Australian Government

NSW GOVERNMENT

sydney METRO

Sydney Metro – Western Sydney Airport

Chapter 7
Project description - operation

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7 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 8 (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.

7.1 Overview

7.1.1 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. 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).

Key operational features of the project are shown on Figure 7-1.

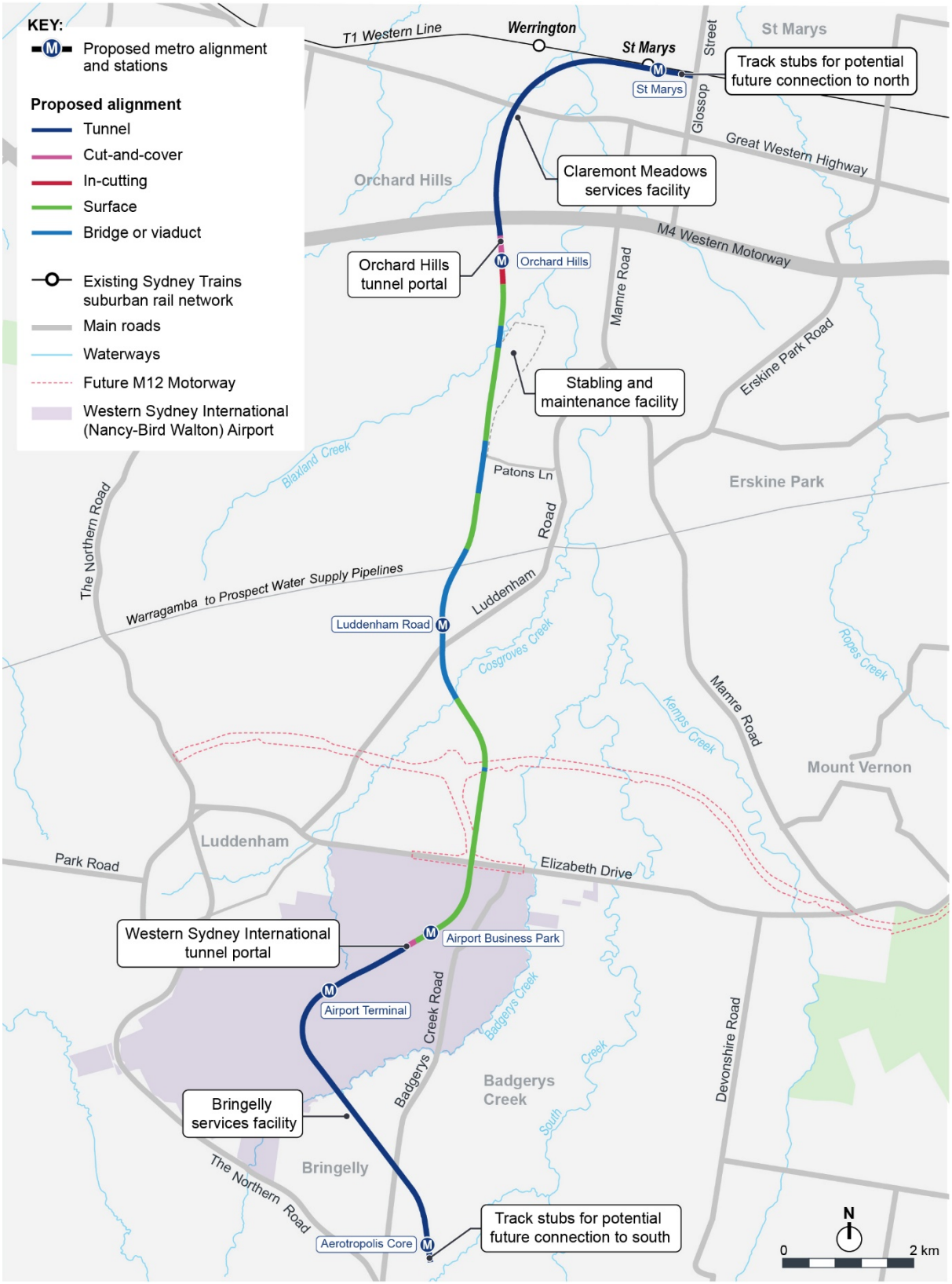


Figure 7-1 Project overview

7.1.2 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 7-1.

Table 7-1 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.

7.1.3 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 (refer to Appendix E).

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 7-2. Figure 7-2 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 7-2 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.

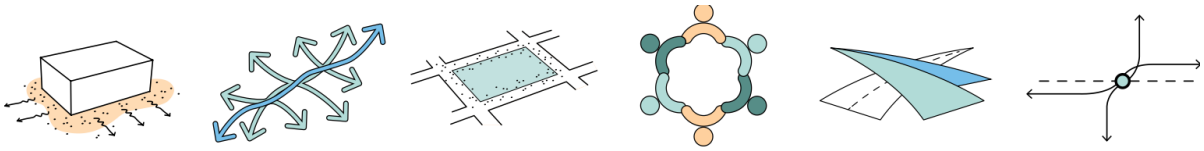
Design guidelines

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 7-2), as well as a set of corridor-wide urban design principles (Figure 7-3) 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 7-3 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 Appendix E (Design Guidelines).

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 7-1 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 7.7.3 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.

7.1.4 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.

7.2 Metro alignment and track infrastructure

7.2.1 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.

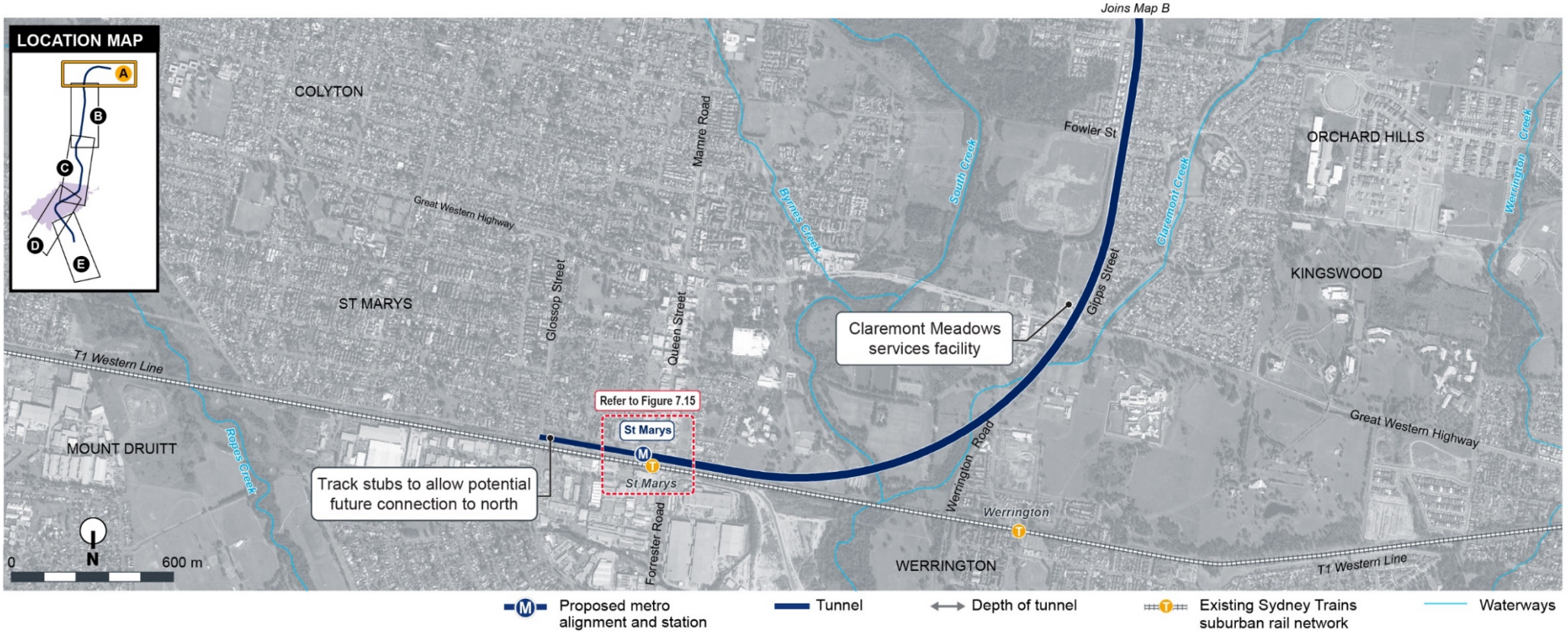
The alignment has been designed to meet the functional requirements of a metro system including the need to:

- 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 7-4a to Figure 7-4e and would continue to be refined as part of design development.



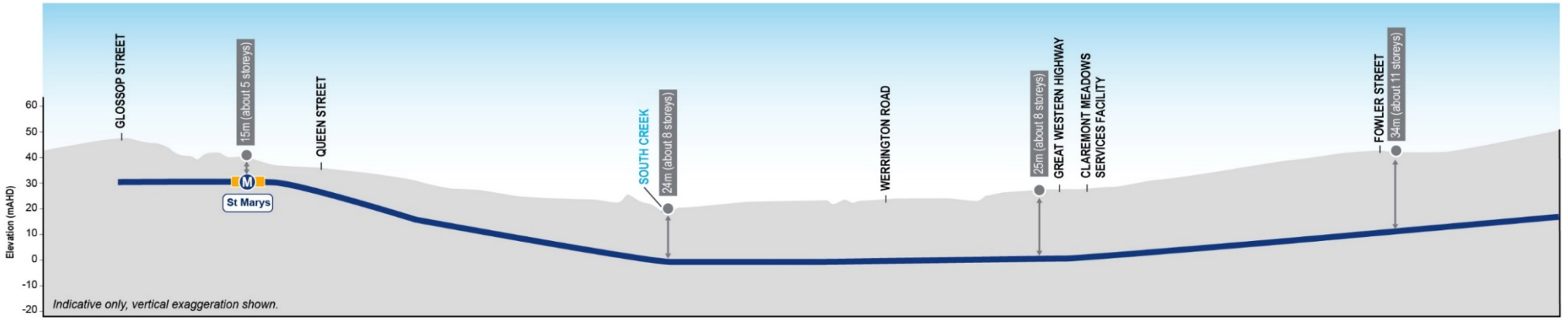
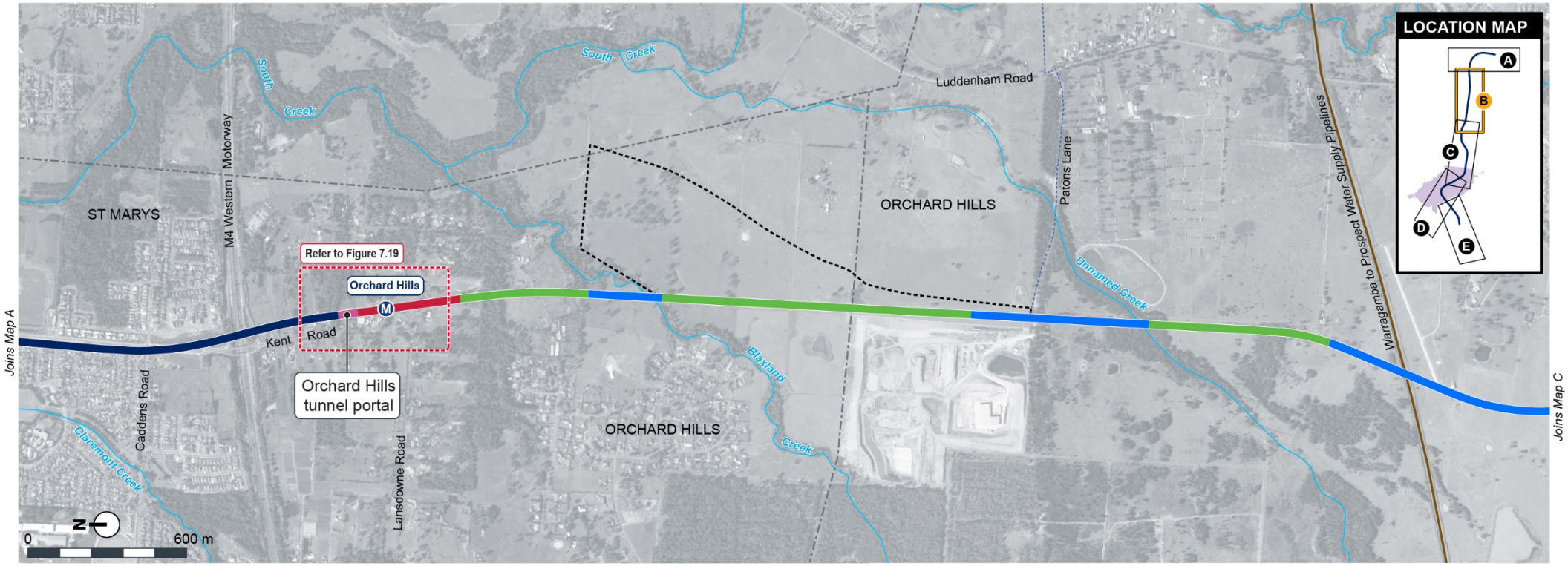


Figure 7-4a Project infrastructure and key features

Note: Indicative only, subject to design development.



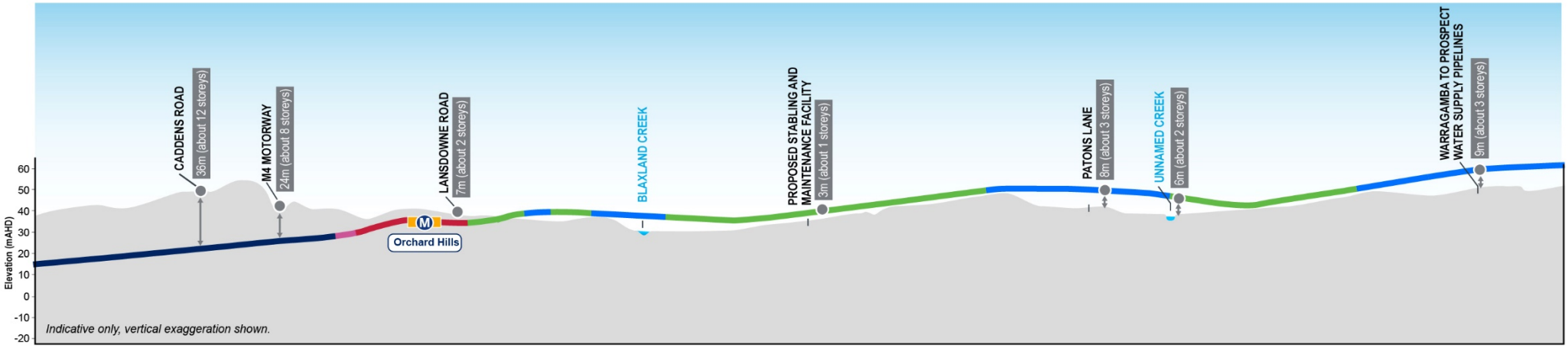


Figure 7-4b Project infrastructure and key features

Note: Indicative only, subject to design development.

