible, the majority of construction activities would be carried out during the following hours:

- 7 am to 6 pm Monday to Friday
- 8 am to 1 pm Saturdays
- No works on Sundays or public holidays.

However, substantial activities would need to be carried out outside of these hours to maintain the safety of the public, construction and rail workers; to protect rail assets; and to minimise disruptions to the transport network. In particular, works that would require rail possessions, or the temporary possession of roads, may need to be carried out up to 24 hours per day and seven days per week.

Other activities that would be carried out outside of the standard daytime construction hours would include:

- Work determined to comply with the relevant noise management level (NML) 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.

With the exception of emergencies, activities would not take place outside standard daytime construction hours without prior notification of local residents, businesses and the Environment Protection Authority.

7.8.3 Construction traffic

Construction traffic would include heavy and light vehicles associated with spoil and waste removal, material deliveries, and the arrival and departure of construction workers. The indicative construction vehicle volumes are based on the following assumed vehicle types:

- Light vehicles – less than 4.5 tonnes
- Heavy vehicles – 12.5 metres long.

Estimated daily worst-case vehicle numbers are summarised in Table 7-1. Vehicle volumes represent one-way movements and therefore the total number of vehicle movements would be double the numbers outlined in Table 7-1.

The vehicle volumes in Table 7-1 for Sydenham Station are those estimated to occur during possession periods. Vehicle volumes are expected to approximately halve during non-possession periods. Vehicle volumes indicated for the Sydney Metro Trains Facility South are for non-possession periods.

Table 7-1 Indicative construction traffic volumes and types

Construction compound	Vehicles per day		Vehicles per hour – AM peak (7.30 – 8.30 am)		Vehicles per hour – PM peak (4.15 – 5.15 pm)		Heavy vehicles per hour outside standard hours	
	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Evening (6pm – 10pm)	Night (10pm – 7am)
Sydney Metro Trains Facility South	50	45	12	10	12	10	11	11
Sydenham	54	54	7	7	7	7	11	11

7.8.4 Interface with the Temporary Transport Strategy

A Temporary Transport Strategy is being prepared as part of the Environmental Impact Statement for the Sydenham to Bankstown upgrade project to describe the process for planning the integrated multi-modal transport network changes during possessions of the T3 Bankstown Line to enable construction of that upgrade project. The Temporary Transport Strategy seeks to identify:

- Temporary transport plan objectives for customers and bus services
- Customer markets to be served by temporary transport plans
- The process for developing temporary transport plans, including stakeholder and community consultation
- Potential options to maintain public transport connections to and from all affected rail stations
- Potential impacts associated with temporary transport options and the level of assessment to be provided in temporary transport plans
- Temporary transport facilities and measures required to support the implementation of temporary transport plans, ensuring accessible services are provided
- Performance outcomes for temporary transport plans.

The Temporary Transport Strategy will guide the development of temporary transport plans for each possession period and will consider the following initiatives:

- Increasing train service frequencies on parallel rail lines, ie Inner West Line between Lidcombe and the city and the Airport / East Hills Line between Revesby and the city
- Delivering alternative train services on Bankstown Line stations west of Bankstown that will remain operable during possessions
- Providing temporary bus services
- Increasing the frequency of regular bus routes
- Providing tailored services for customers with specific mobility impairments and needs
- Improving cycle facilities at stations on other rail lines
- Potential road network enhancements and/or bus interchange improvements to support the temporary bus services
- Reviewing the facilities and commuter parking at station on other rail lines
- Encouraging car-pooling.

Where a TTP identifies the need for additional infrastructure to support its implementation, the relevant planning assessment and approval pathway for such infrastructure would also be identified in the TTP.

Where new infrastructure is proposed, this would be considered for consistency against any Sydney Metro City & Southwest planning approvals. Where required, the scope and any additional environmental impacts would be assessed in accordance with the relevant provisions of the *Environmental Planning and Assessment Act 1979*. Community consultation would be undertaken

Community consultation would be undertaken with affected stakeholders as part of the planning approval process.

The temporary bus services would include the following components (refer Figure 7-2):

- Component 1: Buses that stop at all station along the rail corridor
- Component 2: Buses that stop at a limited number of stations before continuing as an express service to another station
- Component 3: Buses that move customers to other rail lines such as the T2 Airport Line and T2 Inner West and South Line
- Component 4: Increasing frequency of existing bus services at specific locations.

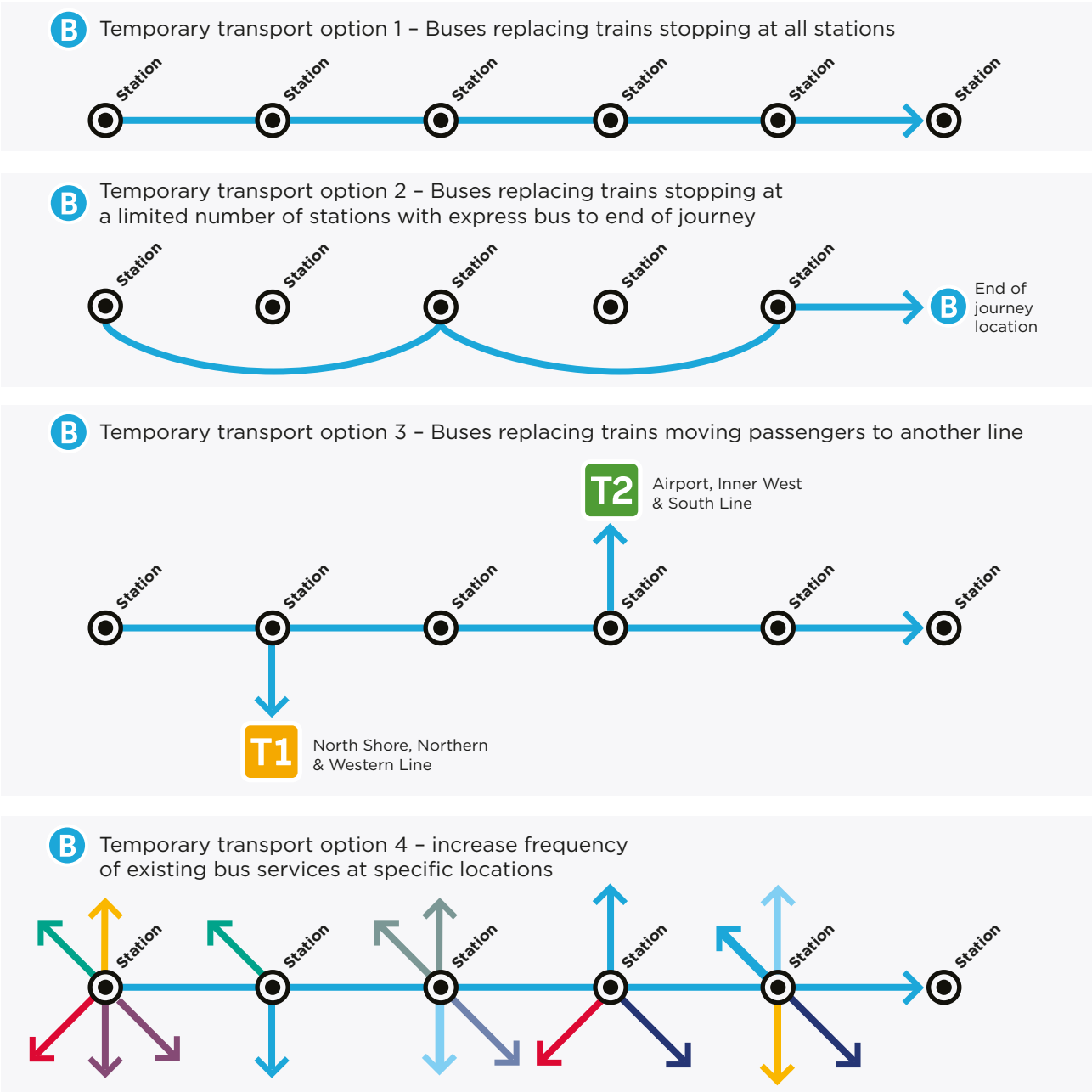


Figure 7-2 Components of temporary bus services

For the purposes of assessment, a ‘baseline’ bus service plan has been developed which includes Components 1 and 2. The ‘baseline’ plan closely represents rail replacement bus services, similar to those used several times each year during scheduled weekend possessions when maintenance occurs. All buses as part of this ‘baseline’ plan would commence or terminate at Sydenham Station. Under the ‘baseline’ plan, a total of 101 bus services per hour would be required to travel in the inbound direction to Sydenham Station during the weekday AM peak period.

Alternative temporary bus service plans are being developed which would reduce the number of buses using roads near Sydenham Station, however the ‘baseline’ plan has been assessed in this modification report to represent a worst-case scenario.

Detailed construction planning would be coordinated with the Sydenham to Bankstown upgrade project and the Temporary Transport Strategy arrangements to minimise the impacts on the traffic and transport network.

The draft Temporary Transport Plan, designed for the first possession of the T3 Bankstown Line in July 2019, will be released to the community by early 2018 for feedback. Community and stakeholder input will be invited at that time, as the Temporary Transport Plan is refined and finalised, ready for implementation.

7.8.5 Workforce

The Environmental Impact Statement for the approved project estimated about 2,820 jobs would be created during the peak construction period, including about 300 at the Marrickville dive site. The proposed modification would increase the indicative construction workforce as shown in Table 7-2.

The Workforce Development and Industry Participation strategy developed as part of the wider Sydney Metro program would apply to the proposed modification, which includes objectives to support local employment and business opportunities, provide skills development, and increase workplace diversity.

Table 7-2 Indicative construction workforce

Location	Non-possession periods		Possession periods	
	Peak	Average	Peak	Average
Sydney Metro Trains Facility South	95	95	95	95
Sydenham Station	60	40	135	65

7.8.6 Construction plant and equipment

An indicative list of the plant and equipment likely to be used during construction of the proposed modification is provided in Table 7-3. The actual plant and equipment to be used would be further refined during the detailed design stage.

Table 7-3 Indicative construction plant and equipment

Equipment	Trains facility – enabling works	Trains facility – earthworks	Trains facility – construction	General worksites	Corridor works – ground and track	Corridor works – track support systems	Station worksites	Bridge worksites
Back hoe						✓		
Ballast tamper					✓	✓		
Bobcat		✓		✓	✓	✓	✓	✓
Compressor	✓		✓	✓	✓		✓	✓
Concrete pump	✓	✓	✓	✓			✓	✓
Concrete truck / agitator	✓	✓	✓	✓			✓	✓
Diamond saw	✓		✓				✓	✓
Excavator	✓	✓	✓	✓	✓		✓	✓
Excavator (breaker)	✓	✓	✓	✓	✓		✓	✓
Franna crane	✓	✓	✓	✓	✓	✓	✓	✓
Front end loader		✓						
Generator	✓	✓	✓	✓	✓	✓	✓	✓
Hand tools	✓		✓	✓	✓	✓	✓	✓
Mobile crane (300 tonne)	✓		✓		✓		✓	✓
Mobile crane (50 tonne)	✓	✓	✓	✓	✓	✓	✓	✓
Piling rig (bored)		✓	✓	✓			✓	✓
Roller (non-vibratory)	✓	✓	✓	✓	✓		✓	✓
Scissor lift			✓			✓	✓	✓
Semi-trailer		✓	✓		✓		✓	✓
Truck	✓	✓	✓	✓	✓	✓	✓	✓
Water tanker	✓	✓	✓	✓	✓		✓	✓
Welding equipment				✓	✓	✓	✓	✓

7.8.7 Materials and water usage

A variety of materials would be required to construct the proposed modification. The major items and indicative quantities are listed in Table 7-4.

Table 7-4 Indicative materials and water usage

Location	Concrete (m³)	Steel (tonnes)	Water (litres)	Ballast (tonnes)
Sydney Metro Trains Facility South (drainage works only)	1,000	250	8,000,000	20,000
Sydenham Station	600 to 800	100 to 150	300,000	1,719

7.8.8 Utility and power supply

Utilities such as water, sewer and telecommunications would need to be supplied to work areas for the proposed modification. Generally, these utilities are located close to the sites (such as the adjacent footpath) and the supply is considered 'business as usual' for supply companies.

Power supply routes for the permanent power supply would generally be located within existing road reserves. Construction of these power supply routes would generally be carried out by open trench. Under bores would be used when crossing major infrastructure or to avoid other major constraints.

Preliminary consultation has been carried out with energy suppliers. A program of ongoing consultation is underway to further assess the requirements for the proposed modification.

Construction contractors would be required to meet the requirements of the Construction Environmental Management Framework included in the Submissions and Preferred Infrastructure Report of the approved project.

7.8.9 Utility adjustments and protection

Table 7-5 provides a preliminary list of major utilities that could be affected by construction of the proposed modification. The list is indicative and subject to further design refinement, investigations, and consultation with asset owners described in the Environmental Impact Statement for the approved project.

Table 7-5 Indicative adjustments to major utility infrastructure

Asset owner	Asset type	Work location		Indicative works	
		Bridge	Corridor	Protect	Relocate
Sydney Metro Trains Facility South					
Ausgrid	HV cables		✓	✓	✓
Ausgrid	LV cables		✓		✓
Ausgrid	Overhead cables		✓		✓
Ausgrid	33kV cables		✓	✓	
Ausgrid	33kV cables		✓		✓
Ausgrid	Kiosk substation		✓		✓
TransGrid	330kV cables		✓	✓	
Sydney Water	Stormwater		✓	✓	✓
Sydney Water	Sewer		✓	✓	✓
Sydney Water	Water main		✓	✓	✓
Telstra	FO cables		✓	✓	✓
Optus	FO cables		✓	✓	✓
Other Comms	FO cables		✓	✓	
Jemena	HP pipeline		✓	✓	✓
Axicom	Tower		✓		✓

Asset owner	Asset type	Work location		Indicative works	
		Bridge	Corridor	Protect	Relocate
Sydenham Station					
Ausgrid	132kV cables		✓	✓	
Ausgrid	33kV cables		✓	✓	
Ausgrid	HV cables		✓	✓	✓
Ausgrid	Overhead cables		✓	✓	✓
Ausgrid	Kiosk substation		✓		✓
TransGrid	330kV cables		✓	✓	
Telstra	Cables	✓	✓	✓	✓
Optus	FO cables		✓		✓
Jemena	MP pipeline		✓		✓
Sydney Water	Stormwater		✓	✓	✓
Sydney Water	Sewer		✓	✓	✓
Sydney Water	Water main		✓	✓	✓
Qenos	HP pipeline		✓	✓	

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ENVIRONMENTAL SCREENING ASSESSMENT

CHAPTER EIGHT



8 Environmental screening assessment

This chapter provides a consideration of the potential for change to the impacts as assessed for the approved project and whether further assessment of each issue is required.

Consideration of each environmental issue as assessed for the approved project was carried out to determine the potential for change to the impacts and, therefore, whether further assessment of the potential impacts of the proposed modification is required. A screening assessment of the potential change in impacts is provided in Table 8-1.

Table 8-1 Environmental screening assessment

Issue	Potential change in impact?	Description
Construction traffic and transport	Yes	The proposed modification would introduce additional construction sites, additional construction vehicles, and alterations to how customers use Sydenham Station and precinct during construction. An assessment of potential changes to construction traffic and transport impacts associated with the proposed modification is provided in Chapter 9.
Operational traffic and transport	Yes	The proposed modification would introduce new station entries, pedestrian plazas and a new aerial concourse within Sydenham Station, changing the way customers move in and around Sydenham Station. The potential phased opening of the Sydney Metro City & Southwest, with the approved project and proposed modification, would provide the opportunity for the final shutdown of the T3 Bankstown Line that is required to complete construction of the Sydenham to Bankstown component to only occur after the opening of the Chatswood to Sydenham component. This would provide benefits to customers as well as operational benefits. The proposed modification would alter commuter car parking arrangements to the west of Sydenham Station and increase traffic volumes around the Sydney Metro Trains Facility South site. An assessment of potential changes to operational traffic and transport impacts associated with the proposed modification is provided in Chapter 10.
Construction noise and vibration	Yes	The proposed modification would require additional construction activities in new locations which may introduce new or increased noise and vibration impacts to receivers. An assessment of potential changes to construction noise and vibration impacts associated with the proposed modification is provided in Chapter 11.
Operational noise and vibration	Yes	The proposed modification would introduce new fixed infrastructure (mechanical and electrical) at Sydenham Station and at the Sydney Metro Trains Facility South. An assessment of potential changes to operational noise and vibration impacts associated with the proposed modification is provided in Chapter 11.
Land use and property	Yes	The proposed modification would require additional property acquisition, impact additional areas of land and provide additional opportunities to integrate with surrounding land use. An assessment of potential changes to land use and property impacts associated with the proposed modification is provided in Chapter 12.

Issue	Potential change in impact?	Description
Business impacts	Yes	The proposed modification would directly and indirectly impact additional businesses around the Sydney Metro Train Facility South and to the west of Sydenham Station. An assessment of potential changes to business impacts associated with the proposed modification is provided in Chapter 13.
Non-Aboriginal heritage	Yes	The proposed modification would impact additional built heritage items within Sydenham Station and water infrastructure heritage items around Sydney Pit and Drainage Pumping Station. An assessment of potential changes to non-Aboriginal heritage impacts associated with the proposed modification is provided in Chapter 14.
Aboriginal heritage	Yes	The proposed modification would require excavation in additional areas which may have Aboriginal heritage potential. An assessment of potential changes to Aboriginal heritage impacts associated with the proposed modification is provided in Chapter 15.
Landscape character and visual amenity	Yes	The proposed modification would require construction activities in new locations, and would introduce new built infrastructure in new locations. An assessment of potential changes to landscape character and visual amenity impacts associated with the proposed modification is provided in Chapter 16.
Groundwater and geology	Yes	The proposed modification would involve piling work which may intercept groundwater. An assessment of potential changes to groundwater impacts associated with the proposed modification is provided in Chapter 17. The proposed modification would not introduce any new potential geology impacts. The mitigation measures identified for the approved project would be applied to the proposed modification and are considered sufficient to manage these risks. An additional assessment of potential changes to geology impacts associated with the proposed modification is therefore not considered necessary.
Soils, contamination and water quality	Yes	The proposed modification would involve excavation in additional areas which may have increased or present new contamination risks. An assessment of potential changes to contamination impacts associated with the proposed modification is provided in Chapter 18. The proposed modification would not introduce any new potential soil or water quality impacts. The mitigation measures identified for the approved project would be applied to the proposed modification and are considered sufficient to manage these risks. An assessment of potential changes to soils and water quality impacts associated with the proposed modification is therefore not considered necessary.

Issue	Potential change in impact?	Description
Social impacts and community infrastructure	No	The assessment for the approved project identified potential social impacts associated with property acquisition, changes to community values, community health and safety, and changes to access and connectivity. Potential impacts to community infrastructure from the approved project include direct loss of infrastructure, changes to amenity and access. The proposed modification would not introduce any new potential social impacts, or directly impact any additional community infrastructure. The mitigation measures identified for the approved project would be applied to the proposed modification and are considered sufficient to manage these risks. Potential changed impacts associated with property acquisition, amenity and access are considered as part of the relevant issue-specific assessment chapter of this report. An additional assessment of potential changes to social and community infrastructure impacts associated with the proposed modification is not considered necessary.
Biodiversity	Yes	The proposed modification would involve additional clearing of vegetation at new locations, including plated native and exotic species. An assessment of potential changes to biodiversity impacts associated with the proposed modification is provided in Chapter 19.
Flooding and hydrology	Yes	The proposed modification would involve works within a floodplain and require extensive changes to the existing drainage network in new locations, which would alter the flooding and hydrology impacts of the approved project. An assessment of potential changes to flooding impacts associated with the proposed modification is provided in Chapter 17.
Air quality	No	The assessment for the approved project identified potential air quality impacts associated with the generation of dust and exhaust emissions during construction. The proposed modification would involve construction works at new locations, and potential air quality impacts in new locations, however it would not introduce any new air quality impacts and the mitigation measures identified for the approved project would be applied to the proposed modification site. An assessment of potential changes to air quality impacts associated with the proposed modification is not considered necessary.
Hazard and risk	No	The assessment for the approved project identified potential hazard and risk impacts associated with the storage, use and transport of dangerous goods and hazardous substances, the rupture or interference of underground utilities, and damage to adjacent buildings due to ground movement. The proposed modification would not introduce any new hazard and risk impacts and the mitigation measures identified for the approved project would be applied to the proposed modification. An assessment of potential changes to hazard and risk impacts associated with the proposed modification is not considered necessary.

Issue	Potential change in impact?	Description
Waste management	No	The assessment for the approved project identified potential waste management impacts associated with the handling and disposal of waste (including spoil) generated during construction and operation. The proposed modification would not introduce any new waste streams, although it would result in some increases to the volume of waste (including spoil) generated. The mitigation measures identified for the approved project would be applied to the proposed modification and would be sufficient to manage the increase in waste volumes. During operation, waste would be managed in accordance with the existing procedures at Sydenham Station. An assessment of potential changes to waste management impacts associated with the proposed modification is not considered necessary.
Sustainability	No	The assessment for the approved project identified potential sustainability impacts associated with climate change adaptation, construction resource use and greenhouse gas emissions. The proposed modification would not introduce any new sustainability impacts, although there would be some minor increases in the volumes of materials used and the greenhouse gas emissions emitted. These increases are not considered to make a material change to the assessment. The mitigation measures identified for the approved project would be applied to the proposed modification and would be sufficient to manage these minor increases at the new locations. In addition, the assessment for the approved project provided the sustainability strategy, objectives and initiatives for Sydney Metro City & Southwest. These would also apply to the proposed modification. An assessment of potential changes to sustainability impacts associated with the proposed modification is not considered necessary.
Cumulative impacts	Yes	The assessment for the approved project identified potential cumulative impacts at the Marrickville dive site associated with the concurrent construction of WestConnex Stage 2: New M5 (Beverly Hills to St Peters), WestConnex Stage 3: M4-M5 Link and potentially with the Sydenham to Bankstown component of Sydney Metro City & Southwest. The proposed modification would carry out works at Sydenham Station and nearby at the proposed Sydney Metro Train Facility South, potentially introducing new cumulative impacts with the WestConnex projects and shifting cumulative impacts with the Sydenham to Bankstown component of Sydney Metro City & Southwest to new locations. An assessment of potential changes to cumulative impacts associated with the proposed modification is provided in Chapter 20.

CONSTRUCTION TRAFFIC AND TRANSPORT

CHAPTER NINE



9 Construction traffic and transport

This chapter assesses the potential change in traffic and transport impacts during the construction phase of the proposed modification. Any changes to mitigation measures to address the potential impacts are also identified.

9.1 Assessment methodology

The construction traffic and transport assessment method followed a similar approach as was carried out for the approved project. This methodology is summarised in the following sections.

9.1.1 Overview

The construction traffic and transport assessment involved:

- Site surveys, including traffic counts, and surveys of turning movements, queue lengths, and parking at key intersections, undertaken at various times between April and December 2016
- Modelling of the traffic performance around Sydenham Station and Sydney Metro Trains Facility South, both with and without construction activities and traffic, to assess the potential impacts of construction works
- Modelling of the worst-case traffic performance around Sydenham Station, with both construction traffic for the proposed modification and the buses required to support the Temporary Transport Strategy, which would be implemented during the rail possessions and close down of the T3 Bankstown Line required to construct the City & Southwest Metro Sydenham to Bankstown project
- Assessment of the other potential construction impacts
- Swept path assessment for the largest construction vehicles anticipated for each compound.

9.1.2 Intersection assessment

Traffic modelling software (SIDRA and / or LinSig) was used to assess intersection capacity and the potential impacts of the proposed modification. The assessment was undertaken for key intersections in the vicinity of the proposed modification, located in the vicinity of construction sites and along haulage routes. Modelling was undertaken in accordance with the *Traffic Modelling Guidelines* (Roads and Maritime, 2013). Traffic volume data was updated from the approved project to reflect the most recent existing conditions. 2023 has been chosen as the construction year for modelling as this is towards the end of the anticipated construction period and represents a worst-case scenario with background traffic growth at its highest. The following scenarios were modelled:

- 2016 (existing) conditions, based on traffic volume data
- 2023 (future) conditions, based on an applied traffic growth rate and the following:
 - ◆ 2023 (future) conditions base model (without construction traffic)
 - ◆ 2023 (future) conditions with construction traffic
 - ◆ 2023 (future) conditions with construction traffic and the Temporary Transport Strategy (required for the Sydenham to Bankstown project).

The last scenario represents the worst-case scenario for the assessment, as it includes estimated additional traffic (bus) volumes generated by implementation of the assumed baseline (worst-case scenario) for the Temporary Transport Strategy for the Sydenham to Bankstown project. The 'baseline' plan presented in the Temporary Transport Strategy involves the use of rail replacement bus services, similar to those used several times each year during scheduled weekend possessions when maintenance occurs. All buses as part of this 'baseline' plan would commence or terminate at Sydenham Station, which equates to a total of 101 bus services per hour travelling in the inbound direction to Sydenham Station during the weekday AM peak period.

As the Temporary Transport Strategy for the Sydenham to Bankstown project is further developed, it is expected that the potential impacts identified in this scenario would be reduced. The Environmental Impact Statement for the Sydenham to Bankstown project will provide further details regarding the ongoing development of the Temporary Transport Strategy. Detailed construction planning would be coordinated with the Sydenham to Bankstown project and the Temporary Transport Strategy arrangements to minimise impacts on the road network.

Modelling was based on the haulage routes and construction traffic volumes described in Chapter 7 (Modification description – construction). Modelling was undertaken for the morning and afternoon peak periods only, however it is acknowledged that at some intersections, a Saturday peak may be slightly worse. The impacts would be reviewed and updated during detailed design and construction planning.

The following indicators were used to assess the impacts of these scenarios on intersection performance:

- Level of service – a measure of the overall performance of the intersection (the criteria used are listed in Table 9-1)
- Degree of saturation – the ratio between traffic volumes and capacity of the intersection, which indicates how close to capacity an intersection is operating
- Average delay – the average time a vehicle spends waiting at an intersection.

Table 9-1 Level of service performance criteria

Level of service	Average delay (seconds)	Traffic signals and roundabouts
A	Less than 14	Good operation
B	15 to 28	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Operating near capacity
E	57 to 70	At capacity, incidents will cause excessive delays at signals
F	>70	Exceeds capacity roundabouts require other control mode

9.1.3 Swept-path analysis

A swept-path analysis was completed for the indicative construction haulage routes using both 8.8 and 12.5 metre long design vehicles (trucks). This type of analysis identifies whether there are any obstructions to the design vehicle performing the manoeuvre safely, and may indicate where road adjustments / works (such as lane widening, kerb or median adjustments, restrictions and / or removal of parking) or alternative routes are required.

9.2 Existing environment

The existing environment around Sydenham, particularly around the proposed Sydney Metro Trains Facility South was described in the assessment of the approved project. This section provides additional details relevant to the proposed modification.

9.2.1 Rail traffic and transport

Heavy rail

Sydenham Station is currently serviced by the T2 Airport Line, T3 Bankstown Line and T4 Eastern Suburbs and Illawarra Line, and provides interchange for passengers switching between these lines. These services continue to the Sydney CBD, Liverpool, Lidcombe and the Eastern Suburbs.

Service details of the train lines passing through Sydenham Station are provided in Table 9-2.

Table 9-2 Service details for Sydenham Station (Sydney Trains 2016)

Line	Weekday		Weekend	
	Temporal span	Service frequency	Temporal span	Service frequency
T3 (Bankstown to City via Sydenham)	5:07am to 23:40pm	Peak: about 8 mins Late PM: 30 mins Other: 15 mins	5:32am to 00:32am	0800-22:30: 15 mins Other: 30 mins
T3 (City to Bankstown via Sydenham)	4:46am to 00:34am	Peak: about 9 mins Late PM: 30 mins Other: 15 mins	4:48am to 1:18am	07:15-22:15: 15 mins Other: 30 mins
T2 (Macarthur to City via Sydenham)	7:27am to 8:27am	15 mins	None	None
T2 (City to Macarthur via Sydenham)	16:44pm to 18:29pm	15 mins	None	None
T4 (Waterfall or Cronulla to Bondi)	4:30am to 00:24am	AM Peak Only: about 6 mins Late PM: about 15 mins Other: about 10 mins	4:39am to 01:06am	08:00-20:30: 10 mins Other: 15 mins
T4 (Bondi to Waterfall or Cronulla)	5:16am to 01:16am	Before 22:15: about 10 mins After 22:15: about 15 mins	5:30am to 01:40am	09:00-21:30: 10 mins Other: 15 mins

Freight rail

The Sydney Freight Network, managed by the Australian Rail Track Corporation, is a network of dedicated railway lines for freight in Sydney linking the state's rural and interstate rail network with the city's main yards at Enfield and Port Botany. Its primary components are the Southern Sydney Freight Line and a line from Sefton to Enfield and Port Botany.

There are three freight rail lines within the proposed modification area including:

- An existing connection from the Down Bankstown Line track to the Metropolitan Freight Network at Meeks Road Junction
- The Botany line, which links from the Metropolitan Freight Network at Meeks Road Junction to the container port at Botany
- The Illawarra line which is a shared passenger and freight line that extends to the south coast from an interface with the Metropolitan Freight Network at Marrickville.

9.2.2 Pedestrian network

Walking was identified as the main mode of travel to Sydenham Station, with 56 per cent of rail customers walking to the station to connect to rail services. The primary and secondary roads around Sydenham Station have footpaths on either side of the road to cater for pedestrians. Pedestrians wishing to cross the railway line are limited to the pedestrian footpaths across Gleeson Avenue bridge. The highest pedestrian traffic volumes are experienced on the southern side of Railway Parade and eastern side of Burrows Avenue.

A four way road junction exists at the corner of Gleeson Avenue and Burrows Avenue, each with a signalised pedestrian crossing. A T-junction exists at the corner of Railway Parade and Gleeson Avenue. Pedestrians accessing the station from the western side of Railway Parade need to use a traffic island to facilitate crossing. A pedestrian island is provided at the corner of George Street and Burrows Avenue to facilitate pedestrian crossing.

9.2.3 Cycle facilities

Thirty-six bike parking spaces are located on Gleeson Avenue outside Sydenham Station for use by rail customers. The existing bike parking spaces outside the station appear to be well used during peak periods, suggesting high proportion of cyclists using the station to interchange. An excess demand for bike parking at Sydenham Station is evident, with informal overflow parking using the adjacent fence.

Sydenham has a short separated cycle path connecting Shirlow Street to Sydney Steel Road and Lilian Fowler Place, shown in Figure 9-1. There are a number of roads in the area which have on-road bike lanes, road shoulders and mixed traffic lanes.

9.2.4 Bus network

Three bus routes connect to Sydenham Station:

- The M30 bus route connects Sydenham to Mosman through the city centre
- The 425 bus route connects Tempe to Dulwich Hill
- The 418 bus route connects Bondi Junction to Burwood.

These three bus routes provide a key east-west connection, providing connections that would otherwise require a trip through the Sydney CBD. School buses, night ride buses and private buses also exist in the area and provide infrequent services.

Two bus stops on Railway Parade (Sydenham Station Stand B and C) service M30, 418 and 425 services for southbound journeys providing direct access to Sydenham Station. Bus passengers interchanging with Sydenham Station do not need to make any road crossings to access the station. The distance from Stand B to Sydenham Station is about 50 metres and about 80 metres from Stand C.

One bus stop on Burrows Avenue (Sydenham Station Stand A) services M30, 418 and 425 for northbound journeys, also providing direct access to Sydenham Station. Bus passengers interchanging with Sydenham Station from this stop cross at a signalised crossing at the intersection of Gleeson Avenue and Burrows Avenue in order to access the station. This is around 70 metres to the station entry.

There are additional bus stops near Sydenham Station on Gleeson Avenue and Burrows Avenue.

Figure 9-1 shows the existing bus routes around Sydenham Station. The bus service frequency is shown in Table 9-3.

Table 9-3 Bus frequency for Sydenham Station (Sydney Buses 2016)

Route number	Weekday		Weekend
	Frequency (peak)	Frequency (off peak)	Frequency
418	About 20 mins	About 30 mins	About 30 mins
425	30 mins	30 mins	60 mins
M30	About 10 minutes	About 15 minutes	About 20 minutes

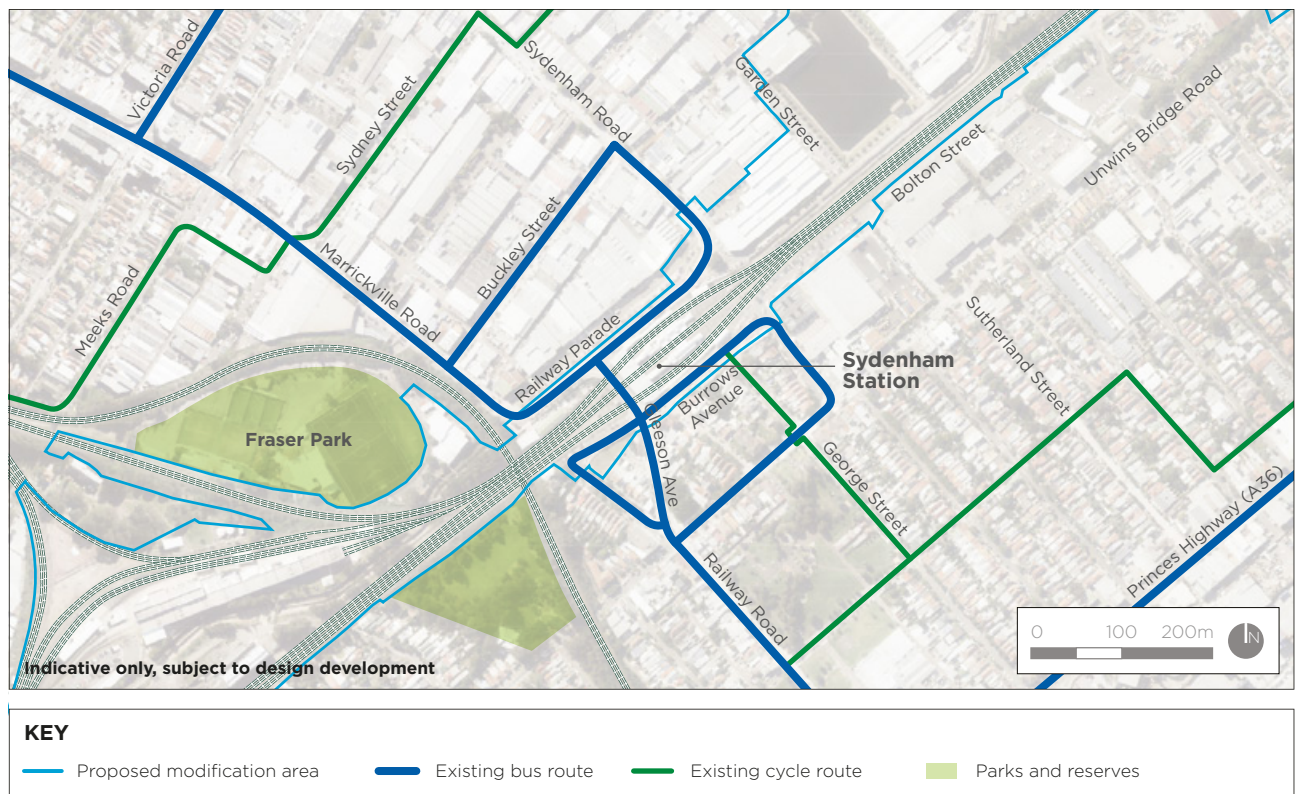


Figure 9-1 Sydenham Station – existing transport facilities

9.2.5 Road network

The road network around Sydenham Station and the Sydney Metro Trains Facility South the subject of the proposed modification contains a number of state and regional roads, as described below:

- State – Princes Highway, Gleeson Avenue and Sydenham Road
- Regional – Marrickville Road, Railway Parade, Unwins Bridge Road and Victoria Road.

Traffic turning counts and queue length surveys were undertaken during three separate surveys between April and December 2016. The existing approach traffic volumes for the intersections assessed are provided in Table 9-4. All intersections surrounding Sydenham Station currently operate at a level of service C or better.

Table 9-4 Existing traffic volumes around the proposed modification

Road	Total count (24 hours)	Light	Heavy	Heavy vehicle (%)
Railway Parade (Between Gleeson Avenue and Sydenham Road)	48,800	46,800	2,000	4.1
Railway Parade (Between Gleeson Avenue and Marrickville Road)	31,000	29,400	1,600	5.2
Gleeson Avenue	62,200	57,000	5,400	8.7
Unwins Bridge Road	30,600	29,800	800	2.6
Marrickville Road (Between Buckley Street and Victoria Road)	38,800	37,000	1,800	4.6

9.2.6 Parking, kiss-and-ride, and taxis

An audit of car parking in streets surrounding Sydenham Station was undertaken by Transport for NSW. There are 153 off-street parking spaces and 1,041 on-street spaces within 400 metres of the station (as shown on Figure 9-2). Table 9-5 outlines the total capacity and use of the parking spaces available to commuters

The 90 degree angle parking on Railway Parade and Bolton Street are unrestricted and can potentially be used by commuters as informal park-and-ride spaces. Parking surrounding Sydenham Station is used by rail customers, and workers and customers accessing surrounding commercial and industrial sites.

There are currently seven kiss-and-ride parking spaces and two taxi parking bays in the Sydenham Station precinct.

Table 9-5 Sydenham Station parking summary

Time restriction	On-street		Off-street	
	Capacity	Use	Capacity	Use
Unrestricted	623	78%	136	94%
Time restricted	418	66%	17	94%
Overall	1041	73%	153	94%



Figure 9-2 Parking facilities around Sydenham Station

9.3 Potential impacts

Potential impacts of the proposed modification relate to impacts within the station (including the movement of customers within Sydenham Station) and impacts to the traffic and transport environment external to Sydenham Station and the Sydney Metro Trains Facility South.

9.3.1 Potential impacts within Sydenham Station

Potential impacts within Sydenham Station relate to the movement of customers within the station, including those interchanging between services and those entering or exiting the station; and impacts to rail services due to the need for rail possessions.

Customer movements within Sydenham Station

Construction works at Sydenham Station would result in some impacts to customers. This may include restrictions on platforms space at certain times due to the presence of worksites and hoarding. Excluding possession periods, suitable access would be maintained into and out of the station at all times.

Impacts to rail services

Impacts to rail services would occur to facilitate construction works at Sydenham Station and the surrounding tracks. This would involve a combination of standard weekend possessions (timed to coincide with the Sydney Trains possessions) and additional possessions (potentially weekends and extended periods).

To carry out the track works to segregate the Sydney Trains network and facilitate the phased opening of the Chatswood to Sydenham component, additional possessions would be required at Sydenham Station. This may involve the shutdown of all lines (T2, T3 and T4) and Sydenham for a short period, as well as an extended possession of the T2 and T3 lines. During this extended possession, it is envisaged that T4 services would be maintained and additional T2 services could be routed via the Airport component of this line.

Rail replacement buses would be provided during all possession works.

9.3.2 Potential impacts external to Sydenham Station

Based on the current program, it is anticipated that construction works associated with the Sydney Metro Trains Facility South as part of proposed modification would occur after the approved project works at the Marrickville dive site in the vicinity of Sydenham have been completed. As such, these represent new impacts associated with the proposed modification.

Potential construction traffic and transport impacts would primarily relate to the addition of trucks and light vehicles to the road network surrounding the construction sites at Sydenham Station and Sydney Metro Trains Facility South. The establishment and use of the construction sites would also result in some additional direct and indirect impacts to pedestrian and cyclist facilities, public transport services and existing car parking.

