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Sydney Metro – Western Sydney Airport

Appendix B
Revised project description and performance outcomes and mitigation measures

Sydney Metro – Western Sydney Airport

Submissions Report

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Sydney Metro – Western Sydney Airport

Submissions Report

Client: Sydney Metro

ABN: 12354063515

Prepared by

M2A
Level 25, 680 George Street, Sydney NSW 2000
ABN: 60 549 956 366

Table of Contents

List of tables

List of figures

1 Revised project description – operation

This chapter provides a description of the key elements of the project, including the location of the track alignment, proposed stations, and other ancillary infrastructure such as the stabling and maintenance facility. This chapter also outlines how the project would operate and how customers would use Sydney Metro – Western Sydney Airport. A description of how the project is proposed to be constructed is provided in Chapter 2 (Revised project description – construction).

The description of the project components presented in this chapter is indicative and based on the current level of design. Some design elements of the project would continue to be refined as part of the design development process. This refinement would also be subject to ongoing consultation with key stakeholders, including Western Sydney Airport and Western Parkland City Authority.

1.1 Overview

1.1.1 Key project features

Sydney Metro – Western Sydney Airport (the project) would involve a new metro railway line around 23 kilometres in length between St Marys in the north and the Aerotropolis Core precinct in the south (the area to be called Bradfield). This would include a section of the alignment which passes through and provides access to Western Sydney International (Nancy-Bird Walton) Airport (Western Sydney International), currently under construction.

Key operational features of the project would include:

- around 4.3 kilometres of twin rail tunnels (generally located side by side) between St Marys (the northern extent of the project) and Orchard Hills
- a cut-and-cover tunnel around 350 metres long (including tunnel portal), transitioning to an in-cutting rail alignment south of the M4 Western Motorway at Orchard Hills
- around 10 kilometres of rail alignment between Orchard Hills and Western Sydney International, consisting of a combination of viaduct and surface rail alignment
- around two kilometres of surface rail alignment within Western Sydney International
- around 3.3 kilometres of twin rail tunnels (including tunnel portal) within Western Sydney International
- around three kilometres of twin rail tunnels between Western Sydney International and the Aerotropolis Core
- six new metro stations:
  - four off-airport stations:
    - St Marys (providing interchange with the existing Sydney Trains suburban rail network)
    - Orchard Hills
    - Luddenham Road
    - Aerotropolis Core
  - two on-airport stations:
    - Airport Business Park
    - Airport Terminal

- grade separation of the track alignment at key locations including:
    - where the alignment interfaces with existing infrastructure such as the Great Western Highway, M4 Western Motorway, Lansdowne Road, Patons Lane, the Warragamba to Prospect Water Supply Pipelines, Luddenham Road, the future M12 Motorway, Elizabeth Drive, Derwent Road and Badgerys Creek Road
    - crossings of Blaxland Creek, Cosgroves Creek, Badgerys Creek and other small waterways to provide flood immunity for the project
- modifications to the existing Sydney Trains station and rail infrastructure at St Marys (where required) to support interchange and customer transfer between the new metro station and the existing Sydney Trains suburban rail network
- a stabling and maintenance facility and operational control centre located to the south of Blaxland Creek and east of the proposed metro track
- new pedestrian, cycle, park-and-ride and kiss-and-ride facilities, public transport interchange infrastructure, road infrastructure and landscaping as part of the station precincts.

The project would also include:

- turnback track arrangements (turnbacks) at St Marys and Aerotropolis Core to allow trains to turn back and run in the opposite direction
- additional track stubs to the east of St Marys Station and south of Aerotropolis Core Station to allow for potential future extension of the line to the north and south respectively without impacting future metro operations
- an integrated tunnel ventilation system including services facilities at Claremont Meadows and Bringelly
- all operational systems and infrastructure such as crossovers, rail sidings, signalling, communications, overhead wiring, power supply, lighting, fencing, security and access tracks/paths
- retaining walls at required locations along the alignment
- environmental protection measures such as noise barriers (if required), on-site water detention, water quality treatment basins and other drainage works.

Off-airport project components

The off-airport components of the project would include the track alignment and associated operational systems and infrastructure north and south of Western Sydney International, four metro stations, the stabling and maintenance facility, two services facilities and a tunnel portal.

On-airport project components

The on-airport components of the project would include the track alignment and associated operational systems and infrastructure within Western Sydney International, two metro stations and a tunnel portal. The on-airport components will be subject to approvals from the Commonwealth.

The key project features as described in this chapter are indicative only and subject to design development in accordance with the process identified in Chapter 6 (Project development and alternatives) of the Environmental Impact Statement.

Key operational features of the project are shown on Figure 1-1.

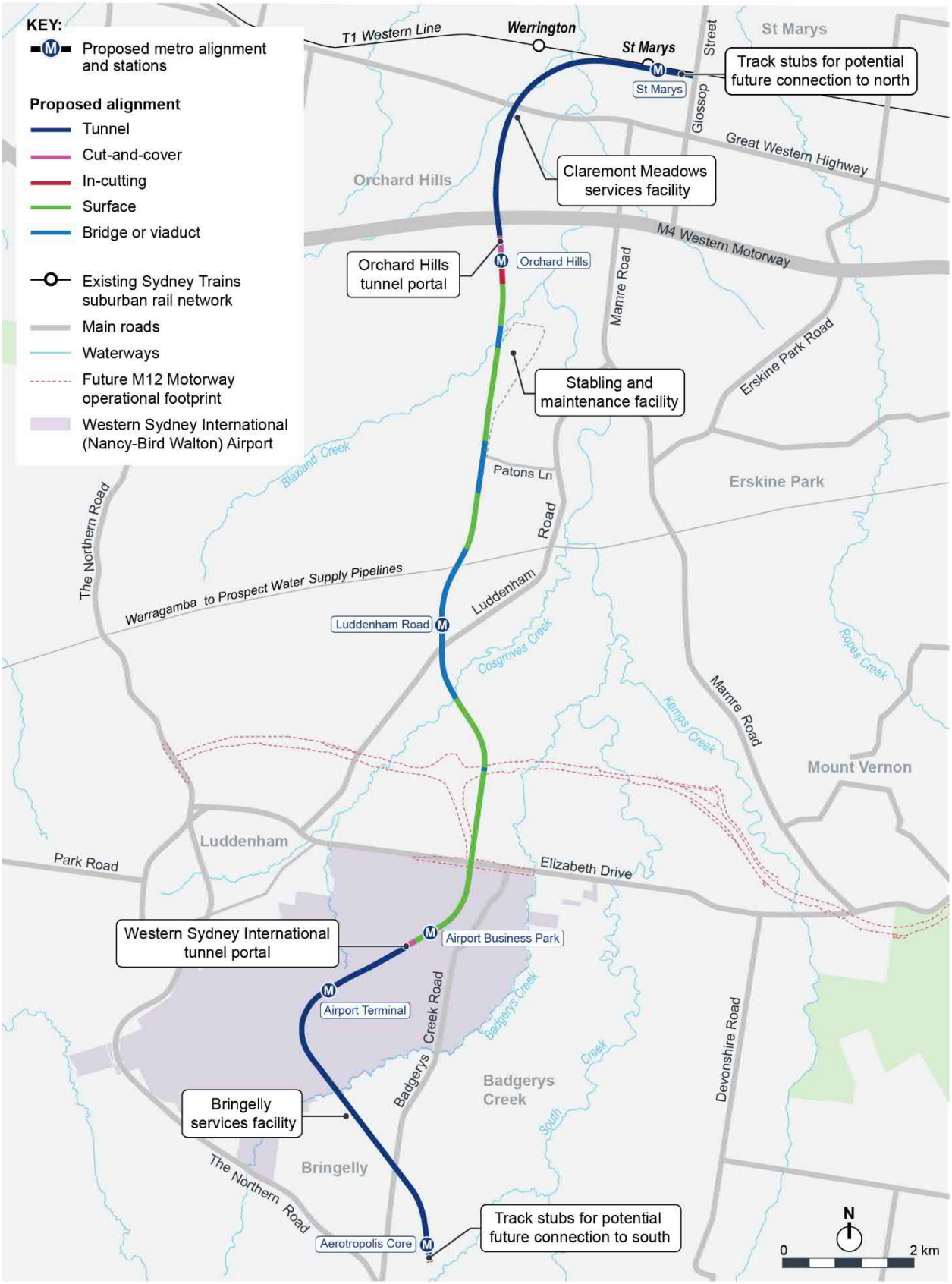


Figure 1-1 Project overview

1.1.2 Key metro characteristics

The Sydney Metro network has been designed with a focus on the customers' experience, which incorporates all aspects of travel associated with the transport network, services and the:

- decision on how to travel – the new metro service would be integrated with other transport modes, including interchanges with the existing Sydney railway network as well as buses and Western Sydney International
- travel information available – state-of-the-art technology is proposed to keep customers connected at all stages of their journey, from smart phone travel apps on the way to stations to real time journey information at metro stations and on board trains
- speed and comfort of the journey
- range and quantity of services available at stations, interchanges and within station precincts – the project would help customers achieve their daily tasks, whether it's travelling to work or home or accessing travel opportunities at Western Sydney International.

A high-quality door-to-door transport service is critical to attract and retain customers while also meeting broader transport and land use objectives. This includes providing:

- a system that is inherently safe for customers on trains, at stations and at the interface with the public domain
- direct, comfortable, well-marked and safe routes for customers between transport modes
- a clean, pleasant and comfortable environment for customers at stations and on trains.

Making it easy for customers at each stage of their journey is integral to the successful delivery of Sydney Metro. Key characteristics of Sydney Metro that would be delivered by the project are outlined in Table 1-1.

Table 1-1 Key metro characteristics

Characteristic	Description
Fast and reliable service	• delivering fast journeys between stations with new generation single deck trains • ensuring easy boarding and alighting to reduce dwell times at stations • creating a highly reliable service (expected ultimate target of 98 per cent on-time running).
Modern trains and technology	• trains operate close together safely with communications-based train control that allows automated train operations and driverless operation • improving safety and comfort with platform screen doors and barriers that run the full length of all metro platforms and only open at the same time as the train doors • on-board real time travel information and live electronic route maps.
Accessible system	• fully accessible stations and single deck trains • three double doors per side per carriage for faster loading and unloading • level access between the platform and train, and reduced gaps between the platform and the train – providing access for everyone, including those with items such as prams, luggage and bicycles • designing for bicycles on trains • delivering modern customer information systems.

Characteristic	Description
Comfortable service	• air-conditioned trains with large windows, warm lighting and open walkways • seating and standing room designed to maximise personal space • easy boarding and alighting at stations • accessible priority seating for those with a disability or using a wheelchair or mobility device, the elderly or those travelling with strollers and children or luggage • suitable for airport travellers, with under seat luggage storage for carry-on bags and level access between the platform and train.
Highly legible	• 'turn up and go' frequencies mean there is no need for a timetable • consistent stopping patterns mean metro trains would stop at all stations.
Safe and secure	• improving customer experiences, with customer service assistants at every station and moving through the network during the day and night • stations, interchanges and precincts that are designed to be highly visible, active spaces with good lighting and amenity • ensuring customers can see all the way along the train and move easily between carriages, with wide, open walkways between carriages • providing platform screen doors at stations which keep people and objects away from the edge, improving customer safety and allowing trains to get in and out of stations much faster • station, interchanges and train design allows for good line of sight to enable passive and active surveillance • stations that allow for safe transfer for passengers to other transport modes and access to the stations by pedestrians and cyclists.

1.1.3 Design development process

The design of the project, including stations and surrounding precincts, is being developed in parallel with the preparation of this Environmental Impact Statement. Prior to project approval, design development will continue after the exhibition of the Environmental Impact Statement in consultation with relevant stakeholders.

The design development process will be guided by a suite of documents which include the following:

- Sydney Metro design objectives
- Design Quality Framework
- Sydney Metro – Western Sydney Airport Design Guidelines (Appendix D).

These documents, along with community and stakeholder engagement and the establishment of a Design Advisory Panel (prior to project approval) and a Design Review Panel (once project approval is obtained), will allow for high quality standards throughout the whole design process. At relevant stages in the design process, the design would be reviewed against the Design Guidelines and design objectives.

Sydney Metro has commenced engagement with local councils and other relevant stakeholders regarding the project design and Sydney Metro would continue to engage these stakeholders throughout design development. In addition, community submissions made during the statutory exhibition of this Environmental Impact Statement or as part of ongoing community involvement and consultation would be considered during design development.

Design objectives

The Sydney Metro design objectives and principles are shown in Figure 1-2. Figure 1-2 also indicates how the project design objectives and principles align with the objectives of the NSW Government's *Better Placed – An integrated design policy for the built environment* (Government Architect of NSW, 2017a) (Better Placed).

SYDNEY METRO – WESTERN SYDNEY AIRPORT PROJECT OBJECTIVES	ALIGNMENT WITH BETTER PLACED OBJECTIVES
Objective 1: Ensuring an easy customer experience **Principle** Sydney Metro – Western Sydney Airport places the customer first. Stations are welcoming and intuitive with simple, uncluttered spaces that ensure a comfortable, enjoyable and safe experience for a diverse range of customers.	**Objective 4** **Better for people** Safe, comfortable and liveable **Objective 5** **Better working** Functional, efficient and fit for purpose
Objective 2: Being part of a fully integrated transport system **Principle** Sydney Metro – Western Sydney Airport is a transit-oriented project that prioritises clear and legible connections with other public and active transport modes within the wider metropolitan travel network that intersect with this new spine.	**Objective 5** **Better working** Functional, efficient and fit for purpose
Objective 3: Being a catalyst for positive change **Principle** Sydney Metro – Western Sydney Airport is a landmark opportunity to regenerate and invigorate the city with new stations and associated development that engage with their precincts, raise the urban quality and enhance the overall experience of the city.	**Objective 6** **Better value** Safe, comfortable and liveable **Objective 7** **Better look and feel** Engaging, inviting and attractive
Objective 4: Being responsive to distinct contexts and communities **Principle** Sydney Metro – Western Sydney Airport's identity is stronger for the unique conditions of centres and communities through which it passes. This local character is to be embraced through distinctive station architecture and public domain that is well integrated with the inherited urban fabric of existing places.	**Objective 1** **Better fit** Contextual, local and of its place **Objective 3** **Better for community** Inclusive, connected and diverse
Objective 5: Delivering an enduring and sustainable legacy for Sydney **Principle** Sydney Metro – Western Sydney Airport is a positive legacy for future generations. A high standard of design across the corridor, stations and station precincts, that sets a new benchmark, is vital to ensuring the longevity of the Metro system, its enduring contribution to civic life and an ability to adapt to a changing city over time.	**Objective 2** **Better performance** Sustainable, adaptable and durable **Objective 6** **Better value** Creating and adding value

Figure 1-2 Project design objectives and principles

Design quality framework

Sydney Metro is preparing a Design Quality Framework in consultation with the NSW Government Architect. The Framework will establish the design quality assurance process for Sydney Metro projects and is intended to provide a structured process to integrate design quality assurance across the life cycle of the project.

Design quality assurance is important in the delivery of Sydney Metro – Western Sydney Airport given design quality is integral to the achievement of the government's value for money. Design value is a balance of social, economic and environmental factors. For Sydney Metro – Western Sydney Airport, these may include how well the metro performs and operates and what benefits the metro generates to the community and the environment.

As each Sydney Metro project differs in terms of timing, procurement and delivery, the Design Quality Framework intends to provide a high-level process detailing how Sydney Metro ensures high quality design throughout the project life cycle, regardless of the procurement and delivery strategy.

The components of the framework would include Sydney Metro's:

- design quality statement defining Sydney Metro's ambition for design quality
- design governance protocols
- internal design gateway process
- design review protocol (including a Design Review Panel)
- design procurement protocol
- design integrity process.

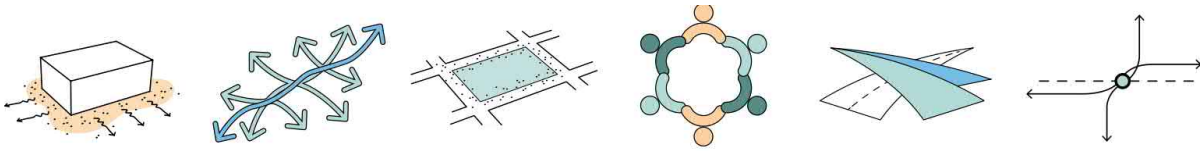
Design guidelines

Design Guidelines have been developed for Sydney Metro – Western Sydney Airport to guide the design of:

- the interface between stations and their surrounding locality including:
  - station entries and associated plazas
  - transport interchange facilities, including precinct streets, and park-and-ride and kiss-and-ride facilities
  - landscaping and other public domain elements
- rail corridor works including the tunnel portals, viaducts, bridges, cuttings, embankments and retaining walls
- stations, services buildings and ancillary facilities.

The Design Guidelines identify design objectives and design principles (Figure 1-2), as well as a set of corridor-wide urban design principles (Figure 1-3) to guide future stages of design development. The corridor-wide precinct design principles have been developed to ensure that while all stations have a unique local character, they are also part of a connected network and together create a corridor of activity centres and opportunities.

These principles provide overarching guidance for the opportunities to create connections to and between stations, to create 'places' along the corridor that are unique and connected to history and context, and the opportunity to facilitate renewal and implement best practice urban design and sustainability measures.



Interface and Activity

Activation of the urban realm of station precincts is important to ensure stations and supporting infrastructure are integrated with existing and future urban settings.

Connectivity

Walkable urban environments and integration with the planned Blue-green Grid of the Western Parkland City are best through the provision of safe, permeable and well-connected station precincts.

Place Making

Sydney Metro has the ability to support and contribute to the delivery of unique, attractive and vibrant urban centres, streets and spaces that provide a sense of connection and identity for local communities and visitors.

Culture

Opportunities to reflect and build on the rich Aboriginal and non-Aboriginal heritage of Western Sydney will strengthen design and place outcomes.

Sustainability

Sydney Metro will contribute to the evolution of a new urban development paradigm in which environmentally sustainable elements, processes and designs are incorporated in the project.

Transport Network

The TfNSW transport modal hierarchy will guide the design of stations, interchanges and associated developments, prioritising walking and other modes of active transport.

Figure 1-3 Corridor urban design principles

The design objectives and design principles have been made relevant to all of the stations, the rail corridor, bridges and viaducts, the stabling and maintenance and other ancillary facilities, the public domain and operations and services. Station and design drivers, as well as urban design strategies, have also been provided for each station.

Further details of the design principles and guidelines are provided in the Design Guidelines (Appendix D).

Design Advisory Panel

As part of the design quality framework being developed, Sydney Metro has established a Design Advisory Panel (DAP) to support the design development process up until project approval is obtained. The DAP provides independent design review to support the achievement of Sydney Metro project objectives, ensure quality design process and outcomes and guide strategic planning and urban design outcomes.

The DAP is chaired by the Government Architect NSW and include suitably qualified, experienced professionals to provide architectural, urban design, public domain and landscape advice.

Design Review Panel

As part of the design quality framework being developed, Sydney Metro would establish a Design Review Panel (DRP) to support the design development process once project approval is obtained. The DRP would provide independent, high level design review of stations and interchange areas and other ancillary facilities in relation to architectural, heritage and landscaping design etc.

The objective of the DRP would be to support the achievement of the design objectives and ensure quality design process and outcomes. The DRP would support good design by:

- having a remit which includes stations and ancillary facilities
- providing independent design review of the integrated project throughout the design development
- refining and endorsing design guidelines
- reviewing and critiquing the design against the design guidelines.

The role of the DRP would be advisory and any recommendations would not be binding on Sydney Metro. The establishment of the DRP, including panel, size and membership would be determined in consultation with the Government Architect NSW. At a minimum, panel members would include at least one member of the State Design Review Panel. Membership would include a mix of skills and disciplines relevant for the project, such as architecture, urban design, place making, heritage, public domain and landscape design. The DRP would be supplemented with technical advisors as required.

Sydney Metro would also provide an independent secretariat to support the DRP. The responsibilities of the independent secretariat would include maintaining a register of actions and outcomes. This would allow transparency and accountability to the DRP. Relevant councils and key stakeholders would be invited to participate in DRP meetings to advise on local issues and design outcomes as they relate to the local context.

Integration with Western Sydney International

The design would also continue to consider the integration of the project with Western Sydney International. Many of the key metro characteristics for the Sydney Metro network described in Table 1-1 are relevant for passengers travelling to and from Western Sydney International. The key characteristics of the Sydney Metro network of being a ‘fast and reliable service’ and ‘highly legible’ would ensure sufficient frequency that passengers can ‘turn up and go’ to Western Sydney International with sufficient time to connect to flights.

The design for the project would further consider the movement of passengers to and from Western Sydney International, including those with luggage. As described in Section 1.7.3 metro trains would provide suitable storage areas for both carry-on and larger sized luggage for customers accessing Western Sydney International.

As part of further design development, the project would also consider and respond to requirements relating to airport operations, for example including lighting and ventilation design, to comply with applicable requirements of the Airports (Protection of Airspace) Regulations 1996 and the *National Airports Safeguarding Framework* (Department of Infrastructure, Transport, Cities and Regional Development, 2018), as well as other relevant regulations and guidelines.

1.1.4 Safeguarding for future public transport

The project includes the following safeguarding provisions:

- potential future extensions from St Marys heading north towards Schofields/Tallawong in Rouse Hill and from the Aerotropolis Core heading south towards Macarthur by providing underground tunnel stubs beyond the St Marys and Aerotropolis Core stations that would allow for minimal disruption of the operating line during construction of the extensions
- potential future rapid bus network to Campbelltown, Liverpool and Penrith from the Airport Business Park, Airport Terminal and Aerotropolis Core stations by providing space for future customer interchange.

The project has also been designed to allow for development of a potential future East West Rail Link and extension of the existing South West Rail Link. This has included provision of space within the corridor, where the rail infrastructure is at surface, from north of Elizabeth Drive to the Aerotropolis Core to allow for development of these potential future rail links. The Airport Business Park, Airport Terminal and Aerotropolis Core stations have also been designed to allow for the future development of these potential rail links.

1.2 Metro alignment and track infrastructure

1.2.1 Track and corridor alignment

The project would be located within a dedicated and restricted access rail corridor. The track alignment for the project would involve:

- track designed with fit-for-purpose horizontal and vertical alignment that consists of a combination of twin rail tunnels, viaduct, surface and in-cutting track types, including connection to the stabling and maintenance facility
- twin standard gauge tracks to allow two-way rail movements, with turnouts to provide access to / from the stabling and maintenance facility and one or more intermediate crossovers at various locations along the alignment
- turnbacks at the northern and southern ends of the project
- additional tunnel stubs to the east of St Marys Station and south of Aerotropolis Core Station to safeguard potential future extensions
- rail sidings to the north of Elizabeth Drive to allow for the temporary storage of trains during operation.

The alignment has been designed to meet the functional requirements of a metro system including the need to:

- provide a maximum vertical grade of 4.5 per cent
- locate station platforms along a straight and level (i.e. a zero per cent grade) section of track
- provide appropriate curvature to accommodate proposed train operating speeds. Tighter radius curves may be adopted at some locations for a variety of reasons, including avoiding surface or subsurface constraints such as areas of ecological sensitivity, flood prone land and other existing or proposed infrastructure
- consider integration with, or crossing of, existing and proposed future transport and other infrastructure.

The alignment of the project has also aimed to:

- avoid existing development including existing buildings, utilities and infrastructure (including other rail and road infrastructure)
- minimise, as far as practicable, direct impacts on private property
- minimise impacts on environmental features such as ecologically sensitive areas, heritage items, areas of contamination and areas of flood prone land
- minimise impacts on sensitive residential receivers and recreational land uses
- provide future land use and movement connectivity across the corridor, particularly in areas planned for future development, such as the Northern Gateway precinct, Western Sydney International and the Aerotropolis Core precinct.

The proposed horizontal and vertical alignment is shown in Figure 1-4a to Figure 1-4e and would continue to be refined as part of design development.

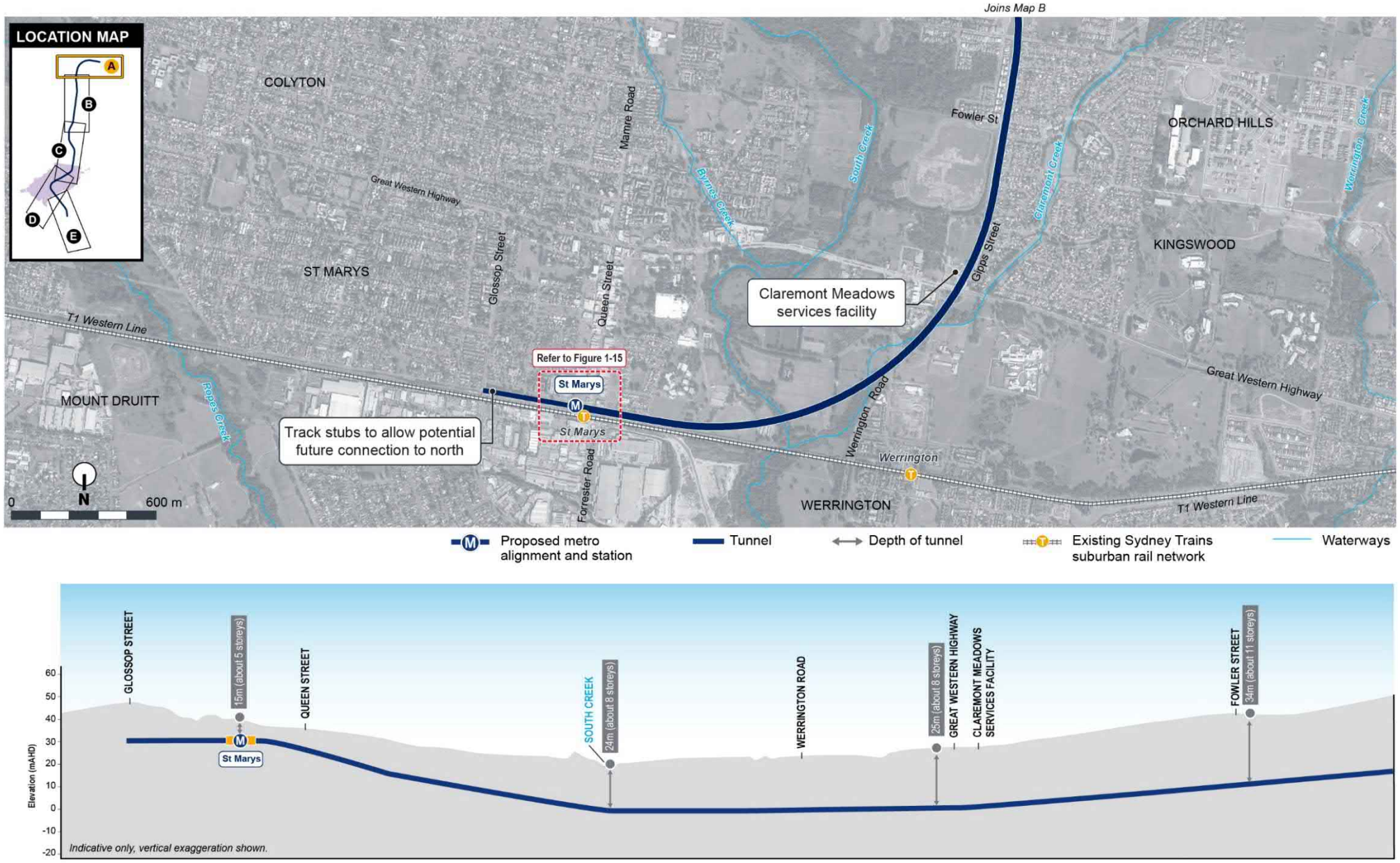


Figure 1-4a Project infrastructure and key features

Note: Indicative only, subject to design development.

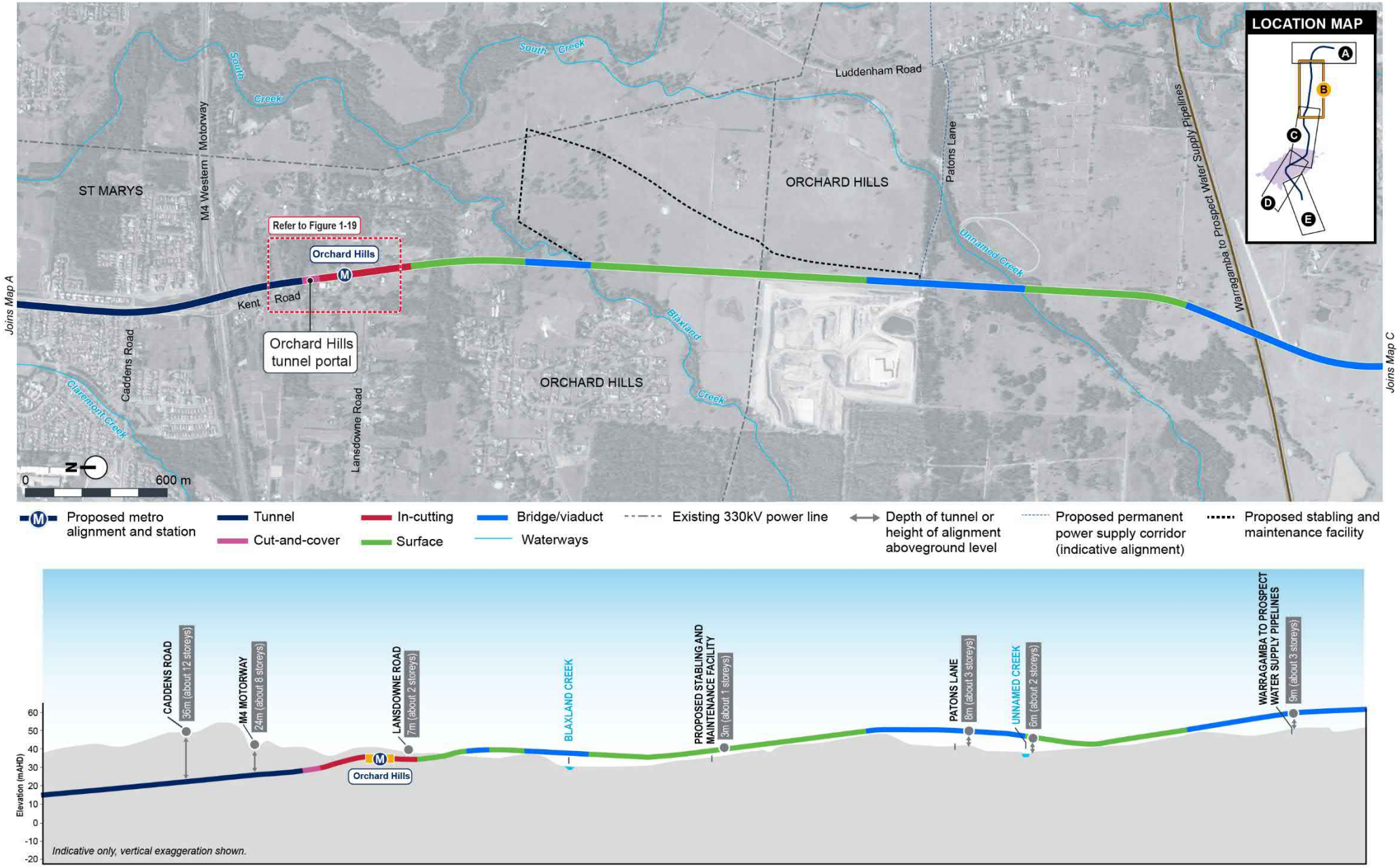


Figure 1-4b Project infrastructure and key features

Note: Indicative only, subject to design development.

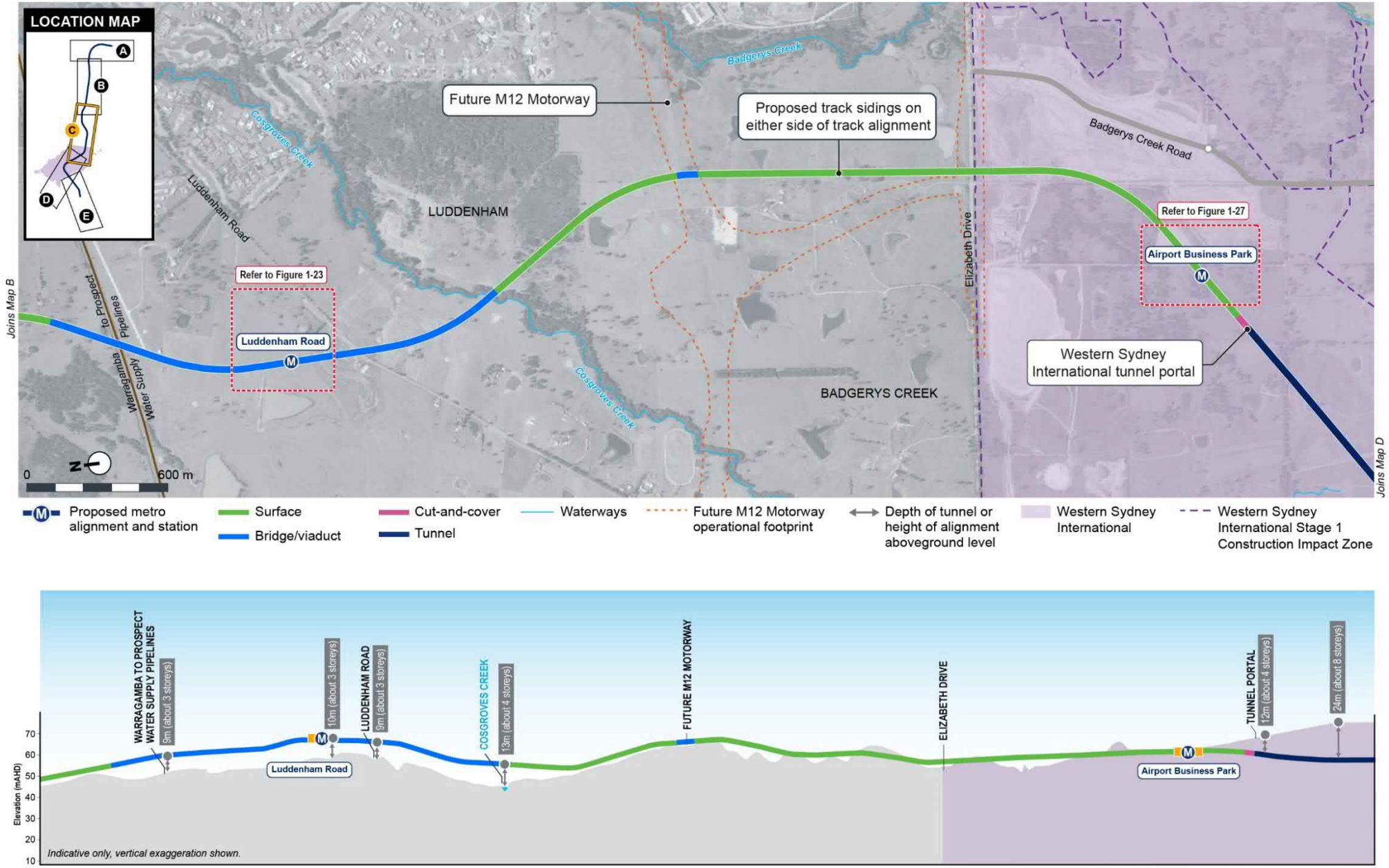


Figure 1-4c Project infrastructure and key features
Note: Indicative only, subject to design development.
Indicative final surface level shown within Western Sydney International.

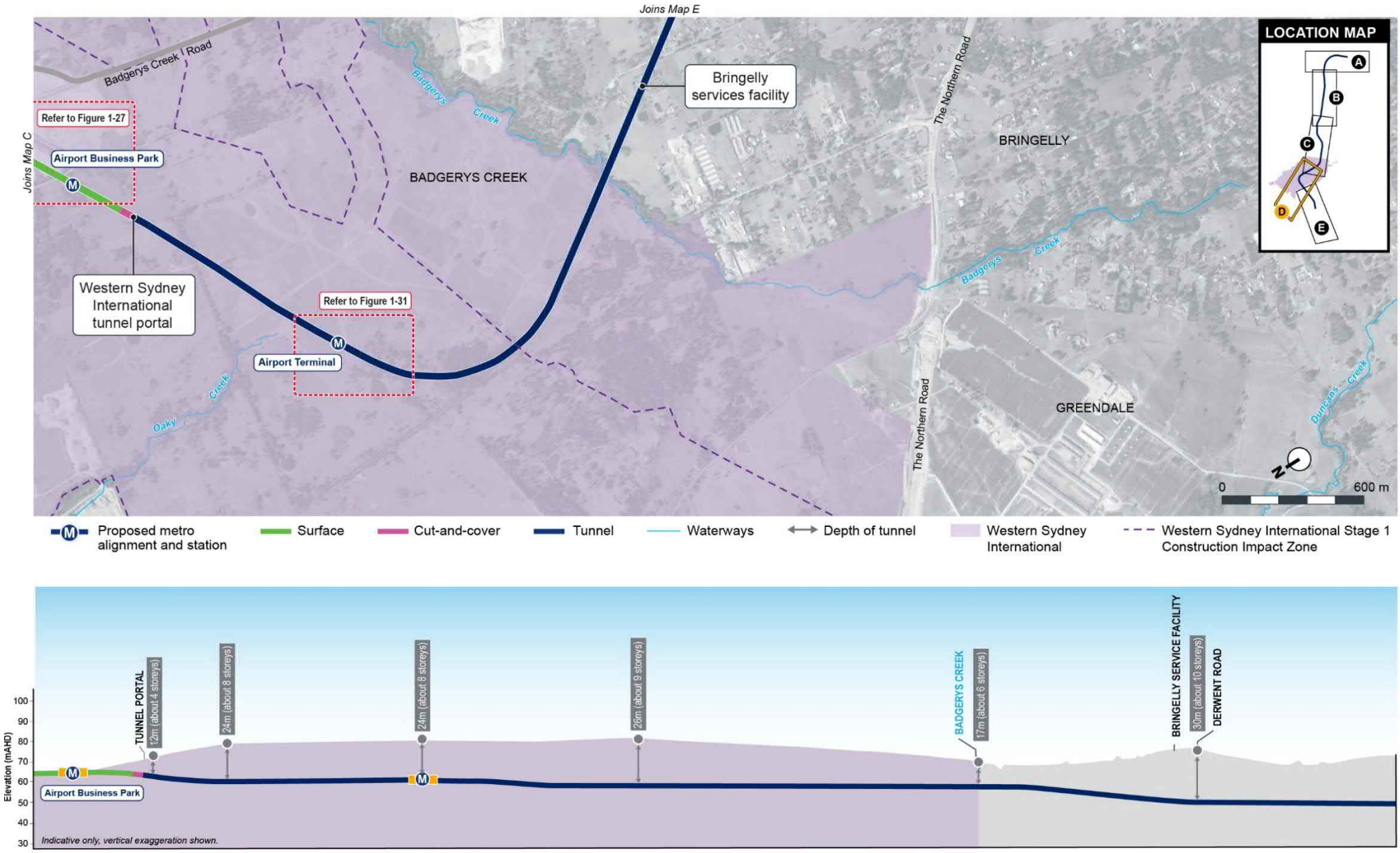
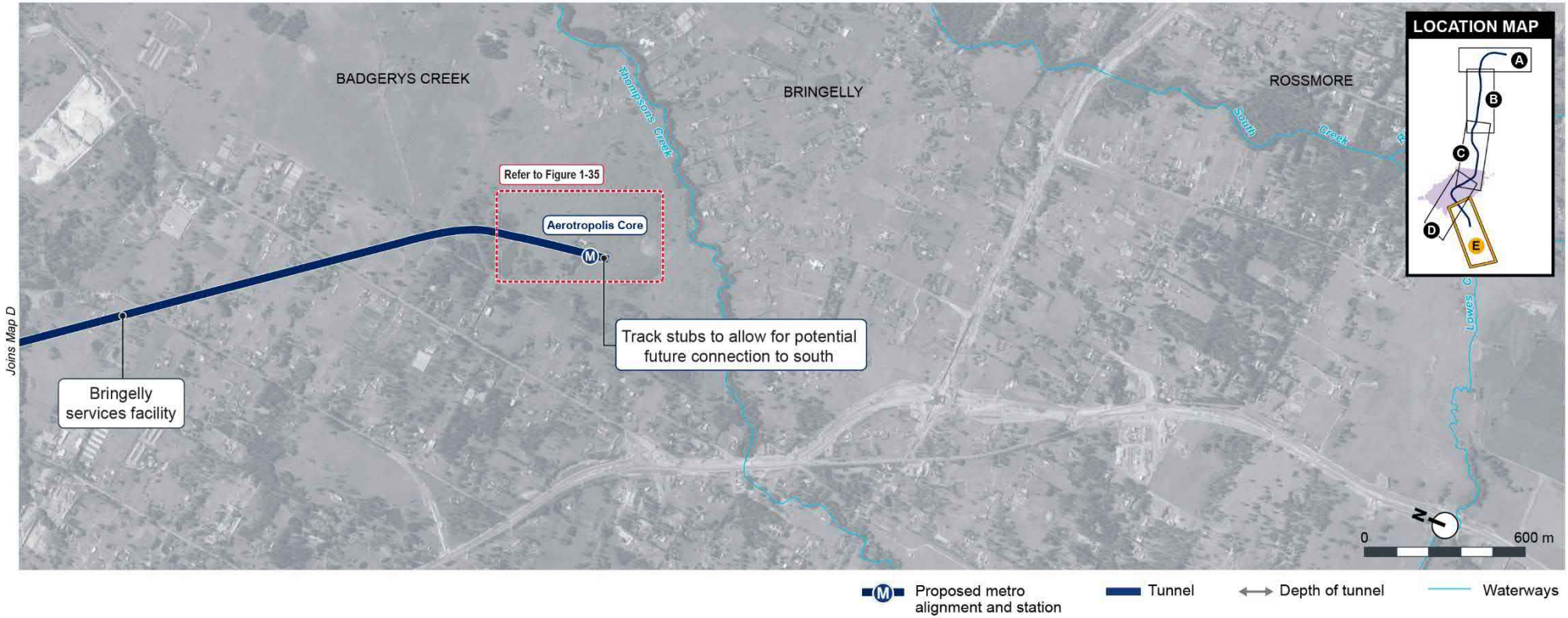


Figure 1-4d Project infrastructure and key features
Note: Indicative only, subject to design development.
Indicative final surface level shown within Western Sydney International.



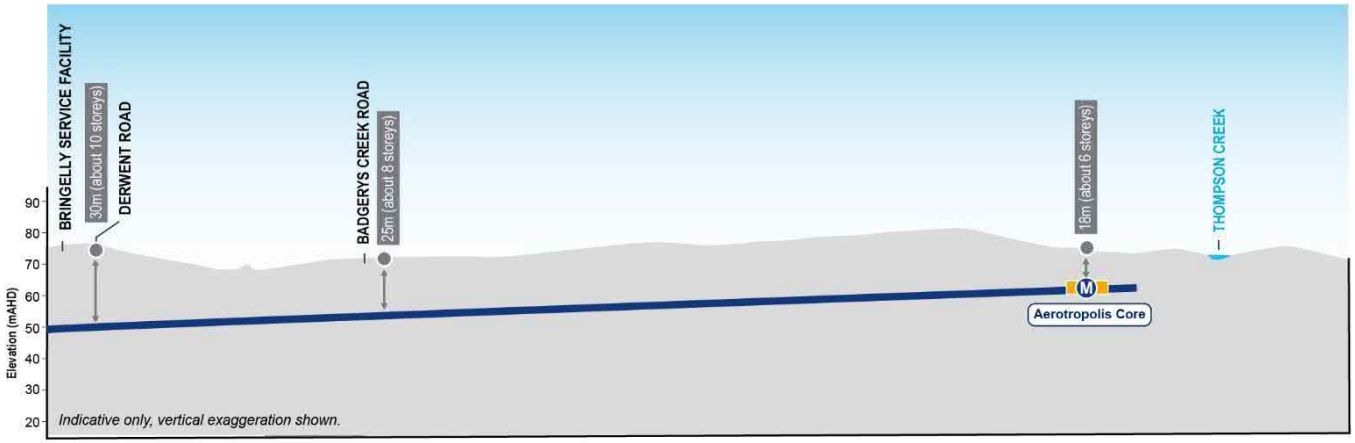


Figure 1-4e Project infrastructure and key features

Note: Indicative only, subject to design development.

1.2.2 Tunnels and underground track features

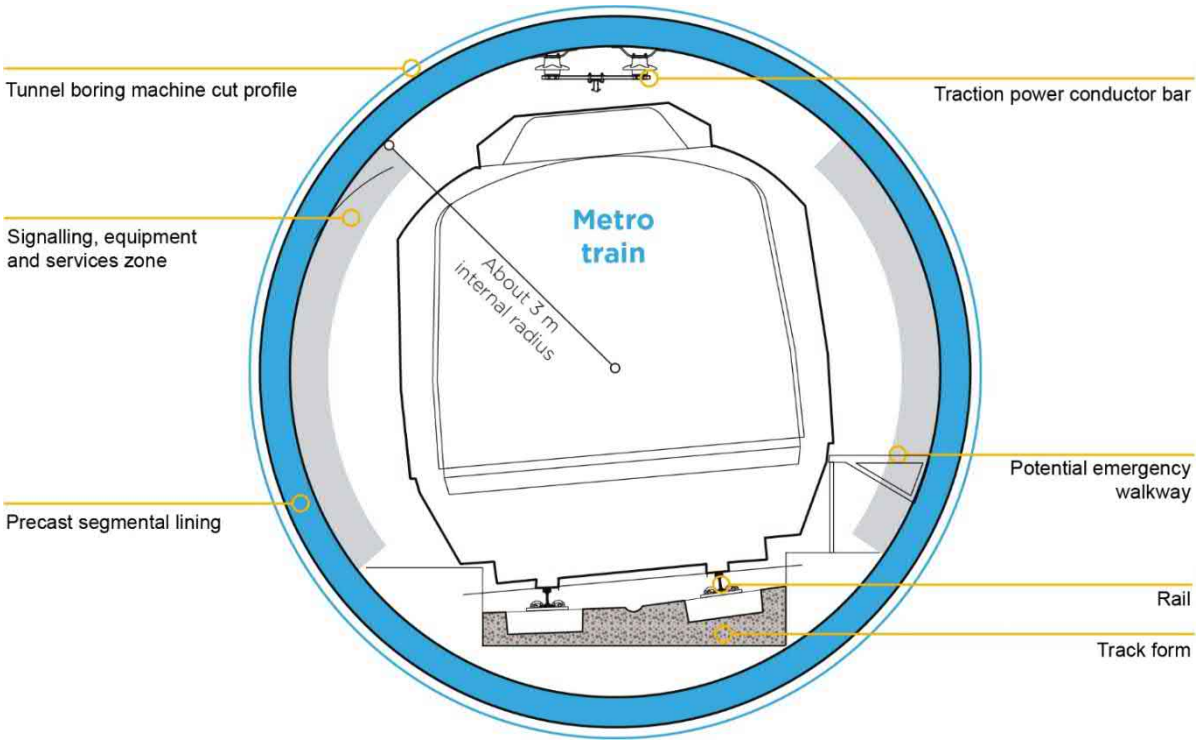
Metro rail tunnels

Two sections of the alignment would consist of twin rail tunnels, comprising two single tunnels generally running parallel to each other. The sections of twin rail tunnels would include (see Figure 1-4a to Figure 1-4e):

- a section around five kilometres in length from the underground station at St Marys to a new tunnel portal around 450 metres south of the M4 Western Motorway at Orchard Hills (the St Marys to Orchard Hills tunnel)
- a section around 6.3 kilometres in length from a tunnel portal around 400 metres southwest of Airport Business Park Station to Aerotropolis Core Station (the Western Sydney International to Bringelly tunnel) (consisting of around 3.3 kilometres of on-airport tunnel and around three kilometres of off-airport tunnel).

The metro rail tunnels would have a circular cross-section with a clear internal lined diameter of about six metres to accommodate a typical metro train.

An indicative cross-section of the underground tunnel is shown in Figure 1-5. The tunnels would be lined with pre-cast concrete segments to ensure the long-term life of the tunnels and to minimise groundwater ingress. The tunnels would provide space for the trains and tracks, and for other equipment and services including rail signalling, controls and communication, overhead traction power, fresh air ventilation, fire and life safety systems, lighting and drainage.



Note: Indicative only, subject to design development.

Figure 1-5 Indicative cross-section of one of the tunnel alignments

Tunnel track type and configuration

The track in tunnel would consist of a fixed concrete slab combined with a continuously welded rail. Typically, the tunnel track centrelines would be about 16 metres apart; however, variations to this tunnel spacing would occur at a number of locations to overcome geotechnical, and other subsurface constraints, surface infrastructure and operational design requirements.

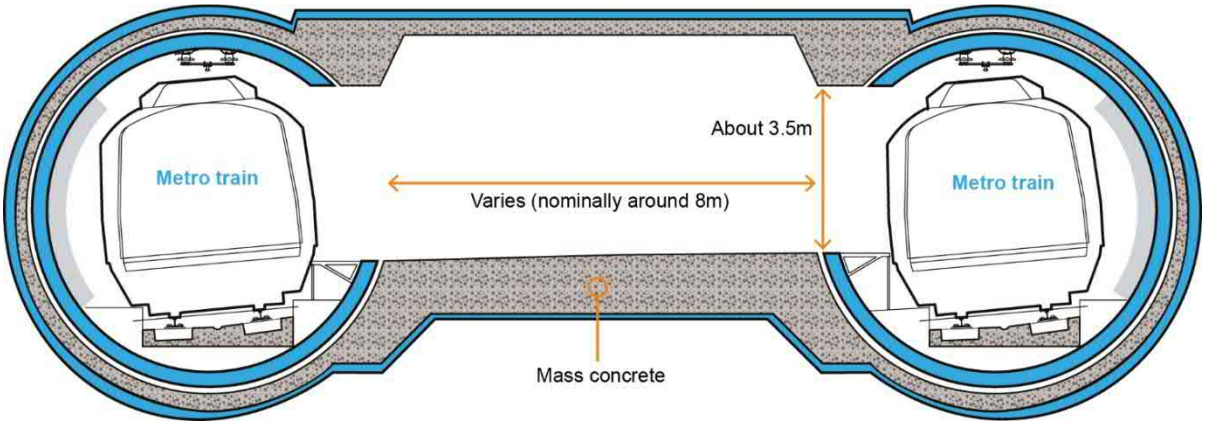
Tunnel depth

The St Marys to Orchard Hills tunnel would typically be about 15 to 35 metres below surface level. Indicative tunnel depths below the existing ground level at various locations along this section of the alignment are shown on Figure 1-4a and Figure 1-4b. The Western Sydney International to Bringelly tunnel would typically be between 12 and 30 metres below the final surface level. Indicative tunnel depths below the existing ground level at various locations along this section of the alignment are shown on Figure 1-4d and Figure 1-4e.

Variations in the tunnel depth may be required to accommodate geotechnical conditions, hydrogeological environments, drainage, surface/subsurface infrastructure and operational design requirements and would be confirmed during design development.

Emergency tunnel access and exit

An emergency egress strategy would be implemented that may involve end of train detrainment, or raised walkways could be provided throughout the tunnel sections of the alignment to provide for emergency access and exit. If provided, the walkways would be the same height as the floor of the train carriage so customers could evacuate in an emergency. Alternatively, passengers would disembark via a ramp to track level. To facilitate emergency access and exit between the two tunnels, cross-passages would be provided at intervals of about 240 metres. Figure 1-6 shows an indicative section of a typical cross-passage.



Note: Indicative only, subject to design development.

Figure 1-6 Indicative section of a tunnel cross-passage

Tunnel portals

Tunnel portals are the transition points for the rail track from below ground to surface. These structures would be required at the following locations:

- Orchard Hills tunnel portal – located around 450 metres south of the M4 Western Motorway as part of the St Marys to Orchard Hills tunnel
- Western Sydney International tunnel portal – located around 400 metres southwest of Airport Business Park Station as part of the Western Sydney International to Bringelly tunnel.

The tunnel portals would be designed to be protected from the probable maximum flood level to avoid floodwater flowing into the tunnels (refer to Chapter 14 (Flooding, hydrology and water quality) of the Environmental Impact Statement). Fire protection walls would be installed along the entire length of the structures to provide separation between the two metro tracks. Tunnel services buildings, including ventilation facilities, to support operations would also be provided at each tunnel portal (see Section 1.5.3).

The proposed tunnels and tunnel portals would be designed to minimise water ingress. Appropriate drainage systems would collect runoff from the open sections of the tunnel portal and groundwater seepage into the tunnel and direct it to the tunnel low points. The water would be treated to a standard suitable for discharge into the surrounding drainage network (see Section 1.5.5).

1.2.3 Surface track features

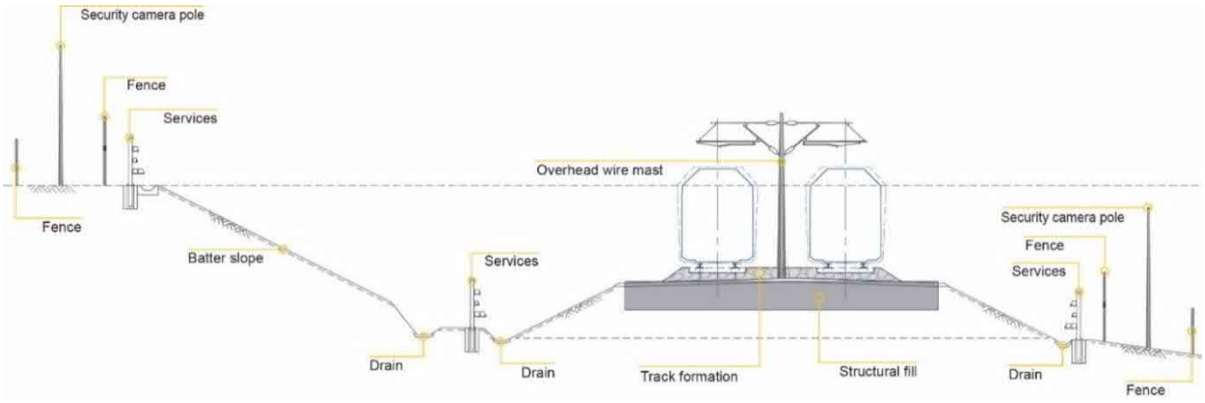
Surface tracks refer to the components of the project alignment that are at the same level as the existing surface, in addition to sections in cuttings or located on embankments. The surface sections of track would generally consist of a slab or ballast track construction with concrete sleepers. The track type, including for the stabling and maintenance facility, would be confirmed as part of design development and would consider areas where noise mitigation may be required.