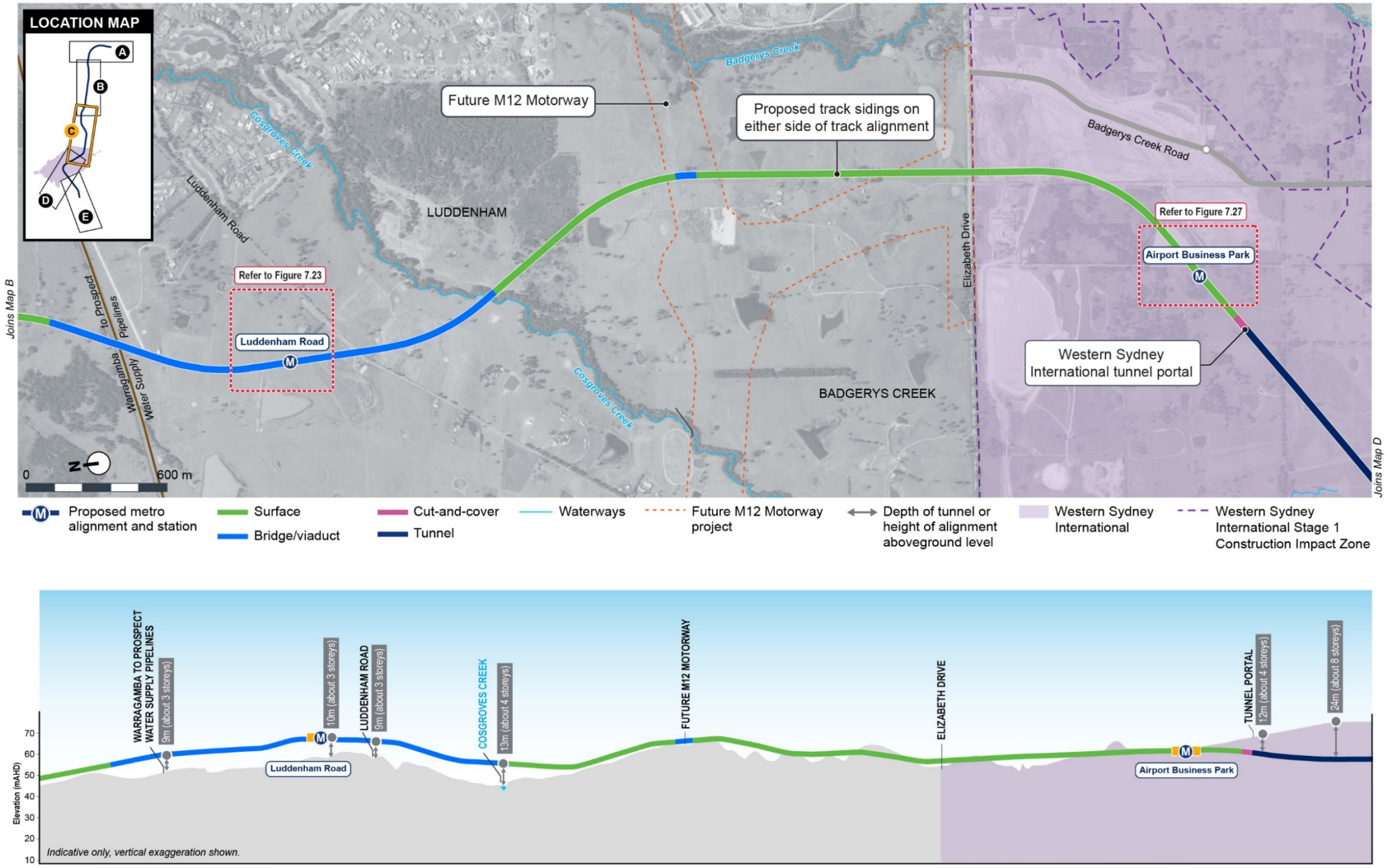
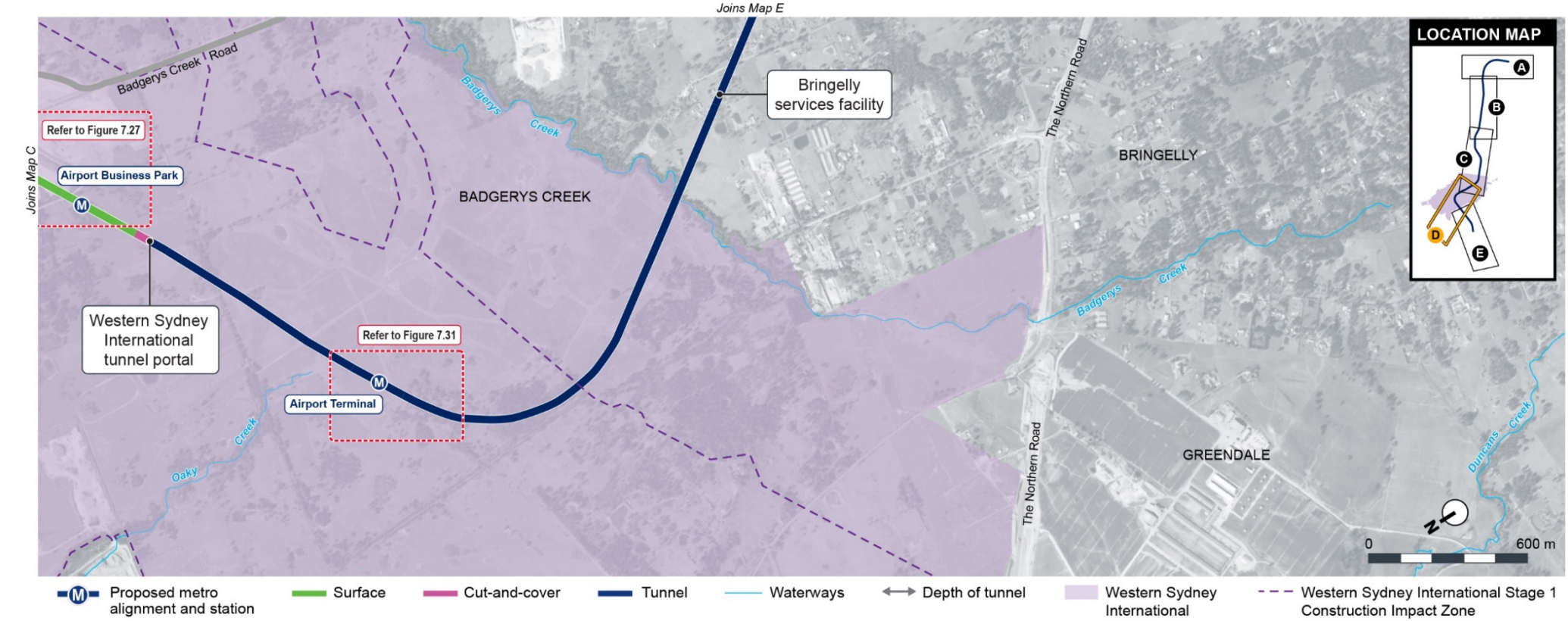


Figure 7-4c Project infrastructure and key features

Note: Indicative only, subject to design development.
Indicative final surface level shown within Western Sydney International.



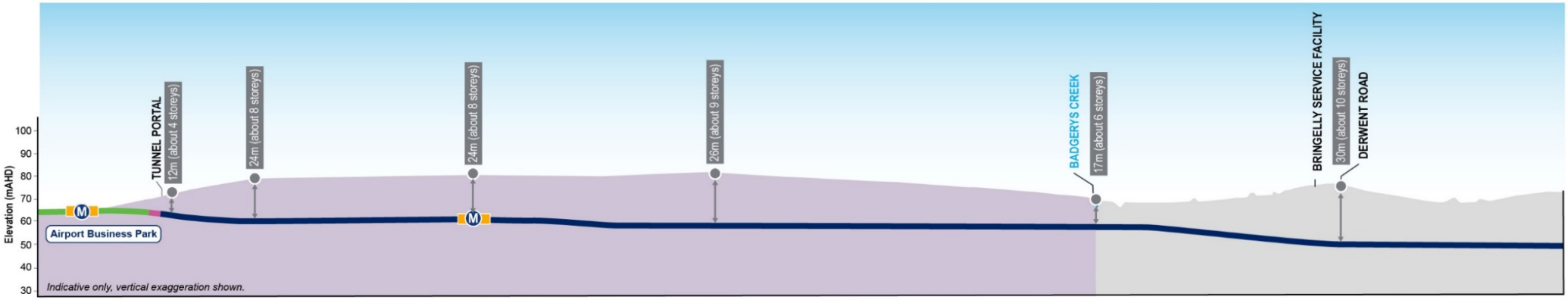
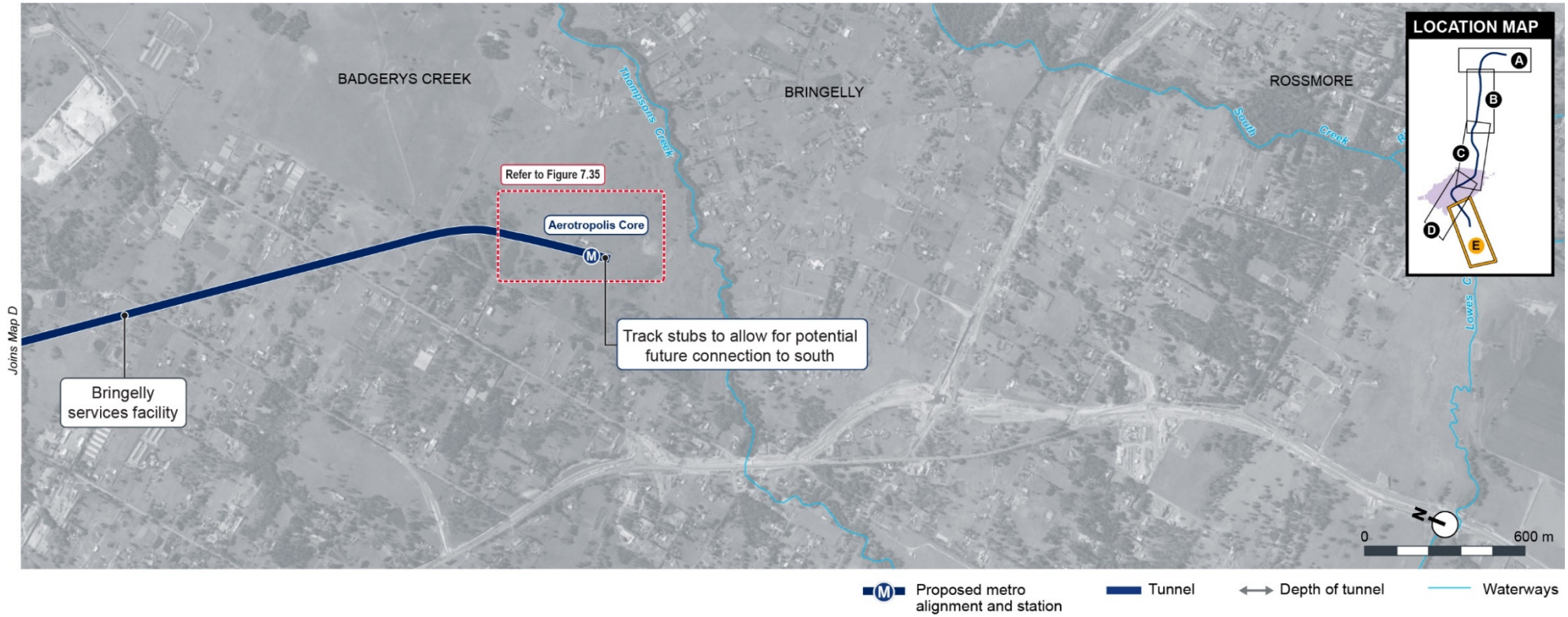


Figure 7-4d Project infrastructure and key features

Note: Indicative only, subject to design development.
Indicative final surface level shown within Western Sydney International.



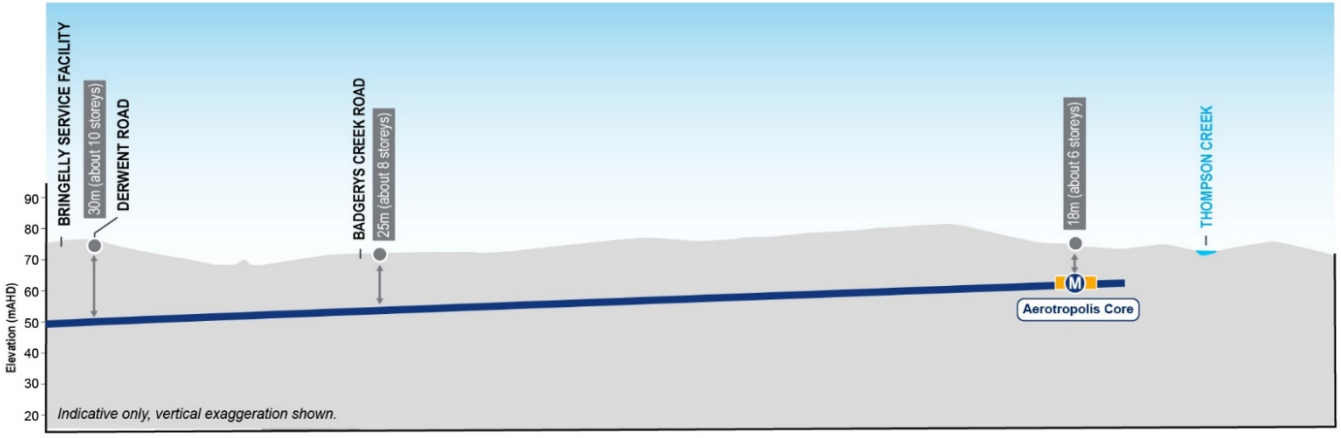


Figure 7-4e Project infrastructure and key features

Note: Indicative only, subject to design development.

7.2.2 Tunnels and underground track features

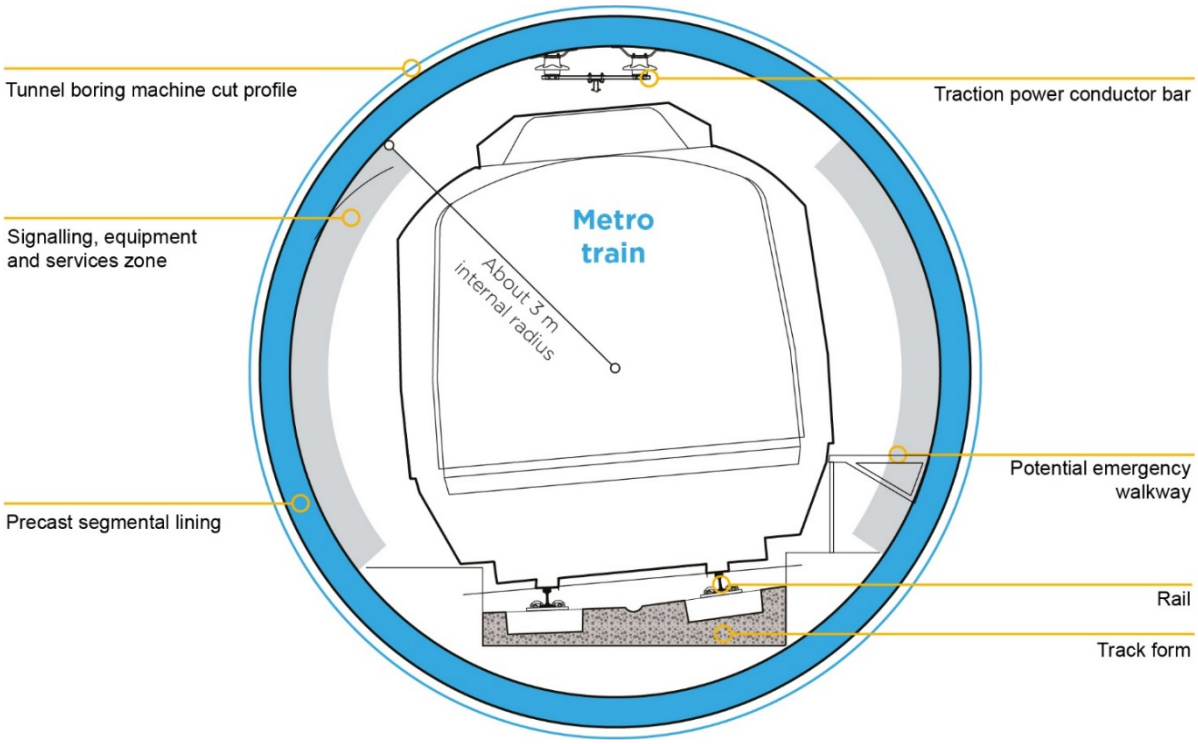
Metro rail tunnels

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 7-4a to Figure 7-4e):

- 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 7-5. 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 7-5 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.

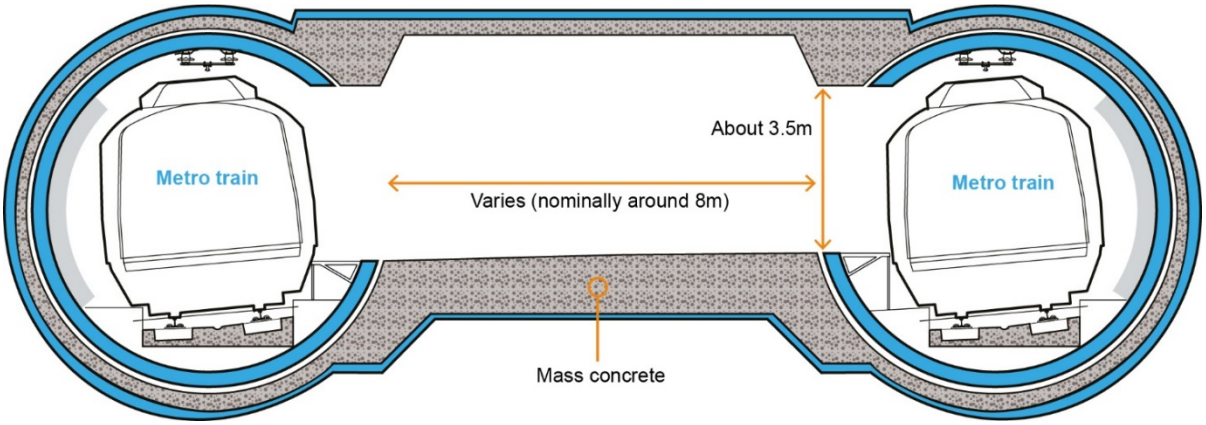
Tunnel depth

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 7-4a and Figure 7-4b. 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 7-4d and Figure 7-4e.

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 7-6 shows an indicative section of a typical cross-passage.



Note: Indicative only, subject to design development.

Figure 7-6 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)). 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 7.5.3).

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 7.5.5).