Vehicle movement forecasts and routes

Figure 9-3 shows the proposed heavy vehicle routes into the sites to be used during construction. The proposed route to and from the Sydney Metro Trains Facility South is consistent with that described for the approved project. Construction vehicle numbers for the peak construction activity are anticipated to be:

- Seven heavy and seven light vehicles at Sydenham Station in the AM and PM peak hours
- 12 heavy and 10 light vehicles at the Sydney Metro Trains Facility in the AM and PM peak hours.

The swept path analysis determined that construction vehicles are able to access all of the proposed construction sites and gates safely.

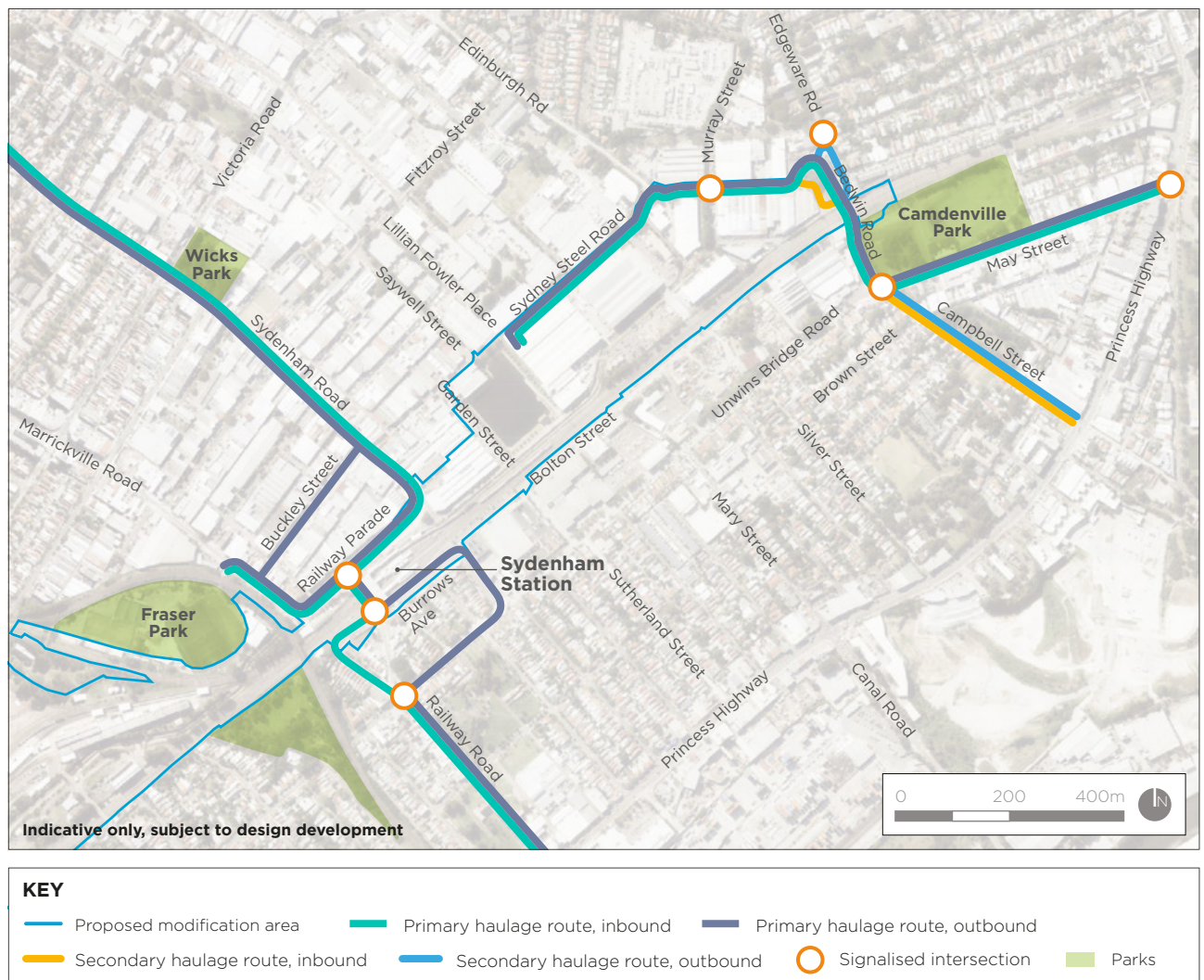


Figure 9-3 Proposed haul routes – Sydenham Station and Sydney Metro Trains Facility South

Pedestrian, cyclist and motorist safety

The introduction of additional heavy vehicles to the road network has the potential to result in safety impacts to pedestrians, cyclists, and other motorists, especially where there is an increased likelihood for interaction between vehicles and pedestrians and cyclists. Key locations where pedestrian and cyclist safety issues may arise include:

- Construction compounds and worksite access and egress points, where construction vehicles would interface with pedestrians using surrounding footpaths
- Construction compounds where access and egress points, and / or haulage routes would interface with marked cycle routes
- Where pedestrian and cyclist diversions are required during bridge works.

Access and egress arrangements at construction compounds have been developed with consideration of pedestrian, cyclist and motorist safety. For example, the need for construction vehicles to turn right to or from arterial roads to access construction sites would be avoided wherever practicable.

Overall, assuming implementation of traffic control measures and other mitigation and management protocols, no significant impacts are predicted in terms of potential conflicts with heavy vehicles.

Appropriate controls would be established where vehicles are required to cross footpaths to access construction sites. This may include manual supervision, physical barriers, or temporary traffic signals as required. Safety audits would be carried out at each construction compound access and egress point.

Emergency services access

Consistent with the approach for the approved project, construction compounds and worksites would be arranged so that emergency vehicle access to nearby buildings and precincts is maintained. Construction compounds may also be made available for emergency vehicle passage if required. Ongoing consultation would be carried out with emergency service providers in relation to changed traffic conditions.

Construction activities requiring partial or full road closures would be planned ahead with appropriate diversions maintaining emergency vehicle accessibility. The appropriate emergency service providers would be consulted ahead of works so that impacts are minimised during works.

Construction worker parking

It is anticipated that four to 10 parking spaces would be provided at any one time for construction staff in the Sydenham Station area. The location of these parking spaces would vary dependent on the specific location within the worksite which has active construction at the time. The approved project includes around 300 car parking spaces for construction workers at the Marrickville dive site. Following tunnelling activities at the site, the volume of car parking would be reduced to accommodate the workforce required for the Sydney Metro Trains Facility South.

Table 9-6 provides the anticipated daily construction workforce volume for the works around Sydenham Station and at the Sydney Metro Trains Facility South. Public transport would be promoted as the primary mode of transport for construction workers. This would reduce the impacts on the local road network and parking requirements. Parking alternatives and associated shuttle arrangements would be investigated to transport workers to and from the site.

Table 9-6 Anticipated daily workforce – Sydenham Station

Construction location	Non possession		Possession	
	Peak	Typical / average	Peak	Typical / average
Sydenham Station	60	40	135	65
Sydney Metro Trains Facility South	95	95	95	95

Active transport network

Pedestrians

Construction activities associated with the Gleeson Avenue overbridge would retain at least one footpath at all times. Appropriate crossings for pedestrians would be managed and provided under active traffic management as required.

The Sydenham Maintenance Centre Access Footbridge would be demolished as part of the proposed modification. This bridge provides access for workers to the Sydenham Maintenance Centre. Following demolition, workers would need to use alternative access points.

Cycle routes

The following roads used for cycling in close proximity to the proposed modification at Sydenham (excluding bridges) and the Sydney Metro Trains Facility South:

- Railway Parade
- Gleeson Avenue
- Sydenham Road
- Tillman Park (off road cycle path)
- Edinburgh Road (off road cycle path)
- Sydney Steel Road.

The use of these roads for cycling is not expected to be impacted by construction activities. Retaining wall works along the south side of Tillman Park reserve are away from the off-road cycle paths and construction works are therefore not expected to impact cyclists. The access to the retaining wall works would be managed via active traffic management to minimise construction vehicle / cyclist conflicts.

There is existing bike parking on Gleeson Avenue, adjacent to Sydenham Station, which would be retained during construction activities. During the construction periods affecting Gleeson Avenue overbridge, cyclists would be diverted to the Bedwin Road overbridge, located about 1.3 kilometres north of Gleeson Avenue. The inclusion of dismount facilities would also be provided at the Gleeson Avenue overbridge to allow cyclists to follow the pedestrian diversion route.

Bus services

Construction works around Sydenham Station would directly impact some bus services. During construction, northbound routes 418, 425 and M30 would be rerouted from Railway Road and Burrows Avenue to Gleeson Avenue.

Termination and turn-around of the M30 service at Sydenham would be maintained, however the service would need to be re-routed during construction.

Bus Stand A (located on Burrows Avenue) would be temporarily moved to Gleeson Avenue. This would increase the walk distance customers interchanging with rail services at Sydenham Station.

During construction activities affecting Gleeson Avenue overbridge, delays and journey time variability would be experienced on bus routes 418, 425 and M30.

A bus layover facility would be provided on the corner of Burrows Avenue and Railway Road, as the existing bus layover facility at Sydenham Station would be affected by the proposed modification.

During construction of those elements of the project subject of the proposed modification, and as part of the phased opening of Chatswood to Sydenham, there would be an increase in the number of buses at Sydenham Station. This would particularly occur during rail possession works and when the Temporary Transport Strategy is in place for the Sydenham to Bankstown project. Detailed construction planning would be coordinated with the Sydenham to Bankstown project and the Temporary Transport Strategy arrangements to minimise impacts on the traffic and transport network, including potential impacts to existing bus services at Sydenham Station.

Parking and taxis

The introduction of the construction workforce would result in additional competition for parking at and around stations and other worksites. Limited parking would be provided within construction sites (about 10 spaces), however the majority of workers, should they drive to work, would need to find parking in other areas. The construction workforce at Sydenham Station is expected to be between 60 and 135 during non-possession periods, and workers would be encouraged to use public transport where possible. Construction worker parking for the workforce at the Sydney Metro Trains Facility South would be provided on the site.

In addition, construction works would result in the loss of parking spaces around Sydenham Station. This would vary depending on the construction works being undertaken. Indicatively, parking loss during different construction works would be:

- During construction of the forecourt on Sydenham Road and Railway Parade – about 30 spaces
- During construction of the forecourt on Burrows Avenue – about 10 spaces
- During construction of the bus stop on Burrows Avenue – about six spaces
- During construction of drainage works from Garden Street along Railway Parade to Lower Railway Parade – about 10 spaces
- During reconstruction of Garden Street – about 60 spaces.

As the on-street parking around Sydenham Station is currently around 73 per cent utilised, there is expected to be sufficient capacity in the local area to accommodate this parking loss.

Road network performance

Table 9-7 and Table 9-5 shows the impact of construction vehicles and buses for the Temporary Transport Strategy for the Sydenham to Bankstown project on nearby key intersections along the proposed haul routes. Additional intersection performance parameters including total demand flow through the intersection and average delay at the intersection are provided in Appendix C.

With the addition of construction vehicles for the proposed modification and buses associated with the Temporary Transport Strategy, the majority of intersection maintain their base level of service. Whilst there are some intersections which show a slight deterioration in performance due to the addition of construction vehicles, these intersections generally continue to perform at acceptable levels.

The Temporary Transport Strategy will be further assessed as part of the Sydenham to Bankstown upgrade Environmental Impact Statement.

Table 9-7 Intersection performance around the proposed modification

Intersection / peak period	Future conditions (2023) without construction		Proposed modification (2023 future conditions + construction traffic)		Proposed modification (2023 future conditions + construction traffic + Temporary Transport Strategy buses) ¹	
	Level of service	Degree of saturation	Level of service	Degree of saturation	Level of service	Degree of saturation
Gleeson Avenue / Burrows Avenue(signals)						
Morning	B	0.67	B	0.68	B	0.89
Afternoon	C	0.66	C	0.67	C	0.86
Gleeson Avenue / Railway Parade (signals)						
Morning	A	0.54	A	0.68	A	0.81
Afternoon	A	0.50	A	0.51	A	0.58
Gleeson Avenue / Unwins Bridge Road (signals)						
Morning	C	0.92	C	0.97	C	0.97
Afternoon	C	0.79	C	0.79	C	0.79
Edinburgh Road / Murray Street (roundabout)						
Morning	A	0.60	A	0.60	N/A	N/A
Afternoon	B	0.67	B	0.67	N/A	N/A
Edinburgh Road / Bedwin Road (signals)						
Morning	A	0.59	A	0.59	N/A	N/A
Afternoon	A	0.58	A	0.58	N/A	N/A
Bedwin Road / May Street (signals)						
Morning	C	1.08	C	1.08	N/A	N/A
Afternoon	E	1.01	E	1.01	N/A	N/A

¹ Temporary Transport Strategy buses would not use intersections near the Sydney Metro Trains Facility South, resulting in no additional impact to these intersections

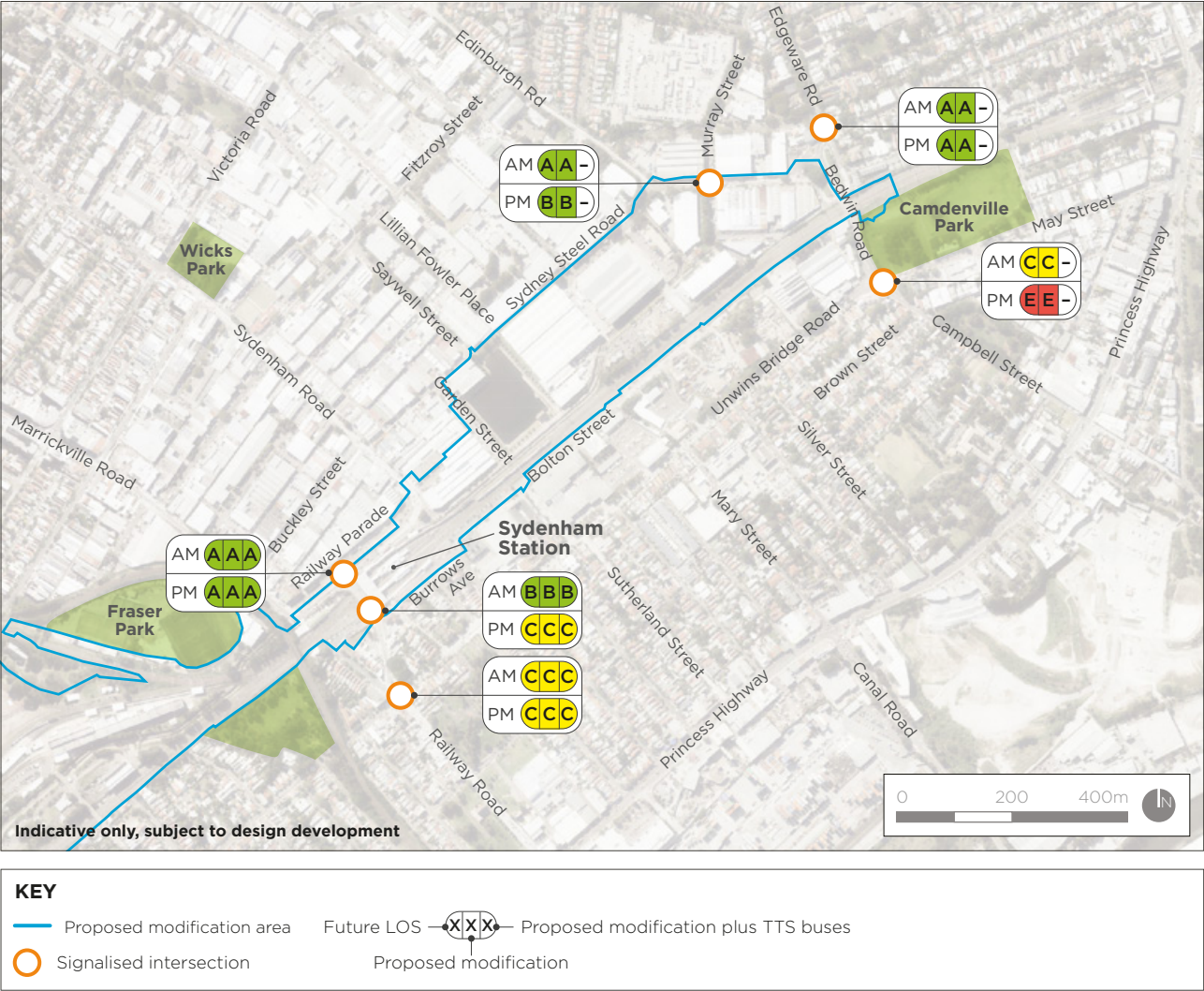


Figure 9-4 Assessed intersection locations

Bridge closures

The Gleeson Avenue overbridge carries two way general traffic with two lanes in each direction with traffic volumes of approximately 43,000 vehicles per day (estimated from September 2016 peak hour traffic counts). During construction of the proposed modification, the bridge would require half-road closures for eight months during weekends and night works.

Lane closure would be restricted to one lane in each direction, while still retaining contra-flow. While some impacts on the local road network are expected as a result of the bridge works, substantial impacts are not anticipated.

The proposed staging of bridge closures, and the need for full or partial closures, would be reviewed by the construction contractor, with the objective of minimising disruptions to the road network.

9.4 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy for the project, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans. The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified.

The assessment of potential changes to construction traffic and transport impacts identified that one additional mitigation measures would be required in relation to managing impact during the Temporary Transport Strategy for the Sydenham to Bankstown project. This mitigation measures is provided in Table 9-8.

In addition, the conditions of approval issued for the approved project would also apply to the proposed modification. Of relevance this includes:

- Condition E80 – minimising truck movements during peak periods
- Condition E81 – development of a Construction Traffic Management Framework which sets out the approach to manage traffic and transport issues for the project.

Table 9-8 Mitigation measures – construction traffic and transport

ID	Mitigation measures	Applicable location(s) ¹
TT27	Detailed construction planning would be coordinated with the Sydenham to Bankstown project and the Temporary Transport Strategy arrangements to minimise impacts on the traffic and transport network.	SS

¹ STW: Surface track works; CDS: Chatswood dive site; AS: Artarmon substation; CN: Crows Nest Station; VC: Victoria Cross Station; BP: Blues Point temporary site; GI: Ground improvement works; BN: Barangaroo Station; MP: Martin Place Station; PS: Pitt Street Station; CS: Central Station; WS: Waterloo Station; MDS: Marrickville dive site (including Sydney Metro Trains Facility South); SS: Sydenham Station; STWS: Surface track works south Metro rail tunnels: Metro rail tunnels not related to other sites (eg TBM works); PSR: Power supply routes.

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OPERATIONAL TRAFFIC AND TRANSPORT

CHAPTER TEN



10 Operational traffic and transport

This chapter provides an assessment of the potential impact on operational traffic and transport as a result of the proposed modification, and identifies mitigation measures to minimise these impacts.

10.1 Assessment methodology

The assessment of potential changes to operational traffic and transport impacts associated with the proposed modification followed a similar approach used for the assessment of the approved project and involved:

- Determining the role and function, associated demand, and transfer movements at and around the existing Sydenham Station (including associated transport interchanges), which is proposed to be converted for Sydney Metro operations
- Reviewing patronage forecasts, including active travel, public transport, and private vehicle access to and from Sydenham Station, and the proposed service operating conditions for Sydney Metro
- Reviewing station design principles and concept design for Sydenham Station and the surrounding interchange area, including how it facilitates the integration of Sydney Metro services with the surrounding transport network (including active transport)
- Undertaking a qualitative assessment of the potential impacts on traffic, transport, and access during operation, including impacts on active travel, private vehicle access to and from Sydenham Station and public transport
- Identifying how implementation of the proposed Sydney Metro transport interchange would directly impact on the surrounding environment and customer transfers between different transport access modes.

10.2 Existing environment

The existing traffic, transport and access environment for the proposed modification is described in Chapter 9 of this report. The baseline for the operational assessment includes other transport and renewal projects planned and under construction within and in the vicinity of the proposed modification as described in the assessment of the approved project. The following additional projects have been considered for the proposed modification in this chapter, and in Chapter 20 (Cumulative impacts) where relevant:

- Inner West Council cycle routes, and routes identified in the *Sydney City Centre Access Strategy* (Transport for NSW, 2013a)
- 'More Trains and More Services' Program Initiatives on the Sydney Trains network
- Sydney Bus Future – Simpler, faster, better bus services (2013)
- Transport network investigations identified in the TfNSW 'Long Term Transport Master Plan' (2012)
- The WestConnex program of works including M4 East, New M5, M4-M5 Link and Sydney Gateway.

For the purposes of the assessment, it was assumed that these projects (and their transport network implications) would be operational at the time of opening of the project as proposed to be modified.

10.3 Potential impacts

The proposed modification would provide the following benefits to the public transport network:

- Customers on the T4 Eastern Suburbs and Illawarra Line and T2 Airport Line would be able to interchange at Sydenham to access metro services to places like Martin Place, Barangaroo, Victoria Cross, Macquarie Park and the Norwest Business Park. Faster and direct access to places like North Sydney and Macquarie University would give customers more choices and better connections to jobs and educational opportunities
- Interchange potential at Sydenham would reduce congestion on the T4 Eastern Suburbs and Illawarra Line and T2 Airport Line and reduce interchange movements at other stations, particularly Central Station
- Support the temporary transport strategy for the final shutdown of the T3 Bankstown Line required for the construction of the Sydenham to Bankstown project. The proposed extension would provide frequent turn-up-and-go metro services at Sydenham Station for travel to and from the Sydney CBD and Sydney's northwest to minimise the impact to existing customers who would temporarily need to travel to and from Sydenham Station via rail replacement bus services during this final shutdown
- Eliminate the need to run empty metro trains from Waterloo Station to the track-turnback just north of Sydenham Station.

The potential phased opening of Sydney Metro City & Southwest, as described in Chapter 6 of this report, would provide the opportunity to enable the benefits of the approved project, including improved road traffic conditions, lower bus network demands, time travel savings, and improved network resilience, to be realised at Sydenham prior to the construction of the Sydenham to Bankstown project. There would also be operational impacts on a number of heavy rail services at Sydenham Station, which are discussed in Section 10.3.1.

10.3.1 Sydenham Station

The proposed integration of the upgraded Sydenham Station with the surrounding traffic and transport network is shown on Figure 10-1. The proposed modification has been designed to:

- Enhance the accessibility of Sydenham Station and in the general vicinity with regard to walking and cycling
- Include infrastructure to support accessible paths of travel and interchange between transport modes to promote active transport
- Maintain and improve access across the rail corridor by providing a new aerial pedestrian concourse.

Upgraded station facilities and platforms would comply with the requirements of the *Disability Discrimination Act 1992* (ie DDA compliant) and *Disability Standards for Accessible Public Transport 2002*.

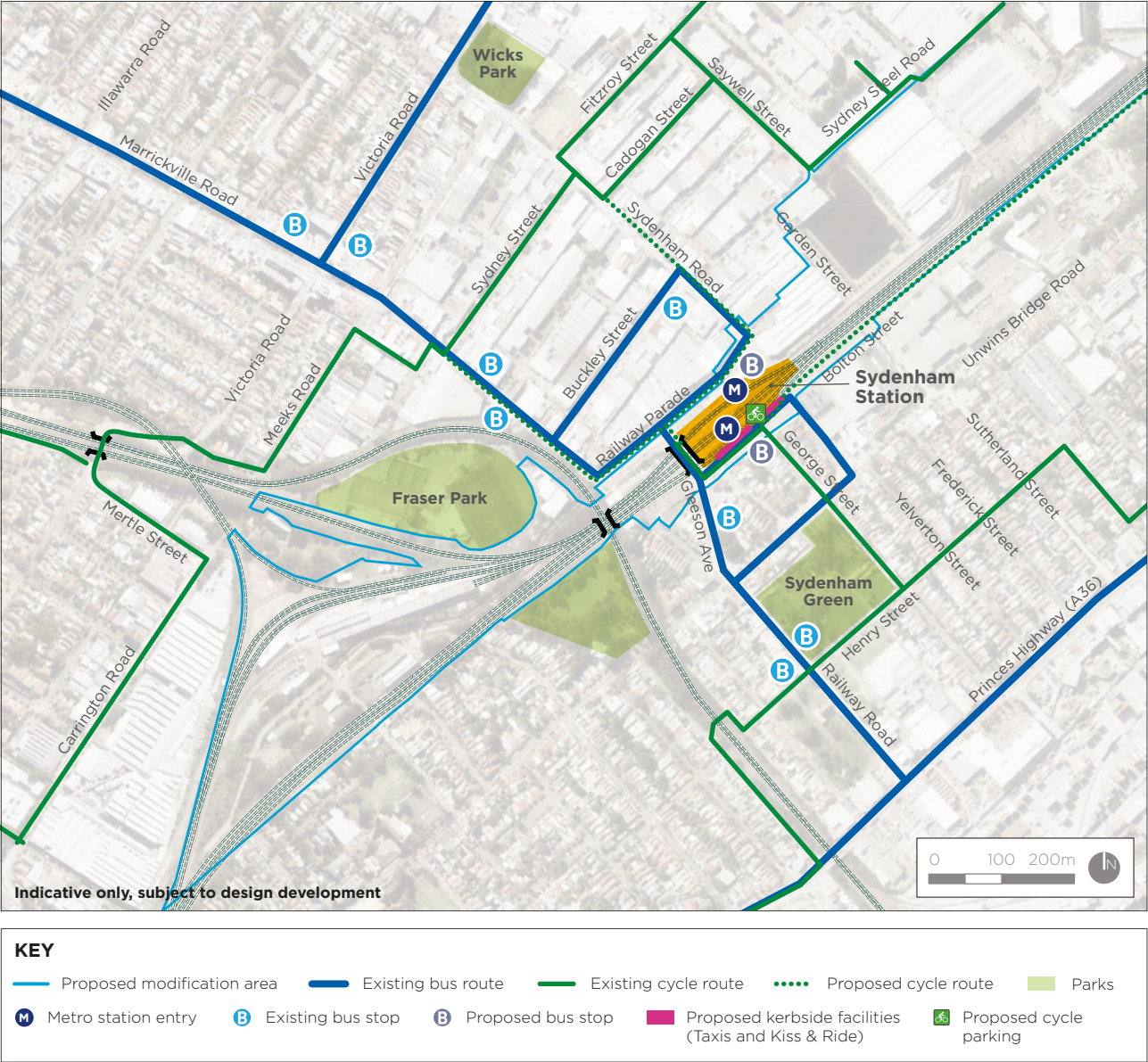


Figure 10-1 Sydney Station – transport integration

Metro patronage and access mode to station

The current and future travel modes to/from the station per day from Sydenham Station are shown in Table 10-1. The volumes listed for the 2026 scenario assume the operation of the Sydenham to Bankstown project, which is due to open in 2024. These mode share increases are discussed in the relevant sections that follow.

Table 10-1 Current and future volumes of travel to/from Sydenham Station

Travel mode to the station	Entry			Exit		
	2016	2026	Change	2016	2026	Change
Walking	2178	3441	+1263	1971	3114	+1143
Cycling	41	65	+24	41	65	+24
Park-and-ride	807	1275	+468	730	1153	+423
Kiss-and-ride	686	1084	+398	621	981	+360
Bus	242	382	+140	219	346	+127

Source: Transport for NSW and extrapolated data

During the phased opening of the Chatswood to Sydenham component of Sydney Metro City & Southwest that may occur for a short period, the catchment for Sydenham Station is expected to extend, particularly to the west. Prior to the opening of metro services to Marrickville Station, customers who currently choose between accessing Marrickville and Sydenham stations, may chose to access Sydenham Station as it would provide Metro services and therefore an ability to connect to new locations such as Barangaroo and Victoria Cross without the need to interchange.

This temporary increase in catchment for Sydenham Station may result in short-term increase in future volumes of customers accessing the station via a number of modes.

Active transport integration

The proposed modification would include works associated with the Sydenham to Bankstown active transport corridor described in Chapter 6 of this report. The active transport corridor generally would provide pedestrian footways, cycleways and designated pedestrian and cyclist road crossings.

The proposed modification at Sydenham would facilitate strategic walking and cycling connections to a number of important destinations, including linking public transport interchanges, residential areas, schools, and employment precincts. The proposed modification provides bike parking for about 126 bikes at Sydenham Station by means of conventional bicycle racks and also spatially safeguards for the future expansion as demand increases.

Public transport integration

Bus routes and services

The proposed modification would not involve major changes to existing bus routes and stops. Existing bus stops on Railway Parade and Burrows Avenue would be relocated to suit the new station area as described in Chapter 6 of this report. Accessible paths from the aerial concourse and new station entries to the bus stops would be provided to improve interchange access at Sydenham Station. The proposed modification would form a component of an integrated public transport network at Sydenham, which would include the bus network.

A new bus layover facility would be provided on the corner of Railway Road and Burrows Avenue, as described in Chapter 6 of this report. The layover facility would accommodate rail replacement buses that currently use Burrows Avenue north of Gleeson Avenue, which would no longer be available due to the new station forecourt.

Heavy rail

As part of Sydney Metro City & Southwest, the proposed modification would also offer a number of strategic transport and access benefits. These include:

- Increasing the reach of the rail network – the proposed modification would provide additional interchange capability at Sydenham Station, and the ability to interchange between Sydney Metro and Sydney Trains services
- Increased accessibility and trip diversity at Sydenham Station – improving the frequency of services, interchange with other transport modes, and connections to key destinations would increase accessibility (for example, to major employment, commercial, industrial, and residential areas) and trip diversity (for example, journey to work, education, local service trips and work related trips)
- Travel time savings – customers at Sydenham Station would have access to direct Sydney Metro services to key activity areas in the Global Economic Corridor. Travel time savings would be experienced by existing rail service passengers (who would directly benefit from shorter travel times), new metro passengers (who could transfer from road-based transport such as buses and cars to rail), and road users, who would potentially experience less congestion
- Improved reliability – reduced train and station crowding at Sydenham Station, and increased service frequencies would improve reliability. This would provide passengers with the ability to ‘turn up and go’ as opposed to pre-planning and co-ordinating with a specific train. This service model has led to greater rail patronage in other cities around the world. The passenger benefits would be further realised through increased reliability across the network resulting from segregation of Sydney Metro from the Sydney Trains network.

There would be operational impacts to the heavy rail lines at Sydenham Station during the potential phased opening of the Chatswood to Sydenham component of Sydney Metro City & Southwest. During the phased opening, metro services would begin operating using existing platforms 1 and 2. This would require T3 Bankstown Line trains to be diverted from these platforms to the platforms used by the T2 Airport Line (platforms 3 and 4) using the cross-over facilities described in Chapter 6 (Modification description – operation). Freight trains that currently use the tracks at platform 2 of Sydenham Station for shunt movements would also need to be diverted to tracks used by the T2 Line. It is anticipated that the shared use of platforms 3 and 4 by T2 and T3 services and freight shunt movements could be accommodated with minor timetable changes due to the current frequency of T2 services at Sydenham Station (see Table 9-2). This could also involve additional T2 train services using the Airport component of this line and by-passing Sydenham Station.

Road network integration

Two accessible taxi facilities and four kiss-and-ride facilities would be provided at Sydenham Station as part of the proposed modification.

The enhanced customer experience provided by metro services at Sydenham Station is expected to result in an ongoing growth in the use of rail services which should result in a reduction in traffic congestion on local roads around Sydenham. This would free up road capacity for other public transport services like buses which should translate into travel time and operational savings for these services.

The travel time savings for customers at Sydenham Station resulting from the proposed modification is one of the factors that would encourage more people to use the rail network, resulting in an ongoing increase in rail patronage and potential shift toward rail from other forms of transport.

Through the enhanced design of the Sydenham Station and precinct areas, including the provision of additional bicycle parking facilities and new entries near existing bus stops, customers would be encouraged to access Sydenham Station using active or public transport modes. A mode shift towards rail, and a reduction in the proportion of car to rail linked journeys, would facilitate a reduction in road congestion thus benefiting other road users.

Impacts to parking availability

The creation of a new station pedestrian plaza and active transport facilities aimed at improving station access by walking and cycling would impact some parking areas adjacent to Sydenham Station currently used by rail customers and the general public. Thirty-six on-street parking spaces would be removed as part of the proposed modification. Three accessible parking spaces would be provided as part of the proposed modification.

Due to this loss of parking, and the anticipated increase in demand for parking near the station, Transport for NSW would work with Inner West Council to complete a parking study to manage the long-term of operation on parking and other kerbside use in local streets.

10.3.2 Sydney Metro Trains Facility South

The Sydney Metro Trains Facility South is expected to operate 24 hours per day and seven days per week and would be used for the operation and maintenance of the rolling stock, stations and the rail corridor. Major periodic maintenance activities would be infrequent and are likely to occur on weekends.

An estimated 150 full time equivalent staff would be required at the facility working in shifts, with an expected 107 staff working on any one day. The estimated number of employees working each shift per day is shown in Table 10-1. It is anticipated that some employees would use metro rail, heavy rail and bus services to commute to work, however there may be additional demand for parking on local streets and minor increases in traffic on the surrounding road network.

Table 10-1 Estimated number of employees per day at Sydney Metro Trans Facility South

	11:30pm – 6:30am	6.30am – 2.30pm	2:30pm – 11:30am
Number of employees (per day)	71	18	18

10.3.3 Maintenance access

The proposed modification would require vehicles to access operational ancillary infrastructure such as stations and services buildings to undertake periodic maintenance activities. Maintenance access vehicle numbers and frequency is expected to be the same as the approved project. Due to the anticipated number of vehicles and expected frequency of access, maintenance access is not expected to result in any impact to the surrounding road network.

10.4 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy for the project, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans. The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified.

The assessment of potential changes to operational traffic and transport impacts identified that additional mitigation measures would be required. These additional mitigation measures are provided in Table 10-3.

In addition, the conditions of approval issued for the approved project would also apply to the proposed modification. Of relevance this includes:

- Condition E75 – in relation to integration with surrounding transport network and facilitating an improved level of service
- Condition E92 – the preparation of Interchange Access Plans for each station.

Table 10-3 Mitigation measures – operational traffic and transport

ID	Mitigation measures	Applicable location(s) ¹
OpT6	Transport for NSW would work with the Inner West Council to facilitate staged completion of relevant sections of the proposed active transport corridor between Sydenham and Bankstown subject to funding.	SS
OpT7	Transport for NSW would work with the Inner West Council to complete a parking study to manage the long term impacts of parking loss around Sydenham Station.	SS

¹ STW: Surface track works; CDS: Chatswood dive site; AS: Artarmon substation; CN: Crows Nest Station; VC: Victoria Cross Station; BP: Blues Point temporary site; GI: Ground improvement works; BN: Barangaroo Station; MP: Martin Place Station; PS: Pitt Street Station; CS: Central Station; WS: Waterloo Station; MDS: Marrickville dive site (including Sydney Metro Trains Facility South); SS: Sydenham Station; STWS: Surface track works south Metro rail tunnels: Metro rail tunnels not related to other sites (eg TBM works); PSR: Power supply routes.

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NOISE AND VIBRATION

CHAPTER ELEVEN



11 Noise and vibration

This chapter assesses the potential changes to noise and vibration impacts during the construction and operational of the proposed modification, and identifies mitigation measures to minimise these impacts.

11.1 Assessment methodology

The assessment of potential changes to construction and operational noise and vibration impacts followed the same approach as was carried out for the approved project and involved:

- Identifying and classifying of sensitive receivers
- Characterising the existing noise environment based on attended and unattended noise measurements at nearby receiver locations
- Determining noise and vibration management levels in accordance with relevant guidelines

The construction and operational noise and vibration assessment for the proposed modification has been carried out in accordance with:

- Interim Construction Noise Guideline (ICNG), (DECC, 2009) for airborne and ground-borne construction noise
- The NSW *Road Noise Policy* (RNP), (NSW EPA, 2011) for construction traffic road noise
- *Assessing Vibration: A technical guideline* (DEC, 2006) for construction vibration.
- The *Rail Infrastructure Noise Guideline* (RING), (NSW EPA, 2013) for noise from the operation of all rail systems
- The *Industrial Noise Policy* (INP), (NSW EPA, 2000) for noise from mechanical plant at stations and ancillary facilities, including sleep disturbance
- *Assessing Vibration: A technical guideline* (DEC, 2006) for construction and operational vibration.

11.1.1 Construction

The assessment methodology for the construction noise and vibration assessment generally involved:

- Modelling to quantify the potential noise and vibration impacts
- Assessing the significance of potential impacts identified
- Examining the proposed construction methodologies and identifying mitigation measures that are likely to be required to minimise construction noise and vibration impacts
- Preparing and documenting mitigation measures that would be implemented during construction.

The assessment provides a 'worst-case' scenario based on the proposed works within a 15 minute period which is typically associated with works located within the nearest site area to a particular receiver. However, in reality at any particular location, the potential construction noise impacts can vary greatly depending on factors including the following:

- The position of the construction works within the site and distance to the nearest sensitive receiver
- The overall duration of the construction works
- The intensity of the noise levels
- The time at which the construction works are undertaken
- The character of the noise.

Noise levels at sensitive receivers can also be significantly lower than the worst case scenario when the construction works move to a more distant location in a works area, as depicted in Figure 11-1.

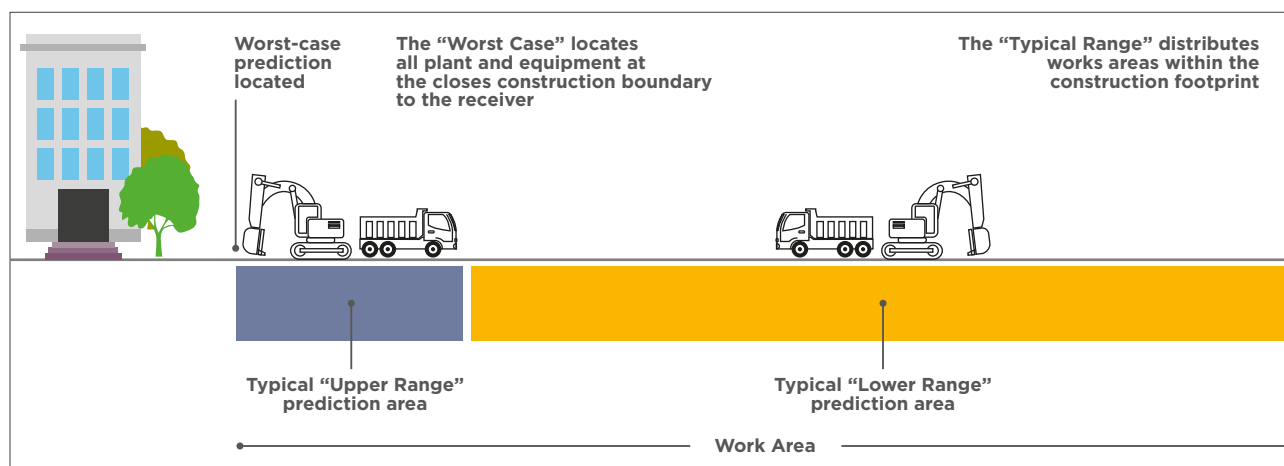


Figure 11-1 Illustration of work areas

As detailed in Chapter 7 of this report, the majority of the construction works would be undertaken in accordance with the ICNG during the standard daytime working hours of:

- 7.00 am and 6.00 pm Monday to Friday
- 8.00 am and 1.00 pm on Saturdays.

As some of the proposed works are located within an active rail corridor, works outside of standard construction hours would however be required where works cannot safely be undertaken due to their proximity to the existing rail lines or where there would be a risk that the works may adversely affect the existing operating lines, ie out of hours works would occur during possessions.

11.1.2 Operation

The following operational noise and vibration noise sources have been assessed:

- Airborne noise from rail operations based on the approach and criteria outlined in the RING
- Ground-borne noise and vibration from rail operations based on the approach and criteria outlined in the RING and British Standard BS 6472
- Airborne noise from the Sydney Metro Trains Facility South based on the approach and criteria outlined in the INP
- Airborne noise from new plant and equipment at Sydenham Station based on the approach and criteria outlined in the INP.

Further details regarding the assumptions and inputs to the operational noise and vibration modelling are provided in Appendix D.