The spacing (track centres) between the metro tracks would typically be between about five and six metres. The surface sections of the tracks are shown in Figure 1-4b to Figure 1-4d.

Embankments and cuttings

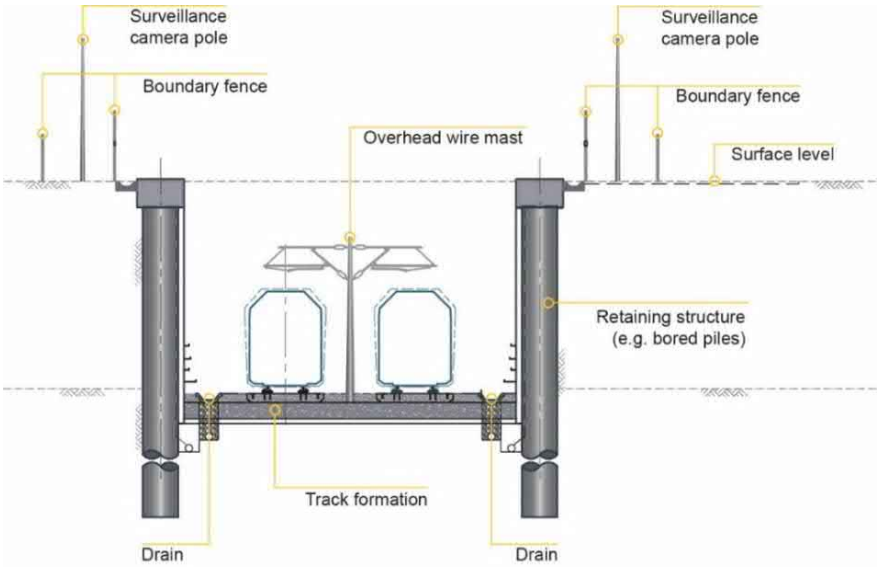
A series of fill embankments and cuttings would be required along the length of the project due to the varying terrain and locational setting of the project within the existing landscape. Batters for cuts and embankments would be designed to minimise property impacts, maintenance requirements and reduce urban design impacts. The batters would typically be designed to have slopes of around 2:1 (horizontal:vertical). Where required, benches (flatter areas between vertical slopes) would be provided to limit the height of each slope section.

All earthworks would be designed to fit the surrounding context, providing a 'natural fit' within their landscape setting wherever possible. An indicative section of an embankment is shown in Figure 1-7 and an indicative cross-section of cutting section of track is provided in Figure 1-8.



Note: Indicative only, subject to design development.

Figure 1-7 Indicative cross-section of an embankment section of track alignment



Note: Indicative only, subject to design development.

Figure 1-8 Indicative cross-section of an in-cutting section of track alignment

Retaining walls

Retaining walls may be required in the vicinity of stations or along the alignment to suit the new metro tracks or to support new infrastructure as a result of local topography. Proposed retaining walls and related elements would be designed to provide a unified design approach that would be integrated with the adjoining landscape (as far as practicable) and other components such as fencing, guard rails, steps and other walls.

The exact positioning and size of retaining walls would be determined during design development.

1.2.4 Viaducts and bridges

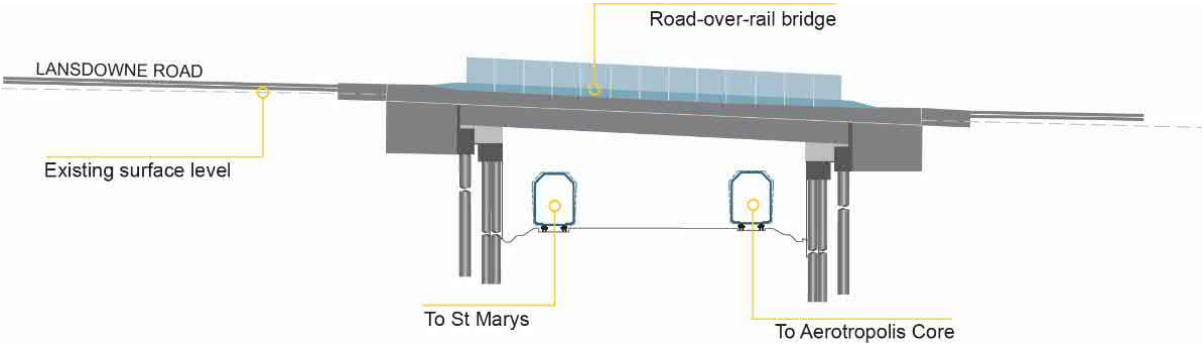
The viaduct and bridge sections would generally consist of a slab track construction with concrete sleepers. The alignment would intersect with infrastructure (such as roads and the Warragamba to Prospect Water Supply Pipelines), a number of watercourses and areas of flood prone land which would require a series of viaduct and bridge structures to cross, as identified in Table 1-2. The location of the proposed viaduct and bridge structures are shown in Figure 1-4b to Figure 1-4c. The design of each proposed bridge and viaduct structure is indicative and would be refined as part of design development.

Table 1-2 Proposed bridge and viaduct structures

Location	Indicative length	Description
Lansdowne Road	30 metres	At Lansdowne Road, the track alignment would be in-cutting and perpendicular to the existing Lansdowne Road. At this location, a new road-over-rail bridge would be provided to maintain the existing alignment of Lansdowne Road over the rail track (see Figure 1-9).
Blaxland Creek	360 metres	The proposed viaduct to cross Blaxland Creek would consist of a series of spanning structures that would have an overall length of around 360 metres to clear the potential flood zone at this location. The viaduct structure would typically consist of an elevated concrete structure supported by reinforced concrete piers. An example of a viaduct structure using a segmented girder is shown in Figure 1-10, noting that design development will define bridge structure form.
Patons Lane	830 metres	The proposed viaduct to cross Patons Lane and an unnamed tributary of South Creek to the south of Patons Lane would consist of a series of spanning structures and would have an overall length of around 830 metres to clear all existing infrastructure, the potential flood zone and vegetation in this location.
Warragamba to Prospect Water Supply Pipelines, Luddenham Road and Cosgroves Creek	2,500 metres	The proposed viaduct to cross the pipelines, Luddenham Road and Cosgroves Creek would consist of a series of spanning structures and would have an overall length of around 2.5 kilometres to clear all infrastructure and the potential flood zone in this location. Luddenham Road Station would be located along this viaduct structure.
Future M12 Motorway	95 metres	The project would cross the proposed alignment of the future M12 Motorway to the north of Elizabeth Drive, before entering Western Sydney International. The project would be grade separated on a new rail-over-road bridge with the future M12 Motorway located in a cutting under the metro rail line, which would be at surface. The bridge would be designed to provide the required clearance to the future M12 Motorway. An indicative location and cross-section of the proposed bridge structure, and interaction with the future M12 Motorway, is provided in Figure 1-11.

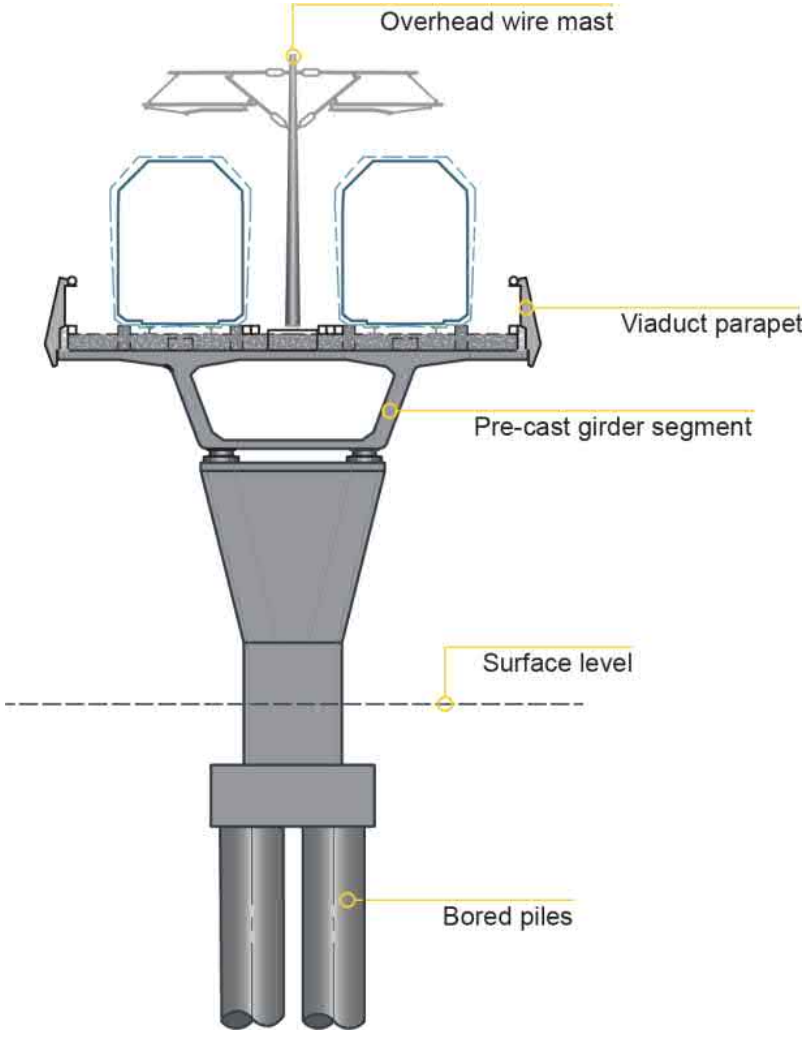
Note: The design of the proposed bridge and viaduct structures is indicative and subject to design development.

In addition to the proposed bridge and viaduct structures identified in Table 1-2, at the point where the project crosses Elizabeth Drive, the project would be at surface level under a new elevated alignment of Elizabeth Drive. This elevated structure is proposed to be delivered as part of the future M12 Motorway project.



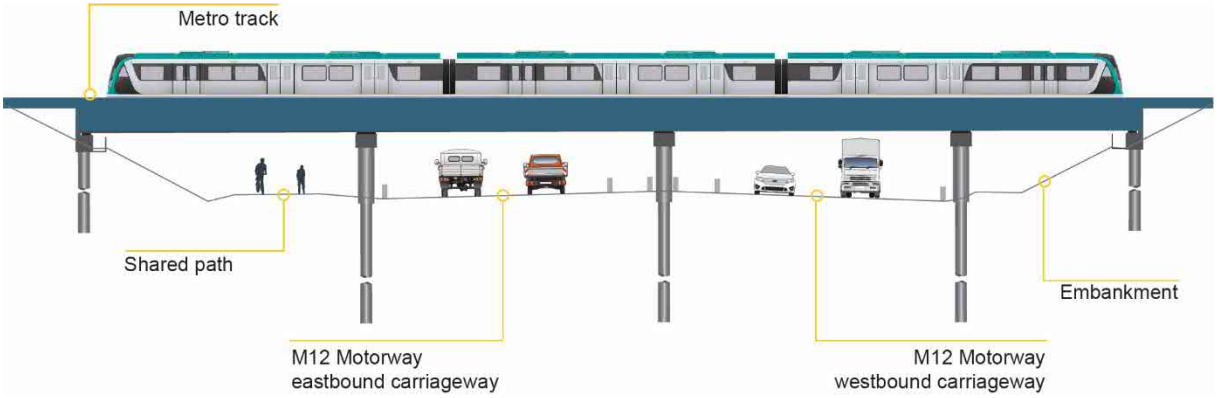
Note: Indicative only, subject to design development.

Figure 1-9 Road-over-rail bridge at Lansdowne Road



Note: Indicative only, subject to design development.

Figure 1-10 Example viaduct structure section



Note: Indicative only, subject to design development. Not to scale..

Figure 1-11 Proposed bridge structure over the future M12 Motorway

For the viaduct or bridge structures, the width of each structure would be designed to carry the twin track railway with provision for access walkways on both sides. The structures would also feature a wider section (where required) to support an elevated station or to span a natural feature such as a floodplain or creek crossing. The width of the elevated structures is subject to design development.

Each of the elevated structures would have a number of similar design elements including:

- derailment and collision protection features
- noise barriers if required (see Section 1.6.2)
- track/bridge deck drainage
- operational infrastructure for lighting, signalling, communications, overhead wiring and power supply.

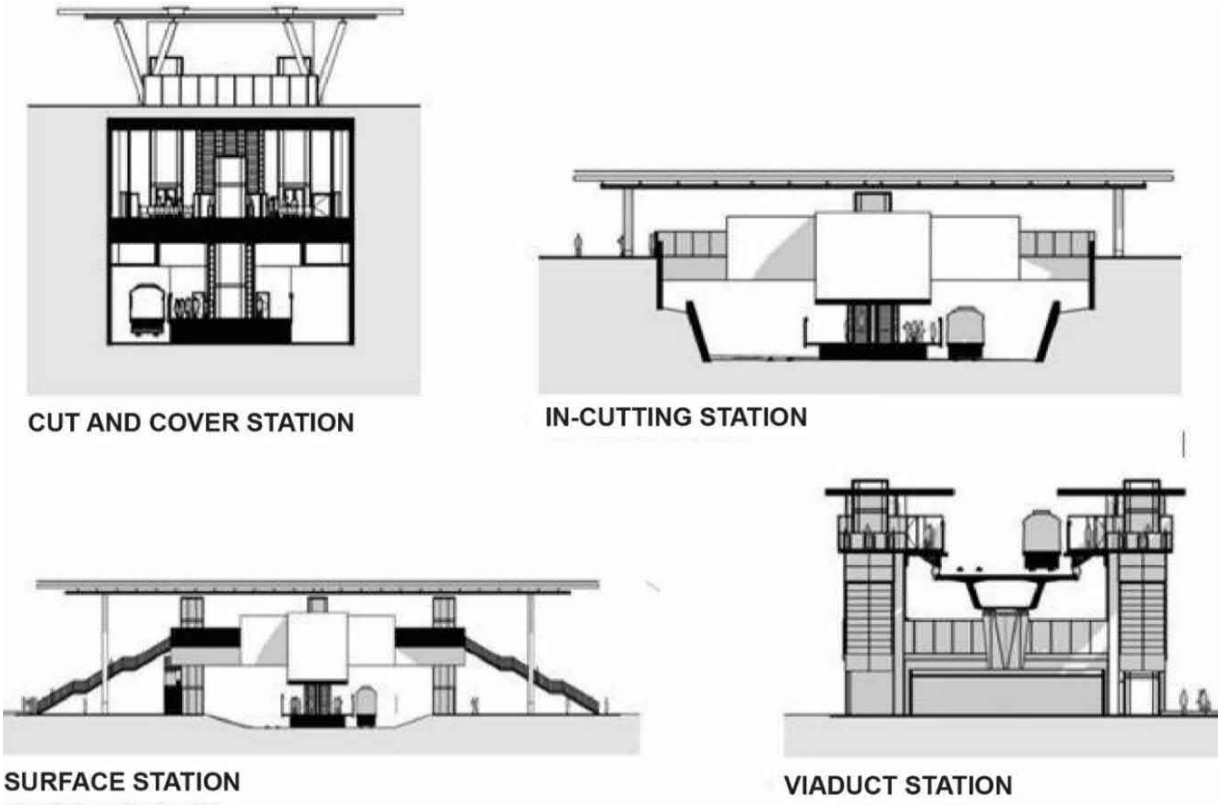
1.3 Overview of metro stations

1.3.1 Station typologies

The project would include six new metro stations between St Marys and the Aerotropolis Core precinct (see Figure 1-1). Four main station typologies have been identified for the project to best meet the proposed track alignment at each station location. These are:

- cut-and-cover stations at St Marys, Airport Terminal and Aerotropolis Core
- an in-cutting station at Orchard Hills
- a viaduct (elevated) station at Luddenham Road
- a surface (shallow cutting) station at Airport Business Park.

Typical configurations of each of these station types are shown in Figure 1-12.



Note: Indicative only, subject to design development.

Figure 1-12 Station configurations

1.3.2 Common station elements

Metro stations would be designed to provide safe and efficient interchange between transport modes, including minimising conflicts between pedestrians, cyclists, buses and vehicles. Each metro station would have a number of common elements or design features. These would include:

- station concourses (both paid and unpaid), including elements such as ticket vending machines, ticket barriers and access to and from the platform and toilets
- emergency stairwell access (typically at the ends of each station)
- platforms with elements such as seating, help points to enable customers to obtain emergency assistance, real-time customer information display screens and public address systems
- vertical transport, including a combination of escalators, lifts and stairs
- cross-corridor connections which provide access across rail lines to ensure permeability
- station service and utilities buildings/facilities
- signage and wayfinding within the station and the surrounding public domain
- awnings for shade and shelter at station entries as well as along station platforms
- provision of space for potential retail and other uses to activate the stations and station precincts
- enhancements to and/or provision of footpaths in the immediate vicinity of the station entries
- landscaping and street furniture to maintain high quality urban design outcomes.

Each platform would also be fitted with elements such as platform screen doors and platform edge barriers. All platforms would comply with the requirements of the *Disability Discrimination Act 1992* (NSW).

Additional station precinct elements for off-airport stations

Building new metro stations would create opportunities to shape and create vibrant and attractive precincts surrounding each station. The off-airport station precincts would include:

- transport interchange points (such as connection to the existing Sydney Trains network at St Marys, potential park-and-ride and kiss-and-ride facilities, bus stops and bus priority measures, point-to-point vehicle facilities and cycle storage areas)
- station access walkways and cycle paths, other pedestrian and cycle facilities, access roads, modal priority infrastructure (bus lanes and access roads), road modifications and intersection treatments, stormwater infrastructure and other ancillary facilities.

On-airport stations

The on-airport stations would be designed to be consistent with the design and layout being developed for the station precincts within Western Sydney International, in consultation with Western Sydney Airport. The broader on-airport precincts associated with the two stations within Western Sydney International would be delivered by others as part of the overall development of Western Sydney International.

1.3.3 Placemaking

The delivery of Sydney Metro – Western Sydney Airport offers the opportunity to support the creation of new places focused around the locations of the proposed stations, such as at the Aerotropolis Core precinct, or to reinforce or enhance existing places, such as St Marys. The approach to placemaking at each station precinct would be contextual, taking into consideration their surrounding environment or 'place' in which they are located by supporting planned or future land use development or renewal. Sydney Metro considers placemaking opportunities at different scales, starting from the station itself, extending to the interchange area, and to the broader precinct in which the station and interchange are located (see Figure 1-13).

Land Use and Statutory Planning	Physical Infrastructure	Integrated and Precinct Development	Precinct Activation
Led by state and local government agencies. Ensures appropriate land uses within station walking catchments, commensurate with mass transit amenity.	Public domain and transport integration elements delivered, usually as part of the project. Ensures stations and interchanges are attractive, safe, functional and facilitate the gathering and movement of people.	Development above, adjacent to or near metro stations. Provides complimentary land uses, spaces and activity to help activate the station and interchange area and contribute to overall precinct vision. Led by Sydney Metro, third parties, or in partnership	Spaces or programmed activities that ensure safe and vibrant station and interchange environments, particularly as wider precinct evolves and develops.

Figure 1-13 Placemaking at different scales for the project

Sydney Metro's role in delivery changes as the scale increases. Sydney Metro's scope to deliver and influence place outcomes is highest within the station and interchange area. The physical extent of this area differs from station to station depending on context, but generally includes station plazas and interchange infrastructure in the immediate surrounds of the station. In some locations this may include areas for future development, placemaking or transport integration purposes.

Sydney Metro's scope to deliver place outcomes would relate to the physical infrastructure to be delivered as part of the project and future potential integrated and precinct developments (subject to separate approval). Together, these scope elements would include the development of rail infrastructure and precinct infrastructure such as bike storage and buses and point-to-point interchanges. These are the elements where public domain and transport can be delivered as part of an integrated solution that can respond to complementary land uses within a wider precinct.

There are a range of different stakeholders who would have a role in delivering place outcomes across the project corridor and at station precincts. At all off-airport stations, Sydney Metro would deliver public domain elements and work with other parts of Transport for NSW and other key stakeholders to deliver transport integration elements. At the on-airport stations, Sydney Metro would work with Western Sydney Airport to ensure the required transport integration elements are effectively delivered to support the project.

This would ensure stations and interchanges are attractive, safe, functional and allow for the gathering and movement of people, whilst also being consistent with the aspirations of the places surrounding them. Within station and interchange areas, Sydney Metro would also explore opportunities for activation, retail and other specialised spaces for the customer and community. The fit out and use of these spaces would be delivered subject to separate planning approvals as appropriate.

The final approach and design to placemaking for the project would be undertaken with consideration to current best practices for urban design and placemaking including consideration of the Government Architect of NSW's Better Placed and the principles of Designing with Country. These frameworks and principles are aimed at creating a clear approach to the design of architecture, public places and environments for the future as well as promoting incorporation of Aboriginal leadership and advice in the design of projects.

These frameworks and principles would be considered as part of the ongoing design development of the project and have been considered as part of the development of the urban design guidelines for the project (Design Guidelines (Appendix D)).

1.3.4 Provision for potential future integrated station and precinct developments

The arrival of new Sydney Metro stations can offer property and infrastructure development opportunities that can be delivered as part of, or independently from, the station design and construction. This development can occur above, adjacent to or as part of wider precinct development.

The project does not propose development that is integrated with stations. Opportunities for development within the wider station precinct would be investigated as part of a precinct development strategy that would focus on this element of placemaking opportunities and the disposal of residual government-owned land. As such, it is outside the scope of the project for which approval is sought.

Beyond the interchange area, in the precinct, the role of Sydney Metro is generally to service key attractions and enable opportunities for land use change and placemaking more broadly. Outside of Western Sydney International, integration with broader land use planning led by State and local government agencies is an important consideration for the station precincts. This can help ensure mass transit amenity offered by the station is supported by appropriate land uses, which contributes to liveability of areas through supporting public transport use and reducing the need for private vehicle use. Within Western Sydney International, integration of the on-airport stations with the Airport Plan will be essential to the success of the airport.

The *Western Sydney Aerotropolis Plan* (NSW Government, 2020) provides an overview of proposed land uses surrounding the Aerotropolis Core Station and Luddenham Road Station. Placemaking and potential future development of the project would be aligned with the land use planning principles and objectives outlined in this plan (refer to Chapter 2 (Strategic need and justification) of the Environmental Impact Statement for further information).

Sydney Metro is also considering potential opportunities for precinct development immediately surrounding the proposed metro stations at St Marys and Orchard Hills, including consideration of the use of residual land. Opportunities for potential future development around these metro stations would be considered as part of future precinct planning and/or master planning activities in consideration of the area's future strategic vision and would be subject to separate planning approval processes.

1.4 Metro stations

The project would include six new metro stations, with four new metro stations located off-airport and two metro stations located on-airport. The following sections provide an overview of the location, station and design drivers and key design elements for each of the proposed stations. The urban design strategies for each station are presented in Design Guidelines (Appendix D).

An overview of the proposed stations and interchange opportunities is shown in Figure 1-14. Buses will service the Western Sydney Airport Ground Transportation Centre but will not provide interchange to the Airport Terminal Station. As such, buses are not shown as an interchange opportunity in Figure 1-14.

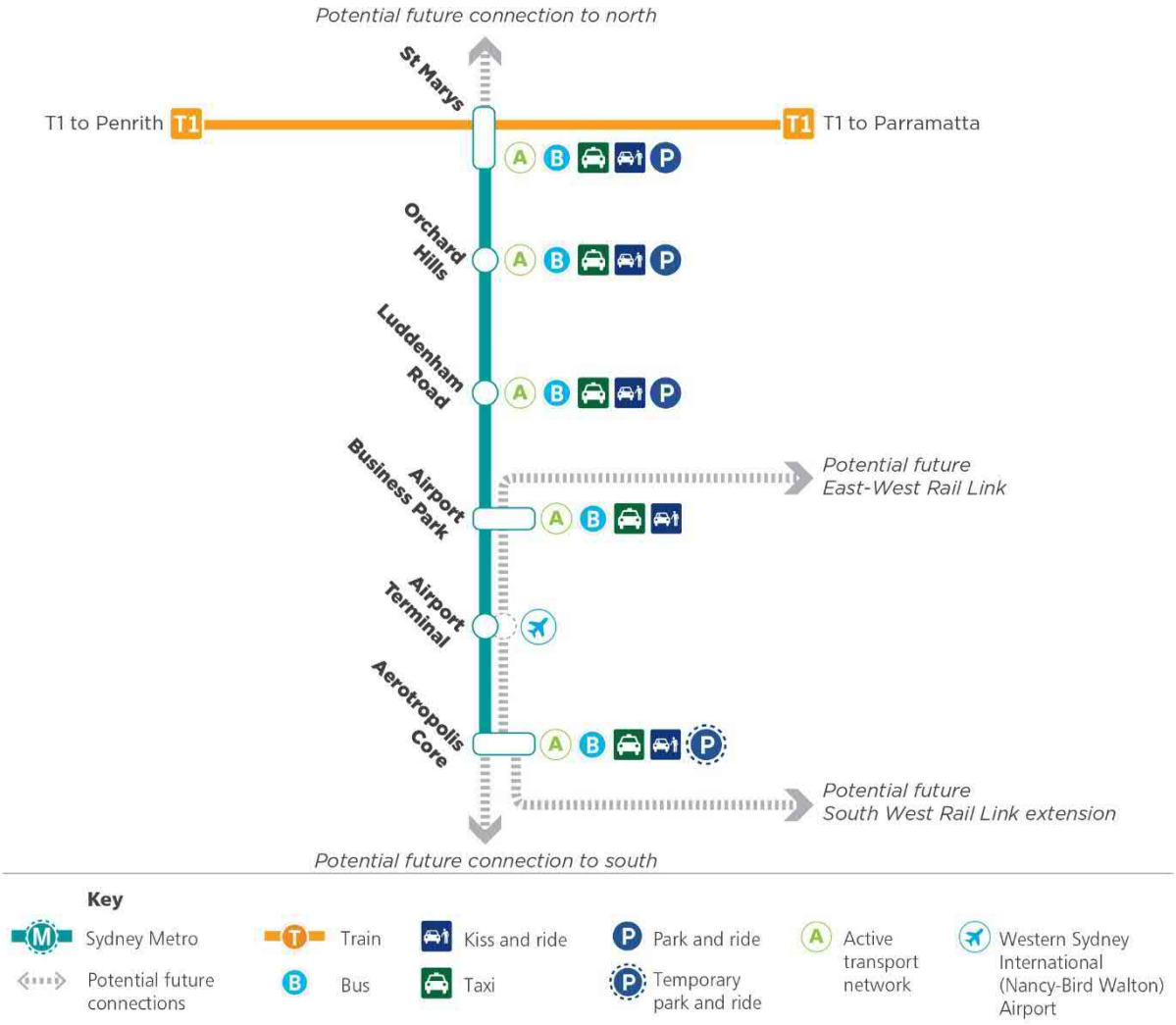


Figure 1-14 Proposed stations and interchange opportunities as part of the project

1.4.1 St Marys Station

Station context

The St Marys Station precinct is proposed to be a regionally significant strategic centre with an important metropolitan transport interchange connecting all modes of public and active transport (refer to the *Western City District Plan*). Penrith City Council has identified St Marys to be one of the two core centres within the Penrith LGA, with the introduction of mixed use and higher density residential zones east of Queen Street (refer to Chapter 19 (Land use and property) of the Environmental Impact Statement for further information).

St Marys Station would be co-located as an interchange station with the existing Sydney Trains Station at St Marys. The existing St Marys Station provides connecting rail services east to the Sydney Central Business District (CBD) and west to Emu Plains as well as connections to local bus services. The proposed St Marys Station is intended to allow easy customer interchange between Sydney Metro services and the existing Sydney Trains services and local bus services.

Station and design drivers

A metro station at St Marys would serve the existing and proposed future retail and commercial precinct of St Marys. The station drivers for St Marys Station are to:

- provide an easy, efficient and accessible interchange with the existing Sydney Trains suburban rail network and bus services
- support St Marys strategic centre through promoting future employment growth and the Queen Street main street
- safeguard for future extension towards Schofields
- serve and support the revitalisation and continued renewal of the St Marys strategic centre both north and south of the T1 Western Line (on the existing Sydney Trains suburban rail network)
- maintain and/or improve active cross-corridor connections
- consider integrated development opportunities.

Station design

St Marys Station would consist of an underground cut-and-cover station with the platforms located below the existing surface level. The station would provide an island platform in an east–west orientation located to the south, and parallel to the T1 Western Line. The station box would be located to the east of the existing Goods Shed, an element of heritage significance within the State heritage listed St Marys Railway Station Group, which would be retained as part of the project (refer to Chapter 12 (Non-Aboriginal heritage) of the Environmental Impact Statement).

Customers would access the station via two new plazas on either side of the T1 Western Line; one from Harris Street in the north and one from Station Street in the south. Escalators, stairs and lifts would provide access from the platform to the surface and the new above-ground pedestrian connection.

An above-ground pedestrian connection to the existing St Marys Station would be provided for access between the metro and heavy rail stations (via escalators, stairs and lifts) and would also provide a connection to the area north of the existing T1 Western Line. Using this connection, customers would be able to easily transfer between metro, heavy rail and bus services.

The station would be designed to provide natural light and ventilation. Areas for station services and utilities would be provided at the eastern and western ends of the station.

The proposed design would also retain the existing pedestrian overpass at St Marys Station.

Station precinct and interchange facilities

St Marys Station would include a series of precinct and interchange elements such as:

- secure bicycle parking
- reconfigured bus interchange and shelters located on both sides of Station Street and a bus layover area located to the east of the metro station
- kiss-and-ride and point-to-point vehicle facilities on both the northern and southern sides of the T1 Western Line
- upgrades to the existing road reserves, new pedestrian crossings and creation of new public plazas adjacent to the proposed station entrances
- built elements to allow for potential future station retail and other station activation opportunities (fit out and use of retail spaces would be subject to separate approval, where required).

An extension of the existing multi-deck St Marys Commuter Car Park will also be delivered as a separate project by Transport for NSW by early 2022.

An indicative layout of St Marys Station is shown in Figure 1-15, with an elevation and cross-section shown in Figure 1-16 and Figure 1-17 respectively. An artist's impression is provided in Figure 1-18.

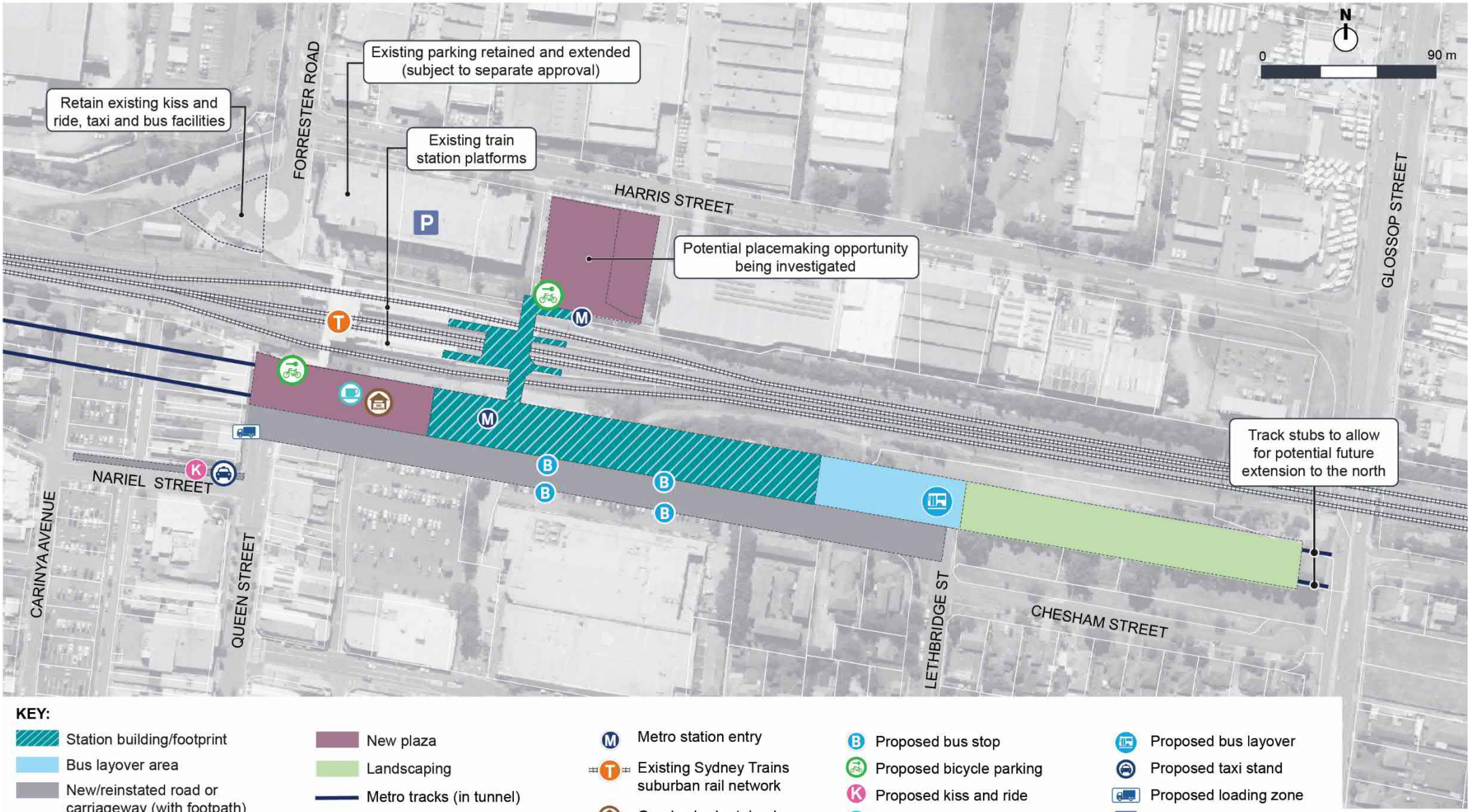
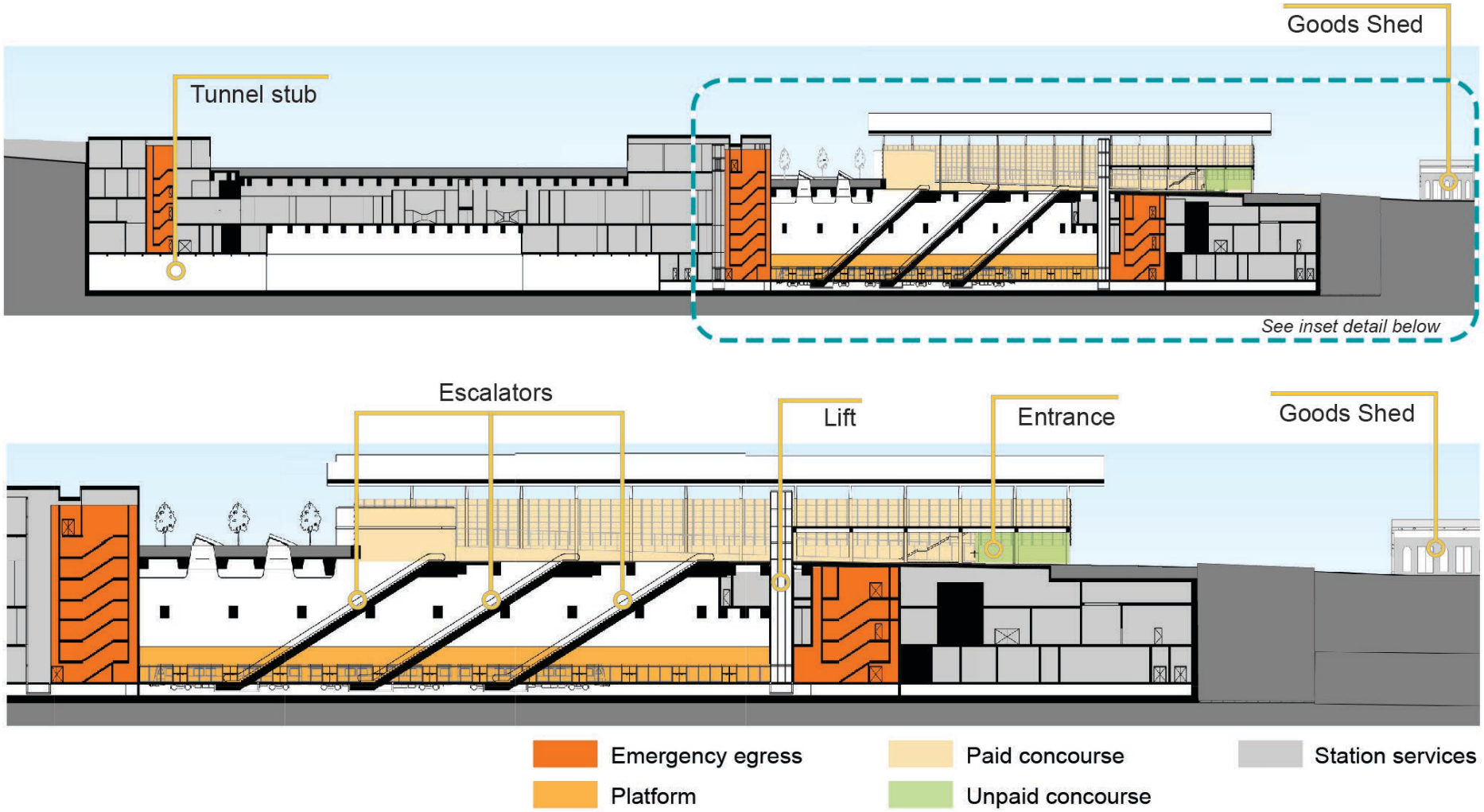


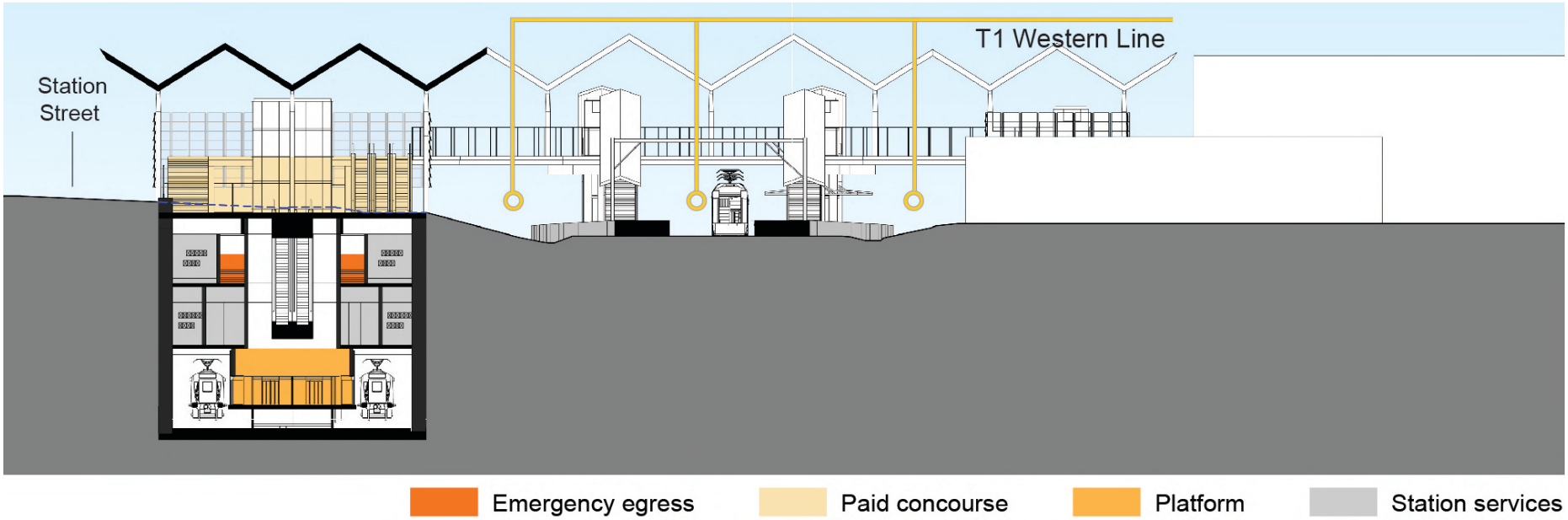
Figure 1-15 St Marys Station - Indicative layout and key design elements

Note: Indicative only, subject to design development.



Note: Indicative only, subject to design development.

Figure 1-16 St Marys Station – indicative elevation



Note: Indicative only, subject to design development.

Figure 1-17 St Marys Station – indicative cross-section

Note: Indicative only, subject to design development.

Figure 1-18 St Marys Station – artist's impression

1.4.2 Orchard Hills Station

Station context

Located south of the M4 Western Motorway, the Orchard Hills Station precinct currently consists of predominantly low density, rural residential dwellings. The suburb has potential for future development and uplift through higher density residential within the catchment as part of the Greater Penrith to Eastern Creek Growth Investigation Area. Detailed planning for future land uses within Orchard Hills is still underway.

Station and design drivers

The Orchard Hills Station precinct is envisaged to become part of a compact, high amenity and walkable new residential community. The station drivers for the Orchard Hills Station are to:

- transform the precinct by establishing a new town centre with mixed-use residential, commercial and retail development
- catalyse urban renewal surrounding the new town centre with a mix of diverse housing types
- consider opportunities to extend station catchment through transport integration establishing an interchange hub to serve catchment to the west (including Glenmore Park).

Station design

Orchard Hills Station would consist of a station in a cutting (in-cutting station typology) below the existing surface level. The station would provide an island platform in a generally north–south orientation located around 450 metres south of the M4 Western Motorway. The station would be located to the south of the Orchard Hills tunnel portal, which would allow for natural light and ventilation.

Customers would access the station via a new plaza area to the west of the station created as part of an upgraded street network (see Figure 1-19). A single entrance point would be provided towards the northern end of the metro station as part of the new plaza. From the station entrance, customers would access the platform via lifts and escalators. Areas for station services and utilities would also be provided at both the northern and southern ends of the station.

Roof canopies for weather protection would be provided to cover the majority of the length of the station platforms.

Station precinct and interchange facilities

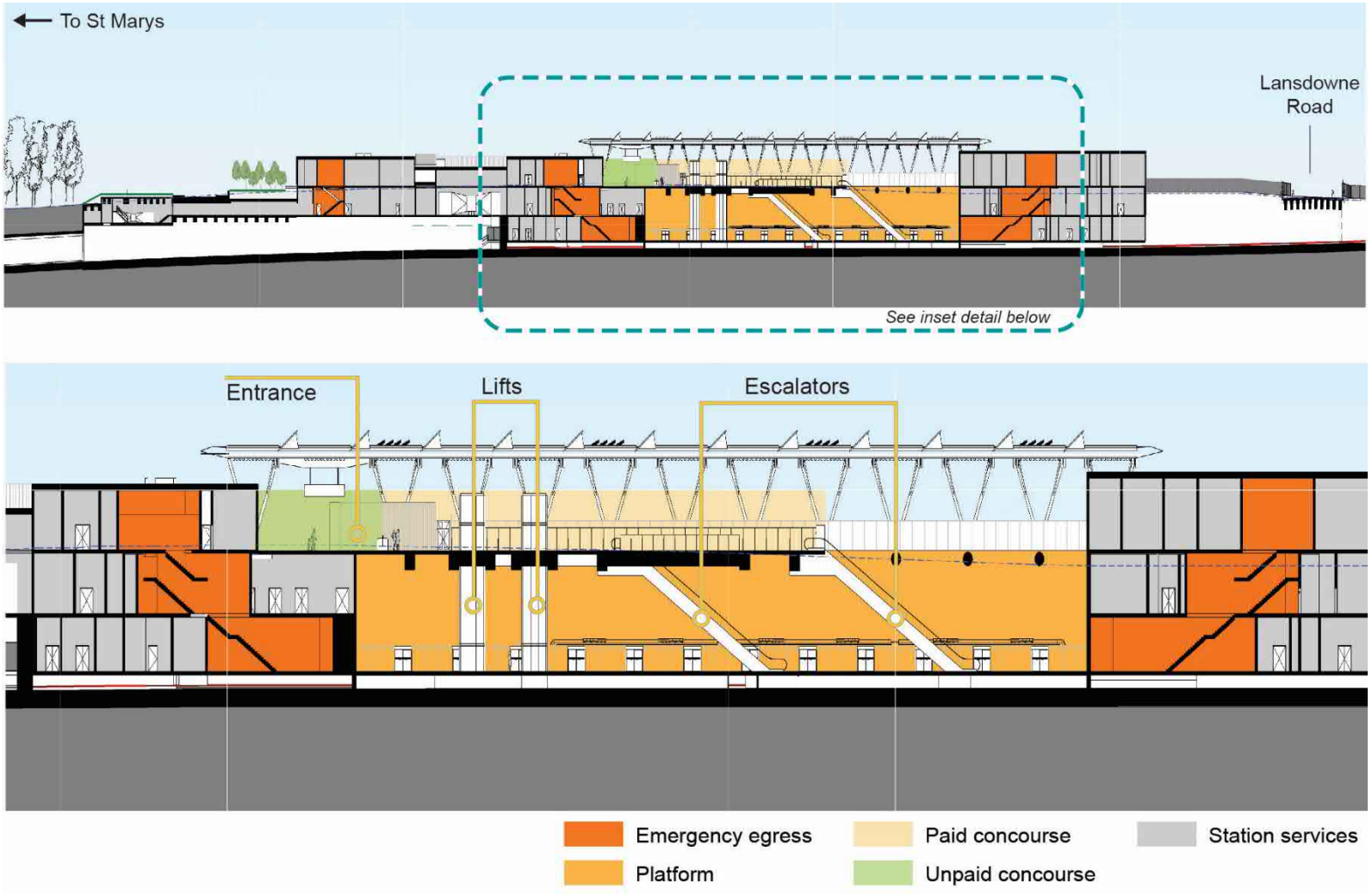
The proposed Orchard Hills Station would include the following precinct and interchange elements:

- secure bicycle parking
- park-and-ride facilities, including up to 500 spaces (potential multi-deck car park) located to the south of Lansdowne Road
- transport interchange facilities, including bus bays and shelters, kiss-and-ride bays and point-to-point vehicle facilities
- upgrades to Kent Road and Lansdowne Road, including intersections with new precinct roads, new pedestrian crossings and creation of a new public plaza/urban domain adjacent to the proposed station entrance
- built elements to allow for potential future station retail and other station activation opportunities (fit out and use of retail spaces would be subject to separate approval, where required).

An indicative layout of Orchard Hills Station is shown in Figure 1-19, with an elevation and cross-section shown in Figure 1-20 and Figure 1-21 respectively. An artist’s impression is provided in Figure 1-22.

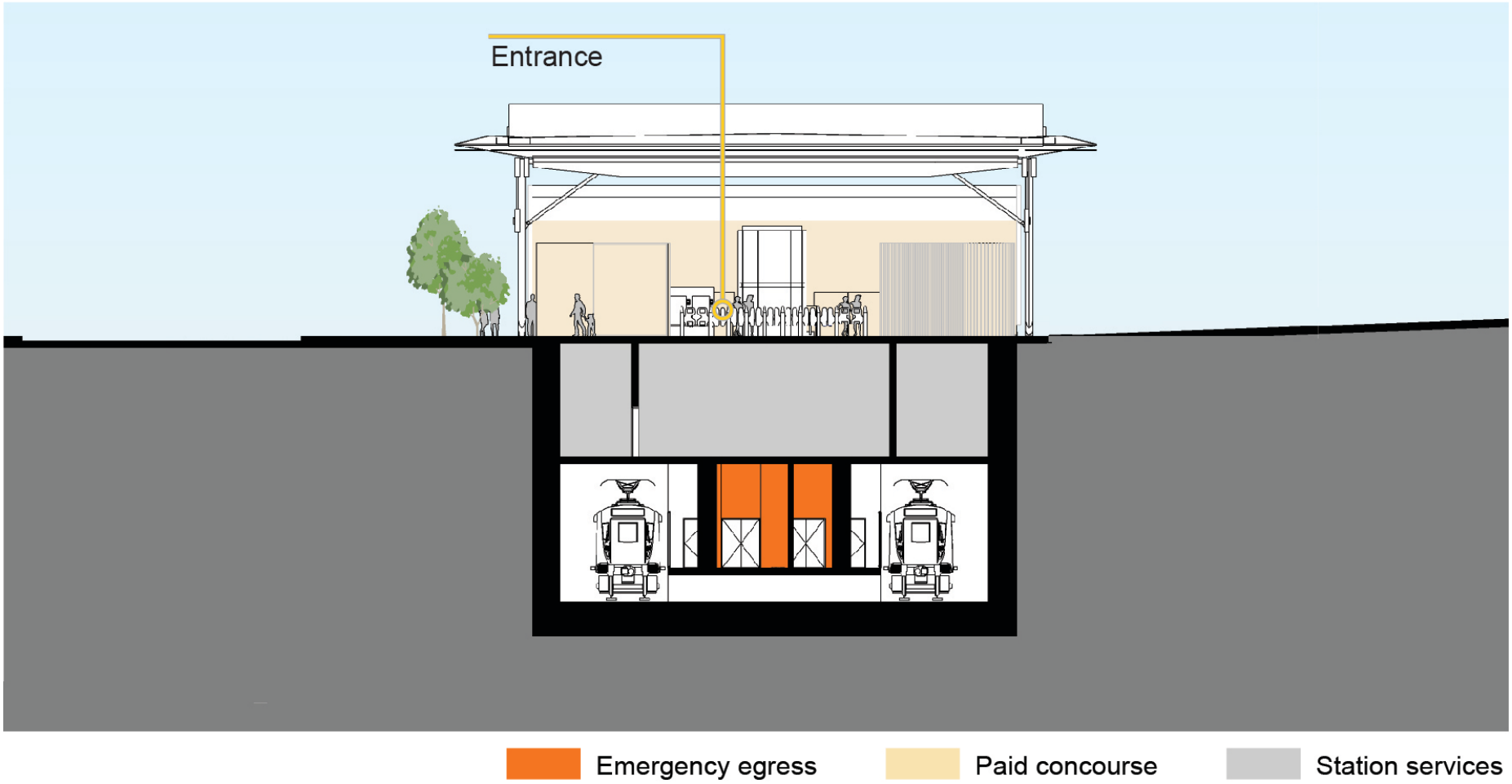
Figure 1-19 Orchard Hills Station - Indicative layout and key design elements

Note: Indicative only, subject to design development.



Note: Indicative only, subject to design development.

Figure 1-20 Orchard Hills Station – indicative elevation



Note: Indicative only, subject to design development.

Figure 1-21 Orchard Hills Station – indicative cross-section

Note: Indicative only, subject to design development.

Figure 1-22 Orchard Hills Station – artist's impression

1.4.3 Luddenham Road Station

Station context

Luddenham Road Station would be located to the west of Luddenham Road within the Northern Gateway precinct of the Western Sydney Aerotropolis. This precinct is intended to transition from a semi-rural landscape to more intensive urban development. The area around Luddenham is intended to comprise flexible employment and mixed flexible employment and urban land.

Station and design drivers

A metro station at Luddenham Road would primarily provide access to the future mixed use (commercial, residential and retail) precinct. The station would also provide access for existing residential communities, primarily to the east at Luddenham. The station drivers for Luddenham Road Station are to:

- serve and support Western Parkland City Northern Gateway precinct focused on education, high technology and research and development
- ensure station design responds to the intended urban structure for a future employment, research and knowledge-based employment precinct.

Station design

Luddenham Road Station would consist of an elevated platform structure (viaduct station typology). The station platforms would be above the existing surface level. The metro station would provide a side platform configuration in a generally north–south orientation. The station would be divided into two main levels, consisting of:

- a ground floor concourse area providing access to the station in addition to the main station services and ancillary infrastructure
- a platform level, consisting of the two side platforms with a centrally located track.

Customer access to the station would be provided at the northern end of the metro station via a new station plaza and concourse area. This plaza would be accessed by a new road connection to Luddenham Road. Access to the platforms would be provided via lifts and escalators. Areas for station services and utilities would also be provided at both the northern and southern ends of the station (at ground level). Roof canopies for weather protection would be provided to cover the majority of the length of the station platforms.

Station precinct and interchange facilities

The proposed Luddenham Road Station would include the following precinct and interchange elements:

- secure bicycle parking
- park-and-ride facilities, with up to 200 spaces (with the potential for future expansion to a multi-deck car park)
- transport interchange facilities including bus bays, associated shelters, bus layover facilities (located under the viaduct structure), as well as kiss-and-ride bays and point-to-point vehicle facilities
- upgrades to Luddenham Road where new intersections to the precinct are proposed, new pedestrian crossings and creation of a new public plaza/urban domain adjacent to the proposed station entrance
- built elements to allow for potential future station retail and other station activation opportunities (fit out and use of retail spaces would be subject to separate approval, where required).

An indicative layout of Luddenham Road Station is shown in Figure 1-23, with an elevation and cross-section shown in Figure 1-24 and Figure 1-25 respectively. An artist's impression of the proposed station is also provided in Figure 1-26.

