Part B

Five Dock Station

12

12.0 Five Dock Station

This chapter provides a description of Five Dock Station and its precinct during operation and construction of this proposal. This chapter also provides an assessment of potential impacts during operation and construction that relate to Five Dock and identifies mitigation measures to address these impacts.

12.1 Overview

Five Dock Station would be located in Five Dock town centre, off Great North Road. The Five Dock Station western site would provide the station entry and would be located between Great North Road and East Street, to the north of Fred Kelly Place and south of St Alban's Anglican Church. The Five Dock Station eastern site would provide station services and would be located on the corner of Second Avenue and Waterview Street.

The Five Dock Station precinct is characterised by its vibrant town centre, which includes a mix of commercial, retail, community, residential and civic open space uses. Fred Kelly Place is a focal point of the community. The town centre is surrounded by low-rise detached residential properties, apartments and townhouse buildings together with a mix of schools, including the Five Dock Public School. Great North Road is the primary north-south spine through the locality leading from Parramatta Road to the peninsula suburbs of Abbotsford and Drummoyne.

The City of Canada Bay Local Strategic Planning Statement (City of Canada Bay Council, 2020) highlights Five Dock Station as supporting development of the local centre focused on Great North Road and building on existing qualities. Priorities include expanding the range of services and employment opportunities and encouraging evening activities and the night-time economy. Key actions include implementing the expansion of Fred Kelly Place and encouraging a diversity of dwellings within the vicinity of the Five Dock town centre. The planning statement also advocates for walking and cycling connections to be integrated with new metro stations. Five Dock Station would also support the local village centre and placemaking outcomes presented in the Five Dock Town Centre Urban Design Study (City of Canada Bay Council, 2013) by providing rail services to the area for the first time. The station also offers opportunity for a new bus interchange.

12.1.1 Operation

The vision for the Five Dock Station and its surrounds is to deliver a station precinct development that contributes to the character and identity of Five Dock as a revitalised, diverse and vibrant local centre, well connected to all transport modes.

The station entry would be from the northern edge of Fred Kelly Place, which would be extended to the north as part of this proposal.

When operational, Five Dock Station would support an enhanced Fred Kelly Place, in consideration of the principles outlined in the Five Dock Town Centre Urban Design Study (City of Canada Bay Council, 2013). It would facilitate improved public and active transport accessibility for the community by providing efficient access and interchange, and respect and contribute to the local character and amenity of the Five Dock town centre. It would promote connectivity to and from the station through streets, lanes and public places.

A number of improvements would be made to the local transport network to facilitate integration of the metro station including new kiss and ride zones in surrounding streets and additional bus stops on Great North Road. There would be some parking loss associated with these changes. The proposed road network changes would have a minor impact on intersection performance with surrounding intersections continuing to perform satisfactorily.

During operation, there is generally expected to be improvements to the character and visual amenity of the area due to the new metro station, and the associated accessibility and placemaking outcomes. This includes potential improvements to the setting of the adjacent local heritage listed St Alban's Anglican Church by setting back the adjacent station entry building. The accessibility and placemaking improvements would also result in social benefits associated with increased access to jobs, education and services and improved amenity, and provide some opportunities for local businesses.

Potential impacts during the operation of Five Dock Station include:

- operation of this proposal is generally expected to result in beneficial visual impacts due to improvements in public domain and the streetscape. However, there would be minor to moderate adverse visual impact to views toward the station services building on the eastern site, which would be of a larger scale than former low-rise residential buildings in this location. There would be some compatibility in terms of massing between the new services building and the adjacent medium-density residential building. The design of the building would be consistent with the principles and outcomes presented in the Design Guidelines developed for Sydney Metro West, including place-specific design principles that respond to contextual factors (refer to Appendix E (Design Guidelines)).

Potential impacts associated with other environmental matters such as operational noise and vibration, non-Aboriginal heritage, groundwater, flooding, social and business would comply with the relevant criteria and/or be minor to negligible.