7.2.3 Surface track features

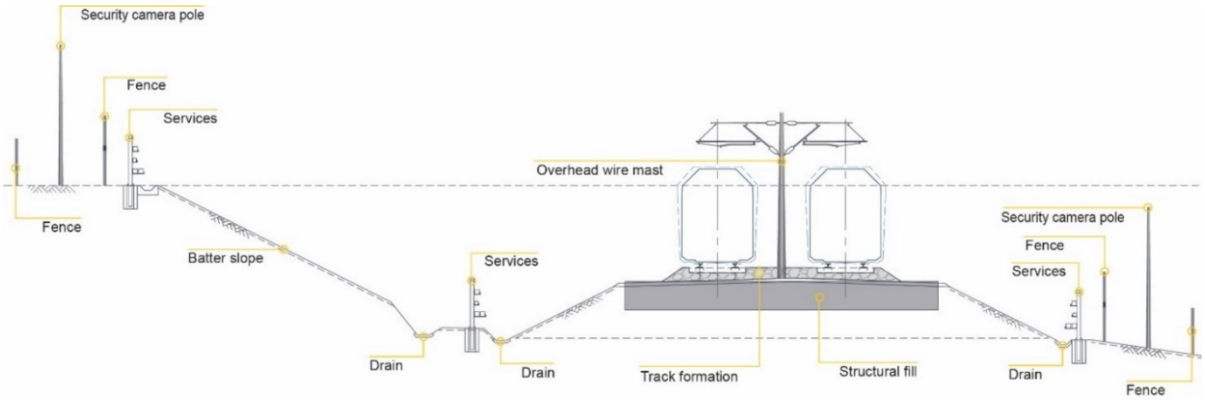
Surface tracks refer to the components of the project alignment that are at the same level as the existing surface, in addition to sections in cuttings or located on embankments. The surface sections of track would generally consist of a slab or ballast track construction with concrete sleepers. The 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 7-4b to Figure 7-4d.

Embankments and cuttings

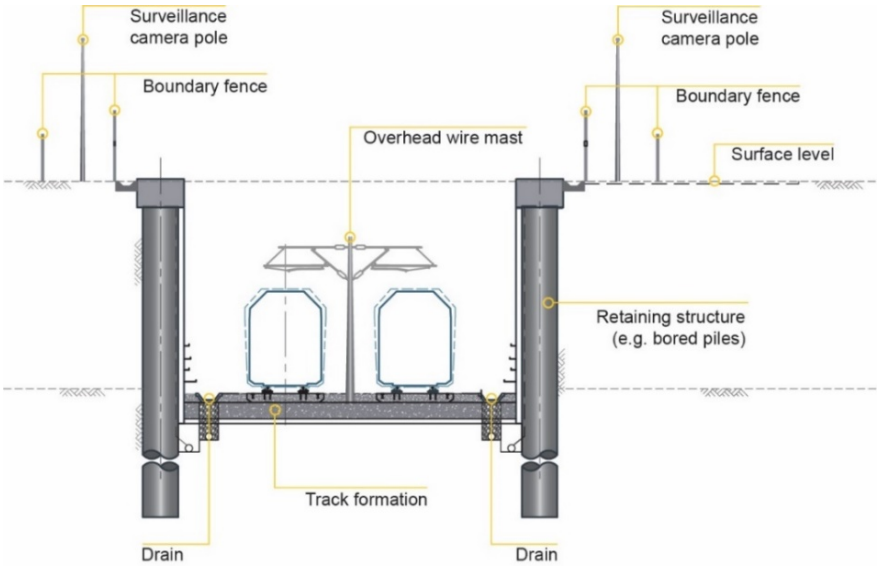
A series of fill embankments and cuttings would be required along the length of the project due to the varying terrain and locational setting of the project within the existing landscape. Batters for cuts and embankments would be designed to minimise property impacts, maintenance requirements and reduce 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 7-7 and an indicative cross-section of cutting section of track is provided in Figure 7-8.



Note: Indicative only, subject to design development.

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



Note: Indicative only, subject to design development.

Figure 7-8 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.

7.2.4 Viaducts and bridges

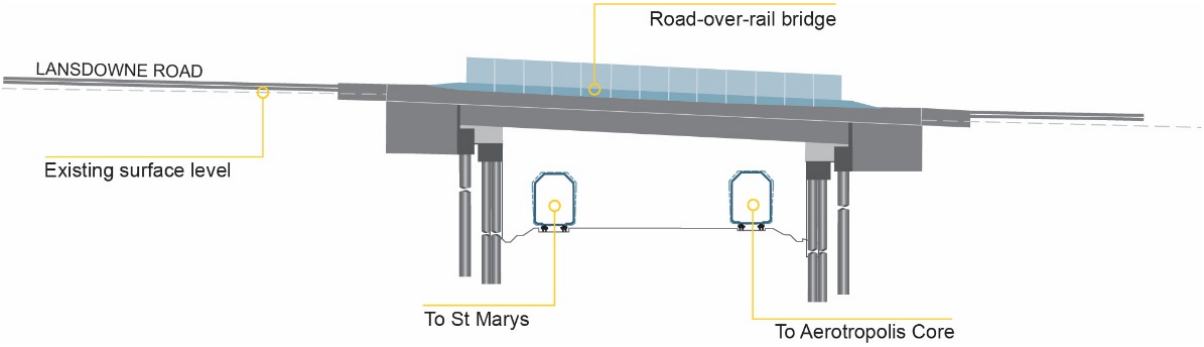
The viaduct and bridge sections would generally consist of a slab track construction with concrete sleepers. The alignment would intersect with infrastructure (such as roads and the Warragamba to Prospect Water Supply Pipelines), a number of watercourses and areas of flood prone land which would require a series of viaduct and bridge structures to cross, as identified in Table 7-2. The location of the proposed viaduct and bridge structures are shown in Figure 7-4b to Figure 7-4c. The design of each proposed bridge and viaduct structure is indicative and would be refined as part of design development.

Table 7-2 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 7-9).
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 7-10, 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 7-11.

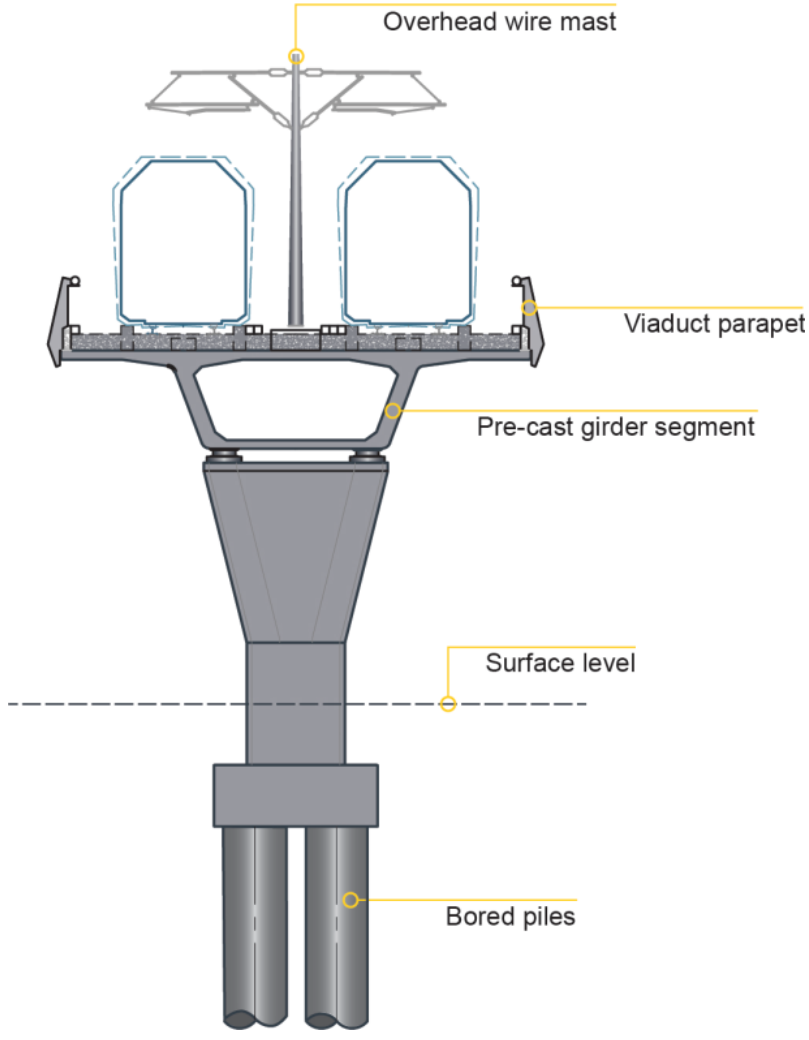
Note: The design of the proposed bridge and viaduct structures is indicative and subject to design development.

In addition to the proposed bridge and viaduct structures identified in Table 7-2, 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.



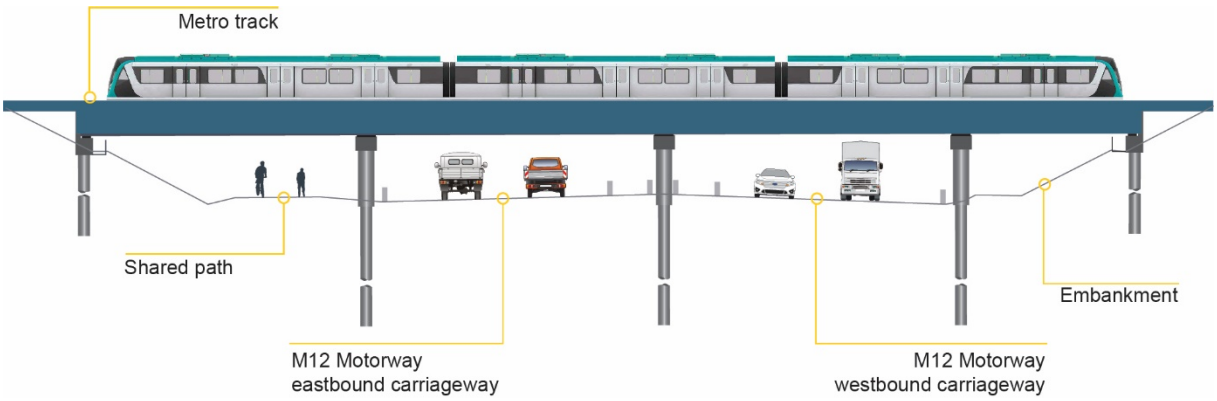
Note: Indicative only, subject to design development.

Figure 7-9 Road-over-rail bridge at Lansdowne Road



Note: Indicative only, subject to design development.

Figure 7-10 Example viaduct structure section



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

Figure 7-11 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 7.6.2)
- track/bridge deck drainage
- operational infrastructure for lighting, signalling, communications, overhead wiring and power supply.

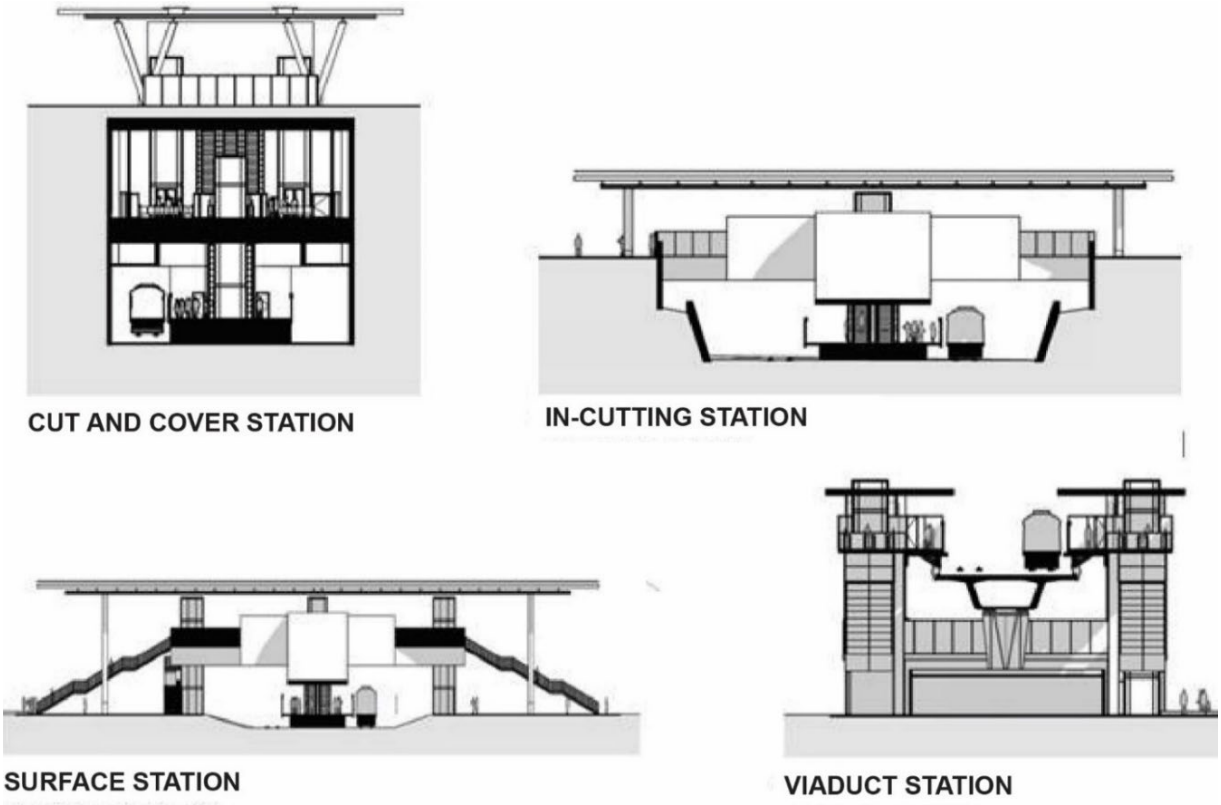
7.3 Overview of metro stations

7.3.1 Station typologies

The project would include six new metro stations between St Marys and the Aerotropolis Core precinct (see Figure 7-1). 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 7-12.



Note: Indicative only, subject to design development.

Figure 7-12 Station configurations

7.3.2 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.

7.3.3 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 7-13).

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 7-13 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 (Appendix E (Design Guidelines)).

7.3.4 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) 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.

7.4 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 Appendix E (Design Guidelines).

An overview of the proposed stations and interchange opportunities is shown in Figure 7-14. 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 7-14.

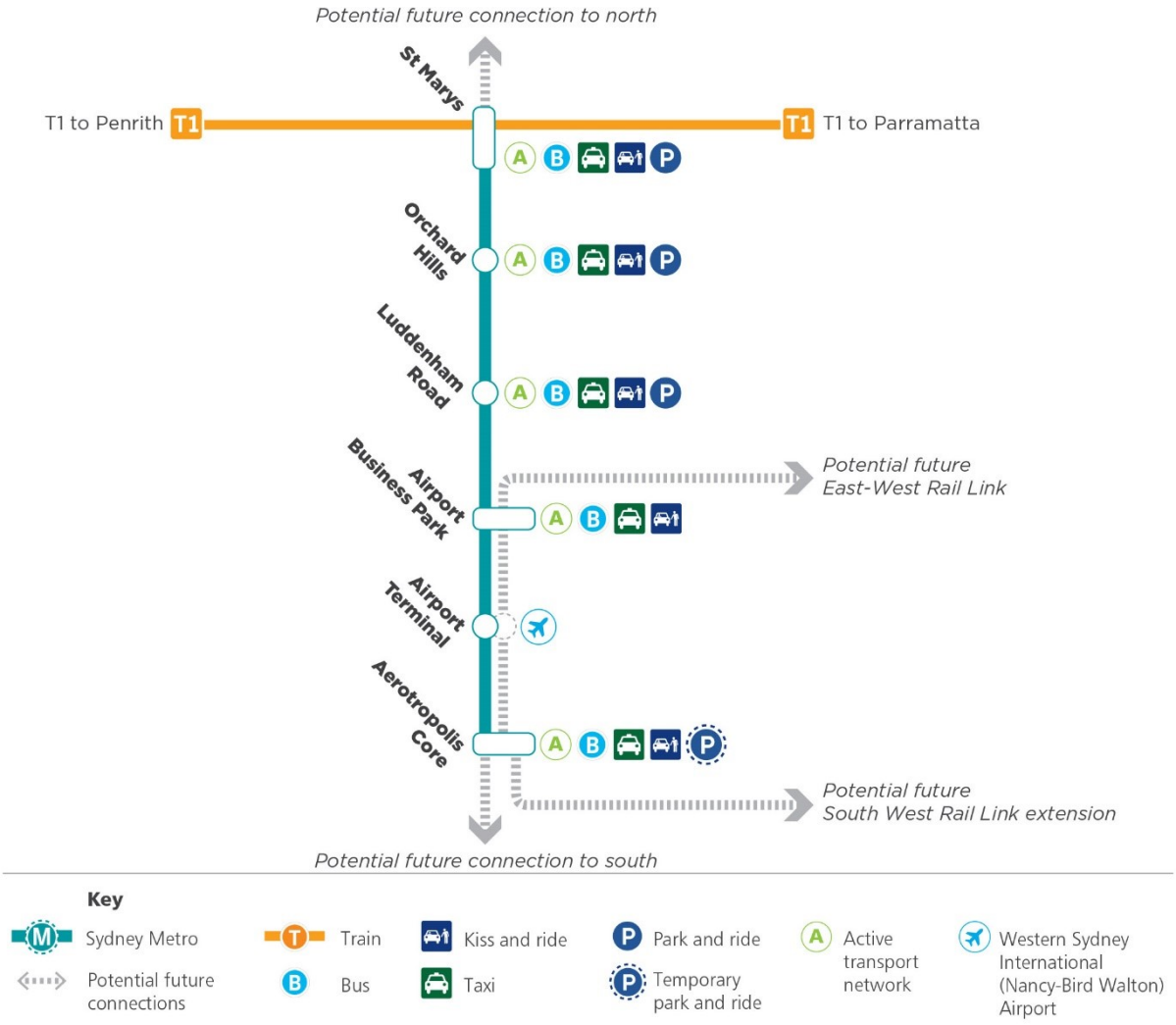


Figure 7-14 Proposed stations and interchange opportunities as part of the project

7.4.1 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) 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).