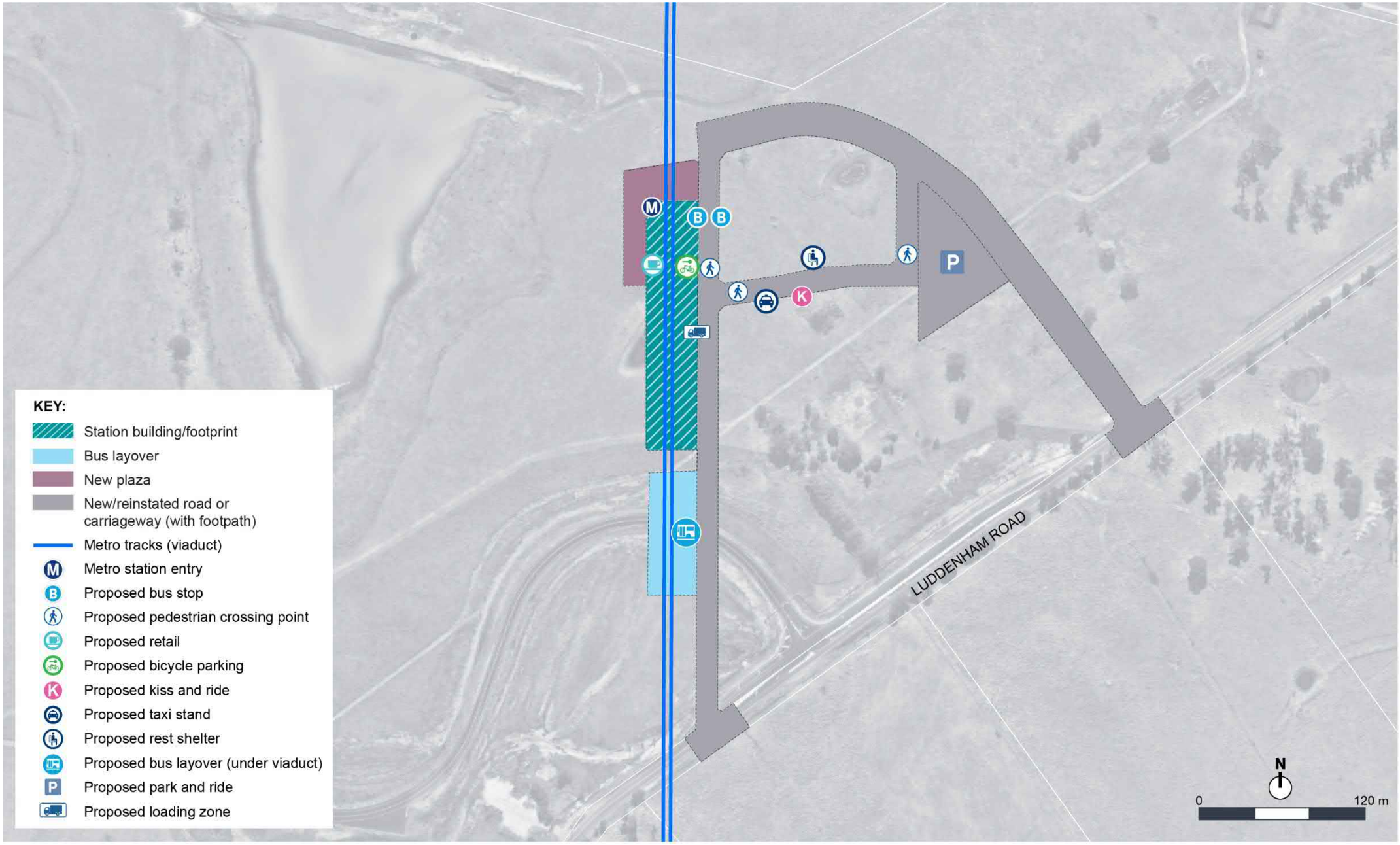
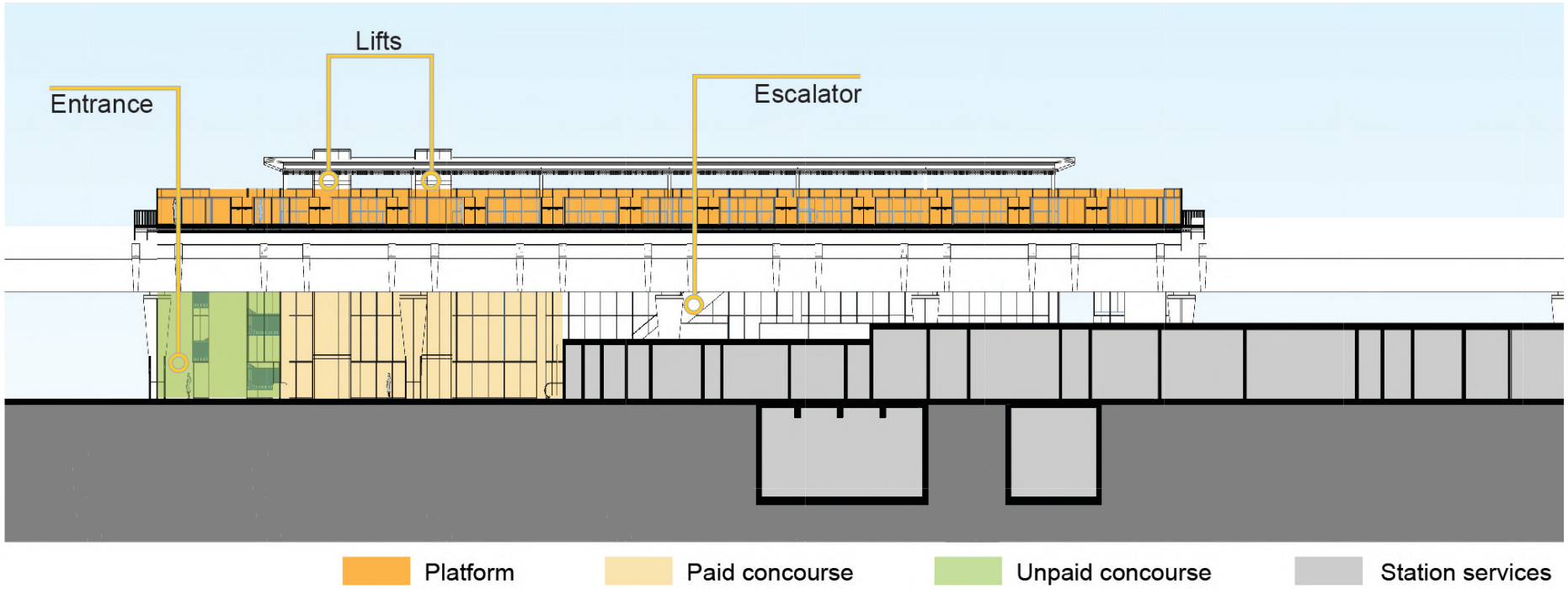


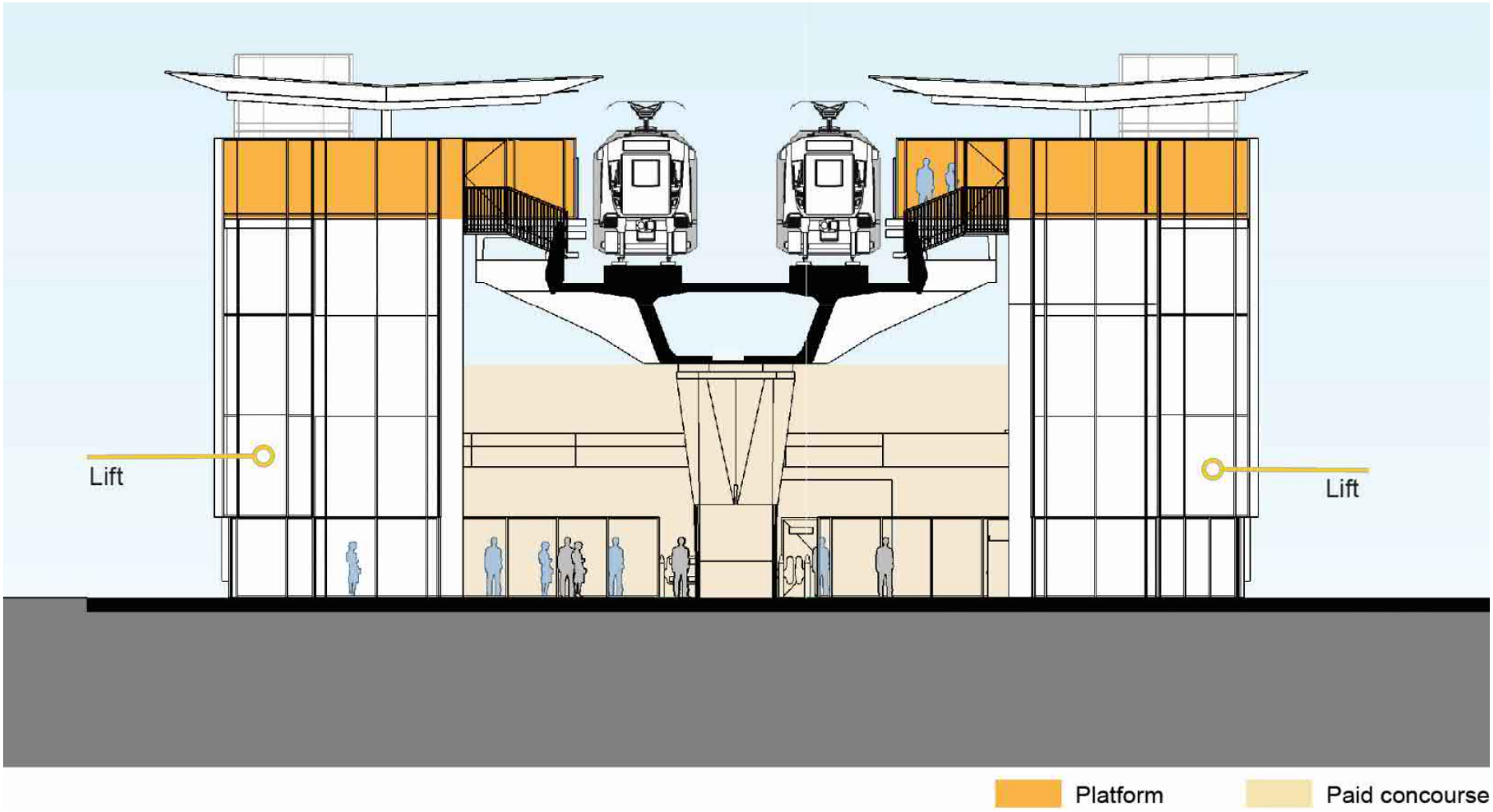
Figure 1-23 Luddenham Road Station - Indicative layout and key design elements

Note: Indicative only, subject to design development.



Note: Indicative only, subject to design development.

Figure 1-24 Luddenham Road Station – indicative elevation



Note: Indicative only, subject to design development.

Figure 1-25 Luddenham Road Station – indicative cross-section

Note: Indicative only, subject to design development.

Figure 1-26 Luddenham Road Station – artist's impression

1.4.4 Airport Business Park Station

Station context

The proposed catchment for Airport Business Park Station would be the future business park precinct that, as part of the Airport Plan, is proposed to be a major employment precinct and services hub.

The Airport Business Park Station would be located between the southern and northern airport business park precincts and would directly adjoin the southern business park area. The Airport Business Park Station would also be located adjacent to the main vehicular entry road to the precinct.

Station and design drivers

A metro station at the Airport Business Park would primarily provide access to the airport and future business park precinct. The station drivers for Airport Business Park Station are to:

- support easy and efficient interchange with local and rapid bus services and the future East West Rail Link to Parramatta
- integrate and support the Airport Plan outcomes for the airport precinct
- maintain flexibility for long-term airport development
- provide easy, efficient and safe cross-corridor active transport access into the north and south Airport Business Park precinct from day one and design to accommodate future widening to create a high amenity public domain
- safeguard for a future rail connection from the east.

Station design

Airport Business Park Station would consist of a surface station (surface cutting station typology) located in a small cutting on one side of the station with an island platform.

Customers would access the station from the south via a pedestrian bridge connecting the station to the future road network of the business park (to be provided by others). The station entrance would be located at the eastern end of the station as part of a new concourse area.

The station entrance would provide access to the platforms via lifts and escalators. Areas for station services and utilities would also be provided at both the eastern and western ends of the station platform.

A roof canopy would be provided to cover the majority of the length of the station platforms.

Station precinct and interchange facilities

The precinct and interchange facilities for Airport Business Park Station would be provided as part of the wider development of Western Sydney International (to be provided by others). As part of the project, Sydney Metro would provide a pedestrian bridge between the station and the future business park precinct (see Figure 1-27). It is expected that the future development (to be delivered by others) would include the following interchange elements:

- bus interchange with bus shelters and road kerb to enable customer transfer
- kiss-and-ride facilities.

The station design would provide built elements to allow for station retail and other station activation opportunities.

An indicative layout of Airport Business Park Station is shown in Figure 1-27, with an elevation and cross-section shown in Figure 1-28 and Figure 1-29 respectively. An artist's impression is provided in Figure 1-30.

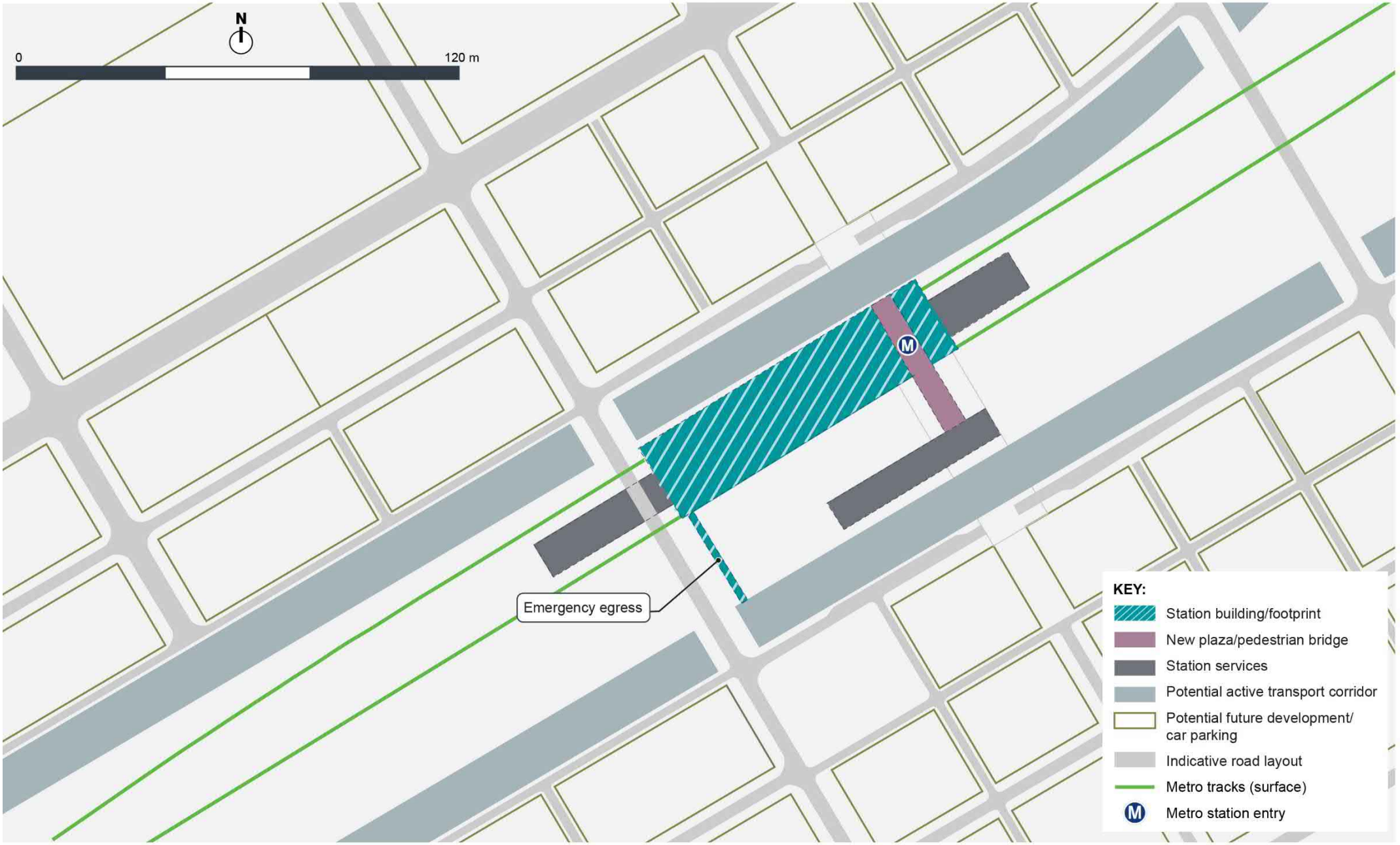
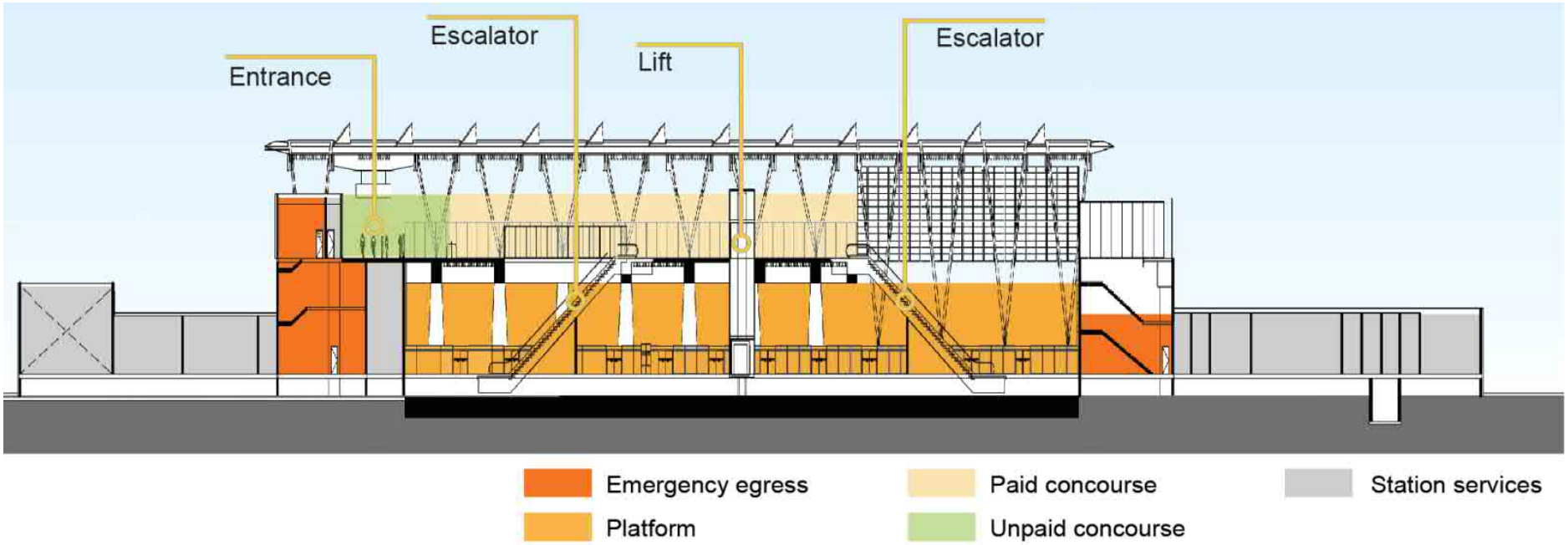


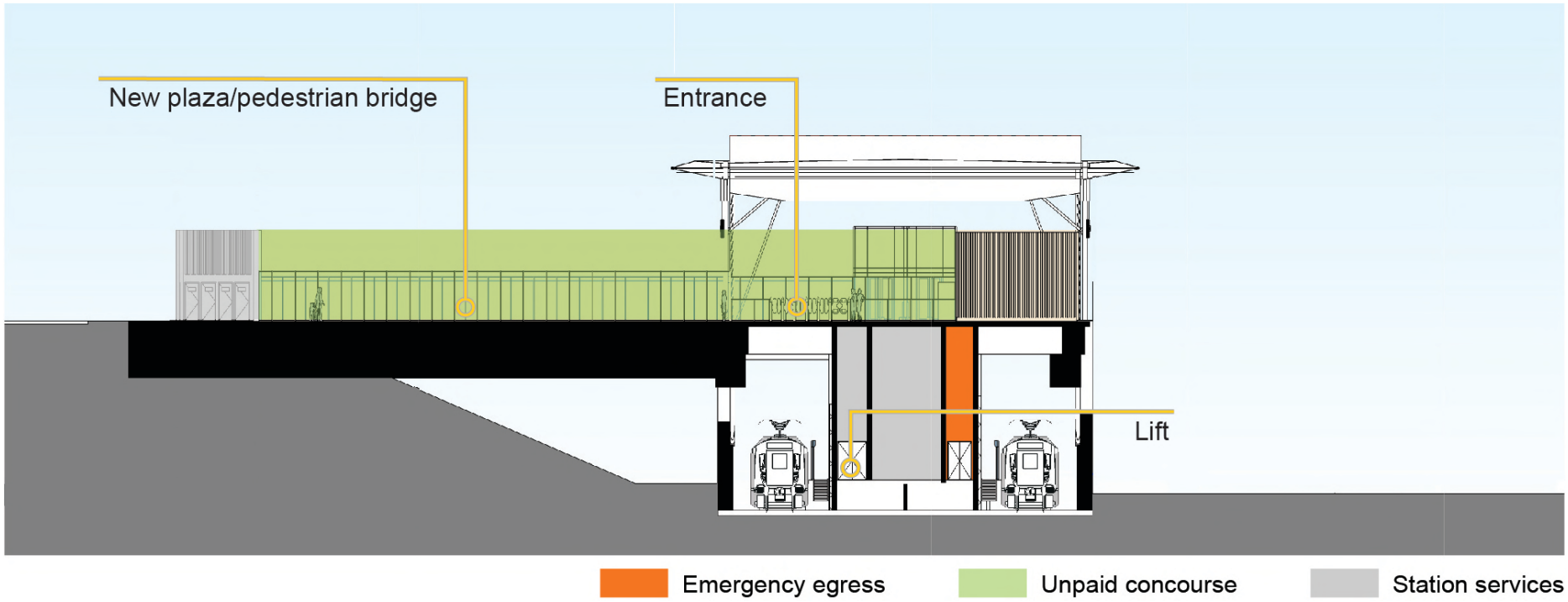
Figure 1-27 Airport Business Park Station - Indicative layout and key design elements

Note: Indicative only, subject to design development.



Note: Indicative only, subject to design development.

Figure 1-28 Airport Business Park Station – indicative station elevation



Note: Indicative only, subject to design development.

Figure 1-29 Airport Business Park Station – indicative station cross-section

Note: Indicative only, subject to design development.

Figure 1-30 Airport Business Park Station – artist's impression

1.4.5 Airport Terminal Station

Station context

Airport Terminal Station would provide access to the future airport terminals and would be located adjacent to the proposed Ground Transportation Centre, a facility within the airport where customers are transferred between transport modes. The proposed catchment for Airport Terminal Station has considered customers accessing flights, employment and other services associated with Western Sydney International.

Station and design drivers

As the gateway for Western Sydney International for both domestic and international travellers, the station's primary purpose would be to serve the needs of aviation customers. The station drivers for Airport Terminal Station are to:

- enable easy, efficient, safe, comfortable and intuitive customer access to the airport terminal/s for day one of airport opening and safeguard for ultimate design
- integrate into and support the design outcomes for the airport
- maintain flexibility for long-term airport development
- safeguard for a future rail connection from the east.

Station design

Airport Terminal Station would consist of an underground station (cut-and-cover station typology) below the anticipated Western Sydney International finished surface level. The metro station would include an island platform configuration.

Customer access would primarily be provided via an airport terminal connection with Western Sydney International (to be provided by others). The station entrance would be located towards the western end of the station as part of a new station plaza (also provided by others).

The station entrance would provide access to the platforms via lifts and escalators. The design of the station would incorporate a number of skylights above the mezzanine level, to provide natural light and ventilation. Areas for station services and utilities would also be provided at both ends of the station platform.

Station precinct and interchange facilities

Airport Terminal Station would be the main connection between the metro rail and the airport terminal. Other interchange opportunities, including bus stops, would be provided as part of the wider development of the precinct and are outside the scope of this project.

The station design would provide built elements to allow for station retail and other station activation opportunities.

An indicative layout of Airport Terminal Station is shown in Figure 1-31, with an elevation and cross-section shown in Figure 1-32 and Figure 1-33 respectively. An artist's impression is provided in Figure 1-34.

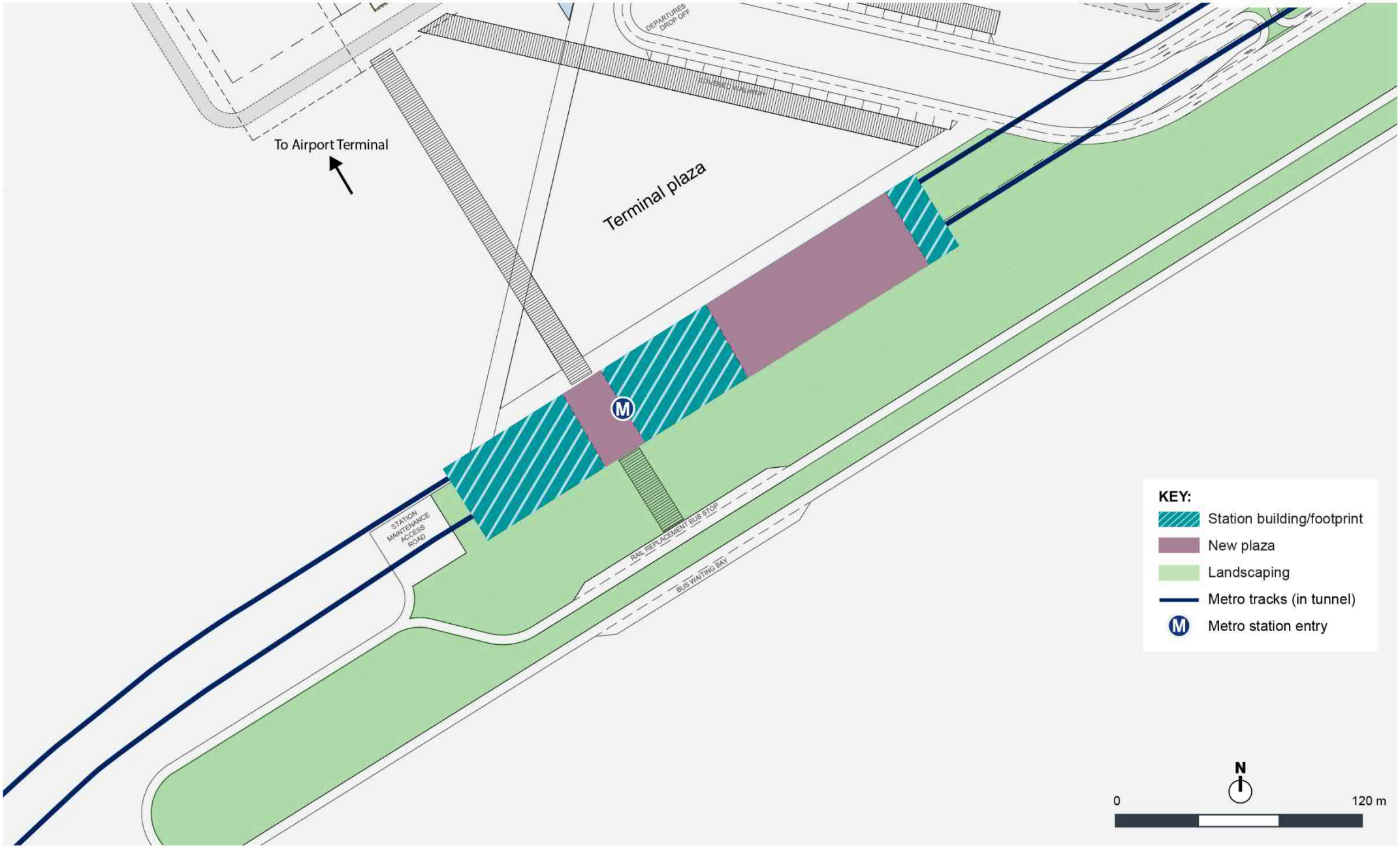
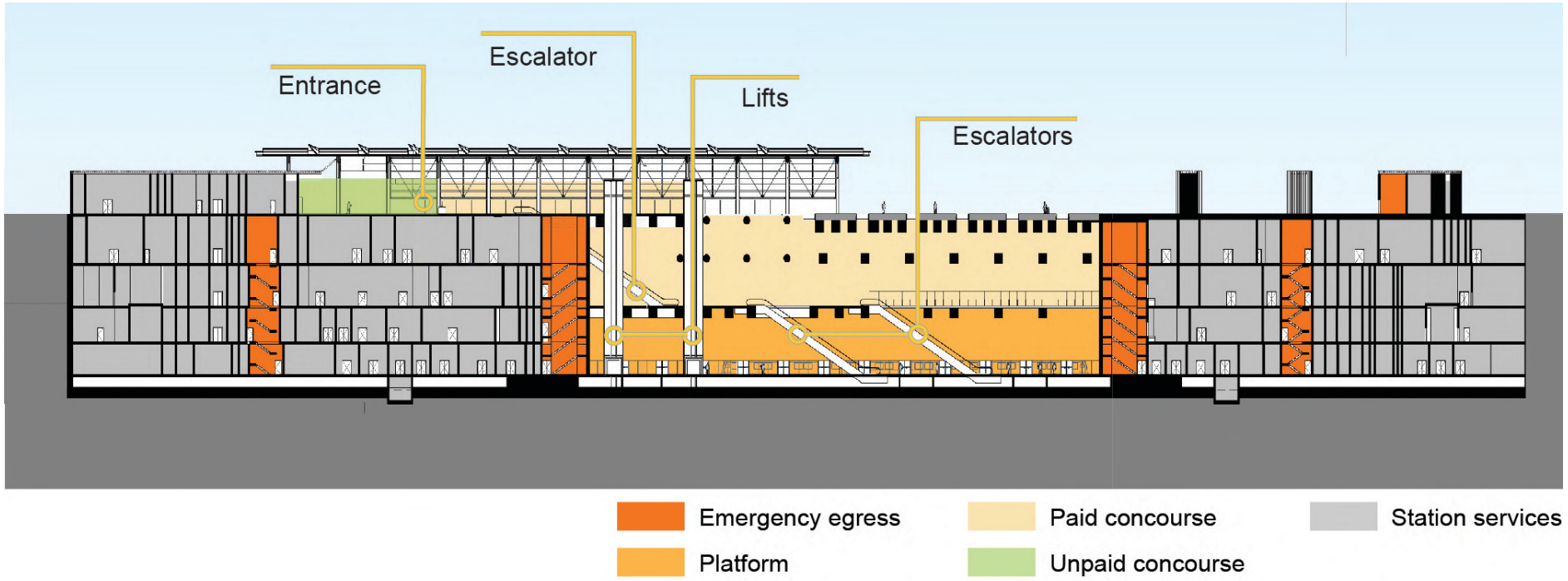


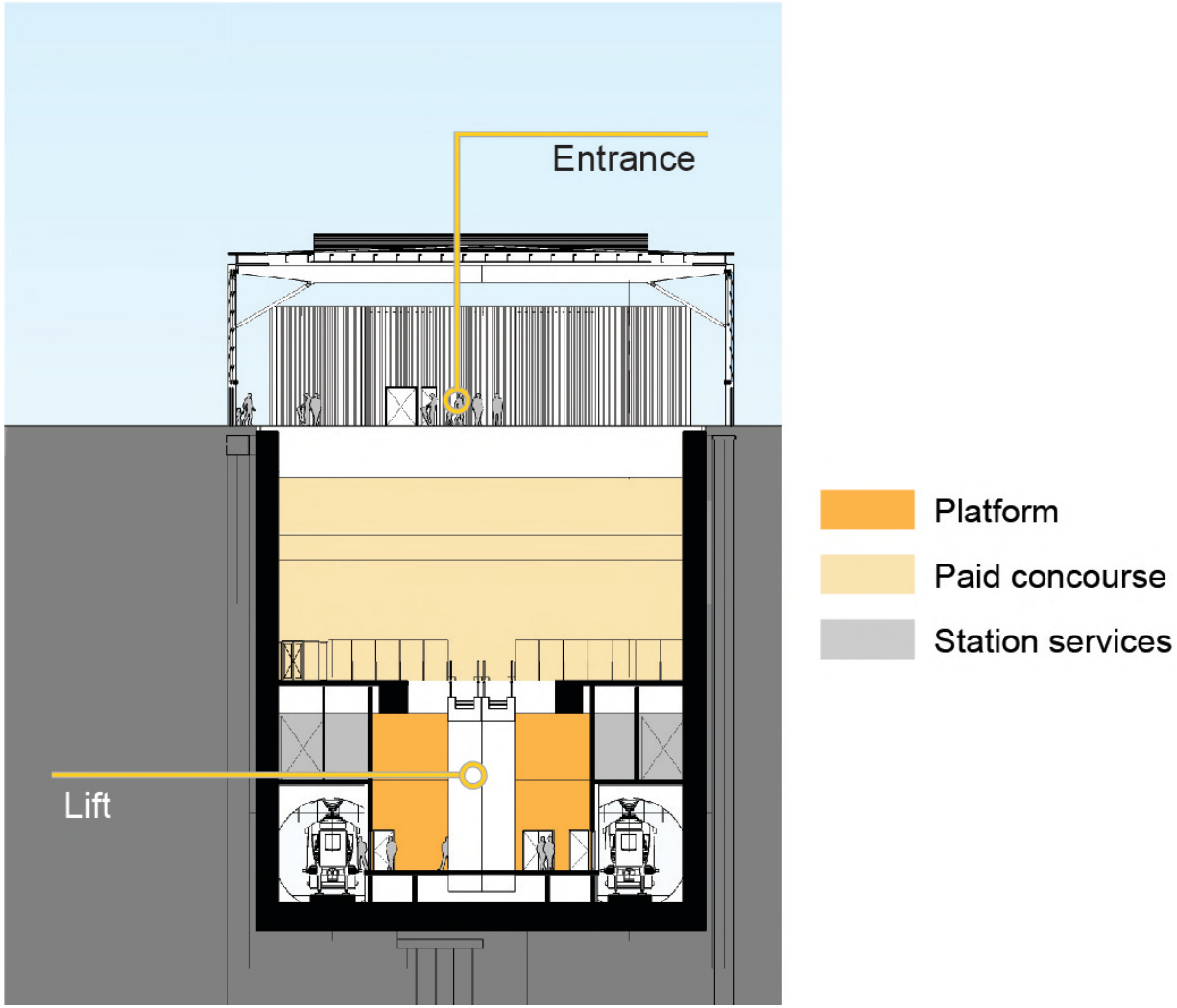
Figure 1-31 Airport Terminal Station - Indicative layout and key design elements

Note: Indicative only, subject to design development.



Note: Indicative only, subject to design development.

Figure 1-32 Airport Terminal Station – indicative elevation



Note: Indicative only, subject to design development.

Figure 1-33 Airport Terminal Station – indicative cross-section

Note: Indicative only, subject to design development.

Figure 1-34 Airport Terminal Station – artist's impression

1.4.6 Aerotropolis Core Station

Station context

The site of the proposed Aerotropolis Core Station currently comprises a large, rural site adjacent to a series of rural residential properties. The site is located to the east of Badgerys Creek Road and to the north and west of Thompsons Creek.

The Aerotropolis Core precinct (the area to be called Bradfield) is proposed as one of the 10 precincts identified within the Western Sydney Aerotropolis Plan. The precinct would be centred around the proposed Aerotropolis Core Station and would be supported by retail, creative industries, civil and cultural facilities, and world-class public open spaces. The Aerotropolis Core precinct is planned to comprise substantial residential and mixed flexible employment land uses to create a new city centre.

Station and design drivers

A metro station at the future Aerotropolis Core precinct would support the growth planned for the precinct, including in employment, education, health, civic, cultural and residential uses and functions. The station drivers for Aerotropolis Core Station are to:

- support and catalyse a thriving city centre precinct at the heart of the Western Parkland City
- contribute to a high-amenity public realm within the Aerotropolis that celebrates the Western Parkland City
- integrate interchange functions with place outcomes to support positive experience and amenity
- support city centre permeability by providing active cross-corridor connections
- minimise severance of the city centre precinct
- support easy, efficient and safe interchange with the South West Rail Link Extension, East West Rail Link and rapid and local bus services.

Station design

Aerotropolis Core Station is proposed to be integrated with the future Aerotropolis Core precinct. The station would consist of an underground structure (cut-and-cover station typology). The metro station would provide an island platform configuration in a generally north–south orientation. The station would be divided into three main levels, consisting of:

- a ground floor concourse area providing access to the station in addition to the main station services and ancillary infrastructure
- a mezzanine level area, generally providing vertical transport between the ground floor concourse and the platform level. This level would also provide a possible transfer point to a future east-west metro service
- a platform level, consisting of two side platforms with a centrally located track alignment.

Customer access to the station would be provided at the northern end of the metro station via a new station plaza and concourse area. This plaza would be accessed by a new road network to be provided as part of the Aerotropolis Core precinct development. Access to the platforms would be provided via lifts and escalators. Areas for station services and utilities would also be provided at both ends of the station (at ground level).

The design of the station would incorporate a number of skylights above the mezzanine level, to provide natural light and ventilation. Areas for station services and utilities would also be provided at both ends of the station platform.

Station precinct and interchange facilities

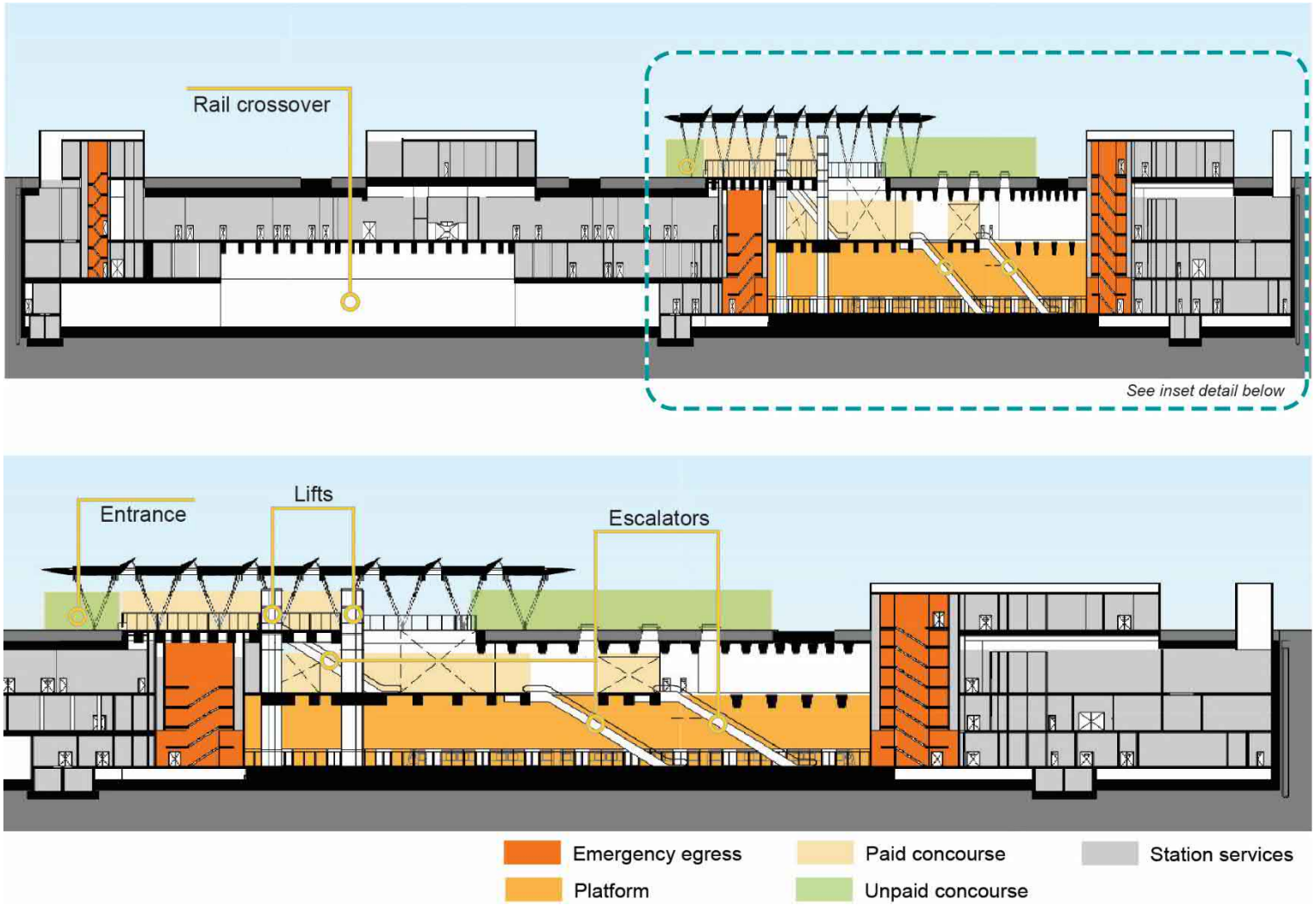
The proposed Aerotropolis Core Station would include the following precinct and interchange elements:

- secure bicycle parking
- transport interchange facilities including bus bays and associated shelters as well as bus layover facilities accessed from a bus-only street
- kiss-and-ride bays and point-to-point vehicle facilities
- temporary surface park-and-ride facility with up to around 300 spaces, located within the space provisioned for potential future rail corridors. The spaces would be relocated or removed in the future as required to accommodate the introduction of the potential future rail corridors and to realise the future preferred access outcomes for the Aerotropolis, in line with its role as the centre of the Western Parkland City
- construction of new road carriageways to connect the wider precinct including new pedestrian crossings and creation of a new public plaza/urban domain adjacent to the proposed station entrance
- built elements to allow for potential future station retail and other station activation opportunities (fit out and use of retail spaces would be subject to separate approval, where required).

An indicative layout of the Aerotropolis Core Station is shown in Figure 1-35, with an elevation and cross-section shown in Figure 1-36 and Figure 1-37 respectively. An artist's impression is provided in Figure 1-38.

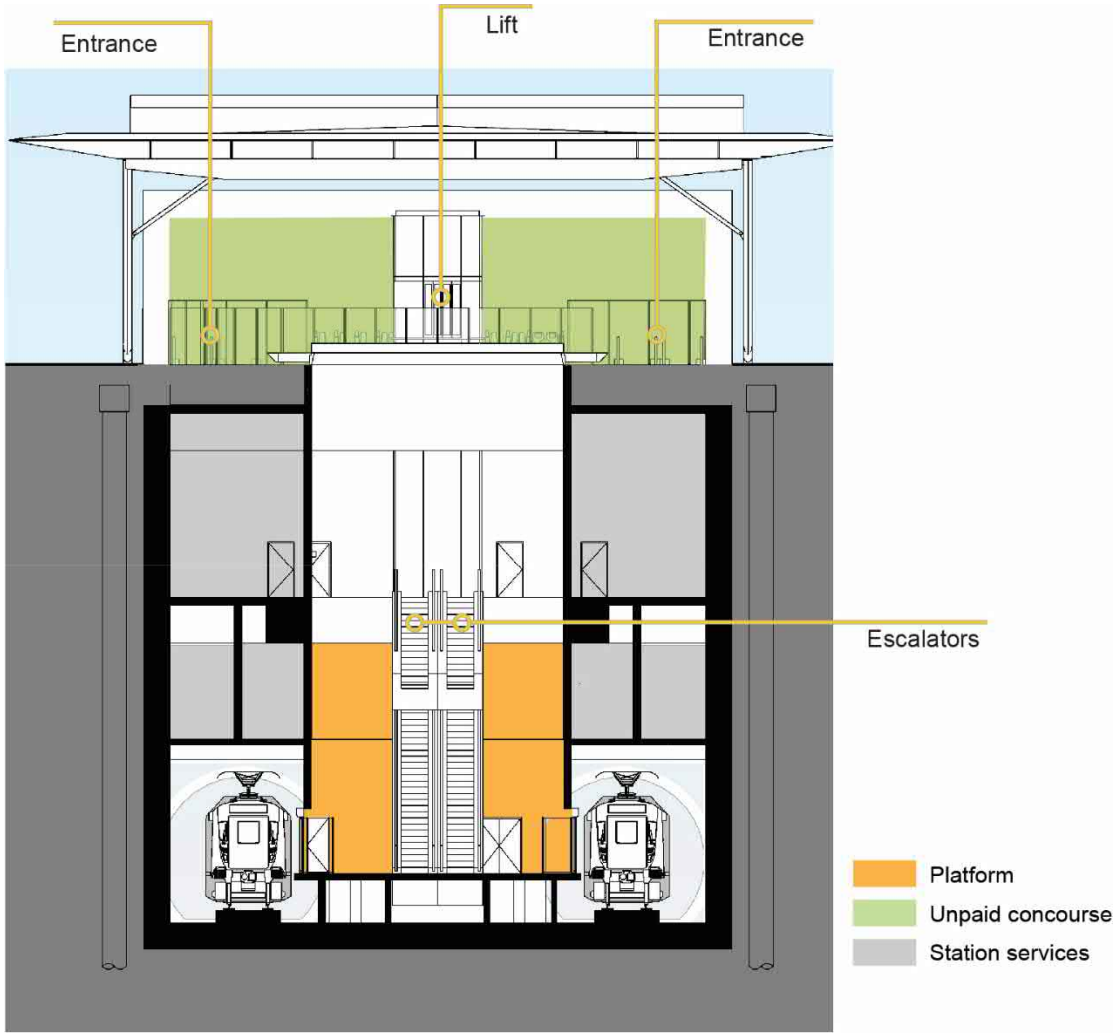
Figure 1-35 Aerotropolis Core Station - Indicative layout and key design elements

Note: Indicative only, subject to design development.



Note: Indicative only, subject to design development.

Figure 1-36 Aerotropolis Core Station – indicative elevation



Note: Indicative only, subject to design development.

Figure 1-37 Aerotropolis Core Station – indicative cross-section

Note: Indicative only, subject to design development.

Figure 1-38 Aerotropolis Core Station – artist's impression

1.5 Ancillary operational infrastructure

1.5.1 Stabling and maintenance facility

Location and key features

Trains would be stabled and maintained at a dedicated facility on the alignment. This would be an integrated facility incorporating most operational functions including the operations control centre and all infrastructure required to maintain the train fleet.

The stabling and maintenance facility would be located in Orchard Hills, to the south of Blaxland Creek and east of the proposed metro track (see Figure 1-4b).

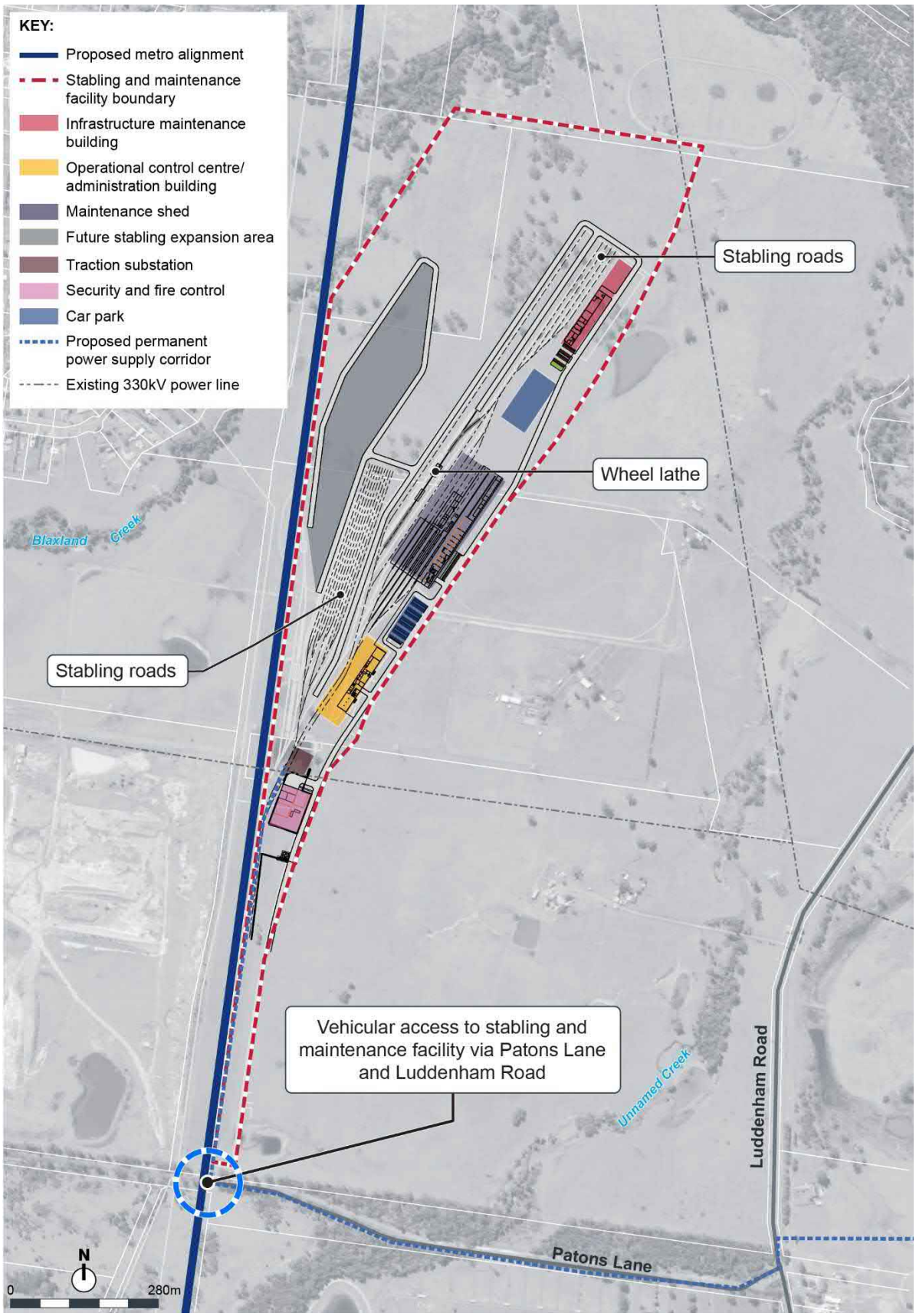
The stabling and maintenance facility layout has been configured to allow for access/egress to the main track alignment at both the northern and southern ends of the stabling and maintenance facility (see Figure 1-39). Vehicular access would be provided via separate access/egress points on Luddenham Road and Patons Lane (for general staff access as well as delivery and large vehicle access). An internal access road network would provide for general circulation while appropriately separated from train movements and with limited crossing points. The site would also be fenced from general public access and lighting would be used at night for safety and security of the site.

The stabling and maintenance facility would include:

- a vehicle equipment measurement system which would provide an automated inspection of the train cars as they enter the stabling and maintenance facility to determine their serviceability and safety
- up to 10 stabling roads to store trains
- an infrastructure maintenance shed
- test tracks to undertake train testing and commissioning
- train monitoring system to allow for monitoring of vehicle integrity, brake systems, wheels, pantographs and other vehicle equipment
- train wash facilities
- wheel lathe
- operations control centre, administration building and driver training facility
- a traction substation and a bulk power supply point
- area for site security personnel
- offices and general storage areas
- staff car parking and internal access roads
- fire control systems including the provision of fire hydrants, hoses and other firefighting equipment within the facility
- on-site water detention and water quality treatment basins
- site landscaping.

Earthworks would be carried out to provide a final site elevation that manages drainage and minimises potential flooding impacts. This may require the import of fill material to the site to achieve required ground surface levels (see Section 2.6).

The facility would operate 24 hours a day, seven days a week. An indicative layout of the stabling and maintenance facility is shown in Figure 1-39.



Note: Indicative only, subject to design development.

Figure 1-39 Stabling and maintenance facility – indicative plan

Stabling activities

Trains not in operation would be stored in the stabling facility outside peak periods and between the last service of the day and the first service commencing the following day. Trains would normally be shut down once they have been stabled and the interior cleaned. They would need to be powered up one hour before their scheduled departure time. A powered standby train would be present in the stabling and maintenance facility during operating hours for use in the event that a train needs to be withdrawn from service at short notice.

The stabling facility would assist in maintaining operational reliability by allowing train services to commence on time from either St Marys or Aerotropolis Core. The stabling facility would provide around 10 stabling roads to accommodate the stabling of trains for initial and future operating scenarios for the project.

Space, and the associated landform (Chapter 2 (Revised project description – construction)), would also be provided for additional stabling roads to accommodate the trains required to support the potential future extensions of the project. While the additional space and associated landform to accommodate these additional stabling roads would be delivered as part of the project, the laying of track for, and the operation of, the additional stabling roads would be subject to separate assessment and approval. Parts of the stabling and maintenance site would also be filled to provide for flood protection.

Train maintenance activities

The maintenance building would provide for both general and more substantial periodic maintenance activities (such as bogie/underframe inspections and other major equipment replacement).

The maintenance building would include workshops and storage areas, inspection pits and elevated walkways (for inspection of the train fleet), a wheel lathe, wash facilities, paint shop and crane lifting facilities. Maintenance operations would also include undertaking inspections, maintenance and component exchange on the train fleet.

Daily internal cleaning of the trains would take place when trains return to the site after the morning and evening peak periods and also at the end of each day. Train wash facilities would be separated into three types:

- general cleaning, involving external washing of the train sets to improve the presentation of the train carriages
- biological cleaning, involving the cleaning of biological substances from the train carriages
- graffiti cleaning, involving the cleaning of graffiti from external and internal surfaces.

The water used for spot cleaning would be collected and treated onsite for reuse.

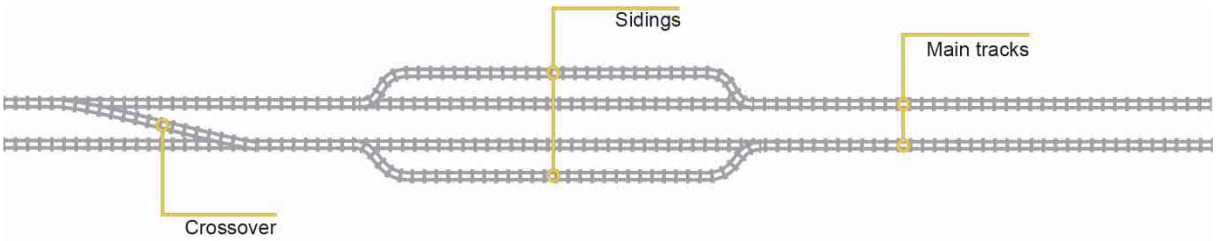
Administration and staff facilities as well as the operations control centre for the metro network would be located within the maintenance building. A driver training facility would also be provided within the stabling and maintenance facility site. For initial opening, it is anticipated that up to around 65 staff would work within the maintenance facility during any given shift.

Parking for up to 140 cars for staff and visitor use would be provided within the site, along with maintenance vehicle parking.

1.5.2 Track configuration (turnbacks, crossovers and rail sidings)

The project would provide two turnbacks (to allow trains to change direction), with one located at each end of the project alignment at St Marys and Aerotropolis Core. Crossover points (a track crossing point that would enable a train to cross between two parallel tracks for use in degraded operations due to maintenance, breakdowns or other emergencies) would be provided at various points along the project alignment. Two track sidings (to store a train) are also proposed adjacent to the main track about one kilometre north of Elizabeth Drive (see Figure 1-4c).

A schematic showing an indicative crossover and track sidings is shown in Figure 1-40.



Note: Indicative only, subject to design development.

Figure 1-40 Schematic of a crossover and track sidings

1.5.3 Tunnel ventilation systems

Tunnel ventilation overview

A tunnel ventilation system would be provided for underground stations and tunnelled sections of the alignment to allow for a range of ventilation requirements including station ventilation and ventilation for fire and life safety and operational scenarios (such as heat build-up). Tunnel ventilation facilities are proposed at the following tunnel portals:

- Orchard Hills tunnel portal
- Western Sydney International tunnel portal.