12.1.2 Construction

Major civil construction including station excavation and tunnelling work at Five Dock was assessed and approved under a previous Sydney Metro West planning application and does not form part of this proposal. This proposal includes the construction activities required to complete Five Dock Station, and associated precinct work required for the operation of Sydney Metro West.

Construction would require the continued use of the two construction sites established under the previous Sydney Metro West planning application. The proposed work is expected to have a total duration of about four years.

Construction transport arrangements would largely be a continuation of those established under the previous Sydney Metro West planning application, including the temporary conversion of parts of Waterview Street and Second Avenue to one-way operation and loss of parking on adjacent streets (some of which would be permanently removed). Existing pedestrian and cycle routes surrounding Five Dock Station would generally be maintained throughout construction. The Parramatta Road / Great North Road, Great North Road / Queens Road / Fairlight Street, and Great North Road / Ramsay Road / First Avenue intersections would see temporary declines in performance during construction, due to the additional construction vehicles on the road network. Construction transport impacts would be managed in accordance with the Construction Traffic Management Framework (CTMF). Construction site traffic generated at the Five Dock Station construction sites would be managed to minimise movements during church services times at St Alban's Anglican Church.

During worst-case situation daytime activities, temporary construction noise impacts are predicted to be ‘moderate’ to ‘high’ when work would be undertaken outside the station, particularly when noise-intensive equipment such as concrete saws are being used. During the worst-case night-time period, 'moderate’ to ‘high’ noise impacts are generally predicted at the nearest residential receivers during external fit-out activities, such as during the installation of cladding. More distant receivers are predicted to have ‘low’ noise impacts or comply with the noise management levels. Moderate sleep disturbance impacts are also predicted at the closest residential receivers. There would be periods when construction noise levels are much lower than the worst-case levels predicted and there would be times when no equipment is in use and no impacts occur. The Sydney Metro Construction Noise and Vibration Standard (CNVS) would be implemented to manage these temporary impacts and further investigation of minimising sleep disturbance would be completed as detailed construction planning information becomes available.

Other key potential impacts during construction would include:

- temporary minor to moderate impacts to landscape character and visual amenity due to the scale and extent of the construction work
- temporary medium social impacts due to construction-related disruptions and potential amenity impacts
- temporary slight to moderate negative impacts to local businesses, mainly associated with changed traffic conditions and potential amenity impacts.

Potential impacts associated with other environmental matters such as non-Aboriginal heritage, Aboriginal heritage, contamination, groundwater, flooding and biodiversity would be minor to negligible.

These impacts would be managed through the implementation of the Sydney Metro management frameworks and standard mitigation measures including the Construction Environmental Management Framework (CEMF), Overarching Community Communications Strategy (OCCS), CTMF and CNVS.

12.2 Station and precinct description

12.2.1 Design development

Development of the design has involved ongoing consultation with stakeholders and the Design Advisory Panel. This has included:

- feedback as part of submissions and consultation associated with the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a)
- ongoing meetings and design workshops held with the City of Canada Bay Council since exhibition of the Environmental Impact Statement for the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a)
- meetings and advice from the Design Advisory Panel.

Key features or changes to the design to avoid or minimise impacts, and respond to feedback from stakeholders and the Design Advisory Panel include:

- the change from a binocular cavern to a single span cavern design. This design change would provide improved customer environment (space and wayfinding) within the station and a more efficient customer journey from the station entry to the platforms
- an expansion of Fred Kelly Place to the north, consistent with the City of Canada Bay Council plans and supported by the Design Advisory Panel
- provision of space for non-station uses (such as retail) fronting the Fred Kelly Place extension, East Street and Great North Road to activate these spaces, responding the feedback from the City of Canada Bay Council
- maximising opportunities for ground level non-station uses (such as retail) at the corner of Second Avenue and Waterview Street and along the future laneway (to be delivered by Council), responding the feedback from Canada Bay Council
- scale and built form of the station buildings aligning with local planning controls, responds to the local village character and minimises visual and overshadowing impacts, responding to feedback from Canada Bay Council
- architectural and contextual heritage response along the interface with the locally-listed St Albans Anglican Church, responding to feedback by the Design Advisory Panel and City of Canada Bay Council.