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 commuter carpark is also proposed (subject to separate approval).

An indicative layout of St Marys Station is shown in Figure 7-15, with an elevation and cross-section shown in Figure 7-16 and Figure 7-17 respectively. An artist's impression is provided in Figure 7-18.

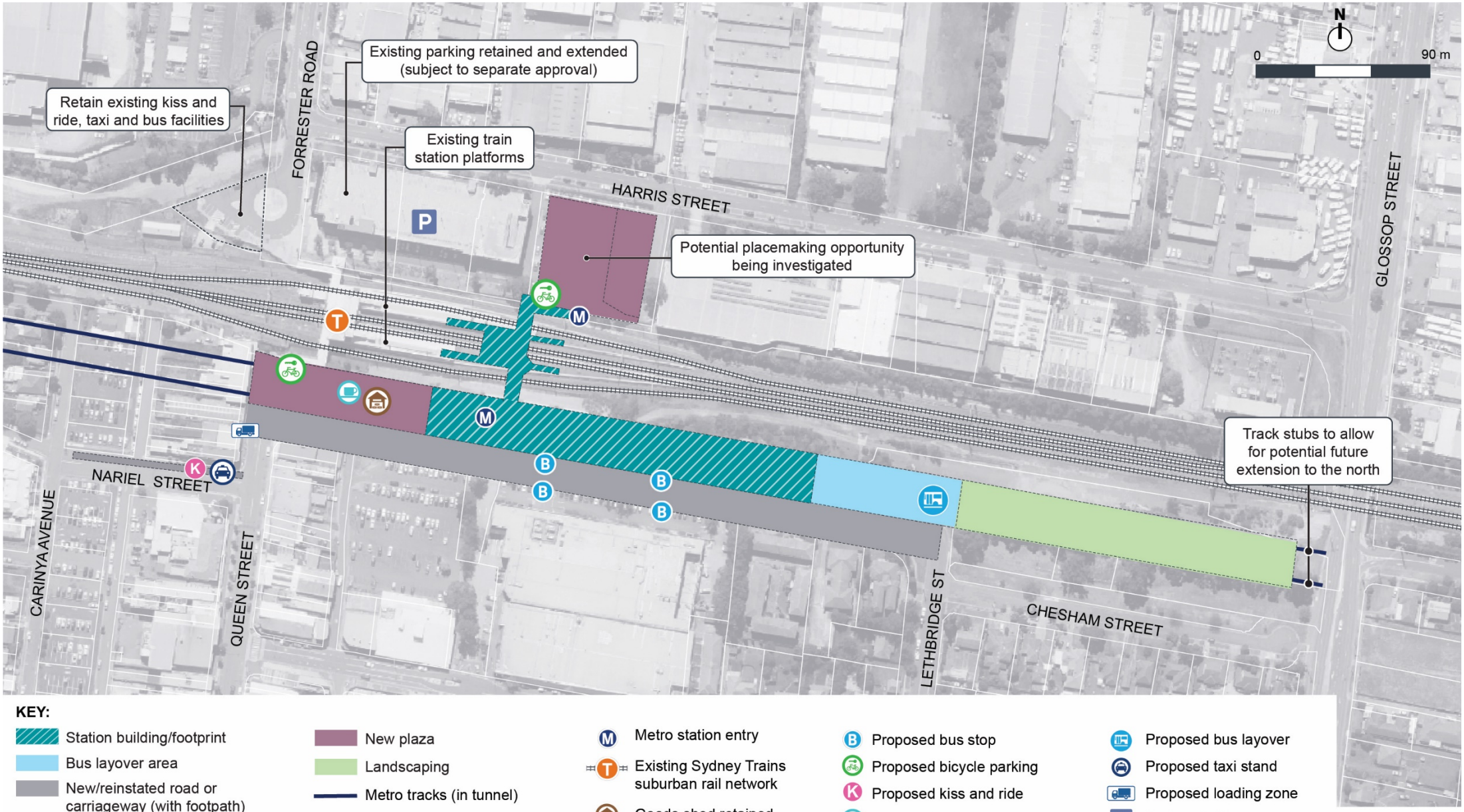
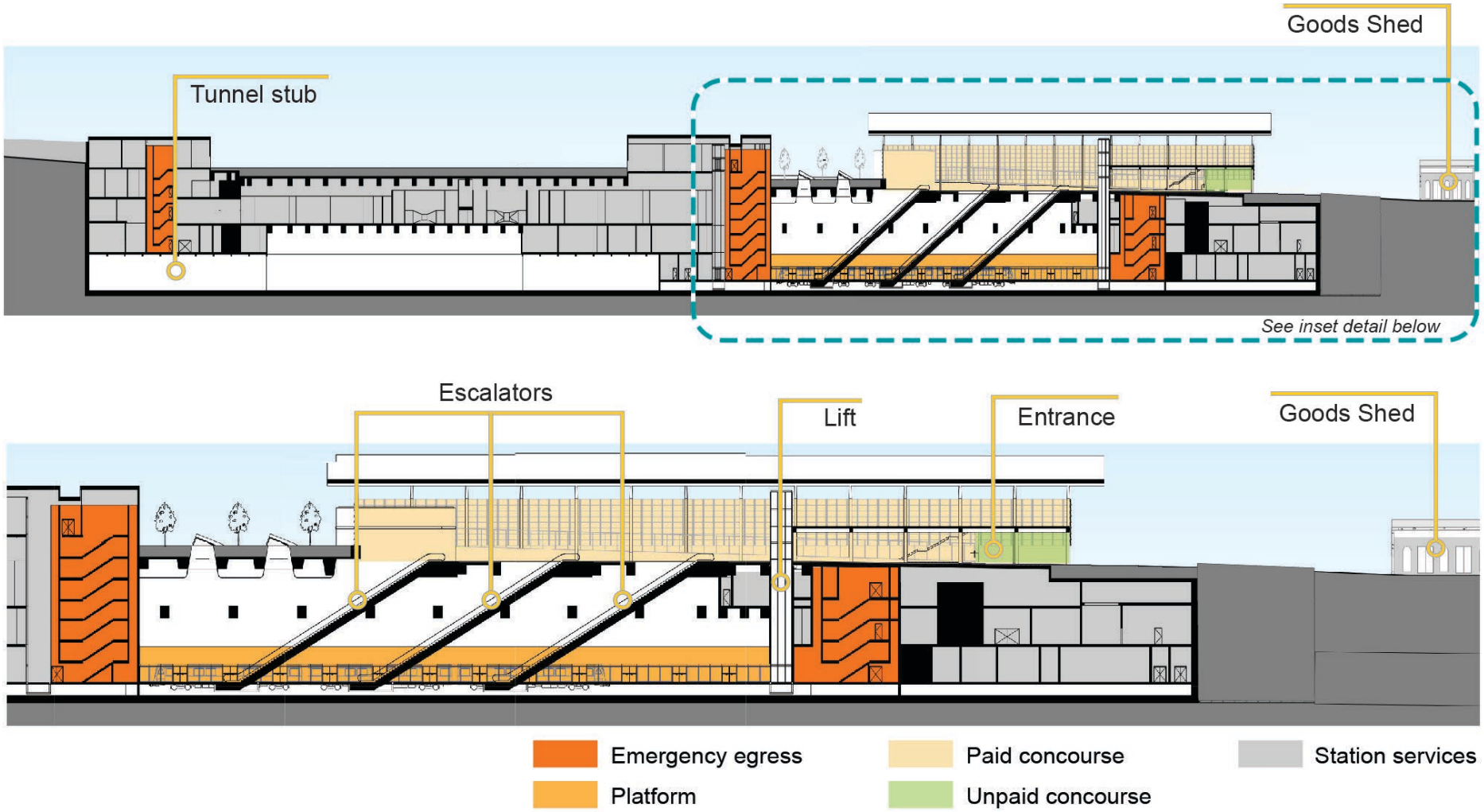


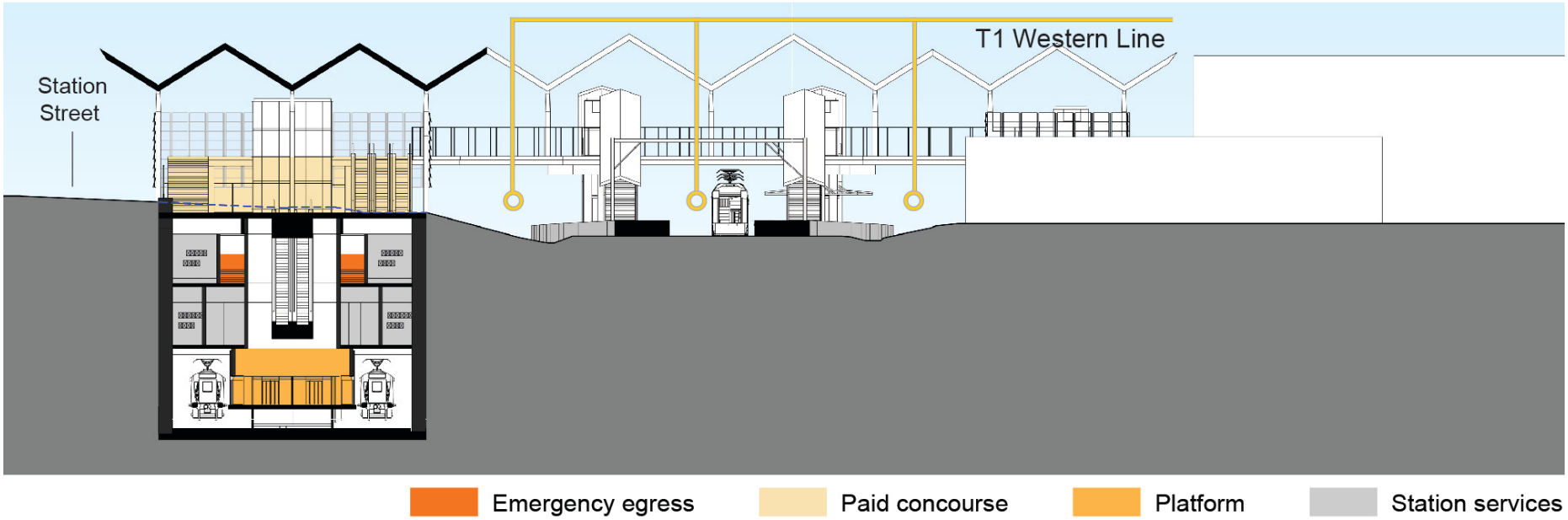
Figure 7-15 St Marys Station - Indicative layout and key design elements

Note: Indicative only, subject to design development.



Note: Indicative only, subject to design development.

Figure 7-16 St Marys Station – indicative elevation



Note: Indicative only, subject to design development.

Figure 7-17 St Marys Station – indicative cross-section

Note: Indicative only, subject to design development.

Figure 7-18 St Marys Station – artist's impression

7.4.2 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 7-19). 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 7-19, with an elevation and cross-section shown in Figure 7-20 and Figure 7-21 respectively. An artist’s impression is provided in Figure 7-22.

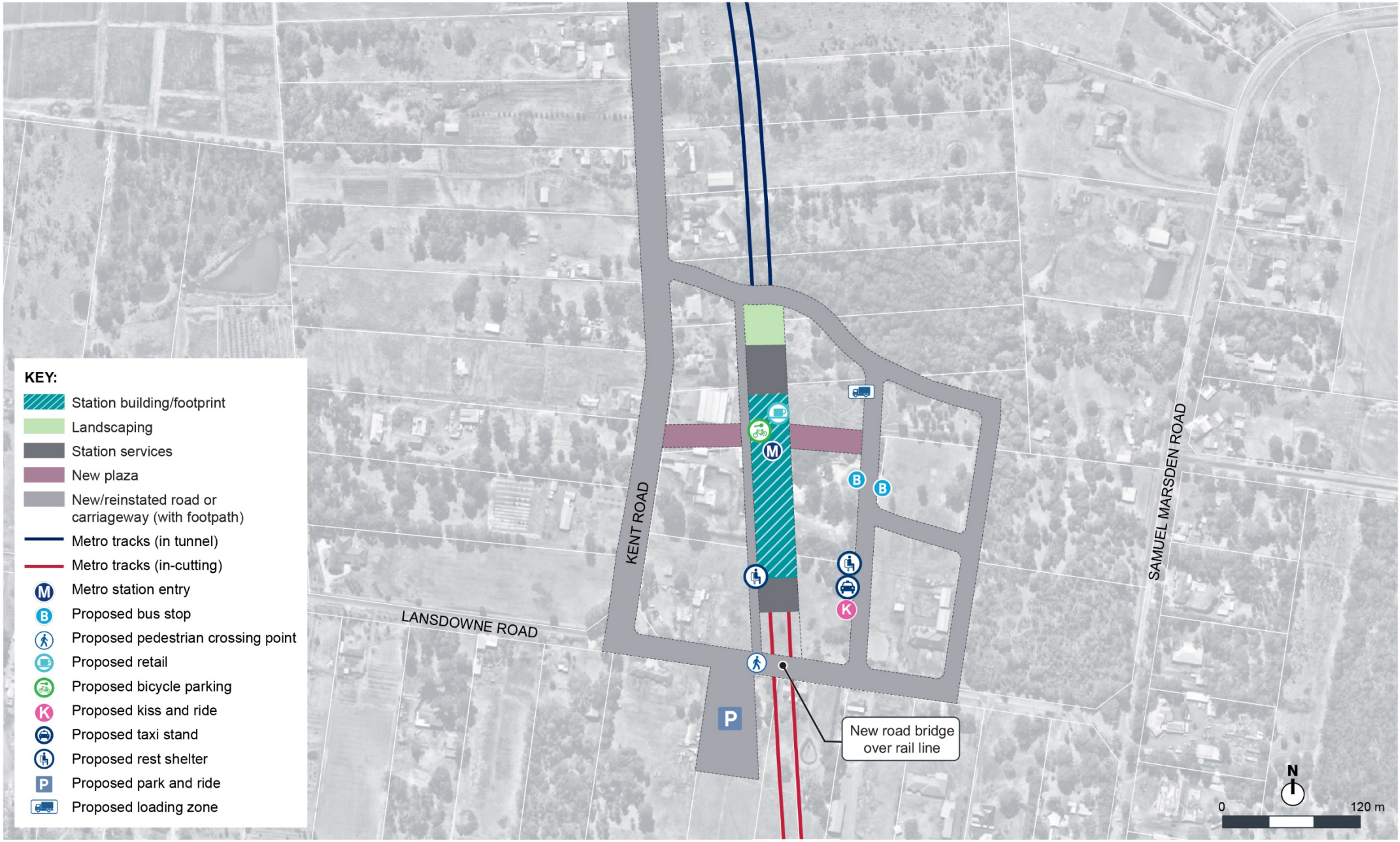
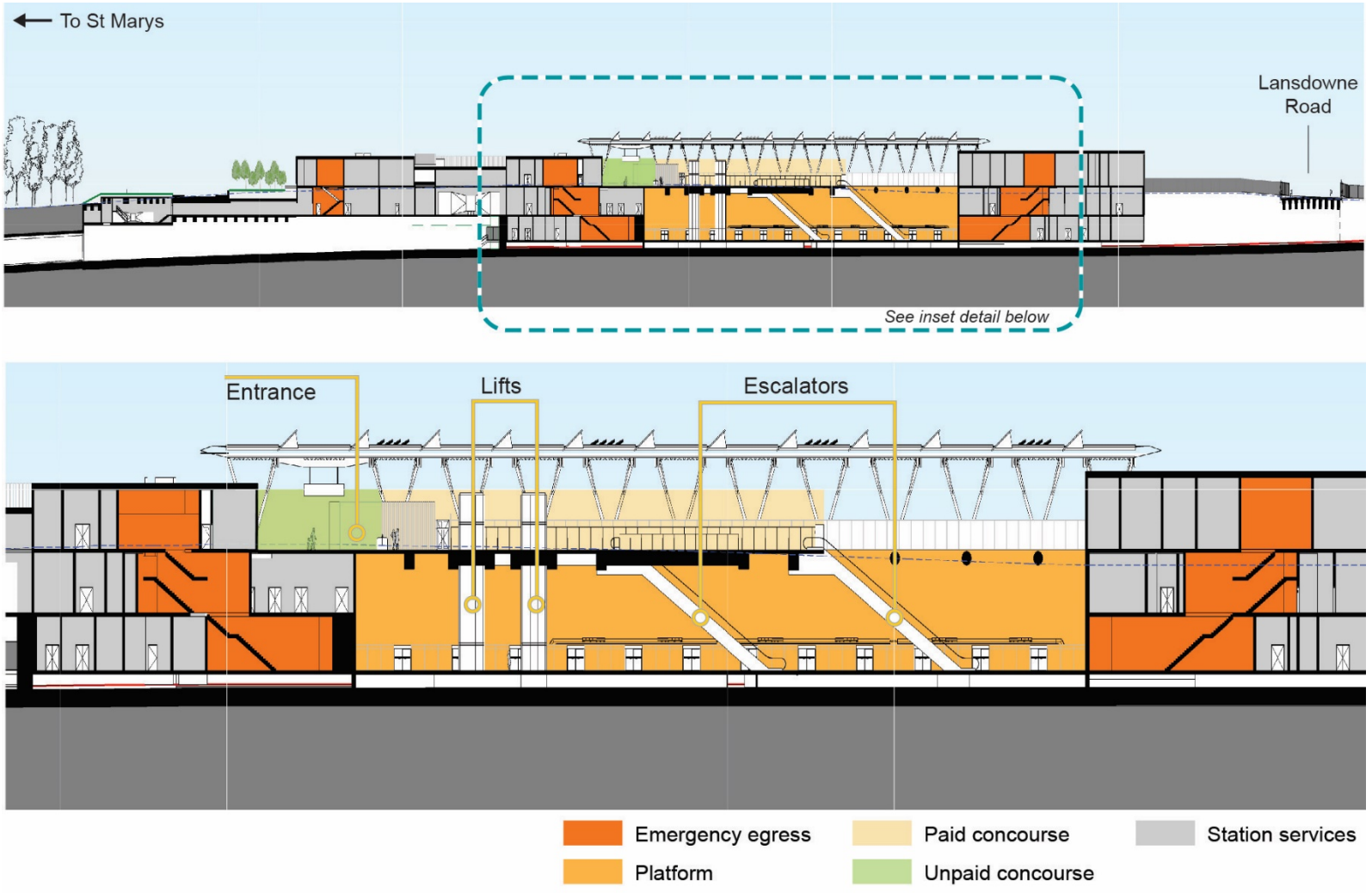