In addition to the ventilation services provided at the tunnel portals, services facilities are also proposed at Claremont Meadows and Bringelly for the St Marys to Orchard Hills tunnel and the Western Sydney International to Bringelly tunnel respectively.

The need for the Claremont Meadows services facility is subject to further investigation. If required, the Claremont Meadows services facility would be located in a cleared area near the south-east corner of the intersection of Gipps Street and the Great Western Highway (see Figure 1-4a). The Bringelly services facility would be located near the northern end of Derwent Road in Bringelly (see Figure 1-4e).

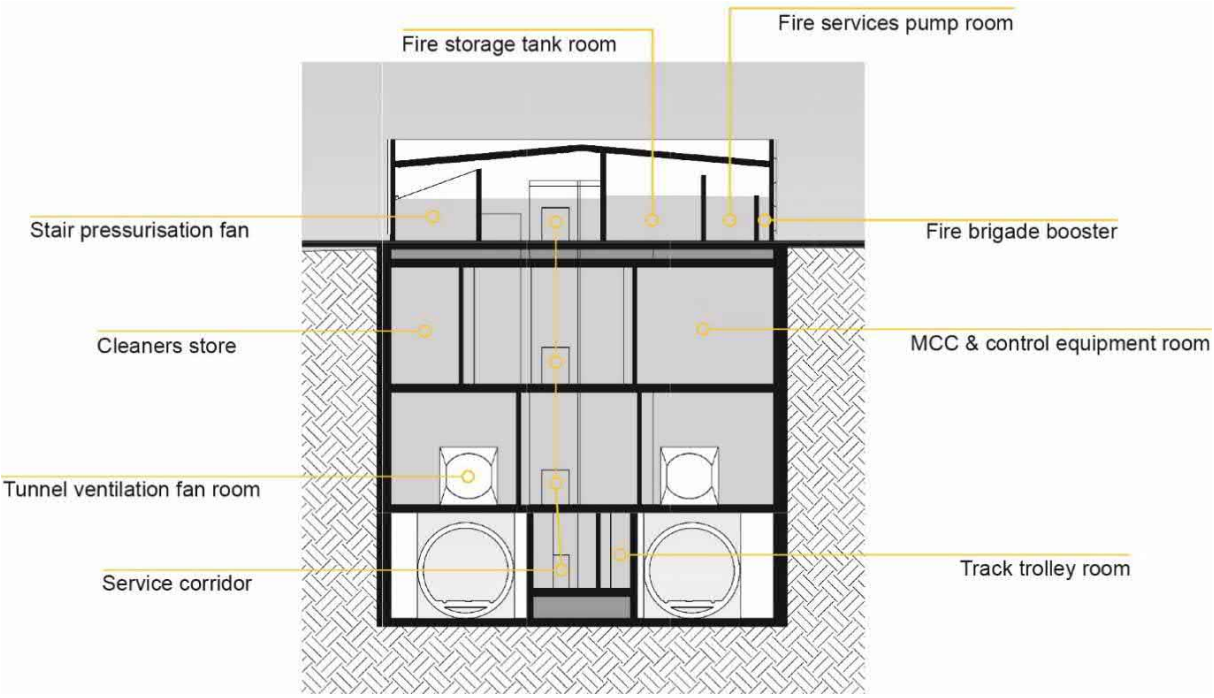
The services facilities would typically include tunnel ventilation plant rooms and associated air-distribution equipment. The services facilities could also include electrical rooms, fire sprinkler systems, emergency lighting and signage, and ancillary rooms supporting the ventilation system and amenities for personnel (kitchenette, toilets).

During normal operations air would be exchanged in the tunnel, with tunnel ventilation provided by train movements and the operation of fans at the underground stations to exhaust air from the tunnels. Heat removal would typically occur via the tunnel portals; however, ventilation fans could also be operated to provide additional heat removal particularly in peak summer conditions.

The ventilation system for the project would be designed to meet the criteria for normal, congested and emergency operating scenarios. The systems would also provide ventilation in the event of fire to ensure suitable conditions in the tunnel for safe egress of customers and safe access for emergency services personnel. In the event of fire, smoke-laden air would be discharged to the atmosphere via ventilation outlets at the stations, the services facilities and the tunnel ventilation facilities at the tunnel portals.

Separate mechanical ventilation systems would also be provided at the proposed underground stations for heat removal and to provide fresh air. Full height platform screen doors at stations would assist in controlling underground station temperatures by physically separating the tunnel and station environments.

A cross-section example of a proposed services facility is shown in Figure 1-41.



Note: Indicative only, subject to design development.

Figure 1-41 Indicative schematic of a services facility

1.5.4 Metro rail systems

Signalling and train control

Similar to the operation of the Metro North West Line, the project would use advanced signalling technology to support safe operations and control the way trains accelerate and brake at stations to enable more trains to operate along the line. The signalling system would keep each train within a safe braking distance of the train ahead, control speed between stations and the opening and closing of train doors.

The signalling and train control system would consist of:

- automatic train protection which would provide train spacing and speed monitoring and control functionality
- automatic train regulation which would monitor and adjust train speeds and station dwell times to maintain timetable and spacing between trains
- automatic train operation providing automated train driving functionality.

The signalling system would control the stopping of trains at stations, ensure trains stop at the correct location on the platform (including lining trains up with platform screen doors), control train speed between stations, and initiate the opening and closing of doors on the correct side of the train.

The signalling system would allow for bi-directional operation (i.e. trains would run in either direction on either track) in special circumstances. This would provide functionality to respond to a range of incidents to support continuity of service. All control systems would be integrated with rail systems to provide consistent performance and high levels of safety. The signalling system for the project would be linked via dedicated fibre optic cable and network to the operations control centre within the stabling and maintenance facility.

Communications

The project would include an integrated information and digital communication system. This would allow communication between customers and metro staff via audio and visual links at each station and on all trains. The communications equipment would be within the designated services area at each station and within the proposed tunnels.

The communications system would comprise:

- customer information display and public address
- customer mobile telephone and other modern telecommunication methods
- ticketing system (see Section 1.7.3)
- CCTV system and video broadcasting system
- radio communications systems for operator and emergency services
- emergency warning information system
- digital voice video recording system
- telephone system and personnel wireless terminal
- access control and trackside intruder detection system.

Power supply

The power supply for the project has been designed to operate as an independent standalone system. All Sydney Metro traction power supply infrastructure would be controlled and monitored from the operations control centre at the stabling and maintenance facility.

The electrical power supply network for the project would comprise:

- the provision of a permanent bulk power supply from the existing electrical network to a bulk supply substation located in the stabling and maintenance facility
- a 25 kV alternating current traction power system that would be used to power the trains
- a high voltage, 22 kV distribution network that originates from the bulk supply point and distributes to distribution substations at each station, each services facility and within the stabling and maintenance facility
- power systems for electrical services at stations for tunnel services, ventilation, lighting, signalling and communications systems.

Overhead wiring and electrical distribution

The project would operate using an overhead wiring system for most sections of the project, with overhead conductor rails proposed to be used for sections within tunnel. Overhead wiring would also be used within the stabling and maintenance facility.

A combined services route containing both high voltage, low voltage and communications and signalling cabling would also be provided along the length of the alignment. The design of the combined services route would vary depending on the location along the project alignment and would include:

- sections of buried cables and access pits
- sections of cabling within galvanised steel troughs
- sections of cable trays where there is limited clearance, such as in the tunnel or cut-and-cover sections of the alignment.

Substations and traction power supply

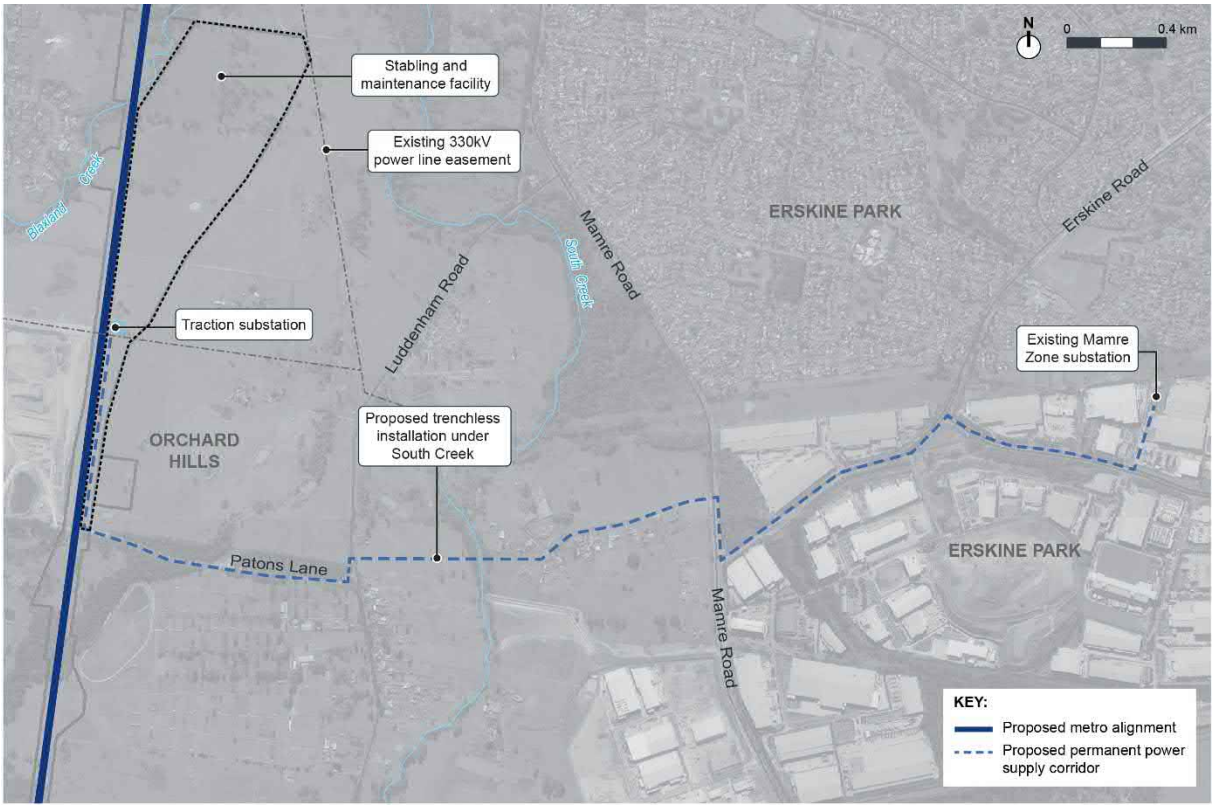
Traction power supply for the project would be provided through dedicated traction substations and supporting feeder line cables. These would be co-located with other infrastructure (such as at each station) wherever possible.

A traction substation and bulk power supply point would also be provided within the stabling and maintenance facility.

Permanent power supply cable

Permanent bulk power for the project would be supplied to the proposed substation at the stabling and maintenance facility via a connection to an existing Endeavour Energy substation at Erskine Park (the Mamre Zone Substation). The connection is subject to design development in consultation with Endeavour Energy and would include around 5.2 kilometres of underground electrical cabling infrastructure.

The indicative alignment for the permanent power supply is shown on Figure 1-42.



Note: Indicative only, subject to design development.

Figure 1-42 Indicative permanent power supply alignment

Key features of the proposed permanent power supply would include:

- installation of underground conduits and cables for two 132 kV underground feeder lines between the Mamre Zone Substation and the proposed stabling and maintenance facility
- associated infrastructure as part of the main conduit and cable works including:
  - jointing bays (required around every kilometre)
  - feeder pulling pits (generally located at bends along the alignment)
  - communications pits along the alignment for periodic maintenance access
- connection of the feeder line to the Mamre Zone Substation and the proposed traction substation within the stabling and maintenance facility. All appropriate connections and activities within the Mamre Zone Substation would be designed and constructed by Endeavour Energy approved suppliers or by Endeavour Energy.

1.5.5 Drainage

Track drainage

The project would include a series of drainage works to ensure that stormwater is efficiently conveyed within and across the corridor to the surrounding stormwater drainage system. This would include new drainage infrastructure along the length of the project corridor, consisting of trunk stormwater and intertrack drainage, both along and across the proposed rail track.

The proposed track drainage system would include new drainage infrastructure for the tunnel, surface and elevated sections of the project alignment (see Figure 1-7 and Figure 1-8). The drainage infrastructure would consist of trunk stormwater drainage, track drainage, onsite detention and various discharge points. Once constructed the stations, tunnels and dive structure portals and retaining walls would generally comprise undrained structures (which prevent groundwater from entering the structure but do not actively drain groundwater).

The design of the drainage for in-cutting, surface and viaduct sections of the project would be developed to safely collect and convey runoff (including rainwater, groundwater and firefighting generated flows) from the project to an appropriate point of discharge. The drainage system would be designed to collect and convey flows for up to a 1 in 100-year event (one per cent annual exceedance probability). The drainage system would typically consist of a combination of pit and pipe, open channel and subsurface drains.

Within the tunnels, drainage depressions would be incorporated into the concrete slabs that form the base for the rail track. The tunnel portals and other critical locations, such as the stabling and maintenance facility, would be designed to be above the Probable Maximum Flood level.

Further details regarding flooding are provided in Chapter 14 (Flooding, hydrology and water quality) of the Environmental Impact Statement.

On-site detention

To manage stormwater and drainage flows along the project alignment, areas for on-site detention have been identified to collect and retain water falling within the project corridor (water from outside the project corridor would be diverted around, and in some instances directed through, the project corridor). The final number, size of, and need for, the proposed detention and water quality basins would be confirmed during design development. In some circumstances, it may be more feasible to provide new drainage, or augment existing drainage within surrounding areas, rather than construct the basins.

Water treatment plants

The proposed drainage system for the project would also include operational water quality treatment plants to manage stormwater and groundwater within the proposed tunnels, portals and in-cutting sections of the project. Water quality treatment plants are proposed to be provided at St Marys Station and the Bringelly services facility. The water quality treatment plants would treat wastewater pumped from the tunnels and other below ground facilities as a result of stormwater entering the tunnel portals or ingress of groundwater. The water treatment plant building would include chemical treatment tanks, water storage tanks, and filters. Treated water would then be discharged into the local stormwater network at St Marys and Bringelly.

The final location and design of the water treatment system for the project would be confirmed during design development.

1.6 Other key project features

1.6.1 Road network and parking changes

While the project would largely be separated from the existing road network, some project elements would impact existing streets. To safely integrate and accommodate the project, the changes summarised in Table 1-3 would be required to the existing road network. Some of these modification works may be delivered by others as part of road upgrades within the precinct ahead of the operation of the project.

Table 1-3 Indicative permanent changes to the road network and existing parking

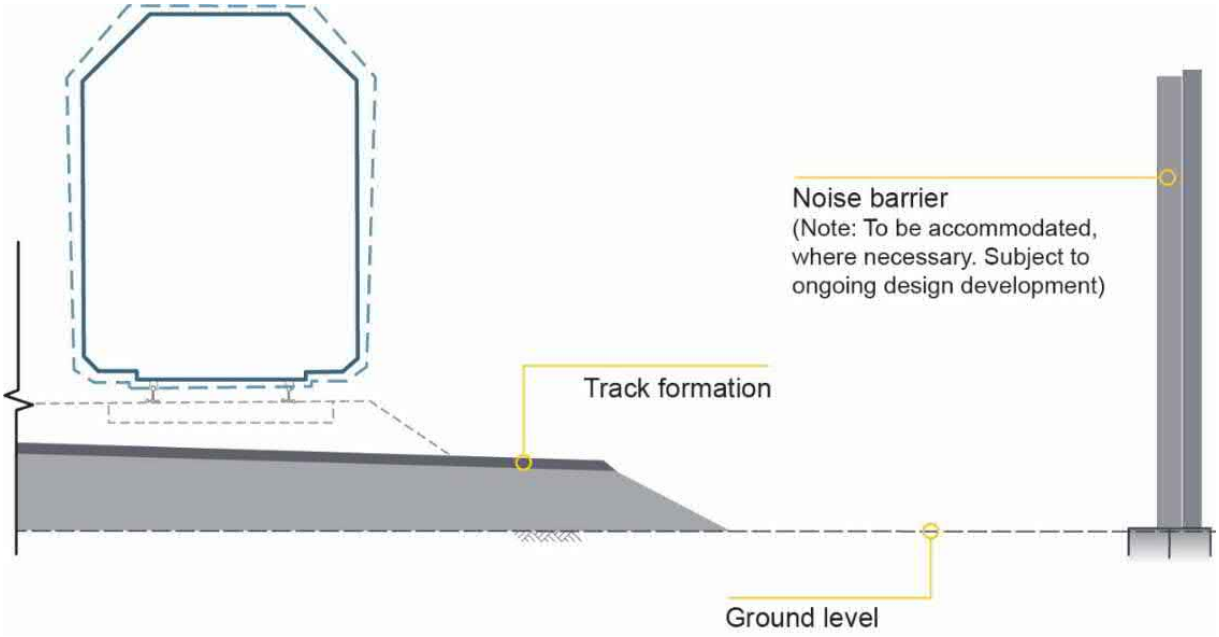
Location	Road/intersection	Indicative change to road network and existing parking
St Marys	Station Street	• change from the current two-way access arrangement to restricted access for properties and service access for buses • traffic calming and bus priority measures (i.e. restriction of access to residents and buses) • conversion of on-street parking to bus bays or no-parking zones • addition of up to three new pedestrian crossing points, which may be signalised • permanent removal of around 125 to 140 car park spaces within the Station Street car park, however the number of car park spaces to be retained on the Station Street car park site would be confirmed during design development and in consultation with Council
	Gidley Street	• closure of northern intersection with Station Street • traffic calming measures or conversion to pedestrian zone between Station Street and Phillip Street.
	Nariel Street	• permanent removal of town centre on-street parking to allow for new kiss-and-ride bays (north side of Nariel Street, east of West Lane).
	Lethbridge Street Queen Street Phillip Street	• changes to on-street parking to allow for bus or construction vehicle movements along these streets.
	Phillip Street and Glossop Street intersection	• changes to traffic signal phasing to enable additional bus movements.
	Harris Street	• removal of some on-street parking to facilitate direct pedestrian access to future plaza area • removal of the at-grade commuter car park on Harris Street (around 120 to 130 car park spaces). The loss of parking would be replaced by the expansion of the existing multi-storey St Marys Commuter Car Park which is a separate project and was subject to separate approvals. The expansion involves the provision of 250 additional commuter car parking spaces.
Claremont Meadows	Gipps Street	• new operational access from Gipps Street into the Claremont Meadows services facility (left in-left out).

Location	Road/intersection	Indicative change to road network and existing parking
Orchard Hills	Lansdowne Road and Kent Road intersection	• upgrade to the intersection including addition of traffic signals to facilitate vehicle movements into the station precinct • bus priority measures.
	New precinct street (north) and Kent Road intersection	• provision of new signalised crossing at the intersection of a new precinct street and Kent Road to facilitate vehicle movements into the station precinct • bus priority measures.
	Kent Road	• provision of new signalised pedestrian crossing.
Luddenham Road	New precinct street (north) and Luddenham Road intersection	• provision of new signalised intersection and pedestrian crossing to facilitate vehicles and pedestrian movements into the station precinct • bus priority measures.
	New precinct street (south) and Luddenham Road intersection	• provision of new signalised intersection and pedestrian crossing to facilitate vehicles and pedestrian movements into the station precinct • bus priority measures.
Aerotropolis Core	New precinct street and Badgerys Creek Road intersection	• provision of new signalised intersection at Badgerys Creek Road and pedestrian crossing to facilitate vehicles and pedestrian movements into the station precinct.

1.6.2 Potential noise barriers

If required, noise barriers may be provided to mitigate noise impacts on surrounding sensitive receivers during operation of the project.

An example of a typical noise barrier is shown in Figure 1-43.



Note: Indicative only, subject to design development.

Figure 1-43 Example of a typical noise barrier configuration (at surface level)

The need for, and exact location and sizing, of noise barriers would be determined during design development and would be subject to ongoing noise modelling and assessment (refer to Chapter 10 (Noise and vibration) of the Environmental Impact Statement). The final design of any potential noise barriers along the track alignment would also need to consider other infrastructure projects including the future M12 Motorway and Western Sydney International. The design of these structures, if required, would be consistent with the Design Guidelines (Appendix D).

1.6.3 Maintenance and emergency access

During operation, vehicular access along the corridor would be required to allow for:

- planned maintenance and inspection activities
- non-scheduled or corrective maintenance
- emergency response during emergency scenarios.

Access would be required both along and across the project alignment. The majority of access for the project would occur using the proposed metro corridor wherever possible.

For each of the twin rail tunnels, access would be restricted to emergency pedestrian access. For the majority of the off-airport components of the project, vehicular access would be provided adjacent to the track for surface sections of the alignment, and adjacent to or beneath viaduct and bridge structures (as required). In addition to access along the corridor, permanent access arrangements would be provided as follows:

- a permanent access road would be constructed under the viaduct to the north and south of Patons Lane, providing access to the stabling and maintenance facility and for maintenance access along the rail corridor between Lansdowne Road and the Warragamba to Prospect Water Supply Pipelines
- an emergency access track/permanent access track generally following the viaduct structure between the Warragamba to Prospect Water Supply Pipelines and Cosgroves Creek. The access track would also provide access to two emergency stairway locations along the viaduct.

Access points to these access tracks would generally be provided from the adjoining road network (Luddenham Road and Patons Lane). Some access points would also include provision for access by rail-mounted vehicles. A permanent access to the services facilities would also be provided from Gipps Street for the Claremont Meadows services facility and Derwent Road for the Bringelly services facility.

Access to the proposed metro corridor within and south of Western Sydney International would be via a dedicated access point within Western Sydney International. The final location of proposed access points along the project corridor would be determined during design development.

1.6.4 Fauna connectivity

The design of the project considers wildlife connectivity requirements across the project corridor where security fencing is not required. This has included appropriate design of bridge and drainage structures to maintain and enhance fauna movement, where possible. Locations at which fauna connectivity has been considered and incorporated includes:

- the proposed bridge structures in the vicinity of Blaxland Creek and Cosgroves Creek
- the proposed viaduct structure crossing two existing vegetation corridors at Patons Lane and the unnamed watercourse to the south of Patons Lane
- a culvert (as part of a series of drainage culverts at this location) measuring around 1.5 metres in diameter providing connectivity for wildlife at an unnamed watercourse (tributary of Blaxland Creek) between Lansdowne Road and Blaxland Creek
- a culvert measuring around 1.5 metres in diameter providing fauna connectivity around 600 metres north of the Warragamba to Prospect Water Supply Pipelines.

Fauna connectivity measures would be refined as part of design development.

1.6.5 Security

Corridor fencing

For most surface sections of the alignment, the project corridor would be bordered by security fencing. The fencing would prevent public access to the operational rail corridor, preclude native fauna and livestock access and accommodate Sydney Metro's needs in terms of ongoing maintenance access.

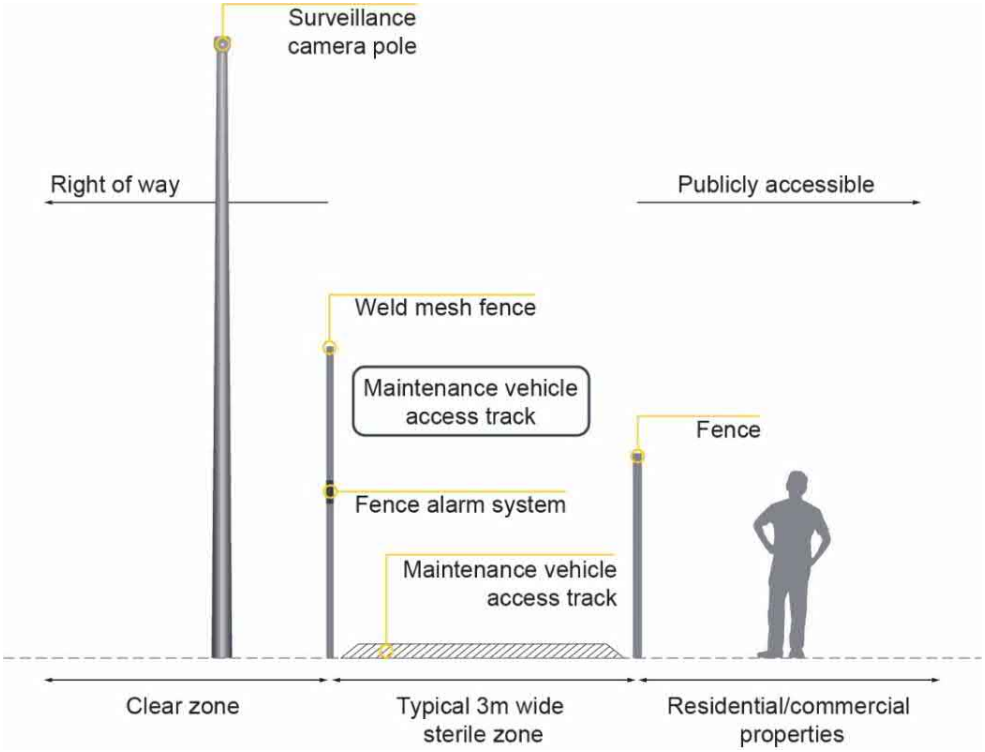
The proposed security fencing along the project corridor would include two separate fences on either side of the corridor, separated by a maintenance access track (see Section 1.6.3). The security fences would have a minimum height of two metres. Controlled access points would be provided at appropriate locations. Rail corridor fencing would not be provided at ground level below the viaduct sections of the alignment to allow for cross-corridor fauna movement.

The design and type of fencing would be confirmed during design development to meet relevant requirements. Where practicable, fencing would be integrated with noise barriers (see Section 1.6.2) where these are required.

Trackside intruder detection system

A trackside intruder detection system would also be installed along the project corridor, where required. This would include CCTV which would monitor all automatic control areas and stations. These would be fitted to communications masts positioned along the corridor.

An indicative arrangement of the proposed security fencing and detection system along the project corridor is shown in Figure 1-44.



Note: Indicative only, subject to design development.

Figure 1-44 Example of a typical cross-section showing proposed security fence arrangement

1.6.6 Subdivision

The project includes the subdivision of land where the project would have impacts on partial interests in existing lots, as well as to create new lots within the off-airport station precincts and corridor, where required.

1.7 Metro operations

This section provides a description of the operation of the project in the context of the broader Sydney Metro network.

The project would operate independently of existing suburban and intercity rail network, and independently of the Metro North West Line, Sydney Metro City & Southwest and Sydney Metro West. All operations for the project would be controlled and monitored from the proposed operations control centre at the stabling and maintenance facility.

1.7.1 Service frequency and reliability

As with the broader Sydney Metro network, the project would deliver a 'turn up and go' service consistent with customer expectations and the needs of the Western Sydney International. It is expected that the end-to-end journey time between St Marys Station and Aerotropolis Core Station would be around 20 minutes. The journey time from St Marys Station to Airport Terminal Station would be around 15 minutes.

It is anticipated that the project would initially operate up to three carriages per train with a service frequency of up to 12 trains per hour in the peak. The design for the ultimate service caters for up to four carriages per train and a frequency of 20 trains per hour. The ultimate number of train movements may further increase should future extensions to the north (to Schofields/Tallawong in Rouse Hill) and south (to Macarthur) become operational.

The proposed service frequency for the project is shown below for both the opening (day one initial services) and expected ultimate service capacity:

- opening (day one initial services) operations:
  - *peak periods* (between 6am and 9am and between 3pm and 6pm) – a metro train every five minutes (up to 12 trains per hour)
  - *non-peak periods* – metro train every 10 minutes (up to six trains per hour)
- future (ultimate service) operations:
  - *peak periods* (between 6am and 9am and between 3pm and 6pm) – a metro train every three minutes (up to 20 trains per hour)
  - *non-peak periods* – a metro train every six minutes (up to 10 trains per hour).

Special events

Depending on the demand, there may be occasions when the rolling stock is scheduled for maintenance and the standby trains are deployed into service to increase capacity. The project would be capable of extending operating hours to cater for special events. Examples of events that would be considered for special event operations relate to peak Western Sydney Airport passenger demand and include city-wide events and heavy passenger demand days such as New Year's Eve and ANZAC Day. Details for special event operations would be determined during the design development process.

1.7.2 Hours of operation

Sydney Metro – Western Sydney Airport has the ability to operate as a 24-hour service. It is anticipated that the project would generally operate from early morning to late at night. The final operating hours would be determined as part of the development of the services schedules for the project taking into account customer and maintenance access requirements.

When the project is not operating (for example, outside of operating hours, during maintenance activities or in the event of an emergency) alternative services would be provided.

The operation of the project combined with alternative services in the evening and early morning where required, would ensure there is a 24-hour transport service to respond to the operational requirements of Western Sydney International.

As described in Section 1.5.1, the stabling and maintenance facility would operate 24 hours a day, seven days a week.

1.7.3 Train types and ticketing

Train types

All trains would be new, single deck metro trains similar to those that operate on the Metro North West Line. These trains would deliver a fast, safe and reliable journey for customers with high performance standards and good customer amenities including:

- air conditioning
- emergency help points
- provision of accessible priority seating for those with a disability or using a wheelchair or mobility device, the elderly or those travelling with strollers and children or luggage
- ability to transport bicycles and scooters
- suitable storage areas for both carry-on and larger sized luggage for customers accessing Western Sydney International
- efficient seating and standing arrangements for the journey
- uninterrupted data connectivity for mobile phones throughout the trip
- clear transport information while on board the metro.

The key features of these trains include:

- an average operating speed of around 70 kilometres per hour (up to a maximum of 100 kilometres per hour)
- level access between the platform and train
- a mixture of seating arrangements and provision for customers in wheelchairs
- heated and air-conditioned carriages
- multiple doors per side per carriage, allowing fast boarding and alighting
- priority seating for mobility impaired, the elderly and people with prams
- allocated multi-purpose areas on each train for prams, bicycles and customers travelling with luggage.

Photograph of the indicative type of trains proposed are provided in Figure 1-45 (external), Figure 1-46 (at a station) and Figure 1-47 (internal).

Source: Sydney Metro

Figure 1-45 Photograph of a train operating on the Metro North West Line

Source: Sydney Metro

Figure 1-46 Photograph of a train at an underground station on the Metro North West Line

Source: Sydney Metro

Figure 1-47 Photograph of an internal metro train carriage

Ticketing

The project would be integrated with the existing Opal electronic ticketing system, which will allow for a ticketing system integrated with all other modes of public transport (Sydney Trains operated trains, buses, ferries, and light rail services). This system would be installed at all stations.

Fares for Sydney Metro would be set by the NSW Government. Ticket pricing for all transport in NSW is determined by the Independent Pricing and Regulatory Tribunal of New South Wales (IPART), and by NSW Government policy. The NSW Government reviews this pricing annually and may consider a change to the Opal policy at any time. Sydney Metro service pricing would be reviewed in line with the pricing review process for other forms of transport.

1.7.4 Operational staff

It is anticipated around 75 staff members would be required per shift to operate and maintain the project for the initial (day one) operations. This would include the operation and maintenance of rolling stock, stations and tracks, in addition to operation control centre and administration staff, station staff and infrastructure maintenance personnel. The final arrangement of staffing to operate the project would be assessed as part of future operator requirements.

1.7.5 Infrastructure maintenance

Maintenance planning would generally allow routine and major periodic maintenance of infrastructure to be carried out with a view to maximising service availability and minimising impacts on customers. Scheduled maintenance would either occur during planned weekend maintenance periods, when train services would not be in operation on parts of the line, or overnight during the no service period.

Rail maintenance vehicles would be able to use the network and the project has been designed to allow access for maintenance crews.

The following types of maintenance activities would typically be required during operation:

- scheduled maintenance – involving routine inspections and repairs to enable operation at prescribed levels of safety, reliability and service frequency. This type of maintenance would be performed on a regular and recurring basis at specified intervals
- non-scheduled maintenance – involving emergency repairs to address unexpected defects (such as signal failure), vandalism and breakage that would impact prescribed levels of safety, reliability and/or service frequency. This type of maintenance would be performed as needed
- overhaul and repairs – involving the repair, replacement and testing of infrastructure that has been removed from its working location.

2 Revised project description – construction

This chapter provides a description of the indicative construction approach and methodology for the project and includes the indicative construction staging, strategy and program. The chapter also provides information on the proposed construction sites required to support the project; construction traffic and access; spoil and water management; equipment and materials required; and proposed construction hours.

The construction approach and methodology presented in this chapter is indicative and would be refined as design and construction planning progresses. A final construction methodology and program would be developed by the construction contractor(s) when appointed.

2.1 Overview

The proposed construction activities that would be undertaken for the project include:

- enabling works
- main construction works including:
  - tunnelling and associated works (see section 2.3)
  - corridor and associated works (see section 2.4)
  - stations and associated works (see section 2.5)
  - ancillary facilities and associated works (see section 2.6)
- rail systems fitout
- finishing works and testing and commissioning.

These activities are described in more detail in this appendix.

The indicative timeframe for the project is for main construction to commence in 2021 and take about five years to complete, subject to planning approval. An indicative main construction program is provided in Figure 2-1.

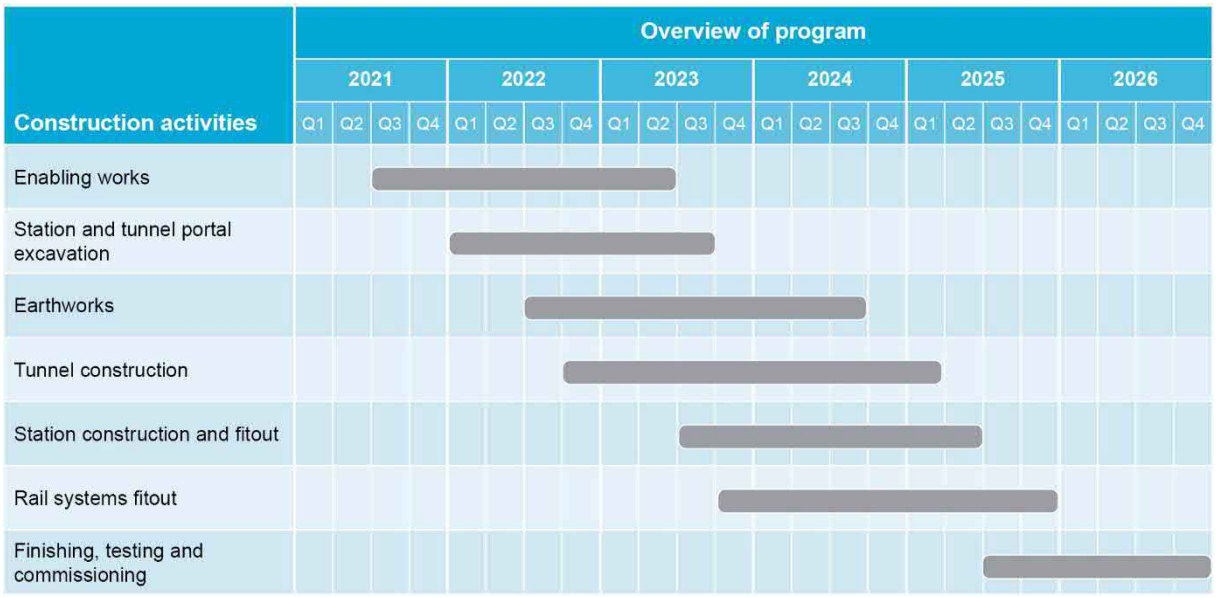
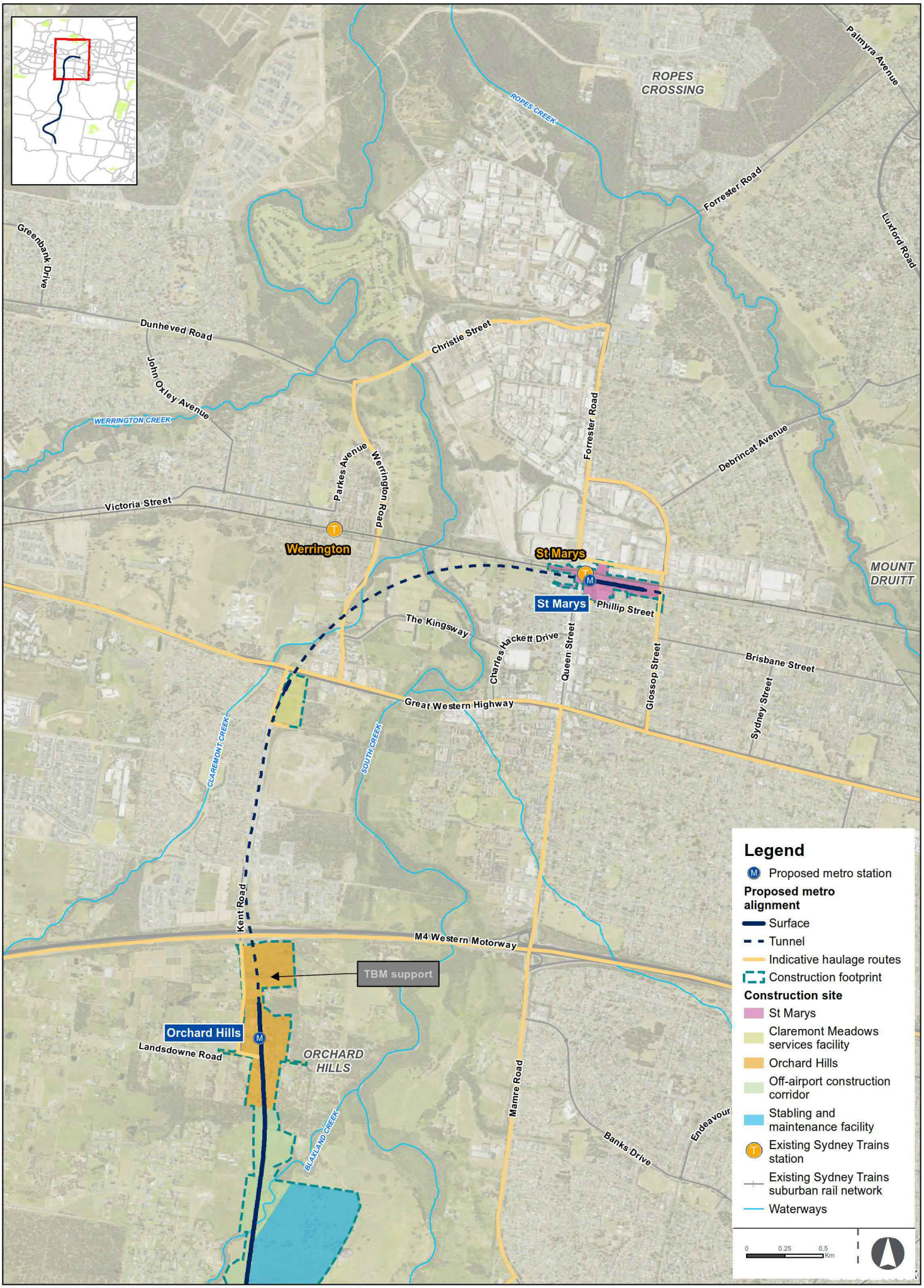


Figure 2-1 Indicative main construction program

The construction footprint and key construction sites proposed for use during construction of the project are shown in Figure 2-2a to Figure 2-2d.

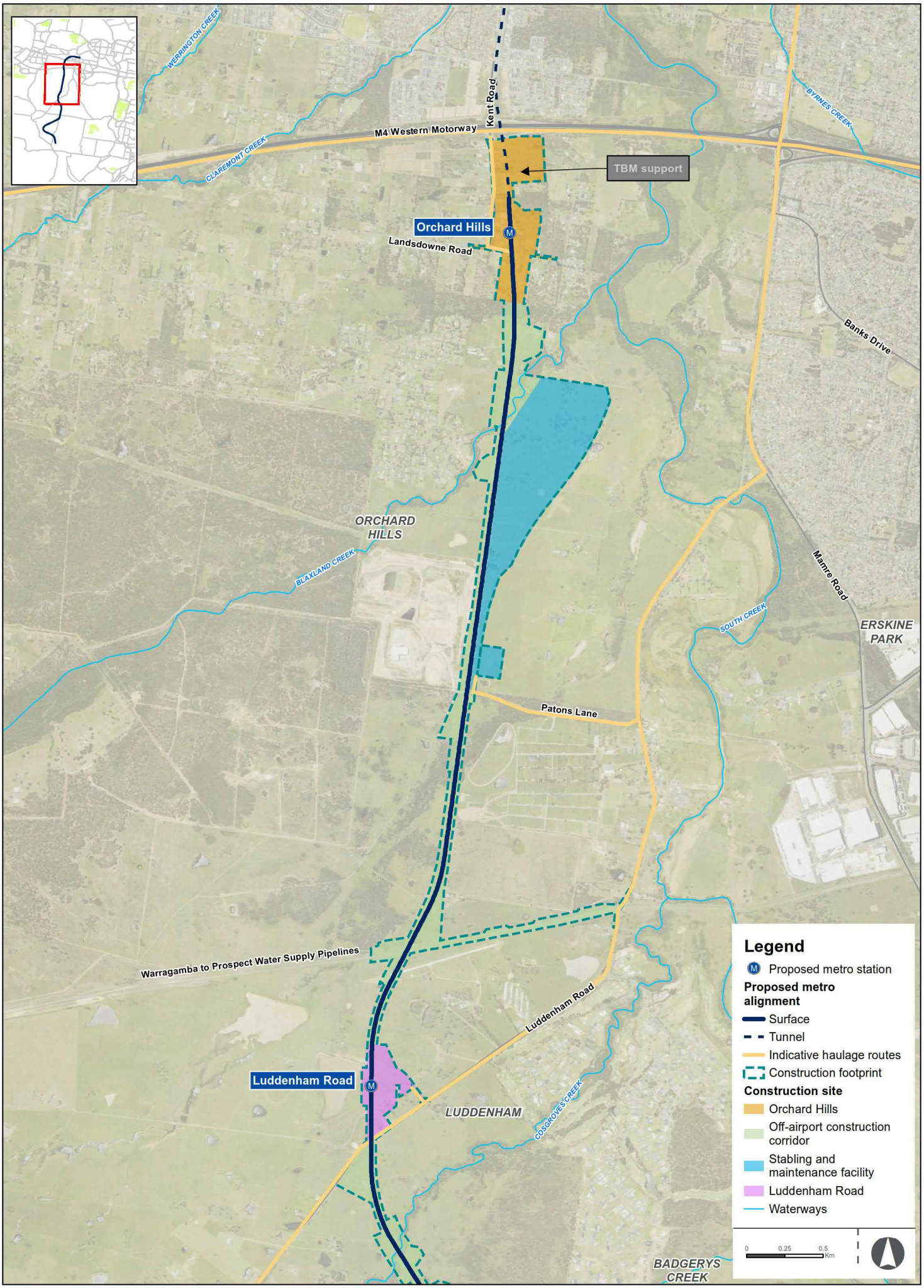


Sydney Metro – Western Sydney Airport

Indicative only, subject to design development

Overview of the construction footprint

Figure 2-2a

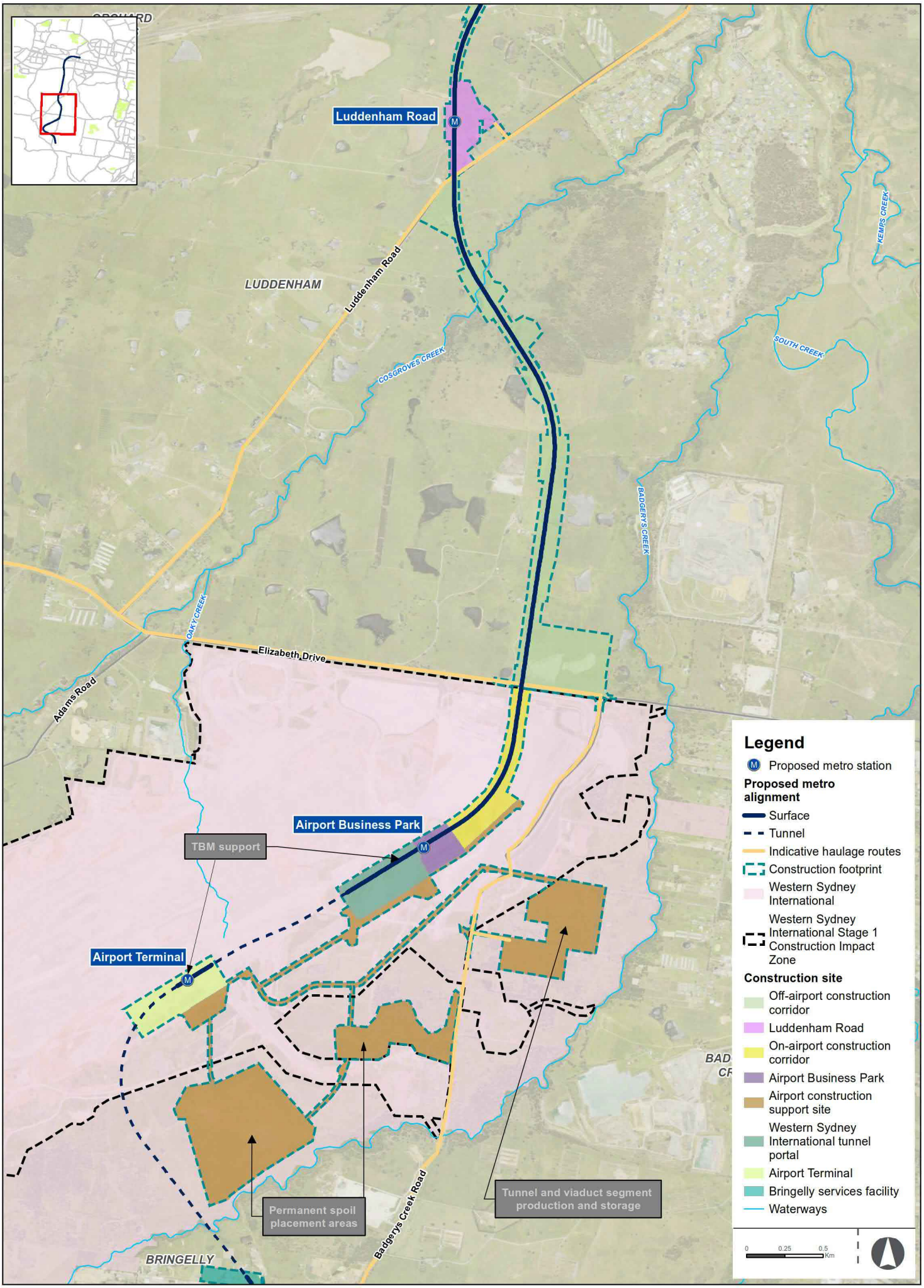


Sydney Metro – Western Sydney Airport

Indicative only, subject to design development

Overview of the construction footprint

Figure 2-2b

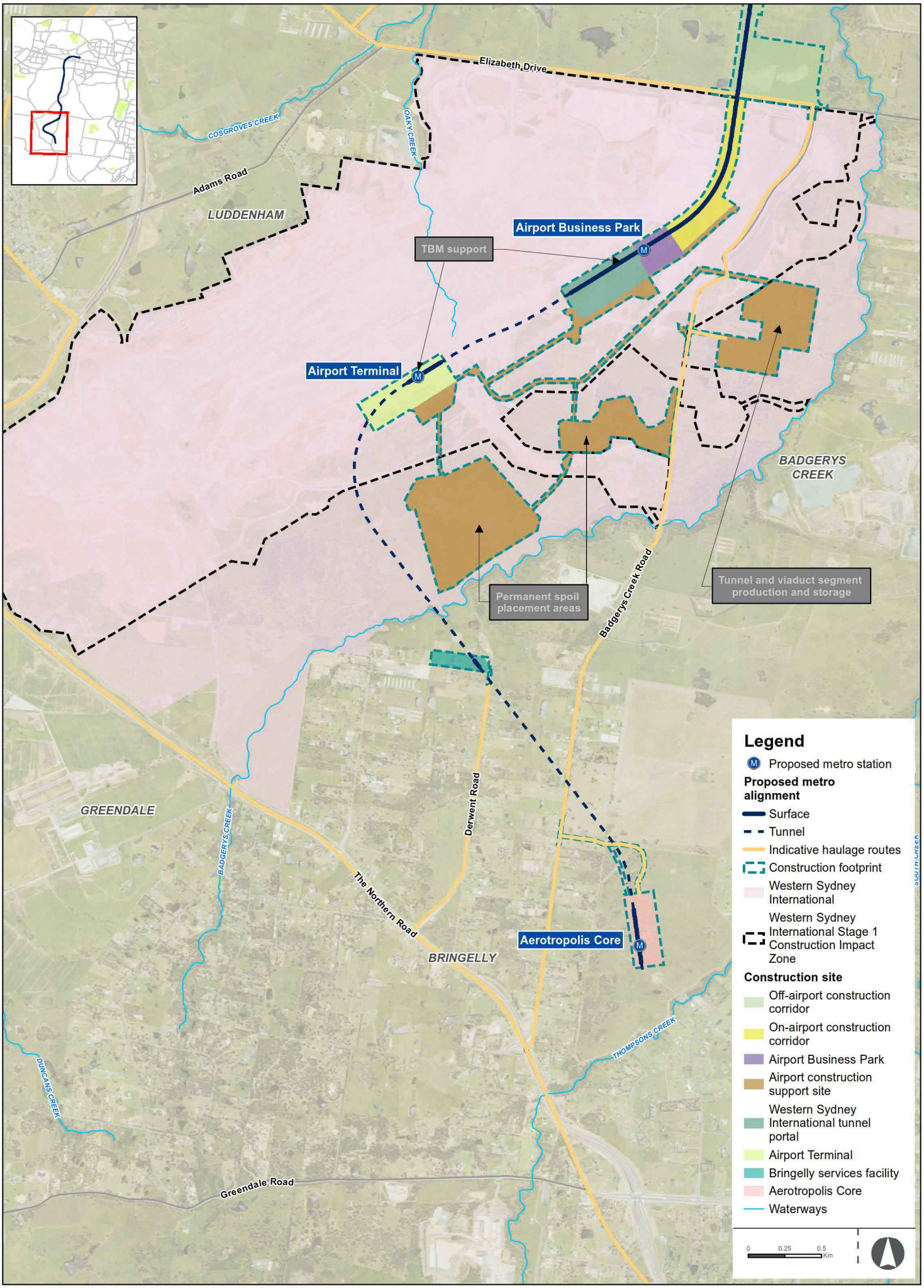


Sydney Metro – Western Sydney Airport

Indicative only, subject to design development

Overview of the construction footprint

Figure 2-2c



Sydney Metro – Western Sydney Airport

Indicative only, subject to design development

Overview of the construction footprint

Figure 2-2d

2.2 Enabling works

Enabling works for the project are required to establish key construction sites and facilitate construction activities.

The majority of the enabling works are expected to commence in advance of the main construction works, such as tunnelling and station excavation, while some enabling works would continue concurrently with the main construction works. Enabling works would include:

- detailed site investigations and subsequent remediation or clearance works (see Section 2.9.1)
- demolition of buildings and other structures where required (see Section 2.9.2)
- transport network adjustments (see Section 2.9.7)
- relocating, adjusting and protecting utilities and services affected by the project (see Section 2.9.11)
- supplying water, power and other utilities to construction sites and other areas within the construction footprint (see Section 2.9.8 and 2.9.10)
- works within and around the T1 Western Line rail corridor (part of the existing Sydney Trains suburban rail network) (see Section 2.7.1)
- vegetation clearance (as required) (see Section 2.9.3).

In addition, there would be related development that is excluded from this Environmental Impact Statement and is subject to separate assessment and planning approvals as discussed in Section 2.12.

2.3 Tunnelling and associated works

The tunnel and excavation method would be driven by ground conditions likely to be encountered during construction, the project design and program. The methodology described below is indicative and would be developed by the construction contractor(s) when appointed.

Tunnel excavation methodologies for the project would include:

- bored tunnels for the St Marys to Orchard Hills tunnel and the Western Sydney International to Bringelly tunnel
- other techniques including the use of roadheaders or excavators to excavate non-standard sections of tunnels including cross-passages and tunnel stubs.

2.3.1 Bored tunnel excavation

A tunnel boring machine (TBM) typically consists of a shielded cutting head and trailing backup support services and mechanisms. At the front of the shield is a rotating cutter head (shown in Figure 2-3), and behind the cutter head is a chamber where the excavated rock spoil would be collected and transferred via a conveyor or slurry pipe back to the TBM launch site or other retrieval point as required. The TBM would be propelled forward by hydraulic jacks pushing off the previously excavated sections of rock. Gaps between the excavated tunnel wall and the tunnel lining would be filled with cement based grout.

It is anticipated a total of four TBMs would be required for the bored twin tunnels (two TBMs for the St Marys to Orchard Hills tunnel and two TBMs for the Western Sydney International to Bringelly tunnel).

The lining for the tunnels would be assembled from precast concrete segments and installed progressively as the TBM moves forward. The precast concrete segments would be manufactured using concrete from a dedicated concrete batching plant and stored at a tunnel segment precast facility, both of which would be located at the airport construction support site (see Section 2.7.11 and Figure 2-4). The precast facility would produce about 300 tunnel lining ring segments per day. The segments would be transported via trucks within the Western Sydney International site and on the road network to Orchard Hills.

The estimated rate of tunnel advance by the TBMs would be around 100 metres per week.

Figure 2-3 Photo of a tunnel boring machine at Epping Station on the Metro North West Line

Figure 2-4 Photo of the tunnel segment storage area at Marrickville for the Sydney Metro City & Southwest project

2.3.2 Tunnel boring machine launch and retrieval sites

St Marys to Orchard Hills tunnel

The indicative strategy for the launch and retrieval of the two TBMs for the St Marys to Orchard Hills tunnel is as follows:

- both TBMs would be launched at the Orchard Hills construction site and driven north, under the M4 Western Motorway to the location of the Claremont Meadows services facility
- if the Claremont Meadows services facility is required, the TBMs would receive maintenance there before being relaunched northwards towards St Marys

- on completion of tunnelling at St Marys, the TBMs would be disassembled and retrieved from a temporary shaft excavated to the west of the proposed station box. The shaft would be decommissioned and backfilled following the retrieval of the TBMs.

Tunnel spoil would primarily be removed from the Orchard Hills construction site. See Section 2.9.4 for further information regarding spoil management.