11.1.3 Terminology

Noise parameters most relevant to the noise assessment are described below:

- Rating Background Level (RBL) or L_{A90} – the background noise level in the absence of proposed construction activities. This parameter represents the average minimum noise level during the daytime, evening and night-time periods and is used to set the $L_{Aeq(15\text{ minute})}$ Noise Management Levels (NMLs) for residential receivers
- $L_{Aeq(15\text{ minute})}$ – the “energy average noise level” evaluated over a 15-minute period. This parameter is used to assess the potential construction noise impacts
- $L_{Aeq(\text{period})}$ – the Energy Average Noise Level evaluated over a defined measurement period (typically 15 minutes for construction noise or the relevant daytime, evening or night-time period for ambient noise monitoring)
- L_{Amax} or $L_{A1(1\text{min})}$ – the ‘typical maximum noise level’ for an event, used in the assessment of potential sleep disturbance during night-time periods.

Regarding train terminology, track chainages are referenced to 0 km at Central Station. Down and Up directions refer to trains travelling away from and towards Central Station respectively.

When referring to the start and end of a rail alignment, the end of the alignment closest to Central Station is referred to as the ‘city-end’. Conversely, the end of the alignment furthest from Central Station is referred to as the ‘country-end’.

11.1.4 Sensitive receivers

The sensitivity of occupants to noise and vibration varies according to the nature of the occupancy and the activities performed within the affected premises. For example, recording studios are more sensitive to noise and vibration than residential premises, which in turn are more sensitive than typical commercial premises.

Properties within about 100 metres of the rail alignment and about 200 metres from construction sites have been classified into one of the following receiver categories:

- Residential
- Commercial
- Industrial
- Educational
- Place of Worship
- Child care
- Hospital
- Other sensitive (eg. areas containing specialist noise and/or vibration sensitive equipment or occupancy usages).

Receivers greater than these distances are unlikely to hear any construction or operational noise. Commercial and industrial receivers are generally considered to be less sensitive to noise and vibration compared to residential receivers.

11.1.5 Noise Catchment Areas

The study area has been divided into two Noise Catchment Areas (NCAs). These NCAs reflect the changing land uses and ambient noise environments adjacent to the proposed modification and are shown in Figure 11-2.

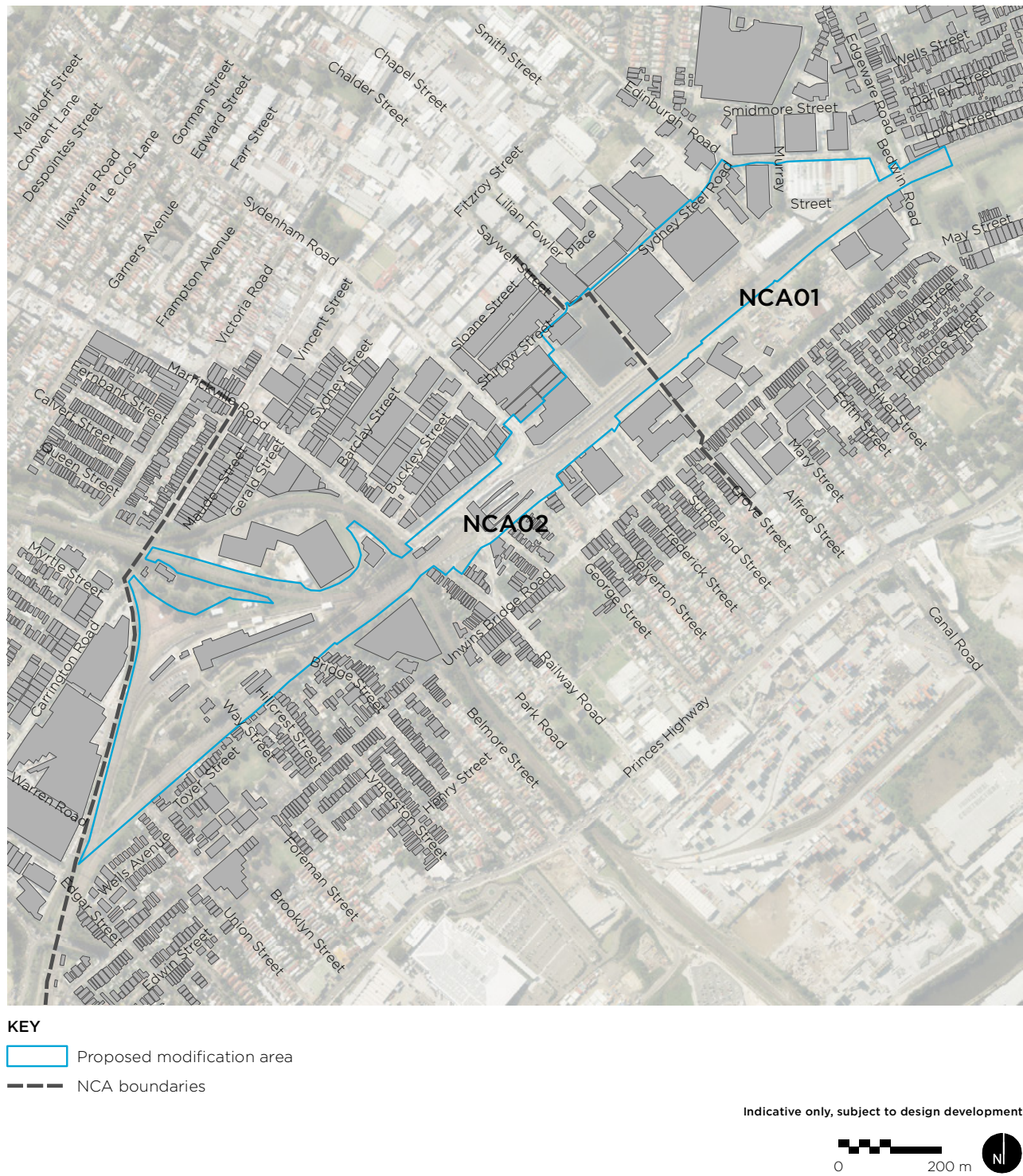


Figure 11-2 Noise catchment areas

11.2 Existing environment

The existing noise and vibration environment around Sydenham was described in the Environmental Impact Statement for the approved project. This section provides further details regarding the existing noise and vibration environment specific to the proposed modification.

11.2.1 Ambient noise surveys and monitoring locations

To characterise the existing ambient noise environment and to establish ambient noise levels on which to base the construction noise management levels (NMLs), noise monitoring was carried out at four locations during June to July 2015 and August to September 2015.

The location of unattended noise surveys is shown on Figure 11-2. The results of the unattended noise survey are summarised in Table 11-1.

Table 11-1 Summary of unattended noise monitoring results

ID	Location	Noise Level (dBA) ¹					
		Daytime 7 am to 6 pm		Evening 6 pm to 10 pm		Night-time 10 pm to 7 am	
		RBL	L _{Aeq}	RBL	L _{Aeq}	RBL	L _{Aeq}
B.01	322 Edgeware Road, Newtown	58	69	52	66	38	62
B.02	1B Leicester Street, Marrickville	52	66	43	64	38	58
B.03	104 Unwins Bridge Road, St Peters	59	71	53	69	41	65
B.04	16 Swain Street, Sydenham	47	69	47	68	39	60

¹ The RBL and L_{Aeq} noise levels have been obtained using the calculation procedures documented in the INP.

In addition, train passby noise and / or vibration measurements were undertaken on 24 November 2015 for the T4 Illawarra Line and during June to July 2016 for the Goods Line within the study area. Train passby measurements are undertaken to confirm the model inputs and outputs are in line with measured noise levels on site. The location of this attended noise and vibration monitoring is shown on Figure 11-2 and the results are presented in Appendix D.

11.3 Construction noise and vibration criteria

11.3.1 Construction noise management levels

Airborne noise

Construction noise management levels for airborne noise were determined using the same approach as for the approved project and in accordance with the Construction Noise and Vibration Strategy (2016). This involved:

- For residential receivers deriving noise management levels based on the background noise level and the guidance provided in the ICNG
- For non-residential receivers, applying the applicable noise management level from the ICNG
- For hotels, cafes, bars, restaurants and libraries applying the 'maximum' internal levels presented in *AS 2107 2000 Recommended Design Sound Levels and Reverberation Times for Building Interiors*
- For child care centres applying the criteria from *Technical Guideline Child Care Centre Noise Assessment* (Association of Australian Acoustical Consultants, 2008).

Table 11-2 provides a summary of the NMLs relevant for each noise catchment area and receiver type.

Table 11-2 Summary of noise management levels

NCA	Receiver type	Standard construction hours ¹		Out of hours ²	
		Daytime	Daytime	Evening	Night-time
NCA01	Residential	68	63	57	43
NCA02	Residential	57	52	52	44
All	Commercial	70	70	N/A	N/A
	Industrial	75	75	N/A	N/A
	Other (Childcare)	50	50	N/A	N/A
	Other (Educational) ³	55	N/A	N/A	N/A
	Other (Medical) ³	55	55	55	N/A
	Other (Place of Worship) ³	55	55	N/A	N/A

¹ Standard construction hours are: 7am-6pm Monday to Friday, 8am-1pm Saturdays

² Out of hours periods are: Daytime: 1pm-6pm Saturdays and 8am-6pm Sunday; Evening 6pm-10pm; Night time hours 10pm-7am Sunday to Saturday and 10pm Saturday to 8am Sunday.

³ External levels, based on the internal levels specified in the ICNG / applicable standards or guidelines, plus 10 dB (assuming open windows).

Ground-borne noise

Consistent with the approach for the assessment of the approved project, ground-borne noise management levels were applied from the ICNG. Construction noise management levels for ground-borne noise were determined using the same approach as for the approved project. Ground-borne NMLs for residential receivers, based on levels provided in the ICNG and the Construction Noise and Vibration Strategy (2016), are presented in Table 11-3.

Table 11-3 Ground-borne noise management levels for residential receivers

Time of day	Ground-borne NMLs $L_{Aeq}(15 \text{ minute})$
Daytime 7 am to 6 pm	45 dBA – internal
Evening 6 pm to 10 pm	40 dBA – internal
Night-time 10 pm to 7 am	35 dBA – internal

For commercial receivers, the ICNG does not provide guidance in relation to acceptable ground-borne noise levels. However, the assessment of the approved project adopted an internal NML of $L_{Aeq}(15 \text{ minute})$ 50 dBA based on the ICNG external airborne noise NML of 70 dBA and that when commercial premises have windows closed this would provide typically 20 dB of noise reduction from outside to inside. This level has also been applied to this assessment.

For other sensitive receivers, such as education institutions, hospital wards and operating theatres, and place of worship, the ICNG does not provide guidance in relation to acceptable ground-borne noise levels. However, the internal airborne noise NMLs provided in the ICNG and AS 2107 for these receivers have been adopted in order to assist in identifying potential impacts.

11.3.2 Construction traffic noise

The assessment of road traffic noise adopted the same approach as was applied for the assessment of the approved project by using guidance in the RNP.

One of the objectives of the RNP is to protect against excessive reduction in amenity as the result of a project by comparing traffic noise levels to the following relevant road traffic noise criteria:

- Existing freeway / arterial / sub-arterial roads:

- ◆ $L_{Aeq(15\text{hour})}$ 60 dBA day
- ◆ $L_{Aeq(9\text{hour})}$ 55 dBA night

- Existing local roads:

- ◆ $L_{Aeq(1\text{hour})}$ 55 dBA day
- ◆ $L_{Aeq(1\text{hour})}$ 50 dBA night.

Where traffic noise levels from the existing traffic plus the additional traffic generated by the development exceeds the above criteria, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.

In considering feasible and reasonable mitigation measures where the relevant noise increase is greater than 2 dB, consideration is also given to the actual noise levels associated with construction traffic.

11.3.3 Construction vibration

The assessment of potential changes to construction vibration used the same screening criteria as the assessment of the approved project. These were derived from guidance provided in British Standard BS 7385. Based on the typical nature of buildings around the proposed modification, the cosmetic damage screening criteria of 7.5 mm/s for unreinforced or light framed structures has been uniformly applied. This same screening criteria is also relevant for heritage items.

11.4 Sleep disturbance

Consistent with the approach for the assessment of the approved project a sleep disturbance NML of 55 dBA (internal) has been adopted, which equates to an external noise level of 65 dBA (assuming open windows).

11.5 Operational noise and vibration criteria

11.5.1 Airborne noise

Rail operations

Operational noise criteria for the assessment of noise from rail operations have been derived from the RING, which is consistent with the approved project.

The RING requires noise to be assessed at project opening and for a future design year typically ten years or more after opening. For this assessment two timeframes are assessed. These are based on forecasts for the operations in the opening scenario (2024) and a future scenario (2034), including the operation of the Sydenham to Bankstown project.

The proposed modification is classified as a redevelopment of an existing rail line development. The relevant airborne noise trigger levels for residential land uses are presented in Table 11-4.

Table 11-4 Airborne rail noise triggers – residential

Sensitive land use	Noise trigger level (dBA)	
	Day time 7:00 am to 10:00 pm	Night-time 10:00 pm to 7:00 am
Residential	Development increases existing $L_{Aeq(period)}$ rail noise levels by 2 dB or more, or existing L_{Amax} rail noise levels by 3 dB or more and predicted rail noise levels exceed:	
	65 $L_{Aeq(15hour)}$ or 85 L_{Amax}	60 $L_{Aeq(9hour)}$ or 85 L_{Amax}

The relevant airborne noise trigger levels for other sensitive land uses, which are applicable when the building or premise is in use, are presented in Table 11-5. All noise trigger levels are external levels except where otherwise stated. Commercial and industrial receivers are not considered sensitive to operational airborne noise impacts.

Table 11-5 Airborne rail noise triggers – sensitive land uses

Sensitive land use	Noise trigger level dBA
	Development increases existing rail noise by 2 dB or more in L_{Aeq} in any hour and resulting rail noise levels exceed:
Schools, educational institutions and child care centres	45 $L_{Aeq(1hour)}$ Internal
Places of worship	45 $L_{Aeq(1hour)}$ Internal
Hospital wards	40 $L_{Aeq(1hour)}$ Internal
Hospital other uses	65 $L_{Aeq(1hour)}$
Open space – passive use (eg parkland, bush reserves)	65 $L_{Aeq(15hour)}$
Open space – active use (eg sports field, golf course)	65 $L_{Aeq(15hour)}$

Sydney Metro Trains Facility South operations

Operational noise criteria for the assessment of noise from the operation of the stabling facility have been derived from the INP.

The INP sets two separate noise criteria to meet environmental noise objectives: one to account for intrusive noise and the other to protect the amenity of particular land uses. These criteria are to be met at the most-affected boundary of the receiver property. The more stringent of the criteria usually defines the proposal specific noise levels. For both amenity and intrusiveness, night-time criteria are more stringent than daytime or evening criteria.

To provide for protection against intrusive noise, the INP states that the L_{Aeq} noise level of the source, measured over a period of 15 minutes, should not be more than five decibels above the ambient (background) L_{A90} noise level (or RBL), measured during the daytime, evening and night-time periods at the nearest sensitive residential receiver. In this case, the intrusiveness criteria are determined from the rating background levels at sensitive receiver locations nearest to the facilities.

To provide protection against impacts on amenity, the INP specifies suitable maximum noise levels for particular land uses and activities during the daytime, evening and night-time periods. The relevant INP external amenity noise criteria are presented in Table 11-6.

Table 11-6 Industrial Noise Policy amenity criteria

Type of receiver	Indicative noise amenity area	Time of day	Recommended L_{Aeq} noise level (dBA)	
			Acceptable	Recommended maximum
Residence	Suburban ¹	Day	55	60
		Evening	45	50
		Night	40	45
Residence	Urban ²	Day	60	65
		Evening	50	55
		Night	45	50
Commercial	All	When in use	65	70
Active recreation area	All	When in use	55	60
Educational	All	When in use	45 ³	50 ³
Place of worship	All	When in use	50 ³	55 ³

¹ Suburban area is characterised by local traffic with intermittent traffic flows, decreasing noise levels in the evening period, and/or evening ambient levels defined by the natural environment and infrequent human activity.

² Urban areas are characterised by an acoustic environment dominated by 'urban hum' or industrial noise sources, through traffic with heavy and continuous traffic flows during peak hours, and/or located near commercial or industrial districts.

³ External levels, based on the internal levels specified in the INP plus 10 dB (assuming open windows).

Table 11-7 provides a summary of the noise criteria for each noise catchment area and receiver type. The 'overall' noise criteria are the applicable criteria for this assessment and are the more conservative criteria of the intrusive and amenity criteria. To provide a more refined assessment of potential operational impacts around the Sydney Metro Trains Facility South, different noise catchment areas have been applied.

Table 11-7 Sydney Metro Trains Facility South noise criteria

NCA	Logger	Period	Measured level, dBA		Noise criteria $L_{Aeq(15\text{minute})}$, dBA			Noise criteria L_{Amax} , dBA
			RBL	$L_{Aeq(\text{period})}$	Intrusive	Amenity ¹	Overall	Sleep Disturbance
NCA-A	B.02	Day	52	66	57	56	56	N/A
		Evening	43	64	48	54	48	N/A
		Night	38	58	43	48	43	53
NCA-B	B.01	Day	58	69	63	59	59	N/A
		Evening	52	66	57	56	56	N/A
		Night	38	62	43	52	43	53
NCA-C	B.03	Day	59	71	64	61	61	N/A
		Evening	53	69	58	59	58	N/A
		Night	41	65	46	55	46	56
NCA-D	B.04	Day	47	69	52	58 ²	52	N/A
		Evening	47	68	52	58	52	N/A
		Night	39	60	44	50	44	54

¹ The area is dominated by traffic noise. The corrections have been made in accordance with Section 2.2.3 of the INP.

² Modification made in accordance with Table 2.2 of the INP.

Station and ancillary facility operations

Operational noise criteria for the assessment of noise from the operation of Sydenham Station have also been derived from the INP, which is consistent with the approach for the assessment of the approved project. The applicable criteria are detailed in Table 11-8.

Table 11-8 Sydenham Station noise criteria

Period	Measured Level, dBA		Noise criteria, dBA	
	RBL	$L_{Aeq, \text{period}}$	Intrusive	Amenity
Day	47	69	52	58
Evening	47	68	52	58
Night	39	60	44	50

11.5.2 Ground-borne noise

Consistent with the approach for the assessment of the approved project, operational criteria for the assessment of ground-borne noise from train movements have been derived from the RING. A summary of the applicable ground-borne noise trigger levels is provided in Table 11-9.

Table 11-9 Ground-borne noise trigger levels

Sensitive land use	Time of day	Internal noise trigger level dB(A)
		Development increases existing rail noise levels by 3 dB(A) or more and resulting rail noise levels exceed:
Residential	Day (7am to 10pm)	40 $L_{Amax(slow)}$
	Night (10pm to 7am)	35 $L_{Amax(slow)}$
Schools, educational institutions, places of worship	When in use	40 – 45 $L_{Amax(slow)}$ ¹

¹ The lower value of the range is most applicable where low internal noise levels are expected, such as in areas assigned to studying, listening and praying.

11.5.3 Ground-borne vibration

Due to the differences in the nature of the approved project and the proposed modification, the assessment of potential ground-borne vibration from the proposed modification used different criteria approved project. The criteria for the approved project used criteria developed specifically for the assessment of human perception of vibration from rail tunnels, whereas the assessment of the proposed modification using criteria developed for vibration dose values for at-surface rail lines. These criteria were derived from guidance provided in British Standard BS 6472 for transient vibration levels and are provided in Table 11-10.

Table 11-10 Acceptable maximum vibration dose values for intermittent vibration (m/s^{1.75})

Location	Daytime	Night-time
Critical areas	0.2	0.2
Residences	0.4	0.26
Offices, schools, educational institutions and places of worship	0.8	0.8
Workshops	1.6	1.6

Where particularly sensitive equipment is identified, further investigation would be required for identified receivers. However, sensitive equipment has not been identified within the vicinity of the proposed modification.

11.6 Potential construction impacts

The construction works associated with the proposed modification are scheduled to commence after the construction works at the Marrickville dive site described in the approved project are completed. As such, sensitive receivers are not anticipated to experience concurrent noise impacts from the approved project and the proposed modification. However, the proposed modification would result in some sensitive receivers being subject to construction noise for a longer duration.

Consistent with the approved project, construction planning has identified the need for measures at construction sites to manage potential noise impacts. Based on this the following has been included as part of the proposed modification and within the noise modelling:

- Noise barriers (indicatively three metres high) around all construction sites. The same noise outcome may be achieved through a range of noise barrier heights and the specific height of construction noise barriers would be identified during detailed construction planning through the implementation of the Construction Noise and Vibration Strategy
- Bored piling – the construction activities assume that piling works would be undertaken using bored piles, as opposed to impact piling, where possible.

The above measures are included in the noise predictions in the following sections.

11.6.1 Airborne noise

This section provides an assessment of the airborne noise impacts as a result of the proposed modification. Specifically, this section includes:

- A summary of the noise impact of the approved project in the vicinity of Sydenham
- An assessment of the predicted construction noise impacts associated with the proposed modification for all construction noise scenarios and relevant time periods.

Approved project

In summary, the approved project would result in the following noise impacts in the vicinity of the Marrickville dive site:

- During demolition and site establishment works during the daytime period:
 - ◆ Exceedances of the relevant noise management levels of between 10 to 20 dB at the closest industrial receivers to the north east and at St Pius Catholic Primary School
 - ◆ Exceedances of the relevant noise management level of less than 10 dB at the closest commercial receivers to the north, residential receivers to the north (on Edinburgh Road and to the east of Edgeware Road), and industrial receivers to the south east
- During track works and earthworks during the daytime period:
 - ◆ Exceedances of the relevant noise management levels of between 10 to 20 dB at St Pius Catholic Primary School
 - ◆ Exceedances of the relevant noise management level of less than 10 dB at the closest residential receivers to the north (to the east of Edgeware Road), and industrial receivers to the south east
- During tunnelling and use of the precast facility exceedances of the relevant noise management levels of less than 10 dB:
 - ◆ During the daytime period at St Pius Catholic Primary School
 - ◆ During the evening and night-time periods at the closest residential receivers to the north on Edinburgh Road
 - ◆ During the night-time period at the closest residential receivers to the north (east of Edgeware Road), to the east (on May Street), to the south east (on Unwins Bridge Road), and to the south east (on Burrows Avenue)

Compliance with the relevant noise management levels were predicted for construction of the acoustic shed and fit-out works.

Proposed modification

The predicted noise management level exceedances associated with the proposed modification are summarised in Table 11-11. In total, 1,950 receivers were considered in the assessment. The table identifies the number of receivers which would experience exceedances of the relevant noise management levels. The remaining receivers would comply with the relevant noise management level.

The predicted noise levels presented are representative of the worst-case noise level expected when the equipment is located as the closest point to each receiver. For most construction activities equipment would move around the construction site and it is expected that the construction noise levels would frequently be lower than predicted at the most-exposed receiver.

Table 11-11 Noise management level exceedances – proposed modification

Activity	HNA ¹	Number of receivers													
		With NML exceedance ²													
		Daytime		Possession works											
				Daytime out of hours ³				Evening				Night-time		Sleep	
Sydney Metro Trains Facility South – enabling works															
Demolition of structures		23	1												
Establishment of site compounds		1													
Sydney Metro Trains Facility South – earthworks															
Piling		1													
Excavation and spoil removal		24	1												
Sydney Metro Trains Facility South – construction															
Concrete works and structural		1													
Landscaping		0													
General worksites															
Earthworks	1	46	8												
Earthworks – with breaker	9	237	31	2											
Piling	1	37	6												
Site establishment		22	1												
Operations		12	1		30	1		29	1		144	19		55	9
Corridor works – ground and track															
Earthworks	1	47	2		100	11	1	97	11	1	677	91	7	229	24
Earthworks – with breaker	3	182	30	1	496	75	7	533	73	7	935	493	50	996	188
Trackform		30	1		75	6	1	73	6	1	493	47	3	91	6
Trackform – with ballast tamper	1	104	14	1	286	43	2	304	42	2	1036	230	25	1040	291

Activity	Number of receivers															
	HNA ¹	With NML exceedance ²														
		Daytime	Possession works													
			Daytime out of hours ³	Evening		Night-time		Sleep								
Corridor works – track support systems																
Overhead wiring modifications		21	1		51	3		50	3		299	32	2	91	6	1
Comms and signalling works		21	1		51	3		50	3		299	32	2	109	7	1
Segregation fencing		8	1		26	1		25	1		149	17	1	47	3	
Station worksite																
Site establishment		6			17	1		17	1		63	8	1	16	1	
Demolition		14	1		31	2		31	2		245	22	1	47	8	
Demolition – with breaker and saw	1	68	9	1	308	29	1	305	29	1	627	179	22	536	39	7
Concrete and structural works		9			23	1		23	1		109	16	1	29	2	
Station installation and fitout		6			17	1		17	1		63	8	1	16	1	
Bridge worksites																
Site establishment and impact protection		4			24			22			268	16		28		
Demolition		1			17			16			141	8		16		
Demolition – with breaker and saw		99	4		387	24		386	22		415	268	16	500	53	
Construction and installation		1			2			1			53			10		

Key

- NML exceedance of less than 10dB
- NML exceedance between 11dB and 20dB
- NML exceedance of greater than 20dB

¹ Highly Noise Affected, based on ICNG definition (ie predicted LAeq(15minute) noise at residential receiver is 75 dBA or greater).

² Based on worst case predicted noise levels.

³ Daytime out of hours refers to the period on Sunday between 7am – 8am, and Saturday between 1pm – 10pm.

The results detailed in Table 11-11 indicate:

- During standard construction hours:
 - ◆ The predicted worst-case exceedances of the noise management levels during standard construction hours are typically minor (up to 10 dB)
 - ◆ Activities which use noise intrusive plant items, such as a rockbreaker, diamond saw and / or ballast tamper, result in the most receiver exceedances of the noise management levels. The highest impacts are predicted during the following works:
 - General worksites, earthworks with breaker
 - Corridor works – ground and track, earthworks with breaker
 - Corridor works – ground and track, trackform with ballast tamper
 - Station worksites, demolition with breaker and saw
 - Bridge worksites, demolition with breaker and saw
 - ◆ The activity with the potential for the highest number of exceedances of the noise management levels is ‘general worksites, earthworks with breaker’. This includes:
 - Up to nine receivers are predicted to be highly noise affected when works are located closest to each receiver during these works
 - Whilst the worst-case impacts may result in a greater than 20 dB exceedance of the daytime noise management level, this is limited to only two receivers, with the majority of the receivers being subject to considerably lower impacts
 - The above impacts result from the use of a rockbreaker, which would only be required sporadically. When this noise intrusive plant item is not in use the predicted noise levels and corresponding exceedances of the noise management level are predicted to reduce by around 8 dB, with no receivers being subject to exceedances of greater than 20 dB of the daytime noise management level
 - ◆ Works during standard daytime construction hours are predicted to impact a relatively small number of receivers with the highest impacts predicted to be at receivers adjacent to worksites. Receivers which are further back from the works would have lower predicted noise levels and correspondingly lower exceedances of the noise management levels
 - ◆ Where rock breaking or ballast tamping works are required in close vicinity of receivers, there is the potential for a small number of receivers to be ‘highly noise affected’ (ie where noise levels are greater than 75 dBA).
- During out of hours works:
 - ◆ There would be increased exceedances of the noise management levels compared to standard hours. The highest predicted impacts are associated with use of a rock breaker or ballast tamper
 - ◆ Highly noise intensive construction plant such as rock-breakers would generally not be used during the most sensitive night-time period

- ♦ The highest numbers of exceedances of the noise management levels would occur during activities which use noise intrusive plant items, such as a rockbreaker and / or diamond saw. The highest impacts are predicted during the following works:
 - Corridor works – ground and track, earthworks with breaker
 - Corridor works – ground and track, trackform with ballast tamper
 - Station worksites, demolition with breaker and saw
 - Bridge worksites, demolition with breaker and saw
- ♦ The activity with potential for the highest number of exceedances of the noise management levels during the night-time is ‘corridor works, earthworks with breaker’
- ♦ Whilst the worst-case impacts may result in a greater than 20 dB exceedance of the night-time noise management levels this is limited to 50 receivers, with the majority of the receivers being subject to considerably lower impacts. These exceedances are a result of the use of a rockbreaker, which would generally not be used during the night-time period. Without the use of rockbreakers during the night-time, the predicted noise levels and corresponding exceedances of the noise management levels are predicted to reduce by around 8 dB, with the number of night-time exceedances of greater than 20 dB of the noise management levels reducing to seven receivers
- Noise intensive activities during both standard and out of hours works would typically only be required to be carried out for relatively short periods, as follows:
 - ♦ General worksites, earthworks with breaker – around six weeks
 - ♦ Corridor works – ground and track, earthworks with breaker – around 10 weeks
 - ♦ Corridor works – ground and track, trackform with ballast tamper around one week
 - ♦ Station worksites, demolition with breaker and saw – around six weeks
 - ♦ Bridge worksites, demolition – with breaker and saw – around two weeks

In addition, the noise intensive works would be required on an intermittent basis during the above activities and would not be expected to operate every day.
- Sleep disturbance:
 - ♦ The sleep disturbance screening criterion is likely to be exceeded when night works are occurring adjacent to residential receivers for the majority of works scenarios. This assessment has included predictions of maximum noise impacts for assessment of potential sleep disturbance, which is a worst-case scenario and which would be further refined during site specific assessments to be undertaken at a later stage of the proposed modification, prior to undertaking any construction works

11.6.2 Ground-borne noise

The ICNG defines internal ground-borne noise goals for residential receivers during the evening (6:00 pm to 10:00 pm) and night-time (10:00 pm to 7:00 am) construction periods and are only applicable when ground-borne noise levels are higher than airborne noise levels.

Construction airborne noise levels for evening and night-time possession works are predicted to be higher than the corresponding ground-borne noise levels. As such, ground-borne noise impacts are not considered further in this assessment.

11.6.3 Construction traffic noise

Approved project

The assessment for the approved project identified that the predicted noise level increase associated with construction traffic exceeds the base criteria. The increase complies with the 2 dB allowance for the daytime period and on Bedwin Road for the night-time period. On May Street the increase marginally exceeds the 2 dB allowance (by 0.4 dB). Whilst there is an exceedance of the sleep disturbance screening criterion (by up to 23 dB) and external sleep disturbance NML of 65 dBA (by up to 14 dB), the L_{Amax} levels would be similar to other heavy vehicles using Bedwin Road and May Street.

Proposed modification

Similar to the impact of the approved project, the additional traffic associated with the proposed modification would result in an increase in traffic noise of less than 2 dB on Bedwin Road and May Street during the daytime and Bedwin Street during the night-time period. As such, there would be no change in impact on these roads at these times associated with the proposed modification. However there is potential for an increase of more than 2 dB due to construction traffic during the night-time period on May Street. As identified in the assessment of the approved project, the noise levels would be similar to other heavy vehicles using May Street and sensitive receivers are not likely to notice an increase in the average road traffic noise levels during construction.

The proposed modification would also result in a less than 2 dB increase in traffic noise on Railway Parade, Gleeson Avenue and Unwins Bridge Road.

Traffic noise associated with the construction and operation of the bus layover facility would be subject to future analysis as part of the Temporary Transport Plan for the Sydenham to Bankstown component of the Sydney Metro City & Southwest project. Management of noise impacts would be generally in accordance with the Construction Noise and Vibration Strategy.

11.6.4 Construction vibration

Approved project

The assessment of the approved project identified that construction vibration levels are anticipated to remain well below the vibration screening levels associated with minor cosmetic building damage at all receivers around Sydenham. Vibration levels may, however be noticeable within surface buildings located close to the main tunnel alignment. The impact at these locations would only be apparent for a relatively short period of time (one or two days) as the tunnel boring machines pass by a particular location.

Proposed modification

The works associated with the proposed modification are anticipated to result in exceedances of the cosmetic damage screening criteria of 7.5 mm/s at up to 14 buildings within NCA02, should a large rock-breaker be used at the outer extents of each works area. In practice, it is unlikely that a rock-breaker would be required at all areas and therefore the vibration impacts presented in this assessment is considered to be worst-case.

Consistent with the management approach identified for the approved project, a more detailed assessment of these structures and attended vibration monitoring would be carried out to ensure vibration levels remain below appropriate limits for these structures.

In addition, the proposed modification is anticipated to result in 51 building in NCA02 within the nominated minimum working distance for human comfort vibration. These receivers would be likely to perceive vibration at times during construction works. This is expected to be primarily due to works associated with rock-breakers and other high vibration plant items. In practice vibration impacts from most construction activities would be intermittent within the duration of the works.

11.7 Potential operational noise impacts

11.7.1 Airborne noise

Rail operations

Approved project

The assessment of the approved project identified that noise levels at receivers around Sydenham without the project are generally already close to, or exceeding, the overall noise criteria levels. The assessment concluded:

- There is generally no change in noise levels from the approved project, with the exception of some receivers on the up side of the corridor where the distance to the dive tracks is shortest. However, the predicted noise levels in this area are below the RING absolute noise level criteria
- There are no RING noise level triggers for residential receivers or other sensitive receivers surrounding the Marrickville dive structure.

Proposed modification

Inputs into the airborne noise modelling for the proposed modification are provided in Appendix D. This includes information relating to:

- Rolling stock noise levels
- Locations of track turnouts
- Correction factors for curves and bridges
- Sydney Trains and Sydney Metro train speed profiles
- Trains numbers on the metro line and existing rail lines.

A summary of the predicted worst-case noise levels for the 2034 (future year) scenario are presented in Table 11-12 for residential receivers and Table 11-13 for other sensitive receivers. The future year 2034 scenario has been presented as it results in the highest noise level predictions. Results for the at-opening 2024 scenario are provided in Appendix D.

Table 11-12 Predicted 2034 airborne noise levels – residential receivers surface track works south

NCA	Side	Worst-case predicted noise level (dBA)									
		Without project			With project			Increase			RING triggers
		L _{Aeq} Day	L _{Aeq} Night	L _{Amax}	L _{Aeq} Day	L _{Aeq} Night	L _{Amax}	L _{Aeq} Day	L _{Aeq} Night	L _{Amax}	
01	Up	49	45	69	51	46	69	1.6	1.0	0.0	0
	Down	54	51	73	56	52	73	1.4	0.8	0.0	0
02	Up	-	-	-	-	-	-	-	-	-	-
	Down	67	60	87	70	62	90	3.0	2.0	3.6	9

1 Bold indicates exceedance of criteria

2 For reference the trigger levels are:
development increases existing L_{Aeq(period)} rail noise levels by 2 dB or more, or existing L_{Amax} rail noise levels by 3 dB or more
and
predicted rail noise levels exceed: daytime 65 L_{Aeq(15hour)} or 85 L_{Amax}, night-time 60 L_{Aeq(9hour)} or 85 L_{Amax}

Table 11-13 Predicted 2034 airborne noise levels – other sensitive receivers surface track works south

NCA	Side	Worst-case predicted noise level (dBA)						
		Without project		With project		Increase		RING triggers
		L _{Aeq} Day	L _{Aeq} Night	L _{Aeq} Day	L _{Aeq} Night	L _{Aeq} Day	L _{Aeq} Night	
01	Up	-	-	-	-	-	-	-
	Down	-	-	-	-	-	-	-
02	Up	68	71	74	72	5.3	0.1	1
	Down	70	68	71	68	0.9	0.3	0

The assessment determined that noise levels at the majority of residential and other noise sensitive receptors would comply with the noise trigger levels from the RING.

Exceedances of the noise trigger levels are predicted at nine residential receivers in NCA02 on the Down side of the rail alignment. These locations are shown on Figure 11-3 and are:

- Between 100 and 110 Railway Road, Sydenham (four residential buildings)
- Between 19 and 25 Bridge Street, Tempe (four residential buildings)
- 9 Bridge Street, Sydenham (residential building).

Exceedances of the noise trigger levels are predicted at one other sensitive receiver on the Up side of the rail alignment in NCA02. This location is shown on Figure 11-3 and is Fraser Park, Marrickville (outdoor recreation area – sports field).

As a result feasible and reasonable noise mitigation measures are required to be considered to minimise these RING trigger level exceedances. Discussion on potential noise mitigation options including source control measures, path control measures and receiver control measures is provided in Appendix D.

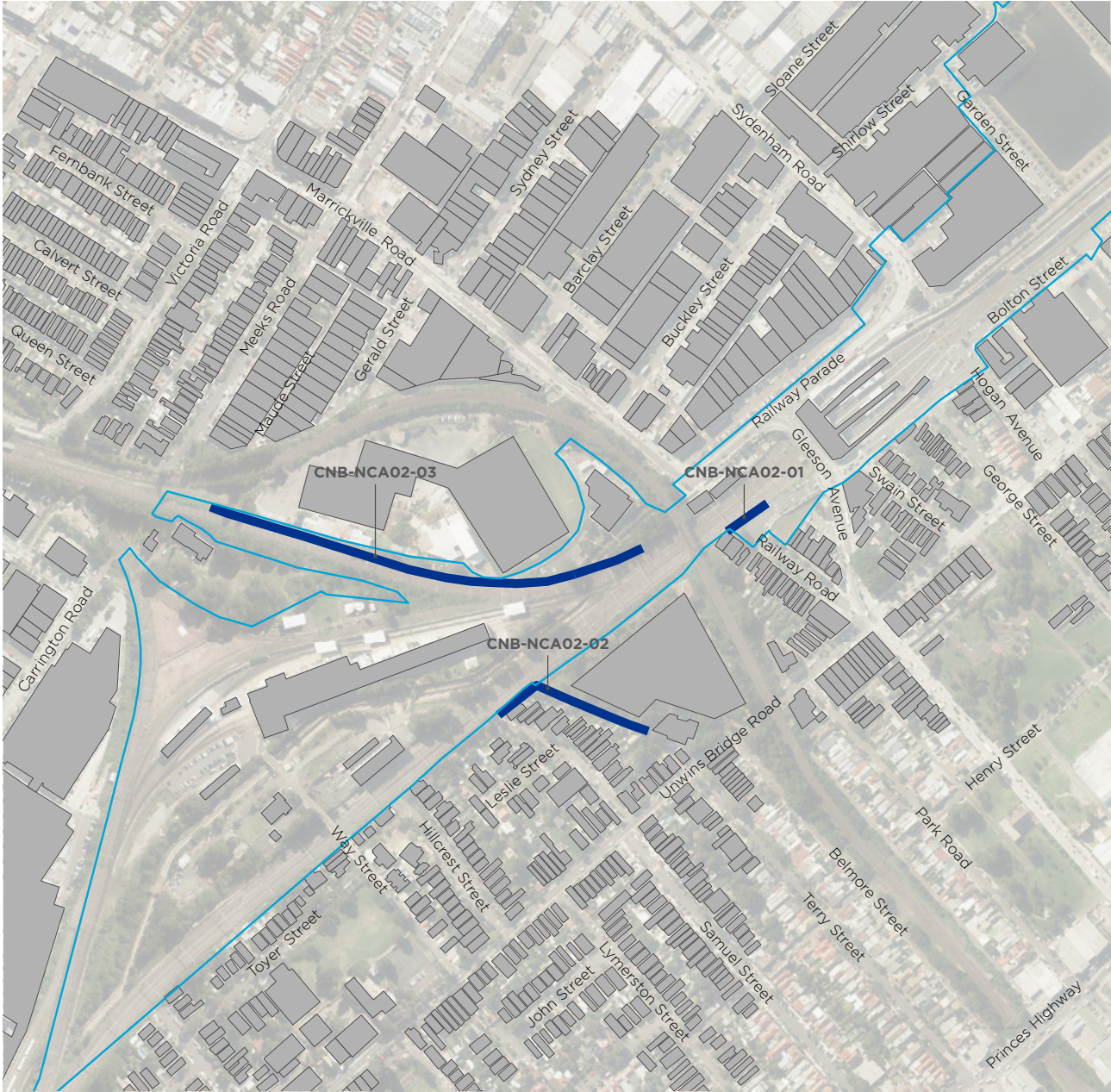
This consideration concluded that, based on the current design of the project, feasible engineering options for the proposed modification to meet the RING criteria may be required in three locations. These are shown on Figure 11-4 and described in Table 11-14. The requirement, extent and height of these barriers would be further considered during detailed design with the aim of not exceeding the trigger levels from the *Rail Infrastructure Noise Guidelines* (Environment Protection Authority, 2013).