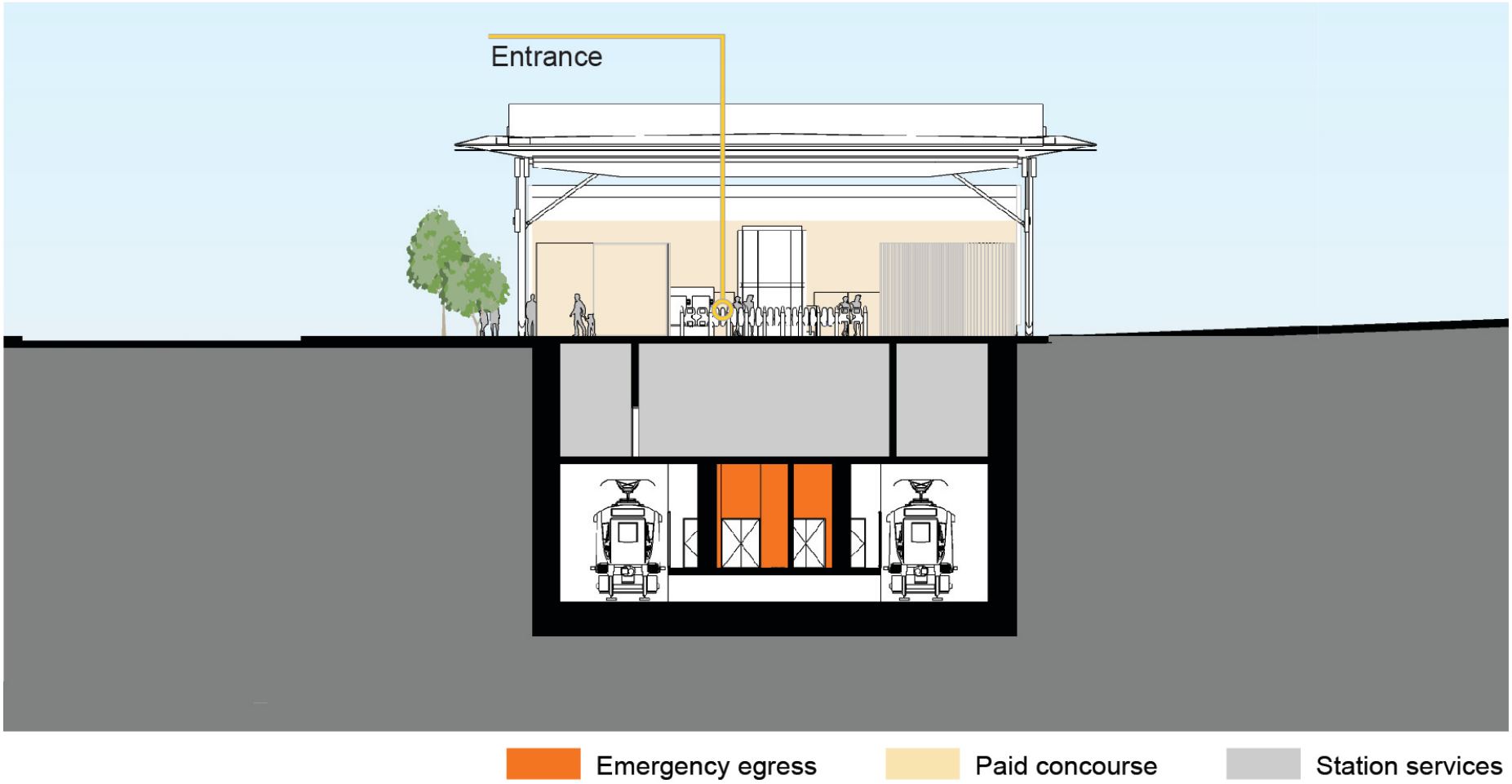
Figure 7-19 Orchard Hills Station - Indicative layout and key design elements

Note: Indicative only, subject to design development.



Note: Indicative only, subject to design development.

Figure 7-20 Orchard Hills Station – indicative elevation



Note: Indicative only, subject to design development.

Figure 7-21 Orchard Hills Station – indicative cross-section

Note: Indicative only, subject to design development.

Figure 7-22 Orchard Hills Station – artist's impression

7.4.3 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 7-23, with an elevation and cross-section shown in Figure 7-24 and Figure 7-25 respectively. An artist's impression of the proposed station is also provided in Figure 7-26.

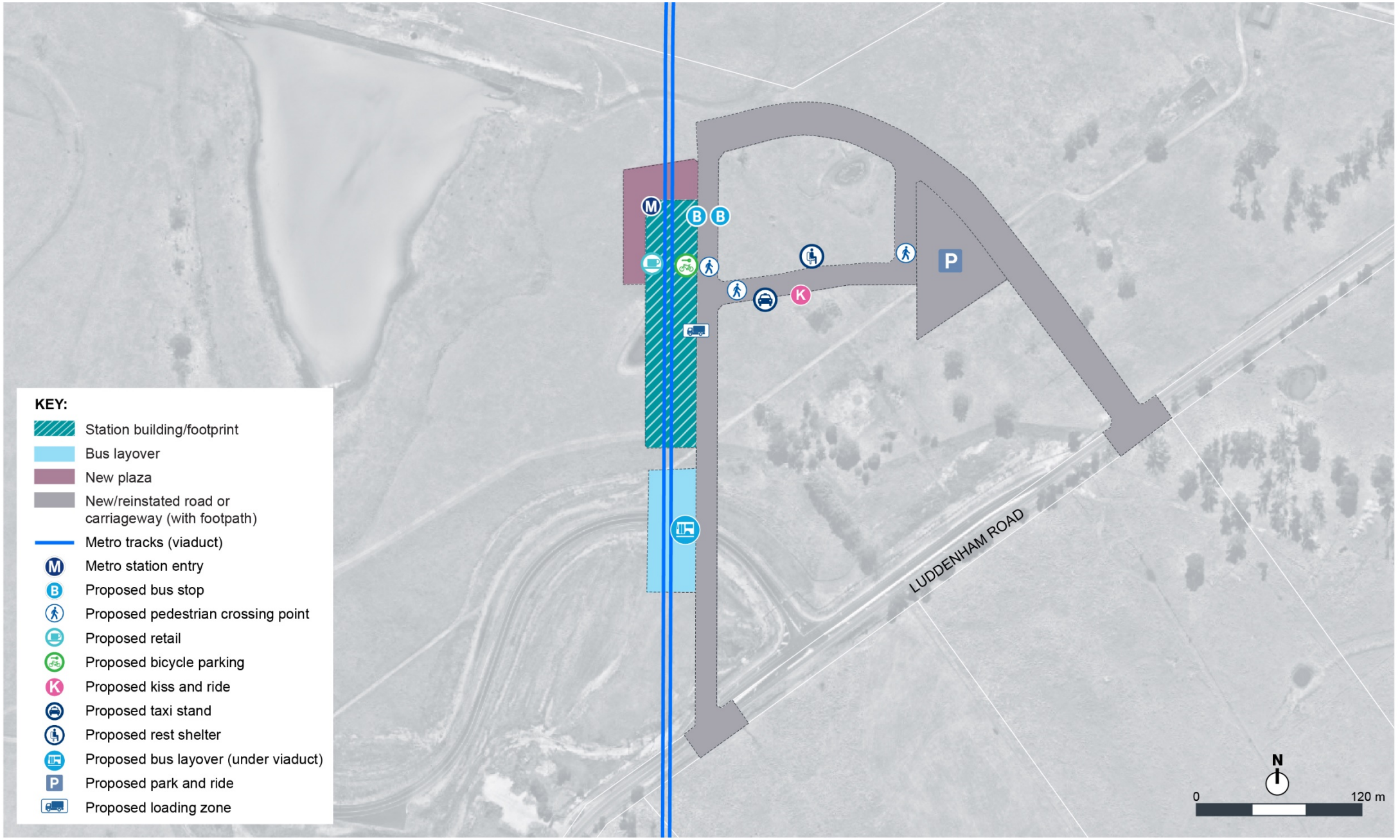
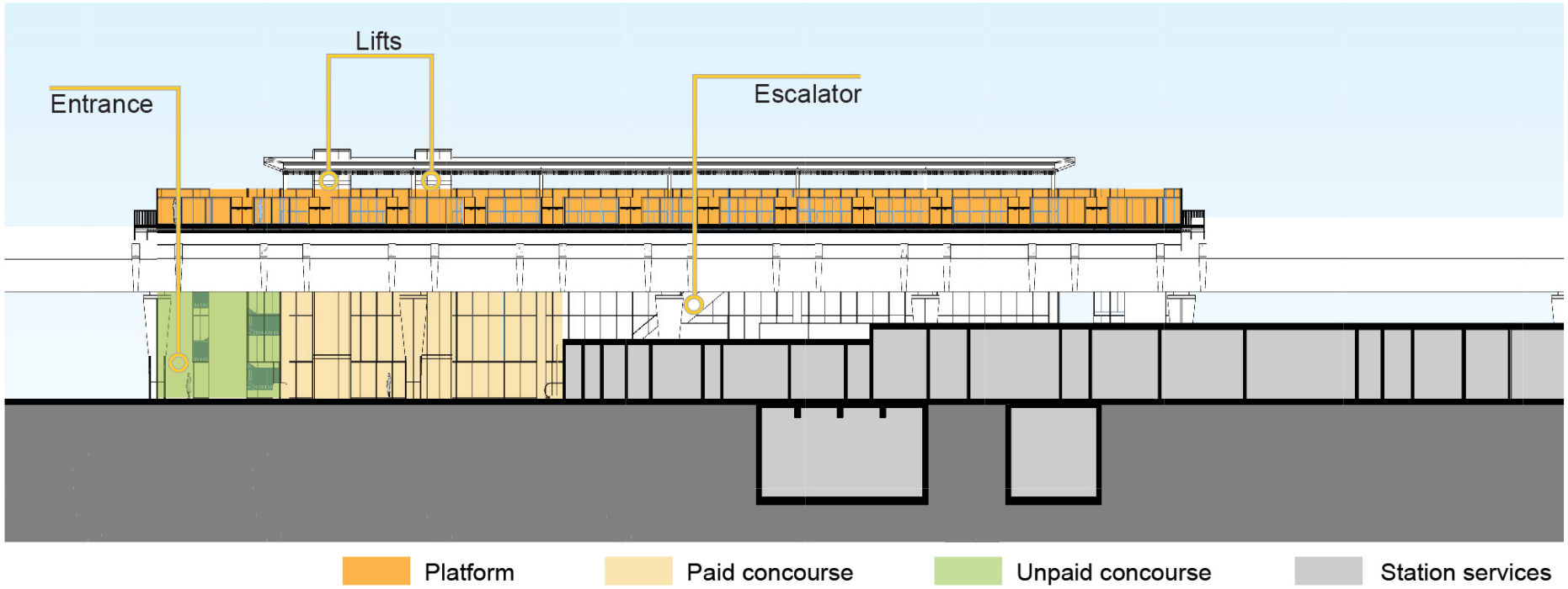


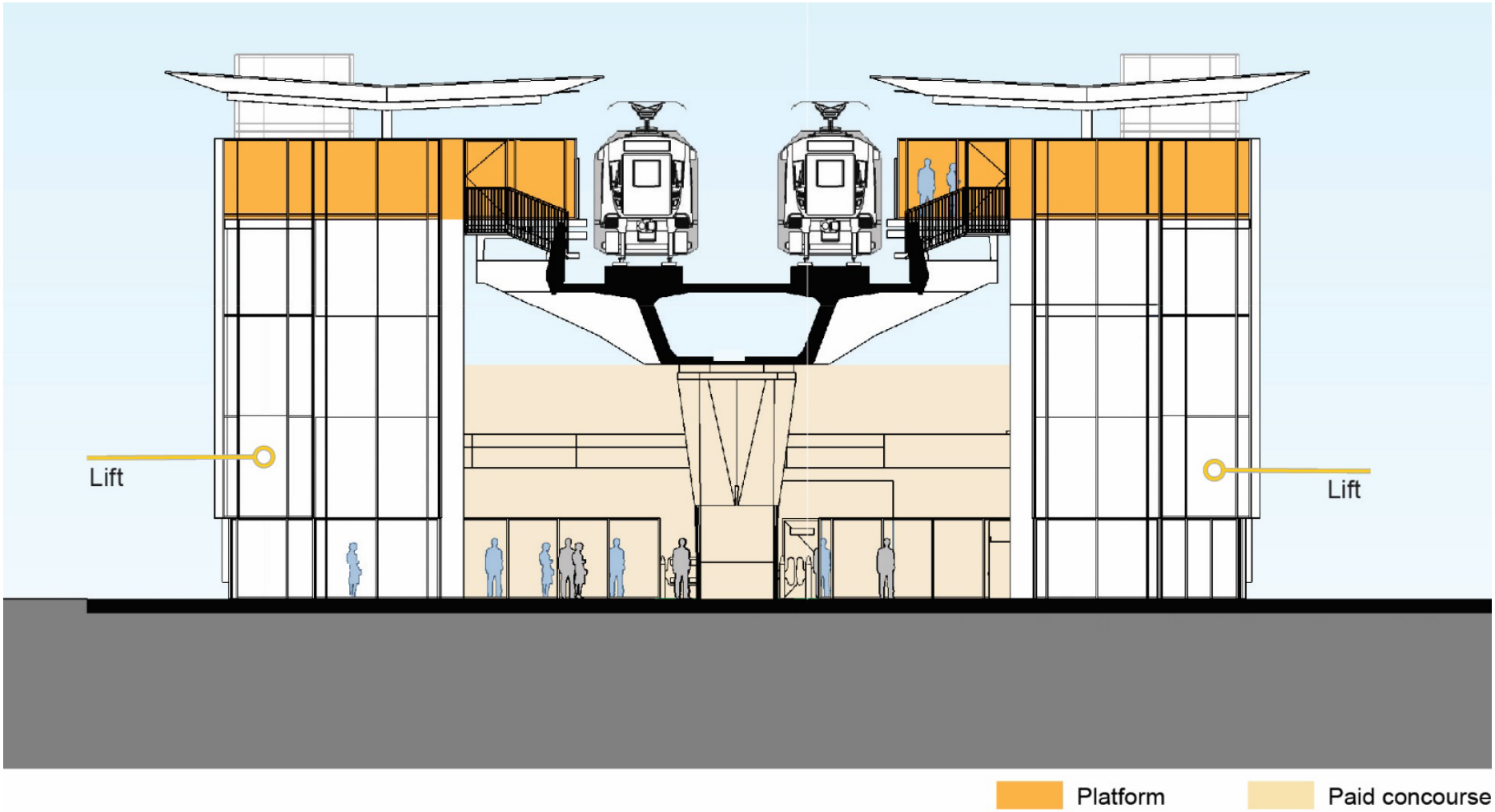
Figure 7-23 Luddenham Road Station - Indicative layout and key design elements

Note: Indicative only. Subject to design development.



Note: Indicative only, subject to design development.

Figure 7-24 Luddenham Road Station – indicative elevation



Note: Indicative only, subject to design development.

Figure 7-25 Luddenham Road Station – indicative cross-section

Note: Indicative only, subject to design development.

Figure 7-26 Luddenham Road Station – artist's impression

7.4.4 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 7-27). 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 7-27, with an elevation and cross-section shown in Figure 7-28 and Figure 7-29 respectively. An artist's impression is provided in Figure 7-30.