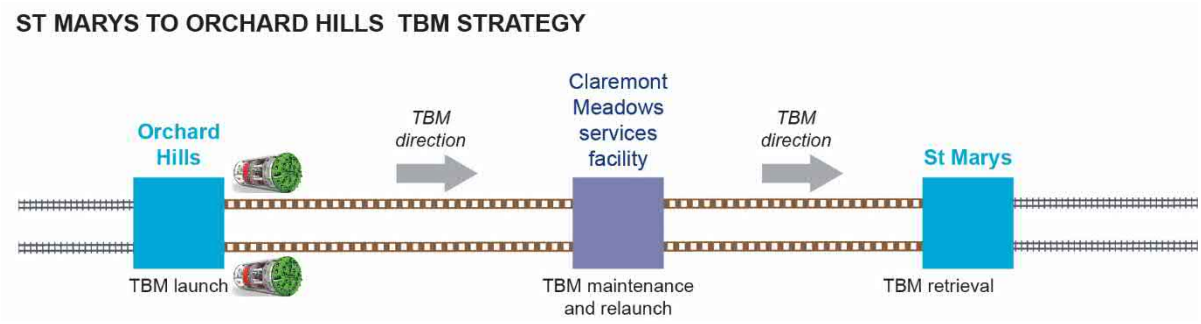


Figure 2-5 Indicative St Marys to Orchard Hills TBM strategy

Western Sydney International to Bringelly tunnel

The indicative strategy for the launch and retrieval of the two TBMs for the Western Sydney International to Bringelly tunnel is as follows:

- both TBMs would be launched from the Western Sydney International tunnel portal construction site and driven southwest towards the Airport Terminal construction site. TBM support activities would be carried out at the Western Sydney International tunnel portal construction site until the TBM reaches the Airport Terminal construction site
- the TBMs would receive maintenance at the Airport Terminal station box before being relaunched to the southeast towards the Bringelly services facility. At this time, relevant infrastructure to support TBM operations including grout plant(s) and ventilation fans would be relocated (as required) from the Western Sydney International tunnel portal construction site to the Airport Terminal construction site. TBM support activities (including spoil handling) would commence from this location and continue until tunnelling is completed
- the TBMs would receive maintenance at the Bringelly services facility before being relaunched southeast towards the Aerotropolis Core construction site
- on completion of tunnelling, the TBMs would be disassembled and retrieved from a temporary shaft excavated at the Aerotropolis Core construction site to the north of the proposed station box. The shaft would be decommissioned and backfilled following the retrieval of the TBMs.

Tunnel spoil would be removed from the Western Sydney International tunnel portal and Airport Terminal construction sites. See Section 2.9.4 for further information regarding spoil management.

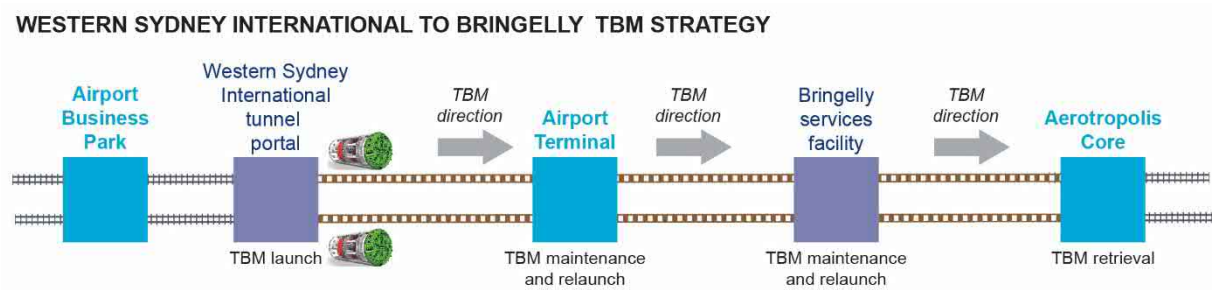


Figure 2-6 Indicative Western Sydney International to Bringelly TBM strategy

2.3.3 Tunnel boring machine support activities

TBM operations require surface construction areas for logistics support and material handling including:

- TBM delivery, assembly and commissioning
- high voltage power supply
- fresh air ventilation (fresh air ventilation fans would operate 24 hours per day, seven days per week during tunnelling)
- water supply
- drainage and water treatment plant
- spoil handling, stockpiling and removal facilities
- workforce facilities
- acoustic shed if required to mitigate environmental impacts.

An example of a tunnel boring machine launch site, the Sydney Metro City & Southwest Marrickville dive site, is shown in Figure 2-7.

TBM support activities would primarily be carried out at the following construction sites:

- Orchard Hills construction site (see Section 2.7.3)
- Western Sydney International tunnel portal construction site (see Section 2.7.9) and Airport Terminal construction site (see Section 2.7.10).

Figure 2-7 Photo of the Sydney Metro City & Southwest Marrickville dive site

2.3.4 Tunnel portal construction

Tunnel portals would be constructed at the following locations:

- directly north of the proposed Orchard Hills Station (the southern extent of the St Marys to Orchard Hills tunnel). A tunnel portal would not be required at St Marys as the alignment would be underground at this location
- about 400 metres southwest of the proposed Airport Business Park station (the northern extent of the Western Sydney International to Bringelly tunnel). A tunnel portal would not be required at the Aerotropolis Core as the alignment would be underground at this location.

A dive structure would be constructed at the tunnel portals to transition the rail track from surface to in-tunnel through the portal.

Construction of the dive structures and tunnel portals would generally involve:

- piling along the edge of the dive structure to form the walls
- excavating below proposed track level
- placing of precast and cast in-situ concrete for the cut-and-cover section and to form the tunnel portal.

Tunnel ventilation facilities would be provided at the tunnel portals as described above.

2.3.5 Other tunnel excavations

Tunnel stubs

Tunnel stubs at St Marys and Aerotropolis Core to support potential future extensions would be constructed using roadheaders and extend around 125 metres from the end of the station and crossover structures. A roadheader is an excavation machine consisting of a boom-mounted rotating cutter head, a loading device usually involving a conveyor, and a crawler travelling track to move the entire machine forward into the rock face (refer to Figure 2-8).

Crossover

The crossover at St Marys and Aerotropolis Core would be constructed using cut-and-cover methods as part of the construction of the station excavation. See Section 2.5.1 for further information.

Cross-passages

Cross-passages would be excavated between the bored twin tunnels at around 240 metre intervals. These would likely be excavated by small roadheaders and/or excavators with rock hammers (refer to Figure 2-9). Additionally, rooms would be excavated with rock hammers at various points along the bored twin tunnels for rail systems services.

Figure 2-8 Photo of a roadheader

Figure 2-9 Photo of a rock hammer

2.4 Corridor and associated works

2.4.1 Bridge and viaduct structures

The project would include the construction of bridges and viaducts to cross floodplains, watercourses and existing and proposed permanent infrastructure. The location and arrangements of proposed bridges and viaducts are described in Section 1.2.4.

It is anticipated the viaducts and bridges would be constructed using cast in-situ concrete piles, columns and headstocks with precast girders between the columns.

The precast viaduct and bridge sections would be manufactured and stored at a dedicated precast facility within Western Sydney International. The precast sections would be transported via trucks on the road network.

The viaduct and bridge construction method would include:

- substructure construction, likely to be from cast in-situ concrete in the following sequence:
  - bored pile construction
  - pile cap construction including localised excavation
  - pier or column construction
  - headstock construction
- construction of the superstructure, likely through the placement of precast concrete segments (typically through the use of a viaduct gantry or crane).

Cast in-situ construction may be employed where the design or the presence of existing infrastructure precludes the use of precast bridge or viaduct segments.

2.4.2 Earthworks

Earthworks (for example, cuttings and embankments) would be required at locations along the project alignment to achieve required levels for the surface track alignment. Sections of cut and embankment batters would not typically require support; however, in some instances, the cut and embankment sections may require structural support (for example by retaining walls, piles and soil nails). Earthworks associated with the excavation of station boxes are described in Section 2.5.1.

The existing geology would influence the slope of the cut batters. The properties of the fill material used to create the embankments would determine the slope of the embankment batters. The width required to transition to the depth below or height above existing ground level would vary along the alignment.

Earthworks would also be required along the project alignment for drainage structures and water quality basins.

The general sequence for earthworks would be as follows:

- ground stabilisation works as required
- construction of bored pile wall or similar infrastructure where required
- earthworks cut and fill to design levels
- construction of retaining structures and drainage elements where required as the earthworks progress.

2.4.3 Rail systems fitout

Indicative access points for the rail systems fitout would be via the construction sites described in Section 2.7. Access points would be confirmed by the construction contractor(s) when appointed.

The rail systems fit-out work is described in Table 2-1.

Table 2-1 Rail systems fit-out

Item	Work
Ventilation	The majority of tunnel ventilation equipment would be located at the tunnel portal facilities, stations and services facilities. The fitout of these elements is described as part of the mechanical and electrical components fitout in Section 2.5.4.
Track slab and rail fastening	The track slab would be formed by mass concrete pours with rail fasteners incorporated into the pours. Rail fasteners would be designed to mitigate operational noise and vibration where required. Ballast track form would be used at the stabling and maintenance facility and may also be used for surface sections of track.
Rail track installation	Rail track would be delivered to the access points at each of the construction sites. Where there is surface access to the tunnel (i.e. the two tunnel portals), rail track sections would be welded together in lengths of up to 120 metres and then transported underground. Where there is no surface access to the tunnel, standard rail lengths would be delivered and lowered down via access shafts at St Marys, the two services facilities, Airport Terminal and Aerotropolis Core construction sites. Close to the access point, the rail lengths would be welded together in lengths of up to 120 metres and moved into the tunnel for installation. For the surface rail, rail would be delivered to site and welded or pre-welded in a casting yard and delivered to site and welded into position.
Cable and equipment installation	Dedicated cable routes would be provided within the tunnel environment for signalling, communications and electricity. Rooms for signalling and communications equipment would be provided at every second cross-passage, alternating with power equipment rooms within the other cross-passages. Signal equipment rooms would be provided at the stabling and maintenance facility, at each station and alongside the surface alignment as required. Communication rooms would be provided at the stabling and maintenance facility and at each station. The signal equipment and communication rooms at the stations would be connected to the communications backbone and subsequent system destinations. Galvanised steel troughs and poles and masts for communications systems and lighting would also be provided.
Overhead wiring	For the tunnels, overhead wiring would be installed at regular intervals on the track. Overhead wiring would have a main support located centrally over the track with a secondary support to the side of the tunnel. For surface rail, overhead wiring structures would be installed into the track subgrade. The viaduct sections would require a more complex overhead wiring structure with structures connected directly to the concrete viaduct segments. Overhead wiring structures at the stabling and maintenance facility would support the stabling roads and turnout configurations.

2.5 Stations and associated works

Six stations are proposed as part of the project. The construction method for the stations is summarised in Table 2-2 with further detail provided in Section 2.5.1 to Section 2.5.4. The methodology described below is indicative and would be confirmed by the construction contractor(s) when appointed. The construction of the stations would consist of structural works (for the station box) and station fitout works. Station fitout works are generally similar for all station types and the methodology for these works is described in Section 2.5.4.

Table 2-2 Indicative station construction method

Station	Vertical alignment	Construction method (structural works)
St Marys	Underground	Cut-and-cover box
Orchard Hills	In-cutting (open cut)	Similar to cut-and-cover box
Luddenham Road	Above ground	Viaduct
Airport Business Park	Surface (shallow cutting)	Surface
Airport Terminal	Underground	Cut-and-cover box
Aerotropolis Core	Underground	Cut-and-cover box

Where the design and site conditions allow, stations would be constructed using modular design elements to minimise the construction timeframes. This approach involves the installation of structures (for example, station buildings and canopies) comprising modularised components.

2.5.1 Cut-and-cover station construction method

Cut-and-cover construction is proposed for St Marys Station, Orchard Hills Station, Airport Terminal Station and Aerotropolis Core Station.

While Orchard Hills is an open cut station, the construction method for the station is comparable to a cut-and-cover station given the requirement for vertical retaining structures on both sides of the station below ground level (refer to Figure 1-21).

Excavation method

A typical construction method for cut-and-cover station excavation would involve excavating the station from the surface and using pile walls to support the surrounding soil and rock.

The construction of the station would progress down to the level of the base slab with intermediate temporary horizontal braces, anchors and shoring installed as required. The base slab and permanent structural elements would then be built up from the bottom of the excavation, removing temporary structural supports as the work progresses upwards. The last element of the structure would be the roof slab – leaving only discrete entry and exit points – and any required backfilling to the new ground level over the slab.

Structural works

Structural works for the underground stations would involve the construction of:

- platforms
- vertical supports
- mezzanine levels and rooms
- roof slabs (covering the station box).

Platform slab construction would involve the placement of formwork panels, followed by pouring of concrete into the panels using concrete pumps located at the surface. Allowance would be made during platform construction for the location of the vertical transportation elements (such as escalators and lifts).

The construction of mezzanine levels would involve installing structural beams to span the full width of the station box, followed by secondary beams between the main beams. A concrete slab would then be poured in sections supported by the beams.

The roof slabs would likely consist of closely spaced precast girders spanning the full width of the station box, placed on the piled wall capping beam (installed as part of the excavation). A concrete topping slab would be poured on the girders, followed by a waterproof membrane and a concrete protection layer. The area would then be backfilled (as required) to the surface level.

The platform canopy components would likely be pre-fabricated at an offsite location. The canopies would likely be assembled at ground level adjacent to the station platform then lifted into place.

2.5.2 Surface station construction method

Surface station construction is proposed at the Airport Business Park Station. At this location the rail track transitions from surface to in-cutting. The station would be constructed at the surface level (or slightly below) relative to the finished surface level at Western Sydney International.

Excavation method

The excavation method for the surface station is consistent with the construction methodology for earthworks as described in Section 2.4.2.

Structural works

Structural works for the surface level station would involve the construction of:

- support columns and foundations for vertical transport structures and the station buildings
- the platform structures
- vertical transport structure and the pedestrian accesses
- the platform canopy
- the emergency egress stairs
- the station buildings.

The structures outlined above would be constructed using a combination of:

- conventional formwork and cast in-situ concrete
- precast concrete elements
- pre-fabricated steel structures
- standard blockwork and/or steel framing.

The construction of the station buildings would occur concurrently with the station construction.

2.5.3 Viaduct station construction method

Viaduct station construction is proposed at Luddenham Road Station.

The construction method for the station would generally be consistent with the construction methodology for bridge and viaduct structures described in Section 2.4.1.

Structural works

The construction methodology for the structural works for the viaduct station would be consistent with the methodology for the surface station described in Section 2.5.2.

2.5.4 Station fitout, precinct and transport integration works

Station fitout works

The mechanical and electrical fitout of the stations consists of two major elements: the rail systems located at the stations and the services required for the function of the stations. For underground stations, the initial fitout of mechanical and electrical services would occur concurrently with the structural works. This would include the installation of large equipment such as ventilation fans. The final fitout of mechanical and electrical services would occur after the completion of structural works and concurrently with the architectural fitout.

The architectural fitout of the stations would occur on completion of the station structural works and involves the final finishes for the stations, such as glazing, wall and ceiling cladding, and floor finishes.

Station precinct and transport integration works

The precinct works around each of the stations would be carried out following completion of the station structural and fitout works, and concurrently with testing and commissioning. Each of the stations would include some form of interface with other transport modes, including connections with roads, active transport links and public transport. Works would include the construction of roads and other transport integration infrastructure consisting of:

- intersection modifications, including traffic signal changes
- traffic signal works
- speed zoning
- safety infrastructure to protect vulnerable road users and manage vehicle speeds
- earthworks
- drainage works
- kerb and guttering
- surfacing including asphalt, concrete and pavers
- transport interchange facilities (for example bus shelters etc)
- public domain and placemaking infrastructure, including landscaping
- accessibility infrastructure (e.g. accessible ramps and lifts)
- line marking, signage and other finishes.

2.6 Ancillary facilities and associated works

A stabling and maintenance facility would be constructed at Orchard Hills to the south of Blaxland Creek and east of the proposed project alignment (see Figure 2-20). Access to the site would be through the off-airport construction corridor via Patons Lane.

Earthworks would be carried out at the site to achieve required ground surface levels and introduce stormwater detention and water quality basins.

Buildings located at the stabling and maintenance facility would be constructed using conventional methods. Access roads and car parking would also be required and would include earthworks, drainage works, kerb and guttering, surfacing including asphalt, concrete or pavers, line marking, signage and other finishes.

The construction of the stabling and maintenance facility would include civil works for the construction of the rail entry/exit structures to the facility from the main track alignment.

The project would complete all earthworks at the site, laying of track and stabling roads to accommodate the stabling of trains for initial and future operating scenarios for the project. Laying of track to support the stabling of additional trains for ultimate operations would be subject to separate assessment and approval.

2.7 Construction sites

The indicative works at proposed construction sites are outlined in Table 2-3 and shown in Figure 2-2a to Figure 2-2d. The construction sites would be confirmed by the construction contractor(s) when appointed.

Table 2-3 Indicative construction works at proposed construction sites

Location	Enabling works	TBM launch	TBM support	TBM retrieval	Spoil handling and removal	Roadheader launch/support	Ancillary facility construction	Stabling and maintenance facility construction	Major earthworks	Bridge and viaduct construction	General civil works	Concrete batch plant	Equipment and material laydown	Rail system fitout	Site offices and worker amenities	Water treatment plant	Potential acoustic shed	Vehicle parking
Off-airport																		
St Marys	✓			✓	✓	✓	✓		✓		✓		✓	✓	✓	✓	✓	✓
Claremont Meadows services facility	✓				✓	✓	✓		✓		✓		✓	✓	✓	✓	✓	✓
Orchard HIlls	✓	✓	✓		✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Off-airport construction corridor	✓				✓		✓		✓	✓	✓		✓	✓	✓			✓
Stabling and maintenance facility	✓				✓		✓	✓	✓		✓		✓	✓	✓			✓
Luddenham Road	✓				✓		✓			✓	✓		✓	✓	✓			✓
Bringelly services facility	✓				✓	✓	✓		✓		✓		✓	✓	✓	✓	✓	✓
Aerotropolis Core	✓			✓	✓	✓	✓		✓		✓		✓	✓	✓	✓	✓	✓
On-airport																		
On-airport construction corridor	✓				✓		✓		✓	✓	✓		✓	✓	✓			✓
Airport Business Park	✓				✓		✓		✓		✓		✓	✓	✓			✓
Western Sydney International tunnel portal	✓	✓	✓		✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓
Airport Terminal	✓		✓		✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓
Airport construction support site	✓				✓				✓		✓	✓	✓	✓	✓			✓

2.7.1 St Marys

The St Marys construction site is located around the existing Sydney Trains station at St Marys (see Figure 2-11). Temporary road network adjustments and parking modifications required at St Marys are identified in Section 2.9.7.

A range of construction activities would be carried out at the site to support TBM retrieval, cut-and-cover station construction and mined excavation of stub tunnels. Key construction works would include:

- administration activities to support construction
- construction of the new station box, station structures (including aerial concourse) and finishes
- construction of the crossover
- construction of stub tunnels
- spoil handling, storage and transport
- temporary TBM retrieval shaft excavation
- TBM retrieval
- station precinct works.

Design development and construction planning of the project would further consider opportunities to reduce or minimise direct and indirect impacts during construction.

The indicative construction program is outlined in Figure 2-10 with the location and indicative layout of the construction site, including vehicle access/egress, provided in Figure 2-11.

Works at and around the T1 Western Line rail corridor (part of the existing Sydney Trains suburban rail network)

Construction works within and adjacent to the existing T1 Western Line rail corridor would be required for the integration of the project with the existing rail line and station at St Marys. Enabling works at this location would include:

- establishment of temporary hoarding and fencing to safely separate works from the public and the T1 Western Line rail operations
- preparatory work to station platforms and infrastructure associated with the construction of the aerial concourse at St Marys. This may also require works to be undertaken in the area around the goods shed to support station construction
- potential relocation of the lift shaft on the southern side of St Marys Station. This may also require temporary relocation of the heritage significant jib crane to the east of the lift.

Some construction activities within the rail corridor would be undertaken during scheduled track possessions, where train services are replaced by bus services. Track possessions would generally occur over the weekend and at night and replacement bus services would be provided for rail customers. Other works within the rail corridor would generally be carried out during standard construction hours and would not disrupt existing rail services.

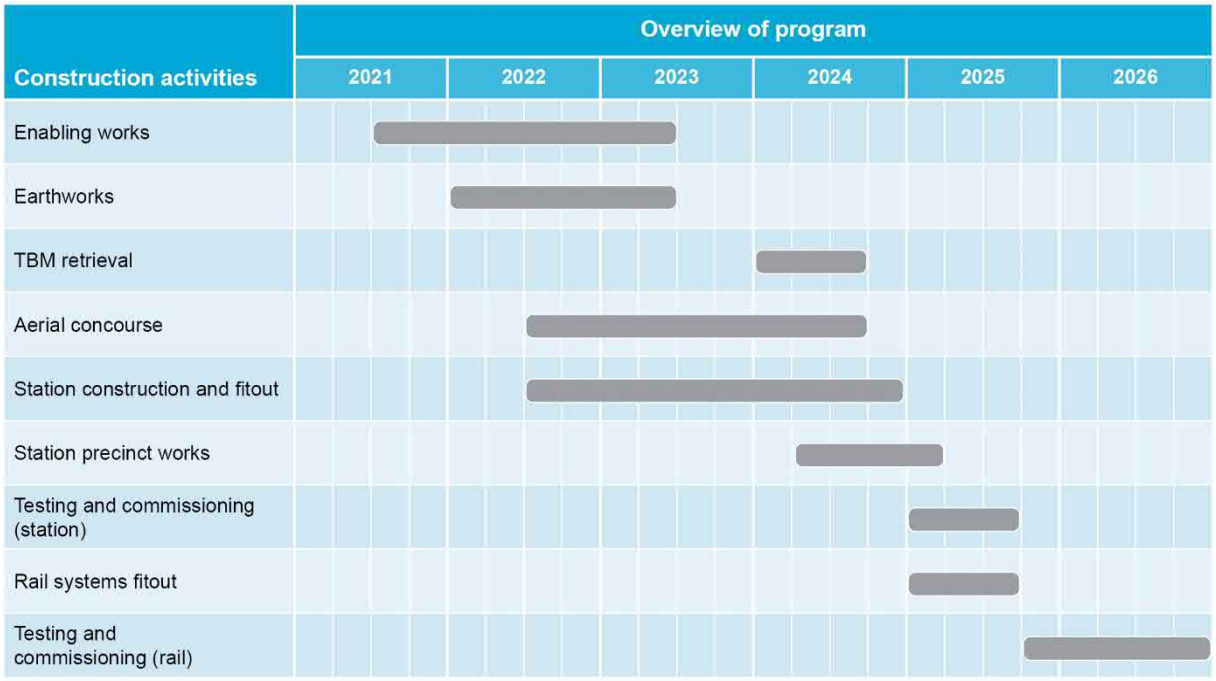
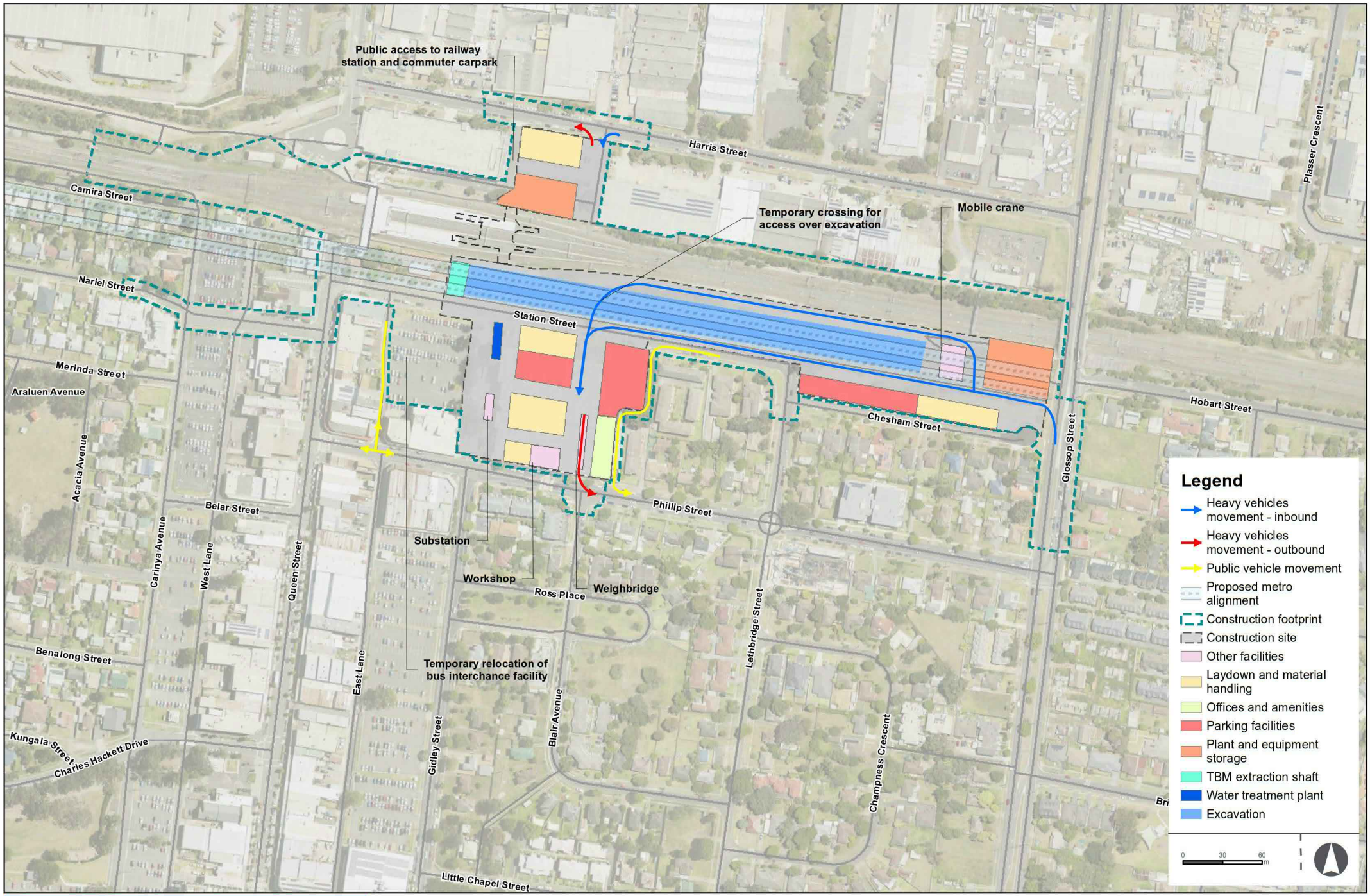


Figure 2-10 Indicative construction program for the St Marys construction site



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St Marys indicative construction site layout

Figure 2-11

2.7.2 Claremont Meadows services facility

The need for the Claremont Meadows services facility is subject to ongoing investigation. If required, it would be located to the southeast of the intersection of the Great Western Highway and Gipps Street. The existing site consists of a primarily cleared grassed area and an area previously disturbed by construction activities.

The construction site would support the construction of the services facility and support the fitout of the tunnel. Key construction works would include:

- piling and pile capping
- temporary shaft excavation
- spoil handling, storage and transport
- construction of above and below ground structures for the services facility
- TBM maintenance and relaunch
- services facility fitout
- rail and tunnel systems fitout.

The indicative construction program for the site is outlined in Figure 2-12 and the location and an indicative layout of the construction site, including vehicle access/egress, is provided in Figure 2-13.

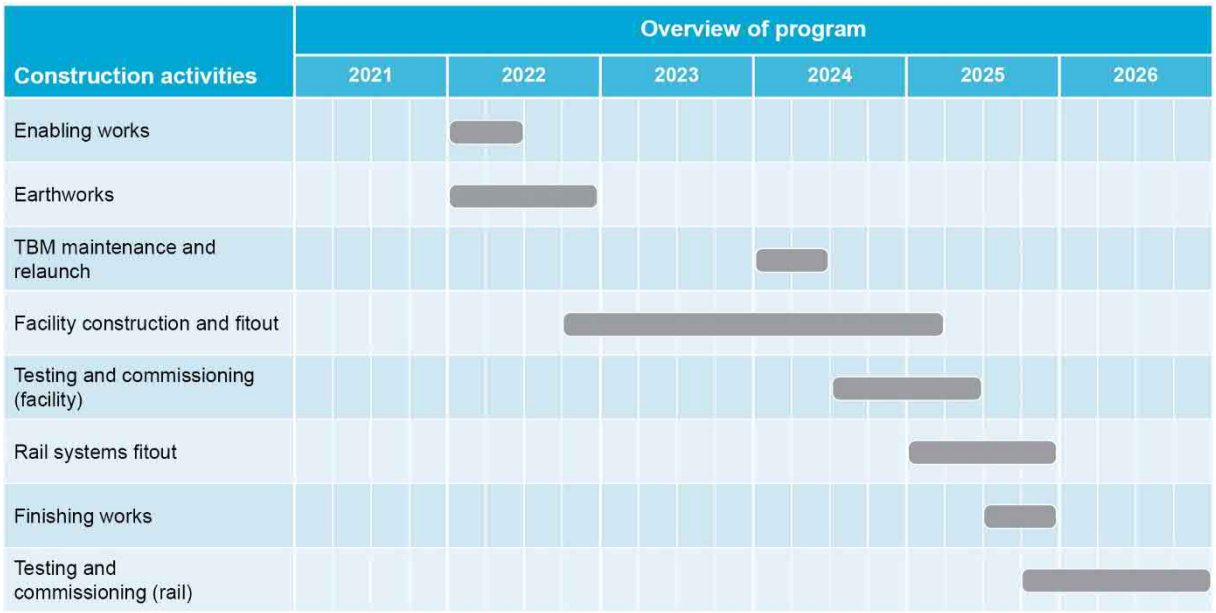
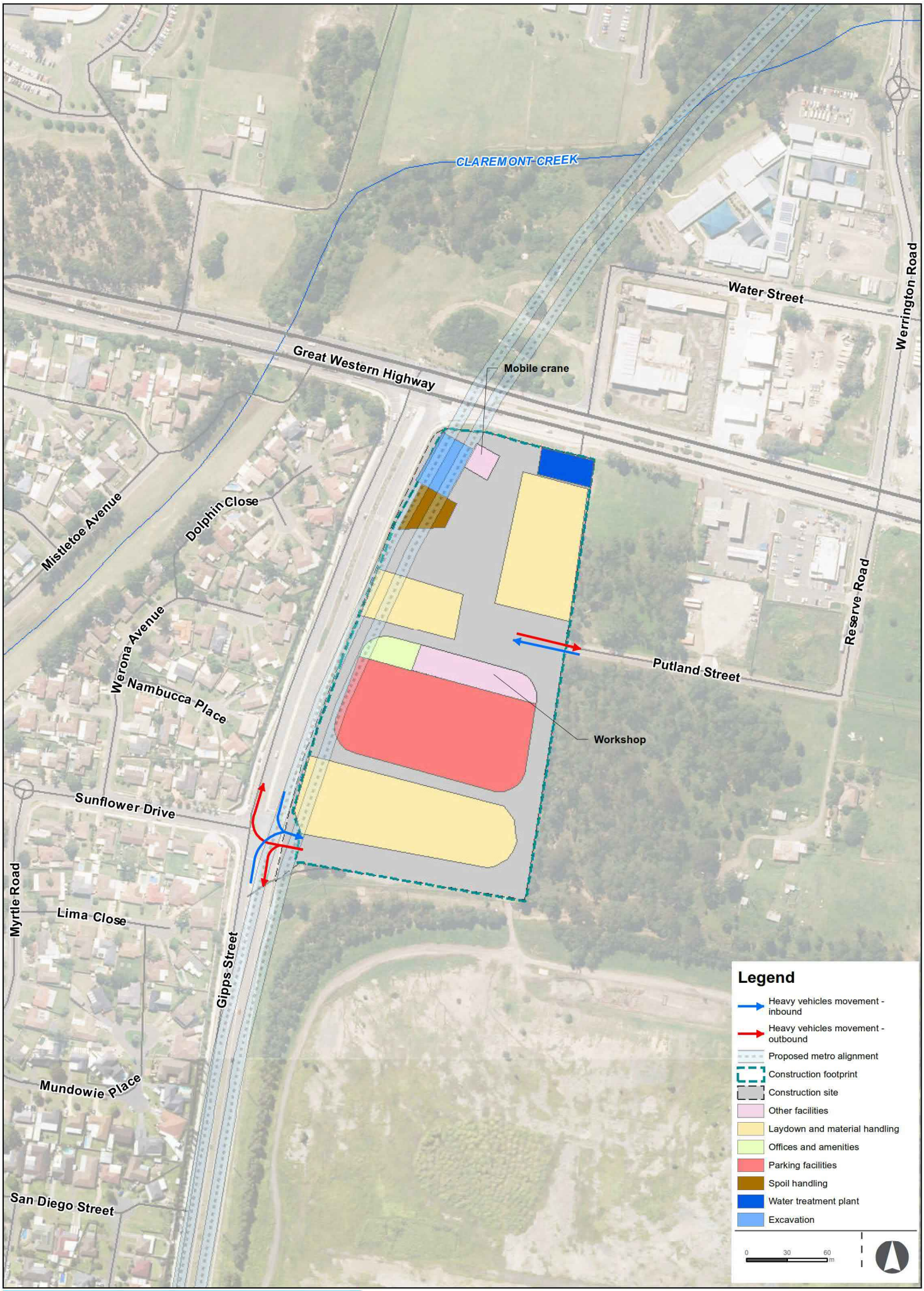


Figure 2-12 Indicative construction program for the Claremont Meadows services facility construction site



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Claremont Meadows services facility indicative construction site layout

Figure 2-13

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2.7.3 Orchard Hills

The Orchard Hills construction site would be located at Orchard Hills, south of the M4 Western Motorway, east of Kent Road and both north and south of Lansdowne Road. The existing site consists of semi-rural residential properties with areas of cleared and vegetated land.

A range of construction works would be carried out at this site to support TBM operations and the construction of Orchard Hills Station. Key construction works would include:

- construction of the tunnel portal
- TBM launch and support
- spoil handling and storage
- construction of the road-over-rail bridge for Lansdowne Road
- construction of the rail alignment
- construction of the Orchard Hills Station structures and finishes
- station precinct works.

The indicative construction program for the site is outlined in Figure 2-14 and the location and indicative layout of the construction site, including vehicle access/egress, is provided in Figure 2-15. The indicative site layout includes two separate areas to support tunnelling activities and station construction activities respectively.

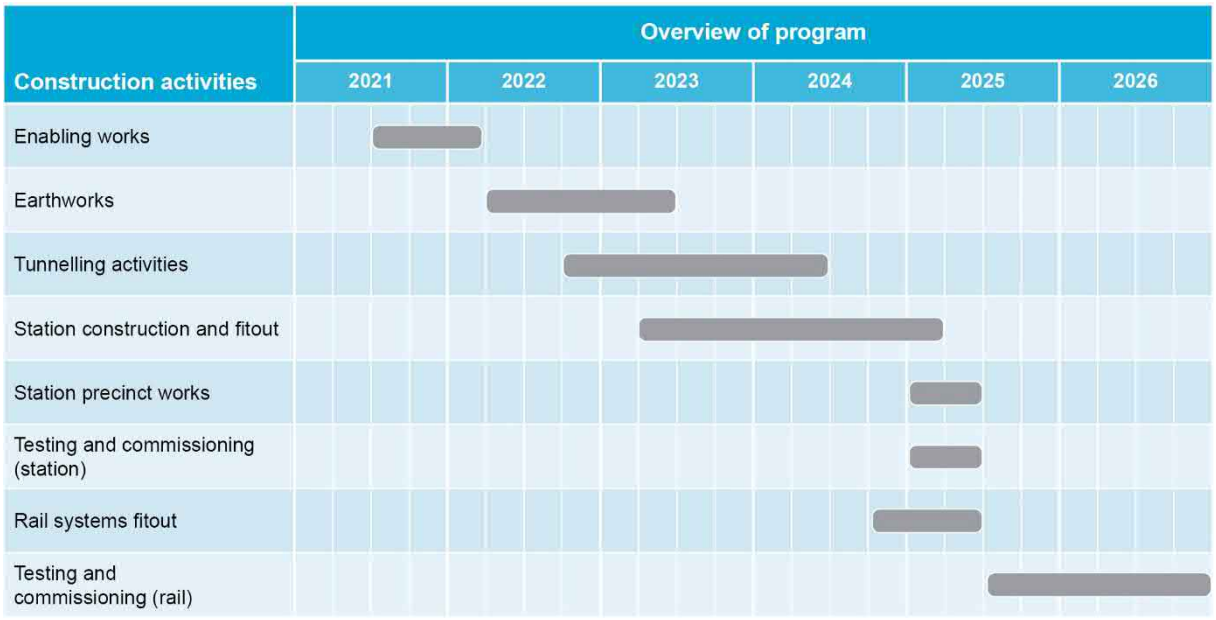
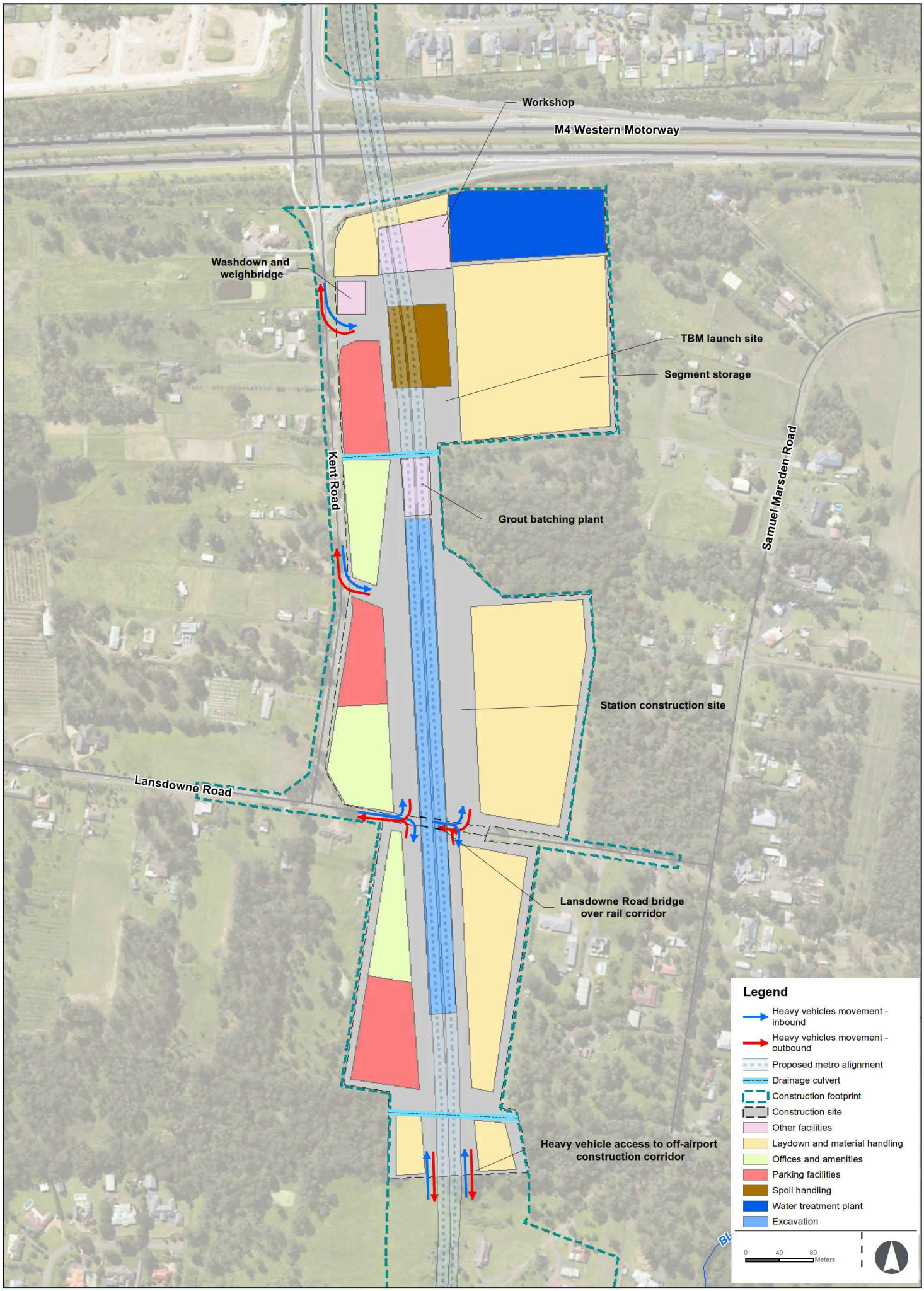


Figure 2-14 Indicative construction program for the Orchard Hills construction site



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Orchard Hills indicative construction site layout

Figure 2-15

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2.7.4 Off-airport construction corridor

A range of rail corridor construction activities would be carried out for the project to the north of Western Sydney International to construct the surface and viaduct sections of the alignment. The existing environment within the corridor consists of rural and semi-rural residential land use with areas of cleared and vegetated land, the riparian areas of Blaxland Creek, Cosgroves Creek and other unnamed watercourses, as well as local roads and utility corridors.

The following key construction works would be carried out within the corridor:

- construction and fitout of the surface sections of the rail alignment
- construction and fitout of the bridge/viaduct sections of the rail alignment
- earthworks and associated spoil handling, storage and transport.

Construction infrastructure within the corridor would be concentrated around areas of high construction activity, for example, gantry mobilisation and demobilisation points for viaduct construction. An indicative viaduct construction cross-section is provided in Figure 2-16.

Creek crossings would be established to provide north–south access across Blaxland Creek (during construction) and Cosgroves Creek (during construction and operation).

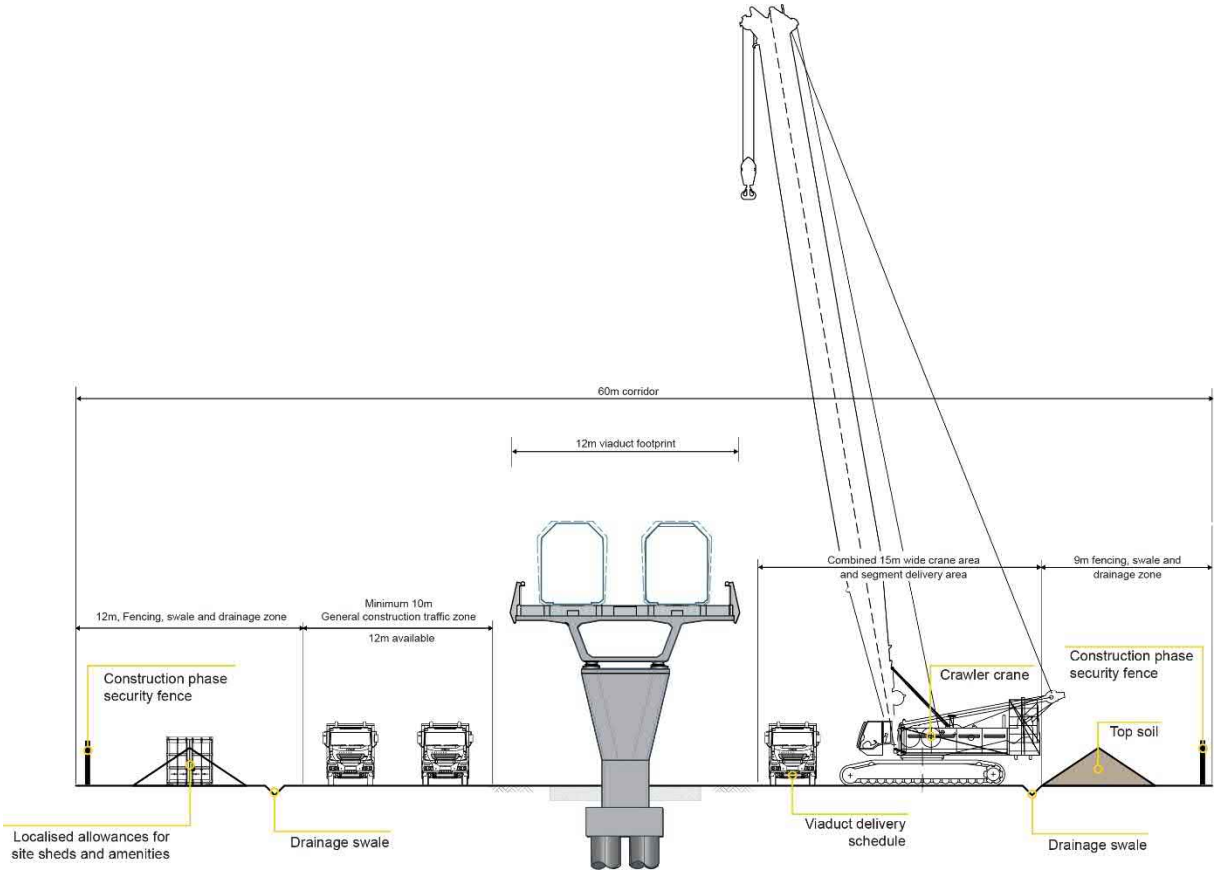


Figure 2-16 Indicative cross-section of viaduct construction

An indicative construction program for the off-airport construction corridor is outlined in Figure 2-17. Figure 2-18 shows the corridor, including construction access arrangements, for the off-airport construction sites.

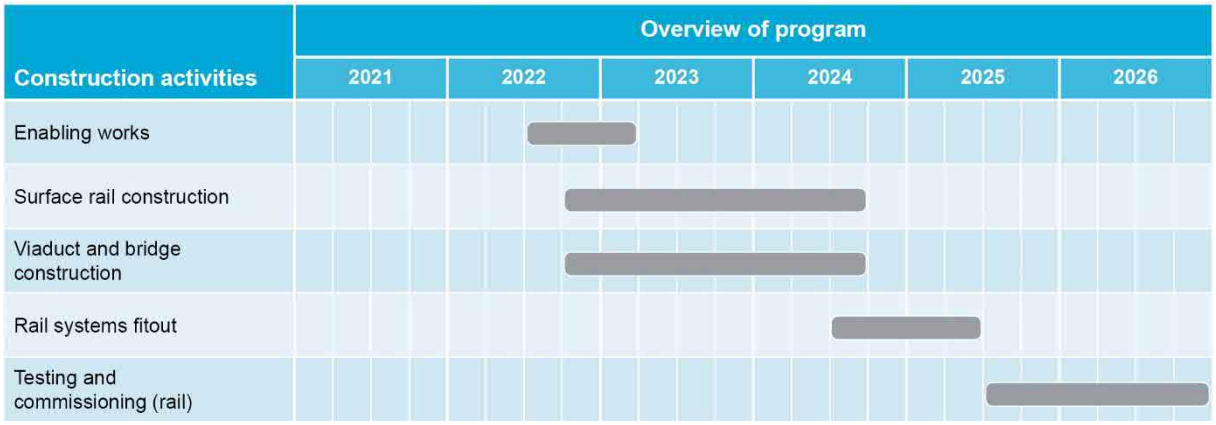
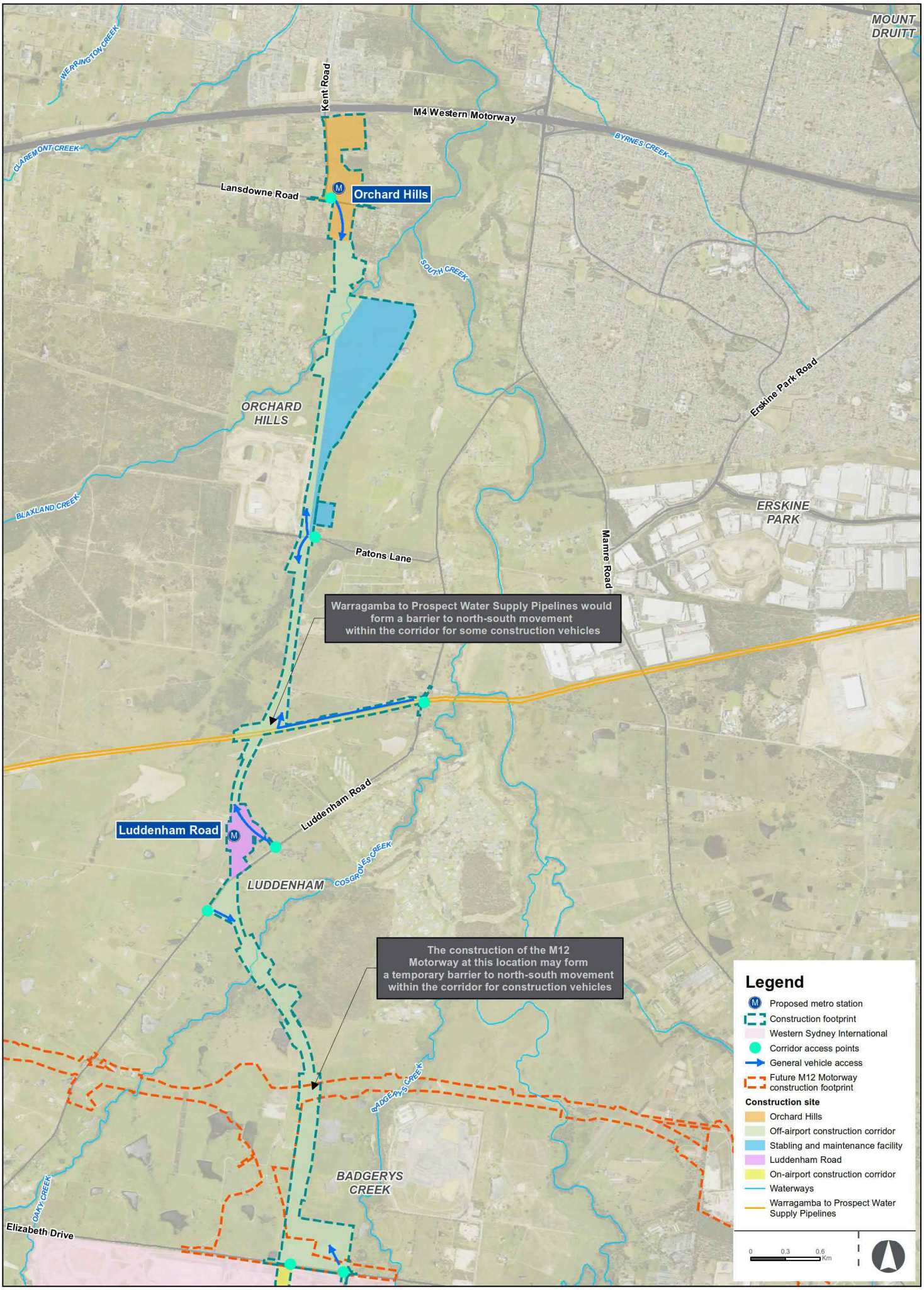


Figure 2-17 Indicative construction program for the off-airport construction corridor



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Off-airport construction corridor and construction access arrangements

Figure 2-18

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2.7.5 Stabling and maintenance facility

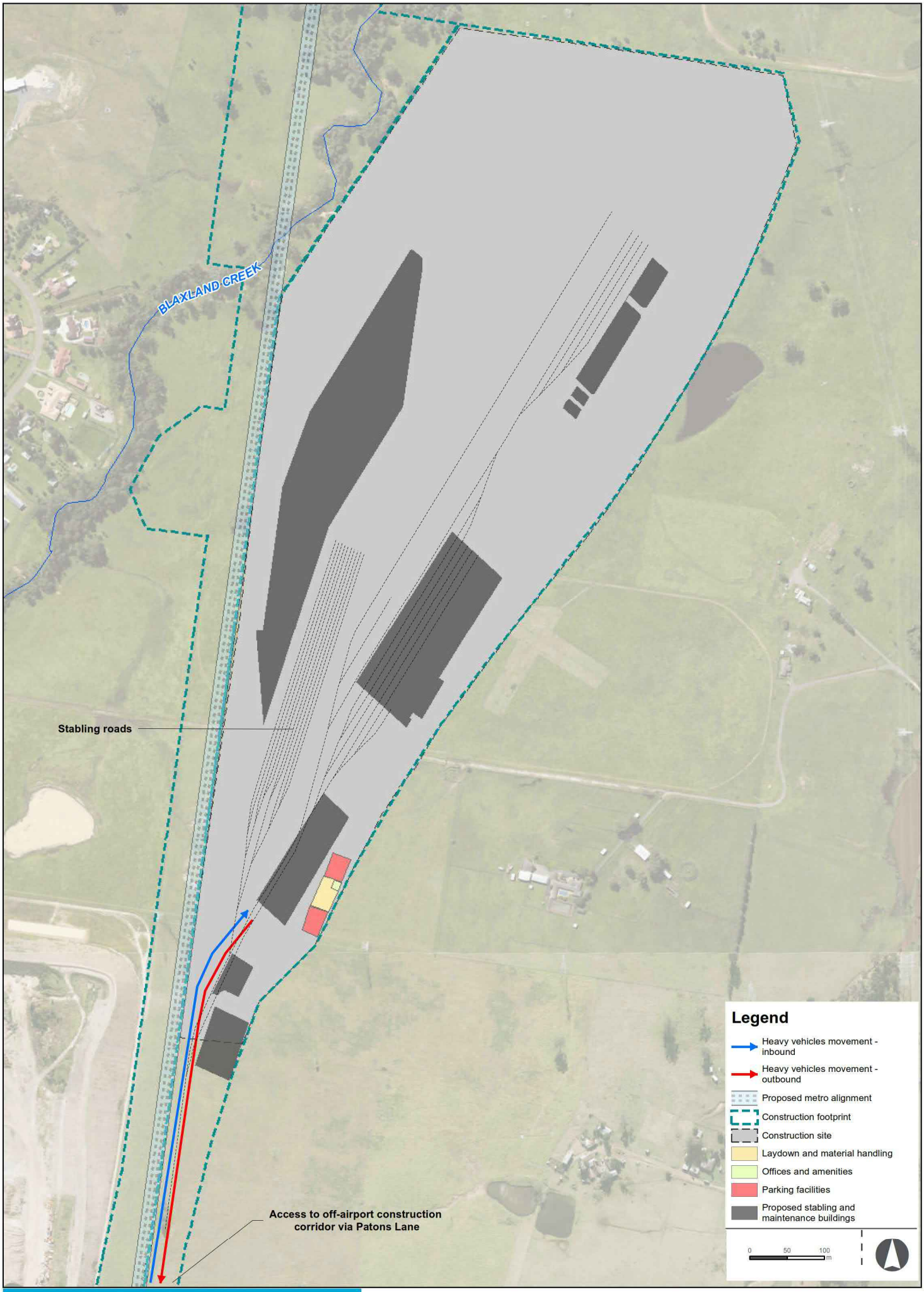
The stabling and maintenance facility construction site would be located at Orchard Hills south of Blaxland Creek, to the east of the project alignment and to the north of Patons Lane. The existing site consists of primarily cleared land used for agriculture.