Table 11-14 Recommended noise barriers

Side	Barrier ID	Description
Down	CNB-NCA02-01	2 metre high conventional noise barrier
Down	CNB-NCA02-02	3 metre high conventional noise barrier
Up	CNB-NCA02-03	2 metre high conventional noise barrier



Figure 11-3 Locations triggered for consideration of noise mitigation



KEY

Proposed modification area

Recommended noise barriers

Indicative only, subject to design development

0200 m

N

Figure 11-4 Recommended noise barriers

Phased opening

The phased opening of Sydney Metro between Chatswood to Sydenham would require changes to the current rail track configuration and train operations in the vicinity of Sydenham Station. These changes and their likely impact to operational noise during this phased opening period are described in Table 11-15.

Based on this information, the potential changes could result in either a slight increase or slight decrease in rail noise levels at nearby sensitive receivers. Further detailed investigations would be undertaken once detailed design and the train timetable to support phased operations is known. This investigation would include determination of the likely change in noise levels at receivers and consideration of the need for any feasible and reasonable mitigation measures taking into consideration the likely duration of the phased operations.

Table 11-15 Operational noise changes during phased opening

Parameter	Changes during phased opening	Potential change to rail noise levels
Track configuration	- Platforms 1 and 2 at Sydney Station converted to metro operations - Platforms 3 and 4 shard operations of T2 Airport Line and T3 Bankstown Line.	Potential increased rail noise of around 1-2 dB
Track alignment	Realignment of tracks is anticipated to be minimal, with horizontal and vertical alignment changes of less than one metre.	Negligible
Track features	- Additional track turnouts to the south of Sydenham Station to connect the T3 Bankstown Line to the track servicing Sydenham Station platforms 3 and 4 - Additional track turnouts to connect the Sydenham Maintenance Centre shunt movement to the tracks servicing Sydenham Station platforms 3 and 4.	Potential increased rail noise of around 1-3 dB
Train speed changed	Potential reductions in train speeds in the vicinity of the track turnouts	Potential decreased rail noise of up to 5 dB

Sydney Metro Trains Facility South

The Sydney Metro Trains Facility South did not form part of the approved project and, as such, the potential noise impacts from this facility are in addition to those identified for the approved project.

A range of operating scenarios at the Sydney Metro Trains Facility South have been modelled to assess the potential airborne noise emissions for both the at-opening and future operations during the early morning, daytime, evening and night-time periods, under both neutral weather conditions and adverse weather conditions.

The details and assumptions of these scenarios are provided in Appendix D.

For neutral weather conditions, the modelling results indicate:

- At-opening noise levels are predicted to comply with the applicable noise criteria at all locations under all operating conditions
- For the future year scenarios exceedances of the relevant criteria are predicted:
 - During the early morning (up to 3 dB exceedance) when eight trains are being prepared
 - During the night-time (up to 4 dB exceedance) when 14 trains are being cleaned
 - There are no predicted exceedances of the sleep disturbance criteria for the at-opening or future year scenarios.

Under adverse weather conditions, the modelling results indicate:

- For the at-opening scenarios exceedances of the relevant criteria are predicted:
 - ◆ During the early morning (up to 1 dB exceedance) when two trains are being prepared
 - ◆ During the night-time (up to 1 dB exceedance) when two trains are being prepared
 - ◆ During the night-time (up to 5 dB exceedance) when six trains are being cleaned
- For the future year scenarios exceedances of the relevant criteria are predicted:
 - ◆ During the early morning (up to 7 dB exceedance) when two trains are being prepared
 - ◆ During the night-time (up to 1 dB exceedance) when two trains are being prepared
 - ◆ During the night-time (up to 8 dB exceedance) when six trains are being cleaned
- There are minor exceedances of the sleep disturbance criteria at-opening (of up to 1 dB) and for the future year (of up to 3 dB).

To mitigate these predicted exceedances, several noise barrier configurations were investigated including locations on the site boundary and within the site. This analysis found that barriers are unlikely to be effective due to the elevation of the nearby receivers compared to the facility. In particular, the residential areas to the east and south are at a higher elevation than the facility which would negate the majority of the benefit from providing noise barriers.

As a result, procedural measures are likely to be the most feasible and reasonable options for the facility. These measures are provided in section 11.8.

Sydenham Station and ancillary facilities

The assessment of operational noise from stations and ancillary facilities for the approved project identified the nearest receiver types and the relevant external noise criteria for each services location to comply with the *Industrial Noise Policy* (EPA, 2000). Proposed upgrades to Sydenham Station and associated ancillary facilities, including the bus layover facility, did not form part of the approved project and, as such, the potential noise impacts from this facility are in addition to those identified for the approved project.

The external noise criteria to be applied around Sydenham Station as a result of the proposed modification are provided in section 11.5.1.

As identified for the approved project, these criteria would be used to guide the detailed design so that compliance with the applicable criteria from the *Industrial Noise Policy* (EPA, 2000) is achieved. Based on previous experience on projects such as Epping to Chatswood Rail Line, it is expected that these levels can be achieved through the use of appropriate noise attenuation measures such as equipment selection, positioning of plant and ventilation discharges, in-duct attenuators, and acoustic enclosures.

11.7.2 Ground-borne noise

The assessment of the approved project identified that, in the vicinity of Sydenham, the proposed ground-borne noise levels are predicted to comply with the ground-borne noise objectives at all residential, commercial and other sensitive receiver locations.

The assessment of the proposed modification identified that all receivers are predicted to comply with the applicable ground-borne noise criteria.

11.7.3 Ground-borne vibration

The assessment of the approved project identified that, in the vicinity of Sydenham, all receivers located above or near the tunnel alignment would comply with the ground-borne vibration design objectives (and the human comfort vibration criteria from *Assessing Vibration: A technical guideline* – DEC, 2006).

The assessment of the proposed modification identified that all receivers are predicted to comply with the applicable ground-borne vibration criteria.

11.8 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy for the project, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans. The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified.

The noise and vibration assessment for the proposed modification identified that existing mitigation measures OpNV1 is required to be applied to the surface track works south location. Additional operational noise and vibration mitigation measures have also been identified in relation to operational noise impacts at the Sydney Metro Trains Facility South and further investigation of potential rail noise impacts during the phased operations. These changes to mitigation measures are provided in Table 11-15 with the additions shown as **bold** text.

In addition, the conditions of approval issued for the approved project would also apply to the proposed modification.

Table 11-15 Mitigation measures – noise and vibration

Ref	Mitigation measure	Applicable location(s)
OpNV1	The height and extent of noise barriers adjacent to the northern and southern surface track works would be confirmed during detailed design with the aim of not exceeding trigger levels from the <i>Rail Infrastructure Noise Guidelines</i> (Environment Protection Authority, 2013). At property treatments would be offered where there are residual exceedances of the trigger levels.	STW, STWS
OpNV4	Procedural mitigation measures would be implemented, where feasible and reasonable, to minimise noise emissions from the Sydney Metro Trains Facility South with the aim of meeting the relevant criteria derived from the <i>Industrial Noise Policy</i> (Environment Protection Authority, 2000). This would consider measures such as: ○ Minimising the number of trains being cleaned simultaneously ○ Cleaning trains without air conditions systems in use ○ Limit cleaning and start-up operations during the night-time and early morning periods to the trains stabled furthest from the most affected residences. In the event that procedural measures are not sufficient to achieve compliance with the criteria derived from the <i>Industrial Noise Policy</i>, at-property treatments would be offered to affected receivers.	MDS

Ref	Mitigation measure	Applicable location(s)
OpNV5	Further detailed investigations would be undertaken of the phased operations once the detail of these changes are determined. This investigation would include determination of the likely change in noise levels at receivers and consideration of the need for any feasible and reasonable mitigation measures taking into consideration the likely duration of the phased operations.	STWS

¹ STW: Surface track works; CDS: Chatswood dive site; AS: Artarmon substation; CN: Crows Nest Station; VC: Victoria Cross Station; BP: Blues Point temporary site; GI: Ground improvement works; BN: Barangaroo Station; MP: Martin Place Station; PS: Pitt Street Station; CS: Central Station; WS: Waterloo Station; MDS: Marrickville dive site (including Sydney Metro Trains Facility South); SS: Sydenham Station; STWS: Surface track works south Metro rail tunnels: Metro rail tunnels not related to other sites (eg TBM works); PSR: Power supply routes.

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LAND USE AND PROPERTY

CHAPTER TWELVE



12 Land use and property

This chapter provides an assessment of the potential changes to impact on land use and property as a result of the proposed modification, and identifies mitigation measures to minimise these impacts.

12.1 Existing environment

The existing land use and property environment in and around Sydenham was described in the Environmental Impact Statement. This section provides additional land use and property information specifically relating to the proposed modification at Sydenham Station and Sydney Metro Trains Facility South. The remaining works for the proposed modification would be carried within the rail corridor, zoned for infrastructure land uses.

12.1.1 Sydenham Station

Land use

Sydenham Station is located about 6.5 kilometres south-west of the Sydney CBD. The station is a junction station on three Sydney Trains rail lines – the T2 Airport Line; the T3 Bankstown Line; and the T4 Eastern Suburbs and Illawarra Line.

The station is surrounded by roads to the north (Railway Parade), west (Gleeson Avenue, which crosses the rail corridor via a road overbridge), and south (Burrows Avenue).

An industrial area, which includes food manufacturing, auto services, warehouse storage, office space, and distribution premises, is located further to the north and north-west of the station. Industrial and commercial land uses, and a council works depot, are located to the north-east, between Bolton Street and Unwins Bridge Road. A large hotel (the General Gordon) and residential land uses, characterised mainly by terrace housing, are located to the south of the station.

Recreational land uses, including Fraser Park, Tillman Park, and Sydenham Green, are located further to the west, south-west, and south respectively.

Land use, derived from land zoning, surrounding the site is shown in Figure 12-1.

Planning controls

The Marrickville Council LEP 2011 defines the land use zoning surrounding the Sydenham Station as a mix of the following zones: SP2 Infrastructure, IN1 General Industrial, IN2 Light Industrial, B1 Neighbourhood Centre, RE1 Public Recreation, R2 Low Density Residential and R3 Medium Density Residential.

The Sydenham Station site and immediate surrounds is zoned SP2 Infrastructure (Rail Infrastructure Facilities). The aims of this zone are to provide for infrastructure and related uses, prevent development that is not compatible with or that may detract from the provision of infrastructure and protect and provide for land used for community purposes.

12.1.2 Sydney Metro Trains Facility South

Land use

The proposed Sydney Metro Trains Facility South would be located about 750 metres north-east of Sydenham Station in Marrickville. To the north of the proposed site is a general industrial area. To the east is generally a low-density residential area interspersed with high density residential. To the south and west of the site is a general and light industrial area followed by a low-density residential area.

The proposed site is currently used for industrial purposes and currently contains several large warehouses, at-grade parking, and limited vegetation, generally consisting of street trees.

A road (Murray Street) and a drainage channel area are also located on the site.

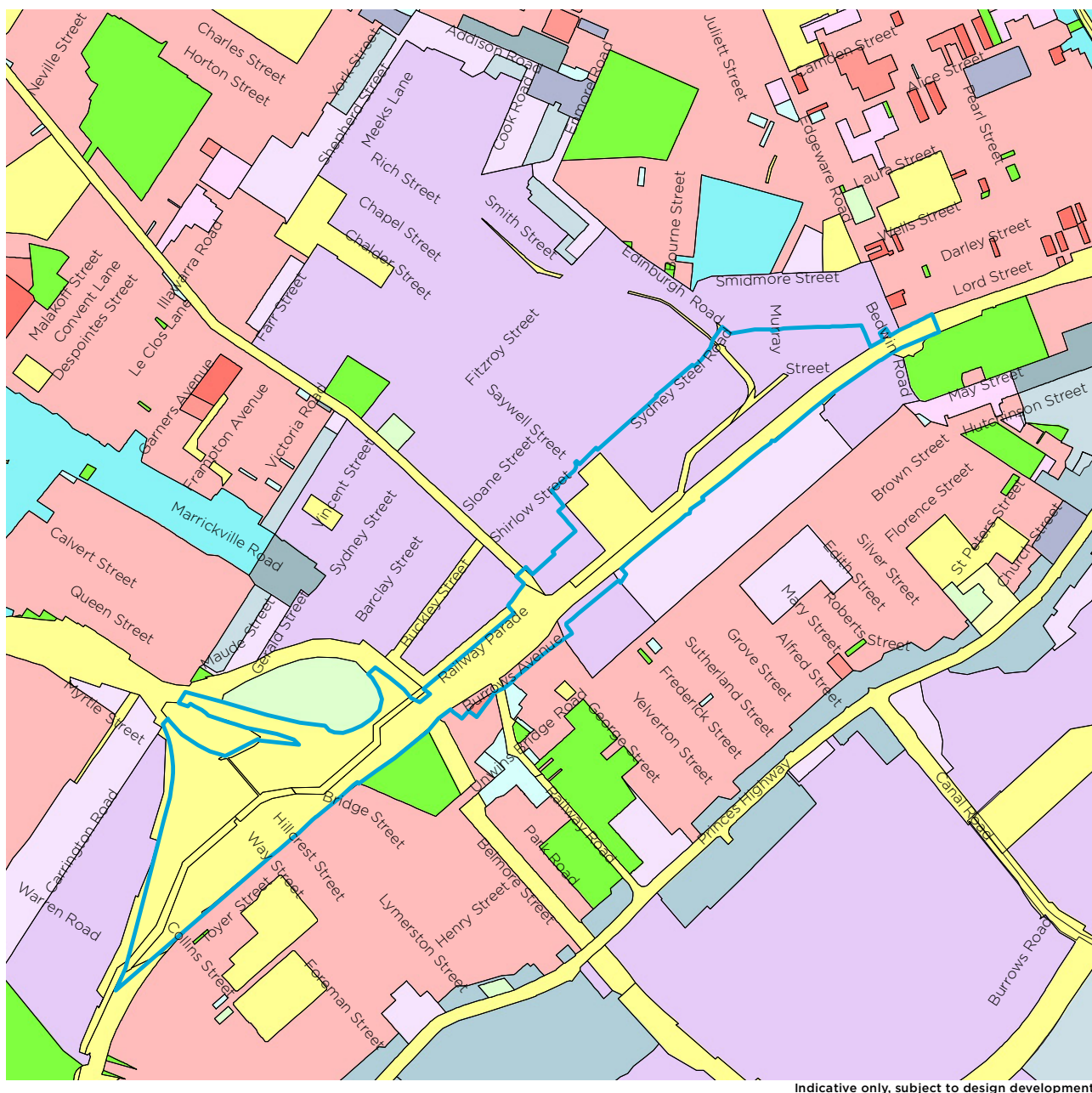
The site would be bounded by Sydney Steel Road to the north, Edinburgh Road to the east, Sydney Trains rail corridor to the south and the existing Sydenham Storage Pit (water detention basin) to the west.

Land use, derived from land zoning, surrounding the site is shown in Figure 12-1.

Planning controls

The *Marrickville Local Environmental Plan 2011* (Marrickville Council LEP 2011) defines the land use zoning surrounding the proposed Sydney Metro Trains Facility South site as a mix of the following zones: SP2 Infrastructure, IN1 General Industrial, IN2 Light Industrial, RE1 Public Recreation, R1 General Residential, R2 Low Density Residential and R4 High Density Residential.

The proposed Sydney Metro Trains Facility South site and immediate surrounds is zoned IN1 General Industrial. The aims of this zone are to provide a wide range of industrial and warehouse land uses, encourage employment opportunities, and minimise any adverse effect of industry on other land uses.



Indicative only, subject to design development

KEY

 Proposed modification area

Zone

 B1 Neighbourhood Centre	 IN1 General Industrial	 RE1 Public Recreation
 B2 Local Centre	 IN2 Light Industrial	 RE2 Private Recreation
 B4 Mixed Use	 R1 General Residential	 SP1 Special Activities
 B5 Business Development	 R2 Low Density Residential	 SP2 Infrastructure
 B6 Enterprise Corridor	 R3 Medium Density Residential	
 B7 Business Park	 R4 High Density Residential	

0 400 m 

Figure 12-1 Land use zoning in the vicinity of Sydenham Station and Sydney Metro Trains Facility South

12.1.3 Integration with planning strategies

Similar to the approved project, the proposed modification would be implemented in an integrated manner in direct collaboration with key planning agencies, including the Department of Planning and Environment, the recently formed Greater Sydney Commission and the Inner West Council.

Strategic planning for the study area is being undertaken by a number of agencies, including the Department of Planning and Environment, the Greater Sydney Commission, and the Inner West Council. This strategic planning is separate to the planning and approval process for the proposed modification.

The main strategies relevant to future land use planning for the study area are summarised below.

State strategies

Draft Sydenham to Bankstown Urban Renewal Corridor Strategy

The draft *Sydenham to Bankstown Urban Renewal Corridor Strategy*, and supporting *Land Use and Infrastructure Analysis* was released by the Department of Planning and Environment in 2015. The strategy was prepared to identify opportunities for urban renewal around the stations over the next 20 years.

A draft land use and infrastructure plan is proposed for each station precinct along the Sydenham to Bankstown corridor, indicating potential future built form and development opportunities; new linkages for pedestrians, vehicles, and public transport; improvements to and additional open space and public domain works; potential to enhance or provide new community infrastructure; and opportunities for new housing and jobs. The draft vision for the area around Sydenham Station is that it is a more intensive and diverse business precinct taking advantage of its proximity to the city and inner west.

The strategy aims to encourage local services, retail and convenience shops in close proximity to the railway stations. At Sydenham, it aims to broaden the range of business activities with the addition of the proposed Sydenham 'enterprise business area', making the area attractive for new creative industries and start-up businesses. The predicted increase in employment (number of jobs) in the vicinity of Sydenham Station is expected to be 1,101.

Although the strategy forecasts that about 36,000 additional dwellings could be built within the corridor from Sydenham to Bankstown by 2036, residential development in the vicinity of Sydenham Station is expected to remain largely unchanged, with the exception of a small area of medium to high rise housing to the west of Sydenham Station.

A Plan for Growing Sydney – the Sydney metropolitan strategy

A Plan for Growing Sydney, which was released in December 2014, is the NSW Government's 20 year plan for the Sydney metropolitan area. It provides a direction for Sydney's productivity, environmental management, and liveability; and for the location of housing, employment, infrastructure and open space.

One of the key directions of the plan is to accelerate housing supply across Sydney in established urban areas through the Priority Precincts and UrbanGrowth NSW programs. The Government is working to match population growth with investment in infrastructure. The Sydenham to Bankstown Urban Renewal Corridor is considered to be a priority precinct, with appropriate future planning undertaken by the Department of Planning and Environment.

A key direction noted by the plan is to 'expand the global economic corridor', which extends from Macquarie Park through the Sydney CBD to Port Botany and Sydney Airport. Sydenham and Marrickville are located at the south-western edge of the global economic corridor. An action under this direction is to 'invest to improve infrastructure and remove bottlenecks to grow economic activity'.

Greater Sydney Commission – district plans

In 2016, the Greater Sydney Commission was established to coordinate and align the planning that will shape the future of Greater Sydney. The Sydney Region has been divided into six districts with a district plan to be developed for each district. Draft district plans have been exhibited for comment in late 2016. The proposed modification is located within the Central district.

The draft plan seeks to increase the number of jobs and dwellings within the plan area. The plan notes that urban renewal activities, such as the draft *Sydenham to Bankstown Urban Renewal Corridor Strategy*, would assist with driving this growth, particularly along the T3 Bankstown Line. The metro network, which would include the proposed modification, is identified as being a key driver.

Local strategies

Marrickville Development Control Plan 2011

The proposed modification is located across two planning precincts as identified in the *Marrickville Development Control Plan 2011* (Marrickville DCP), with Sydenham Station included in both precincts. The area to the north and west of the rail corridor, including Sydenham Pit and Drainage Pumping Station and the Sydney Metro Trains Facility South, is located within the Sydney Steel precinct (Precinct 43). The proposed modification would support the desired future character of the precinct by maintaining the land-use patterns of the area, which generally consist of medium-large lot general industrial and commercial business uses. The new station entrance and pedestrian plaza on Sydenham Road and landscaping works around the Sydney Metro Trains Facility South would enhance the public domain and support both pedestrian and cyclist access. Sydenham Pit and Drainage Pumping Station would be retained as State significant heritage items and would provide opportunities for new public access to the pumping station building.

The area to the south and east of the rail corridor is located within the Unwins Bridge Road precinct (Precinct 31). The predominating land use in this precinct is low density residential, with a mixture of industrial, commercial and community land uses including St Peters Town Hall and a number of schools and parks. The proposed modification would generally support the desired future character of the precinct through the upgrade of the Burrows Avenue station entrance. The station entrance would support pedestrian and cyclist access to the station and would enhance the amenity of the public domain. The proposed modification would not impact heritage items within the precinct (excluding Sydenham Station) or the low density residential character of the precinct.

Sydenham Station Creative Hub Vision and Planning Proposal 2016

The proposed modification is located within the area identified by Inner West Council for the Sydenham Station Creative Hub. The vision for the Creative Hub is to balance the historic and current industrial land uses with emerging creative industries, including entertainment, artistic and design. The proposed modification would provide new public transport links to this area and a new pedestrian plaza within the Creative Hub area on Sydenham Road. The proposed modification would maintain the traditional and light industrial land uses to the north and west of the rail corridor identified in the vision.

The design of the Sydney Metro Trains Facility South allows for future rail corridor development above and around the facility. The future development potential would allow for the Sydenham Station Creative Hub vision to be realised.

A planning proposal for the Sydenham Station Creative Hub has gateway approval from the Department of Planning and Environment and will be placed on public exhibition in mid-2017.

Marrickville Urban Strategy 2007

The Marrickville Urban Strategy establishes an environment and planning vision for the area that formerly comprised the Marrickville local government area (now part of the Inner West local government area), including the proposed modification site. The proposed modification site is primarily located within the Marrickville / Sydenham Strategic Employment Area identified in the Marrickville Urban Strategy.

The proposed modification would contribute to the achievement of strategy directions by improving local public transport, walking and cycling connections in and around Sydenham Station. The proposed modification would also provide opportunities to strengthen and renew areas within the strategic employment lands along the rail corridor to the north and west of Sydenham Station.

Marrickville Integrated Transport Strategy 2007

The Marrickville Integrated Transport Strategy aims to address local transport issues and foster sustainable transport initiatives in the area that formerly comprised the Marrickville local government area (now part of the Inner West local government area), including the proposed modification site. A variety of local transport infrastructure is located within the proposed modification site, including Sydenham Station, local and State classified roads, bus stops, bike parking facilities and pedestrian footpaths.

The proposed modification would integrate public transport modes at Sydenham Station as recommended by the Marrickville Integrated Transport Strategy. The proposed modification would increase rail connectivity at Sydenham Station by providing both metro and suburban rail services. Pedestrian and cycle connections to Sydenham Station would also be improved by the proposed modification through the provision of new pedestrian entrances and plazas on Burrows Avenue and Sydenham Road. Accessible bus stops at Sydenham Station would also be provided by the proposed modification.

Marrickville Public Art Strategy 2003

The proposed modification would provide opportunities to contribute to the Marrickville Public Art Strategy through functional (architectural forms and facades, textiles, street furniture) and applied (paving and pathways, fencing and landscape features) design. The proposed modification would seek to incorporate a responsive design approach to enhance aspects of the built and natural environment and reaffirm the sense of place of each site.

While the proposed modification would require the removal of some instances of street art around the Sydney Metro Trains Facility South site, the proposed modification would provide new opportunities to incorporate street art into the surrounding landscape.

12.2 Potential impacts

12.2.1 Property

A direct impact on property and land use is expected where land would be acquired to enable construction of the Sydney Metro Trains Facility South and at Sydenham Station for the provision of station entrances, plazas and shared zones. Property acquisition for the proposed modification would occur during the planning and pre-construction phases.

Providing the new station forecourt at Sydenham Station would require acquisition of land used for industrial purposes to the north of the station. The use of this land would change from industrial to transport, which would be in context with the adjacent land uses. Development of the Sydney Metro Trains Facility South requires acquisition of land used for industrial purposes (by a number of strata properties) on Edinburgh Road, Sydenham. Land to the south-west, south, and east of this property was acquired for the approved project. The additional acquisition would result in a minor impact, given the use of the site as a construction area for the approved project.

The property acquisitions required for the proposed modification are summarised in Table 12-1 and shown in Figure 12-2.

Consistent with the approved project, all property acquisition would be managed in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*.

The land for the bus layover facility on Burrows Avenue is currently a vacant lot owned by RailCorp (and zoned for medium density residential development).

Table 12-1 Additional property acquisition and leases required for the proposed modification

Modification feature	Lot to be acquired	Address	Existing land use	Number of registered property interests
Sydenham Station and services buildings	CP & Lot 1, SP73349, Lots 3 to 8 SP78714	11 Sydenham Road, Marrickville	Industrial	Freehold: 8 Leasehold: 7
	Untitled Carriageway and Lot 1 DP411281	Railway Parade (part road and island refuge)	Infrastructure (access road)	Freehold: 2 Leasehold : 0
Sydney Metro Trains Facility South	SP34104	102 to 112 Edinburgh Road, Marrickville	Industrial	Freehold: 20 Leasehold: 13
	Untitled Carriageway	Land to Garden Street, Marrickville	Infrastructure (access road)	Freehold: 1 Leasehold: 0



Figure 12-2 Additional property acquisition at Sydenham due to the proposed modification

12.2.2 Land use

The assessment of the approved project identified the use of 70,000 square metres of industrial land for construction of the Marrickville dive site (southern). This site, in addition to the industrial land that would be acquired for the proposed Sydney Metro Trains Facility South, would then continue to be used for construction of the proposed modification.

Operational land use impacts for the approved project identified a minor impact in the change in land use from industrial to transport infrastructure at the location of the approved tunnel dive and services facility site and identified residual land (land required for construction but not operation) that would be available for potential reuse after completion of construction of the approved project. The introduction of a stabling and maintenance facility at this location, as part of the proposed modification, would result in land use of the residual area from the approved project being used as transport infrastructure. As there are other areas of industrial land locally, the proposed modification is still considered to have a minor land use impact overall.

The proposed modification would also result in the change in land use for the bus layover facility from a vacant lot to transport infrastructure.

As identified in Chapter 6 (Modification description – operation), the proposed modification would include enabling works to support future rail corridor development at and above the Sydney Metro Trains Facility South, including civil works for a screening development. The future rail corridor development would be subject to a separate approval process.

The potential operational land use impacts, benefits and opportunities at Sydenham Station include:

- Improved access to the station from the north and south, with new plazas, improving amenity for customers, and occupiers of surrounding land uses
- Potential for a small retail store in the entry plazas.

These changes would have the potential for beneficial impacts to local businesses. This is considered further in Chapter 13 (Business impacts).

The proposed modification would also provide improvements in accessibility to Sydenham Station and better integration of the rail network with existing and planned pedestrian, cycle and bus networks. The proposed modification would provide the opportunity for urban renewal and future development in the vicinity of Sydenham Station and Sydney Metro Trains Facility South.

12.2.3 Future development opportunities

The modification presents opportunities for positive change within the vicinity of Sydenham Station by supporting urban renewal and broader economic benefits by facilitating strong business-to-business connectivity, and creating attractive, vibrant and highly accessible places.

The modification would also support future development opportunities through the provision of enabling works for rail corridor development at and above the Sydney Metro Trains Facility South. This could positively impact on future property values and land use.

The modification would play a small part in facilitating the future development envisaged by the broader urban renewal program.

12.3 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans.

The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified. These mitigation measures would adequately address the potential additional land use and property impacts. No additional or revised land use and property mitigation measures are considered necessary. In addition, the conditions of approval issued for the approved project would also apply to the proposed modification.

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BUSINESS IMPACTS

CHAPTER THIRTEEN



13 Business impacts

This chapter provides an assessment of the potential change in impacts on local businesses as a result of the proposed modification, and identifies mitigation measures to minimise these impacts.

13.1 Assessment methodology

The methodology for the assessment of potential changes to local business impact associated with the proposed modification, used the same approach as was carried out for the approved project and included:

- Defining the study area and local business precincts for the purpose of the assessment
- Examination of the existing business composition and function in the modification area, which involved:
 - ◆ Visiting sites and scoping of local business uses, their operations including operating hours and their proximity to the proposed station, stabling facility and construction areas
 - ◆ Defining the employment characteristics of the modification area using Bureau of Transport Statistics Journey to Work data
 - ◆ Reviewing data and reports from the Australian Bureau of Statistics, Transport for NSW's Transport Performance and Analytics unit (created following merger of the Bureau of Transport Statistics and the Bureau of Freight Statistics), and the Inner West and Canterbury Bankstown councils
 - ◆ Analysing 'Employment by Industry' using Australian and New Zealand Standard Industrial Classification (ANZSIC), a standard classification developed by the Australian Bureau of Statistics for use in Australia and New Zealand for the analysis of industry statistics.
- Identification and survey of local businesses to develop an understanding of current business operations, issues and concerns
- Review of local business impact studies for comparable projects, including lessons learned and mitigation strategies
- Assessment of potential changes to impacts of the approved project based on analysis of research and feedback to define a list of positive and negative impacts, categorised by business type and location, through construction and operation
- Development of mitigation strategies to minimise construction phase disruption and maximise leverage of the proposed modification for local businesses once it is operational.

13.2 Existing environment

The existing local business environment in and around Sydenham was described in the Environmental Impact Statement. This section provides additional local business information specifically relating to the proposed modification.

13.2.1 Local business precinct

The local business precinct identified for assessment purposes is extensive as the surrounding areas include a large number of businesses. Therefore, two local business areas within the wider local business precinct have been identified for the purposes of this assessment. These are referred to as the Sydney Metro Trains Facility South area and the Sydenham Station area.

At the most recent Census (2011), there were 7417 people working within the local business precinct. The industrial significance of the precinct is highlighted by the fact that manufacturing (2247 jobs) comprises nearly 30 per cent of all jobs in the precinct. Wholesale trade (1074 jobs) is also a prominent source of employment in the precinct.

The key business and employment characteristics of each sub-precinct are described in the following sections.

Sydney Metro Trains Facility South area

The Sydney Metro Trains Facility South area is situated on the northern side of the rail corridor and comprises mostly industrial land uses, with food processing and distribution being common. These industrial uses located within this area benefit from existing infrastructure as well as relatively close proximity to Sydney Airport, Port Botany and the Sydney CBD.

Sydenham station area

The Sydenham Station area is situated on the southern side of the rail corridor. It is a typical inner west residential suburb comprising mostly medium density residential dwellings, light industrial land uses, small pockets of residential and commercial uses and scattered retail outlets. Local businesses include cafés, a local pub, takeaway food shops, restaurants as well as a small retail strip near the intersection of Unwins Bridge Road and Gleeson Avenue.

13.2.2 Travel patterns

Private vehicle is the preferred mode of transport for people commuting to this precinct (66 per cent). This reflects the fact that the precinct has a strong industrial presence and available parking. Train (17 per cent) and to a lesser extent buses (three per cent) are other important modes for commuters, reflecting the relatively good public transport connections in the area.

Future vision for the precinct

The precinct will continue to grow as an employment centre and residential suburb. This will be stimulated by the precinct's proximity to Sydney CBD, Sydney Airport, Port Botany and Sydenham Station.

The intensive industrial uses, especially on the northern side of Sydenham Station, will likely come under pressure to convert to residential uses, a process which has already begun.

The southern side of the station has considerable scope for development, but it is constrained by aircraft noise, which is a major inhibitor to future development and unlikely to change.

13.3 Potential impacts

The potential change in impacts of the proposed modification compared to the approved project has been assessed for the local business precinct for both the construction and operation phases (refer to Table 13-1). The assessment considers whether a particular impact is:

- Positive or negative
- Significant, moderate, slight or neutral
- During construction and / or operation.

Table 13-1 Impact assessment ratings

Impact rating	Description
Significant negative	Impacts with serious, long term or possibly irreversible effects. This category also includes localised impacts that can only be addressed through compensatory measures (as in the case of property acquisition).
Moderate negative	Impacts that may be short, medium or long term in duration and most likely to respond to management actions.
Slight negative	Impacts that would have minimal effect, could be short term, can be mitigated, would not cause substantial detrimental effects, and may be confined to a small area.
Neutral	No discernible or predictable positive or negative impact.
Slight positive	Impacts that would have minimal effect, could be short term, and may be confined to a small area.
Moderate positive	Impacts that may be short, medium or long term in duration and may result in a positive outcome in terms of new opportunities and outcomes of enhancement or improvement.
Significant positive	Impacts that would result in substantial and long term improvements or enhancements to the existing environment.

13.3.1 Construction

While construction of the proposed modification, as part of the approved project, is likely to result in broader economic benefits by way of job generation and construction multipliers, local or precinct level businesses and landowners would experience a degree of disruption and other temporary negative impacts, particularly, those located close to the construction sites. The main potential for business impacts during construction would occur as a result of:

- Property impacts due to acquisition or lease termination
- Changes to access arrangements and connectivity
- Amenity impacts as a result of construction works
- Increased demand for goods and services.

A summary of the results of the business impact assessment in relation to these potential impacts in both local business areas is provided in Table 13-2.

Table 13-2 Construction impact assessment

Impacts during construction of the proposed modification	Impact from modification	Impact from approved project	Change in impact
Servicing and delivery access New and altered signals at intersections could result in constraints or restrictions to access for businesses located close to the site. Construction related traffic congestion is not expected to be a major issue for local businesses because any increases in delays would be relatively minor.	Moderate negative	Moderate negative	No change in impact
Loss of on-street parking On-street parking is a major factor in business patronage in the area. As it is relatively dense for an industrial area, the on-street parking is considered an important asset both for staff parking and for customers. The construction work for the approved project would result in the estimated loss of up to four car parking spaces in the local business precinct, the proposed modification would result in an additional loss of parking around Sydenham Station.	Slight negative	Slight negative	An increase in parking loss is anticipated, however this loss is not likely to be substantial and would primarily be during periods of rail possession, when demand for parking is considered to be lower. The overall impact would remain as slight negative.
Noise, vibration and dust Construction work, including excavation, could disturb businesses and the work environment, although expected impacts would be substantially reduced through the implementation of mitigation measures. Additionally, there are minimal business uses with high sensitivity to noise, vibrations or dust in proximity to the construction areas.	Moderate negative	Moderate negative	No change in impact
Property acquisition and lease cessation The approved project requires the acquisition of 13 properties around the Marrickville dive site. The proposed modification would require additional acquisition and the associated acquisition or relocation of occupying businesses (industrial and warehousing oriented) in the Sydney Metro Trains Facility South area and in the Sydenham Station area. Considering the size of the precinct, there is the potential for businesses to relocate within the same area.	Significant negative	Significant negative	Additional property acquisitions or lease terminations would be required for the proposed modification. The overall impact would remain as significant negative.
Demand for services As a mostly industrial area, local businesses may benefit during the construction phase of the proposed modification from increased demand for industrial services or construction materials compared to the approved project.	Moderate positive	Moderate positive	No change in impact

Impacts during construction of the proposed modification	Impact from modification	Impact from approved project	Change in impact
Increased trade for food and beverage The increase in the number of workers required during construction of the proposed modification would benefit food and beverage outlets and other retailers, particularly those on the eastern side of the rail corridor.	Moderate positive	Moderate positive	No change in impact

Operation

Table 13-3 outlines the impacts during operation for the proposed modification. Identified impacts at the local and regional scales would largely be positive due to the enhanced capacity and frequency of transport services, which would improve access to the Sydney CBD.

Negative impacts for local businesses during operation would include the potential for increased commercial rents, increased levels of competition, changes to customer access and parking, and noise.

Table 13-3 Operational impact assessment

Impacts during operation of the proposed modification	Impact from modification	Impact from approved project	Change in impact
Noise and vibration Noise and vibration from the proposed modification is not expected to exceed adopted criteria (refer to Chapter 11 – Noise and vibration).	Moderate negative	Moderate negative	Impacts on local businesses from the operation of the Sydney Metro Trains Facility South or Sydenham Station were not part of the approved project. Some exceedances are predicted during certain operating conditions and activities. Opportunities for mitigation and management are discussed further in Chapter 11 – Noise and vibration.
Development stimulus The proposed modification would create a positive opportunity for the redevelopment of some under-utilised sites and locations in the precinct (subject to separate assessment and approval processes). This could result in additional housing and business opportunities with the additional population supporting demand for businesses and services.	Significant positive	Significant positive	No change in impact

Impacts during operation of the proposed modification	Impact from modification	Impact from approved project	Change in impact
Enhanced access for customers The proposed modification would create a major gateway for additional customers in the precinct. This would have major benefits for existing businesses in this precinct and attract investment from new businesses. Additionally, the proposed modification would result in increased connectivity for employees within the industrial precinct to the north of the station and along Bolton Street to the south and increased connectivity to the café and pub on George Street.	Significant positive	N/A	Impacts on local businesses from the operation of the Sydney Metro Trains Facility South and Sydenham Station regarding these impact types were not part of the approved project.
Enhanced business connectivity The proposed modification, as part of the approved project, would enhance connections between the precinct and business and employment nodes within the Sydney CBD and Global Economic Corridor. This would enhance the appeal of the precinct as a place for businesses to invest and support the continued growth of the economic, innovation and research clusters in the southern and western sections of Sydney.	Significant positive	N/A	
Staff access, recruitment and retention The proposed modification, as part of the approved project, would improve connectivity to employment and residential locations across Sydney, which would enhance the appeal of the precinct to potential employees, and improve the prospects for retaining them. It would also lead to job generation for local residents.	Significant positive	N/A	
Loss of parking The removal of on-street parking is required for the station interchange and design resulting in a permanent loss of 36 car parking spaces at Sydenham Station. This loss of car parking spaces may result in: - Reduced customer access potentially acting as a deterrent - Reduction in customers and business revenue - Reduced efficiency and reliability of deliveries and servicing - Reduced employee access and workplace productivity.	Slight negative	N/A	

Impacts during operation of the proposed modification	Impact from modification	Impact from approved project	Change in impact
Visual amenity It is likely that the Sydney Metro Trains Facility South would be absorbed into its surrounding industrial locality with minimal impacts to visual amenity. The café on Burrows Avenue would benefit from increased amenity including potential street trees and the new station plaza.	Neutral	N/A	
	Slight positive	N/A	
Urban renewal and development opportunity The proposed modification has the potential to result in the following: ○ Increase in potential business and residential population leading to potential increase in sales and business revenue ○ Increased competition for some businesses ○ Improvements to streetscape amenity and public realm as a result of new station development ○ Potential increased commercial rents with capacity to push some businesses out.	Moderate positive at a local economy scale	N/A	
	Slight negative at a local business scale	N/A	
Land values The proposed modification, as part of the approved project, would improve the capacity and reliability of public transport, which would increase the appeal of the surrounding area and likely create benefits for landowners.	Moderate positive	N/A	

13.4 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans.

The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified. These mitigation measures would adequately address the potential additional local business impacts. No additional or revised local business mitigation measures are considered necessary.

In addition, the conditions of approval issued for the approved project would also apply to the proposed modification. Of relevance this includes condition E64 requiring the development of a Business Management Plan to minimise impacts on businesses adjacent to major construction sites.