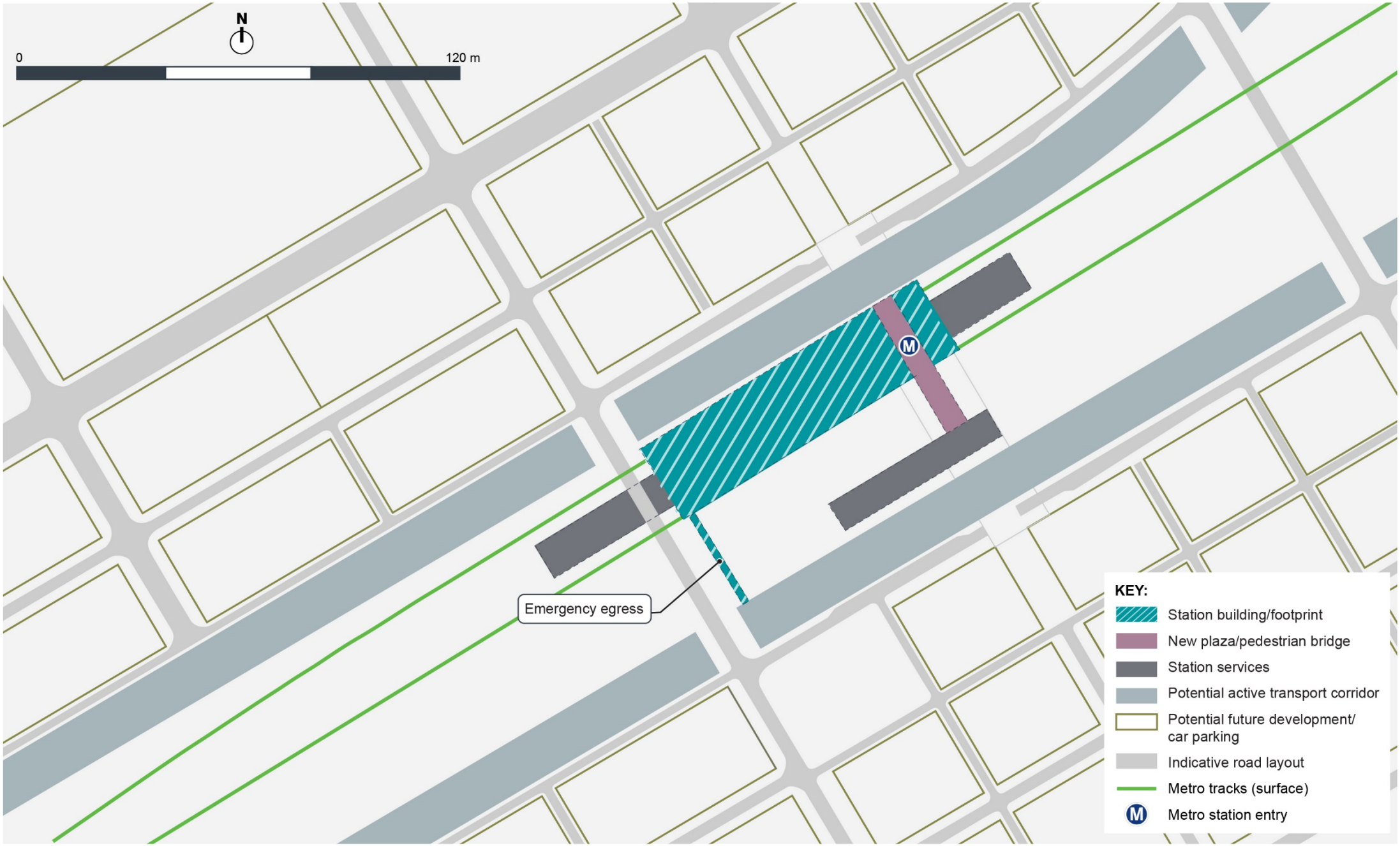
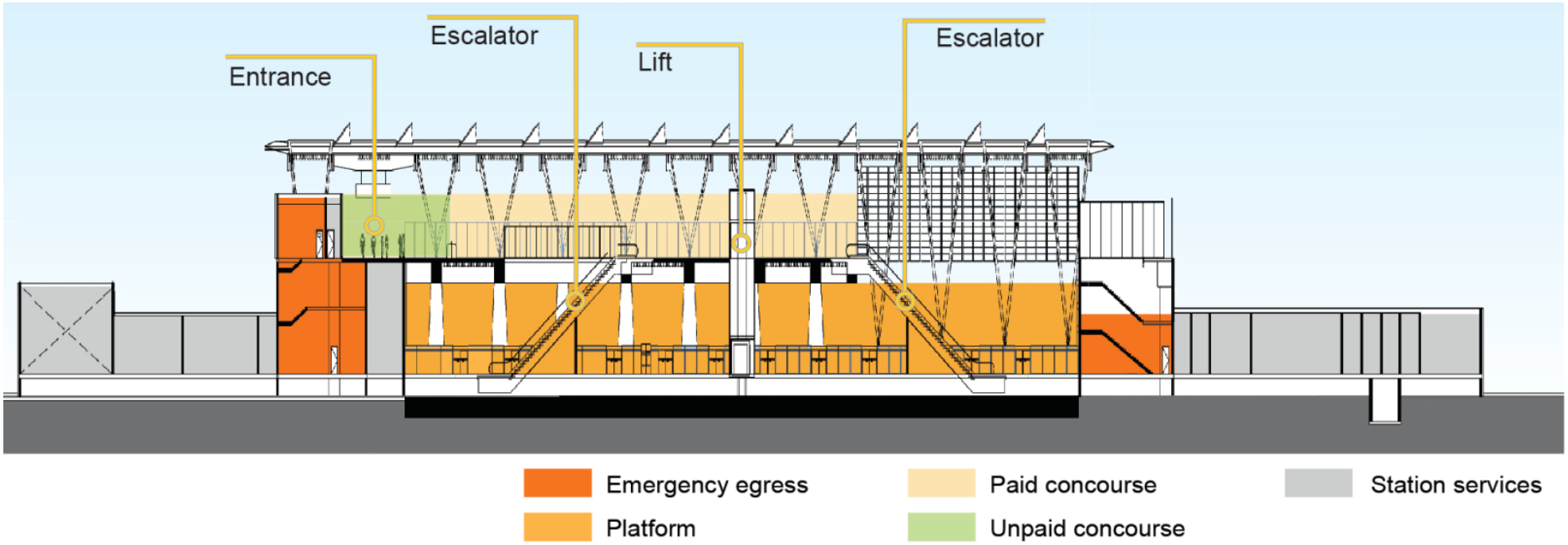


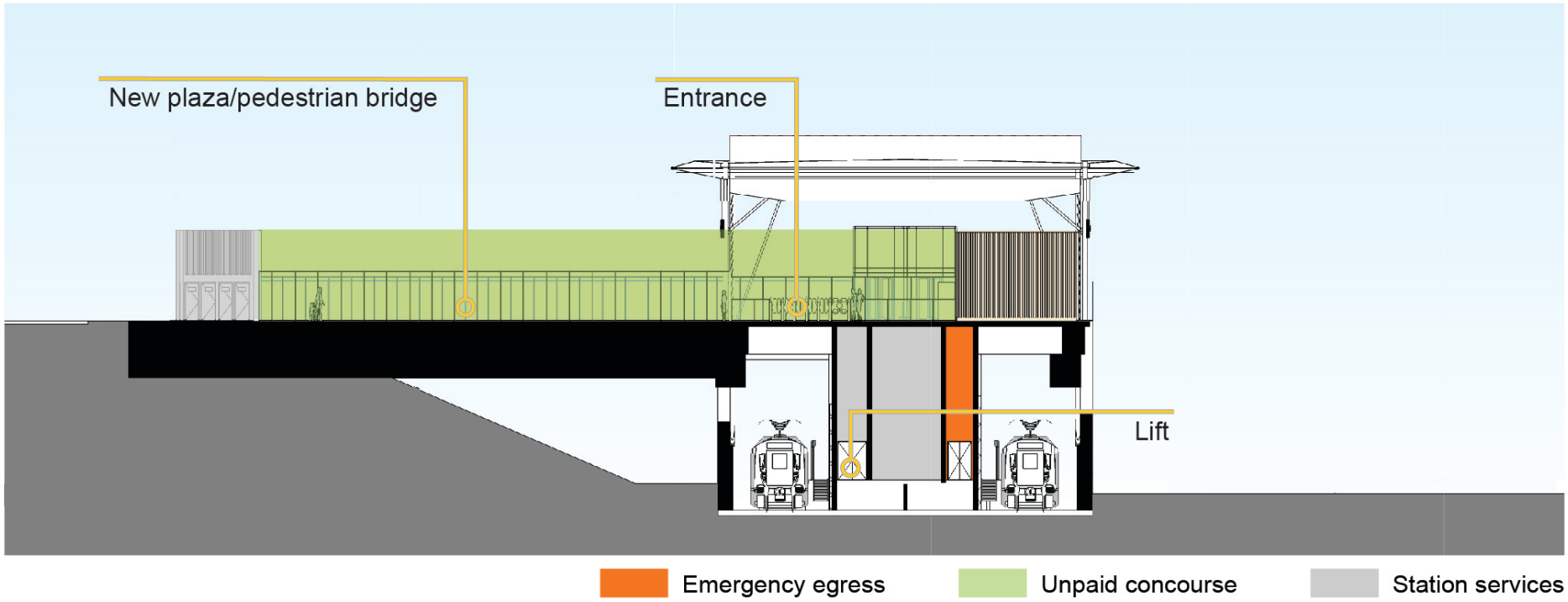
Figure 7-27 Airport Business Park Station - Indicative layout and key design elements

Note: Indicative only, subject to design development.



Note: Indicative only, subject to design development.

Figure 7-28 Airport Business Park Station – indicative station elevation



Note: Indicative only, subject to design development.

Figure 7-29 Airport Business Park Station – indicative station cross-section

Note: Indicative only, subject to design development.

Figure 7-30 Airport Business Park Station – artist's impression

7.4.5 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 7-31, with an elevation and cross-section shown in Figure 7-32 and Figure 7-33 respectively. An artist's impression is provided in Figure 7-34.

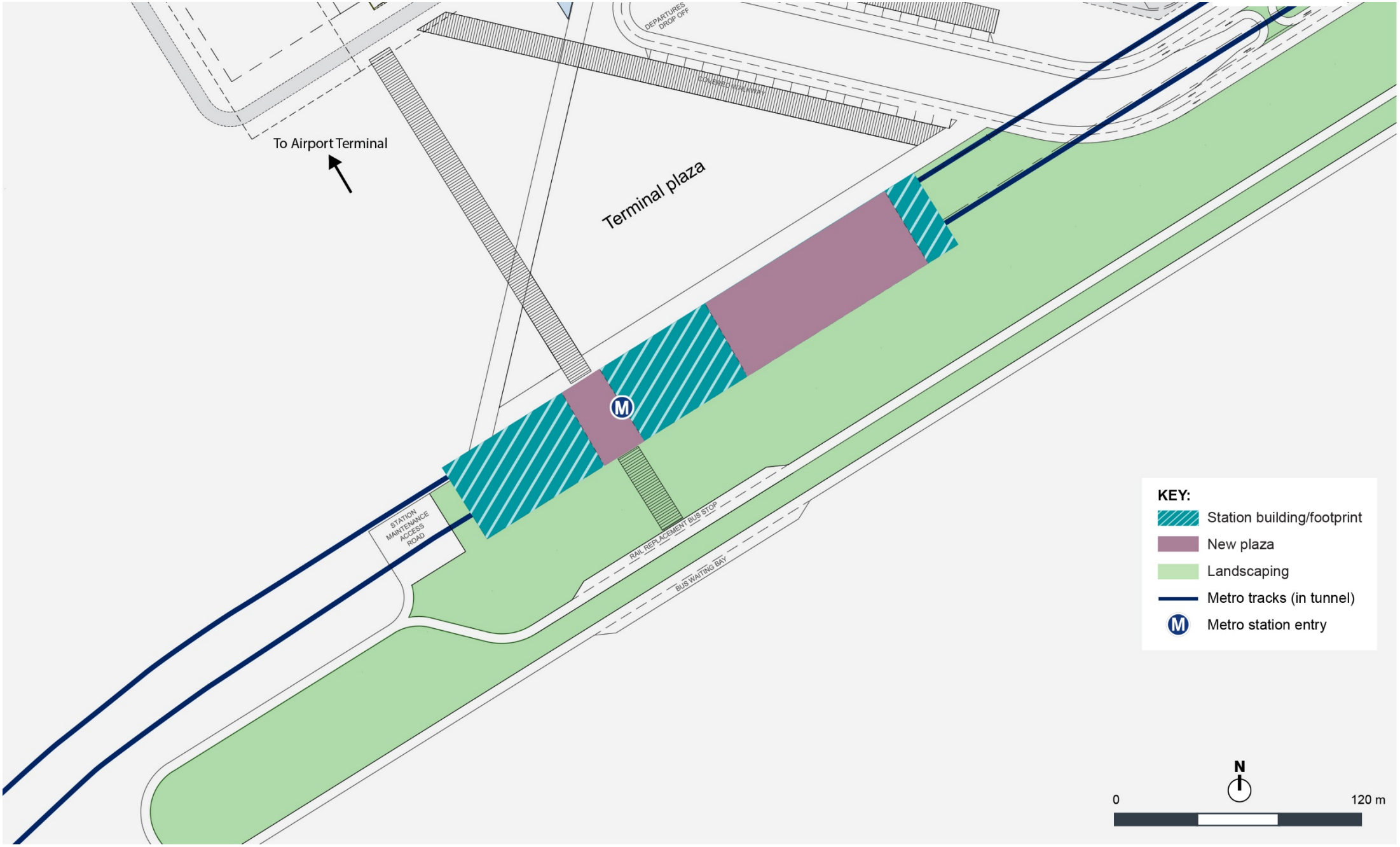
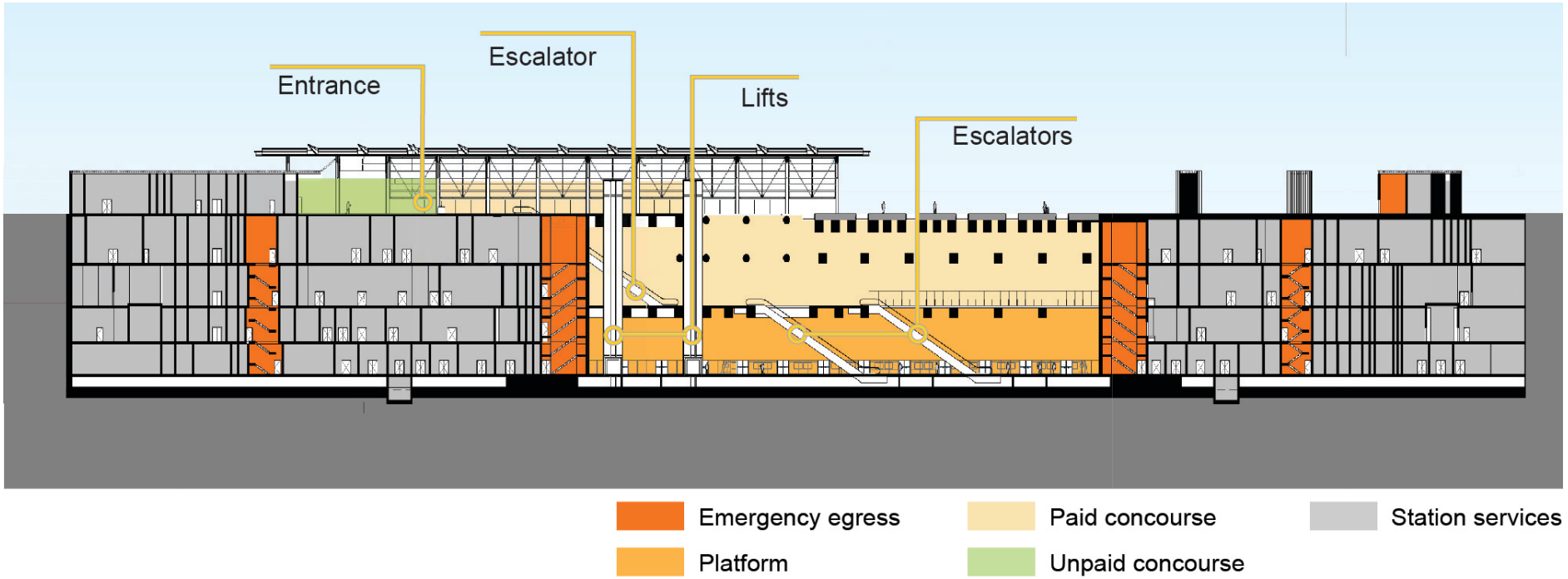