The construction site would support the construction of the stabling and maintenance facility. Key construction works would include:

- earthworks and structural works for the stabling and maintenance facility including buildings and internal roads
- construction of the stabling and maintenance facility rail entry/exit.

The indicative construction program for the site is outlined in Figure 2-19 and the location and an indicative layout of the construction site, including vehicle access/egress, is provided in Figure 2-20.

Figure 2-19 Indicative construction program for the stabling and maintenance facility construction site



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Stabling and maintenance facility indicative construction site layout

Figure 2-20

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2.7.6 Luddenham Road

The Luddenham Road construction site would be located north of Luddenham Road at Luddenham. The existing site consists of cleared land used for agriculture.

The construction site would support the construction of Luddenham Road Station and the viaduct section of the rail alignment in this location. Key construction works would include:

- construction of Luddenham Road Station, station structures and finishes
- construction of the viaduct section of the rail alignment
- station precinct works which includes a bus layover area and park and ride facility with 200 spaces (with the potential for a future expansion to a multi-deck facility).

The indicative construction program for the site is outlined in Figure 2-21 and the location and an indicative layout of the construction site, including vehicle access/egress, is provided in Figure 2-22.

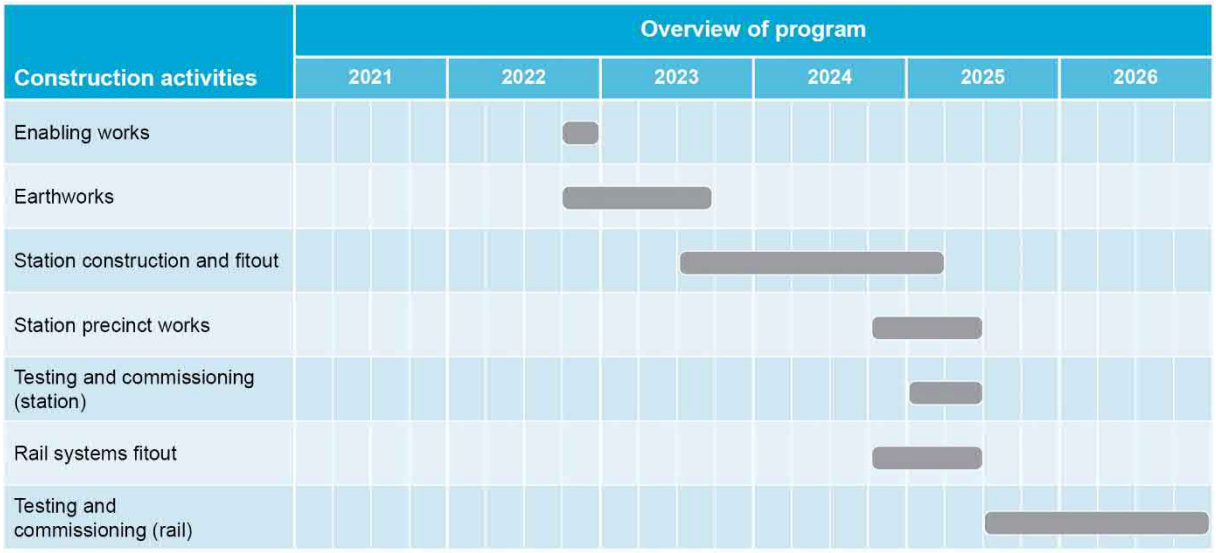
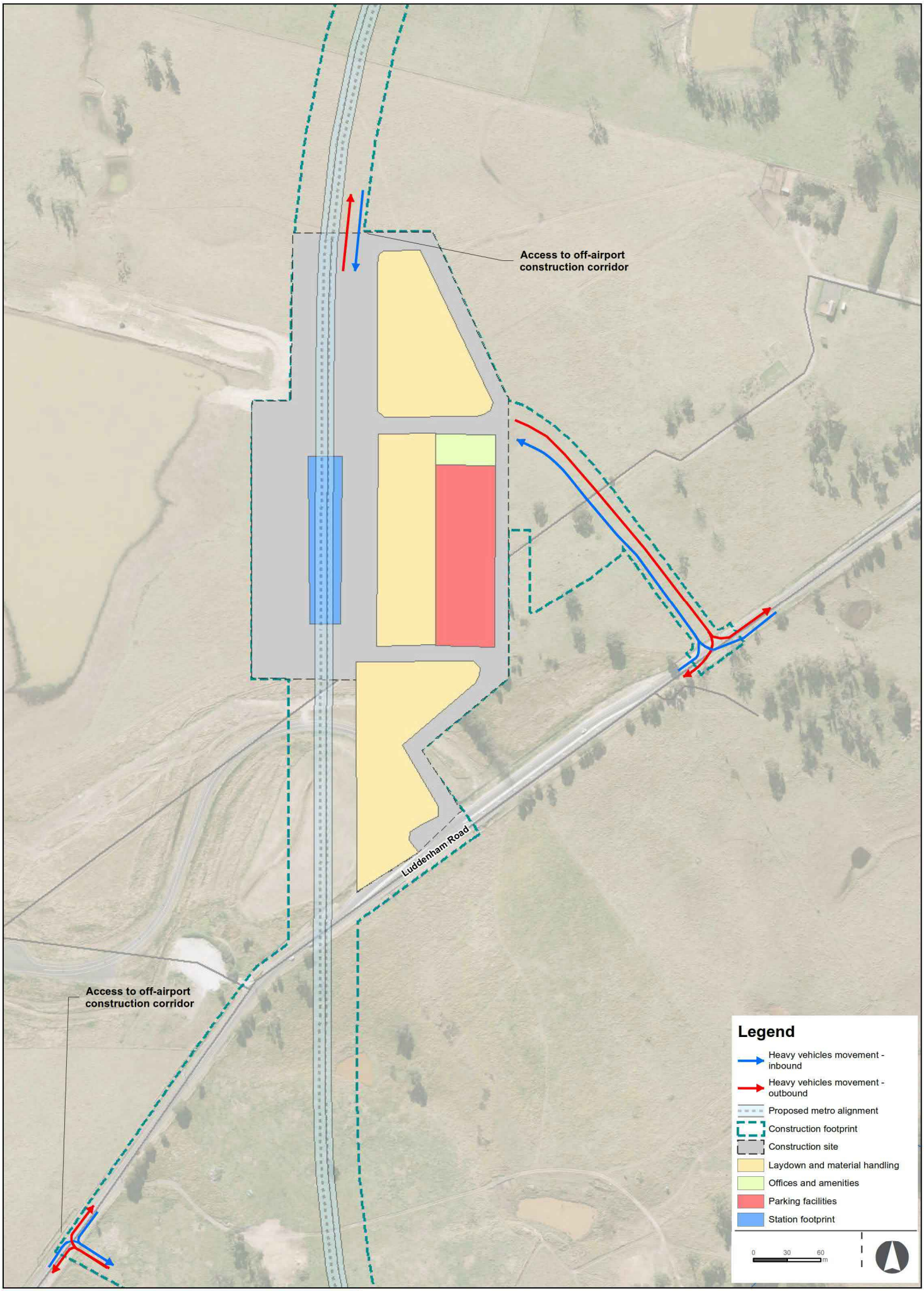


Figure 2-21 Indicative construction program for the Luddenham Road construction site



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Luddenham Road indicative construction site layout

Figure 2-22

Indicative only, subject to design development

2.7.7 On-airport construction corridor

The on-airport construction corridor is located within the Western Sydney International Stage 1 Construction Impact Zone and consists of the rail corridor between Elizabeth Drive and Airport Business Park Station. The site would support the construction and fit-out of this section of the alignment within Western Sydney International.

A temporary crossing of the Western Sydney International drainage swale may be required to support work within the on-airport construction corridor.

The indicative construction program for the site is outlined in Figure 2-23.The on-airport construction corridor is shown in the context of all on-airport construction activities in Figure 2-24.

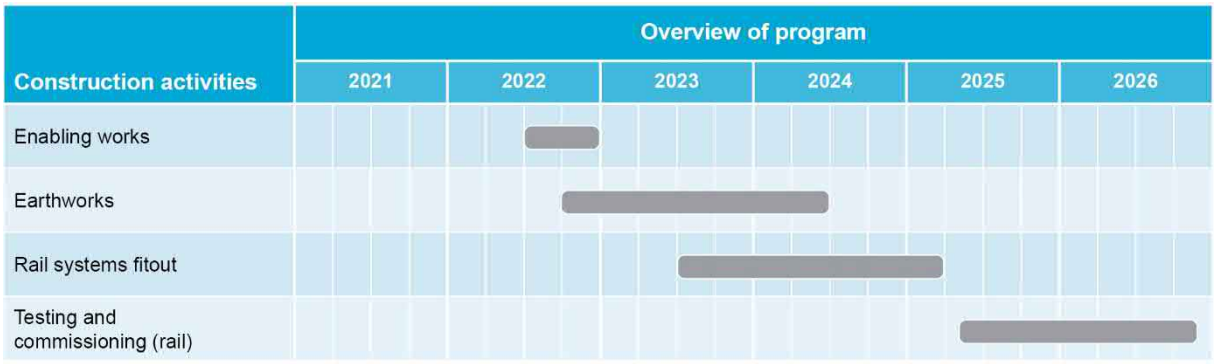
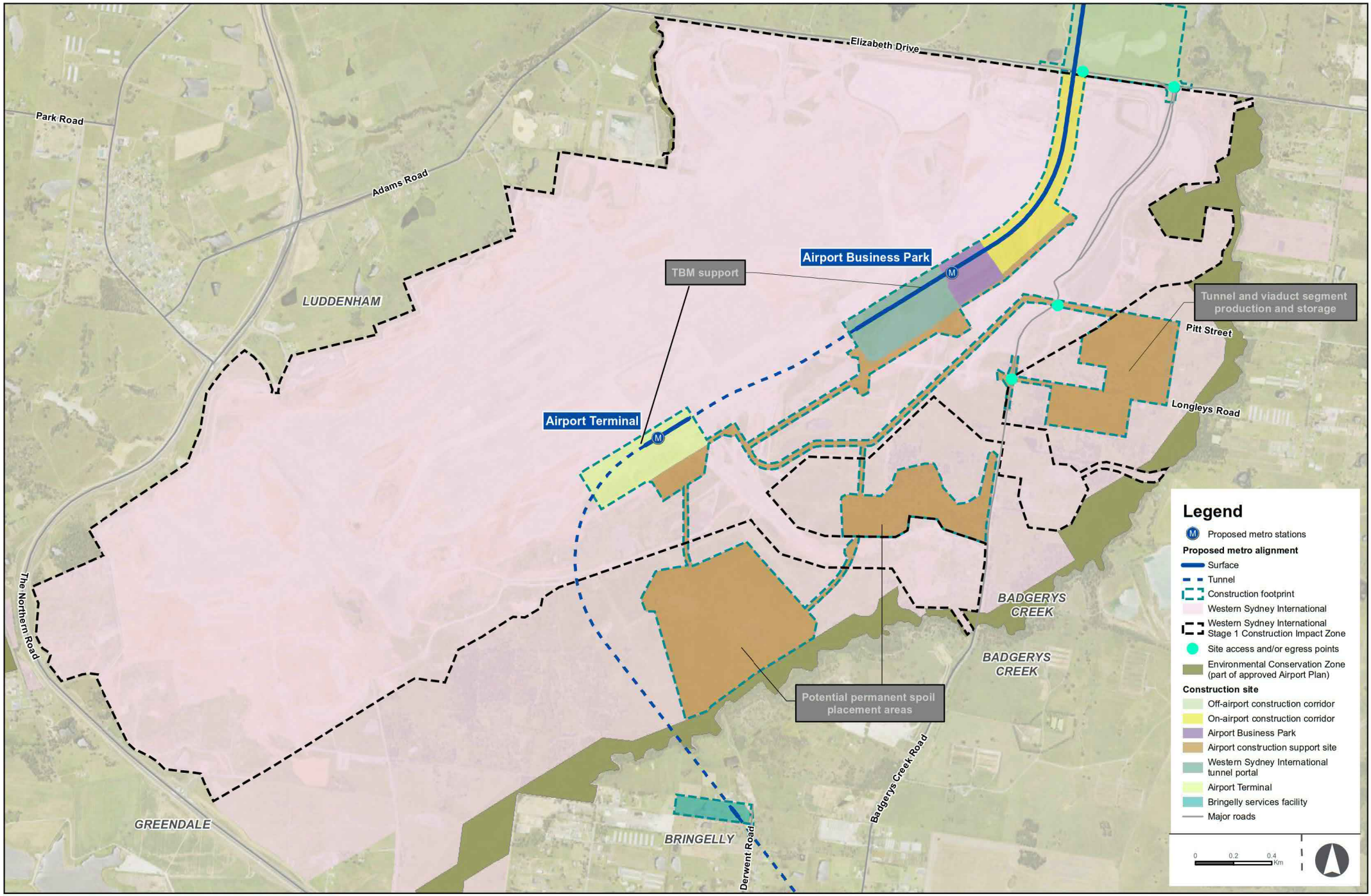


Figure 2-23 Indicative construction program for the on-airport construction corridor



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On-airport construction overview

Figure 2-24

2.7.8 Airport Business Park

The Airport Business Park construction site is located within the Western Sydney International Stage 1 Construction Impact Zone. The site would support the construction of the Airport Business Park Station. Key construction works would include:

- construction of the rail alignment including earthworks for the transition of the rail alignment from surface to in-cutting
- construction of an access road to the Airport Business Park Station from Badgerys Creek Road
- construction of the Airport Business Park Station structures, finishes and fitout.

The indicative construction program for the site is outlined in Figure 2-25. The location and an indicative layout of the construction site, including vehicle access/egress, is provided in Figure 2-26.

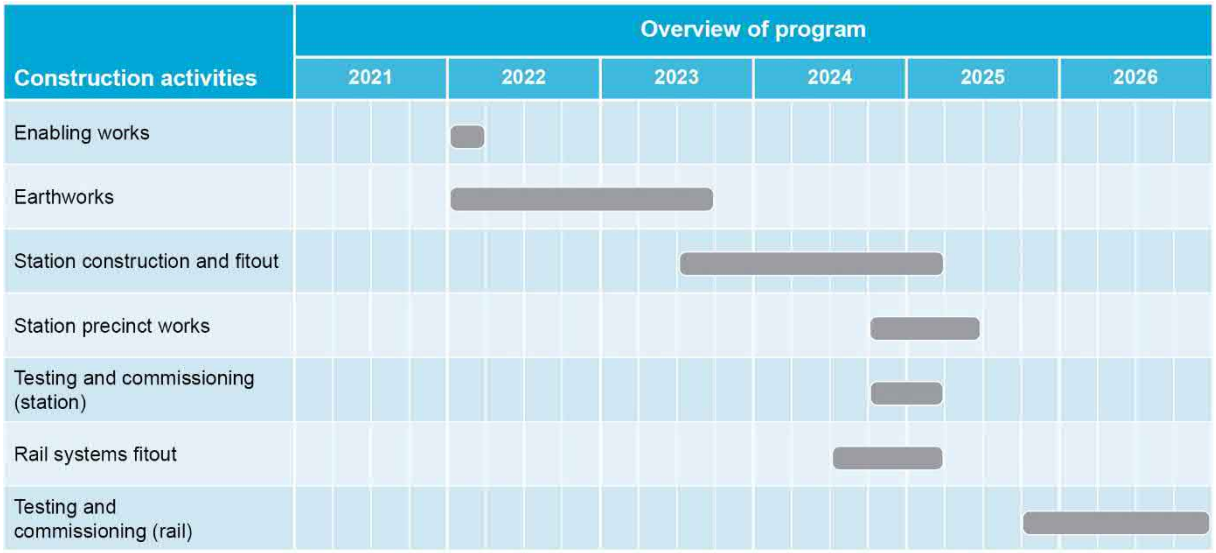
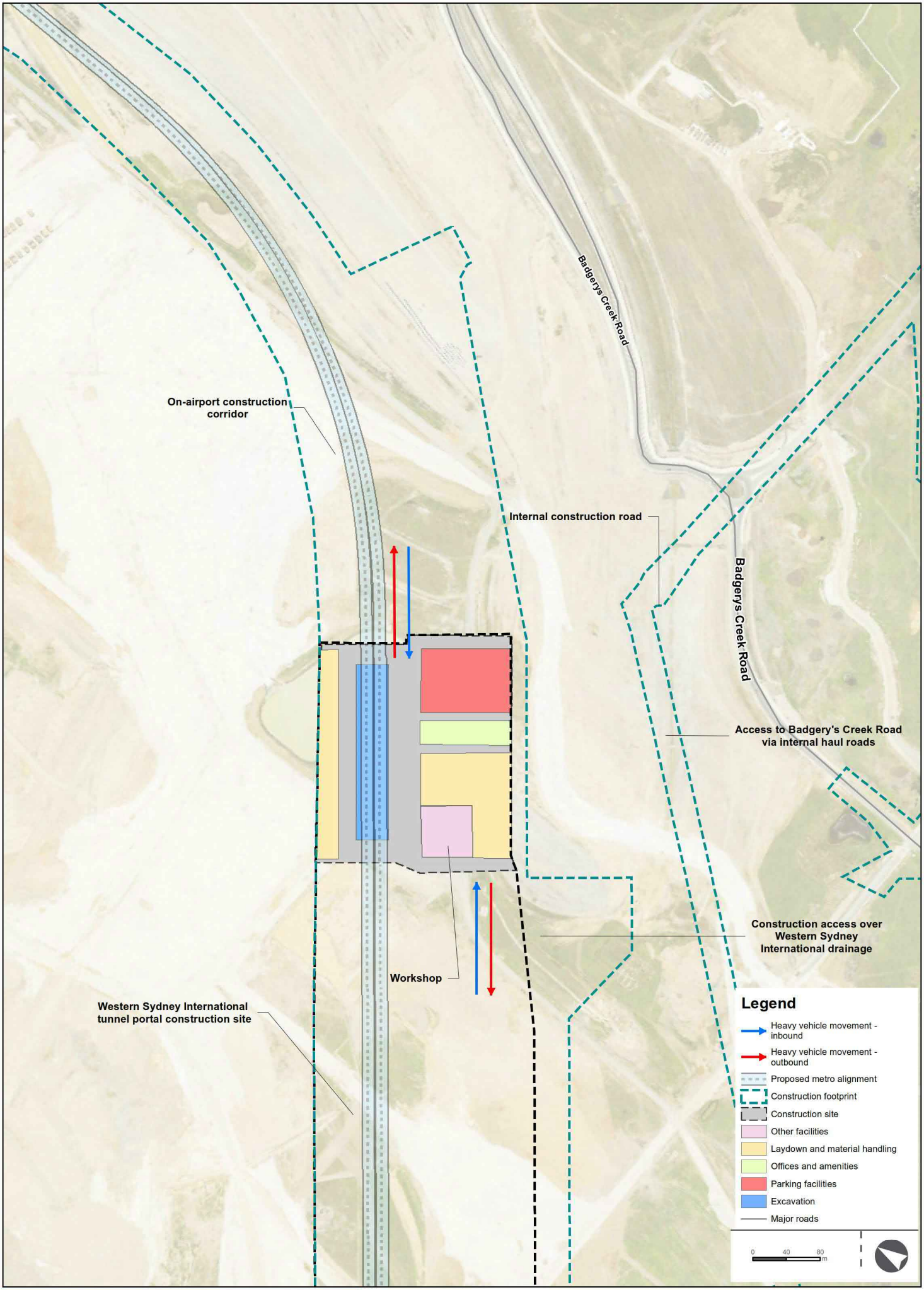


Figure 2-25 Indicative construction program for the Airport Business Park construction site



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Airport Business Park indicative construction site layout

Figure 2-26

Indicative only, subject to design development

2.7.9 Western Sydney International tunnel portal

The Western Sydney International tunnel portal construction site is located within the Western Sydney International Stage 1 Construction Impact Zone, southwest of the Airport Business Park construction site.

Key construction works would include:

- construction of the rail alignment including earthworks for the transition of the rail alignment from in-cutting to in-tunnel
- TBM launch
- TBM support including spoil handling
- construction of the tunnel portal
- finishing works.

The indicative construction program for the site is outlined in Figure 2-27. The location and an indicative layout of the construction site, including vehicle access/egress, is provided in Figure 2-28.

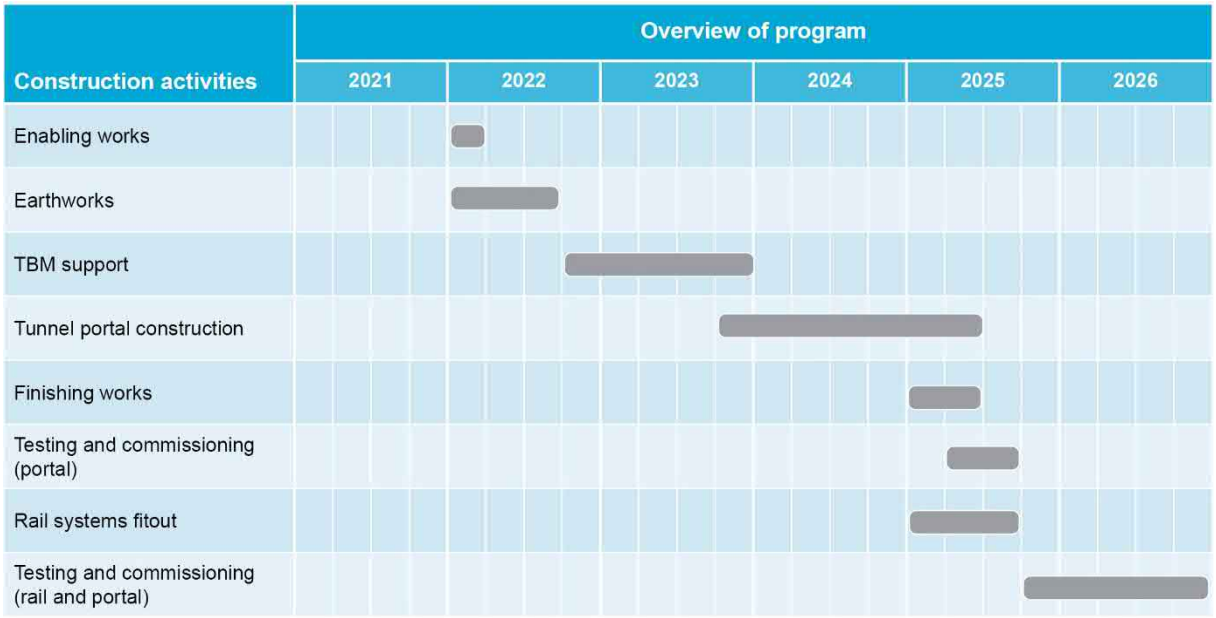
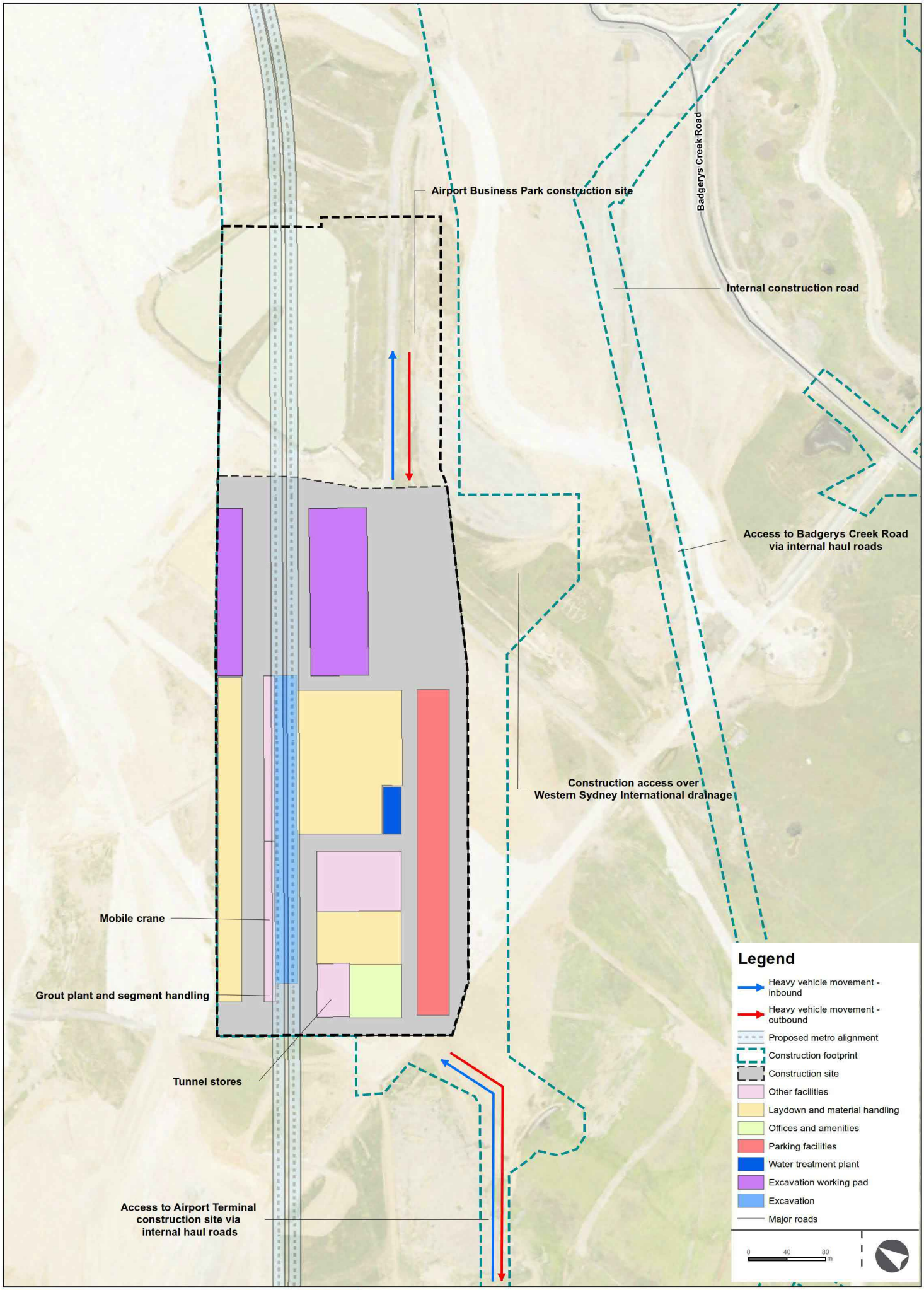


Figure 2-27 Indicative construction program for the Western Sydney International tunnel portal construction site



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Western Sydney International tunnel portal indicative construction site layout

Figure 2-28

Indicative only, subject to design development

2.7.10 Airport Terminal

The Airport Terminal construction site is located within the Western Sydney International Stage 1 Construction Impact Zone. The site would effectively be separated into two sites, one supporting the construction of the Airport Terminal Station and the other supporting tunnelling activities for the Western Sydney International to Bringelly tunnel. Key construction works would include:

- earthworks to accommodate the station and tunnelling activities
- TBM maintenance and relaunch
- TBM support including spoil handling
- construction of the Airport Terminal Station structures, finishes and fitout.

The indicative construction program for the site is outlined in Figure 2-29 and the location and an indicative layout of the construction site, including vehicle access/egress, is provided in Figure 2-30.

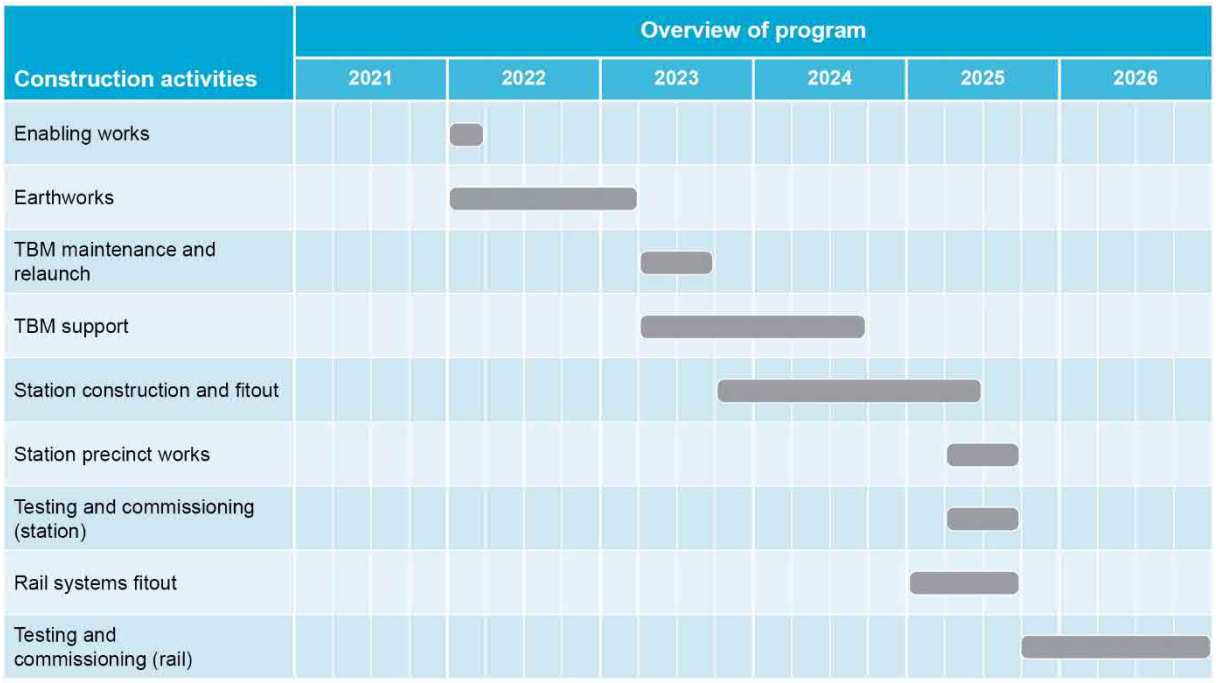
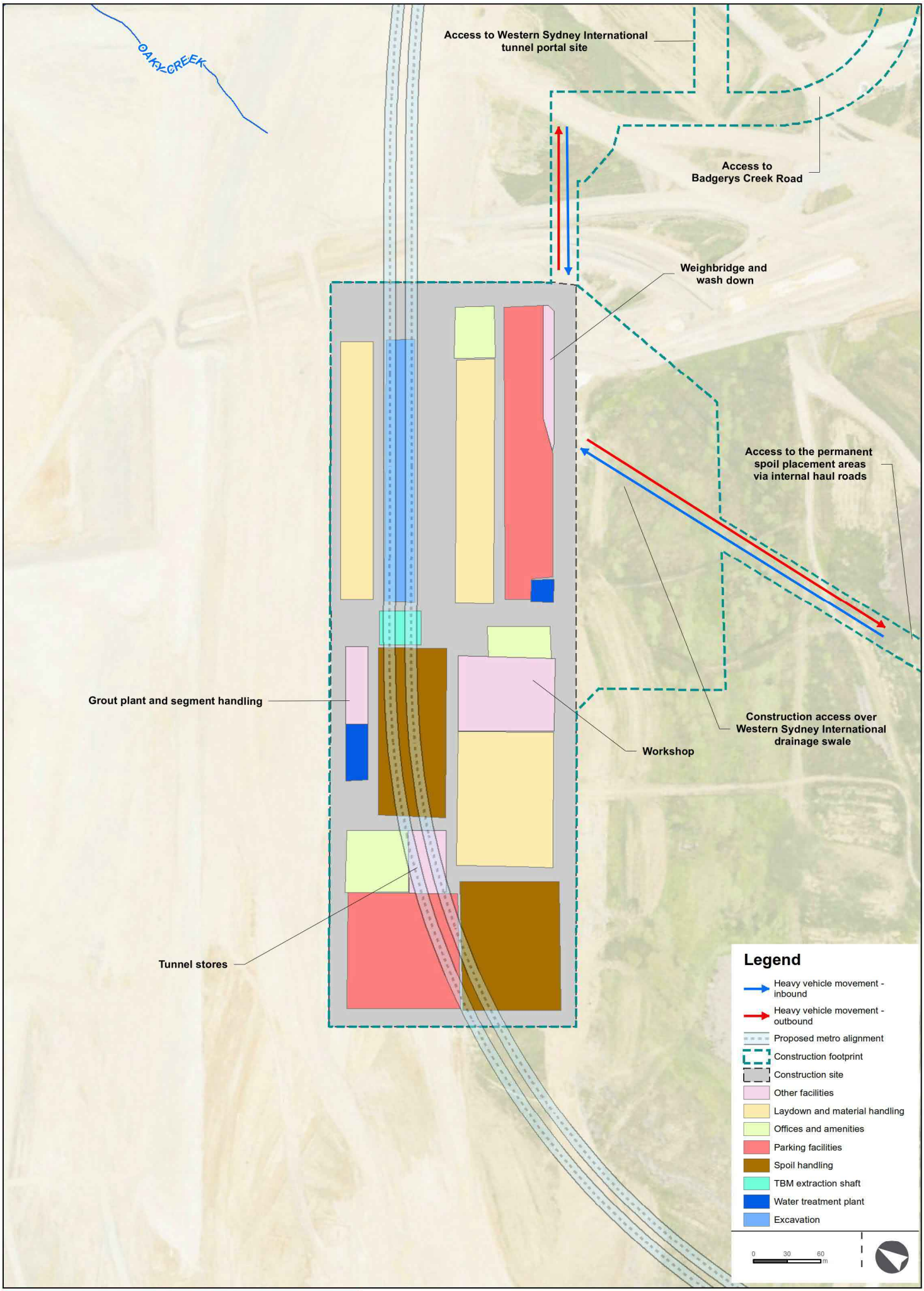


Figure 2-29 Indicative construction program for the Airport Terminal construction site



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Airport Terminal indicative construction site layout

Figure 2-30

Indicative only, subject to design development

2.7.11 Airport construction support site

The airport construction support site sits across both the Western Sydney International Stage 1 Construction Impact Zone and the area located outside of the Western Sydney International Stage 1 Construction Impact Zone (see Figure 2-24 for the boundary between these two areas). The airport construction support site comprises multiple ancillary areas where the key construction works would include:

- construction and use of haulage roads to support the construction of the project within Western Sydney International
- activities required for the production and storage of viaduct and tunnel segments, including concrete batching, site offices and construction worker car parking
- potential permanent placement of spoil.

The combination of sites would support construction activities at all on-airport construction sites as well as the production of viaduct and tunnel segments to be transported and used both on-airport and off-airport as appropriate.

The indicative construction program for the site is outlined in Figure 2-31. The location and an indicative layout of the tunnel and viaduct segment production and storage facility, including vehicle access/egress, is provided in Figure 2-32 with the remainder of this site shown in Figure 2-24.

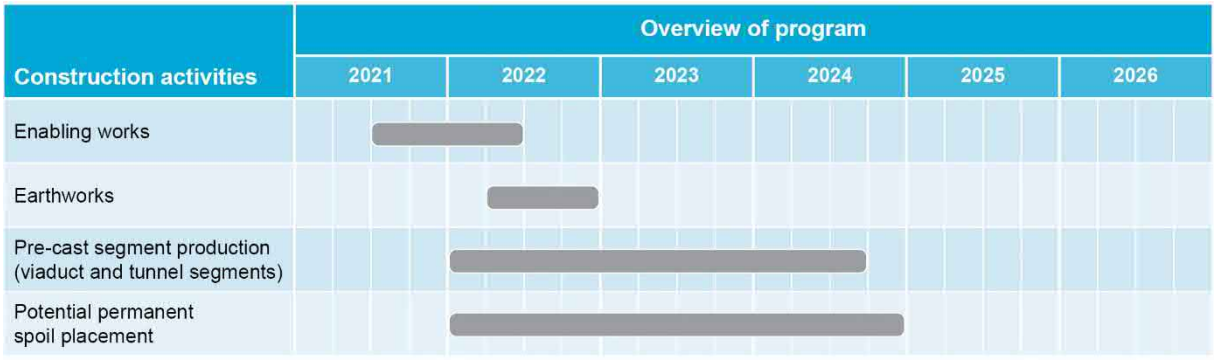
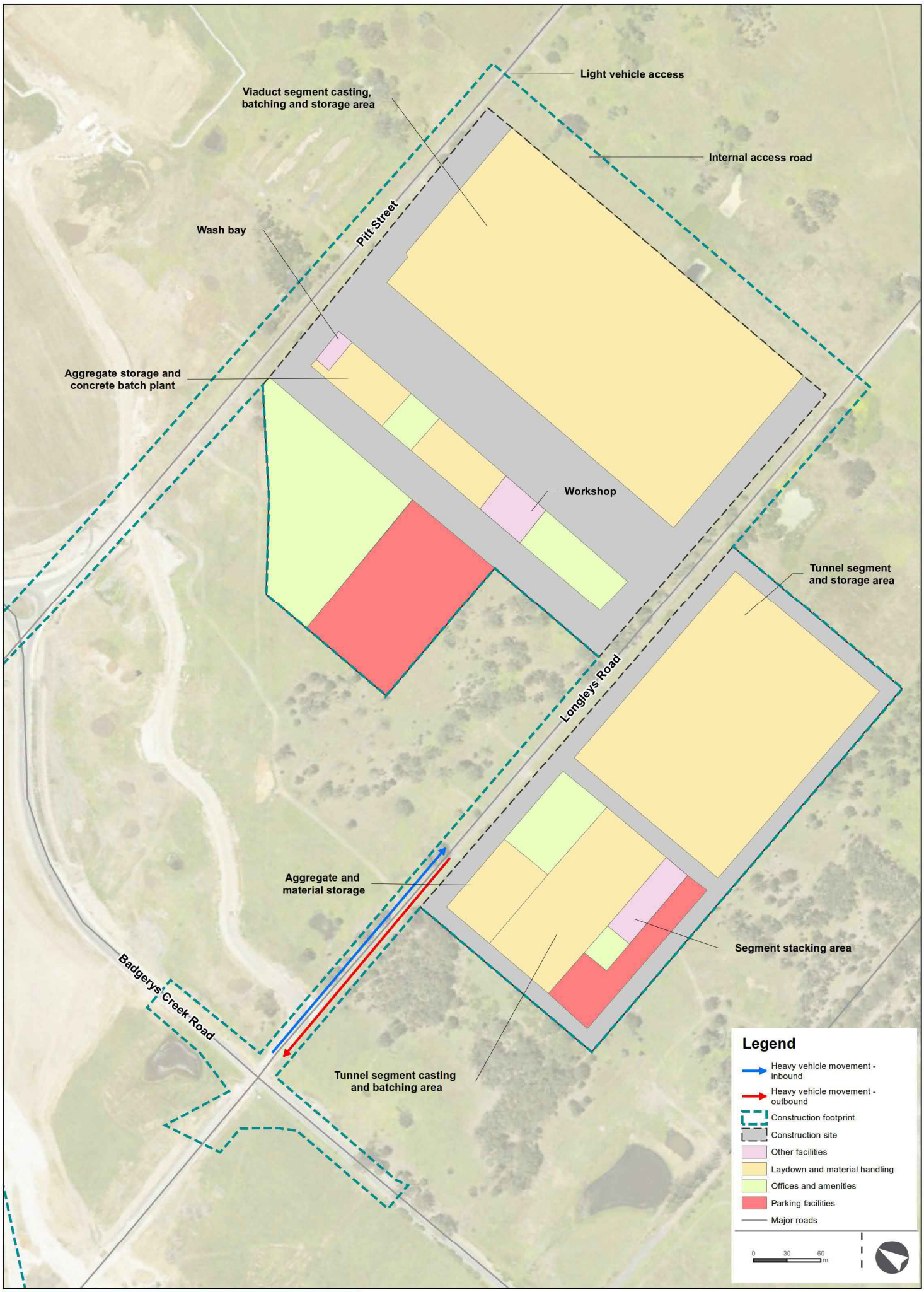


Figure 2-31 Indicative construction program for the airport construction support site



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Tunnel and viaduct segment production and storage indicative construction site layout

Figure 2-32

Indicative only, subject to design development

2.7.12 Bringelly services facility

The Bringelly services facility would be located at the northern end (western side) of Derwent Road at Bringelly. The existing site consists of a rural-residential property.

Key construction works would include:

- piling and pile capping
- shaft excavation
- spoil handling, storage and transport
- construction of above and below ground structures for the services facility
- TBM maintenance and relaunch
- services facility fitout
- rail and tunnel systems fitout.

The indicative construction program for the site is outlined in Figure 2-33. The location and an indicative layout of the construction site, including vehicle access/egress, is provided in Figure 2-34.

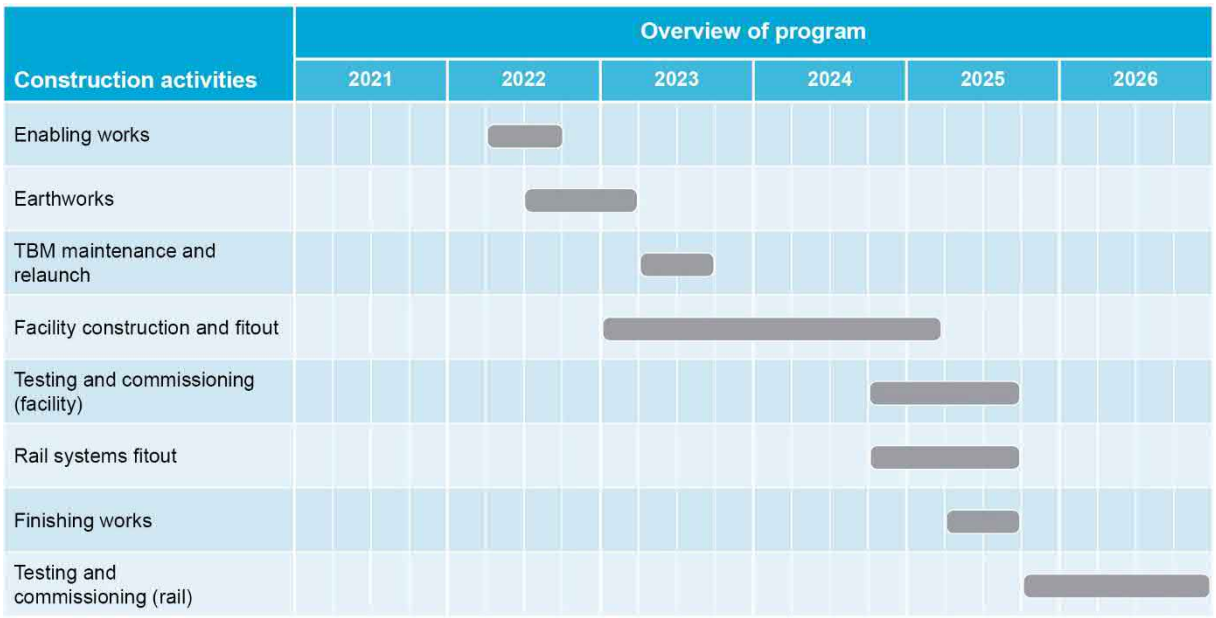
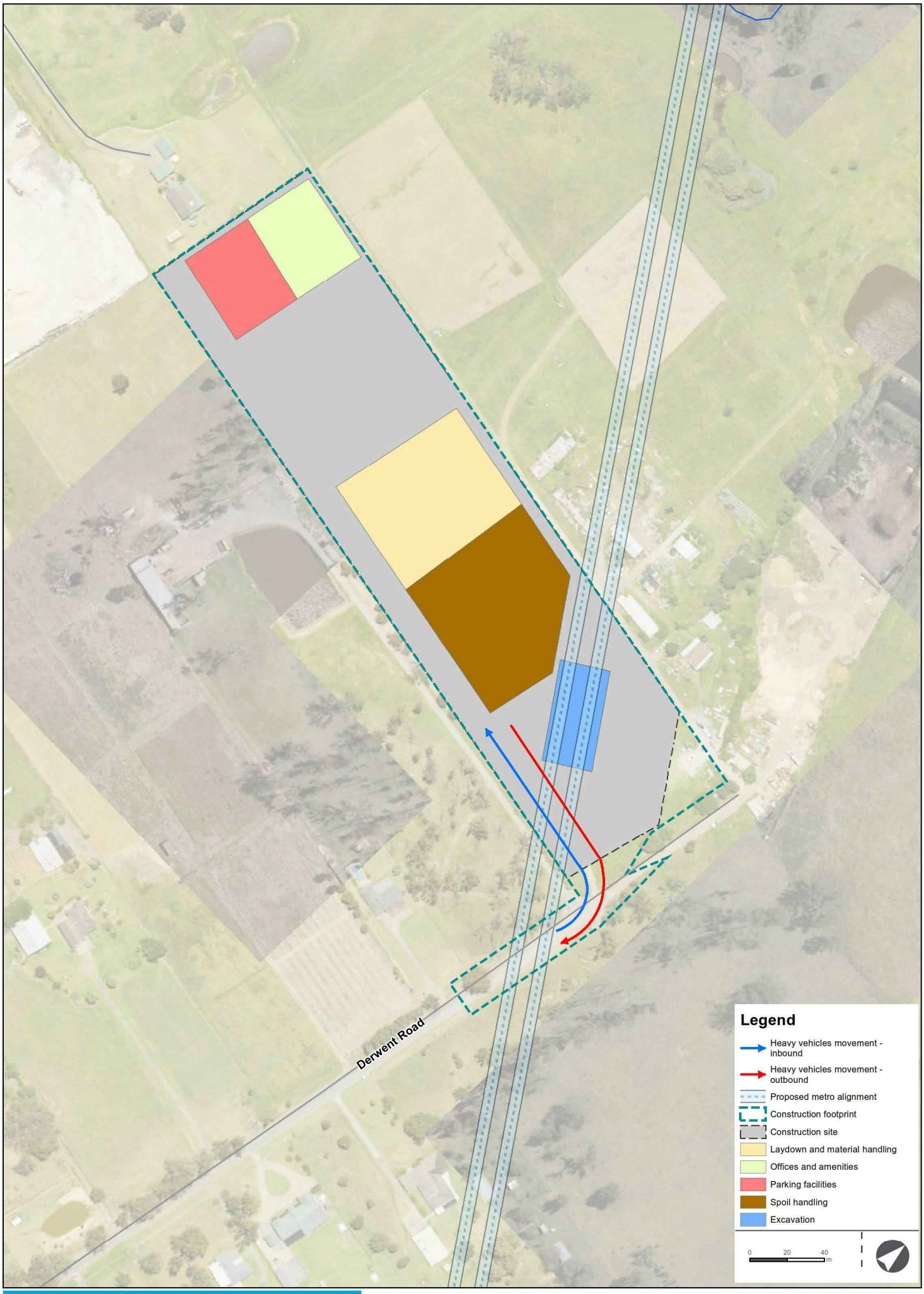


Figure 2-33 Indicative construction program for the Bringelly services facility construction site



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Bringelly services facility indicative construction site layout

Figure 2-34

Indicative only, subject to design development

2.7.13 Aerotropolis Core

The Aerotropolis Core construction site would be located to the east of Badgerys Creek Road. The existing site consists of partially cleared land.

A range of construction activities would be carried out at the site to support TBM retrieval, cut-and-cover station construction and mined excavation of the stub tunnel.

Key construction works at the site would include:

- construction of the new station box, station structures and finishes
- construction of the crossover
- construction of stub tunnels
- spoil handling, storage and transport
- temporary TBM retrieval shaft excavation
- TBM retrieval
- station precinct works.

The indicative construction program for the site is outlined in Figure 2-35. The location and an indicative layout of the construction site, including vehicle access/egress, is provided in Figure 2-36.

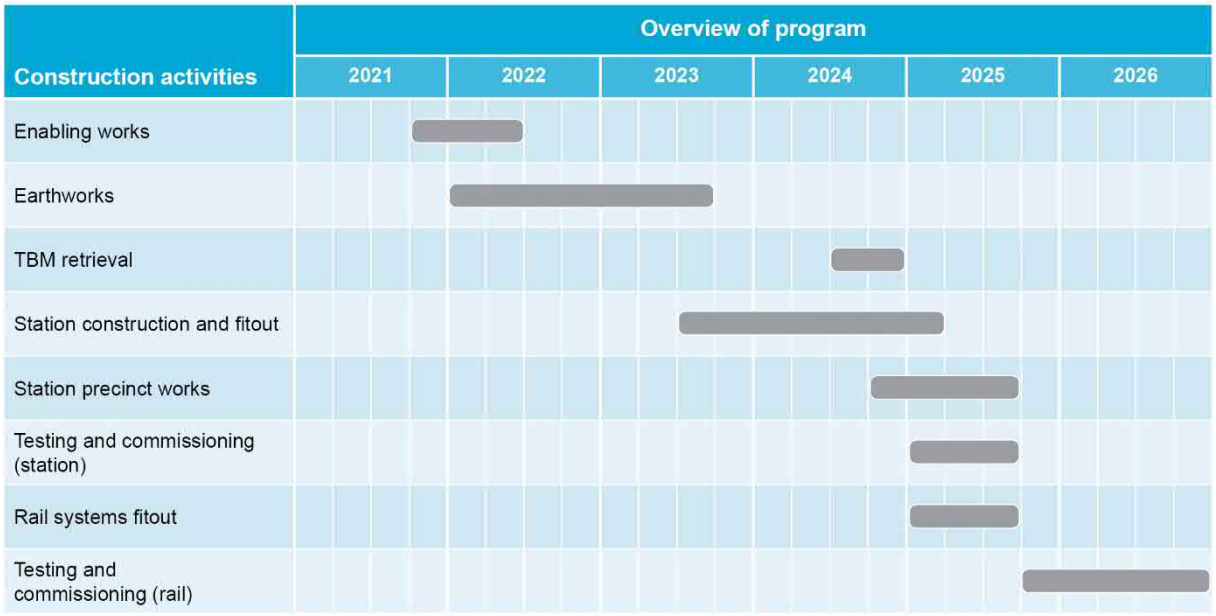
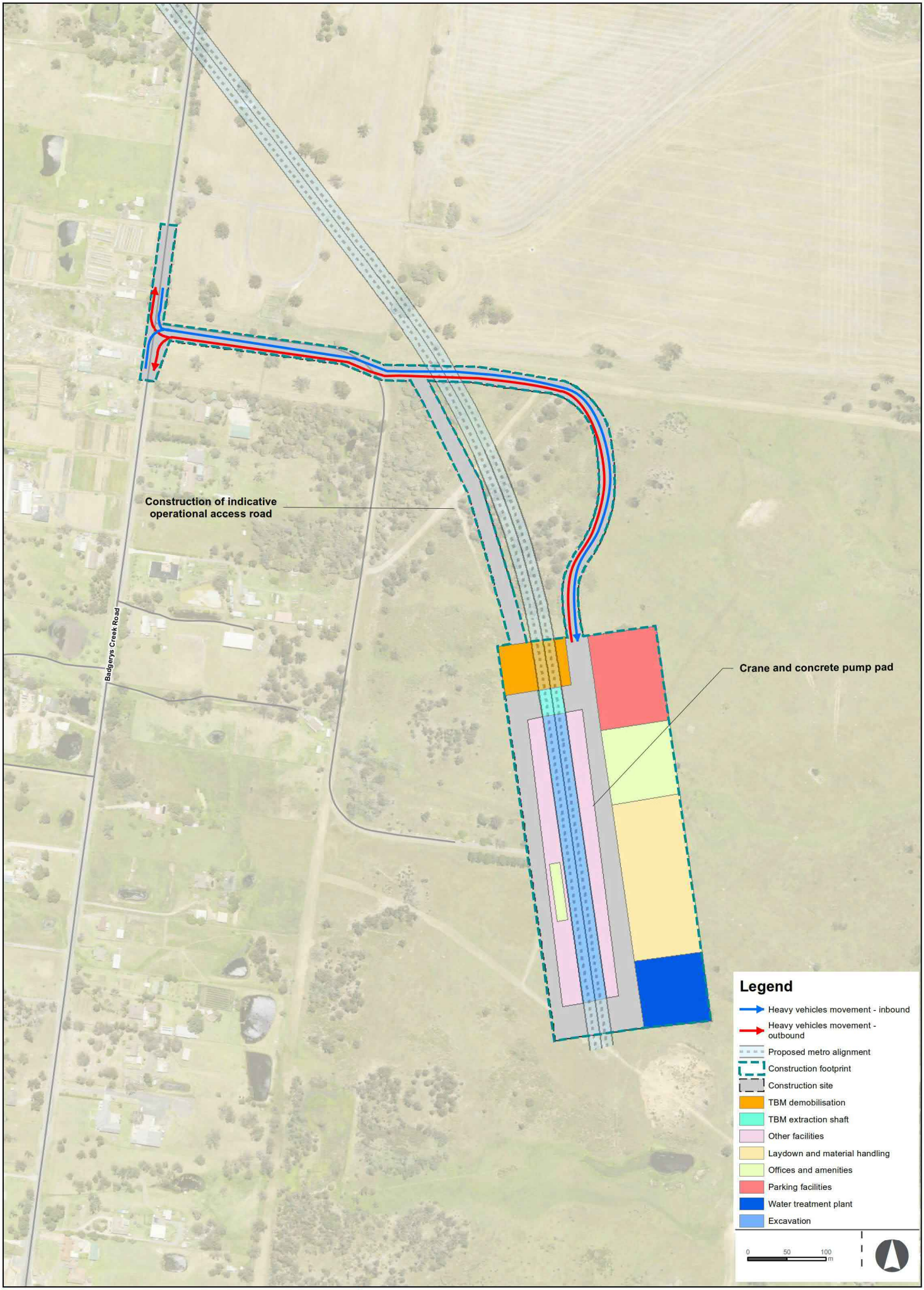


Figure 2-35 Indicative construction program for the Aerotropolis Core construction site



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Aerotropolis Core indicative construction site layout

Figure 2-36

Indicative only, subject to design development

2.8 Interface with other construction projects

Construction of the project is likely to coincide with the construction of other planned infrastructure projects in the region including the future M12 Motorway, Western Sydney International, The Northern Road, St Marys Intermodal and the St Marys Commuter Car Park Expansion. Construction activities for these projects are likely to be concurrent or consecutive and have activities located close to each other (for example construction vehicles and construction activities) at and around Elizabeth Drive.

Preliminary construction planning for the project has involved consultation with the respective proponents of other infrastructure projects, including Transport for NSW and Western Sydney Airport, to identify potential construction conflicts and where possible minimise cumulative construction impacts. This consultation and coordination of construction activities would be ongoing throughout the delivery of the project.

A brief description of the interfaces with nearby projects is provided below. Further detail of potential cumulative impacts associated with construction activities is provided in Chapter 24 (Cumulative impacts) of the Environmental Impact Statement.