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NON-ABORIGINAL HERITAGE

CHAPTER FOURTEEN



14 Non-Aboriginal heritage

This chapter provides an assessment of the potential change in impact on non-Aboriginal heritage as a result of the proposed modification, and identifies mitigation measures to minimise these impacts.

14.1 Assessment methodology

The scope of the non-Aboriginal heritage assessment used the same method as the assessment of the approved project and involved:

- Determination of the study area, comprising a 25 metre buffer around the proposed modification area
- A site survey and photographic inventory
- Consideration of the historical context of the study area
- Identification of heritage listed items within the study area through a search of various heritage registers, including:
 - ◆ World Heritage List
 - ◆ Commonwealth Heritage List
 - ◆ National Heritage List
 - ◆ NSW State Heritage Register (SHR)
 - ◆ *Marrickville Local Environmental Plan 2011* (Marrickville LEP)
 - ◆ Section 170 Heritage and Conservation Registers for Sydney Water, Roads and Maritime, RailCorp, Ausgrid and Department of Housing.
- Review of historical archaeological investigations within or close to the study area that provide evidence that helps to evaluate the potential historical archaeological resource of the study area
- Determination of the significance of heritage items or a potential archaeological resource by following the evaluation criteria set out in the NSW Heritage Office guideline *Assessing Heritage Significance* (2001)
- Assessment of the potential to impacts on heritage items from the proposed modification
- Development of environmental mitigation measures.

The following legislation and guidelines were considered during the preparation of the non-Aboriginal heritage assessment for the proposed modification:

- ◉ *Heritage Act 1977*
- ◉ *Environmental Planning and Assessment Act 1979*
- ◉ *Environmental Protection and Biodiversity Conservation Act 1999*
- ◉ *NSW Heritage Manual 1996* (Heritage Office and Department of Urban Affairs and Planning, 1996)
- ◉ *Assessing Heritage Significance* (Heritage Office, 2001)
- ◉ *Statements of Heritage Impact* (Heritage Office, 2002)
- ◉ *Railway Footbridges Heritage Conservation Strategy*, NSW Government Architect's Office (August 2016)
- ◉ *Railway Overhead Booking Offices Heritage Conservation Strategy*, Transport for NSW (2014)
- ◉ *Heritage Platforms Conservation Management Strategy*, Sydney Trains (2015)
- ◉ *Canopies and Shelters, Design Guide for Heritage Stations*, Sydney Trains (December 2016)
- ◉ *Design in Context Guidelines for infill Development in the Historic Environment*, NSW Heritage Office (June 2006).
- ◉ *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia ICOMOS, 2013) ('the Burra Charter')
- ◉ *Historical Archaeology Code of Practice* (Heritage Office, 2006).

Impacts on heritage are identified as either:

- ◉ Direct impacts, resulting in the demolition or alteration of fabric of heritage significance
- ◉ Indirect impacts, resulting in changes to the setting or curtilage of heritage items or places, historic streetscapes or views
- ◉ Potential direct impact, resulting in impacts from vibration and demolition of adjoining structures.

The magnitude of potential impacts is assessed using the terminology provided in Table 14-1.

Table 14-1 Terminology for assessing the magnitude of heritage impact

Magnitude	Definition
Major	Actions that would have a long term and substantial impact on the significance of a heritage item. Actions that would remove key historic building elements, key historic landscape features, or significant archaeological materials, thereby resulting in a change of historic character, or altering of a historical resource. These actions cannot be fully mitigated.
Moderate	Actions involving the modification of a heritage item, including altering the setting of a heritage item or landscape, partially removing archaeological remains, or the alteration of significant elements of fabric from historic structures. The impacts arising from such actions may be able to be partially mitigated.
Minor	Actions that would result in the slight alteration of heritage buildings, archaeological remains, or the setting of an historical item. The impacts arising from such actions can usually be mitigated.
Negligible	Actions that would result in very minor changes to heritage items.
Neutral	Actions that would have no heritage impact.

14.2 Existing environment

The existing non-Aboriginal heritage environment around Sydenham was described in the assessment of the approved project. This section provides further details regarding the existing non-Aboriginal heritage environment specific to the proposed modification.

14.2.1 Heritage listed items and areas

The following sections provide a list of the heritage items located within the study area, which includes the Sydney Metro Trains Facility South site and the Sydenham Station site. No other listed heritage items are present within the study area.

Sydney Metro Trains Facility South

The Sydney Metro Trains Facility South site includes one heritage item, and the buffer zone around the area also includes one heritage item and one conservation area (Table 14-2 and Figure 14-1).

Table 14-2 Heritage items – Sydney Metro Trains Facility South

Item	Suburb	Significance	Listing
Within modification area			
Sydenham Pit and Drainage Pumping Station 1	Sydenham	State	- SHR (No. 01644) - Sydney Water s170 Heritage and Conservation Register (4571743) - Marrickville LEP (I81)
Within buffer zone			
Waugh and Josephson Industrial Buildings	Sydenham	Local	Marrickville LEP (I280)
Goodsell Estate Heritage Conservation Area	Sydenham	Local	Marrickville LEP (C16)

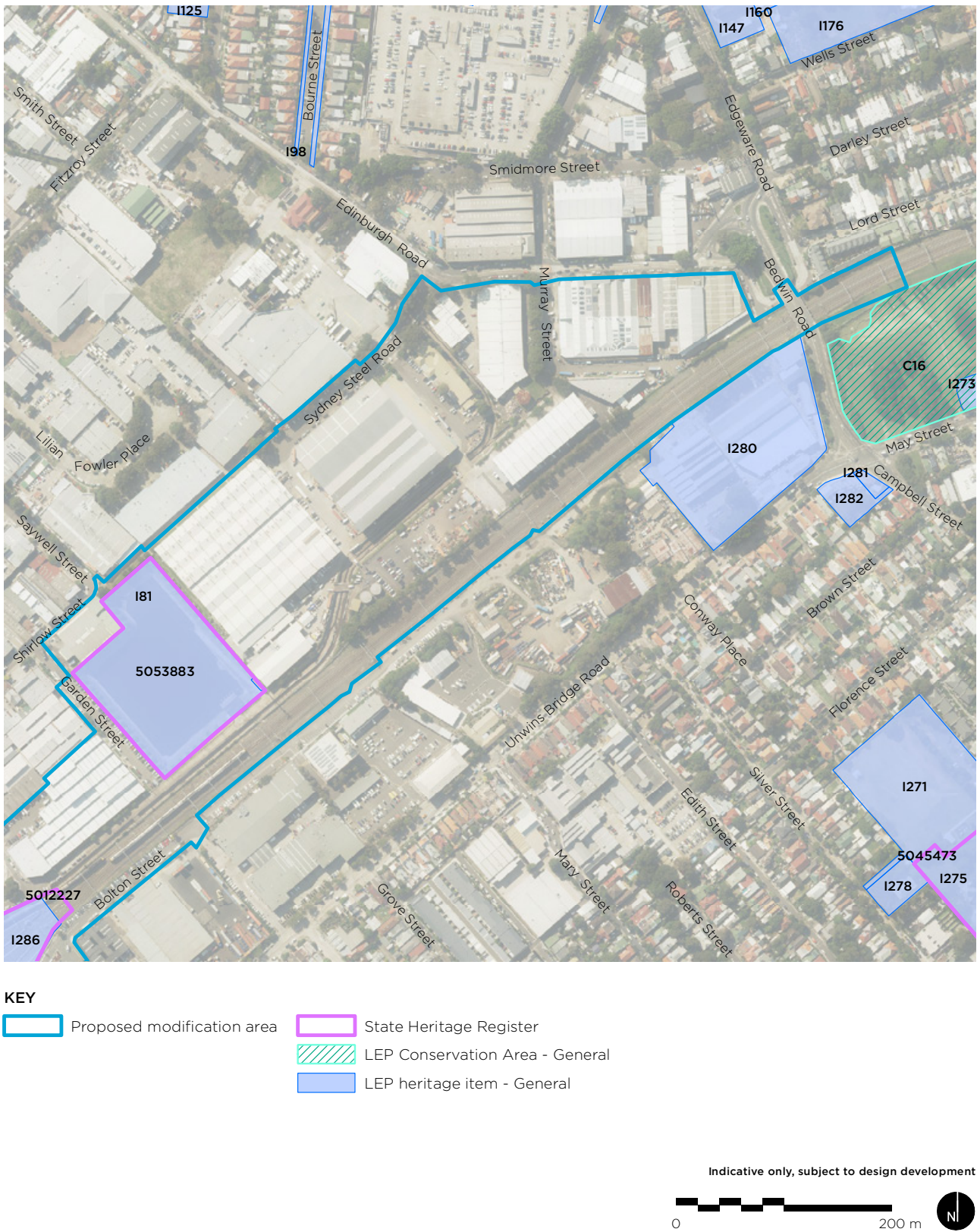


Figure 14-1 Heritage items – Sydney Metro Trains Facility South

Sydenham Station

The Sydenham Station site includes three heritage items and the buffer zone around the area includes one heritage item, as detailed in Table 14-3 and Figure 14-2.

Table 14-3 Heritage items – Sydenham Station

Item	Suburb	Significance	Listing
Within modification area			
Sydenham Railway Station Group	Sydenham	State	- SHR (No. 01254) - RailCorp s170 Heritage and Conservation Register (4801154) - Marrickville LEP (I286)
Sydenham (Illawarra Line) Underbridge	Sydenham	Local	RailCorp s170 Heritage and Conservation Register (4805746)
Brick retaining walls	Sydenham	Local	Marrickville LEP (I287)
Within buffer zone			
General Gordon Hotel	Sydenham	Local	Marrickville LEP (I290)



Figure 14-2 Heritage items – Sydenham Station

14.2.2 Archaeological sites and potential

There are no listed archaeological sites within or adjacent to the study area. Additionally, the study area is considered to have nil to low archaeological potential and / or significance due to high levels of previous ground disturbance, as shown in Table 14-4. No particular areas of archaeological potential were identified within the rail corridor.

Table 14-4 Archaeological potential

Phase of activity	Details	Archaeological potential
Sydney Metro Trains Facility South		
Phase 1 (1799 -1840s)	Early land grants	Nil-low
Phase 2 (1840s – 1880)	Scattered residential and industrial settlement	Nil-low
Phase 3 (1880 – 1909)	Arrival of the tramway, railway, residential subdivisions and scattered industrial settlement	Low
Phase 4 (1909 – present)	Rail line extension, Sydenham Pit and Drainage Pumping Station and Sydney Steel established	Nil-low
Sydenham Station		
Phase 1 (1788 -1840s)	Early land grants	Nil-low
Phase 2 (1840s – 1880)	Brickmaking, farming and subdivision	Nil-low
Phase 3 (1880 – 1920s)	Railway Station and construction of Sewage Pumping Station No 271	Low-moderate
Phase 4 (1930s – present)	Railway Station upgrades and continued use	Moderate

14.3 Potential impacts

Construction and operation of the modification would potentially impact on heritage items, conservation areas, and sites with archaeological potential. These impacts would be in addition to those assessed in the Environmental Impact Statement for the approved project.

This section summarises the potential impact of the modification on non-Aboriginal heritage items or potential archaeological remains during construction and operation, with further detail provided in Appendix E.

14.3.1 Sydney Metro Trains Facility South

Impacts on the heritage items and potential archaeological remains within the Sydney Metro Trains Facility South area are summarised in Table 14-5. The assessment for the approved project identified potential impacts to the Sydenham Pit and Drainage Pumping Station 1 site. The change in impact to this item as a result of the proposed modification is discussed in Table 14-3. Impacts to other items described in Table 14-3 would be new impacts introduced by the proposed modification.

Table 14-5 Impacts on heritage items and potential archaeological remains – Sydney Metro Trains Facility South

Item and listing	Impacts	Additional information
Sydenham Pit and Drainage Pumping Station 1 State: - SHR (No. 01644) - Sydney Water s170 (4571743) Local: Marrickville LEP (I81)	Direct impact Moderate impact on the heritage item due to the following: - Installation of an aqueduct over the flood storage of Sydenham Pit and Drainage Pumping Station with pylons to be anchored into the storage pit - Construction of a new pumping station building and access road. Indirect impact - Provided that the aqueduct and pylons are designed to minimise visual impacts and be sympathetic to the existing character of the pit and drainage pumping station impacts, it is anticipated that this aspect of the modification would result in a moderate visual impact on the pit - As the bulk of the new pumping station is somewhat reduced by retaining the original pumping station, there would be minor-moderate visual impact - The access ramp would add a new visual element in the pit and alter the current open views of the pit, which would result in a moderate visual impact - The proposed stabling infrastructure would be lower in scale in comparison with the buildings proposed for demolition and their removal would potentially create more open views from the heritage pit when looking east, resulting in a minor visual impact - Overall, the visual impacts on Sydenham Pit and Drainage Pumping Station 1 would be major - Additionally, construction activities would result in a temporary minor visual impact on the item during construction. Potential direct impact Potential negligible to minor direct impacts as a result of: - Minor potential for vibration impacts to buildings and structures located close to the modification area - Inadvertent damage to items located close to the study area.	Change in impact from the approved project The change in heritage impacts from the approved project on Sydenham Pit and Drainage Pumping Station 1 are: Direct impact: from None to Moderate Indirect impact: from Minor to Major Potential direct impact: from Neutral to Negligible to Minor As such, the proposed modification would result in increased direct and indirect impacts to Sydenham Pit and Drainage Pumping Station 1.

Item and listing	Impacts	Additional information
Waugh & Josephson Industrial Buildings Local: Marrickville LEP (I280)	No direct impact Indirect impact - Distance, existing development and vegetation prevents any views from the heritage item onto the Sydney Metro Trains Facility South site and Sydenham Station, resulting in a neutral visual impact. - The proposed Sydney Metro Trains Facility South site would be located directly opposite the heritage item across the railway corridor in an area currently composed of medium-scale industrial buildings and warehouses. The proposed works would have a negligible visual impact on the heritage item. Overall, visual impacts on Waugh & Josephson Industrial Buildings would be negligible. Potential direct impact Potential negligible to minor direct impacts as a result of: - Minor potential for vibration impacts to buildings and structures located close to the modification area - Inadvertent damage to items located close to the study area.	The Waugh & Josephson Industrial Buildings were not assessed as part of the approved project. As such, the proposed modification would introduce new impacts to the heritage item. The Waugh & Josephson Industrial Buildings would continue to meet the threshold for local significance.
Goodsell Estate Heritage Conservation Area Local: Marrickville LEP (C16)	No direct impact Indirect impact - Distance, existing development and vegetation prevents any views from the conservation area onto the proposed Sydney Metro Trains Facility South site and Sydenham Station. Works at these sites would result in a neutral visual impact on the conservation area. - The proposed Sydney Metro Trains Facility South site would be located in proximity to the conservation area in an area currently composed of medium-scale industrial buildings and warehouses. The stabling facility would not greatly differ from existing uses in the vicinity of the conservation area and would be of a lower scale than existing development, resulting in a negligible visual impact. - Overall, the visual impacts on the conservation area would be negligible. Potential direct impact Potential negligible to minor direct impacts as a result of: - No potential for vibration or damage predicted. - Inadvertent damage to items located close to the study area.	The Waugh & Josephson Industrial Buildings were not assessed as part of the approved project. As such, the proposed modification would introduce new impacts to the heritage item. The Goodsell Estate Heritage Conservation Area item would continue to meet the threshold for local significance.
Potential archaeological remains	The modification is unlikely to impact on archaeological remains within the study area as there is nil to low potential for archaeological remains to be present.	

14.3.2 Sydenham Station

The Sydenham Station area comprises four heritage items, including the State listed Sydenham Railway Station Group. Heritage impacts of the proposed modification have been minimised where possible in accordance with the Heritage Strategy, as outlined in Section 3.6.2 of this report. Residual impacts on heritage items and potential archaeological remains within the area are summarised in Table 14-6. No impacts to these items were identified for the approved project and as such these would be new impacts of the proposed modification.

Further details, including potential impacts to individual elements within the Sydenham Railway Station Group, are provided in Appendix E.

Table 14-6 Impacts on heritage items and potential archaeological remains – Sydenham Station

Item and listing	Impacts	Conclusion
Sydenham Railway Station Group State: - SHR (No. 01254) - RailCorp s170 (4801154) Local: Marrickville LEP (I286)	Direct impact All elements of exceptional significance and most elements of significance would be retained and adaptively reused, which would be a positive impact. However, the modification would remove two of four significant buildings within the station group and platform 1 (two of four original platforms), the parcels office and waiting sheds, which would result in an overall major impact on the station group. The integrity of the station has been previously impacted by the removal of the 1914 footbridge, stairs and timber overhead booking office and would be further impacted by the removal of the 1925 and 1962 structures. The retention of the platforms 2/3 and 4/5 buildings would retain the historical significance of Sydenham Station as a historically major junction station. The retention of platform 4/5 would retain a representative example of the original 1894 platforms as a brick face platform that was later converted into an island platform. Overall, the modification would result in a major direct impact on Sydenham Railway Station Group. Indirect impact - The modification would result in an overall moderate impact on the character and setting of the station due to the proposed large-scale canopy structure, covered concourse and station and platform buildings. Generally, internal and external views onto buildings of exceptional significance proposed for retention would enable continued appreciation of the station. - Construction activities would result in a temporary minor visual impact on the item during construction. Potential direct impact Potential negligible to minor direct impacts as a result of: - Minor potential for vibration impacts to buildings and structures located close to the modification area - Inadvertent damage to items located close to the study area.	The Sydenham Railway Station Group would continue to meet the threshold for State significance.

Item and listing	Impacts	Conclusion
Sydenham (Illawarra Line) Underbridge Local: RailCorp s170 (4805746)	Direct impact The project would have a minor impact on the brick piers as a result of strengthening works for collision loads. Indirect impact Views onto Sydenham Station from the Sydenham (Illawarra Line) Underbridge are mostly screened and would be very limited. Provided that the modification is designed to remain sympathetic to the heritage context, visual impacts on the Sydenham (Illawarra Line) Underbridge would be minor. Potential direct impact - Minor potential for vibration impacts to buildings and structures located close to the modification area - Inadvertent damage to items located close to the study area.	Sydenham (Illawarra Line) Underbridge would continue to meet the threshold for local significance.
Brick Retaining Walls Local: Marrickville LEP (1287)	No direct impact Indirect impact The removal of the existing brick wall and station building along platform 1 of the station would have some visual impact on the item. New structures to be located along Railway Parade would alter the existing setting and have a negligible to minor impact on the item. Potential direct impact - Minor potential for vibration impacts to buildings and structures located close to the modification area - Inadvertent damage to items located close to the study area.	The Brick Retaining Walls would continue to meet the threshold for local significance.
General Gordon Hotel Local: Marrickville LEP (1290)	No direct impact Indirect impact The item is located on the corner of Burrows Avenue and Gleeson Avenue about 25 metres from the station concourse. There would be some distant views from the heritage item on the new small to large-scale structures along Railway Parade, and some views onto the new boundary treatment along Burrows Avenue. Any views of the new metro tracks and overhead wiring would be in keeping with the current views and vistas. There would be a minor impact. Potential direct impact - Minor potential for vibration impacts to buildings and structures located close to the modification area - Inadvertent damage to items located close to the study area.	The General Gordon Hotel would continue to meet the threshold for local significance.
Potential archaeological remains	The majority of works in the area would be undertaken within the station and rail corridor where impacts to significant archaeological remains are unlikely.	

14.4 Mitigation measures

The Sydney Metro Construction Environmental Management Framework prepared for the approved project sets out the environmental management approach and strategy for the project, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans. The relevant project-specific mitigation measures identified for the approved project would continue to apply to the project as proposed to be modified.

The non-Aboriginal heritage assessment for the proposed modification identified that existing mitigation measures NAH1, NAH7 and NAH11 are required to be applied to the proposed modification, and an additional mitigation measures is required in relation to the works to the Sydenham Pit and Drainage Pumping Station. These changes to mitigation measures are listed in Table 14-7, with additions shown in **bold** text.

In addition, the conditions of approval issued for the approved project would also apply to the proposed modification. Of relevance this includes condition E21 relating to the preparation of a Heritage Interpretation Plan. It is also recommended that conditions E13 and E16 regarding archival recording and salvage respectively are modified to include the Sydenham Pit and Drainage Pumping Station and Sydenham Railway Station Group: Platform 6 building and Platform 1 Parcels Office.

Table 14-7 Mitigation measures – Non-Aboriginal heritage

ID	Mitigation measure	Applicable location(s) ¹
NAH1	Archival recording and reporting of the following heritage items would be carried out in accordance with the NSW Heritage Office's <i>How to Prepare Archival Records of Heritage Items</i> (1998a), and <i>Photographic Recording of Heritage Items Using Film or Digital Capture</i> (2006): • The internal heritage fabric and any non-original elements removed from within the curtilage of Mowbray House, Chatswood • The interior, exterior and setting of the shop at 187 Miller Street, North Sydney • The fabric and setting of the North Sydney bus shelters requiring removal and temporary relocation at Victoria Cross Station and Blues Point temporary site • Any component of the Blues Point Waterfront Group and the McMahons Point South heritage conservation area to be directly affected or altered, including vegetation and significant landscape features • Hickson Road wall in the vicinity of proposed ventilation risers and skylights for Barangaroo Station • The interior, exterior and setting of the 'Flat Building' at 7 Elizabeth Street, Sydney • Martin Place, between Elizabeth and Castlereagh streets, Sydney • The heritage fabric of areas of the existing Martin Place Station affected by the project • The Rolling Stock Officers Garden, Rolling Stock Officers Building and Cleaners Amenities Building in Sydney Yard and any other component of the Sydney Terminal and Central Railway Stations group to be removed or altered • Directly impacted parts of the Congregational Church at Waterloo • Sydenham Pit and Drainage Pumping Station 1 • Sydenham Railway Station Group: Platform 6 building and Platform 1 Parcels Office.	CDS, VC, BP, MP, CS, WS, MDS, SS

ID	Mitigation measure	Applicable location(s) ¹
NAH7	The project design would be sympathetic to heritage items and, where reasonable and feasible, minimise impacts to the setting of heritage items. The detailed design for Martin Place Station, and Central Station, Sydenham Station and the aqueduct over the Sydenham Pit and Drainage Pumping Station would be developed with input from a heritage architect.	STW, CDS, CN, VC, BN, MP, PS, CS, WS, MDS, SS
NAH11	Except for heritage significant elements affected by the project, direct impact on other heritage significant elements forming part of the following items would be avoided: ● The Blues Point Waterfront Group (including the former tram turning circle, stone retaining wall, bollards and steps) ● The Millers Point and Dawes Point Village Precinct ● The existing Martin Place Station ● Sydney Terminal and Central Railway Stations group ● Sydney Yard (including the Shunters Hut and Prince Alfred Sewer) ● The existing Sydenham Station ● Brick retaining walls near Sydenham Station.	BP, BN, MP, CS, SS, STWS
NAH20	The design and detailed construction planning of works directly impacting the Sydenham Pit and Drainage Pumping Station would consider the requirements of the Sydenham Pit & Drainage Pumping Station 1 Conservation Management Plan (Sydney Water, 2004).	MDS

¹ STW: Surface track works; CDS: Chatswood dive site; AS: Artarmon substation; CN: Crows Nest Station; VC: Victoria Cross Station; BP: Blues Point temporary site; GI: Ground improvement works; BN: Barangaroo Station; MP: Martin Place Station; PS: Pitt Street Station; CS: Central Station; WS: Waterloo Station; MDS: Marrickville dive site (including Sydney Metro Trains Facility South); SS: Sydenham Station; STWS: Surface track works south Metro rail tunnels: Metro rail tunnels not related to other sites (eg TBM works); PSR: Power supply routes.

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ABORIGINAL HERITAGE

CHAPTER FIFTEEN



15 Aboriginal heritage

This chapter provides an assessment of the potential changes to impacts on Aboriginal heritage sites and areas of archaeological potential as a result of the proposed modification, and identifies mitigation measures to minimise these impacts.

15.1 Assessment methodology

The scope of the Aboriginal heritage assessment used a similar approach to the assessment of the approved project and involved:

- A review of previous archaeological investigations and a search of the NSW Office of Environment and Heritage's (OEH) Aboriginal Heritage Information Management System (AHIMS) to determine whether Aboriginal heritage sites had previously been recorded within the study area for the proposed modification
- Development of a predictive model for the study area to help determine archaeological potential
- A site inspection of the study area, in the presence of a representative from the Metropolitan Local Aboriginal Land Council and Gandangarra Local Aboriginal Land Council
- Assessment of the potential to disturb Aboriginal heritage (sites, objects, remains, values, features or places)
- Identification of any additional or altered environmental mitigation measures that would be implemented to minimise the risk of impacting previously unrecorded items of Aboriginal heritage significance and / or areas of Aboriginal cultural sensitivity during construction.

The following government guidelines were considered during the preparation of the Aboriginal heritage assessment for the proposed modification:

- *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (Department of Environment, Climate Change and Water, 2011b)
- *Aboriginal Cultural Heritage Consultation requirements for proponents* (Department of Environment, Climate Change and Water, 2010a)
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (Department of Environment, Climate Change and Water, 2010b)
- *NSW Skeletal Remains: Guidelines for Management of Human Remains* (Heritage Office, 1998)
- *Criteria for the assessment of excavation directors* (NSW Heritage Council, 2011).

15.2 Existing environment

The existing Aboriginal heritage environment around Sydenham was described in the assessment for the approved project. This section provides further details regarding the existing Aboriginal heritage environment specific to the proposed modification.

15.2.1 Previously registered Aboriginal heritage sites

A search of AHIMS did not identify any previously recorded Aboriginal heritage in or around the proposed modification.

The closest previously recorded Aboriginal heritage site is a potential archaeological deposit (PAD) (the Fraser Park PAD) located about 130 metres east of Sydenham Station. The Fraser Park PAD was subject to archaeological excavations for proposed underground electricity supplies by Tamwoy in 2003. The report concluded the Fraser Park area had previously been underwater and prior to British settlement had been a low-lying swamp (Tamwoy, 2003). The Fraser Park PAD was found not to be an Aboriginal site.

15.2.2 Aboriginal heritage sites identified during site inspections

No new areas of potential archaeological deposits were identified during field surveys in and around the proposed modification.

15.2.3 Archaeological potential and significance

Consistent with the assessment of the approved project, the area of the proposed Sydney Metro Trains Facility South was identified as an area of moderate to high archaeological potential. This is based on the likelihood of deep soils remaining intact beneath large areas of surface disturbance in that area.

The preliminary assessment of archaeological potential indicates the possible survival of Aboriginal objects in sub-surface contexts. Intact Aboriginal archaeological deposits in this area would be extremely rare and would be of high research significance.

No other sites of Aboriginal archaeological potential were identified in relation to the proposed modification.

15.2.4 Potential impacts

The potential impacts on Aboriginal heritage during construction of the proposed modification are provided in this section. Aboriginal heritage would not be impacted during the operation of the proposed modification as widespread ground disturbance and excavation would be restricted to the construction phase.

Aboriginal heritage sites

Similar to the approved project, construction of the proposed modification would not directly (ie damaged as a direct result of construction) or indirectly (ie damaged due to construction vibration) impact any previously recorded Aboriginal heritage sites. As such, there would be no change in direct impact to Aboriginal heritage sites from the approved project as a result of the proposed modification.

Archaeological potential and significance

The assessment of the approved project included the area of the proposed Sydney Metro Trains Facility South. The assessment found that this area has a moderate to high potential for Aboriginal archaeology and the significance of any deposits in this area would be potentially high.

There would be no change to this archaeological potential or significance as a result on the proposed modification.

Due to the largely modified nature of the remainder of the proposed modification site, no other areas of archaeological potential have been identified.

15.3 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy for the project, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans.

The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified. These mitigation measures would adequately address the potential changes to Aboriginal heritage impacts. No additional or revised Aboriginal heritage measures are considered necessary. In addition, the conditions of approval issued for the approved project would also apply to the proposed modification.

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LANDSCAPE CHARACTER AND VISUAL AMENITY

CHAPTER SIXTEEN



16 Landscape character and visual amenity

This chapter provides an assessment of the potential impact on landscape character and visual amenity as a result of the proposed modification, and identifies mitigation measures to minimise these impacts.

16.1 Assessment methodology

The potential changes to landscape character and visual amenity impacts were assessed during construction and operation of the proposed modification. The assessment methodology is consistent with the approach used for the approved project and includes:

- A description of the existing environment
- Identification of potential landscape and visual receivers and the sensitivity of those receivers
- Identification of potential landscape character and visual amenity impacts
- A general assessment of the potential improvement or reduction in landscape character and visual values
- Identification of any changes to mitigation measures.

16.1.1 Landscape impact assessment

Landscape in the urban context refers to the overall character and function of a place. It includes all elements within the public realm and the interrelationship between these elements and the people who use them.

To identify these impacts, the assessment identified the sensitivity of the element to change and the magnitude of change expected as a result of the proposed modification, and then made an overall assessment of the level of impact expected.

The degree of sensitivity of each landscape element to change was identified as either neighbourhood, local, regional, State or National. Definitions are provided in the Environmental Impact Statement for the approved project.

The magnitude of modification to landscape quality of each landscape element was identified as either considerable reduction, noticeable reduction, no perceived change, noticeable improvement, or considerable improvement. Definitions are provided in the Environmental Impact Statement for the approved project.

The assessed sensitivity and landscape modification change was then combined for each element to identify a level of landscape impact based on the matrix in Table 16-1.

Table 16-1 Landscape impact matrix

Landscape change	Landscape sensitivity				
	National	State	Regional	Local	Neighbourhood
Considerable reduction	Very high adverse	Very high adverse	High adverse	Moderate adverse	Minor adverse
Noticeable reduction	Very high adverse	High adverse	Moderate adverse	Minor adverse	Negligible
No perceived change	Negligible	Negligible	Negligible	Negligible	Negligible
Noticeable improvement	Very high beneficial	High beneficial	Moderate beneficial	Minor beneficial	Negligible
Considerable improvement	Very high beneficial	Very high beneficial	High beneficial	Moderate beneficial	Minor beneficial

16.1.2 Visual impact assessment

Daytime

The daytime visual impact assessment, as described in the Environmental Impact Statement, considered visual amenity as experienced by the people (including rail customers, residents, workers, tourists, etc) using the site surrounds. It aimed to identify the range of views to the site that may be impacted, including views from public spaces, residential areas, offices and streets. The assessment of these impacts involved identifying the existing visual conditions, views that are representative of these conditions, the sensitivity of the views (based on the definitions in the Environmental Impact Statement), and the magnitude of change expected as a result of Sydenham Station and Sydney Metro Trains Facility South (based on the definitions in the Environmental Impact Statement). An overall assessment was then made of the level of impact expected (based on the matrix in Table 16-2).

The sensitivity levels incorporate a consideration of heritage values within a viewpoint, however the visual impact assessment is based on the potential change in views only. Assessment of potential impacts to views and vistas associated with individual heritage items and elements is provided in Chapter 14 (Non-Aboriginal heritage).

Table 16-2 Daytime visual impact matrix

Visual change	Daytime visual sensitivity				
	National	State	Regional	Local	Neighbourhood
Considerable reduction	Very high adverse	Very high adverse	High adverse	Moderate adverse	Minor adverse
Noticeable reduction	Very high adverse	High adverse	Moderate adverse	Minor adverse	Negligible
No perceived change	Negligible	Negligible	Negligible	Negligible	Negligible
Noticeable improvement	Very high beneficial	High beneficial	Moderate beneficial	Minor beneficial	Negligible
Considerable improvement	Very high beneficial	Very high beneficial	High beneficial	Moderate beneficial	Minor beneficial

Night-time

The assessment of night-time impacts was carried out with a similar methodology to the daytime assessment as described in the Environmental Impact Statement.

The resulting impact levels are shown in Table 16-3.

Table 16-3 Night-time visual impact matrix

Visual change	Night-time visual sensitivity			
	E1: Intrinsically dark landscapes	E2: Low district brightness	E3: Medium district brightness	E4: High district brightness
Considerable reduction	Very high adverse	Very high adverse	High adverse	Moderate adverse
Noticeable reduction	Very high adverse	High adverse	Moderate adverse	Minor adverse
No perceived change	Negligible	Negligible	Negligible	Negligible
Noticeable improvement	Very high beneficial	High beneficial	Moderate beneficial	Minor beneficial
Considerable improvement	Very high beneficial	Very high beneficial	High beneficial	Moderate beneficial

16.2 Existing environment

16.2.1 Sydenham Station

Sydenham Station is of State heritage significance and dated to the 19th and early 20th centuries. The station contains several Victorian buildings and structures with unique architectural detailing. The topography of the area is gently undulating and rises to the west of the station at Gleeson Avenue, providing city views to the east. The station fronts Gleeson Avenue, which functions as the commercial centre of Sydenham and contains shops, restaurants, offices and 'shop top' housing extending south from the station.

The character of the area surrounding the station is strongly influenced by its industrial history and the transport network, including rail, busy main roads and Sydney Airport. Areas to the north and west of the station are predominantly single and double storey industrial buildings. The Goods Line to Port Botany crosses the commuter rail corridor via a Pratt truss bridge to the immediate south-west of the station.

The area surrounding the station includes several recreation and open space areas, including Fraser Park to the south-west, and Sydenham Green and Tillman Park to the south. These spaces are described further in Section 16.2.3.



Plate 16-1 View of Sydenham Station south-west from Burrows Avenue



Plate 16-2 Sydenham Station entrance at Gleeson Avenue



Plate 16-3 View north-east along Burrows Avenue from Sydenham Station



Plate 16-4 View south-west towards Gleeson Avenue from Sydenham Road / Railway Parade



Plate 16-5 Open drain running between Railway Parade and the rail corridor near Sydenham Station

16.2.2 Sydney Metro Trains Facility South

The existing environment at the Sydney Metro Trains Facility South was described in the Environmental Impact Statement for the approved project in relation to the Marrickville dive site (southern). The proposed modification would involve the construction and operation of the Sydney Metro Trains Facility South at the site of the approved project works, which would be expanded to include additional areas between Murray Street, Edinburgh and Sydney Steel roads.

In summary, the site is located on flat and low-lying industrial land in Marrickville to the north-east of Sydenham Station. The character of this area is strongly influenced by its industrial history and the transport network, including rail, busy mains roads and Sydney Airport.

The locality comprises a mix of residential and industrial buildings reflective of its historical development. Building heights are predominately single and double storey industrial buildings, intermixed with some three to four storey commercial and industrial buildings. The narrowness of the surrounding streets and the high proportion of built development generally contribute to a lack of street trees within the area.

Graffiti and commissioned street art are found on nearby industrial buildings, along concrete drainage channels and on Sydenham Pit and Drainage Pumping Station.



Plate 16-6 View north-east from trains on the rail corridor of the Marrickville dive site (Southern)

16.2.3 Rail corridor

The area between and the approved project boundary in the north and Marrickville Station in the south is characterised by rail related development and flanked by parkland and vegetated areas. In this area, the Goods Line crosses the commuter rail corridor via a pratt truss bridge, a visual feature in nearby parts of Sydenham and a heritage item (Section 170 Heritage and Conservation Register). To the west, the rail corridor splits into the T3 Bankstown Line to the north and the T4 Illawarra Line to the south. The Sydenham Maintenance Centre is located between these two lines at Way Street. Fraser Park is situated to the north of the T3 Bankstown Line.

Fraser Park is located in a large pocket of flat land between the Goods Line and the Sydenham Maintenance Centre. The park includes a synthetic football field, grandstand and club house building, three smaller soccer pitches, perimeter road (alongside the rail corridor) and three car parks.

Tillman Park is located on Unwins Bridge Road, adjacent to the T4 Illawarra Line and Goods Line, immediately south of the pratt truss bridge. The park includes a central playground with park equipment, pathways, seating and amenities set amid mature trees and grassy mounds. North of the playground, the park opens up into a large lawn area used for informal recreation and community events. The rail corridor is well screened by a wide strip of mature trees, shrubs and native grasses along the northern boundary of the park and glimpses to the pratt truss bridge can be seen above this vegetation.

Sydney Water sewage pumping station 271 is also located within this area on Carrington Road. The pumping station includes a State heritage listed house, boiler house, chimney stack and embankment, containing several mature trees which provide a seating for the buildings. The chimney stack of the pumping station is a visual landmark in the local area, particularly in views from areas to the south.



Plate 16-7 Goods Line pratt truss bridge



Plate 16-8 Fraser Park



Plate 16-9 Tillman Park



Plate 16-10 View to sewage pumping station 271 chimney stack from Fraser Park

16.3 Potential impacts

16.3.1 Landscape character impacts

Sydenham Station

The proposed modification would introduce potential landscape character impacts in new areas that were not assessed for the approved project. One landscape character area was identified to inform the landscape character assessment for the proposed modification: Sydenham Station precinct.

Landscape impacts anticipated during construction and operation are summarised in Table 16-4 and Table 16-5.

Table 16-4 Landscape character impacts – construction

Location	Sensitivity rating	Approved project		Proposed modification	
		Landscape change	Landscape impact	Landscape change	Landscape impact
Sydenham Station precinct	Local	N/A	N/A	Considerable reduction	Moderate adverse

Table 16-5 Landscape character impacts – operation

Location	Sensitivity rating	Approved project		Proposed modification	
		Landscape change	Landscape impact	Landscape change	Landscape impact
Sydenham Station precinct	Local	N/A	N/A	Noticeable improvement	Minor beneficial

Overall, it is expected that there would be a considerable reduction in the landscape quality of Sydenham Station precinct during construction of the proposed modification due to the removal of heritage buildings, trees and impacts to local footpaths.

During operation, it is expected that there would be a noticeable improvement in the landscape quality of the Sydenham Station precinct landscape character area, producing an overall beneficial result. These benefits would be due to the introduction of a northern entry, interchange facilities and streetscape finishes.

Sydney Metro Trains Facility South

Two landscape character areas, the Marrickville flood storage reserve and industrial areas of Sydenham and Marrickville – Street Art precinct, was assessed for the approved project at the location of the proposed Sydney Metro Trains Facility South. The proposed modification would result in changed landscape character impacts to this area and, as such, have been reassessed below.

The proposed modification would introduce potential landscape character impacts in new areas. One additional landscape character areas was identified to inform the landscape character assessment for the proposed modification: Street trees and vegetation within the industrial areas of Sydenham and Marrickville.

Landscape impacts anticipated during construction and operation are summarised in Table 16-6 and Table 16-7, with further details provided in Appendix F.

Table 16-6 Landscape character impacts – construction

Location	Sensitivity rating	Approved project		Proposed modification	
		Landscape change	Landscape impact	Landscape change	Landscape impact
Marrickville flood storage	Local	Noticeable reduction	Minor adverse	Considerable reduction	Moderate adverse
Industrial areas of Sydenham and Marrickville – Street Art precinct	Local	Noticeable reduction	Minor adverse	Noticeable reduction	Minor adverse
Industrial areas of Sydenham and Marrickville – street trees and vegetation	Neighbourhood	N/A	N/A	Considerable reduction	Minor adverse

Table 16-7 Landscape character impacts – operation

Location	Sensitivity rating	Approved project		Proposed modification	
		Landscape change	Landscape impact	Landscape change	Landscape impact
Marrickville flood storage	Local	N/A	N/A	Considerable reduction	Moderate adverse
Industrial areas of Sydenham and Marrickville – Street Art precinct	Local	No perceived change	Negligible	No perceived change	Negligible
Industrial areas of Sydenham and Marrickville – street trees and vegetation	Neighbourhood	N/A	N/A	No perceived change	Negligible

In addition to the impacts identified in the assessment of the approved project, there would be an increased impact on the Marrickville Flood Storage Reserve during construction. As a part of the proposed modification there would be a direct impact on the Sydenham Pit and Drainage Pumping Station, including the alterations to the walls and introduction of the aqueduct and new pumping station. There would be a minor adverse landscape impact on the street trees and vegetation of the industrial areas of Sydenham and Marrickville due to the removal of vegetation along the drainage corridors, and Edinburgh and Sydney Steel roads. There would be no change to the impact on the industrial areas of Sydenham and Marrickville – Street Art precinct as a result of the proposed modification.