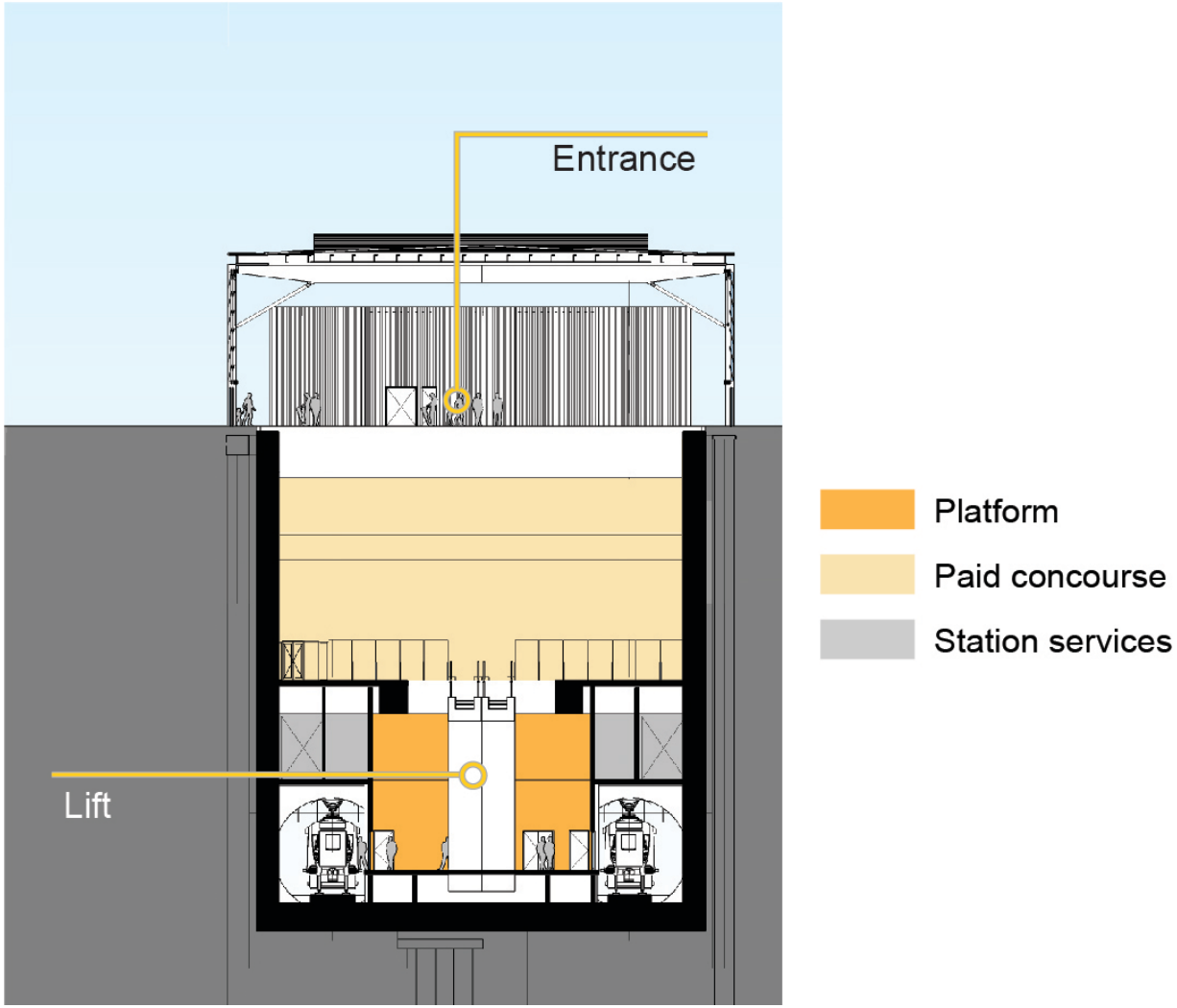
Figure 7-31 Airport Terminal Station - Indicative layout and key design elements

Note: Indicative only, subject to design development.



Note: Indicative only, subject to design development.

Figure 7-32 Airport Terminal Station – indicative elevation



Note: Indicative only, subject to design development.

Figure 7-33 Airport Terminal Station – indicative cross-section

Note: Indicative only, subject to design development.

Figure 7-34 Airport Terminal Station – artist's impression

7.4.6 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 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 7-35, with an elevation and cross-section shown in Figure 7-36 and Figure 7-37 respectively. An artist's impression is provided in Figure 7-38.

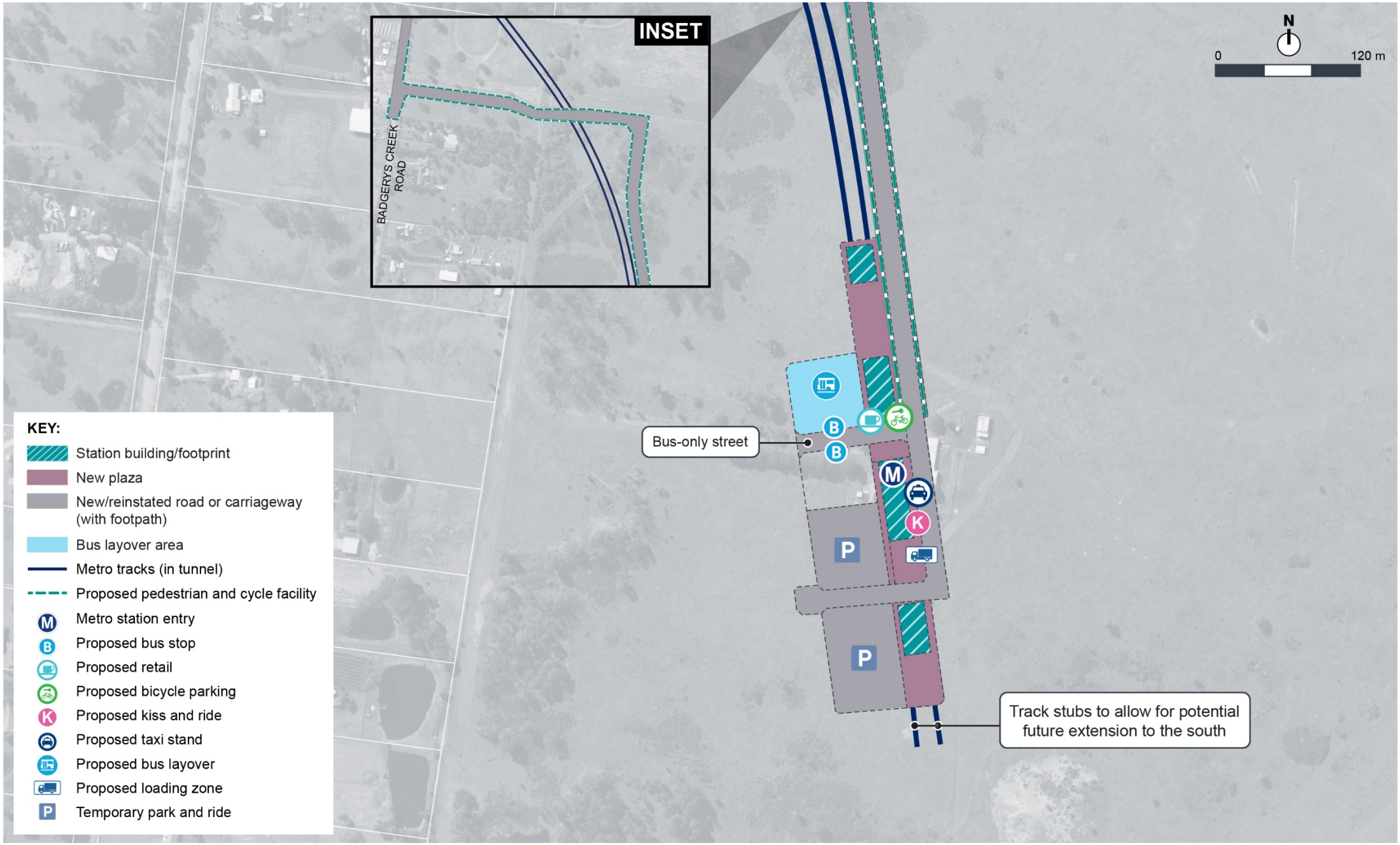
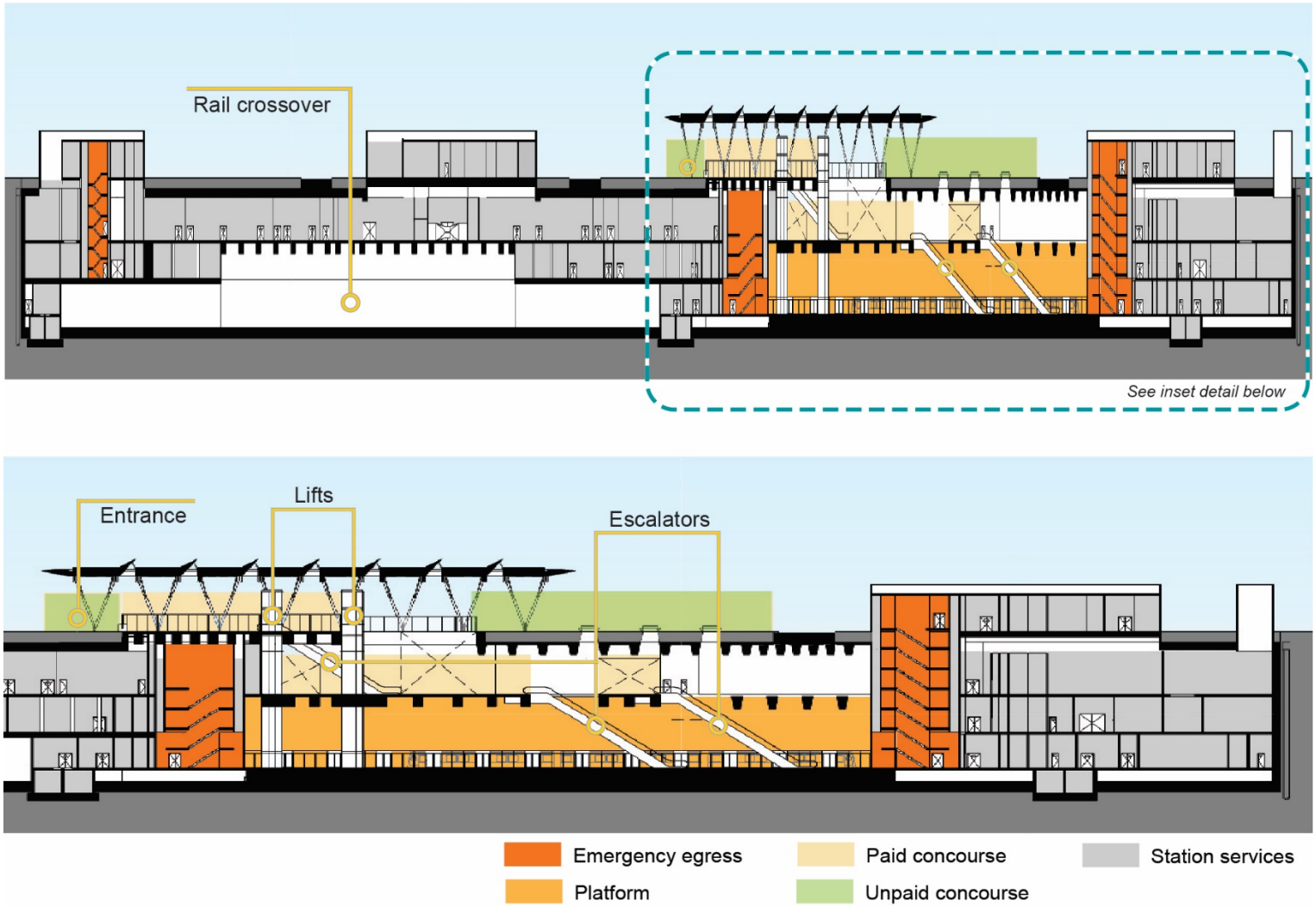


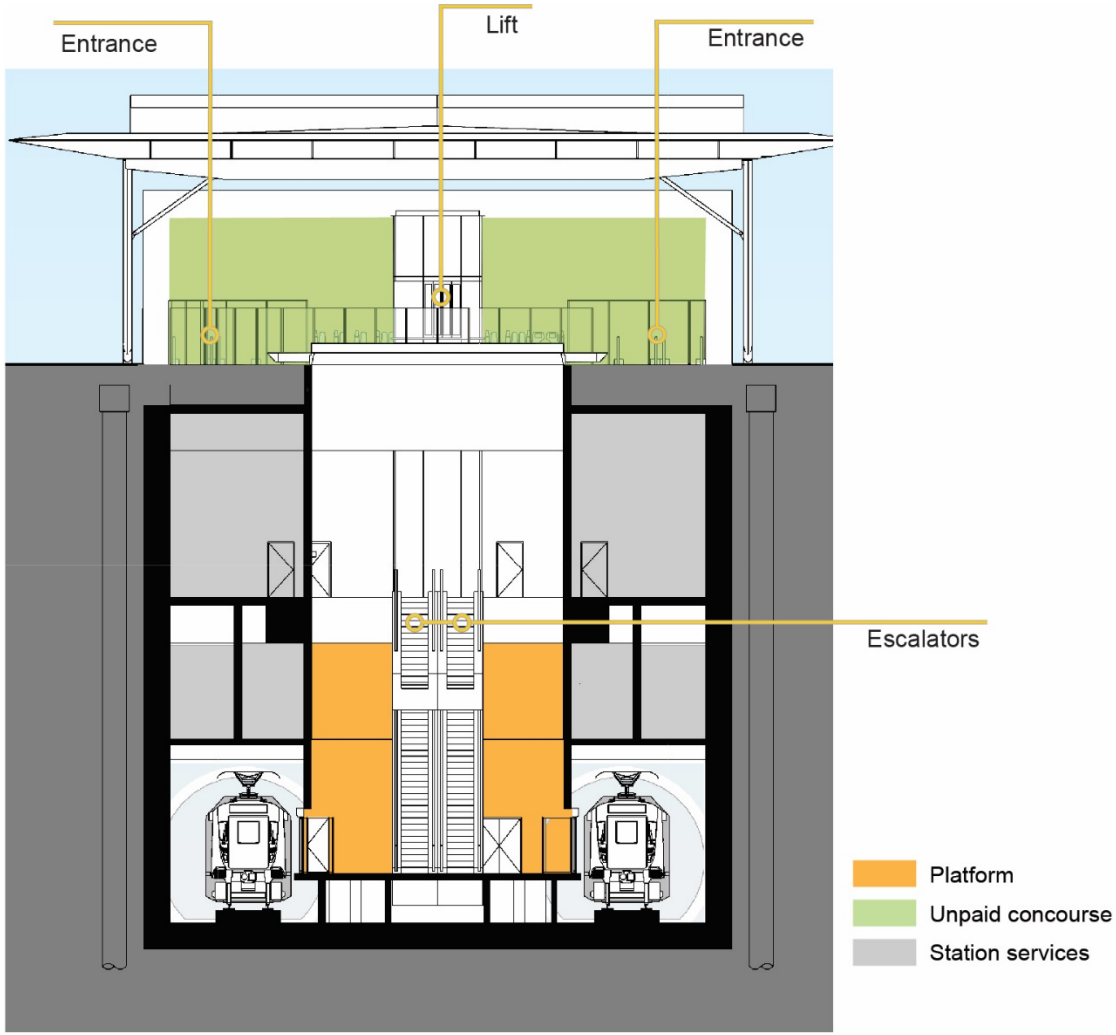
Figure 7-35 Aerotropolis Core Station - Indicative layout and key design elements

Note: Indicative only, subject to design development.



Note: Indicative only, subject to design development.

Figure 7-36 Aerotropolis Core Station – indicative elevation



Note: Indicative only, subject to design development.

Figure 7-37 Aerotropolis Core Station – indicative cross-section

Note: Indicative only, subject to design development.

Figure 7-38 Aerotropolis Core Station – artist's impression

7.5 Ancillary operational infrastructure

7.5.1 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 7-4b).