2.8.1 Future M12 Motorway

Construction of the future M12 Motorway project is anticipated to commence in 2022, subject to approval. The key interface between the project and the future M12 Motorway is within the off-airport construction corridor, north of Elizabeth Drive.

A small portion of the off-airport corridor is located within the footprint of the future M12 Motorway where the project passes over the top of the M12 Motorway on a bridge. Given the construction footprint of the future M12 Motorway may form a barrier to north–south movements during its construction, project construction vehicles would access the off-airport corridor via Luddenham Road from the north and via Elizabeth Drive from the south.

North of Elizabeth Drive, project construction infrastructure and support sites would generally be located to the east of the project corridor to minimise conflict with the M12 Motorway construction footprint, which is located primarily to the west of the project corridor. A small portion of the construction footprint for the future M12 Motorway and the project would overlap around Elizabeth Drive. This includes construction and operation of two signalised intersections into Western Sydney International. The intersections would include provision for future connections to potential developments to the north of Western Sydney International.

It is anticipated that during the construction of the project there would be concurrent construction activities occurring for the future M12 Motorway in this location. Construction activities, including construction traffic management and environmental management requirements in this location would be coordinated as part of ongoing consultation during the delivery of the project. Ongoing consultation with the M12 Motorway project team is occurring to manage and coordinate sequencing of construction activities.

2.8.2 Western Sydney International Stage 1 project

Detail regarding the context of the project within and outside of the Western Sydney International Stage 1 project is provided in Chapter 3 (Project location and setting) of the Environmental Impact Statement. Construction of the project within the Western Sydney International Stage 1 Construction Impact Zone is likely to begin on a cleared and level site.

Ongoing consultation with Western Sydney Airport has ensured the design of temporary project infrastructure also considers the temporary infrastructure required for construction of the Western Sydney International Stage 1 project. In addition, construction planning for on-airport project elements have taken into consideration the Western Sydney Airport Construction Plan.

Construction activities and infrastructure for the project that would occur outside the Western Sydney International Stage 1 Construction Impact Zone (wholly or partially) would include:

- activities required for viaduct segment and tunnel segment manufacture and storage, located within the airport construction support site
- potential permanent spoil placement

- upgrade at the intersection of Longleys Road and Badgerys Creek Road
- temporary haulage roads
- temporary power supply and other utilities to support construction
- site offices and construction worker car parking, located within the airport construction support site.

See Figure 2-24 for further information.

A number of internal roads are being delivered in this area as part of the Western Sydney International project. Internal vehicle access arrangements for the project have been developed to utilise these roads where possible. Temporary haulage roads for the project would be constructed to connect the Western Sydney International internal roads to construction infrastructure for the project.

Construction planning for the project has considered the initial design of the intersection (roundabout) with Elizabeth Drive and the realigned Badgerys Creek Road and would deliver an additional northbound exit for the intersection to facilitate construction vehicle access to the off-airport construction corridor as well as a separate new access to the west to access the on-airport construction corridor.

There would be continued consultation between Sydney Metro and Western Sydney Airport as part of the ongoing development of the construction approach for the two projects. Opportunities for the construction of the project to integrate with construction activities for Western Sydney International would be developed as the project design and construction planning is refined.

2.8.3 The Northern Road

Transport for NSW has commenced the upgrade of 35 kilometres of The Northern Road between Mersey Road, Bringelly and Glenmore Parkway, Glenmore Park. The Northern Road project, once completed, will run in a north–south direction to the west of the project including immediately adjacent to Western Sydney International. The upgrade is being delivered in six stages. All stages are expected to be operational by 2021, except Stage 5 (Littlefields Road, Luddenham to Glenmore Parkway, Glenmore Park) which is expected to be operational in 2022. Stage 1 between Narellan and Oran Park has been completed. Therefore, concurrent construction with Stage 5 is possible which would include potential shared construction traffic routes.

Ongoing consultation with Transport for NSW is occurring to manage and coordinate sequencing of construction activities.

2.8.4 St Marys Intermodal

Pacific National is proposing the staged construction and operation of an intermodal terminal (road and rail) and container park adjacent to the T1 Western line and to the west of St Marys Station. The facility will facilitate the introduction of a new container rail shuttle service between Port Botany and greater western Sydney, increasing the volume of import and export freight moved via rail.

The project received NSW State significant development approval in May 2020. Construction of the project is expected to be completed during 2021. There is potential for some shared use of traffic routes during construction of the project and also construction and operation of the Intermodal project.

Ongoing consultation with Pacific National is occurring to manage and coordinate sequencing of construction activities.

2.8.5 St Marys Commuter Car Park Expansion

Transport for NSW is adding two levels to the existing multi-storey commuter car park north of St Marys Station at the corner of Forrester Road and Harris Street to provide around 250 new off-street commuter car parking spaces.

The *St Marys Commuter Car Park Expansion Review of Environmental Factors* (Transport for NSW, 2020) was determined in February 2021. Work on this project is expected to commence in 2021 and take around 12 months to complete. Therefore, construction of the St Marys Commuter Car Park Expansion may overlap with construction of the project at St Marys for a period of around nine months.

Ongoing consultation with Transport for NSW and Penrith City Council is occurring to manage car parking impacts during construction activities.

2.9 Other construction elements

2.9.1 Detailed investigations and subsequent works

Detailed investigations would be required before the start of main construction works. Detailed investigations that would be carried out as enabling works would include:

- site surveys
- utility investigations
- geotechnical investigations including groundwater monitoring
- contamination investigations and subsequent remediation works (if required)
- heritage investigations and subsequent protection, recording and salvage and clearance works (if required).

2.9.2 Demolition works

The project would require the demolition of some buildings and structures, which would be confirmed by the construction contractor(s) when appointed. A summary of the indicative demolition works required for the project is provided in Table 2-4.

Table 2-4 Indicative demolition works

Location	Demolition required
St Marys	Demolition of the Station Plaza site between Station and Phillip streets and the St Marys Bus Layover on Station Street.
Orchard Hills	Demolition of residential structures and all sheds and other structures at properties within the Orchard Hills construction footprint on Kent Road and Lansdowne Road.
Orchard Hills to Badgerys Creek	Demolition of residential structures, sheds and other structures at properties within the off-airport construction corridor as well as the stabling and maintenance facility and Luddenham Road construction sites.
Bringelly	Demolition of ex-Defence force structures within the Aerotropolis Core construction site.

Demolition works would be carried out by licensed contractors. Typically, demolition would involve:

- demolition of the building using an excavator, bobcat, cranes or other conventional methods
- temporary propping and/or waterproofing provided for structural integrity of adjacent structures.

A hazardous materials analysis would be carried out before soft stripping and demolition of the main structures. Hazardous materials would be removed and disposed of in accordance with the relevant legislation, codes of practice and Australian Standards.

Materials such as bricks, tiles, timber, plastics and metals would be sorted where practicable and sent to a waste facility with recycling capabilities.

In addition, a pre-clearing process (including pre-clearing survey for fauna) for biodiversity related impacts and adequate protection for heritage items and Aboriginal heritage test excavation investigations (where required) in the vicinity of project works to prevent inadvertent damage would be undertaken prior to demolition works.

2.9.3 Vegetation clearing

For the purposes of this Environmental Impact Statement it has been assumed that all vegetation within the construction footprint would be removed. This assumption ensures the assessment of impacts to vegetation is representative of a worst case scenario. However, there may be opportunities to retain some vegetation within parts of the construction footprint and this would be confirmed by the

construction contractor(s) when appointed. Where the project construction footprint is within the Western Sydney International Stage 1 Construction Impact Zone it is assumed that all vegetation has already been cleared as part of that project.

2.9.4 Spoil

Indicative cut and fill volumes along the alignment are summarised in Table 2-5. The volumes include earthworks required to achieve required ground surface levels for surface (shallow cut and embankment) and in-cutting sections as well as the construction of bored tunnels and the excavation of station boxes.

Table 2-5 Indicative cut and fill volumes

Off-airport location	Cut volume (m^3)	Fill volume (m^3)
St Marys (station and tunnel stubs)	510,000	15,000
Claremont Meadows services facility	85,000	20,000
Orchard Hills (including St Marys to Orchard Hills tunnel)	715,000	25,000
Off-airport construction corridor from Orchard Hills to Patons Lane	240,000	275,000
Stabling and maintenance facility	705,000	1,295,000
Off-airport construction corridor from Patons Lane to Elizabeth Drive	240,000	330,000
Bringelly services facility	80,000	20,000
Aerotropolis Core (station and tunnel stubs)	355,000	65,000
Total off-airport	**2,930,000**	**2,045,000**
Balance off-airport	**885,000 surplus (m^3)**	
On-airport location		
Western Sydney International - Elizabeth Drive to Airport Business Park	130,000	75,000
Airport Business Park	25,000	15,000
Airport construction support site	65,000	65,000
Airport Business Park to Aerotropolis Core (including Airport Terminal and Western Sydney International to Bringelly tunnel)	1,065,000	75,000
Total on-airport	**1,285,000**	**230,000**
Balance on-airport	**1,055,000 surplus**	
Total balance (on- and off-airport)	**1,940,000 surplus (m^3)**	

The estimates are based on the assumption that cut material can be used as fill for the project, which may not be the case if unsuitable material is encountered during earthworks. Fill volumes do not include reuse opportunities beyond the project which would reduce surplus volumes. Spoil volumes would be confirmed by the construction contractor(s) when appointed.

An opportunity has been identified to reuse material from the project as fill material for future development at Western Sydney International. Subject to relevant approvals and agreement with Western Sydney Airport, spoil from both on-airport and off-airport could be placed at permanent spoil placement areas. The permanent spoil placement areas form part of the airport construction support site (see Section 2.7.11 and Figure 2-24) and will be accessed from the proposed construction haul road network within the airport site. Up to 1.9 million cubic metres of spoil could be permanently placed on-airport. The exact location for placement of the spoil would be confirmed during design

development in consultation with Western Sydney Airport. The areas for the placement of spoil would be outside the Environmental Conservation Zone along Badgerys Creek.

The reuse of spoil at these locations would reduce potential impacts that would otherwise be associated with the movement of this spoil to other reuse locations via the public road network. Reuse of spoil within Western Sydney International would be undertaken in accordance with the Airport Plan, Construction (Rail) Plan and any relevant CEMPs.

Other opportunities to reuse spoil would also continue to be investigated as the project design progresses. This could involve the use of spoil as fill material elsewhere within the project footprint such as at the stabling and maintenance facility or possibly by other projects in the area, such as the future M12 Motorway project.

Temporary stockpiling sites would be established as required throughout the construction footprint. Stockpiling sites would be established at the Orchard Hills construction site to stockpile material excavated from the St Marys to Orchard Hills tunnel as well as other sources of excavated material from the project.

Spoil removal from construction sites would be via trucks on the road network. Refer to Chapter 9 (Transport) of the Environmental Impact Statement for details on haulage routes and Chapter 18 (Resource management) of the Environmental Impact Statement for further information regarding spoil management.

2.9.5 Construction hours

The majority of the station fitout and other above ground construction activities would be carried out during standard construction hours, as defined by the *Interim Construction Noise Guideline*:

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

Activities resulting in impulsive or tonal noise emissions would be limited to these hours, except as permitted by an environment protection licence and the planning approval issued by the Minister for Planning and Public Spaces.

Activities that may be carried out outside the standard construction hours include:

- utility works
- tunnelling works and other underground works
- works within an acoustic shed
- tunnel fit-out and associated works
- construction during road and rail possessions
- spoil haulage, deliveries and TBM activities at St Marys, Orchard Hills, Western Sydney International tunnel portal, Airport Terminal and Aerotropolis Core
- spoil haulage associated with placement of material at the potential permanent spoil placement areas within the airport construction support site
- activities at the tunnel and viaduct segment production and storage facility within the airport construction support site, including transport of material to support segment production and segment deliveries
- work determined to comply with the relevant noise management level (NML) at the nearest sensitive receiver
- works on major roads in accordance with a Road Occupancy Licence
- the delivery of oversized materials or materials outside approved hours as required by the NSW Police or other authorities (including Transport for NSW) for safety reasons

- emergency situations where it is required to avoid the loss of lives and property and/or to prevent environmental harm
- testing and commissioning
- situations where agreement is reached with affected receivers.

With the exception of emergencies and subject to the terms of the planning approval and any environment protection licence, activities would not take place outside standard construction hours without prior notification of the affected community and the NSW Environmental Protection Authority as required.

Out-of-hours work

The approach to out-of-hours work would be in accordance with an Out-of-Hours Work Protocol to guide the assessment, management, and approval of works outside the recommended standard construction work hours. The protocol would ensure that out-of-hours works are managed effectively during construction, to reduce incidents and minimise impacts on the community.

The protocol would:

- be consistent with the Construction Noise and Vibration Standard (Appendix F)
- address the requirements of any environment protection licence for the project
- provide guidance for the preparation of out-of-hours work plans in consultation with key stakeholders and the community
- document procedures to control potential impacts
- identify responsibilities for implementation and management including managing complaints.

In relation to on-airport out-of-hours work, this would be undertaken in accordance with the existing Western Sydney Airport out-of-hours works procedure.

2.9.6 Construction workforce

Overall, the project is anticipated to support around 14,000 jobs. The peak anticipated construction workforce is shown in Figure 2-37. It is estimated that during peak construction activity a workforce of up to around 3,000 people would be required.

Sydney Metro has developed a Workforce Development and Industry Participation Plan including an Aboriginal Participation Plan which includes objectives to support jobs and skills for a more diverse and inclusive workforce and supply chain.

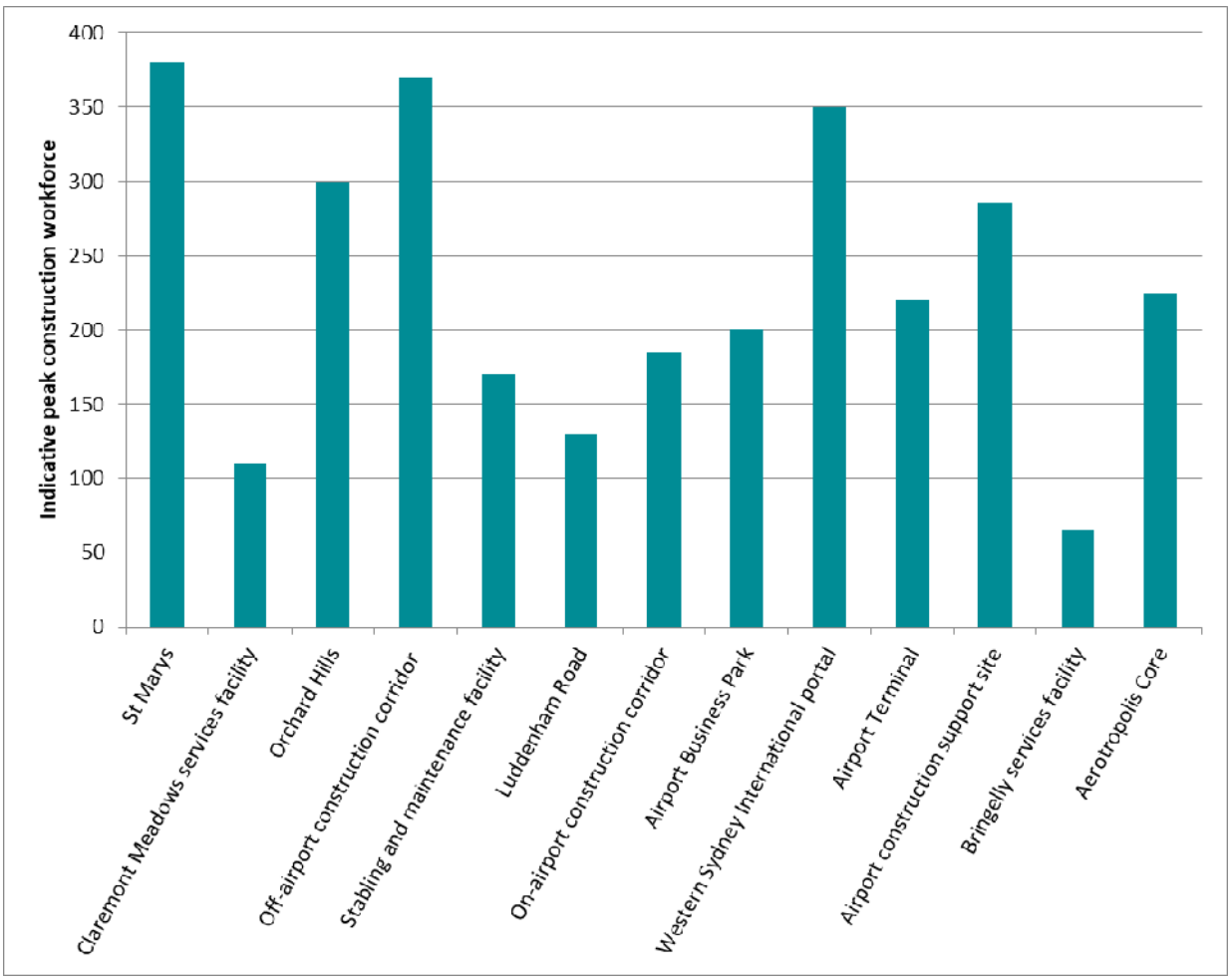


Figure 2-37 Indicative peak construction workforce at each construction site

2.9.7 Construction traffic and access

Temporary access and egress at construction sites

The proposed indicative access to the construction sites are shown in the site layout figures presented in Section 2.7. The indicative temporary access and egress to constructions sites would be subject to confirmation by the construction contractor(s) through the Construction Traffic Management Plans which would be prepared in accordance with the Construction Traffic Management Framework (refer Appendix G of the Environmental Impact Statement). Further information relating to construction traffic impacts and mitigation is provided in Chapter 9 (Transport) of the Environmental Impact Statement and Chapter 7 (Revised performance outcomes and mitigation measures).

Temporary road network adjustments and parking modifications

Temporary road network adjustments would include road modifications and traffic signal works to facilitate the movement of construction vehicles and measures to ensure the ongoing function and safety of existing transport networks. The modifications are subject to further design development and construction planning and would also be reviewed and confirmed by the construction contractor(s) during the preparation of Construction Traffic Management Plans, with the objective of minimising disruptions to the road network. Construction Traffic Management Plans would be prepared in accordance with the Construction Traffic Management Framework (refer Appendix G of the Environmental Impact Statement).

All temporary road network and parking modifications would be carried out to ensure access to private property is maintained, where possible.

Given the proposed infrastructure required to support the Western Parkland City, other transport network adjustments may be undertaken by other agencies such as Transport for NSW (subject to separate assessment and approvals) within the project area that would support the delivery of the project.

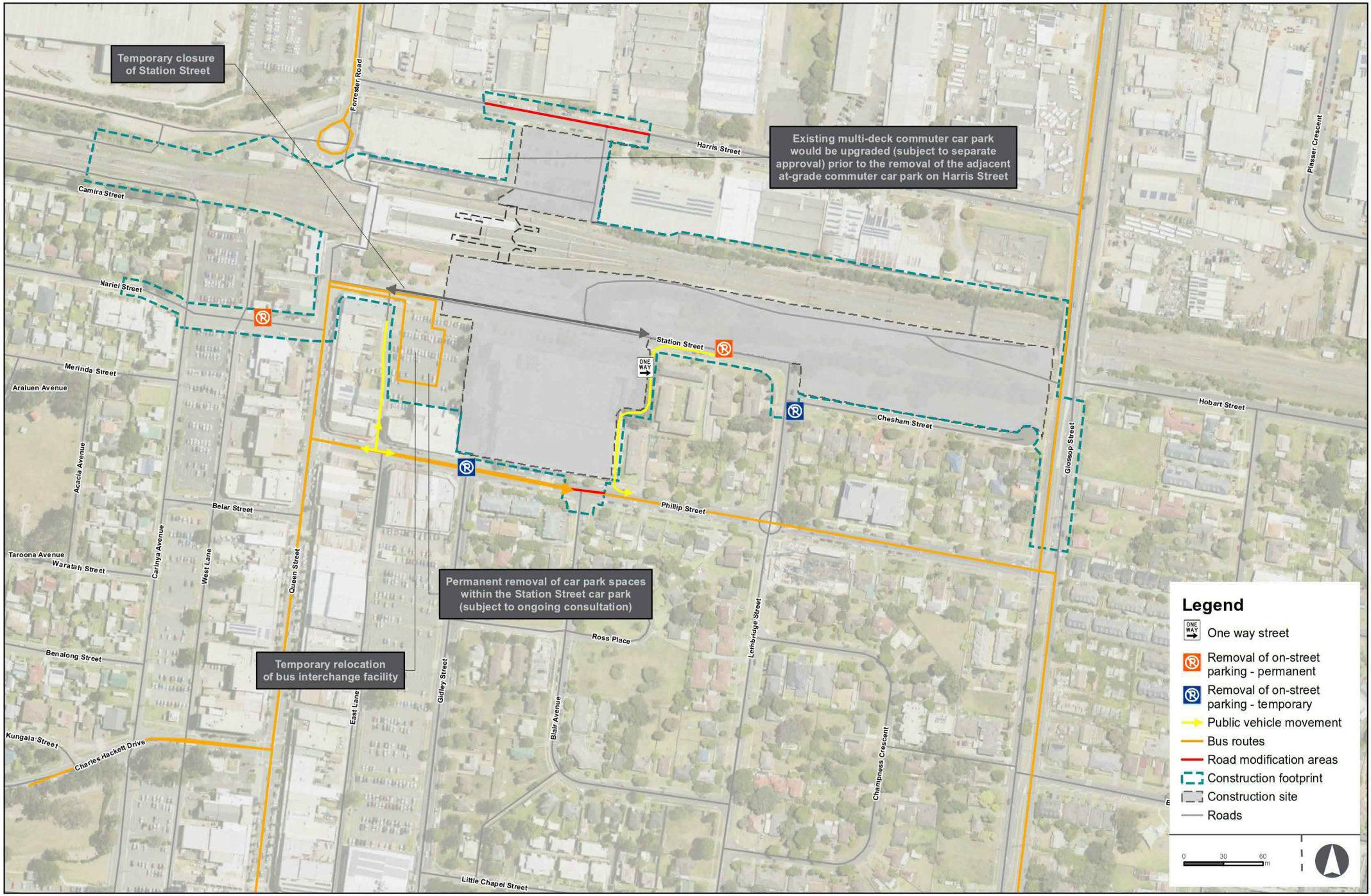
Measures to manage potential traffic impacts associated with temporary network and parking modifications are described in Chapter 7 (Revised performance outcomes and mitigation measures).

Table 2-6 Indicative road network adjustments and parking modifications

Location	Indicative road network adjustments and parking modifications
Off-airport	
St Marys	• minor temporary localised modifications to Harris Street to facilitate access for construction vehicles entering and exiting the Harris Street construction site • temporary closure of Station Street from around the eastern side of the Station Plaza site in the east and East Lane in the west. A one-way arrangement would be introduced to provide access for local through traffic (including for residents) westbound from Lethbridge Street along Station Street and southbound to Phillip Street via the eastern boundary of the construction site • temporary modifications to Phillip Street to facilitate egress for construction vehicles opposite Blair Avenue • adjustments to kerb and gutter, line marking and street furniture at Queen Street for the temporary adjustment/relocation of bus services (routes and stops) • adjustments to kerb and gutter, line marking and street furniture at West Lane and Nariel Street for the relocation of the kiss and ride facilities • permanent removal of the at-grade commuter car park on Harris Street (around 120 to 130 car park spaces). This car park would be retained during the start of construction and would be permanently closed when the extension of the existing multi-deck St Marys Commuter Car Park (subject to separate approval) is completed • relocation of the kiss and ride facilities to Nariel Street during construction. The point to point facilities (including taxis) would be relocated to the northern end of Queen Street adjacent to St Marys Station during construction • temporary removal of on-street car parking on Lethbridge Street (around 16 car park spaces) • temporary removal of on-street car parking on Phillip Street (around 27 car park spaces) to facilitate bus routes to the temporary bus interchange at the Station Street car park • permanent removal of all on-street car parking on Station Street (around 41 car park spaces) • removal of around 125 to 140 car park spaces within the Station Street car park. Once the temporary bus interchange is operational, the number of car park spaces to be retained on the Station Street car park site would be confirmed during design development and in consultation with Council • permanent removal of on-street parking on Nariel Street (around 10 car park spaces) to accommodate kiss and ride facilities. Changes to the road network and parking at St Marys are shown on Figure 2-38. At St Marys, works to extend the existing multi-deck St Marys Commuter Car Park are proposed (subject to separate approval) and would be completed prior to the occupation of the at-grade commuter car park on Harris Street for the purposes of construction of the project. Commuter parking spaces removed by the project during construction would be accommodated nearby in conjunction with the extension of the multi-deck commuter car park.

Location	Indicative road network adjustments and parking modifications
	Some construction vehicles may need to temporarily use Lethbridge Street to access Phillip Street until heavy vehicle routes have been established within the construction footprint.
Claremont Meadows construction power route	• trenching works for the construction power connection (see Section 2.9.10), may result in short term (around four weeks) lane reduction/closure or temporary road closures and local diversions of: - Sunflower Drive - Gagoor Close - Nullaga Way - Pearra Way - Geewan Place - Myrtle Road - San Diego Street - Gipps Street - intersection of Gipps Street and Sunflower Drive/Fowler Street/Caddens Road - Kent Road. • construction of slip lanes on the southbound carriageway of Kent Road to facilitate access to the area between Caddens Road and the M4 Western Motorway for underboring work for the construction power connection.
Orchard Hills	• upgrade and widening of Kent Road between the M4 Western Motorway and Lansdowne Road • upgrade of the Kent Road/Lansdowne Road intersection to allow for heavy vehicle movements • temporary diversion of Lansdowne Road for the construction of the road over rail bridge.
Permanent power supply route	• trenching works for the permanent power connection, may result in short term (around four weeks) traffic changes on: - John Morphett Place - Lenore Drive - Erskine Park Road - Mamre Road - Mandalong Close - Patons Lane.
Off-airport construction corridor	• upgrade and implementation of temporary one-way traffic control and diversions of Patons Lane to maintain access to the nearby waste management facility while utilising this road for construction site access • localised upgrades of the intersection of Luddenham Road and Patons Lane at Orchard Hills to support access to the construction corridor • construction of a new northbound exit for the Elizabeth Drive/Badgerys Creek Road intersection (roundabout or other agreed treatment). Construction planning for the project has considered the initial design of the intersection and would deliver an additional northbound exit for the intersection to facilitate construction vehicle access to the off-airport construction corridor • implementation of temporary traffic control during construction of a viaduct over Luddenham Road.
Luddenham Road	• localised upgrade of Luddenham Road to support provision of construction access and subsequent permanent access arrangements into the Luddenham Road Station precinct (two locations).

Location	Indicative road network adjustments and parking modifications
Kemps Creek construction power route	• trenching works for the construction power connection, would result in short term (around four weeks) lane reduction/closure or temporary road closure and local diversion of: - Cross Street - Western Road - Martin Road - Cuthel Road - Lawson Road - Pitt Street.
Bringelly services facility	• upgrade of Derwent Road including provision of turning lanes to provide access to the services facility.
Aerotropolis Core	• upgrade of Badgerys Creek Road south of Western Sydney International including provision of turning lanes to provide access to the construction site.
On-airport	
On-airport construction corridor	• minor modification to a Western Sydney International internal access road to connect to temporary haulage roads • a new construction haulage road from Badgerys Creek Road to the Airport Business Park construction site and the Airport Terminal construction site.
Airport construction support site	• upgrade to sections of Longleys Road and Badgerys Creek Road, including intersection works where Longleys Road and Badgerys Creek Road intersect to provide heavy vehicle access • an additional haulage route accessing the potential permanent spoil placement areas from Badgerys Creek Road is subject to further design development and is being considered to minimise spoil haulage distances and to reduce the number of heavy vehicles accessing the on-airport haulage roads from the intersection of Badgerys Creek Road and Longleys Road.



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Temporary and permanent changes to the road network and parking at St Marys

Figure 2-38

Changes to the existing public transport network

Changes to the existing public transport network during the construction of the project would be limited to changes around the existing St Marys Station with safe and controlled access to be maintained during construction. There would be no changes to infrastructure supporting the existing public transport network at other locations.

The existing bus interchange and layover at Station Street would be decommissioned and temporarily relocated to the Station Street Car Park. Relocation works would be completed prior to the decommissioning of the existing interchange to ensure disruption to bus services is minimised. The indicative temporary bus layover and bus routes are shown in Figure 2-38.

As part of the precinct works at St Marys, a reconfigured bus interchange and layover area would be provided. Following the completion of the precinct works, the temporary interchange at Station Street car park would be decommissioned. Some construction activities within the rail corridor would require track possessions where train services are temporarily not provided. Track possessions would generally occur over the weekend and at night and replacement services (i.e. buses) would be provided for rail customers. Other works within the rail corridor would generally be carried out during standard construction hours and would not disrupt existing rail services.

The kiss and ride facilities will be moved to Nariel Street and the existing kiss-and-ride on Queen Street south of St Marys Station will be used for point-to-point facilities. The existing point-to-point facilities on Station Street would be removed to limit interactions between buses and other vehicles. Access to the existing kiss and ride on Forrester Road to the north of St Marys Station may be temporarily disrupted but would be retained during construction.

Changes to the public transport network would be reviewed and confirmed by the construction contractor(s) through the preparation of Construction Traffic Management Plans, with the objective of minimising disruptions to public transport services.

Changes to pedestrian and cycling infrastructure

Proposed changes to existing pedestrian and cycling infrastructure is primarily limited to the following locations:

- St Marys
- in the vicinity of the Claremont Meadows construction power route in Orchard Hills
- in the vicinity of the permanent bulk power supply route at Erskine Park.

Modifications to pedestrian and cycling infrastructure for these sites are outlined in Table 2-7. The modifications would be reviewed and confirmed during the preparation of Construction Traffic Management Plans, with the objective of minimising disruptions to the pedestrian and cycling network.

Table 2-7 Indicative modifications to pedestrian and cycling infrastructure

Location	Indicative temporary modifications
Off-airport	
St Marys	• existing footpath on Harris Street would be temporarily affected by the movement of construction vehicles into the proposed construction site access point. Pedestrian access would be maintained through local traffic controls • pedestrian access to Station Street would be temporarily blocked during construction. Pedestrian access to St Marys Station would be maintained through diversions via Queen Street • pedestrian access to residential properties on Station Street would be maintained through local traffic controls.
Claremont Meadows construction power route	• temporary local pedestrian diversions may be required within the residential area west of Gipps Street • temporary local pedestrian and cyclist diversions may be required for the shared pathway and the footpath located to the west and east of Gipps Street/Kent Road respectively.

Location	Indicative temporary modifications
Permanent bulk power supply route	• temporary local pedestrian and cyclist diversions may be required for the shared pathways to the south of Erskine Park Road.

2.9.8 Construction water management

Treated water discharge

The excavation of the tunnels, stations and shafts is likely to intercept groundwater, resulting in the need to capture, treat and reuse or discharge water. Treated water would be recirculated to the tunnel cutting face and used for surface dust suppression.

Treated water that could not be recirculated would be discharged from the sites via construction water treatment plants (refer to Table 2-8). The reuse of treated water would be maximised during the construction works. Where surplus treated water needs to be discharged from the sites, subject to the relevant performance outcomes and mitigation measures in Chapter 7 (Revised performance outcomes and mitigation measures), it may be discharged to the local stormwater system or to a surrounding local watercourse. Other reuse options including Sydney Water trade waste agreement(s) and use of treated water at Western Sydney International or other nearby projects (such as the future M12 Motorway) would be investigated during construction planning.

Table 2-8 Treated water discharge from construction water treatment plants

Location	Discharge point	Indicative discharge volume (litres per second)
Off-airport		
St Marys	Existing stormwater system	10
Claremont Meadows services facility	Existing stormwater system	10
Orchard Hills	South Creek via existing M4 Motorway drainage infrastructure	10
	Existing stormwater system	10
Bringelly services facility	Unnamed drainage line	2
Aerotropolis Core	Thompsons Creek	10
On-airport		
Western Sydney International tunnel portal	Badgerys Creek via Western Sydney International swale	10
Airport Terminal	Badgerys Creek via Western Sydney International swale	10

At Aerotropolis Core, treated water surplus to reuse requirements would be discharged to Thompsons Creek. A connection would be required to transfer treated water from the water treatment plant to Thompsons Creek. The location of the connection and discharge point would be identified during design development and be subject to the performance criteria identified in Section 2.11.

The potential water treatment regime, likely discharge quantity and quality, and other relevant performance outcomes, are provided in Chapter 14 (Flooding, hydrology and water quality) of the Environmental Impact Statement.

Surface water management

Surface water management at the construction sites would be managed through the implementation of standard erosion and sediment control mitigation measures in accordance with *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004) and *Managing Urban Stormwater:*

Soils and Construction Volume 2 (Department of Environment and Climate Change, 2008). Further details regarding surface water quality management are provided in Chapter 14 (Flooding, hydrology and water quality) of the Environmental Impact Statement and Chapter 7 (Revised performance outcomes and mitigation measures).

Within Western Sydney International, construction water would be pumped to water quality basins, treated and then reused or discharged via constructed swales to Badgerys Creek or left to evaporate in the surrounding landscape.

Details regarding water use during construction are provided in Table 2-10. Opportunities would be considered to maximise the reuse of construction water (refer to Chapter 17 (Sustainability, climate change and greenhouse gas) of the Environmental Impact Statement for further information).

2.9.9 Construction equipment, resources and materials

Plant and equipment

The indicative plant and equipment expected to be used during construction of the project is summarised in Figure 2-39. The actual plant and equipment used at each work site would be confirmed by the construction contractor(s).

Location	Bulldozer	Compressor	Concrete pump	Concrete truck	Roadheader	Concrete saw	Crusher	Excavator	Generator	Gantry crane	Hand tools	Jackhammer	Mobile crane	Pile boring rig	TBM	Vibratory roller	Viaduct segment gantry	Water cart
Off-airport																		
St Marys	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Claremont Meadows services facility		✓	✓	✓	✓	✓		✓	✓		✓	✓	✓		✓	✓		
Orchard Hills	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Off-airport construction corridor	✓	✓	✓	✓		✓		✓	✓		✓	✓		✓		✓	✓	✓
Stabling and maintenance facility	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓			✓		✓
Luddenham Road	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Bringelly services facility	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓		✓	✓	✓		✓
Aerotropolis Core	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
On-airport																		
On-airport construction corridor	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓		✓		✓		✓
Airport Business Park	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓		✓		✓
Western Sydney International tunnel portal site	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Airport Terminal	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Airport construction support site	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓			✓		✓

Figure 2-39 Plant and equipment at proposed construction sites

Raw materials

Indicative quantities of major raw materials required are provided in Table 2-9. Efficiencies in material use, management and transport would continue to be investigated during design development and construction planning stages.

Table 2-9 Estimated quantities of major raw materials

Material	Estimated quantity
Diesel	63,000 kilolitres
Concrete	520,000 cubic metres
Precast concrete (including segments)	75,000 tonnes
Cement grout	70,000 tonnes
Epoxy (waterproof) grout	10 kilolitres
Rail steel	5,700 tonnes
Reinforcing steel	125,000 tonnes
Galvanised steel	9,000 tonnes
Structural steel	12,000 tonnes
Aluminium	650 tonnes
Asphalt	65,000 tonnes
Sand and aggregates	250,000 tonnes
Ballast	71,000 tonnes
Electrical cables	1,400 tonnes
Structural fill	875,000 tonnes

Water requirements

Table 2-10 outlines estimated water use for the construction of the project.

Table 2-10 Estimated water use for the construction of the project

Activity	Quantity (kilolitres)	Water source
Earthworks	38,400	Recycled
Concreting	17,800	Recycled subject to meeting Australian Standard AS1379
Tunnelling	223,100	Potable
Site facilities	34,200	Potable
Wheel washes	5,200	Recycled
Hot works	3,600	Recycled
Dust suppression	35,700	Recycled
Landscaping	165,700	Recycled
Total	**523,700**	

Water would be sourced from water treatment plants, sedimentation basins and rainwater tanks where feasible. Opportunities for Sydney Water to provide a recycled water connection to the project are currently being investigated. Construction water management is further discussed in Section 2.9.8.

2.9.10 Power supply

Temporary construction power supply

High voltage power supply would be required to provide traction power supply and support tunnelling activities at the Orchard Hills construction site and Western Sydney International tunnel portal construction site. It is anticipated that around 520,000 megawatt hours would be required during the construction of the project. The following sections describe the power supply required for the construction of the project.

Indicative Claremont Meadows construction power route

High voltage construction power would be provided to the Orchard Hills construction site to support tunnelling activities via a new connection from the existing Claremont Meadows substation at Nullaga Way which is located north of the M4 Western Motorway. The indicative construction power route is shown in Figure 2-40, noting the exact route would be confirmed during design development in consultation with the relevant utility provider. Trenching works would be carried out within the road reserve.

An area on the eastern side of Kent Road, between Caddens Road and just north of the M4 Western Motorway, would be used to stage works for the power connection to cross the M4 Western Motorway and extend into the Orchard Hills construction site using a horizontal direction drill. Areas for a small site office, worker amenities and light and heavy vehicle parking would be also established in this location. The work would be carried out over a period of around six months, commencing in late 2021.

Indicative Kemps Creek construction power route

High voltage construction power would be provided to the Western Sydney International tunnel portal site to support tunnelling activities via a new connection from the existing Kemps Creek substation located to the east at Devonshire Road, Kemps Creek. The indicative Kemps Creek construction power route is shown in Figure 2-41, noting the exact route would be confirmed during design development in consultation with the relevant utility provider.

Trenching works would generally be carried out within the road reserve and existing power distribution easements. Trenching works may be required in some areas of private property. Where the power route crosses South Creek and Badgerys Creek, horizontal directional drilling may be required to avoid surface impacts to riparian vegetation.

Within the airport site, the indicative construction power route generally follows internal roads or temporary haulage roads for the project.

The work would be carried out over a period of around four months, commencing in late 2021.

Construction power for other construction sites

Construction power at other construction sites would be supplied from local low voltage sources or diesel generators. Generators may be required at construction sites before the mains power supply becoming available. Each generator is likely to be around 1,000 kVA. At the St Marys construction site, construction power may be sourced from an existing substation located on the corner of Harris Street and Glossop Street.

Permanent bulk power supply

Traction power supply for the project would be provided from a new bulk power supply point at the stabling and maintenance facility and then through dedicated traction substations and supporting feeder line cables along the alignment. The proposed traction substations would be co-located with other infrastructure (such as at each station) wherever possible.

The bulk power supply point at the stabling and maintenance facility would be via a new connection to the existing substation located off Lenore Drive, Erskine Park (see Section 1.5.4). Trenching works would be carried out along the route, primarily within the road reserve but may also be required in some areas of private property. Where the power route crosses South Creek, horizontal directional drilling would be carried out to install the cable underground and avoid surface impacts to riparian vegetation.

Construction of substations would generally involve:

- enabling works
- earthworks to provide a level site
- piling works and site excavation for in-ground services including:
  - use of piling rigs to construct piles required for ground slab
  - excavation of building and bund yard areas for construction of in-ground pits and conduits
  - excavation for oil/water separator tank and related services
- preparation of concrete slab in the location of the substation or services building
- fitout, including connection to the electrical network and overhead wiring structures
- finishing, testing and commissioning.

Buildings would either be prefabricated off-site and delivered and installed on a concrete slab or constructed on-site using prefabricated segments.

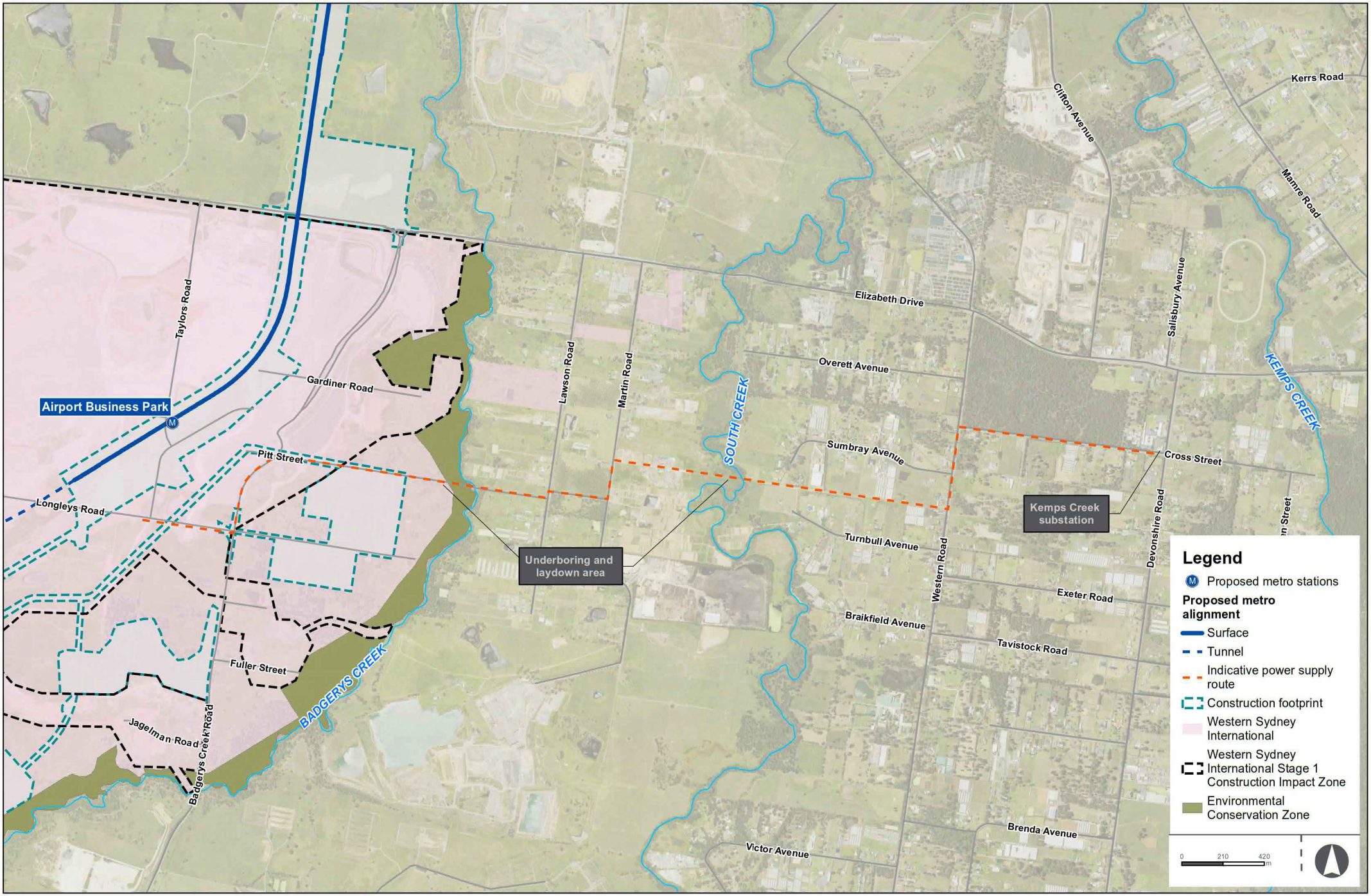
Given the proposed infrastructure required to support the Western Parkland City, provision of other power supplies may be undertaken within the project area (subject to separate assessment and approvals) that would support the delivery of the project. These works may affect the need or scope of the proposed temporary construction power supply or permanent bulk power supply identified in this section.

Sydney Metro – Western Sydney Airport

Indicative Claremont Meadows construction power route

Figure 2-40

Indicative only, subject to design development



Sydney Metro – Western Sydney Airport

Indicative only, subject to design development

Indicative Kemps Creek construction power route

Figure 2-41

2.9.11 Utility protection, adjustment and relocation

There are a number of active and disused utilities within the project footprint. Utilities that are located both above ground and below ground have the potential to be affected by construction of the project.

The locations of utilities have been identified based on Dial Before You Dig searches and a review of utility data, including as-built surveys, and agency and council records. The following utility providers and other agencies are known to have assets within the project footprint:

- Sydney Water (water supply, sewerage and stormwater infrastructure)
- Endeavour Energy (power and communications)
- TransGrid (power and communications)
- Penrith City Council and Liverpool City Council (stormwater infrastructure)
- Sydney Trains (power and communications)
- Jemena (gas supply infrastructure)
- Telstra, Optus and other communications providers (communications)
- Western Sydney International (power, communications and stormwater infrastructure)
- WaterNSW (Warragamba to Prospect Water Supply Pipelines)
- Transport for NSW (traffic signal infrastructure).

Sydney Metro would consult with local councils and utility providers to determine their requirements and identify any opportunities to support future initiatives or utility augmentations.

Table 2-11 provides a preliminary list of major utilities that could be affected by construction and may require protection and/or relocation. The list is indicative only and subject to design refinement, site investigations and detailed assessment in consultation with asset owners. Access would be provided to utility assets within or adjacent to the construction footprint when required during construction.

Table 2-11 Known major utility protection works

Location	Potentially affected major utility	Utility owner(s)	Work required
M4 Western Motorway	Trunk sewer and water supply infrastructure	Sydney Water	Protection
Orchard Hills	High voltage (330 kV and 500 kV) overhead power lines south of Lansdowne Road and south of Patons Lane	TransGrid	Protection
Orchard Hills	Warragamba to Prospect Water Supply Pipelines	WaterNSW	Protection

Where an existing utility conflicts with the project, it may be necessary to:

- provide physical protection for the utility, where the utility is not directly affected but may be indirectly affected by vibration or accidental impact. Protection could include constructing a piled wall between the excavation and the utility, plating over the utility to minimise the impact of construction traffic, or marking out or fencing off the location of a utility to avoid it being accidentally damaged
- modify construction methods to avoid impacting a nearby utility. This could involve using smaller plant and equipment, hand excavation and compaction tools such as hand digging tools, a vibration plate or pedestrian rollers where compacting within a specified distance of utilities
- divert the utility around the construction footprint.

A utilities coordination manager would be appointed for the project to coordinate the delivery of the utility works. Utility works do not include investigative works (such as surveying or pot-holing of utility assets) to gather information to inform design and construction methodologies.

The utilities coordination manager would:

- establish a utility working group with nominated representatives from utility service providers that may be impacted by the project
- review design and construction methodologies to assist with identifying potentially impacted utility assets
- assist with the coordination of design and construction methodology reviews by utility services providers to identify necessary utility works
- communicate with the working group and construction contractors' delivery teams to understand the proposed program of works to coordinate intercepting, interconnecting and interrelated works and manage priorities as they may arise
- observe utility works, where relevant
- manage escalation of utility work-related issues within Sydney Metro and the utility service providers as required. This may also include coordination with other projects such as the future M12 Motorway and Western Sydney International.

Respite for potentially affected sensitive receivers would be considered throughout the coordination and management of the utility works in accordance with the Construction Noise and Vibration Standard (Appendix F) and the Overarching Community Communications Strategy (Appendix C).

Provision of respite will consider many factors, including but not limited to, the predicted noise level, construction duration, time of day, surrounding land uses and community feedback. The utilities coordination manager will endeavour to coordinate works to avoid the same receiver being affected over consecutive nights by more than one contractor as much as possible. Furthermore, the utilities coordination manager will endeavour to stagger the timing of works by different contractors that affect the same receiver as much as possible in order to maximise the respite period between the works.

2.10 Finishing works and testing and commissioning

2.10.1 Finishing works

Following the completion of the construction works, the contractor would remove construction equipment from the construction sites. Where relevant, sites that were used for construction but do not form part of the operational project footprint would be stabilised and/or rehabilitated.

Site stabilisation and rehabilitation would be carried out progressively during the works, and would include the following activities:

- demobilise construction sites and facilities
- remove materials, waste and redundant structures from the works sites
- forming and stabilising of spoil mounds
- decommission temporary work site signs
- remove temporary fencing
- establish permanent fencing
- decommission temporary haulage roads that are no longer required
- restoration of disturbed areas as required, including revegetation where required.

Landscaping and finishing works would be carried out at permanent operational sites. Landscaping works would generally involve:

- earthworks
- soil improvement and topsoil dressing
- drainage works

- irrigation systems
- planting vegetation and laying turf.

2.10.2 Testing and commissioning

Testing and commissioning would be carried out to ensure that all systems and infrastructure have been installed and are operating according to Sydney Metro's operational requirements.

Once all services are installed, testing and commissioning of the whole system would occur in three stages:

- collection of safety and quality assurance documentation and commissioning of readiness checks
- installation and operation tests and checks
- final inspection, site acceptance tests, commissioning and validation of individual systems.

During the final stages of commissioning, test trains would run on the line to test the signalling system and the traction power supply.

2.11 Approach to identifying and selecting additional construction related elements of the project

While every endeavour has been made to identify and quantify the likely land requirements for construction, the construction contractor may require changes to elements of construction. As such performance criteria have been established to manage the approach to identifying and selecting additional construction related elements of the project, as described in the following sections.

2.11.1 Construction sites

Additional or alternative locations for construction sites would be determined on their ability to meet the performance outcomes for the project (refer to Chapter 7 (Revised performance outcomes and mitigation measures)) and the following performance criteria:

- be located more than 50 metres from a waterway, unless an erosion and sediment control plan is developed and implemented
- have ready and safe access to the road network
- be located to minimise the need for heavy vehicles to travel on local streets and/or through residential areas
- be located on relatively level land
- be separated from the nearest residences by at least 200 metres, unless reasonable and feasible noise and light spill mitigation measures are implemented
- not require native vegetation clearing beyond that already required for the project or impact any vegetation within non-certified land within the South West Growth Area
- have no greater impact on heritage items beyond those already assessed for the project
- not unreasonably affect the land use of adjacent properties
- be above the five per cent annual exceedance probability flood level, unless a contingency plan to manage flooding is prepared and implemented
- provide sufficient space for the storage of raw materials to minimise, to the greatest extent practical, the number of deliveries required outside standard daytime construction hours.

Consultation would be undertaken with affected landowners (including councils) in relation to any additional land requirements.

2.11.2 Western Sydney International

Additional or revised construction haulage routes and refinements to the construction sites and permanent spoil placement areas within Western Sydney International may be required during design

development and construction planning, subject to agreement with Western Sydney Airport. Changes to, or the introduction of additional haulage routes and sites would be subject to the following performance criteria:

- the works have no direct impact on heritage items (including areas of archaeological sensitivity), threatened species, populations or ecological communities or the Western Sydney International Environmental Conservation Zone
- the works can be carried out and managed consistent with the specific mitigation measures and performance outcomes described in Chapter 7 (Revised performance outcomes and mitigation measures).

If the works are not consistent with the performance criteria described above, the works would be managed through construction planning and consultation with Western Sydney Airport.

2.11.3 Surface water discharge to Thompsons Creek

At Aerotropolis Core, treated water surplus to reuse requirements during construction would be discharged to Thompsons Creek. The location of the connection and discharge point would be identified during design development and be subject to the following performance criteria:

- no removal of vegetation within the riparian zone areas adjacent to Thompsons Creek or outside the boundary of certified areas identified in the strategic assessment and conservation planning undertaken for the South West Growth Area (see Figure 11-1 of the Environmental Impact Statement)
- the works must be consistent with the specific mitigation measures and performance outcomes described in Chapter 7 (Revised performance outcomes and mitigation measures).

The potential water treatment regime, likely discharge quantity and quality, and other relevant performance outcomes are provided in Chapter 14 (Flooding, hydrology and water quality) of the Environmental Impact Statement.

2.11.4 Water quality and detention basins

Construction stormwater detention basins and water quality basins would be located within the construction footprint as required. The basins would discharge treated water into nearby local watercourses subject to the relevant performance outcomes and mitigation measures outlined in Chapter 7 (Revised performance outcomes and mitigation measures).

2.11.5 Utilities

During design development it may be identified that additional utility works are required outside of the construction footprint for the project. Such utility works would be delivered for the project provided the works are consistent with the following performance criteria:

- the works connect to the construction footprint or to a point adjacent to the construction footprint
- the works have no direct impact on heritage items (including areas of archaeological sensitivity), threatened species, populations or ecological communities beyond the impacts assessed in the Environmental Impact Statement
- the works can be carried out and managed consistent with the performance outcomes identified in Chapter 7 (Revised performance outcomes and mitigation measures).

If the works are not consistent with the performance criteria, the works may require further assessment

2.12 Related development excluded from this Environmental Impact Statement

The following are related development that are not part of the State significant infrastructure, are excluded from this Environmental Impact Statement and are subject to separate assessment and planning approvals:

- relocation of high voltage power and demolition of incident management centre within rail corridor at St Marys to be undertaken by Sydney Trains

- addition of two levels of commuter car parking at St Marys multi-storey commuter car park to be undertaken by Transport for NSW
- intersection upgrade work at intersection of Gipps Street and Sunflower Drive (north), Claremont Meadows to be undertaken by Transport for NSW
- works to allow permanent access to the rail corridor in St Marys on Glossop Street, St Marys to be undertaken by Transport for NSW
- utility infrastructure (such as road, water, power or other utilities) that may be provided to support the broader Western Parkland City and could be used by the project for construction or operational purposes.

3 Revised performance outcomes and mitigation measures

This chapter provides a complete set of revised performance outcomes and environmental mitigation measures for the project. These tables supersede the performance outcomes and mitigation measures presented in the Environmental Impact Statement.

Environmental management for the project would be undertaken through the approach detailed in Chapter 25 (Environmental management and mitigation) of the Environmental Impact Statement. The construction and operational environmental management frameworks are discussed in Sections 25.2 and 25.3 of the Environmental Impact Statement respectively.

Under these broad frameworks, a series of performance outcomes were developed to define the minimum environmental standards that would be achieved during construction and operation of the project, and mitigation measures that would be implemented during construction and operation to manage potential identified impacts.

The performance outcomes and mitigation measures that were presented in Chapter 27 (Synthesis) of the Environmental Impact Statement have been updated with consideration given to the submissions received during public exhibition, clarifications to the Environmental Impact Statement and additional field work and assessment undertaken. Further discussion about these updates is provided in Chapter 7 (Revised performance outcomes and mitigation measures), including a full list of revised performance outcomes and mitigation measures with additions and deletions presented as bold and strikethrough.

Table 3-1 provides the full set of revised performance outcomes and Table 3-2 provides the full set of revised mitigation measures to avoid, mitigate and/or manage the potential impacts of the project.