During operation there would be no perceived change to the street trees and vegetation of the site as additional street tree planting would be provided on the property boundaries and around the administration building. This would result in a negligible landscape impact.

Rail corridor

The proposed modification would introduce potential landscape character impacts in new areas that were not assessed for the approved project. One landscape character area was identified to inform the landscape character assessment for the proposed modification: Rail corridor.

Landscape character impacts anticipated during construction and operation and summarised in Table 16-8 and Table 16-9.

Table 16-8 Landscape character impacts – construction

Location	Sensitivity rating	Approved project		Proposed modification	
		Landscape change	Landscape impact	Landscape change	Landscape impact
Rail corridor	Local	N/A	N/A	Noticeable reduction	Minor adverse

Table 16-9 Landscape character impacts – operation

Location	Sensitivity rating	Approved project		Proposed modification	
		Landscape change	Landscape impact	Landscape change	Landscape impact
Rail corridor	Local	N/A	N/A	Noticeable reduction	Minor adverse

Overall, it is expected that there would be a noticeable reduction in landscape quality of the rail corridor precinct during construction of the proposed modification due to the establishment of construction compounds and worksites, the clearance of vegetation and major earthworks.

During operation, there would be a noticeable reduction in landscape quality of the rail corridor due to the intensification of rail corridor infrastructure. In addition, trees removed during construction would not be reinstated.

16.3.2 Visual impacts

Sydenham Station

Daytime visual impacts

The proposed modification would introduce potential daytime visual impacts in new areas that were not assessed for the approved project. Five representative viewpoints were selected to inform the visual amenity assessment for the proposed modification. The five additional representative viewpoints (shown in Figure 16-1) are:

- Viewpoint 1: View north-east from Railway Parade
- Viewpoint 2: View south-east from Sydenham Road
- Viewpoint 3: View south-west from Railway Parade
- Viewpoint 4: View north-west from Hogan Avenue
- Viewpoint 5: View north-east along Burrows Avenue.

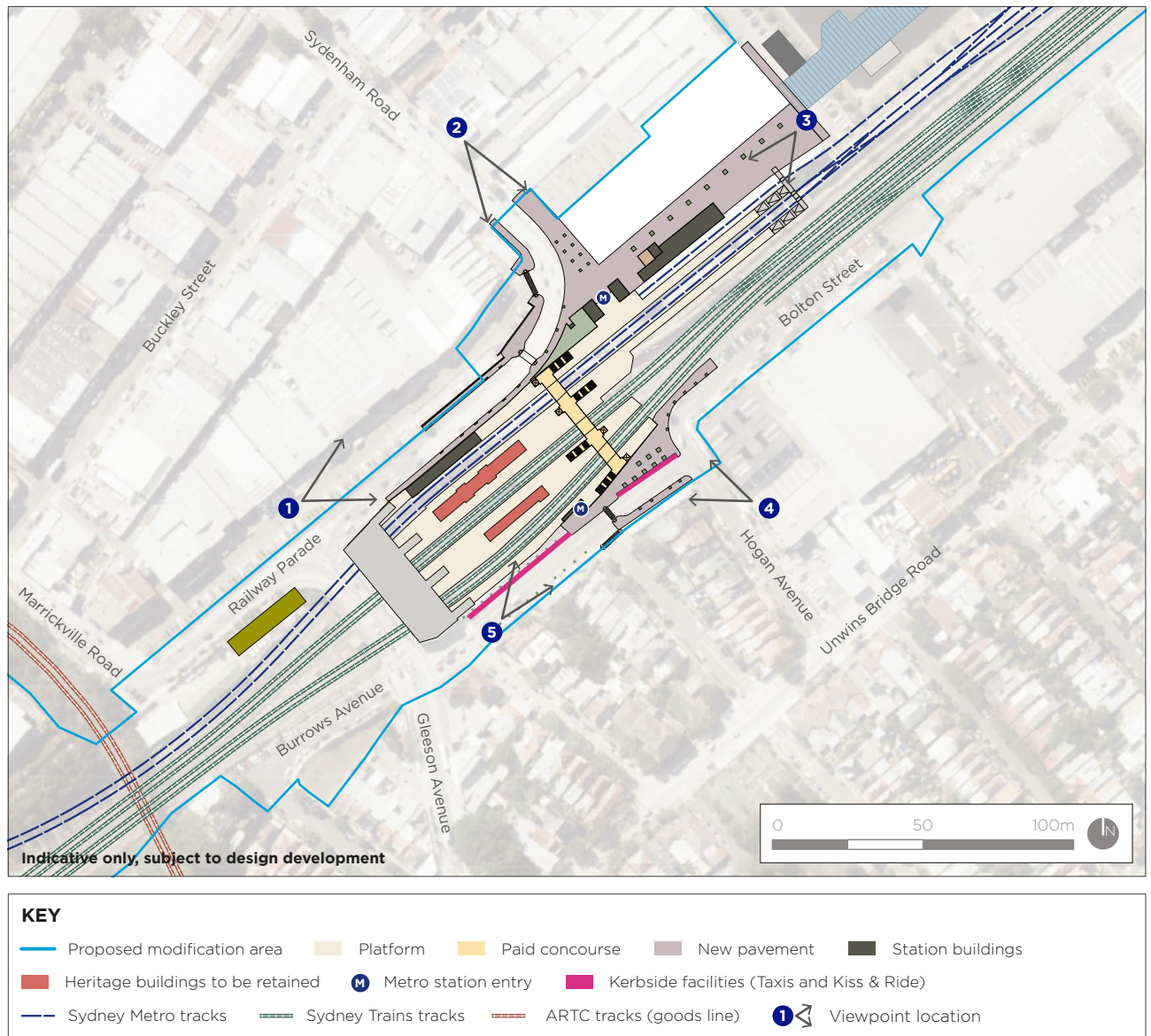


Figure 16-1 Representative viewpoints for Sydenham Station

The anticipated daytime visual impacts of the proposed modification construction and operation are summarised in Table 16-10, with further details provided in Appendix F.

Existing views are provided in Plate 16-11 to Plate 16-15.



Plate 16-11 Viewpoint 1: View north-east from Railway Parade



Plate 16-12 Viewpoint 2: View south-east from Sydenham Road



Plate 16-13 Viewpoint 3: View south-west from Railway Parade



Plate 16-14 Viewpoint 4: View north-west from Hogan Avenue



Plate 16-15 Viewpoint 5: View north-east along Burrow Road

Table 16-10 Daytime visual impacts

Location	Sensitivity rating	Construction		Operation	
		Visual change	Visual impact	Visual change	Visual impact
Viewpoint 1 View north-east from Railway Parade	Local	Noticeable reduction	Minor adverse	Noticeable improvement	Minor beneficial
Viewpoint 2 View south-east from Sydenham Road	Neighbourhood	Considerable reduction	Minor adverse	Considerable improvement	Minor beneficial
Viewpoint 3 View south-west from Railway Parade	Neighbourhood	N/A	N/A	Considerable improvement	Minor beneficial
Viewpoint 4 View north-west from Hogan Avenue	Neighbourhood	Considerable reduction	Minor adverse	Noticeable improvement	Negligible
Viewpoint 5 View north-east along Burrows Avenue	Local	Noticeable reduction	Minor adverse	Noticeable reduction	Minor adverse

The proposed modification would result in additional visual impacts at new locations than the approved project. Construction of the proposed modification would result in minor adverse visual impacts on most assessed viewpoints. This impact would be due to the scale of the construction sites, and the removal of trees and heritage buildings.

Operation of the proposed modification would result in mostly negligible visual impacts at the viewpoints assessed. There would be a minor beneficial visual impact on the view south-east from Sydenham Road (viewpoints 1-3) and a minor adverse visual impact on the view north-east along Burrows Avenue. Although the heritage character of this view would have been impacted, the architectural qualities of the new station and public realm improvements would result in improved general amenity.

Night-time visual impacts

The proposed modification would introduce potential night-time visual impacts in new areas that were not assessed for the approved project.

A summary of the potential night-time visual impacts of the proposed modification on the Sydenham Station precinct is provided for construction and operation in Table 16-11.

Table 16-11 Night-time visual impacts – construction

Location	Sensitivity rating	Construction		Operation	
		Visual change	Visual impact	Visual change	Visual impact
Sydenham Station precinct	E3: Medium district brightness	Noticeable reduction	Minor adverse	No perceived change	Minor adverse

At night, there would be a minor adverse visual impact during construction due to the introduction of night works adjacent to residential areas to the south-east of the site.

There would be a minor adverse visual impact during operation from adjacent residential streets to the south-east, given the increased intensity of lighting that would be near residential properties on Burrows Avenue, George and Hogan streets due to the location of the new station entries.

Sydney Metro Trains Facility South

Daytime visual impacts

In total 11 representative viewpoints were assessed for the approved project for the daytime visual impact assessment at the Marrickville dive site (southern) (two of these were not numbered). Of these, 10 are considered relevant to the proposed modification and have been re-assessed for the Sydney Metro Trains Facility South. These 10 viewpoints (shown on Figure 16-2) are:

- Viewpoint 1: View west from Edgeware Road
- Viewpoint 2: View west from the Bedwin Road Bridge
- Viewpoint 3: View west from Camdenville Park
- Viewpoint 4: View north-west from Unwins Bridge Road
- Viewpoint 5: View north from Bolton Street
- Viewpoint 6: View north-east along Railway Parade
- Viewpoint 7: View southeast from Sydney Steel Road to footpath connection with Shirlow Street
- Viewpoint 8: View south-west from Sydney Steel Road
- Viewpoint 9: View south-east from the corner of Murray Street and Edinburgh Road
- Viewpoint 10: Views from the rail corridor.

The remaining viewpoint assessed for the approved project would not have views to the proposed modification and there would be no change to the approved project impacts.

Two additional representative viewpoints were selected to inform the visual amenity assessment for the proposed modification. The two additional representative viewpoints (shown in Figure 16-2) are:

- Viewpoint 11: View from path between Shirlow Street and Sydney Steel Road
- Viewpoint 12: View south-east along Edinburgh Road.

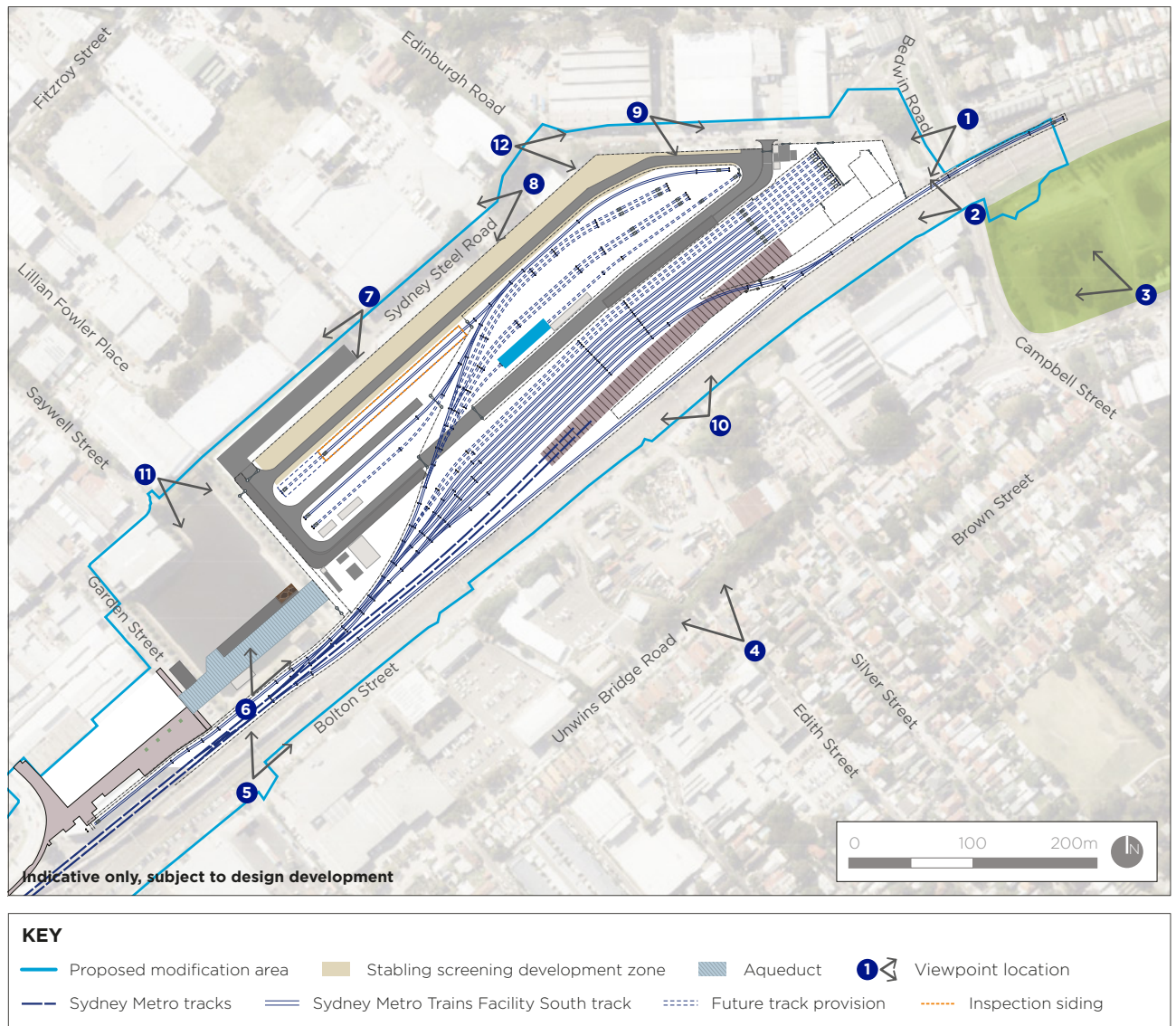


Figure 16-2 Representative viewpoints for Sydney Metro Trains Facility South

The anticipated daytime visual impacts and the relative change in impact compared to the approved project on representative viewpoints during construction and operation are summarised in Table 16-12 and Table 16-13 respectively.

Existing views of the new viewpoints are provided in Plate 16-16 and Plate 16-17a respectively. An artist's impression of the Sydney Metro Trains Facility South from viewpoint 12 is provided as Plate 16-17b.



Plate 16-16 Viewpoint 11: View from path between Shirlow Street to Sydney Steel Road



Plate 16-17a Viewpoint 12: View south-east along Edinburgh Road (existing view)



Plate 16-17b Viewpoint 12: View south-east along Edinburgh Road (artist's impression)

Table 16-12 Daytime visual impacts – construction

Location	Sensitivity rating	Approved project		Proposed modification	
		Visual change	Visual impact	Visual change	Visual impact
Viewpoint 1 View west from Edgeware Road	Neighbourhood	Noticeable reduction	Negligible	Noticeable reduction	Negligible
Viewpoint 2 View west from the Bedwin Road Bridge	Neighbourhood	No perceived change	Negligible	No perceived change	Negligible
Viewpoint 3 View west from Camdenville Park	Local	No perceived change	Negligible	No perceived change	Negligible
Viewpoint 4 View north-west from Unwins Bridge Road	Neighbourhood	No perceived change	Negligible	No perceived change	Negligible
Viewpoint 5 View north from Bolton Street	Neighbourhood	No perceived change	Negligible	No perceived change	Negligible
Viewpoint 6 View north-east along Railway Parade	Neighbourhood	Noticeable reduction	Negligible	Noticeable reduction	Negligible

Location	Sensitivity rating	Approved project		Proposed modification	
		Visual change	Visual impact	Visual change	Visual impact
Viewpoint 7 View southeast from Sydney Steel Road to footpath connection with Shirlow Street	Neighbourhood	No perceived change	Negligible	No perceived change	Negligible
Viewpoint 8 View south-west from Sydney Steel Road	Neighbourhood	No perceived change	Negligible	Considerable reduction	Minor adverse
Viewpoint 9 View south-east from the corner of Murray Street and Edinburgh Road	Neighbourhood	Noticeable reduction	Negligible	Considerable reduction	Minor adverse
Viewpoint 10 Views from the rail corridor.	Local	Noticeable reduction	Minor adverse	Considerable reduction	Moderate adverse
Viewpoint 11 View from path between Shirlow Street and Sydney Steel Road	Local	N/A	N/A	Considerable reduction	Moderate adverse
Viewpoint 12 View south-east along Edinburgh Road.	Neighbourhood	N/A	N/A	Considerable reduction	Moderate adverse

In addition to the visual impacts identified in the for the approved project, there would be an increased adverse impact during construction in views southwest from Sydney Steel Road, views from Murray Street and Edinburgh Road (viewpoints 8 and 9) as a result of the expansion of the site, the scale of the earthworks required and additional removal of vegetation. This would result in a minor adverse visual impact at these locations. There would also be an increased adverse visual impact in views from the rail corridor due to the extending of works into the Marrickville drainage reserve and works to construct the new pumping station and aqueduct. This would result in a moderate adverse visual impact during construction.

Table 16-13 Daytime visual impacts – operation

Location	Sensitivity rating	Approved project		Proposed modification	
		Visual change	Visual impact	Visual change	Visual impact
Viewpoint 1 View west from Edgeware Road	Neighbourhood	No perceived change	Negligible	No perceived change	Negligible
Viewpoint 2 View west from the Bedwin Road Bridge	Neighbourhood	No perceived change	Negligible	No perceived change	Negligible
Viewpoint 3 View west from Camdenville Park	Local	No perceived change	Negligible	No perceived change	Negligible

Location	Sensitivity rating	Approved project		Proposed modification	
		Visual change	Visual impact	Visual change	Visual impact
Viewpoint 4 View north-west from Unwins Bridge Road	Neighbourhood	No perceived change	Negligible	No perceived change	Negligible
Viewpoint 5 View north from Bolton Street	Neighbourhood	No perceived change	Negligible	No perceived change	Negligible
Viewpoint 6 View north-east along Railway Parade	Neighbourhood	No perceived change	Negligible	No perceived change	Negligible
Viewpoint 7 View southeast from Sydney Steel Road to footpath connection with Shirlow Street	Neighbourhood	No perceived change	Negligible	No perceived change	Negligible
Viewpoint 8 View south-west from Sydney Steel Road	Neighbourhood	No perceived change	Negligible	No perceived change	Negligible
Viewpoint 9 View south-east from the corner of Murray Street and Edinburgh Road	Neighbourhood	Noticeable reduction	Negligible	Noticeable reduction	Negligible
Viewpoint 10 Views from the rail corridor.	Local	No perceived change	Negligible	Considerable reduction	Moderate adverse
Viewpoint 11 View from path between Shirlow Street to Sydney Steel Road	Local	N/A	N/A	Considerable reduction	Moderate adverse
Viewpoint 12 View south-east along Edinburgh Road.	Neighbourhood	N/A	N/A	No perceived change	Negligible

During operation, there would be an increased adverse visual impact in views from the rail corridor, due to the changes to the Sydenham Pit and Drainage Pumping Station. The introduction of the aqueduct and new pumping station would alter the character and obstruct views to the water and stone embankments of the pit. This would result in a moderate adverse visual impact during operation.

Night-time visual impacts

The Marrickville dive site (southern) was assessed for the approved project for the night-time visual impact assessment. This location is considered relevant to the proposed modification and has been re-assessed for Sydney Metro Trains Facility South.

A summary of the potential night-time visual impacts, and the potential change in night-time visual impacts from the approved project, is provided for construction and operation in Table 16-14 and Table 16-15.

Table 16-14 Night-time visual impacts – construction

Location	Sensitivity rating	Approved project		Proposed modification	
		Visual change	Visual impact	Visual change	Visual impact
Marrickville dive site	E3: medium district brightness	No perceived change	Negligible	No perceived change	Negligible

Table 16-15 Night-time visual impacts – operation

Location	Sensitivity rating	Approved project		Proposed modification	
		Visual change	Visual impact	Visual change	Visual impact
Marrickville dive site	E3: medium district brightness	No perceived change	Negligible	No perceived change	Negligible

The proposed modification would not result in any change at the Marrickville dive site (southern) to the potential night-time visual impacts of the approved project during construction or operation. This is due to the relatively low sensitivity of the surrounding viewing areas and absorption of the change into the surrounding area.

Rail corridor

Daytime visual impacts

The proposed modification would introduce potential daytime visual impacts in new areas that were not assessed for the approved project. Two representative viewpoints were selected to inform the visual amenity assessment for the proposed modification. The two additional representative viewpoints (shown in Figure 16-3) are:

- Viewpoint 1: View north-west from Tillman Park, Tempe
- Viewpoint 2: View south from Fraser Park, Marrickville.

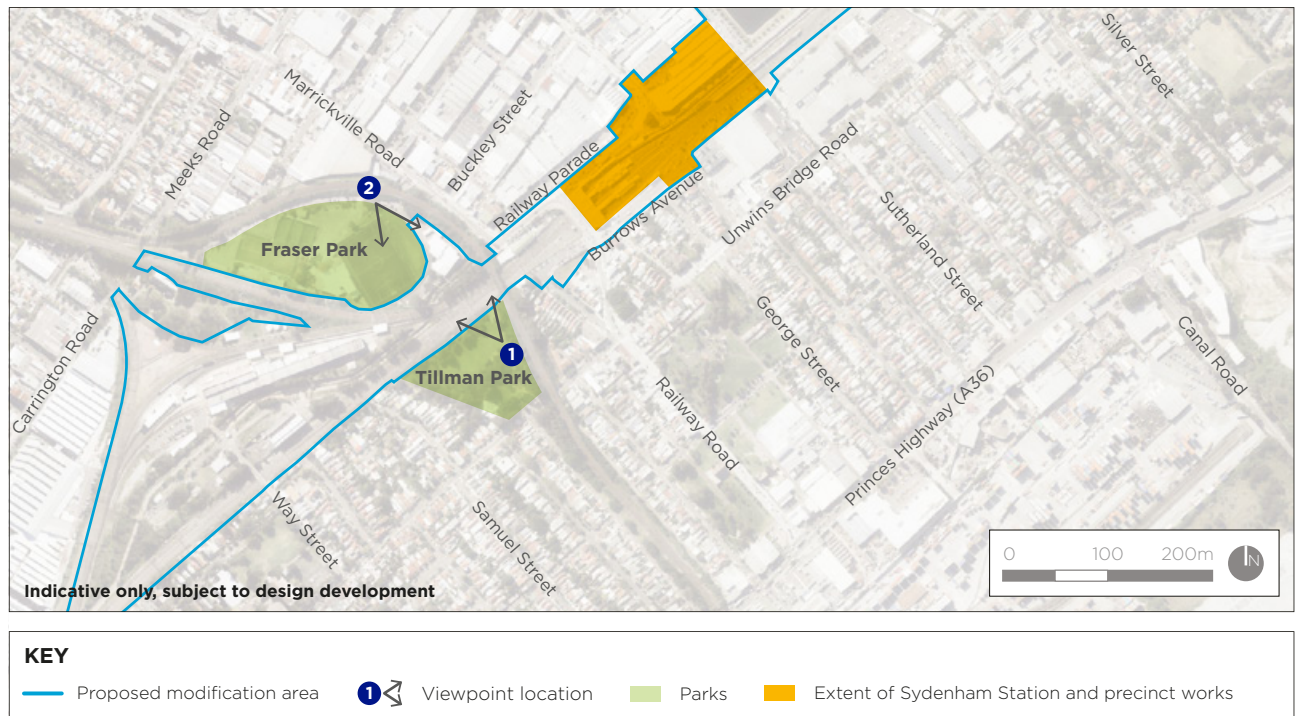


Figure 16-3 Representative viewpoints for the rail corridor

The anticipated daytime visual impacts of the proposed modification construction and operation are summarised in Table 16-16.

Existing views of these new viewpoints are provided in Plate 16-8 and Plate 16-9 respectively.



Plate 16-18 Viewpoint 1: View north-west from Tillman Park, Tempe



Plate 16-19 Viewpoint 2: View south from Fraser Park, Marrickville

Table 16-16 Daytime visual impacts

Location	Sensitivity rating	Construction		Operation	
		Visual change	Visual impact	Visual change	Visual impact
Viewpoint 1 View north-west from Tillman Park, Tempe	Local	No perceived change	Negligible	No perceived change	Negligible
Viewpoint 2 View south from Fraser Park, Marrickville	Local	Noticeable reduction	Minor adverse	No perceived change	Negligible

The proposed modification would result in additional visual impacts at new locations than the approved project. Construction of the proposed modification would result in minor adverse visual impacts on views from Fraser Park due to the removal of vegetation within the rail corridor and the scale of construction sites located in close proximity to Fraser Park.

Operation of the proposed modification would result in negligible visual impacts. Intensification of rail corridor infrastructure may be seen from these viewpoints and from nearby residential properties.

Night-time visual impacts

The proposed modification would introduce potential night-time visual impacts in new areas that were not assessed for the approved project.

A summary of the potential night-time visual impacts of the proposed modification on the rail corridor is provided for construction and operation in Table 16-17.

Table 16-17 Night-time visual impacts – construction

Location	Sensitivity rating	Construction		Operation	
		Visual change	Visual impact	Visual change	Visual impact
Rail corridor	E3: Medium district brightness	Noticeable reduction	Minor adverse	Noticeable reduction	Minor adverse

At night there would be a negligible visual impact during construction due to the absorption of the works into the existing, brightly lit night scene.

During operation, the rail corridor would not be lit at night, however, the headlights and internal lighting of a more frequent metro train service, would be seen along the alignment. This would be generally consistent with the surrounding night scene and would result in a minor adverse visual impact along the railway corridor.

16.4 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans.

The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified. These mitigation measures would adequately address the potential additional landscape character and visual amenity impacts. No additional or revised landscape character and visual amenity mitigation measures are considered necessary.

In addition, the conditions of approval issued for the approved project would also apply to the proposed modification. Of relevance this includes:

- Condition E101 – development of Station Design and Precinct Plans to present an integrated urban and place making outcome
- Condition E102 – requirement to achieve a minimum visual impact of ‘minor benefit’ for all design elements of the project
- Condition E104 – requirement for permanent external lighting to comply with relevant Australian Standards.

FLOODING AND HYDROLOGY

CHAPTER SEVENTEEN



17 Flooding and hydrology

This chapter provides an assessment of the potential change in impact on flooding and hydrology as a result of the proposed modification, and identifies mitigation measures to minimise these impacts.

17.1 Assessment methodology

17.1.1 Flooding

The flooding assessment used a similar method as was used for the assessment of the approved project and involved:

- Hydraulic modelling to quantify flood behaviour, using catchment study reports and GIS drainage data from the local council
- An assessment of the potential change in flooding impacts and risks associated with the proposed modification around Sydenham Station and Sydney Metro Trains Facility South
- Developing measures to mitigate changes to the flood regime as a result of the proposed modification.

A one per cent annual exceedance probability (AEP) rainfall event was adopted for the flooding assessment and the design of the proposed modification. AEP is a measure of the frequency of a rainfall event. A one per cent AEP event is a rainfall event with a one per cent change of being exceeded in magnitude in any year.

The following plans, policies and guidelines were considered in the assessment:

- *Floodplain Development Manual: the management of flood liable land* (DIPNR, 2005)
- *Floodplain Risk Management Guide Incorporating Sea Level Rise Benchmarks in Flood Risk Assessments* (DECCW, 2010)
- *Floodplain Risk Management Guideline: Practical Considerations of Climate Change* (DECC, 2007)
- *Planning circular: New guideline and changes to section 117 direction and EP&A Regulation on flood prone land* (Department of Planning, 2007).

The assessment of flooding for the approved project included consideration of elements between the approved dive structure and Sydenham Station. That assessment also noted that the Sydenham to Bankstown Environmental Impact Statement would refine and update the flood modelling in the area between the Marrickville tunnel portal and Sydenham Station. The updated flood modelling is now being carried out as part of this assessment of the proposed modification.

17.1.2 Hydrology

The hydrology assessment used a similar method as was used for the assessment of the approved project and involved:

- Reviewing background information relevant to the study area to define the existing environment, including previous studies, mapping, survey data and topography
- A site visit to ground truth the results of the desktop review
- Identifying and assessing construction and operational activities that may impact on the surface water hydrology of watercourses within the study area
- Identifying potential impacts on groundwater
- Identifying management and mitigation measures to manage potential impacts on surface water and groundwater hydrology.

The following plans, policies and guidelines were considered in the assessment:

- *Greater Metropolitan Region Groundwater Sources*
- *Greater Metropolitan Regional Environmental Plan No 2 – Georges River Catchment*
- *Cooks River Catchment Management Strategy* (Cooks River Catchment Management Committee, 1999)
- *NSW Aquifer Interference Policy* (NSW Office of Water, 2012).

17.2 Existing environment

The existing flooding, hydrology and water quality environment around Sydenham was described in the assessment for the approved project. This section provides further details specifically related to the proposed modification.

17.2.1 Catchment

The proposed modification would be located in the Cooks River catchment. The Cooks River catchment, located in the inner to middle south-western suburbs of Sydney, has an area of about 102 square kilometres. The majority of the catchment is highly developed. The Cooks River itself is about 23 kilometres long, and flows from Chullora in the west to Botany Bay in the east. The river discharges into the north of Botany Bay, near Sydney Airport. The river is tidally influenced as far as South Enfield. Major tributaries of the river include:

- Coxs Creek
- Cup and Saucer Creek
- Wolli Creek
- Alexandra Canal
- Muddy Creek
- Eastern Channel
- Western Channel.

Parts of the river are natural; however, other sections were lined with concrete from the 1940s onwards. Sydney Water has undertaken progressive channel naturalisation works at three locations to restore the river closer to its natural state. The former Sydney Metropolitan Catchment Management Authority undertook a number of wetland remediation projects along the Cooks River, in consultation with local councils, between 2008 and 2012.

The catchment is highly urbanised, meaning that the rainfall-runoff response of the catchment has been altered from a natural state, resulting in changes to the quantity and speed of runoff within the catchment.

17.2.2 Existing watercourses

The proposed modification would cross the Eastern Channel (a tributary of the Cooks River) about 250 metres south-west of Sydenham Station. The watercourse is highly modified, with some form of straightening, realignment and concrete lining having occurred on the majority of Cooks River and its tributaries.

17.2.3 Catchment flooding conditions

The Cooks River catchment in the area around the proposed modification is susceptible to flooding. The modelling of the existing flooding extents shows that minor flooding occurs in the vicinity of Sydenham Station, with more extensive flooding occurring in the areas surrounding the station. Deep and fast flowing floodwaters also occur within the Eastern Channel.

The *Marrickville Valley Flood Study* (NSW Government and Sydney Water, 2013) noted the following:

- The rail corridor (including the tracks) in the vicinity of Sydenham Station would flood during a 39 per cent AEP event.
- Roads to the south (including Swain Street, Wright Street, Hogan Avenue, George Street, Bolton Street and Burrows Avenue) and to the north (including Railway Parade, Murray Street and Garden Street) of the rail corridor would flood during a one per cent AEP event.
- Flooding of the roads on either side of Sydenham Station (Railway Parade to the north and Bolton Street to the south) would be greater than 100 millimetres in a one per cent AEP event.

Flood risk management

The Cooks River Floodplain Risk Management Study and Plan (WMA Water and Storm Consulting, 2015) does not include any floodplain management measures specifically related to the area around the proposed modification.

The East Channel East Subcatchment Management Plan Technical Report Volume 1 – Management Study (Marrickville Council, 2011) identified proposed flood mitigation works at the intersection of Railway Parade and Edgeware Road (Marrickville), to minimise flood hazards during the one per cent AEP event, and some drainage issues during smaller events. The proposed works include the duplication of the culvert along Railway Parade and some other works to existing infrastructure. The report did not provide any timing for the works.

17.2.4 Surface hydrology, drainage infrastructure and flooding conditions

Surface hydrology and drainage infrastructure

The stormwater drainage network controls stormwater flows for the smaller storm events throughout the project area. There are numerous stormwater drainage crossings beneath the rail line within the proposed modification study area. This network manages stormwater flows predominantly from roads and urban areas, and crosses beneath the rail line in culverts at low points.

Existing drainage issues within the rail corridor are generally related to insufficient capacity within the surrounding local stormwater drainage network, which overflows into the rail corridor during flood events.

The Eastern Channel runs along the north-western edge of the rail corridor north of Sydenham Station. The upstream stormwater in the channel is directed into Sydney Water's Sydenham Pit and Drainage Pumping Station. Water is stored in the pit to minimise the impacts of peak flows during storm events. Water is then pumped into the Eastern Channel in a controlled manner to minimise the likelihood of flooding.

Flooding conditions

Flood modelling of the existing drainage network carried out for the location of the Sydney Metro Trains Facility South found that an extensive network of overland flow paths drain into the Eastern Channel during large storm events, resulting in the existing network being at capacity. The overland flows were found to be from all directions, including the Sydney Metro Trains Facility South site. The modelling also found that the following occurred during larger storms:

- Minor flooding in the vicinity of Sydenham Station with more extensive flooding in the surrounding areas
- Deep and fast flowing flood waters within the Eastern Channel.

Modelling of the existing flood situation was undertaken for the one per cent AEP event, with a ten per cent allowance for an increase in peak rainfall intensity. This is referred to as the one per cent AEP climate change event. Modelling was also undertaken for the probable maximum flood event, which is the maximum flood which can theoretically occur. The extent of existing flooding for the one per cent AEP climate change event and the probable maximum flood event was mapped and is shown in Figure 17-1.

A summary of the existing flood conditions as shown in the flood mapping is as follows:

- During the one per cent AEP climate change event, flooding of the rail tracks is between 0.2 and 0.5 metres deep near Sydenham Station, while flood velocity is less than one metre per second
- During the probable maximum flood event, flooding extents are generally greater and flood depths are deeper
- In the Eastern Channel, peak velocities are around 2.5 metres per second, while peak flood velocities in the probable maximum flood event are typically up to 0.5 metres per second higher than those in the one per cent AEP event.

The modelling indicated that access routes around Sydenham and Marrickville stations would also be flooded, including:

- Unwins Bridge Road
- Bolton Street
- Burrows Avenue
- Railway Parade
- Sydenham Road
- Marrickville Road.



KEY

 Proposed modification area

Flood depth (m)

	0.00 - 0.05		1.01 - 1.50
	0.05 - 0.30		1.50 - 2.00
	0.30 - 0.50		2.00 - 2.50
	0.50 - 1.00		>2.50

Indicative only, subject to design development



Figure 17-1 Existing flood affected areas around the proposed modification site - 1% AEP with 10% climate change

Emergency management

The applicable emergency management plan for the study area is the *South West Metropolitan Emergency Management District Disaster Plan* (NSW Government, July 2012).

Preliminary discussions between the design team and the NSW State Emergency Service indicated that the key flood evacuation routes in the Sydenham area are Edgeware Road in a north-westerly direction to Stanmore Road, and Unwins Bridge Road in Marrickville.

17.2.5 Groundwater

The groundwater level within the proposed modification area was recorded at about 2.3 metres below ground level.

Groundwater has been observed discharging from open cuttings along the T3 Bankstown Line, within which the proposed modification is located. The surface groundwater system is likely to be recharged by rainfall and percolation from irrigation of residential gardens and open spaces, as well as incidental runoff from impervious surfaces, such as roads and footpaths.

Quaternary alluvium underlies the Cooks River and its tributaries and forms an aquifer. Groundwater is also present within localised alluvial deposits in some gullies.

Groundwater salinity within the Quaternary alluvium and localised alluvial deposits is expected to vary from lower salinity in the upper reaches of the Cooks River, to higher salinity in the lower reaches due to mixing and tidal influences (AECOM, 2015).

Groundwater encountered at deeper levels is expected to have lower salinity and low concentrations of dissolved metals and nutrients.

17.3 Potential impacts

17.3.1 Construction impacts

Hydrology and flooding

The construction of the Sydney Metro Trains Facility South is not expected to result in a substantial change in construction phase flood impacts from those identified for the approved project.

Impacts to flooding in the vicinity of Sydenham Station during construction of the proposed modification are expected to be highly localised and minor.

17.3.2 Operation impacts

Hydrology and flooding

Extensive changes to the existing stormwater drainage network would be required for the proposed modification, including:

- Realignment of the Eastern Channel and modifications at the Sydenham Pit and Drainage Pumping Station
- Raising of the Sydney Metro Trains Facility South to a level above the probable maximum flood
- Replacement of the existing Eastern Channel by culverts, which would pass beneath the facility on a new alignment
- Raising of the tracks to the level of the probable maximum flood at the tunnel dive structure, to prevent entry of water into the tunnel portal in all flood events.

With the proposed drainage and flood improvements in place flooding impacts would generally be less than those identified for the approved project. Flooding impacts from the proposed modification compared to the existing situation are described below. The change in flood levels in the vicinity of the proposed modification is shown on Figure 17-2.

Overland flows blocked by the Sydney Metro Trains Facility South would be captured and directed to the new Eastern Channel culverts through provision of a series of new stormwater inlets in events up to and including the one per cent AEP climate change event. Flood levels would be reduced in Edinburgh Road in this event. Flood levels at Sydenham Station would also be reduced. Flood level increases are predicted in the Eastern Channel as a result of increased flows being directed into the Eastern Channel. A proposed raised western channel bank near Tempe Station would keep flows within the Eastern Channel.

Properties located along the Eastern Channel are predicted to experience no worse flooding than under existing conditions with the design measures in place.

Peak flood velocities in the Eastern Channel and on Edinburgh Road are predicted to increase by up to 1 m/s in the Eastern Channel in the one per cent AEP climate change event compared to the existing situation. A reduction in flood levels would occur near Unwins Road bridge, Sydney Steel Road and Edinburg Road, for events up to the one per cent AEP climate change event compared to the existing situation.

Flood levels in the PMF near the Sydenham Pit and Drainage Pumping Station and on Edinburgh Road would decrease. The presence of the Sydney Metro tracks would block flood water from entering the Eastern Channel in the PMF however, resulting in flood level increases of up to 600 mm in Bolton Street and increases within the rail corridor of up to 700 mm compared to the existing situation. A flood level increase of up to 370 mm in Unwins Bridge Road is predicted for the PMF. Affected properties include commercial and industrial facilities on the north side of Unwins Bridge Road, with predicted flood level increases of over 500 mm in some locations. A number of residential properties on the south side of Unwins Bridge Road would be affected by flood level increases in the PMF of between 100 mm and 400 mm compared to the existing situation. Increases in flood extent compared to the existing situation are predicted on Sutherland Street and Frederick Street on the southern side of the rail corridor.

The presence of aqueduct piers and access ramp to the Sydenham Pit and Drainage Pumping Station would result in a small decrease in the available storage capacity in the pit. It is proposed to increase the pump out rate from the pit to counteract any reductions in flood storage capacity.