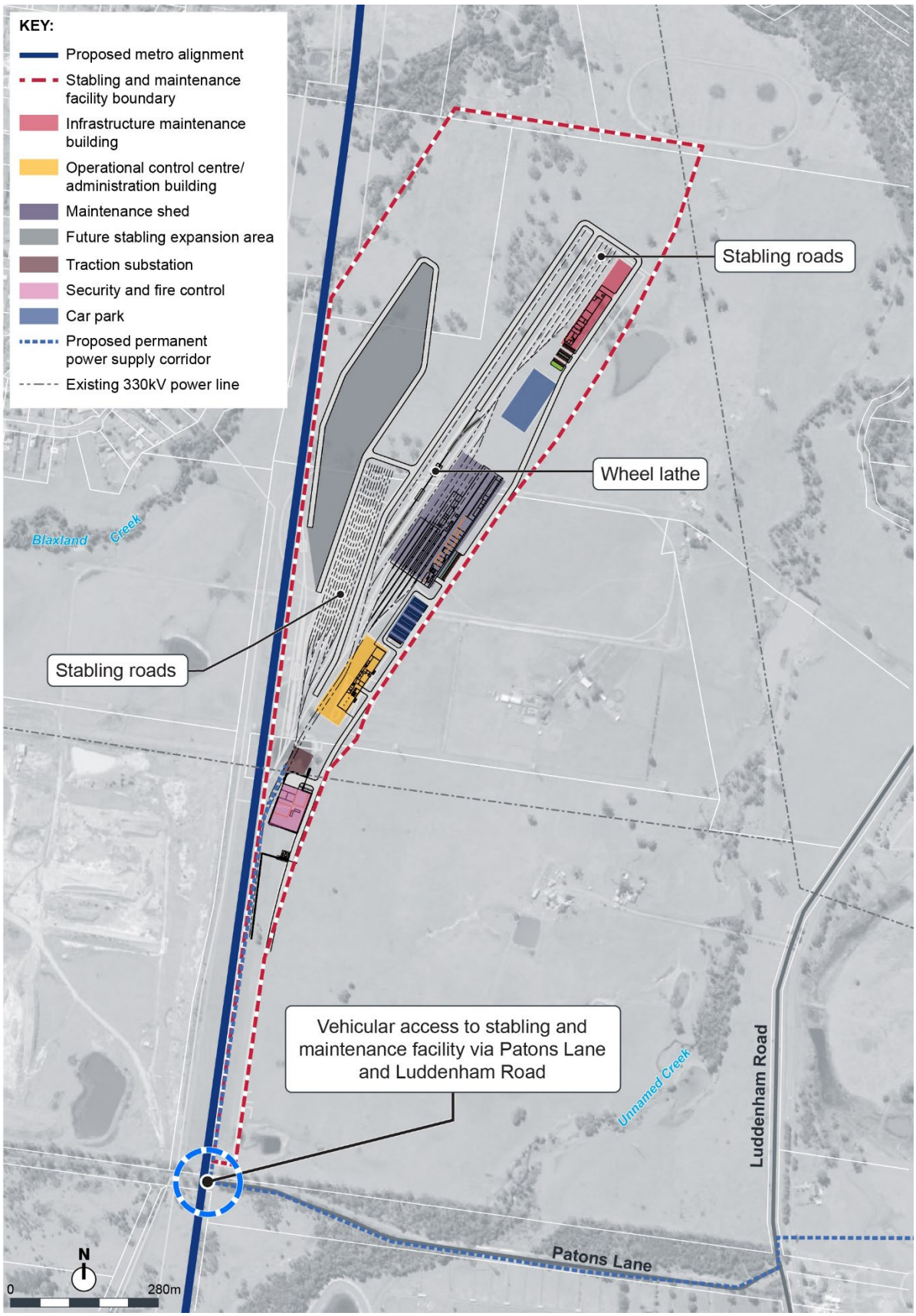
The stabling and maintenance facility layout has been configured to allow for access/egress to the main track alignment at both the northern and southern ends of the stabling and maintenance facility (see Figure 7-39). Vehicular access would be provided via separate access/egress points on Luddenham 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 8.6).

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 7-39.



Note: Indicative only, subject to design development.

Figure 7-39 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 (refer to Chapter 8 (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.

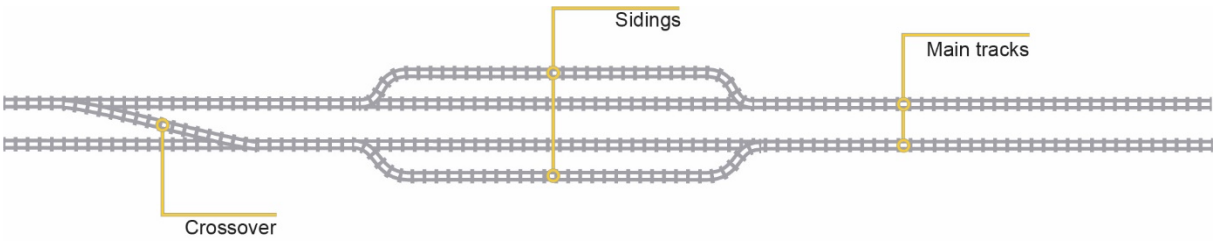
Administration and staff facilities as well as the operations control centre for the metro network would be located within the maintenance building. A driver training facility would also be provided within the stabling and maintenance facility site. For initial opening, it is anticipated that up to around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

7.5.2 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 7-4c).

A schematic showing an indicative crossover and track sidings is shown in Figure 7-40.



Note: Indicative only, subject to design development.

Figure 7-40 Schematic of a crossover and track sidings

7.5.3 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 7-4a). The Bringelly services facility would be located near the northern end of Derwent Road in Bringelly (see Figure 7-4e).

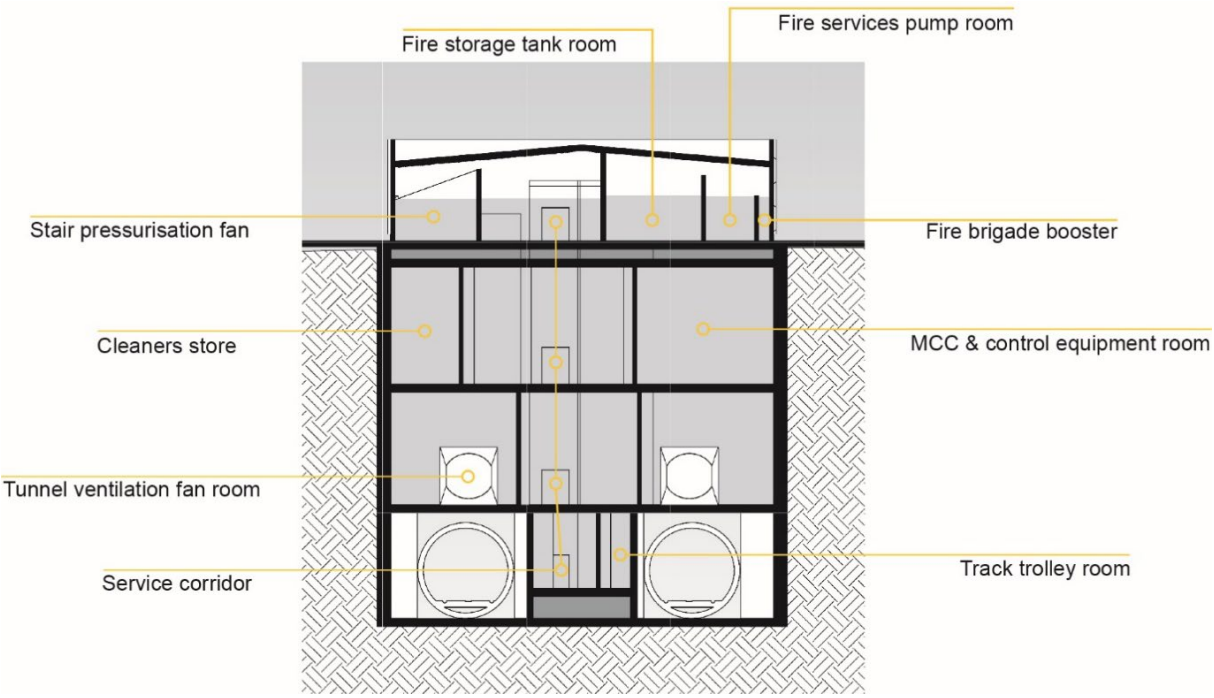
The services facilities would typically include tunnel ventilation plant rooms and associated air-distribution equipment. The services facilities could also include electrical rooms, fire sprinkler systems, emergency lighting and signage, and ancillary rooms supporting the ventilation system and amenities 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 7-41.



Note: Indicative only, subject to design development.

Figure 7-41 Indicative schematic of a services facility

7.5.4 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 7.7.3)
- 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

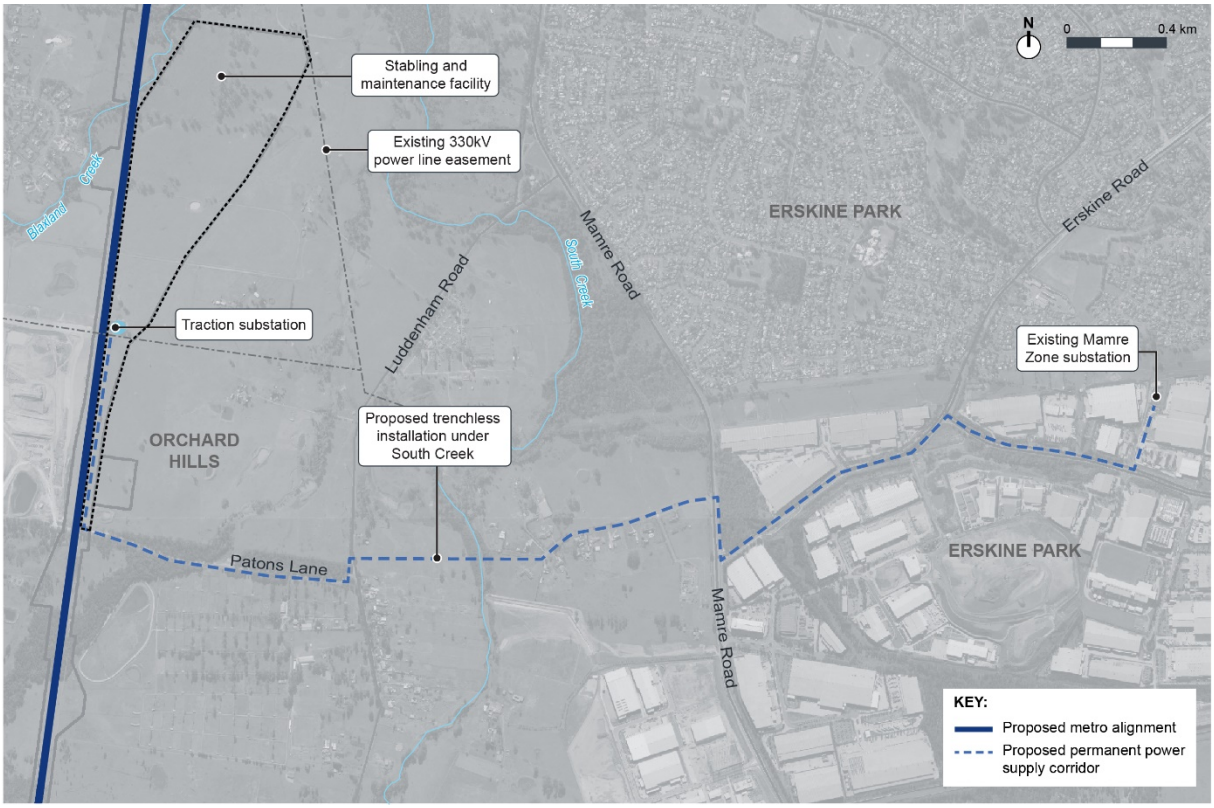
Traction power supply for the project would be provided through dedicated traction substations and supporting feeder line cables. These would be co-located with other infrastructure (such as at each station) wherever possible.

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 7-42.



Note: Indicative only, subject to design development.

Figure 7-42 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.

7.5.5 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 7-7 and Figure 7-8). 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).

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.

7.6 Other key project features

7.6.1 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 7-3 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 7-3 Indicative permanent changes to the road network and existing parking

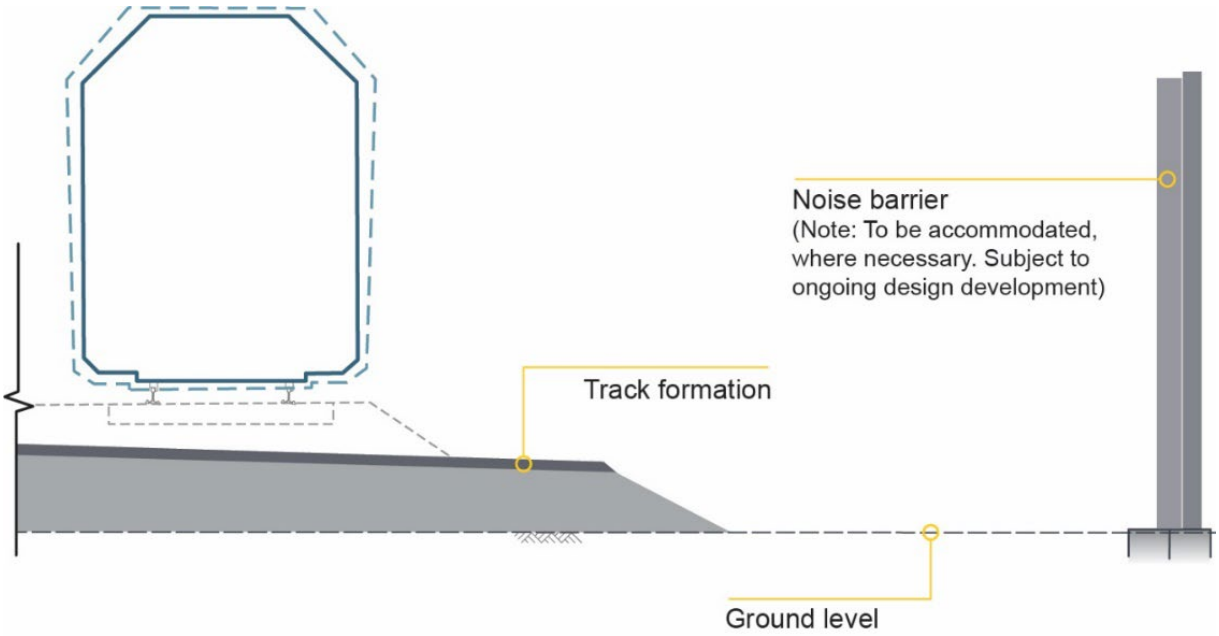
Location	Road/intersection	Indicative change to road network and existing parking
St Marys	Station Street	• change from the current two-way access arrangement to restricted access for properties and service access for buses • traffic calming and bus priority measures (i.e. restriction of access to residents 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 • potential removal and relocation of some driveways in the vicinity of the bus interchange and layover area • permanent removal of around 130 to 140 car park spaces within the Station Street car park, with the potential to retain 20 to 30 car park spaces for the purposes of public parking access to the employment centres on Phillip Street, subject to ongoing consultation.
	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	• removal of town centre on-street parking to allow for new point-to-point vehicle facilities and 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 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 130 to 140 car park spaces). The loss of parking would be replaced by the expansion of the existing multi-deck commuter car park (subject to separate approval).
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.

7.6.2 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 7-43.



Note: Indicative only, subject to design development.

Figure 7-43 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)). 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 Appendix E (Design Guidelines).

7.6.3 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.

7.6.4 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 allow for fauna movement. 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.

7.6.5 Security

Corridor fencing

For all 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.

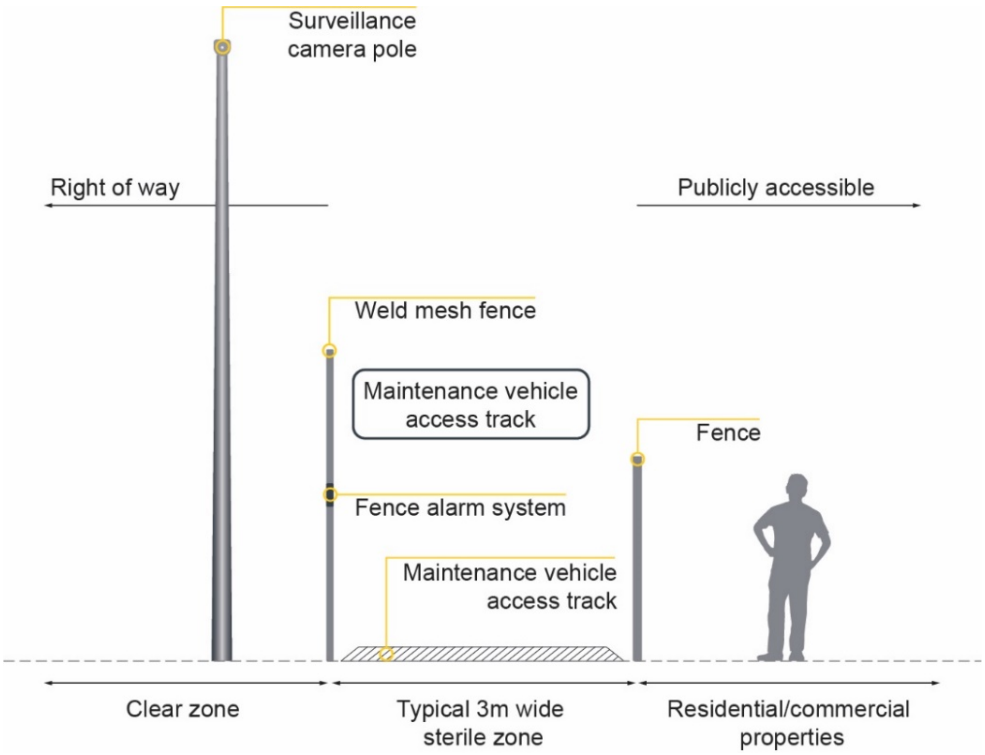
The proposed security fencing along the project corridor would include two separate fences on either side of the corridor, separated by a maintenance access track (see Section 7.6.3). The security fences would have a minimum height of two metres. Controlled access points would be provided at appropriate locations.

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 7.6.2) 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 7-44.



Note: Indicative only, subject to design development.

Figure 7-44 Example of a typical cross-section showing proposed security fence arrangement

7.6.6 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.

7.7 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.

7.7.1 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.

7.7.2 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 7.5.1, the stabling and maintenance facility would operate 24 hours a day, seven days a week.

7.7.3 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 7-45 (external), Figure 7-46 (at a station) and Figure 7-47 (internal).

Source: Sydney Metro

Figure 7-45 Photograph of a train operating on the Metro North West Line

Source: Sydney Metro

Figure 7-46 Photograph of a train at an underground station on the Metro North West Line

Source: Sydney Metro

Figure 7-47 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.

7.7.4 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.

7.7.5 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.