Table 3-1 Revised performance outcomes

SEARS desired performance outcome	Project performance outcome	Phase
Design, place and movement		
Supporting the provision of successful places - the project is integrated with and enhances the environment where it is located, including improved accessibility and connectivity for communities	The Sydney Metro – Western Sydney Airport Design Guidelines and Design Quality Framework are implemented to deliver a rail corridor, stations and ancillary facilities that achieve the project vision and design objectives	Operation
	Design excellence is exhibited in the project to complement the anticipated character of the precincts in which the project is located	Operation
	Accessibility and connectivity between future communities is supported by the project through opportunities to integrate with key project components such as stations	Operation
	Within Western Sydney International, the project is integrated with and supports the outcomes and design objectives set out in the Airport Plan, future master plans for Western Sydney International and design guidelines for Western Sydney International	Operation
The project contributes to greener places through supporting the enhancement and provision of green infrastructure	The number of trees within the project area is increased at a ratio of 2:1 (for vegetation removal not subject to biodiversity offset); and tree canopy coverage is increased, using a range of local species, subject to the constraints on tree planting associated with safe airport operations	Operation

SEARS desired performance outcome	Project performance outcome	Phase
Transport		
Network connectivity, safety and efficiency of the transport system in the vicinity of the project are managed to minimise impacts The safety of transport system customers is maintained Impacts on network capacity and the level of service are effectively managed	Safe and efficient routes are provided for pedestrians, cyclists and road users at/near construction sites	Construction
	Access to the existing St Marys Station is maintained while train services are operating	Construction
	Safe access to properties and businesses is maintained during construction, unless alternatives are agreed with property owners and businesses	Construction
	Heavy vehicles access the arterial network as soon as practicable on route to, and immediately after leaving, a construction site	Construction
	The local community and relevant authorities are informed of transport, access and parking changes/impacts to minimise inconvenience to the public	Construction
	Safe and efficient interchanges are provided between transport modes	Operation
	Transport interchange facilities provided at station precincts are designed in accordance with the modal access hierarchy	Operation
	Each station and station plaza is provided with sufficient customer capacity to achieve a minimum Fruin's Level of Service C (for 2056 demand)	Operation
	Stations and interchanges are fully accessible and compliant with the *Disability Discrimination Act 1992* (Cth) and the *Disability Standards for Accessible Public Transport* (Australian Government, 2002)	Operation
Works are compatible with existing infrastructure and future transport corridors	The project is designed to be compatible with existing infrastructure and future transport corridors	Operation
Noise and vibration		
Construction noise and vibration (including airborne noise, ground-borne noise and blasting) is effectively managed to minimise adverse impacts on acoustic amenity Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimise adverse impacts on the structural integrity of buildings and items including Aboriginal places and environmental heritage	Construction noise and vibration impacts on local communities (including airborne noise and ground-borne noise and vibration) are managed in accordance with the Construction Noise and Vibration Standard, the *Interim Construction Noise Guideline,* and the Airports (Environment Protection) Regulations 1997	Construction
	Structural damage to buildings, heritage items and public utilities and infrastructure, including the Warragamba to Prospect Water Supply Pipelines, from construction vibration to be avoided	Construction
Increases in noise emissions and vibration affecting nearby properties and other sensitive receivers during operation of the project are effectively managed to protect the	Operational noise and vibration levels from rail operations are managed in accordance with the Rail Infrastructure Noise Guidelines and Airports (Environment Protection) Regulations 1997	Operation

SEARS desired performance outcome	Project performance outcome	Phase
amenity and well-being of the community	Operational noise levels for the stabling and maintenance facility, stations and other fixed infrastructure are managed in accordance with the *Noise Policy for Industry 2017*	
Biodiversity		
The project design considers all feasible measures to avoid and minimise impacts on terrestrial and aquatic biodiversity	Minimise or where possible avoid impacts on threatened flora and fauna species, and ecological communities listed under the *Biodiversity Conservation Act 2016* (NSW) and *Environment Protection and Biodiversity Conservation Act 1999* (Cth)	Construction
	Manage groundwater drawdown at Orchard Hills to avoid or minimise impacts on groundwater dependent ecosystems	Construction
	No removal of any vegetation within the Thompsons Creek riparian zone or any adjacent areas that are non-certified under the South West Growth Area	Construction
	Culverts and bridges would be appropriately sized to maintain fauna habitat connectivity	Operation
	Maintain integrity and functionality of rail corridor fencing to minimise wildlife-train collision while providing opportunities for cross-corridor wildlife movement	Operation
	Re-establish native vegetation in accordance with the National Airports Safeguarding Framework Principles and Guidelines including *Guideline C: Managing the Risk of Wildlife Strikes in the Vicinity of Airports* (Australian Government, 2014)	Operation
Offsets and/or supplementary measures are assured which are equivalent to any residual impacts of project construction and operation	Impacts on threatened ecological communities and threatened species are offset in accordance with the requirements of the *NSW Biodiversity Assessment Method* (OEH, 2017)	Construction
Non-Aboriginal heritage		
The design, construction and operation of the project facilitates, to the greatest extent possible, the long term protection, conservation and management of the heritage significance of items of environmental heritage The design, construction and operation of the project avoids or minimises impacts, to the greatest extent possible, on the heritage significance of environmental heritage	Impacts on the State heritage significant St Marys Railway Station Group are avoided or minimised so that the overall heritage value of the item is maintained	Construction
	Impacts on non-Aboriginal heritage items and archaeology are minimised or where possible avoided	Construction
	The design of St Marys Station is sympathetic to retained and adjacent heritage items	Operation
	The design of the project incorporates non-Aboriginal heritage interpretation	Operation

SEARS desired performance outcome	Project performance outcome	Phase
Aboriginal heritage		
The design, construction and operation of the project facilitates, to the greatest extent possible, the long term protection, conservation and management of the heritage significance of items of Aboriginal objects and places The design, construction and operation of the project avoids or minimises impacts, to the greatest extent possible, on the heritage significance of Aboriginal objects and places	The heritage significance of Aboriginal objects and places are protected, conserved and/or managed in order to ensure the project does not diminish the story and cultural understanding associated with the objects and places of Aboriginal people in New South Wales	Construction
	Impacts on areas of archaeological sensitivity and significance are avoided or minimised, where practical	Construction
	The design of the project incorporates Aboriginal heritage interpretation and Aboriginal cultural design principles in consultation with Aboriginal knowledge holders	Operation
Flooding, hydrology and water quality		
The project minimises adverse impacts on flooding characteristics Construction and operation of the project avoids or minimises the risk of, and adverse impacts from, infrastructure flooding, flooding hazards, or dam failure Long term impacts on surface water and groundwater hydrology (including drawdown, flow rates and volumes) are minimised The environmental values of nearby, connected and affected water sources, groundwater and dependent ecological systems including estuarine and marine water (if applicable) are maintained (where values are achieved) or improved and maintained (where values are not achieved) Sustainable use of water resources The project is designed, constructed and operated to protect the NSW Water Quality Objectives where they are currently being achieved, and contribute towards achievement of the Water Quality Objectives over time where they are currently not being achieved, including	Land and property beyond the construction footprint would not be impacted by construction for the 0.5 Exceedances per Year (EY) storm event	Construction
	No aspect of construction to materially adversely affect existing water quality in receiving waters to a minimum 0.5 EY storm event, or in line with the 'Blue Book' (*Managing Urban Stormwater: Soils & Construction Volume 1* (Landcom, 2004))	Construction
	No material change to channel shape within the construction footprint for the 0.5 EY storm event for streams classified first order and higher	Construction
	Water discharged from the project, including runoff from hardstand areas, surface and ground water storages would: • contribute towards achieving ANZECC guideline water quality trigger values for physical and chemical stressors for slightly disturbed ecosystems in lowland rivers in southeast NSW, or • meet any water quality criteria determined in consultation with the NSW Environment Protection Authority (off-airport) where an EPL is required or in consultation with Western Sydney Airport in accordance with the Airports (Environmental Protection) Regulations 1997 (on-airport)	Construction and operation
	Drainage from the project (including the stabling and maintenance facility, service facilities and stations) designed in accordance with local council requirements for managing urban stormwater quality and quantity	Operation
	For all land currently flooded up to the one per cent annual exceedance probability event, no change to peak flood levels up to the following limits, unless otherwise agreed with the affected property owner: • residential, commercial, critical infrastructure – no new above floor flooding, maximum change of 10 millimetres for existing flooded buildings and maximum of 50 millimetres for properties where flooding is below floor level	Operation

SEARS desired performance outcome	Project performance outcome	Phase
downstream of the project to the extent of the project impact including estuarine and marine waters (if applicable)	• roads – maximum change of 50 millimetres • Crown land open space, farming, grazing and cropping land – maximum change of 200 millimetres	
	Where flood water velocities are currently below one metre per second (m/s), the project is designed and operated to ensure they remain below one metre per second. Where velocities are above one m/s, an increase of no more than 20 per cent is permitted	Operation
	No change to flood hazard vulnerability classification limits for residential and commercial buildings or roads	Operation
	No change to flood hazard vulnerability classification limits for all land types as a result of the location of the permanent spoil placement areas at Western Sydney International	Operation
	No change to the one per cent annual exceedance probability duration of inundation up to the following limits: • residential, commercial, critical infrastructure – no increase for above floor flooding • roads – maximum change of 10 per cent increase in duration • agricultural land for cropping – dependant on cropping type	Operation
	For moderate and high fragility watercourses impacted by the project (as defined by the NSW River Styles mapping (NSW, Department of Planning, Industry and Environment 2019)), maintain existing flow regimes and velocities as best as possible to preserve and minimise changes to the watercourses	Operation
	Critical infrastructure (including stations entries and tunnel portals) to have immunity against the probable maximum flood event	Operation
Groundwater and geology		
Long term impacts on surface water and groundwater hydrology (including drawdown, flow rates and volumes) are minimised	Groundwater availability and quality for water supply and environmental benefit (e.g. groundwater dependent ecosystems) is not affected beyond the requirements outlined in the NSW Aquifer Interference Policy	Construction and operation
	Structural damage to buildings, heritage items and public utilities and infrastructure, including the Warragamba to Prospect Water Supply Pipelines, from ground movement to be avoided	Construction
Soils and contamination		
The environmental values of land, including soils, subsoils and landforms, are protected Risks arising from the disturbance and excavation of land and disposal of soil are minimised, including disturbance to acid sulfate soils and site contamination	Contamination risks to human health and ecological receivers are minimised through effective management of existing contaminated land	Construction
	Contaminated land and soil within the footprint of the project is remediated where required, to ensure the land is suitable for the intended future land use	Operation

SEARS desired performance outcome	Project performance outcome	Phase
Sustainability, climate change and greenhouse gas		
The project reduces the NSW Government's operating costs and ensures the effective and efficient use of resources Conservation of natural resources is maximised	The project achieves a minimum 'Design' and 'As built' rating score of Leading +75, using the Infrastructure Sustainability Council of Australia *Infrastructure Sustainability Rating Scheme Version 1.2* or equivalent	Operation
	Sustainability initiatives are incorporated into the planning, design and construction of the project	Construction and operation
	100 per cent of the greenhouse gas emissions associated with consumption of electricity during operation are offset	Operation
	25 per cent of the greenhouse gas emissions associated with consumption of electricity during construction are offset	Construction
The project is designed, constructed and operated to be resilient to the future impacts of climate change	The project is designed to withstand known impacts associated with climate change to year 2100	Construction and operation
Resource management		
Conservation of natural resources is maximised	100 per cent of useable spoil is reused in accordance with the spoil reuse hierarchy	Construction
	A minimum 95 per cent recycling target is achieved for construction and demolition waste	Construction
	Products made from recycled content are prioritised	Construction
	The use of potable water for non-potable purposes is avoided if non-potable water is available	Construction and operation
	The reuse of water is maximised, either on-site or off-site	Construction and operation
Cumulative impacts		
	Cumulative impacts are managed through coordination of construction activities and communication processes with nearby projects (Western Sydney International, M12 Motorway, The Northern Road, St Marys Intermodal and St Marys Commuter Car Park Expansion)	Construction

Table 3-2 Revised mitigation measures

Ref	Mitigation measures	Applicable location(s)
Transport – construction		
T1	Construction Traffic Management Plans would be prepared in accordance with the Construction Traffic Management Framework	All
T2	The Construction Traffic Management Plan for St Marys would be developed in consultation with the Traffic and Transport Liaison Group to ensure existing transport interchange infrastructure continues to operate effectively within the St Marys station precinct	St Marys construction site
T3	Coordination with Western Sydney Airport and Transport for NSW would be undertaken through the Traffic and Transport Liaison Group to manage potential cumulative construction traffic impacts with M12 Motorway and Elizabeth Drive	All
T4	Road Safety Audits would be carried out to address vehicular access and egress, and pedestrian, cyclist and public transport safety. Road Safety Audits would be carried out as per the guidelines outlined in Section 10 of the Construction Traffic Management Framework	All
T5	Maintain access for pedestrians and cyclists around construction sites as per the guidelines outlined in the Construction Traffic Management Framework. Appropriate signage and line marking would be provided to guide pedestrians and cyclists past construction sites and on the surrounding network to allow access to be maintained	All
T6	Access for construction vehicles to be planned as per the guidelines outlined in the Construction Traffic Management Framework. Construction site traffic would be managed to minimise movements during peak periods. Vehicle access to and from construction sites would be managed to maintain pedestrian, cyclist and motorist safety	All
T7	Temporary relocation of bus stops and the bus layover to the Station Street car park in St Marys would be implemented prior to the commencement of construction works that impact on the existing bus facilities. The temporary relocation of bus stops and the bus layover at St Marys would be carried out in consultation with Transport for NSW, Penrith City Council and bus operators. Wayfinding and customer information would guide customers to temporary bus stop locations	St Marys construction site
T8	Transport for NSW would be consulted to discuss opportunities for their delivery of intersection upgrades at Mamre Road/M4 Western Motorway on and off ramps prior to the peak year of construction	Off-airport construction corridor Stabling and maintenance facility construction site Luddenham Road construction site

Ref	Mitigation measures	Applicable location(s)
T9	A construction worker car parking strategy for St Marys would be prepared in consultation with Penrith City Council and Transport for NSW prior to the commencement of construction. The strategy would seek to: • minimise overall demand for construction worker car parking through initiatives such as use of other project construction worksites in combination with shuttle buses, car-pooling and encouraging the use of public transport • minimise potential use of on-street car parking by construction workers The construction worker car parking strategy would be implemented throughout construction	St Marys
Transport – operation		
OT1	Interchange access plans would be prepared, in consultation with the Traffic and Transport Liaison Group and relevant authorities including Western Parkland City Authority, to ensure adequate pedestrian and cycle facilities and other transport interchange infrastructure is provided at each station precinct	Off-airport
OT2	The project would be designed such that access to properties and existing infrastructure neighbouring the proposed stations would be maintained	Off-airport
OT3	Consultation and coordination would be undertaken with Transport for NSW through the Traffic and Transport Liaison Group to align planned road and intersection upgrades with the year of opening, to enable safe and efficient interchanges between transport modes	Off-airport
OT4	An operational car parking strategy for St Marys would be prepared in consultation with Penrith City Council and Transport for NSW prior to commencement of operation. The strategy would include consideration of measures that could be implemented to address any parking impacts as a result of the project	St Marys
Noise and vibration – construction		
NV1	Where acoustic sheds are installed, the internal lining and type of material used in the construction of the sheds would be considered during design development and construction planning to ensure appropriate attenuation is provided	St Marys construction site Claremont Meadows services facility construction site Orchard Hills construction site Western Sydney International tunnel portal construction site Airport Terminal construction site

Ref	Mitigation measures	Applicable location(s)
		Bringelly services facility construction site Aerotropolis Core construction site
NV2	To avoid potential vibration impacts to the Warragamba to Prospect Water Supply Pipelines, a detailed construction vibration assessment would be undertaken in accordance with the *Guidelines for Development Adjacent to the Upper Canal and Warragamba Pipelines* (WaterNSW, 2020) and would consider the following requirements: • velocity limits for construction activities and the impact the works will have on WaterNSW assets • excavation methods in accordance with German Standard DIN 4150-3:2016 • vibration monitoring prior to and during construction for high risk construction activities • vibration monitoring reports would be provided to WaterNSW	Off-airport construction corridor
Noise and vibration – operation		
ONV1	An Operational Noise and Vibration Review would be prepared during design development to confirm the mitigation measures required to manage: • airborne and ground-borne noise impacts from rail operations • airborne noise impacts from the stabling and maintenance facility • airborne noise impacts from fixed industrial sources, including stations and services facilities The Operational Noise and Vibration Review would consider existing and potential future land use to establish Project Noise Trigger Levels. The EPA would be consulted during preparation of the Operational Noise and Vibration Review	Off-airport
Biodiversity – construction		
FF1	The Biodiversity Construction Environmental Management Plan (on-airport) and Flora and Fauna Management Plan (off-airport) would be prepared by a suitably qualified and experienced person to minimise and manage the clearing of native vegetation and habitat by: • seeking to locate site offices, site compounds and ancillary facilities in areas where there are limited biodiversity values (e.g. cleared land) • delaying the removal of vegetation until absolutely necessary • avoiding the removal of hollow-bearing trees, where possible • using a qualified surveyor and suitably qualified ecologist to mark out exclusion zones and clearing/project boundaries prior to construction • providing contractors with regularly updated sensitive area maps (showing clearing boundaries and exclusion zones) • investigating opportunities for salvage and storage of felled native trees for potential use in landscape design The Biodiversity Construction Environmental Management Plan (on-airport) and Flora and Fauna Management Plan (off-airport) would be implemented throughout construction	Orchard Hills construction site Off-airport construction corridor Stabling and maintenance facility construction site Luddenham Road construction site Airport construction

Ref	Mitigation measures	Applicable location(s)
		support site Bringelly services facility construction site Aerotropolis Core construction site
FF2	A Nest Box Strategy would be prepared to minimise habitat loss to hollow-dependent fauna in accordance with the Flora and Fauna Management Plan and would include the following requirements: • hollow-bearing trees would be marked/tagged and mapped prior to their removal. The size, type, number and location of nest boxes required would be based on the results of the pre-clearing survey • about 70 per cent of nest boxes would be installed about one month prior to any vegetation removal to provide alternate habitat for hollow-dependent fauna displaced during clearing	Claremont Meadows services facility construction site Off-airport construction corridor
FF3	Works on-airport would be undertaken in consultation with Western Sydney Airport subject to the wildlife hazard management requirements	On-airport
FF4	A targeted microbat survey (including Eastern Coastal Free-tailed Bat, Large Bent-winged bat and Eastern False Pipistrelle) of dwellings and structures proposed for demolition, removal or modification would be undertaken in accordance with 'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method (OEH, 2018) prior to disturbance Other human-made structures such as culverts and other under-road structures within the construction footprint would be surveyed for threatened microbats (e.g. particularly the Southern Myotis) in accordance with the Biodiversity Assessment Method (OEH, 2018). If threatened microbats are detected, a Microbat Management Plan would be developed as part of the Flora and Fauna Management Plan and implemented by a suitably qualified bat specialist	Claremont Meadows services facility construction site Off-airport construction corridor
FF5	Works on-airport would be managed in accordance with the *Western Sydney Airport Microbat Management Plan* and in consultation with Western Sydney Airport	On-airport
FF6	During construction, shading and artificial light impacts would be minimised in areas adjoining remnant bushland that is in intact condition	Claremont Meadows services facility construction site Orchard Hills construction site Off-airport construction corridor On-airport construction

Ref	Mitigation measures	Applicable location(s)
		support site
FF7	Fish passage and fish habitat associated with Cosgrove Creek and Blaxland Creek would be protected in accordance with the *Policy and Guidelines for Fish Habitat Conservation and Management* (DPI (Fisheries NSW), 2013)	Off-airport construction corridor
FF8	A Dewatering Plan would be prepared and implemented for the dewatering of rural dams which are impacted as a result of the construction of the project. This would include measures to manage the transfer of native aquatic fauna, if required, prior to dewatering and removing of dams	Off-airport
FF9	A Dewatering Plan would be prepared and implemented for the dewatering of rural dams which are impacted as a result of the construction of the project. This would include measures to manage the transfer of native aquatic fauna, if required, prior to dewatering and removing of dams. The plan would be consistent with the *Western Sydney Airport Biodiversity Construction Environmental Management Plan* (on-airport)	On-airport
FF10	The impact of Key Threatening Processes as a result of the project would be managed and minimised where possible through: • implementation of weed management measures to prevent the introduction and spread of weeds including exotic vines and scramblers, *Olea europaea* (African Olive), *Chrysanthemoides monilifera*, *Lantana camara*, and exotic perennial grasses • implementation of pathogen management measures to prevent the introduction and spread of pathogens including amphibian chytrid, *Phytophthora implementa*, and Exotic Rust Fungi of the order Pucciniales • implementation of management measures to protect the riparian zone to ensure fish passage and protect fish habitat in accordance with the *Policy and Guidelines for Fish Habitat Conservation and Management* (DPI (Fisheries NSW,) 2013), and minimisation of vegetation removal within the riparian zone where possible	All
FF11	A native vegetation seed collection and salvage program would be developed prior to the commencement of construction and implemented during construction. The seed collection and salvage program would target native species prioritising the Cumberland Plain Woodland species to be utilised in landscaping for the project where possible. Opportunities for use of collected and salvaged seed outside of the project would also be investigated	All
Biodiversity – operation		
OFF1	Wildlife connectivity would be maintained (where possible) through the installation of viaduct/bridge structures designed in accordance with the following: • height and width of the area under a bridge to be maximised for all species, noting a minimum height of approximately 3 metres of dry passage will provide connectivity for most terrestrial species • bridges wide enough to encompass water flow, stream bank and riparian vegetation, preferably on both sides of the watercourse • for small and medium sized mammals, provide fauna furniture as shelter (e.g. vegetation, logs, rocks, leaf-litter, refuge pipes, escape poles, roofing tiles, and roofing iron) • height and carriageway separation designed to allow sufficient light and moisture to enhance growth of vegetation under the structure • if used for multiple purposes (e.g. pathways or access roads) aim to provide the 3 metre of natural passage for fauna	Off-airport

Ref	Mitigation measures	Applicable location(s)
	• relocation or adjustment of the stream bed avoided where possible • the structure to tie in with the natural hydrology of the surrounding habitat such that the width, depth and gradient of the watercourse are maintained in the structure • consistent with the *Policy and Guidelines for Fish Friendly Waterway Crossings* (DPI (Fisheries NSW), 2013)	
OFF2	The design of viaduct structures over the wildlife/riparian corridors at Blaxland Creek, the unnamed tributary south of Patons Lane and Cosgroves Creek would seek to: • maximise the span over the wildlife/riparian corridor • minimise native vegetation removal within the wildlife/riparian corridors • maintain opportunities for fauna movement along the wildlife/riparian corridors and • provide opportunities to enhance fauna movement where possible	Off-airport
Non-Aboriginal heritage – construction		
NAH1	Potential moveable heritage items would be identified and assessed and a significant fabric salvage schedule would be prepared by an appropriately qualified and experienced heritage specialist for St Marys Railway Station, Bringelly RAAF Base, McGarvie-Smith Farm and McMasters Farm. Significant fabric would only be salvaged if it can be salvaged in such a way that it can be reused and is likely to be able to be reused	St Marys construction site Off-airport construction corridor Aerotropolis Core construction site
NAH2	Heritage advice would be sought to develop solutions to manage potential ground movement impacts to the St Marys Goods Shed	St Marys construction site
NAH3	Archival recording of heritage items which would be impacted or that would have their setting altered, would be carried out in accordance with the NSW Heritage Office's *Photographic Recording of Heritage Items Using Film or Digital Capture* (2006). The following items would be archivally recorded: • St Marys Railway Station • Luddenham Road Alignment • McMaster Farm • McGarvie-Smith Farm • Kelvin (the State Heritage listed curtilage) • Bringelly RAAF Base	St Marys construction site Off-airport construction corridor Luddenham Road construction site Aerotropolis Core construction site
NAH4	Not used	
NAH5	Archaeological investigations would be undertaken in accordance with recommendations in the non-Aboriginal Archaeological Research Design	St Marys construction site

Ref	Mitigation measures	Applicable location(s)
NAH6	The following heritage items would be monitored for potential vibration impacts during construction: • St Marys Railway Station Group • Queen Street Post-War Commercial Building • St Marys Munitions Workers Housing • McGarvie Smith Farm • McMaster Farm	St Marys construction site Off-airport construction corridor
NAH7	If required, the St Marys Station jib crane would be temporarily relocated prior to construction that may impact on this item, safely stored and appropriately maintained and conserved before reinstatement. If relocation is required, a detailed methodology for the removal and reinstatement of the jib crane would be prepared in consultation with an appropriately qualified heritage advisor	St Marys construction site
NAH8	A dilapidation survey of the Warragamba to Prospect Water Supply Pipelines would be undertaken prior to construction commencing in the vicinity of this item	Off-airport construction corridor
NAH9	If suspected human remains or unexpected items of potential heritage significance are discovered within the on-airport area, all activity would cease and the unexpected/chance finds requirements specified in the *Western Sydney Airport European and Other Heritage Construction Environmental Management Plan* would be followed	On-airport
Non-Aboriginal heritage – operation		
ONAH1	Design development for the project would endeavour to minimise adverse impacts to heritage buildings, elements, fabric, and heritage significant settings and view lines that contribute to the overall heritage significance of heritage items	Off-airport
ONAH2	The architectural design for the project would take account local heritage context and be sympathetic to local heritage character. This would include using sympathetic building materials, colours and finishes Design should aim to minimise visual impacts by ensuring that significant elements are not obstructed or overshadowed Design should adhere to the Sydney Metro – Western Sydney Airport Design Guidelines The Design Review Panel and Heritage Working Group would be consulted in regard to the design, form and material of new built structures that may impact heritage items	Off-airport
ONAH3	Consultation with the Heritage Council and relevant stakeholders would occur for the design of works that have the potential to impact State significant items including St Marys Railway Station	St Marys Station
ONAH4	A heritage interpretation strategy would be prepared for the project identifying key stories and interpretive opportunities related to non-Aboriginal heritage. The strategy would address historic and contemporary heritage and community values and would identify innovative and engaging opportunities for interpretation	Off-airport
ONAH5	A conservation management plan would be prepared for St Marys Railway Station, in accordance with NSW Heritage Council guidelines. The plan would address any changes to the station, including updated assessment of significance of elements and recommendations on curtilage changes. It would also provide site specific exemptions and management policies	St Marys Station

Ref	Mitigation measures	Applicable location(s)
ONAH6	Heritage inventory registers for heritage items modified by the project would be updated to document their change in condition following the completion of construction works for the project	Off-airport
ONAH7	An appropriately qualified and suitably experienced heritage architect would be engaged to provide input into design development at St Marys Station	St Marys Station
Aboriginal heritage – construction		
AH1	Aboriginal stakeholder consultation would continue to be carried out in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (NSW Office of Environment and Heritage, 2010). Registered Aboriginal Parties would be provided with opportunities to participate in survey and testing in unverified areas of Aboriginal archaeological sensitivity, archaeological salvage works and unexpected find assessments (if required).	Off-airport
AH2	Areas of unverified Aboriginal archaeological sensitivity would be subject to archaeological survey, if required, and test excavation prior to construction in accordance with the Aboriginal Cultural Heritage Management Plan	Off-airport
AH3	Not used	
AH4	Not used	
AH5	All Aboriginal objects recovered from the construction footprint as a result of test excavation and salvage works would be appropriately secured and under the care of the archaeological consultant while options for their long-term management, as determined through consultation with Registered Aboriginal Parties, are being investigated	Off-airport
AH6	Aboriginal Heritage Information Management System site cards would be produced for all newly identified sites other than those identified on Commonwealth land. These should be submitted to the Aboriginal Heritage Information Management System Registrar as soon as practicable within one month of being identified. Newly identified sites within the revised boundaries of Defence Establishment Orchard Hills (Commonwealth land) would be reported to the Department of Defence to be managed in accordance with the relevant provisions of the *Defence Establishment Orchard Hills Heritage Management Plan*	Off-airport
AH7	Aboriginal Site Impact Recording forms for sites subject to archaeological salvage would be submitted to the Aboriginal Heritage Information Management System register within one month of the completion of salvage works within their bounds	Off-airport
AH8	If any suspected human remains or unexpected Aboriginal cultural heritage objects are discovered within the on-airport area, all activity would cease and the unexpected finds protocol and discovery of human remains protocol specified in the *Western Sydney Airport Aboriginal Cultural Heritage Construction Environmental Management Plan* would be followed	On-airport
AH9	Works within the bounds of existing Aboriginal Heritage Impact Permit areas should be undertaken in accordance with the conditions of those permits and with permission from the relevant Aboriginal Heritage Impact Permit holder. Works undertaken within the revised boundaries on Defence Establishment Orchard Hills (Commonwealth land) should be undertaken in accordance with the *Defence Establishment Orchard Hills Heritage Management Plan*	Off-airport
AH10	Impacted Aboriginal Sites would be managed in accordance with the Aboriginal Cultural Heritage Management Plan	Off-airport

Ref	Mitigation measures	Applicable location(s)
AH11	Measures would be implemented to ensure that Aboriginal sites located outside of the construction footprint, but within 100m of it, would not be affected by construction activities	Off-airport
AH12	An Archaeological Salvage Report detailing the results of the archaeological salvage program (including the results of any post-excavation analyses) would be completed within two years of the completion of the fieldwork component of the program. The Archaeological Salvage Report would be consistent with the best practice guidelines suggested by the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010) and the *Aboriginal Cultural Heritage Standards & Guidelines Kit* (NSW NPWS 1997)	Off-airport
AH13	Measures to manage and protect the identified cultural values would be developed collaboratively through a consultation process with knowledge holders to inform construction planning and design development	Off-airport
Aboriginal heritage – operation		
OAH1	A heritage interpretation strategy would be prepared for the project in consultation with Aboriginal knowledge holders. Aboriginal heritage interpretation would be developed with reference to the findings of the Aboriginal Cultural Heritage Assessment Report and Aboriginal Archaeological Report, to promote understanding and awareness of cultural heritage values	All
Flooding, hydrology and water quality – construction		
HYD1	Construction planning would consider flood related mitigation, including: • staging construction works to reduce the duration of works within the floodplain • daily and continuous monitoring of weather forecasts and storm events, rainfall levels and water levels in key watercourses to identify potential flooding events and related flood emergency response • consultation with NSW State Emergency Services and relevant local councils to ensure consistent approaches to the management of flood events (off-airport only) • provide flood-proofing to excavations at risk of flooding during construction, where reasonable and feasible, such as raised entry into shafts and/or pump-out facilities to minimise ingress of floodwaters into shafts and the dive structure • review of site layout and staging of construction works to avoid or minimise obstruction of overland flow paths and limit the extent of flow diversion required	Orchard Hills construction site Off-airport construction corridor On-airport construction corridor Airport construction support site
HYD2	Minimise works in the main creek channels (at Blaxland Creek, unnamed watercourse south of Patons Lane and Cosgroves Creek) where possible and avoid works in the channel during rainfall events	Off-airport construction corridor
HYD3	Surface water flows during construction would be managed to ensure that there is no increase in flows into or through the Warragamba to Prospect Water Supply Pipelines corridor	Off-airport construction corridor
WQ1	A surface water quality monitoring program would be implemented to monitor water quality during construction. The program would be developed in consultation with (as relevant) Western Sydney Airport, NSW Environment Protection Authority, relevant sections of Department of Planning, Industry and Environment and relevant local councils. The program would consider monitoring being undertaken as part of other	All

Ref	Mitigation measures	Applicable location(s)
	infrastructure projects such as the M12 Motorway and Western Sydney International On-airport, the water quality monitoring program would ensure that works meet the requirements under Schedule 2 of the Airports (Environment Protection) Regulations 1997 The program would monitor all construction discharge locations	
WQ2	Water treatment plants would be designed to ensure that wastewater is treated to a level that is compliant with the ANZECC/ ARMCANZ (2000), ANZG (2018) and draft ANZG (2020) default guidelines for 95 per cent species protection and 99 per cent species protection level for toxicants that bioaccumulate unless other discharge criteria are agreed with relevant authorities	All
WQ3	The design and construction of the project would take into account the former NSW Office of Water's Guidelines for controlled activities on waterfront land	Off-airport
Flooding, hydrology and water quality – operation		
OHYD1	The flood model for the project would be updated with regard to flood modelling undertaken for the South Creek Sector Review (anticipated to be released in 2021) and would include updated calibration and validation. The updated flood modelling would be used to inform design development including but not limited to, addressing potential residual flood impacts identified at the following locations: • the viaduct and earthworks in the vicinity of Blaxland Creek so as to minimise the extent of the project within the floodplain • the earthworks arrangement at the stabling and maintenance facility in the area affected by the Probable Maximum Flood The flood model for the project would be updated in consultation with relevant stakeholders	All
OHYD2	Develop localised stormwater management plans at St Marys Station and Aerotropolis Core Station to ensure these stations are protected from localised flooding	St Marys Station Aerotropolis Core Station
OHYD3	Flood compatible design would need to be demonstrated for the permanent spoil placement areas to ensure compliance with applicable land use criteria	On-airport
OHYD4	The design of the viaduct crossing over the Warragamba to Prospect Water Supply Pipelines would not result in an increase of overland flows into or through the pipelines corridor for each storm event up to and including the 1% AEP event	Off-airport
OWQ1	Design batter slope gradients and surface treatments to minimise erosion risk	All
OWQ2	Drainage and water treatment design to be undertaken in accordance with Water Sensitive Urban Design requirements specified in local council, Transport for NSW and on-airport standards	All
OWQ3	Suitably designed scour and erosion controls should be included at drainage and sedimentation basin outlet discharge points	All
OWQ4	Detailed design of viaducts across waterways would aim to minimise infrastructure within the bed and banks of existing waterways and minimise changes to flood behaviour across the floodplain	Off-airport

Ref	Mitigation measures	Applicable location(s)
OWQ5	Where feasible, 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	All
OWQ6	At all locations where stormwater is discharged, water quality measures such as gross pollutant traps, bio-retention swales and Water Sensitive Urban Design features would be investigated and implemented where feasible and reasonable	All
OWQ7	Water treatment plants would be designed to ensure that wastewater is treated to a level that is compliant with the ANZECC/ ARMCANZ (2000), ANZG (2018) and draft ANZG (2020) default guidelines for 95 per cent species protection and 99 per cent species protection level for toxicants that bioaccumulate unless other discharge criteria are agreed with relevant authorities	St Marys Station Bringelly services facility
Groundwater and geology – construction		
GW1	Further assessment would be undertaken during design development, and prior to construction commencing, to ensure that damage to buildings and structures at risk of ground movement impacts around St Marys, Claremont Meadows, Orchard Hills and Bringelly are avoided or managed Where building damage risk is rated as slight, moderate or high (as per Rankin 1988), a structural assessment of the affected buildings/structures would be carried out and specific measures implemented to address the risk of damage	St Marys construction site Claremont Meadows services facility construction site Orchard Hills construction site Bringelly services facility construction site

Ref	Mitigation measures	Applicable location(s)
GW2	Further assessment of road and rail infrastructure and utility assets (including the Warragamba to Prospect Water Supply Pipelines) considered to be at risk from ground movement would be undertaken during design development. Consultation would be undertaken with the infrastructure and asset owners in each case to determine appropriate ground movement criteria for the assessment and, if required, to agree management measures to manage potential impacts	St Marys construction site Claremont Meadows services facility construction site Orchard Hills construction site Off-airport construction corridor Bringelly services facility construction site
GW3	Further assessment of potential ground movement impacts on the Goods Shed building at St Marys Station, including a building condition survey, would be carried out during design development and prior to the commencement of construction. The assessment would be carried out in consultation with a suitably qualified heritage architect and would identify acceptable ground movement criteria and, if required, feasible measures to reduce or mitigate the effects of ground movement on this structure Ground movement in the vicinity of the Goods Shed and the condition of the Goods Shed building would be monitored during construction A dilapidation survey of the Goods Shed would be carried out prior to work commencing in the vicinity of the building. At the completion of construction, should there be any damage to the building which is determined to be as a result of the project construction works, the building would be repaired in consultation with a suitably qualified heritage architect	St Marys construction site
GW4	Consultation with Western Sydney Airport will be on-going in respect to the construction programs for both projects to understand the potential for ground movement impacts to proposed buildings and structures	On-airport

Ref	Mitigation measures	Applicable location(s)
GW5	Detailed hydrogeological and geotechnical models for the project would be developed and progressively updated during design and construction These models would: • be informed by the results of groundwater monitoring undertaken before and during construction • identify predicted changes to groundwater levels, including at nearby water supply works and at groundwater dependent ecosystems or other sensitive groundwater receptors Where changes to groundwater levels are predicted at nearby water supply works, groundwater dependent ecosystems or other sensitive groundwater receivers, an appropriate groundwater monitoring program would be developed and implemented Where changes to groundwater level are close to the ground surface, dryland salinity monitoring would be implemented to allow for management of any identified impacts The groundwater monitoring program would aim to confirm no adverse impacts on the receiver during construction or to effectively manage any impacts with the implementation of appropriate mitigation measures. Monitoring at any specific location would be subject to the status of the water supply work and agreement with the landowner	All
GW6	A Groundwater Management Plan would be prepared and implemented. The plan must include the following trigger-action-response measures in relation to groundwater levels in areas identified as subject to potential drawdown (at groundwater dependent ecosystems or other sensitive receivers) but outside the construction footprint and Western Sydney International Stage 1 Construction Impact Zone: a. target criteria, set with reference to relevant standards and site specific parameters b. trigger values and corresponding corrective actions to prevent recurring or long-term exceedance of the target criteria described in (a) c. corrective actions to compensate for any recurring or long-term exceedance of the target criteria described in (a) Response measures may include: • targeted ground improvement and grouting to limit groundwater inflows into station excavations, tunnels and cross-passage to reduce groundwater drawdown • design of undrained temporary retention systems to minimise groundwater inflow into station excavations and reduce groundwater drawdown • supplementing groundwater supply at affected groundwater dependent ecosystems or watercourses • make good provisions for groundwater supply wells impacted by changes in groundwater level or quality	All
Groundwater and geology – operation		
OGW1	Ongoing groundwater inflows from drained project elements (or incidental flows) would be treated and tested before discharge to comply with any relevant Environment Protection Licence or agreed discharge criteria	St Marys Station Bringelly services facility

Ref	Mitigation measures	Applicable location(s)
Soils and contamination – construction		
SC1	The Soil and Water Management Plan would incorporate the following measures: • for low risk areas of environmental concern, worker health and safety measures, waste management and tracking for contamination would be outlined • for medium and high risk areas of environmental concern, detailed site investigations and review of further available information would be undertaken prior to the start of construction	All
SC2	Based on outcomes of SC1: • if a medium or high risk area of environmental concern is reassessed as low risk, the site would be managed in accordance with the Soil and Water Management Plan. This would typically occur where there is minor, isolated contamination that can be readily remediated through standard construction practices such as excavation and off-site disposal • for areas of environmental concern that remain or change to medium risk, visual inspections and monitoring would be performed during earthworks. If suspected contamination is encountered, the materials would be subject to sampling and analysis to assess management requirements in accordance with statutory guidelines made or endorsed by the NSW Environment Protection Authority • for areas of environmental concern that remain or change to high risk, a Sampling, Analysis and Quality Plan would be prepared for Detailed Site Investigations or data gap investigations. The results from the site investigations would be assessed against criteria contained within the *National Environment Protection (Assessment of Site Contamination) Measure* (2013) and other applicable NSW statutory guidelines to assess whether remediation is required. Remediation works would be performed in accordance with the hierarchy of preferred strategies in the *Guidelines for the NSW Site Auditor Scheme* (NSW Environment Protection Authority, 2017) and other guidelines made or endorsed by the NSW Environment Protection Authority Where practical, remediation works would be integrated with excavation and development works performed during construction	Off-airport

Ref	Mitigation measures	Applicable location(s)
SC3	Where information gathered from investigations for medium and high risk areas of environmental concern (as per mitigation measure SC1) is insufficient to determine the risk of contamination, a detailed site investigation would be carried out in accordance with the *National Environment Protection Measure* (2013) and other guidelines made or endorsed by the NSW Environment Protection Authority Where data from the additional data review (mitigation measure SC1) or the detailed site investigation (mitigation measure SC2) confirms that contamination would require remediation, a Remediation Action Plan would be developed for the area of the construction footprint If a Remediation Action Plan is required, it would be developed in accordance with NSW Environment Protection Authority statutory guidelines and a Site Auditor would be engaged. Remediation methodologies would be undertaken in accordance with Australian Standards and other relevant government guidelines and codes of practice Remediation would be performed as an integrated component of construction and to a standard commensurate with the proposed end use of the land	Off-airport
SC4	If a duty to report to the NSW Environment Protection Authority under Section 60 of the *Contaminated Lands Management Act 1997* is triggered, or where a medium to high risk of contamination is identified, an accredited Site Auditor would review and approve the Remediation Action Plan (including issue of interim audit advice), and would develop a Site Audit Statement and Site Audit Report upon completion of remediation	Off-airport
SC5	An unexpected finds procedure would be developed and implemented as part of the project Soil and Water Management Plan, outlining a set of potential contamination issues which could be encountered, and detailing the management actions to be implemented. The unexpected finds procedure would include a process for chemical and asbestos contamination and would generally include: • cessation of works within the affected area until inspection of the suspected contamination by a qualified contaminated lands consultant • collection of soil samples for chemical or asbestos analysis, where required, based on observations • assessment of results against applicable land use or waste classification criteria in accordance with statutory guidelines made or endorsed by the NSW Environment Protection Authority • management of the contamination in accordance with statutory guidelines made or endorsed by the NSW Environment Protection Authority • the unexpected finds procedure for on-airport construction would be consistent with the Western Sydney Airport unexpected finds procedure detailed in the *Western Sydney Airport Soil and Water Construction Environmental Management Plan*	All

Ref	Mitigation measures	Applicable location(s)
SC6	Post construction, an inspection of construction, stockpiling and laydown sites and soil validation of redundant sedimentation/water quality basins would be undertaken to assess if further investigation and remediation is required. Investigation and remediation (if required) would be undertaken in accordance with the Soil and Water Management Plan (off-airport) and a project specific Remediation Action Plan that would be prepared in a manner consistent with the *Western Sydney Airport Remediation Action Plan* (on-airport). All inspections, investigations and remediation would be undertaken by a qualified contaminated lands consultant with reports prepared or reviewed by a Certified Contaminated Land Consultant	All
SC7	Prior to ground disturbance in areas of potential acid sulfate soil occurrence, testing would be carried out to determine the actual presence of acid sulfate soils. If acid sulfate soils are encountered, they would be managed in accordance with the *Acid Sulfate Soil Manual* (Acid Sulfate Soil Management Advisory Committee, 1998)	All
SC8	Prior to ground disturbance in high probability salinity areas testing would be carried out to determine the presence of saline soils. If salinity is encountered, excavated soils would not be reused or would be managed in accordance with *Book 4 Dryland Salinity: Productive Use of Saline Land and Water* (NSW DECC 2008). Erosion controls would be implemented in accordance with the *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004)	All
SC9	Targeted groundwater investigations would be undertaken prior to construction to identify high salinity areas at risk from rising groundwater. Where high saline areas (>1000 µS/cm) are identified, measures such as planting, regenerating and maintaining native vegetation and good ground cover in recharge, transmission and discharge zones would be implemented where possible	All
SC10	Where the construction footprint is not used as part of the operational footprint (residual land), an assessment of the suitability of the site for the proposed land use would be undertaken in accordance with statutory guidelines made or endorsed by the NSW Environment Protection Authority	Off-airport
SC11	For works within Western Sydney International: • a review of further available information from Western Sydney Airport would be undertaken prior to the commencement of construction, which may include review of investigations, the *Western Sydney Airport Remediation Action Plan* and validation reports • any remediation works (for contamination encountered by Sydney Metro that has not been remediated by Western Sydney Airport) would be undertaken in accordance with the Sydney Metro Remediation Action Plan, developed in a manner consistent with the *Western Sydney Airport Remediation Action Plan*	On-airport

Ref	Mitigation measures	Applicable location(s)
Sustainability, climate change and greenhouse gas – construction		
SUS1	A Sustainability Plan would be developed and implemented during construction of the project. The Sustainability Plan would identify the sustainability, climate change and greenhouse gas objectives, initiatives and targets which would be implemented during further design development and construction of the project. The Sustainability Plan would be developed to be consistent with the *Western Sydney Airport Sustainability Plan* for on-airport works The Sustainability Plan would also inform the preparation of Sustainability Management Plans for each off-airport construction work package	All
SUS2	Protect sensitive construction equipment from the effects of extreme weather, such as direct exposure to the sun on extreme heat days and flooding	All
SUS3	Address climate change impacts in emergency management procedures for the construction of the project, such as consideration of impacts of flash flooding on evacuation procedures	All
GHG1	Carry out an iterative process of greenhouse gas assessments and design refinement prior to construction to identify opportunities to minimise greenhouse gas emissions Performance would be measured in terms of a percentage reduction in greenhouse gas emissions, and assessed against a business as usual project benchmark verified by Infrastructure Sustainability Council of Australia or equivalent independent industry body	All
Sustainability, climate change and greenhouse gas – operation		
OSUS1	A Sustainability Plan would be developed and implemented during operation of the project. The Sustainability Plan would identify the sustainability, climate change and greenhouse gas objectives, initiatives and targets which would be implemented during further design development and operation of the project. The Sustainability Plan would be developed to be consistent with the *Western Sydney Airport Sustainability Plan* for on-airport works	All
OSUS2	Climate change risk treatments would be confirmed and incorporated during further design development	All
OGHG1	Carry out an iterative process of greenhouse gas assessments and design refinement during detailed design to identify opportunities to minimise greenhouse gas emissions Performance would be measured in terms of a percentage reduction in greenhouse gas emissions, and assessed against a business as usual project benchmark verified by Infrastructure Sustainability Council of Australia or equivalent independent industry body	All
Resource management – construction		
WR1	Construction waste would be minimised by accurately calculating materials brought to the site and limiting materials packaging	All
WR2	Waste streams would be segregated to avoid cross-contamination of materials and maximise reuse and recycling opportunities	All
WR3	A materials tracking system would be implemented for material transferred between construction sites	All

Ref	Mitigation measures	Applicable location(s)
Resource management – operation		
OWR1	Generation of waste would be minimised and reused where possible in line with the waste hierarchy and the sustainability objectives outlined in a Sustainability Plan. In addition: • bins would be provided for general waste and recyclables and collection would be undertaken by an authorised contractor for off-site recycling or disposal at a licenced waste facility • waste from maintenance activities, including containers holding grease and lubricants, would be stored in designated areas for collection by an authorised contractor for off-site disposal • waste oil and oil filters would be stored in recycling bins and collected by an authorised contractor, and recycled off-site, where feasible • wastewater, sewage and grey water would be disposed to stormwater, sewer, recycled wastewater system or transported to an appropriately licenced liquid waste treatment facility (if water quality does not meet requirements for discharge to the stormwater/sewer system)	All
Land use and property – construction		
LU1	Areas of land leased for the purposes of construction would be reinstated at the end of the lease to at least equivalent standard in consultation with the landowner	Off-airport
LU2	Where required property adjustments have the potential to impact farm infrastructure (such as fencing or dams) or local access to properties, consultation with affected property owners would be carried out prior to these works occurring, in order to determine reasonable, feasible and acceptable solutions	Off-airport
LU3	Where a property would be potentially fragmented by the construction corridor, access to properties would be maintained, in consultation with the landowner(s)	Off-airport construction corridor
Land use and property – operation		
OLU1	Where a property would be potentially fragmented by the rail corridor, access to properties would be provided. The location of access to be provided would be agreed in consultation with the landowner(s)	Off-airport
OLU2	Sydney Metro would continue to consult with key stakeholders during design development of the station interchanges and precincts	Off-airport
Landscape and visual – construction		
LV1	Opportunities for the retention and protection of existing street trees and trees within the construction sites would be identified during detailed construction planning	Off-airport
LV2	Existing trees to be retained would be protected prior to the commencement of construction in the vicinity of these trees in accordance with AS4970-2009 Protection of Trees on Development Sites	All
LV3	All structures (including potential acoustic sheds, site offices, workshop sheds and site hoarding) would be finished in a colour which aims to minimise their visual impact where appropriate. This finish is to be applied to all visible fixtures and fittings (such as exposed downpipes)	All

Ref	Mitigation measures	Applicable location(s)
Landscape and visual – operation		
OLV1	The landscape design for the project would include consideration of appropriate species lists to minimise opportunities to attract wildlife at levels likely to present a hazard to aviation operations. The landscape design would have regard to relevant requirements and species lists under the *Western Sydney Airport Wildlife Management Plan* and other relevant guidelines, including the *National Airports Safeguarding Framework Guideline C: Managing the Risk of Wildlife Strikes in the Vicinity of Airports* (Australian Government, 2014) and *Recommended Practices No. 1 – Standards for Aerodrome Bird/Wildlife Control* (International Birdstrike Committee 2006)	All
OLV2	Lighting at stations would be designed and operated in accordance with AS4282- 2019 Control of the obtrusive effects of outdoor lighting and the *National Airports Safeguarding Framework Guideline E: Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airports* (Australian Government, 2014) (where relevant)	All
OLV3	Opportunities to provide vegetation screening of the stabling and maintenance facility (from sensitive receivers such as Luddenham Road and the surrounding rural areas within the viewshed) would be investigated during design development. This would include investigating options for establishing screening vegetation as early in the construction phase as possible	Stabling and maintenance facility
OLV4	Landscape screening would be provided along the corridor including restoring vegetation along the creeks to contain local views, in accordance with the Sydney Metro – Western Sydney Airport Design Guidelines, to minimise adverse visual impacts where feasible	All
OLV5	Corridor services, including the combined services route would be designed to reduce visual clutter and minimise visual impact ensuring these structures have a low profile and do not obstruct views across the corridor	All
OLV6	Proposed engineering batters and water management measures would be designed to integrate with the existing landforms and natural features	All
OLV7	The landscape design for the project would: • incorporate salvaged native trees (including tree hollows and root balls), to enhance fauna habitat in suitable locations, including riparian corridors, where practicable • use native species from the relevant native vegetation communities within the local area for tree planting programs	All
Social and economic – construction		
SE1	Consultation with the local community and project stakeholders would be undertaken to: • identify and deliver opportunities for facilitating local creative and cultural activities in appropriate project locations • identify and deliver initiatives and opportunities to provide a positive contribution to the potentially affected community and affected locations such as temporary public art and targeted community events and programs	Off-airport
SE2	Not used	
SE3	Where partial property acquisition has been identified, undertake property liaison and consultation activities to minimise disruption to property owners and activities on impacted sites	Off-airport

Ref	Mitigation measures	Applicable location(s)
Air quality – construction		
AQ1	The Air Quality Management Plan for the project would incorporate the following best-practice odour management measures which would be implemented as appropriate during relevant construction works: • the extent of opened and disturbed contaminated soil at any given time would be minimised • temporary coverings or odour supressing agents would be applied to excavated areas where appropriate • regular odour monitoring would be conducted during excavation to verify that no offensive odours are being generated	All
AQ2	Where acoustic sheds are proposed these would be designed and managed to prevent/minimise the escape of dust emissions	All
AQ3	Air quality monitoring, consistent with the *Western Sydney Airport Air Quality Construction Environmental Management Plan* would be carried out during construction to ensure that works meet the requirements under Schedule 1 of the Airports (Environment Protection) Regulations 1997	On-airport
Hazard and risk – construction		
HR1	All hazardous substances that may be required for construction would be stored and managed in accordance with the *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005), the *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33* (Department of Planning, Industry and Environment, 2011) the *Work Health and Safety Act 2011* (Commonwealth and NSW) and the requirements of the *Environmentally Hazardous Chemicals Act 1985* (NSW)	All
HR2	A Bushfire Management Plan would be prepared and implemented to manage current bushfire risk and identify response actions during construction of the project. The Plan would be prepared in consultation with the NSW Rural Fire Service and Western Sydney Airport. For project areas within Western Sydney International the Plan would be prepared having regard to the existing *Western Sydney Airport Site at Badgerys Creek Bushfire Risk Management Plan*	All
HR3	A hazardous materials analysis would be carried out prior to stripping and demolition of structures and buildings which are suspected of containing hazardous materials (particularly asbestos) Hazardous materials and special waste (such as asbestos) would be removed and disposed of in accordance with the relevant legislation, codes of practice and Australian Standards (including the Work Health and Safety and Regulation 2011 (NSW))	All
HR4	Where the project crosses or is adjacent to the Warragamba to Prospect Water Supply Pipelines, construction planning, and approaches to minimising risks of damage or rupture to the Pipelines, would be developed in consultation with WaterNSW, and in accordance with the *Guidelines for Development Adjacent to the Upper Canal and Warragamba Pipelines* (Water NSW, 2020)	Off-airport construction corridor

Ref	Mitigation measures	Applicable location(s)
Hazard and risk – operation		
OHR1	All hazardous substances that may be required for operation would be stored and managed in accordance with the *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005), the *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33* (Department of Planning, Industry and Environment, 2011), the *Work Health and Safety Act 2011* (Commonwealth and NSW) and the requirements of the *Environmentally Hazardous Chemicals Act 1985* (NSW)	All
OHR2	A Bushfire Management Plan would be prepared and implemented to manage current bushfire risk and identify response actions during operation of the project. The Plan would be prepared in consultation with the NSW Rural Fire Service and Western Sydney Airport. For project areas within Western Sydney International the Plan would be prepared having regard to the existing *Western Sydney Airport Site at Badgerys Creek Bushfire Risk Management Plan*	All
OHR3	Where the project crosses or is adjacent to the Warragamba to Prospect Water Supply Pipelines, the design of the project would aim to minimise risks of damage or rupture of the Pipelines in consultation with WaterNSW, and in accordance with the *Guidelines for Development Adjacent to the Upper Canal and Warragamba Pipelines* (Water NSW, 2020)	Off-airport construction corridor
OHR4	The project would be designed to avoid pilot distraction and minimise the risk of headlight glare from metro trains where on surface rail alignment. This would include providing glare screens in those locations where the project creates an unacceptable risk of pilot distraction	All
Cumulative impacts – construction		
CL1	A Cumulative Construction Impacts Management Plan would be developed and would detail co-ordination and consultation requirements with the following stakeholders (as relevant) to manage the interface of projects under construction at the same time: • Western Sydney Airport • Transport for NSW • Western Parkland City Authority • Sydney Water • Emergency service providers • Utility providers Co-ordination and consultation requirements with these stakeholders would be detailed in the plan to include: • provision of regular updates to the detailed construction program, construction sites and haul routes • identification of key interfaces with other construction projects • development of mitigation strategies to manage cumulative impacts associated with these interfaces	All