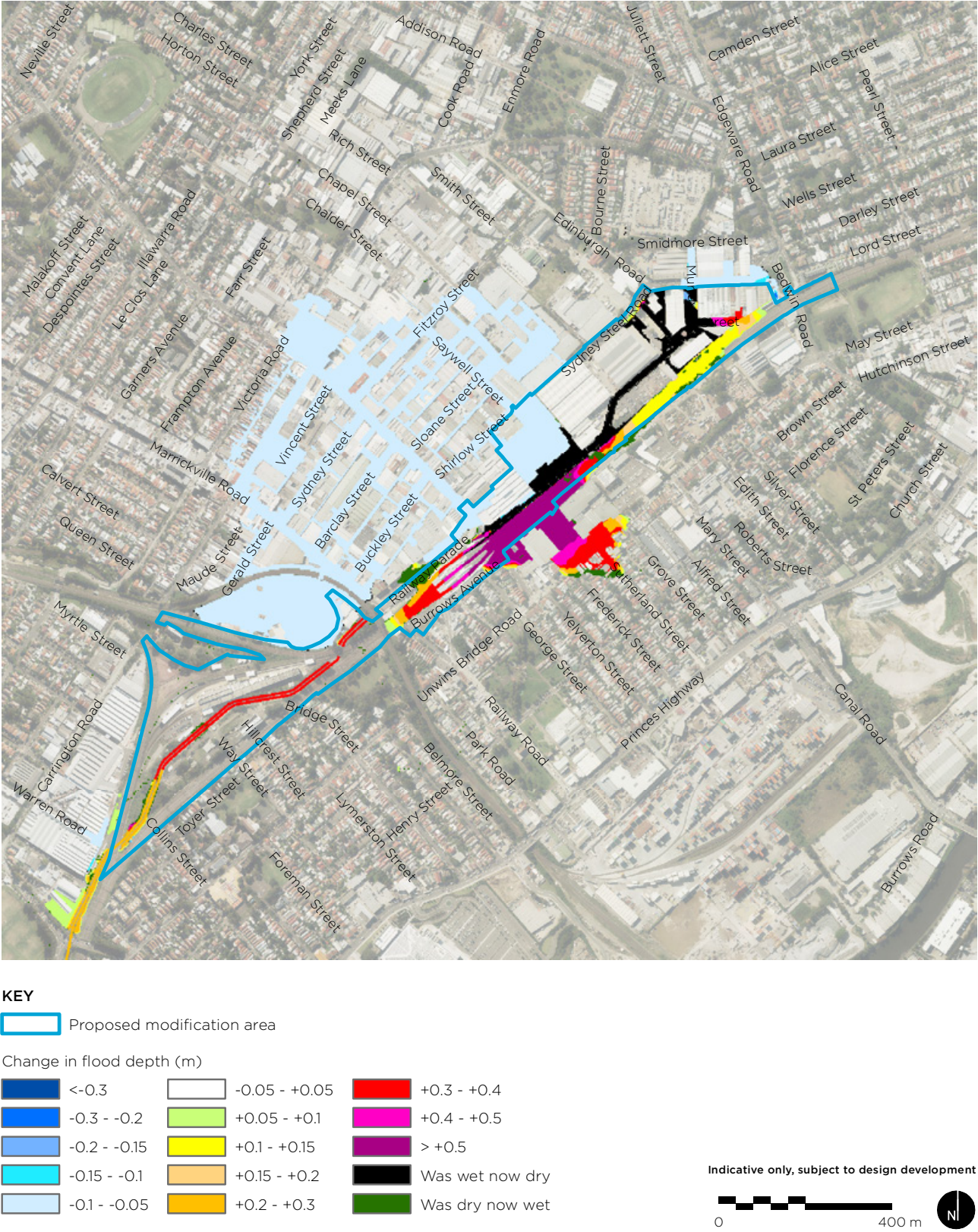


Figure 17-2 Changes in flood levels

17.4 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans. The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified.

The flooding and hydrology assessment for the proposed modification identified that existing mitigation measures FH4, FH5, FH6, FH7 and FH8 would be applied to the Sydenham Station and surface track works south locations. These changes to mitigation measures are listed in Table 17-1, with additions shown in **bold** text.

In addition, the conditions of approval issued for the approved project would also apply to the proposed modification.

Table 17-1 Mitigation measures – flooding and hydrology

ID	Mitigation measure	Applicable location(s) ¹
FH4	Where feasible and reasonable, detailed design would result in no net increase in stormwater runoff rates in all storm events unless it can be demonstrated that increased runoff rates as a result of the project would not increase downstream flood risk.	STW, AS, MDS, SS , STWS
FH5	Where space permits, on-site detention of stormwater would be introduced where stormwater runoff rates are increased. Where there is insufficient space for the provision of on-site detention, the upgrade of downstream infrastructure would be implemented where feasible and reasonable.	STW, AS, MDS, SS , STWS
FH6	Detailed design would occur in consultation with Inner West Council to ensure future drainage improvement works around the Marrickville dive site, Sydenham Station and the surface track works south would not be precluded.	MDS, SS , STWS
FH7	Consultation would be carried out with Inner West Council to ensure flood-related outcomes of the project are consistent with any future floodplain risk management study and / or plan developed for the Marrickville Valley Catchment.	MDS, SS , STWS
FH8	The frequency of Sydney Trains rail service disruptions due to flooding would not be increased in the vicinity of the Marrickville dive structure, Sydenham Station and the surface track works south .	MDS, SS , STWS

¹ STW: Surface track works; CDS: Chatswood dive site; AS: Artarmon substation; CN: Crows Nest Station; VC: Victoria Cross Station; BP: Blues Point temporary site; GI: Ground improvement works; BN: Barangaroo Station; MP: Martin Place Station; PS: Pitt Street Station; CS: Central Station; WS: Waterloo Station; MDS: Marrickville dive site (including Sydney Metro Trains Facility South); SS: Sydenham Station; STWS: Surface track works south Metro rail tunnels: Metro rail tunnels not related to other sites (eg TBM works); PSR: Power supply routes.

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CONTAMINATION

CHAPTER EIGHTEEN



18 Contamination

This chapter provides an assessment of the potential changes to contamination impacts as a result of the proposed modification, and identifies mitigation measures to address these impacts.

18.1 Assessment methodology

The assessment methodology applied for contamination was the same as used for the assessment of the approved project and involved:

- A review of contamination assessments previously carried out near the proposed modification, where available
- A review of publicly available data and web-based information searches, including:
 - ◆ the Contaminated Sites Register and Record of Notices under Section 58 of the *Contaminated Land Management Act 1997*, maintained by the NSW Environment Protection Authority
 - ◆ environment protection licences, applications, notices, audits or pollution studies and reduction programs
- A review of historical aerial photography to identify potential contamination sources located near the proposed modification based on previous land use
- Identification of the potential for the project to disturb acid sulfate soils and the associated impacts
- Recommendations for additional investigations and / or management of potentially contaminated sites which may be encountered during construction
- Development of mitigation measures to address potential contamination impacts.

The following guidelines were considered (where relevant):

- *Acid Sulfate Soils Assessment Guidelines* (Department of Planning, 2008)
- *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and EPA, 1998)
- *AS4482:2005 Guide to the investigation and sampling of sites with potentially contaminated soil*
- *Guidelines for Consultants Reporting on Contaminated Sites* (Office of Environment and Heritage, 2011)
- *National Environment Protection (Assessment of Site Contamination) Amendment Measure (No.1)* (National Environment Protection Council (NEPC), 2013))
- *Waste Classification Guidelines* (EPA, 2014a)
- *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (EPA, 2015a).

18.2 Existing environment

The existing contamination environment around Sydenham was described in the assessment of the approved project. This section provides further details specific to the proposed modification.

18.2.1 Historical aerial photographs

Historical aerial photographs from the NSW Land and Property Management Authority (Land and Property Information Division) were reviewed for the years 1943, 1961, 1970, 1994, 2003 and 2014. The photographs show that:

- Since the 1930s, the site and surrounds of the proposed Sydney Metro Trains Facility South site has increasingly changed from residential land use to commercial / industrial uses
- Sydenham Station has been renovated during this time with the commercial buildings on the north eastern portion of Sydenham Station being extended
- The rail corridor within the proposed modification study area has been used for rail infrastructure since at least 1943, surrounded by a mix of commercial, industrial and residential land uses.

18.2.2 NSW contaminated sites register

A search of the Contaminated Sites Register and Record of Notices under Section 58 of the *Contaminated Land Management Act 1997* (CLM Act) identified a two sites within 100 metres of the proposed modification that have been notified to the NSW Environment Protection Authority (EPA) (refer to Table 18-2). The assessment for the approved project did not identify any notified sites in the vicinity of Sydenham.

Table 18-2 Additional notified contamination sites

Site name	Site address	Contamination type	Contamination status	Location in relation to the proposed modification
Camdenville Park	Camdenville Park, May Street	Other Industry	Regulation under CLM Act not required	North-east of the area for the proposed Sydney Metro Trains Facility South
Sydenham Maintenance Centre	Way Street	Other Industry	Regulation under CLM Act not required	South-west of Sydenham Station and at the rail entry to Sydenham Maintenance Centre

18.2.3 Acid sulfate soils

Consistent with mapping provided as part of the assessment of the approved project, areas within the proposed modification are mapped as ‘disturbed terrain’ indicating the presence of acid sulfate soils across the site. Disturbed terrain may include filled areas, which often occur during reclamation of low lying swamps for urban development.

18.3 Potential impacts

18.3.1 Construction

Potentially contaminated sites

Based on the review of background information as presented in Section 18.2, there is the potential for contamination to be encountered at a number of locations within the proposed modification. As the assessment for the approved project did not identify any notified sites in the vicinity of Sydenham, these potential impacts would be in addition to the approved project.

Potential receivers during the construction phase may include:

- Human – construction workers, and nearby residents and commercial users
- Environment – groundwater and surface water.

Potential pathways for human (ie construction workers) exposure to contaminated soils and groundwater via direct contact, inhalation of dust and vapours, or ingestion and also leaching or run off in exposed soils.

Table 18-3 provides a summary of the sources of contamination in relation to the proposed modification, including the likely contamination risk during the construction works in these areas.

In summary, the main source of potential contamination identified at the proposed modification site is in relation to historical and current land use within these areas including rail activities and commercial and residential land use in and surrounding the proposed modification.

The main contaminants of potential concern include:

- Asbestos
- Hydrocarbons including total recoverable hydrocarbons, cyanides, semivolatile organic compounds (including polycyclic aromatic hydrocarbons, polychlorinated biphenyls, phenols and ethylene glycol) and volatile organic compounds (including benzene, toluene, ethylbenzene and xylene, and volatile chlorinated hydrocarbons)
- Heavy metals including lead
- Herbicides.

Sources of potential contamination in relation to the proposed Sydney Metro Trains Facility South were identified as part of the approved project and assessed in relation to the Marrickville dive site.

Additional activities and ground disturbance works would be undertaken as part of the proposed construction works at this location for the proposed Sydney Metro Trains Facility South as outlined in Table 18-3, as well as additional sources of potential contamination in relation to works in and around Sydenham Station.

The potential risks associated with the Sydney Metro Trains Facility South site, Sydenham Station and the Sydenham Maintenance Centre site were outside the scope of the assessment for the approved project and are new risk areas associated with the proposed modification.

Table 18-3 Areas of potential contamination

Site	Location relative to site	Potential contamination source	Likely risk
Proposed Sydney Metro Trains Facility South	On site at the proposed Sydney Metro Trains Facility South	- On-site activities associated with use of the site for railway purposes - Surrounding land use included railway corridor, commercial and light industrial land use - Previous construction works fill materials associated with existing rail corridor and surrounding commercial / industrial properties.	Moderate to high (potentially significant soil and groundwater contamination)
Sydenham Station	On site at Sydenham Station	- On-site activities associated with use of the site for railway purposes - Surrounding land use included commercial and light industrial - Previous construction works fill materials are likely to be present across the station area including the existing rail corridor, car parking, station building and station platforms.	Low to moderate (potential soil / groundwater contamination)
Rail corridor and Sydenham Maintenance Centre site	North east and south west of Sydenham Station and at the rail entry to Sydenham Maintenance Centre	- On-site activities associated with use of the Sydenham Maintenance Centre site for train cleaning, refuelling and train maintenance activities - Fill soil and petroleum hydrocarbons impacted soils previously recorded at the Sydenham Maintenance Centre site.	Moderate to high (identified soil and groundwater contamination)

The potential impact associated with exposure or disturbance of contaminants during construction of the proposed modification would be consistent with the risks identified for the approved project. These are:

- Mobilisation of surface and subsurface contaminants (impacting groundwater, surface water and soils)
- Migration of potential contaminants into surrounding areas (impacting groundwater, surface water and soils) via leaching, overland flow and / or subsurface flow (water and / or vapour)
- Mobilising potential groundwater and / or surface water contaminants
- Exposure to site workers, site users and site visitors
- Exposure to surrounding environmental receivers (such as flora, fauna and surrounding ecosystems).

These risks would be minimised and managed through the implementation of mitigation measures as discussed in Section 18.4.

Potentially contaminating construction activities

Consistent with the approved project, construction activities associated with the proposed modification would have the potential to result in the following contamination risks:

- Contamination of soils and / or groundwater due to spills and leaks of fuel, oils and other hazardous materials
- Disturbance of hazardous materials, including asbestos and / or materials containing lead paint during demolition of buildings and structures.

Mishandling of hazardous material waste has the potential to contaminate soils and to create health risks to construction workers and the community.

These impacts would be readily manageable by implementing standard construction environment mitigation measures as identified for the approved project.

Acid sulfate soils

Areas within the proposed modification are mapped as 'disturbed terrain', with a potential for acid sulfate soil to a depth of four metres below ground level. Therefore there is a high probability of encountering these soils during excavation in these areas.

The exposure of acid sulfate soils during excavation could result in the release of acid sulfates, which would damage surrounding vegetation, or cause acidic runoff offsite which would damage aquatic environments and / or drainage lines.

Further geotechnical testing of underlying sub-soil and rock stratum would be undertaken to determine the composition of rock and soil types likely to be present within excavation areas. If acid sulfate soils are encountered, they would be effectively managed in accordance with the *Acid Sulfate Soil Manual* (Acid Sulfate Soil Management Advisory Committee, 1998). The manual includes procedures for the investigation, handling, treatment and management of such soils.

This is consistent with the potential impacts of the approved project in relation to the impacts associated with the Marrickville dive site which would also be subject to works associated with the proposed Sydney Metro Trains Facility South and would be managed through the implementation of mitigation measures identified for the approved project. Additional impacts would occur in relation to excavation works in other areas of the proposed modification.

18.3.2 Operation

The assessment for the approved project identified potential contamination risks associated with spills and leaks of hazardous material from the operational water treatment plant adjacent to the Marrickville dive structure. The proposed modification would not change this potential risk.

In addition, and in the event that contamination is uncovered during the construction works, there would be potential for human health exposure during operation of the proposed modification. This is likely to be low in the context of the proposed use of the site, as most areas would have pathways broken by the presence of hard cover (ie the direct contact pathway will be eliminated).

No immediate vapour intrusion risk was identified for the proposed modification, however given a service station is located in the vicinity of Sydenham Station (about 95 metres south-west of the station on the corner of Unwins Bridge Road and Hogan Avenue), there may be potential vapour intrusion pathway at this site. This potential impact would be additional to any operational impacts identified and assessed as part of the approved project.

18.4 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (included as part of the EIS for the approved project) sets out the environmental management approach and strategy for the project, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans. The relevant project-specific mitigation measures identified for the approved project would continue to apply to the project as proposed to be modified.

The contamination assessment for the proposed modification identified that existing mitigation measures SCW1 would be applied to the Sydenham Maintenance Centre site at surface track works south location and SCW2 would be applied to the Sydenham Station and surface track works south location. These changes to mitigation measures are listed in Table 18-4, with additions shown in **bold** text.

In addition, the conditions of approval issued for the approved project would also apply to the proposed modification. Of relevance this includes condition E66 requiring the development of a Site Contamination Report to document the outcomes of Phase 1 and Phase 2 contamination assessments.

Table 18-4 Mitigation measures – contamination

ID	Mitigation measure	Applicable location(s) ¹
SCW1	Updated desktop contamination assessments would be carried out for Chatswood dive site, Blues Point temporary site, Barangaroo Station, Central Station, Waterloo Station and the Sydenham Maintenance Centre site within surface track works south. If sufficient information is not available to determine the remediation requirements and the impact on potential receivers, then detailed contamination assessments, including collection and analysis of soil and groundwater samples would be carried out. Detailed contamination assessment would also be carried out for the Barangaroo power supply route within Hickson Road and the Marrickville power supply route adjacent to Sydney Park and Camdenville Oval. In the event a Remediation Action Plan is required, these would be developed in accordance with <i>Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land</i> (Department of Urban Affairs and Planning and Environment Protection Authority, 1998) and a site auditor would be engaged.	CDS, BP, BN, CS, WS, STWS PSR
SCW2	Prior to ground disturbance in high probability acid sulfate areas at Barangaroo Station, Waterloo Station, and Marrickville dive site, Sydenham Station and the surface track works south, testing would be carried out to determine the presence of acid sulfate soils. If acid sulfate soils are encountered, they would be managed in accordance with the <i>Acid Sulfate Soil Manual</i> (Acid Sulfate Soil Management Advisory Committee, 1998).	BN, WS, MDS, SS , STWS

¹ STW: Surface track works; CDS: Chatswood dive site; AS: Artarmon substation; CN: Crows Nest Station; VC: Victoria Cross Station; BP: Blues Point temporary site; GI: Ground improvement works; BN: Barangaroo Station; MP: Martin Place Station; PS: Pitt Street Station; CS: Central Station; WS: Waterloo Station; MDS: Marrickville dive site (including the Sydney Metro Trains Facility South); SS: Sydenham Station; STWS: Surface track works south Metro rail tunnels; Metro rail tunnels not related to other sites (eg TBM works); PSR: Power supply routes.

BIODIVERSITY

CHAPTER NINETEEN



19 Biodiversity

This chapter provides an assessment of the potential changes to biodiversity impacts as a result of the construction and operation of the proposed modification and identifies mitigation measures to minimise these impacts.

19.1 Assessment methodology

The assessment of the potential biodiversity impacts followed the same methodology as was applied for the assessment of the approved project and involved:

- Desktop literature reviews of flora and fauna listed as occurring or potentially occurring in the vicinity of the modification area
- Field surveys and assessment.

19.1.1 Literature review and database searches

Existing information on the biodiversity of the modification area was obtained from a range of sources, including databases, aerial photographs and maps, and previous studies carried out in the modification area. Previous documents and reports relevant to the modification area were reviewed, including previous biodiversity studies, environmental attribute mapping, and previous impact assessments. Digital aerial photography was reviewed to identify spatial patterns in vegetation, land use, and landscape features.

Searches were undertaken of species databases to identify listed threatened species (under the *Threatened Species Conservation Act 1995*, *Environment Protection and Biodiversity Conservation Act 1999*, and the *Fisheries Management Act 1994*), known or likely to occur within the 'search area' (a radius of ten kilometres around the proposed modification area).

19.1.2 Study area

The study area for the biodiversity assessment for the proposed modification included both the Marrickville dive site (southern) area assessed as part of the approved project and the footprint of the Sydenham Station, Sydney Metro Trains Facility South and rail corridor works.

19.1.3 Field survey

Surveys of the study area (in addition to those carried out for the approved project) were conducted with reference to Section 6 of the *Framework for Biodiversity Assessment* and targeted survey guidelines as relevant. Surveys were undertaken between 16 June 2016 and 5 October 2016.

19.1.4 Likelihood of occurrence

The database searches identified threatened flora and fauna species that have been recorded or that are likely to occur within 10 kilometres of the study area. The probability that each threatened species occurs within the study area was determined as being either low, moderate, high or known.

19.2 Existing environment

The existing biodiversity environment in the vicinity of Sydenham was described as part of the assessment of the approved project.

19.3 Potential impacts

19.3.1 Construction

Key threatening processes

The assessment of the approved project identified two Key Threatening Processes of relevance to the project, being loss of hollow-bearing trees and invasion and establishment of exotic vines and scramblers. However, these were not related to the works in the vicinity of Sydenham.

In addition, the proposed modification would make a small contribution to the following Key Threatening Processes through clearing and edge effects:

- Removal of dead wood and dead trees
- Human-caused climate change.

Assessment according to the Framework for Biodiversity Assessment

Under the *Framework for Biodiversity Assessment*, impacts that require further consideration include impacts on critical habitat or on threatened species that are likely to significantly affect the persistence or viability of a population of a threatened species.

Although the proposed modification would result in the loss of very small areas of foraging habitat, it would not affect any critical habitat for the Grey-headed Flying-fox, threatened microbats, or other mobile threatened fauna that may potentially occur. The proposed modification would remove low quality, potential habitat for the endangered population of the Long-nosed Bandicoot in the Inner West located outside of its known area of occupancy. However, this is highly unlikely to threaten the viability of these species or population.

The proposed modification would not threaten the persistence or viability of the populations of any threatened species.

The proposed modification does not include any impacts on matters that require further consideration.

Loss of native vegetation

There is minimal native vegetation in the area to be impacted by the proposed modification. Native vegetation is limited to planted trees and shrubs and occasional scattered regeneration of common native plant species within previously disturbed areas.

Loss of fauna habitat

Clearing vegetation at the proposed modification site would result in the removal of fauna habitat. Planted trees and landscaped vegetation would be removed which could impact foraging habitat and shelter for fauna species. However, impacts would be to a very small amount of vegetation and would therefore be minor and generally restricted to common fauna species that inhabit urban environments.

Works on existing bridges, the removal of buildings at Sydenham Station and of additional buildings at the Sydney Metro Train Facility South site has the potential to impact roosting and nesting fauna including microbat habitat.

19.3.2 Operation

Potential impacts during operation of the proposed modification include:

- Generation of additional light and noise as a result of increased train movements
- Erosion and sedimentation as a result of runoff from hard stand areas
- Introduction of weed propagules by vehicles, maintenance staff, or customers
- Fauna mortality as a result of collision with trains.

The proposed modification area is dominated by existing rail and road infrastructure and industrial land uses, and is located in a highly modified environment. Vegetation within the study area is already subject to weed infestation and other edge effects. Fauna that occupy habitats within the study area and adjacent areas are likely to be accustomed to existing noise originating from passenger trains, road traffic, and the urban environment. Additional train movements are unlikely to increase significantly the risk of collisions above current levels, given the highly modified habitats present.

In this context, the proposed modification is not likely to comprise a substantial increase in any of these potential negative effects compared to the approved project.

19.4 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy for the project, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans. The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified.

The biodiversity assessment for the proposed modification identified that existing mitigation measure B2 is required to be applied to the location of the proposed modification. This change to mitigation measure B2 is listed in Table 19-1, with additions shown in bold text. In addition, the conditions of approval issued for the approved project would also apply to the proposed modification.

Table 19-1 Mitigation measures – biodiversity

Ref	Mitigation measure	Applicable location(s) ¹
B2	Potential bat roosting locations at Central Station, Waterloo Station, Marrickville dive site, Sydenham Station and the surface track works south would be checked by a qualified ecologist or wildlife handler prior to demolition. Any bats found would be relocated.	CS, WS, MDS, SS, STWS

¹ STW: Surface track works; CDS: Chatswood dive site; AS: Artarmon substation; CN: Crows Nest Station; VC: Victoria Cross Station; BP: Blues Point temporary site; GI: Ground improvement works; BN: Barangaroo Station; MP: Martin Place Station; PS: Pitt Street Station; CS: Central Station; WS: Waterloo Station; MDS: Marrickville dive site (including the Sydney Metro Trains Facility South); SS: Sydenham Station; STWS: Surface track works south Metro rail tunnels: Metro rail tunnels not related to other sites (eg TBM works); PSR: Power supply routes.

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CUMULATIVE IMPACTS

CHAPTER TWENTY



20 Cumulative impacts

This chapter provides an assessment of the potential changes to cumulative impacts as a result of the proposed modification, and identifies any changes to mitigation measures.

20.1 Assessment methodology

20.1.1 Overview

Potential cumulative impacts associated with the construction of the Marrickville dive site with the concurrent construction of a range of other projects were assessed for the approved project. This assessment provides consideration of any changes in potential cumulative impacts with these projects, and whether there are any potential cumulative impacts with other projects due to the proposed modification.

Cumulative impacts would occur when impacts from the project interact or overlap with impacts from other projects and potentially resulting in a larger overall impact.

Projects assessed as part of this assessment of potential changes to cumulative impacts are described in Table 20-1 along with their likely timeframe and proximity to the proposed modification.

Table 20-1 Projects assessed as part of the cumulative impact assessment

Project and date	Project details and proximity to the proposed modification
Sydney Metro City & Southwest Sydenham to Bankstown 2017 – 2023 (Project not yet approved)	The Sydney Metro Sydenham to Bankstown project would include an upgrade of the T3 Bankstown Line between Sydenham and Bankstown. The work between Sydenham and Bankstown would include upgrading the corridor and stations, with improvements to wayfinding and signage. The closest approved project construction site would be the Marrickville dive site (southern). The proposed modification would adjoin with the eastern extent of the Sydenham to Bankstown project.
WestConnex Stage 2: New M5 (Beverly Hills to St Peters) 2015 – 2019	Stage 2 of WestConnex: the New M5 – would run from the existing M5 East corridor at Beverly Hills via a tunnel to St Peters. The New M5 would include: • Twin tunnels that would more than double capacity along the M5 East corridor and provide motorway access to north of Sydney Airport • An interchange at an industrial site at St Peters • Connections from the interchange to key roads, including Campbell Road / Street, Euston Road and across the canal to Bourke Road • Widening of Campbell Road / Street and Euston Road. Work commenced in late 2015, with the upgrading of the M5 – King Georges Road interchange. The proposed modification works would be close to the WestConnex St Peters interchange.
WestConnex Stage 3: M4–M5 link 2019–2023 (Project not yet approved)	Stage 3 of WestConnex would deliver an 8.5 kilometre motorway tunnel with three lanes in each direction between the first two stages, linking the M4 and M5 corridors. The alignment would provide a western bypass of the Sydney CBD. It would generally run north of the Parramatta Road corridor from Haberfield with connections at Rozelle before heading south near Camperdown and connect to St Peters Interchange. The proposed modification would be close to the WestConnex St Peters interchange.

Project and date	Project details and proximity to the proposed modification
Sydenham to Bankstown Urban Renewal Corridor Strategy (Planning study – not a specific project)	The Sydenham to Bankstown Urban Renewal Corridor Strategy establishes a strategic planning framework to guide future development and infrastructure delivery throughout the corridor. The proposed modification would form part of the Sydenham Precinct and would provide new rail infrastructure to support growth within the precinct. As this is a planning study with no specific projects approved or timeframes identified, a cumulative impact assessment has not been undertaken.
Sydney Metro rail corridor development (Project(s) not yet approved)	Rail corridor development proposed in the vicinity of Sydenham Station and the Sydney Metro Trains Facility South. The nature and timing of rail corridor development is not currently known, however it is unlikely that rail corridor development at Sydenham would occur concurrently with the proposed modification works. As such, a cumulative impact assessment has not been undertaken.

20.2 Potential impacts

The potential changes to cumulative impacts, based on the likely interactions with the projects described above are identified in the following sections. Mitigation measures are included in Section 20.3.

20.2.1 Sydney Metro City & Southwest Sydenham to Bankstown

The approved project assessed potential cumulative impacts of the Marrickville dive site (southern) with the works at Sydenham Station as part of the Sydney Metro City & Southwest Sydenham to Bankstown project. As the Sydenham Station works now form part of this proposed modification, these impacts are assessed in the relevant chapters of this report.

Potential cumulative impacts may still occur with the Sydenham to Bankstown project in the vicinity of Sydenham and Marrickville stations. These cumulative impacts would be generally consistent with those described in the assessment of the approved project.

20.2.2 WestConnex Stage 2: New M5 (Beverley Hills to St Peters)

The nature of potential cumulative impacts of the proposed modification with WestConnex Stage 2 would be largely consistent with those identified for the approved project. There may be increases in the level of impacts due to the proposed modification, however no increase greater than a minor nature are expected.

Consultation would continue with the WestConnex Stage 2 delivery team in relation to the coordination of flooding and hydrology works in the vicinity of the proposed modification.

20.2.3 WestConnex Stage 3: M4-M5 link

The nature of potential cumulative impacts of the proposed modification with WestConnex Stage 3 would be largely consistent with those identified for the approved project. There may be increases in the level of impacts due to the proposed modification, however no increase greater than a minor nature are expected.

20.3 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy for the project, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans.

The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified. These measures would be adequate to manage the potential changes to cumulative impacts. No additional or revised cumulative impact mitigation measures are considered necessary.

In addition, the conditions of approval issued for the approved project would also apply to the proposed modification.

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CONSOLIDATED REVISED ENVIRONMENTAL MITIGATION MEASURES

CHAPTER TWENTY ONE



21 Consolidated revised environmental mitigation measures

21.1 Approach to environmental mitigation and management

The project approach to environmental mitigation and management was described in the Environmental Impact Statement and the Submissions and Preferred Infrastructure Report for the approved project. The approach is illustrated in Figure 21-1 and includes:

- Project design – measures which are inherent in the design of the project to avoid and minimise impacts
- Mitigation measures – additional to the project design which are identified through the environment impact assessment in Chapters 9 to 20. These measures are consolidated in Table 21-1
- Construction environmental management framework – details the management processes and documentation for the project. Further details are provided in the Preferred Infrastructure Report
- Construction noise and vibration strategy – identifies how Sydney Metro proposes to manage construction noise and vibration. Further details are provided in the Preferred Infrastructure Report
- Design guidelines – provides an assurance of end-state design quality. Further details are provided in the Preferred Infrastructure Report
- Environmental performance outcomes – which establish the intended outcomes which would be achieved by the project. The performance outcomes are identified in the Preferred Infrastructure Report.

This approach would also be applied to the proposed Sydenham Station and Sydney Metro Trains Facility South modification.

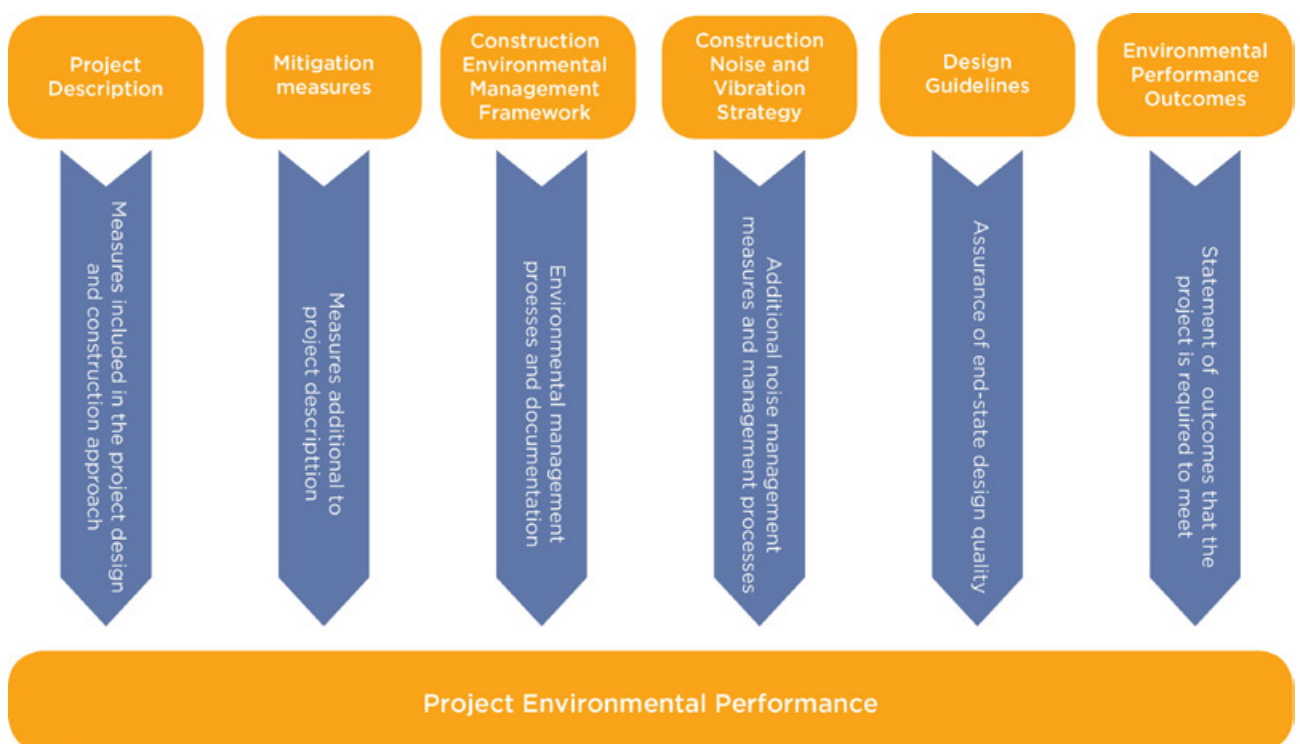


Figure 21-1 Project approach to environmental mitigation and management

21.2 Revised environmental mitigation measures

The list of mitigation measures presented in the Submissions and Preferred Infrastructure Report, the Victoria Cross Station and Artarmon Substation modification, the Central Walk modification and the Martin Place Station modification has been revised based on the assessment carried out for Sydenham Station and Sydney Metro Trains Facility South.

Table 21-1 provides the revised consolidated environmental mitigation measures. This table supersedes the mitigation measures presented in the Submissions and Preferred Infrastructure Report, the Victoria Cross Station and Artarmon Substation modification, the Central Walk modification and the Martin Place Station modification. New mitigation measures or additions to existing mitigation measures are shown in **bold** text, with deletions shown with a ~~strike through~~. This table assumes that the Victoria Cross Station and Artarmon Substation modification, the Central Walk modification and the Martin Place Station modification are approved without changes.

As per the approach for the approved project, the location(s) applicable to each mitigation measure are identified by using a unique identifier as follows:

- STW – Surface track works
- CDS – Chatswood dive site
- AS – Artarmon substation
- CN – Crows Nest Station
- VC – Victoria Cross Station
- BP – Blues Point temporary site
- GI – Ground improvement works
- BN – Barangaroo Station
- MP – Martin Place Station
- PS – Pitt Street Station
- CS – Central Station
- WS – Waterloo Station
- MDS – Marrickville dive site (this area also includes the necessary mitigation measures for the Sydney Metro Trains Facility South)
- SS – Sydenham Station
- STWS – Surface track works south
- Metro rail tunnels – Metro rail tunnels not related to other sites (eg TBM works)
- PSR – Power supply routes.

Table 21-1 Revised environmental mitigation measures

ID	Mitigation measure	Applicable location(s) ¹
Construction traffic and transport		
T1	Ongoing consultation would be carried out with (as relevant to the location) the CBD Coordination Office, Roads and Maritime Services, Sydney Trains, NSW Trains, the Port Authority of NSW, Barangaroo Delivery Authority, local councils, emergency services and bus operators in order to minimise traffic and transport impacts during construction.	All except metro rail tunnels
T2	Road Safety Audits would be carried out at each construction site. Audits would address vehicular access and egress, and pedestrian, cyclist and public transport safety.	All except metro rail tunnels
T3	Directional signage and line marking would be used to direct and guide drivers and pedestrians past construction sites and on the surrounding network. This would be supplemented by Variable Message Signs to advise drivers of potential delays, traffic diversions, speed restrictions, or alternate routes.	All except metro rail tunnels
T4	In the event of a traffic related incident, co-ordination would be carried out with the CBD Coordination Office and / or the Transport Management Centre's Operations Manager.	All except metro rail tunnels
T5	The community would be notified in advance of proposed road and pedestrian network changes through media channels and other appropriate forms of community liaison.	All except metro rail tunnels
T6	Vehicle access to and from construction sites would be managed to ensure pedestrian, cyclist and motorist safety. Depending on the location, this may require manual supervision, physical barriers, temporary traffic signals and modifications to existing signals or, on occasions, police presence.	All except metro rail tunnels
T7	Additional enhancements for pedestrian, cyclist and motorist safety in the vicinity of the construction sites would be implemented during construction. This would include measures such as: ● Use of speed awareness signs in conjunction with variable message signs near construction sites to provide alerts to drivers ● Community educational events that allow pedestrians, cyclists or motorists to sit in trucks and understand the visibility restrictions of truck drivers, and for truck drivers to understand the visibility from a bicycle; and a campaign to engage with local schools to educate children about road safety and to encourage visual contact with drivers to ensure they are aware of the presence of children ● Specific construction driver training to understand route constraints, expectations, safety issues, human error and its relationship with fitness for work and chain of responsibility duties, and to limit the use of compression braking ● Use of In Vehicle Monitoring Systems (telematics) to monitor vehicle location and driver behavior ● Safety devices on construction vehicles that warn drivers of the presence of a vulnerable road user located in the vehicles' blind spots and warn the vulnerable road user that a vehicle is about to turn.	All except metro rail tunnels
T8	Access to existing properties and buildings would be maintained in consultation with property owners.	All except metro rail tunnels
T9	All trucks would enter and exit construction sites in a forward gear, where feasible and reasonable.	All except metro rail tunnels

ID	Mitigation measure	Applicable location(s) ¹
T10	Any relocation of bus stops would be carried out by Transport for NSW in consultation with Roads and Maritime Services, the CBD Coordination Office (for relevant locations), the relevant local council and bus operators. Wayfinding and customer information would be provided to notify customers of relocated bus stops.	All except metro rail tunnels
T11	For special events that require specific traffic measures, those measures would be developed in consultation the CBD Coordination Office (for relevant locations), Roads and Maritime Services, Barangaroo Delivery Authority (for relevant locations) and the organisers of the event.	BN, MP, PS, CS
T12	Construction sites would be managed to minimise construction staff parking on surrounding streets. The following measures would be implemented: - Encouraging staff to use public or active transport - Encouraging ride sharing - Provision of alternative parking locations and shuttle bus transfers where feasible and reasonable. Transport for NSW would work with local councils to minimise adverse impacts of construction on parking and other kerbside use in local streets, such as loading zones, bus zones, taxi zones and coach zones.	All except metro rail tunnels
T13	Construction site traffic would be managed to minimise movements in the AM and PM peak periods.	All except metro rail tunnels
T14	Construction site traffic immediately around construction sites would be managed to minimise movements through school zones during pick up and drop off times.	All except metro rail tunnels
T15	Pedestrian and cyclist access would be maintained at Crows Nest during the temporary closure of Hume Street, and at Martin Place during the temporary partial closure of Martin Place. Wayfinding and customer information would be provided to guide pedestrians and cyclists to alternative routes.	CN, MP
T16	Timing for the temporary closure of the Devonshire Street tunnel would avoid periods of peak pedestrian demand. Wayfinding and customer information would be provided to guide pedestrians to alternative routes.	CS
T17	Consultation would occur with the Harbour Master, Roads and Maritime Services and Sydney Ferries' to ensure shipping channels are maintained during the Sydney Harbour ground improvement works.	GI
T18	During the closure of existing entrances to Martin Place Station, marshalls would be provided during the AM and PM peak periods to direct customers to available access and egress points.	MP
T19	Where existing parking is removed to facilitate construction activities, alternative parking facilities would be provided where feasible and reasonable.	All except metro rail tunnels
T20	Alternative pedestrian routes and property access would be provided where these are affected during the construction of the power supply routes.	PSR
T21	The potential combined impact of trucks from multiple construction sites would be further considered during the development of Construction Traffic Management Plans.	All except metro rail tunnels

ID	Mitigation measure	Applicable location(s) ¹
T22	Where existing footpath routes used by pedestrians and / or cyclists are affected by construction, a condition survey would be carried out to confirm they are suitable for use (eg suitably paved and lit), with any necessary modifications to be carried out in consultation with the relevant local council.	All except metro rail tunnels
T23	Specific station management measures would be implemented during pedestrian movement Phase 2. This would include strategies such as encouraging passengers to exit platforms at the closest stair case or escalator, signage and marshalling of passengers waiting to board to minimise those waiting adjacent to hoarding and to direct passengers so that there is even distribution along the platform.	CS
T24	The temporary closures of footpaths on Chalmers Street would not occur at the same time as the temporary closure of the Devonshire Street Tunnel.	CS
T25	During the closure of Randle Lane, traffic control would be provided at either end. Reversing movements out of Randle Lane onto Elizabeth Street and Randle Street would not be carried out during the peak periods of 7 am to 10 am and 3 pm to 7 pm.	CS
T26	During the closure of Randle Lane, access to basement car parking would be maintained where feasible and reasonable. If access cannot be maintained, alternative parking would be arranged.	CS
TT27	Detailed construction planning would be coordinated with the Sydenham to Bankstown project and the Temporary Transport Strategy arrangements to minimise impacts on the traffic and transport network.	SS
Operational traffic and transport		
OpT1	Enhancement of pedestrian infrastructure in the vicinity of Victoria Cross and Martin Place stations would be investigated further in consultation with (as relevant to the location) the CBD Coordination Office, Roads and Maritime Services and the relevant local council.	VC, MP
OpT2	Access would be maintained to neighbouring properties.	All except metro rail tunnels
OpT3	The design of the interface between the Frank Channon Walk extension and the signalised intersection at Mowbray Road / Hampden Road (including any shared zone proposal) would be developed in consultation with Roads and Maritime Services and Willoughby Council.	CDS
OpT4	Transport for NSW would work with local councils to minimise adverse impacts of operation on parking and other kerbside use in local streets, such as loading zones, bus zones, taxi zones and coach zones.	All except metro rail tunnels
OpT5	During detailed design, Transport for NSW would consult with Inner West Council, Roads and Maritime Services and other stakeholder on strategies to reduce the number of staged pedestrian marked foot crossings at the Edinburgh Road / Edgeware Road intersection.	MDS
OpT6	Transport for NSW would work with the Inner West Council to facilitate staged completion of relevant sections of the proposed active transport corridor between Sydenham and Bankstown subject to funding.	SS
OpT7	Transport for NSW would work with the Inner West Council to complete a parking study to manage the long term impacts of parking loss around Sydenham Station.	SS

ID	Mitigation measure	Applicable location(s) ¹
Construction noise and vibration		
NV1	The Construction Noise and Vibration Strategy would be implemented with the aim of achieving the noise management levels where feasible and reasonable. This would include the following example standard mitigation measures where feasible and reasonable: - Provision of noise barriers around each construction site - Provision of acoustic sheds at Chatswood dive site, Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street, Waterloo and Marrickville dive site - The coincidence of noisy plant working simultaneously close together would be avoided - Offset distances between noisy plant and sensitive receivers would be increased - Residential grade mufflers would be fitted to all mobile plant - Dampened rock hammers would be used - Non-tonal reversing alarms would be fitted to all permanent mobile plant - High noise generating activities would be scheduled for less sensitive period considering the nearby receivers - The layout of construction sites would consider opportunities to shield receivers from noise. This would also include carrying out the requirements in relation to construction noise and vibration monitoring.	All
NV2	Unless compliance with the relevant traffic noise criteria can be achieved, night time heavy vehicle movements at the Chatswood dive site, Crows Nest Station, Victoria Cross Station and Waterloo Station sites would be restricted to: - The Pacific Highway and Mowbray Road at the Chatswood dive site - The Pacific Highway, Hume Street and Oxley Street at the Crows Nest Station construction site - McLaren Street, Miller Street and Berry Street at the Victoria Cross station construction site - Botany Road and Raglan Streets at the Waterloo Station construction site	CDS, CN, VC, WS
NV3	Where vibration levels are predicted to exceed the screening criteria, a more detailed assessment of the structure and attended vibration monitoring would be carried out to ensure vibration levels remain below appropriate limits for that structure. For heritage items, the more detailed assessment would specifically consider the heritage values of the structure in consultation with a heritage specialist to ensure sensitive heritage fabric is adequately monitored and managed.	All except metro rail tunnels
NV4	Feasible and reasonable measures would be implemented to minimise ground borne noise where exceedences are predicted.	All

ID	Mitigation measure	Applicable location(s) ¹
NV5	- Feasible and reasonable mitigation measures would be implemented where power supply works would result in elevated noise levels at receivers. This would include: - Carrying out works during the daytime period when in the vicinity of residential receivers - Where out of hours works are required, scheduling the noisiest activities to occur in the evening period (up to 10 pm) - Use of portable noise barriers around particularly noisy equipment such as concrete saws.	PSR
NV6	Transport for NSW would engage an Independent Acoustic Advisor to act independently of the design and construction teams and provide oversight of construction methods, construction noise and vibration planning, management and mitigation, and construction noise and vibration monitoring and reporting. The key responsibilities of the Independent Acoustic Advisor would include : - Assurance of contractor noise and vibration planning, modelling, management and monitoring practices - Verification of compliance with relevant guidelines and approval requirements - Audit noise and vibration management practices.	All
NV7	Alternative demolition techniques that minimise noise and vibration levels would be investigated and implemented where feasible and reasonable. This would include consideration of: - The use of hydraulic concrete shears in lieu of hammers/rock breakers - Sequencing works to shield noise sensitive receivers by retaining building wall elements - Locating demolition load out areas away from the nearby noise sensitive receivers - Providing respite periods for noise intensive works - Methods to minimise structural-borne noise to adjacent buildings including separating the structural connection prior to demolition through saw-cutting and propping, using hand held splitters and pulverisers or hand demolition - Installing sound barrier screening to scaffolding facing noise sensitive neighbours - Modifying demolition works sequencing / hours to minimise impacts during peak pedestrian times and / or adjoining neighbour outdoor activity periods.	All except metro rail tunnels
NV8	Opportunities to minimise heavy vehicles movements on Randle Lane at night would be further investigated during detailed construction planning.	CS
NV9	Measures would be implemented to reduce work health and safety noise exposure for station workers, retail staff and members of the public within Central Station. These would include: - The use of hoarding and / or temporary noise barriers around construction sites - Providing hearing protection to station staff employees where appropriate - Providing specific work health and safety noise training to commercial receiver employers including guidance on managing their employees during highly noisy periods - The use of signage around construction sites to inform the general public of high noise exposure areas.	CS

ID	Mitigation measure	Applicable location(s) ¹
Operational noise and vibration		
OpNV1	The height and extent of noise barriers adjacent to the northern and southern surface track works would be confirmed during detailed design with the aim of not exceeding trigger levels from the <i>Rail Infrastructure Noise Guidelines</i> (Environment Protection Authority, 2013). At property treatments would be offered where there are residual exceedances of the trigger levels.	STW, STWS
OpNV2	Track form would be confirmed during the detailed design process in order to meet the relevant ground-borne noise and vibration criteria from the <i>Rail Infrastructure Noise Guidelines</i> (EPA, 2013) and the <i>Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects</i> (DECC, 2007a).	Metro rail tunnels
OpNV3	Stations and ancillary facilities including train breakout noise from draught relief shafts would be designed to meet the applicable noise criteria derived from the <i>Industrial Noise Policy</i> (EPA, 2000).	All except metro rail tunnels
OpNV4	Procedural mitigation measures would be implemented to minimise noise emissions from the Sydney Metro Trains Facility South with the aim of meeting the relevant criteria derived from the <i>Industrial Noise Policy</i> (Environment Protection Authority, 2000). This would consider measures such as: - Minimising the number of trains being cleaned simultaneously - Cleaning trains without air conditions systems in use - Limit cleaning and start-up operations during the night-time and early morning periods to the trains stabled furthest from the most affected residences. In the event that procedural measures are not sufficient to achieve compliance with the criteria derived from the Industrial Noise Policy, at-property treatments would be offered to affected receivers.	MDS
OpNV5	Further detailed investigations would be undertaken of the phased operations once the detail of these changes are determined. This investigation would include determination of the likely change in noise levels at receivers and consideration of the need for any feasible and reasonable mitigation measures taking into consideration the likely duration of the phased operations.	STWS
Land use and property		
LP1	Opportunities to integrate the eastern entry with local strategic planning initiatives would be investigated in consultation with City of Sydney Council	CS
Business impacts		
BI1	Specific consultation would be carried out with businesses potentially impacted during construction. Consultation would aim to identify and develop measures to manage the specific construction impacts for individual businesses.	All
BI2	A business impact risk register would be developed to identify, rate and manage the specific construction impacts for individual businesses.	All
BI3	Appropriate signage would be provided around construction sites to provide visibility to retained businesses.	All except metro rail tunnels

ID	Mitigation measure	Applicable location(s) ¹
Non-Aboriginal heritage		
NAH1	Archival recording and reporting of the following heritage items would be carried out in accordance with the NSW Heritage Office's <i>How to Prepare Archival Records of Heritage Items</i> (1998a), and <i>Photographic Recording of Heritage Items Using Film or Digital Capture</i> (2006): • The internal heritage fabric and any non-original elements removed from within the curtilage of Mowbray House, Chatswood • The interior, exterior and setting of the shop at 187 Miller Street, North Sydney • The fabric and setting of the North Sydney bus shelters requiring removal and temporary relocation at Victoria Cross Station and Blues Point temporary site • Any component of the Blues Point Waterfront Group and the McMahons Point South heritage conservation area to be directly affected or altered, including vegetation and significant landscape features • Hickson Road wall in the vicinity of proposed ventilation risers and skylights for Barangaroo Station • The interior, exterior and setting of the 'Flat Building' at 7 Elizabeth Street, Sydney • Martin Place, between Elizabeth and Castlereagh streets, Sydney • The heritage fabric of areas of the existing Martin Place Station affected by the project • The Rolling Stock Officers Garden, Rolling Stock Officers Building and Cleaners Amenities Building in Sydney Yard and any other component of the Sydney Terminal and Central Railway Stations group to be removed or altered • The Bounce Hostel building (former MGM building) • Directly impacted parts of the Congregational Church at Waterloo • Sydenham Pit and Drainage Pumping Station 1 • Sydenham Railway Station Group: Platform 6 building and Platform 1 Parcels Office.	CDS, VC, BP, MP, CS, WS, MDS, SS
NAH2	The archaeological research design would be implemented. Significant archaeological findings would be considered for inclusion in heritage interpretation (as per NAH8) for the project and be developed in consultation with the relevant local council.	CDS, CN, VC, BP, BN, MP, PS, CS, WS, PSR
NAH3	An Exhumation Policy and Guideline would be prepared and implemented. It would be developed in accordance with the <i>Guidelines for Management of Human Skeletal Remains</i> (NSW Heritage Office, 1998b) and NSW Health Policy Directive – Exhumation of human remains (December, 2013). It would be prepared in consultation with NSW Heritage Office and NSW Health.	All except metro rail tunnels
NAH4	The method for the demolition of existing buildings and / or structures at Chatswood dive site, Victoria Cross Station, Martin Place Station, Pitt Street Station, Central Station and Waterloo Station would be developed to minimise direct and indirect impacts to adjacent and / or adjoining heritage items.	CDS, VC, MP, PS, CS, WS
NAH5	Prior to total or partial demolition of heritage items at Victoria Cross and Martin Place stations, and the Bounce Hostel building (former MGM building at Central Station), heritage fabric for salvage would be identified and reuse opportunities for salvaged fabric considered. This would include salvage and reuse of heritage tiles to be impacted at Martin Place Station.	VC, MP, CS
NAH6	An appropriately qualified and experienced heritage architect would form part of the Sydney Metro Design Review Panel and would provide independent review periodically throughout detailed design.	All

ID	Mitigation measure	Applicable location(s) ¹
NAH7	The project design would be sympathetic to heritage items and, where reasonable and feasible, minimise impacts to the setting of heritage items. The detailed design for Martin Place Station, and Central Station, Sydenham Station and the aqueduct over the Sydenham Pit and Drainage Pumping Station would be developed with input from a heritage architect.	STW, CDS, CN, VC, BN, MP, PS, CS, WS, MDS, SS
NAH8	Appropriate heritage interpretation would be incorporated into the design for the project in accordance with the NSW Heritage Manual, the NSW Heritage Office's <i>Interpreting Heritage Places and Items: Guidelines</i> (August 2005), and the <i>NSW Heritage Council's Heritage Interpretation Policy</i> .	CDS, CN, VC, BP, BN, MP, PS, WS
NAH9	A Central Station heritage interpretation plan would be developed and implemented. It would be consistent with the <i>Central Station Conservation Management Plan</i> (Rappoport and Government Architects Office, 2013) and in accordance with the guidelines identified in NAH8.	CS
NAH10	The detailed design of the Sydney Yard Access Bridge would be carried out in accordance with the relevant specific element principles in the Design Guidelines.	CS
NAH11	Except for heritage significant elements affected by the project, direct impact on other heritage significant elements forming part of the following items would be avoided: • The Blues Point Waterfront Group (including the former tram turning circle, stone retaining wall, bollards and steps) • The Millers Point and Dawes Point Village Precinct • The existing Martin Place Station • Sydney Terminal and Central Railway Stations group • Sydney Yard (including the Shunters Hut and Prince Alfred Sewer) • The existing Sydenham Station • Brick retaining walls near Sydenham Station.	BP, BN, MP, CS, SS, STWS
NAH12	Power supply works would be designed and constructed to avoid impacts to the Tank Stream and Bennelong Stormwater Channel.	PSR
NAH13	The design and detailed construction planning of work at Central Station would consider the requirements of the <i>Central Station Conservation Management Plan</i> (Rappoport and Government Architects Office, 2013) and include consideration of opportunities for the retention, conservation and / or reuse of original and significant heritage fabric and movable heritage items. Consultation would be carried out with Sydney Trains and the Heritage Council of NSW during design development.	CS
NAH14	The final design and location of the new connection and opening at Martin Place Railway Station would minimise removal of the significant red ceramic tiling where feasible and reasonable.	MP
NAH15	Opportunities for the reuse of any tiles at Martin Place Railway Station that are removed would be investigated.	MP
NAH16	Opportunities for the reuse of the circular seating within Martin Place Station would be investigated.	MP
NAH17	Opportunities for the salvage and reuse of the bus shelters temporarily removed at Victoria Cross and Blues Point would be investigated in consultation with North Sydney Council.	VC, BP
NAH18	Works at Central Station would be carried out with the oversight of heritage specialists.	CS

ID	Mitigation measure	Applicable location(s) ¹
NAH19	Subject to outcomes of consultation with the church, temporary and permanent works at the Congregational Church would: - Minimise impacts to heritage fabric - Be sympathetic to the heritage values and architectural form of the building.	WS
NAH20	The design and detailed construction planning of works directly impacting the Sydenham Pit and Drainage Pumping Station would consider the requirements of the <i>Sydenham Pit & Drainage Pumping Station 1 Conservation Management Plan</i> (Sydney Water, 2004).	MDS
NAH21	The internal and external finishes of the infilled openings between 9-19 Elizabeth Street and the Commonwealth Bank of Australia building would be developed in consultation with a heritage architect.	MP
Aboriginal heritage		
AH1	Aboriginal stakeholder consultation would be carried out in accordance with the NSW Office of Environment and Heritage's Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010.	All
AH2	The cultural heritage assessment report would be implemented.	All
AH3	Archaeological test excavation (and salvage when required) would be carried out where intact natural soil profiles with the potential to contain significant archaeological deposits are encountered at the Blues Point temporary site, Barangaroo Station, Martin Place Station, Pitt Street Station, Central Station, Waterloo Station and Marrickville dive site. Excavations would be conducted in accordance with the methodology outlined in the Aboriginal cultural heritage assessment report	BP, BN, MP, PS, CS, WS, MDS
AH4	Appropriate Aboriginal heritage interpretation would be incorporated into the design for the project in consultation with Aboriginal stakeholders.	All
AH5	Feasible and reasonable mitigation at the ground improvement locations would be identified in consultation with the Office of Environment and Heritage.	GI
AH6	The Aboriginal cultural heritage assessment report would address areas of archaeological potential associated with the power supply routes.	PSR
AH7	The cultural heritage assessment report would be updated to include the scope of the proposed Central Walk modification.	CS
Landscape character and visual amenity		
Construction		
LV1	Where feasible and reasonable, the elements within construction sites would be located to minimise visual impacts, for example materials and machinery would be stored behind fencing.	All except metro rail tunnels
LV2	Existing trees to be retained would be protected prior to the commencement of construction in accordance with Australian Standard AS4970 the <i>Australian Standard for Protection of Trees on Development Sites and Adjoining Properties</i> .	All except metro rail tunnels
LV3	Lighting of construction sites would be oriented to minimise glare and light spill impact on adjacent receivers.	All except metro rail tunnels
LV4	Visual mitigation would be implemented as soon as feasible and reasonable after the commencement of construction, and remain for the duration of the construction period.	All except metro rail tunnels

ID	Mitigation measure	Applicable location(s) ¹
LV5	Opportunities for the retention and protection of existing trees would be identified during detailed construction planning.	All except metro rail tunnels
LV6	The design and maintenance of construction site hoardings would aim to minimise visual amenity and landscape character impacts, including the prompt removal of graffiti. Public art opportunities would be considered.	All except metro rail tunnels
LV7	The selection of materials and colours for acoustic sheds would aim to minimise their visual prominence.	CDS, CN, VC, BN, MP, PS, WS, MDS
LV8	Tunnel boring machine retrieval works at the Blues Point temporary site would be timed to avoid key harbour viewing events.	BP
LV9	Benching would be used where feasible and reasonable at Blues Point temporary site to minimise visual amenity impacts.	BP
LV10	Temporary impacts to public open space would be rehabilitated in consultation with the relevant local council and / or landowner.	All except metro rail tunnels
Operation		
LV11	Cut off and direct light fittings (or similar technologies) would be used to minimise glare and light spill onto private property.	CDS, AS, CS, MDS
LV12	Where feasible and reasonable, vegetation would be provided to screen and visually integrate sites with the surrounding area.	STW, CDS, AS, MDS
LV13	Identify and implement appropriate landscape treatments for Frank Channon Walk.	STW, CDS
LV14	The architectural treatment of Artarmon substation would minimise visual amenity and landscape character impacts.	AS
LV15	The Harbour cycles sculpture at North Sydney would be reinstated at a location determined in consultation with North Sydney Council.	VC
LV16	The P&O Fountain, the mid-20th century bas relief sculpture and the Douglas Annand glass screen at 55 Hunter Street would be reinstated at a location determined in consultation with City of Sydney Council.	MP
LV17	Opportunities would be investigated to provide a permanent wall for street art at Marrickville dive site in consultation with Marrickville Council.	MDS
LV18	Noise barriers would be transparent where they are augmenting existing transparent noise barriers.	STW
LV19	Notification processes in relation to moral rights for public art and architecture under Commonwealth <i>Copyright Act 1968</i> would be carried out.	All except metro rail tunnels

ID	Mitigation measure	Applicable location(s) ¹
Groundwater and geology		
GWG1	A detailed geotechnical model for the project would be developed and progressively updated during design and construction. The detailed geotechnical model would include: - Assessment of the potential for damage to structures, services, basements and other sub-surface elements through settlement or strain - Predicted changes to groundwater levels, including at nearby water supply works. Where building damage risk is rated as moderate or higher (as per the CIRIA 1996 risk-based criteria), a structural assessment of the affected buildings / structures would be carried out and specific measures implemented to address the risk of damage. With each progressive update of the geotechnical model the potential for exceedance of the following target changes to groundwater levels would be reviewed: - Less than 2.0 metres – general target - Less than 4.0 metres – where deep building foundations present - Less than 1.0 metre – residual soils - Less than 0.5 metre – residual soils (Blues Point) (fill / Aeolian sand). Where a significant exceedance of target changes to groundwater levels are predicted at surrounding land uses and nearby water supply works, an appropriate groundwater monitoring program would be developed and implemented. The program would aim to confirm no adverse impacts on groundwater levels or to appropriately manage any impacts. Monitoring at any specific location would be subject to the status of the water supply work and agreement with the landowner. The geotechnical model and groundwater monitoring program would be developed in consultation with the Department of Primary Industries (Water).	All
GWG2	Condition surveys of buildings and structures in the vicinity of the tunnel and excavations would be carried out prior to the commencement of excavation at each site.	All
Soils, contamination and water quality		
Construction		
SCW1	Updated desktop contamination assessments would be carried out for Chatswood dive site, Victoria Cross Station, Artarmon substation, Blues Point temporary site, Barangaroo Station, Central Station and Waterloo Station and the Sydenham Maintenance Centre site within surface track works south. If sufficient information is not available to determine the remediation requirements and the impact on potential receivers, then detailed contamination assessments, including collection and analysis of soil and groundwater samples would be carried out. Detailed contamination assessment would also be carried out for the Barangaroo power supply route within Hickson Road and the Marrickville power supply route adjacent to Sydney Park and Camdenville Oval. In the event a Remediation Action Plan is required, these would be developed in accordance with <i>Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land</i> (Department of Urban Affairs and Planning and Environment Protection Authority, 1998) and a site auditor would be engaged.	CDS, AS, VC, BP, BN, CS, WS, STWS , PSR
SCW2	Prior to ground disturbance in high probability acid sulfate areas at Barangaroo Station, Waterloo Station, and Marrickville dive site Sydenham Station and the surface track works south, testing would be carried out to determine the presence of acid sulfate soils. If acid sulfate soils are encountered, they would be managed in accordance with the <i>Acid Sulfate Soil Manual</i> (Acid Sulfate Soil Management Advisory Committee, 1998).	BN, WS, MDS, SS , STWS

ID	Mitigation measure	Applicable location(s) ¹
SCW3	Erosion and sediment control measures would be implemented in accordance with <i>Managing Urban Stormwater: Soils and Construction Volume 1</i> (Landcom, 2004) and <i>Managing Urban Stormwater: Soils and Construction Volume 2</i> (Department of Environment and Climate Change, 2008a). Measures would be designed as a minimum for the 80th percentile; 5-day rainfall event.	All except metro rail tunnels
SCW4	Discharges from the construction water treatment plants would be monitored to ensure compliance with the discharge criteria in an environment protection licence issued to the project.	All except metro rail tunnels
SCW5	A silt curtain would be used around the Sydney Harbour ground improvement work barges.	GI
SCW6	A water quality monitoring program would be implemented to monitor water quality within Sydney Harbour during ground improvement work. The water quality monitoring program would be carried out to detect any potential impacts on the water quality of Sydney Harbour from the ground improvement work and inform management responses in the event any impacts are identified. Specific monitoring locations and frequencies would be determined during the development of the program in consultation with the Environment Protection Authority.	GI
Operation		
SCW7	Discharges from the tunnel water treatment plant would be monitored to ensure compliance with the discharge criteria determined in consultation with the NSW Environment Protection Authority.	MDS
Social impacts and community infrastructure		
SO1	Direct impacts to public open space at the Blues Point temporary site would be minimised.	BP
SO2	Specific consultation would be carried out with sensitive community facilities (including aged care, child care centres, educational institutions and places of worship) potentially impacted during construction. Consultation would aim to identify and develop measures to manage the specific construction impacts for individual sensitive community facilities.	All except metro rail tunnels
Biodiversity		
B1	An ecologist would be present during the removal of any hollow-bearing trees.	CDS
B2	Potential bat roosting locations at Central Station, Waterloo Station and Marrickville dive site, Sydenham Station and the surface track works south would be checked by a qualified ecologist or wildlife handler prior to demolition. Any bats found would be relocated, unless in torpor, in which case the relocation would be delayed until the end of the torpor period.	CS, WS, MDS, SS, STWS
B3	The local WIRES group and / or veterinarian would be contacted if any fauna are injured on site or require capture and / or relocation.	All except metro rail tunnels
B4	Procedures would be developed and implemented, in accordance with the National System for the Prevention and Management of Marine Pest Incursions, during Sydney Harbour ground improvement works to avoid transportation of marine pests from other locations, particularly the marine alga <i>Caulerpa taxifolia</i> .	GI

ID	Mitigation measure	Applicable location(s) ¹
Flooding and hydrology		
Construction		
FH1	Detailed construction planning would consider flood risk at Barangaroo Station, Martin Place Station and the Waterloo Station construction sites. This would include identification of measures to, where feasible and reasonable, not worsen existing flooding characteristics up to and including the 100 year annual recurrence interval event in the vicinity of the project. Not worsen is defined as: ● A maximum increase flood levels of 50mm in a 100 year Average Recurrence Interval flood event ● A maximum increase in time of inundation of one hour in a 100 year Average Recurrence Interval flood event ● No increase in the potential for soil erosion and scouring from any increase in flow velocity in a 100 year Average Recurrence Interval flood event..	BN, MP, WS
FH2	The site layout and staging of construction activities at Marrickville dive site would avoid or minimise obstruction of overland flow paths and limit the extent of flow diversion required.	MDS
FH3	Overland flow diversions during construction at the Marrickville dive site would meet the following criteria, where feasible and reasonable: ● Not worsen existing flooding characteristics up to and including the 100 year annual recurrence interval event in the vicinity of the project ● Dedicated evacuation routes would not be adversely impacted in flood events up to and including the probable maximum flood. This may include the requirement for changes to existing arrangements for flood warning systems and signage. Construction planning for the Marrickville dive site would be carried out in consultation with the State Emergency Services and Inner West Council. Not worsen is defined as: ● A maximum increase flood levels of 50mm in a 100 year Average Recurrence Interval flood event ● A maximum increase in time of inundation of one hour in a 100 year Average Recurrence Interval flood event ● No increase in the potential for soil erosion and scouring from any increase in flow velocity in a 100 year Average Recurrence Interval flood event.	MDS
Operation		
FH4	Where feasible and reasonable, detailed design would result in no net increase in stormwater runoff rates in all storm events unless it can be demonstrated that increased runoff rates as a result of the project would not increase downstream flood risk.	STW, AS, MDS, SS , STWS
FH5	Where space permits, on-site detention of stormwater would be introduced where stormwater runoff rates are increased. Where there is insufficient space for the provision of on-site detention, the upgrade of downstream infrastructure would be implemented where feasible and reasonable.	STW, AS, MDS, SS , STWS
FH6	Detailed design would occur in consultation with Inner West Council to ensure future drainage improvement works around the Marrickville dive site, Sydenham Station and the surface track works south would not be precluded.	MDS, SS , STWS

ID	Mitigation measure	Applicable location(s) ¹
FH7	Consultation would be carried out with Inner West Council to ensure flood-related outcomes of the project are consistent with any future floodplain risk management study and / or plan developed for the Marrickville Valley Catchment.	MDS, SS, STWS
FH8	The frequency of Sydney Trains rail service disruptions due to flooding would not be increased in the vicinity of the Marrickville dive structure, Sydenham Station and the surface track works south .	MDS, SS, STWS
FH9	Design of the project would be reviewed to, where feasible and reasonable, not worsen existing flooding characteristics up to and including the 100 year annual recurrence interval event in the vicinity of the project. Detailed flood modelling would consider: ○ Potential changes to flood prone land and flood levels ○ Potential changes to overland flow paths ○ Redistribution of surface runoff as a result of project infrastructure ○ Behaviour of existing stormwater runoff ○ Potential changes required to flood evacuation routes, flood warning systems and signage. Flood modelling to support detailed design would be carried out in accordance with the following guidelines: ○ <i>Floodplain Development Manual</i> (NSW Government, 2005b) ○ <i>Floodplain Risk Management Guideline: Practical Consideration of Climate Change</i> (DECC, 2007b) ○ <i>Floodplain Risk Management Guide: Incorporating Sea Level Rise Benchmarks in Flood Risk Assessments</i> (DECCW, 2010c) ○ <i>New guideline and changes to section 117 direction and EP&A Regulation on flood prone land, Planning Circular PS 07-003</i> (NSW Department of Planning, 2007). Flood modelling and consideration of mitigation measures would be carried out in consultation with the relevant local councils, the Office of Environment and Heritage and the State Emergency Services. Not worsen is defined as: ○ A maximum increase flood levels of 50mm in a 100 year Average Recurrence Interval flood event ○ A maximum increase in time of inundation of one hour in a 100 year Average Recurrence Interval flood event ○ No increase in the potential for soil erosion and scouring from any increase in flow velocity in a 100 year Average Recurrence Interval flood event.	All except metro rail tunnels
FH10	During detailed design, project infrastructure would be designed to meet the following criteria, where feasible and reasonable: ○ Locate station and service entrances to underground stations above the greater of the 100 year annual recurrence interval flood level plus 500mm or the probable maximum flood level ○ Provide site surface grading and drainage collection systems at the Chatswood and Marrickville dive structures to manage the risk of local catchment and overland flooding for events up to and including the probable maximum flood event ○ Locate aboveground rail system facilities (such as traction power supply sub stations) at least above the 100 year annual recurrence interval flood level plus 500mm ○ Protect facilities that are identified as being critical to emergency response operations from the probable maximum flood level.	All except metro rail tunnels

ID	Mitigation measure	Applicable location(s) ¹
Air quality		
AQ1	The engines of all on-site vehicles and plant would be switched off when not in use for an extended period.	All
AQ2	Plant would be well maintained and serviced to minimise emissions. Emissions from plant would be considered as part of pre-acceptance checks.	All
AQ3	Construction site layout and placement of plant would consider air quality impacts to nearby receivers.	All except metro rail tunnels
AQ4	Hard surfaces would be installed on long term haul routes and regularly cleaned.	All except metro rail tunnels
AQ5	Unsurfaced haul routes and work area would be regularly damped down in dry and windy conditions.	All except metro rail tunnels
AQ6	All vehicles carrying loose or potentially dusty material to or from the site would be fully covered.	All except metro rail tunnels
AQ7	Stockpiles would be managed to minimise dust generation.	All except metro rail tunnels
AQ8	Demolition would be managed to minimise dust generation.	All except metro rail tunnels
AQ9	Ventilation from acoustic sheds would be filtered.	CDS, CN, VC, BN, MP, PS, WS, MDS
Hazard and risk		
Construction		
HR1	All hazardous substances that may be required for construction would be stored and managed in accordance with the <i>Storage and Handling of Dangerous Goods Code of Practice</i> (WorkCover NSW, 2005) and <i>Hazardous and Offensive Development Application Guidelines: Applying SEPP 33</i> (Department of Planning, 2011).	All
HR2	Dial before you dig searches and non-destructive digging would be carried out to identify the presence of underground utilities.	All
HR3	A hazardous material survey would be completed for those buildings and structures suspected of containing hazardous materials (particularly asbestos) prior to their demolition. If asbestos is encountered, it would be handled and managed in accordance with relevant legislation, codes of practice and Australian standards.	CDS, CN, VC, MP, PS, CS, WS, MDS, SS
HR4	The method for delivery of explosives would be developed prior to the commencement of blasting in consultation with the Department of Planning and Environment and be timed to avoid the need for on-site storage.	CN, VC, BN, MP, PS, WS
Operation		
HR5	All hazardous substances that may be required for operation would be stored and managed in accordance with the <i>Storage and Handling of Dangerous Goods Code of Practice</i> (WorkCover NSW, 2005) and <i>Hazardous and Offensive Development Application Guidelines: Applying SEPP 33</i> (Department of Planning, 2011).	All

ID	Mitigation measure	Applicable location(s) ¹
Waste management		
Construction		
WM1	All waste would be assessed, classified, managed and disposed of in accordance with the <i>NSW Waste Classification Guidelines</i> .	All
WM2	100 per cent of spoil that can be reused would be beneficially reused in accordance with the project spoil reuse hierarchy.	All
WM3	A recycling target of at least 90 per cent would be adopted for the project.	All
WM4	Construction waste would be minimised by accurately calculating materials brought to the site and limiting materials packaging.	All
Operation		
WM5	Generation of operation phase waste would be minimised.	All
Sustainability		
Construction		
SUS1	Sustainability initiatives would be incorporated into the detailed design and construction of the project to support the achievement of the project sustainability objectives.	All
SUS2	A best practice level of performance would be achieved using market leading sustainability rating tools during design and construction.	All
SUS3	A workforce development and industry participation strategy would be developed and implemented during construction.	All
SUS4	Climate change risk treatments would be incorporated into the detailed design of the project including: - Ensuring that adequate flood modelling is carried out and integrated with design - Testing the sensitivity of air-conditioning systems to increased temperatures, and identify potential additional capacity of air-conditioning systems that may be required within the life of the project, with a view to safeguarding space if required - Testing the sensitivity of ventilation systems to increased temperatures and provide adequate capacity.	All
SUS5	An iterative process of greenhouse gas assessments and design refinements would be carried out during detailed design and construction to identify opportunities to minimise greenhouse gas emissions. Performance would be measured in terms of a percentage reduction in greenhouse gas emissions from a defined reference footprint.	All
SUS6	25 per cent of the greenhouse gas emissions associated with consumption of electricity during construction would be offset.	All
Operation		
SUS7	Sustainability initiatives would be incorporated into the operation of the project to support the achievement of the project sustainability objectives.	All
SUS8	Periodic review of climate change risks would be carried out to ensure ongoing resilience to the impacts of climate change.	All
SUS9	A workforce development and industry participation strategy would be developed and implemented during operation.	All
SUS10	100 per cent of the greenhouse gas emissions associated with consumption of electricity during operation would be offset.	All

ID	Mitigation measure	Applicable location(s) ¹
Cumulative impacts		
CU1	Transport for NSW would manage and co-ordinate the interface with projects under construction at the same time. Co-ordination and consultation with the following stakeholders would occur, where required: ○ CBD Coordination Office ○ Department of Planning and Environment ○ Roads and Maritime Services ○ Sydney Trains ○ NSW Trains ○ Sydney Buses ○ Sydney Water ○ Port Authority of NSW ○ Willoughby Council ○ North Sydney Council ○ City of Sydney Council ○ Marrickville Council ○ Sydney Motorways Corporation ○ Barangaroo Delivery Authority ○ Emergency service providers ○ Utility providers ○ Construction contractors. Co-ordination and consultation with these stakeholders would include: ○ Provision of regular updates to the detailed construction program, construction sites and haul routes ○ Identification of key potential conflict points with other construction projects ○ Developing mitigation strategies in order to manage conflicts. Depending on the nature of the conflict, this could involve: ◆ Adjustments to the Sydney Metro construction program, work activities or haul routes; or adjustments to the program, activities or haul routes of other construction projects ◆ Co-ordination of traffic management arrangements between projects.	All

¹ STW: Surface track works; CDS: Chatswood dive site; AS: Artarmon substation; CN: Crows Nest Station; VC: Victoria Cross Station; BP: Blues Point temporary site; GI: Ground improvement works; BN: Barangaroo Station; MP: Martin Place Station; PS: Pitt Street Station; CS: Central Station; WS: Waterloo Station; MDS: Marrickville dive site (including the Sydney Metro Trains Facility South); SS: Sydenham Station; STWS: Surface track works south Metro rail tunnels; Metro rail tunnels not related to other sites (eg TBM works); PSR: Power supply routes.

21.3 Recommended changes to conditions of approval

The assessment carried out for the proposed modification has identified recommended changes to the conditions of approval. These recommended changes, beyond the necessary changes to administrative conditions, are:

- Inclusion of the Sydenham Pit and Drainage Pumping Station and Sydenham Railway Station Group: Platform 6 building and Platform 1 Parcels Office in condition E13 relating to archival recording
- Inclusion of the Sydenham Pit and Drainage Pumping Station and Sydenham Railway Station Group: Platform 6 building and Platform 1 Parcels Office in condition E16 relating the heritage salvage.

JUSTIFICATION AND CONCLUSION

CHAPTER TWENTY TWO



22 Justification and conclusion

This chapter outlines the justification and conclusions for the proposed modification.

As noted in the Sydenham to Bankstown State Significant Infrastructure Application Report, Transport for NSW has been investigating opening Sydney Metro City & Southwest in two phases. Further project planning has now identified that the Chatswood to Sydenham component could be opened some months in advance of the Sydenham to Bankstown component and could be extended through to Sydenham Station. The phased opening through to Sydenham Station would provide the opportunity to enable Sydney Metro services at Sydenham Station during the final shutdown of the T3 Bankstown Line that is required to complete construction of the Sydenham to Bankstown component.

Sydenham Station and Sydney Metro Trains Facility South were considered for inclusion in the scope of works for the Sydenham to Bankstown upgrade project i. The application report for that project noted that delivery of works to support the phased opening of the Chatswood to Sydenham component through to Sydenham Station could be accelerated under a separate planning approval. To support the delivery of these works, Transport for NSW propose to extend the scope of the approved project to incorporate Sydenham Station and Sydney Metro Trains Facility South through a project modification.

The proposed extension of the approved project to Sydenham Station would provide the following benefits:

- Customers on the T4 Eastern Suburbs and Illawarra Line and T2 Airport Line would be able to interchange at Sydenham to access metro services to places like Martin Place, Barangaroo, Victoria Cross, Macquarie Park and the Norwest Business Park. Faster and direct access to places like North Sydney and Macquarie University would give customers more choices and better connections to jobs and educational opportunities
- Improved interchange potential at Sydenham would reduce congestion on the T4 Eastern Suburbs and Illawarra Line and T2 Airport Line and reduce interchange movements at other stations, particularly Central Station
- Support the temporary transport strategy for the final shutdown of the T3 Bankstown Line required for the construction of the Sydenham to Bankstown project. The proposed extension would provide frequent turn-up-and-go metro services at Sydenham Station for travel to and from the Sydney CBD and Sydney's northwest to minimise the impact to existing customers who would temporarily need to travel to and from Sydenham Station via rail replacement bus services during this final shutdown

The provision of the Sydney Metro Trains Facility South as part of the Chatswood to Sydenham project would result in more efficient operations of metro services during the potential phased opening as stabling facilities would be located across the metro line, avoiding the need to run empty metro trains.

Some additional environmental impacts would occur as a result of the proposed modification as a result of adding new construction and operational sites to the approved project. Some of the environmental impacts differ from those identified in the approved project due to the nature of Sydenham Station and Sydney Metro Trains Facility South as above-ground developments.

The environmental impacts of the proposed modification are as follows:

- Direct and indirect impacts to the State heritage listed Sydenham Station and Sydenham Pit and Drainage Pumping Station
- Some adverse landscape character and visual amenity impacts due to construction works and introduction of an aqueduct over the Sydenham Pit and Drainage Pumping Station
- Permanent changes to the existing stormwater drainage network, including the realignment of the Eastern Channel, modifications at the Sydenham Pit and Drainage Pumping Station, and raising of the Sydney Metro Trains Facility South and tracks to above the probable maximum flood level
- Additional operational noise impact for receivers around the Sydney Metro Trains Facility South and along some parts of the rail corridor
- Extension of construction noise impacts for some sensitive receivers around the construction sites
- Some short-term construction traffic impacts on local roads
- Additional acquisitions of commercial and industrial properties around the Sydney Metro Trains Facility South and Sydenham Station
- Additional potential interface with areas of contamination
- Additional biodiversity impacts, however these would be limited to the minor impact of clearing exotic and planted native vegetation.

The proposed modification would be constructed in accordance with the Sydney Metro Construction Environmental Management Framework provided as part of the Submissions and Preferred Infrastructure Report for the approved project. While the project-specific mitigation measures identified for the approved project are generally sufficient to address the potential impacts of the proposed modification, some additional measures or changes to measures have been identified to manage specific potential impacts of the proposed modification. The relevant conditions of approval for the approved project would also apply, with some recommendations made in relation to potential modifications to these conditions.

Overall, the proposed modification is considered to be justified and would represent an overall beneficial outcome for the approved project by improving operational flexibility and efficiency across the metro network during the construction of the Sydenham to Bankstown project.

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GLOSSARY



Glossary

Acronym	Definition
AEP	Annual exceedance probability
AHIMS	Aboriginal Heritage Information Management System
ANZSIC	Australian and New Zealand Standard Industrial Classification
ARTC	Australian Rail Track Corporation
CLM Act	<i>Contaminated Land Management Act 1997</i>
db	Decibel
dBA	A-weighted decibels
DDA	<i>Disability Discrimination Act 1992</i>
DSAPT	Disability Standards for Accessible Public Transport
EPA	NSW Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
HNA	Highly Noise Affected, based on the ICNG definition
ICNG	Interim Construction Noise Guideline
INP	Industrial Noise Policy
LEP	Local Environmental Plan
NCA's	Noise Catchment Areas
NML's	Noise Management Levels
OEH	NSW Office of Environment and Heritage
PAD	Potential archaeological deposit
PAHs	Polycyclic aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
RBL	Rating Background Level
RING	Rail Infrastructure Noise Guideline
RNP	Road Policy Policy
s170	Section 170 Heritage and Conservation Register
SHR	NSW State Heritage Register
SVOC	Semivolatile organics compound
TRH	Total recoverable hydrocarbons
VOC	Volatile organic compound

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CHATSWOOD TO SYDENHAM
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MODIFICATION REPORT**