12.2.2 Station design

The indicative layout of Five Dock Station is shown in Figure 12-1, with a long-section and cross-section shown in Figure 12-2 and Figure 12-3 respectively. The design of the metro station is subject to design development.

The key features of Five Dock Station are provided in Table 12-1.

Table 12-1 Key features – Five Dock Station

Key features	Description
Proposed station entry	Entry at Fred Kelly Place.
Customers	• residents within walking and cycling distance • visitors to commercial, retail and recreational areas • customers transferring to and from other transport modes.
Primary station function	Origin and interchange.
Catchment	Residential, commercial and retail.
Transport interchange	• walk • cycle • bus • point-to-point transport • kiss and ride

Five Dock Station would consist of an underground station with two platforms in an east–west orientation.

Customers would access the station via an entrance at the northern edge of Fred Kelly Place, which would be extended to the north as part of this proposal. An internal concourse would be provided. Escalators and/or stairs and lifts would provide access from the platform to the surface.

The eastern site would accommodate station related plant and emergency egress stairs from the eastern end of the platforms.

The aboveground station infrastructure (including the station services and space for non-station use) would rise about five storeys from street level. Station building heights would consider the local planning controls subject to ongoing consultation with Canada Bay Council.

Figure 12-1 Indicative layout and key design elements – Five Dock Station

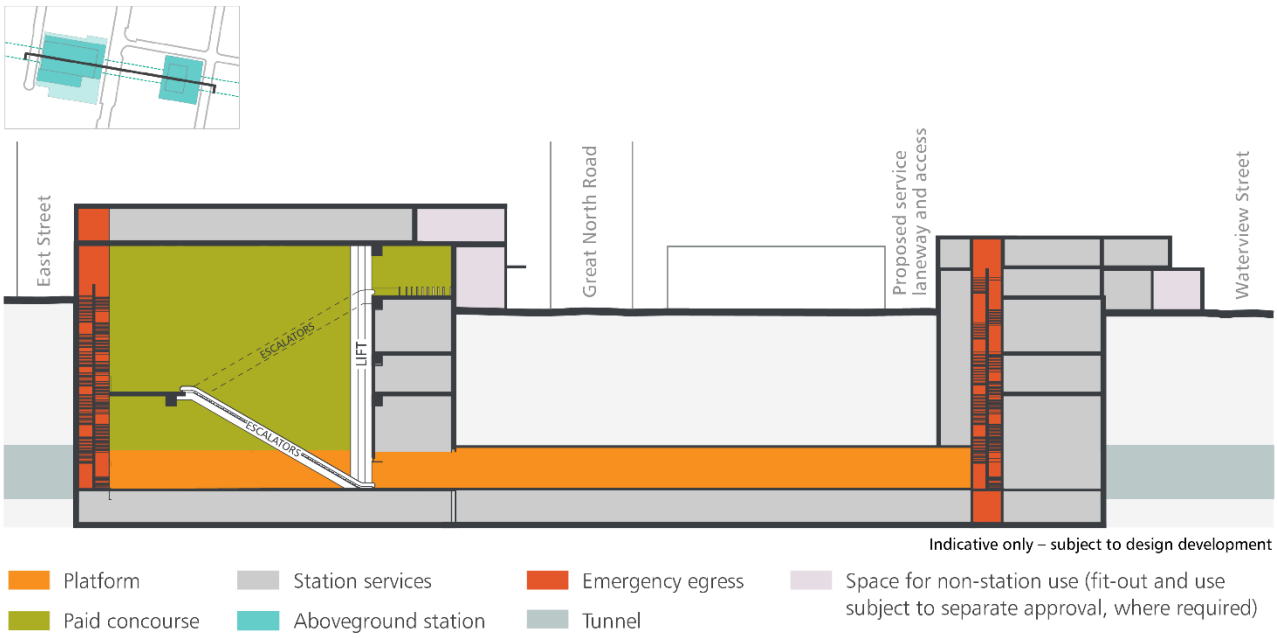

Figure 12-2 Indicative long-section – Five Dock Station

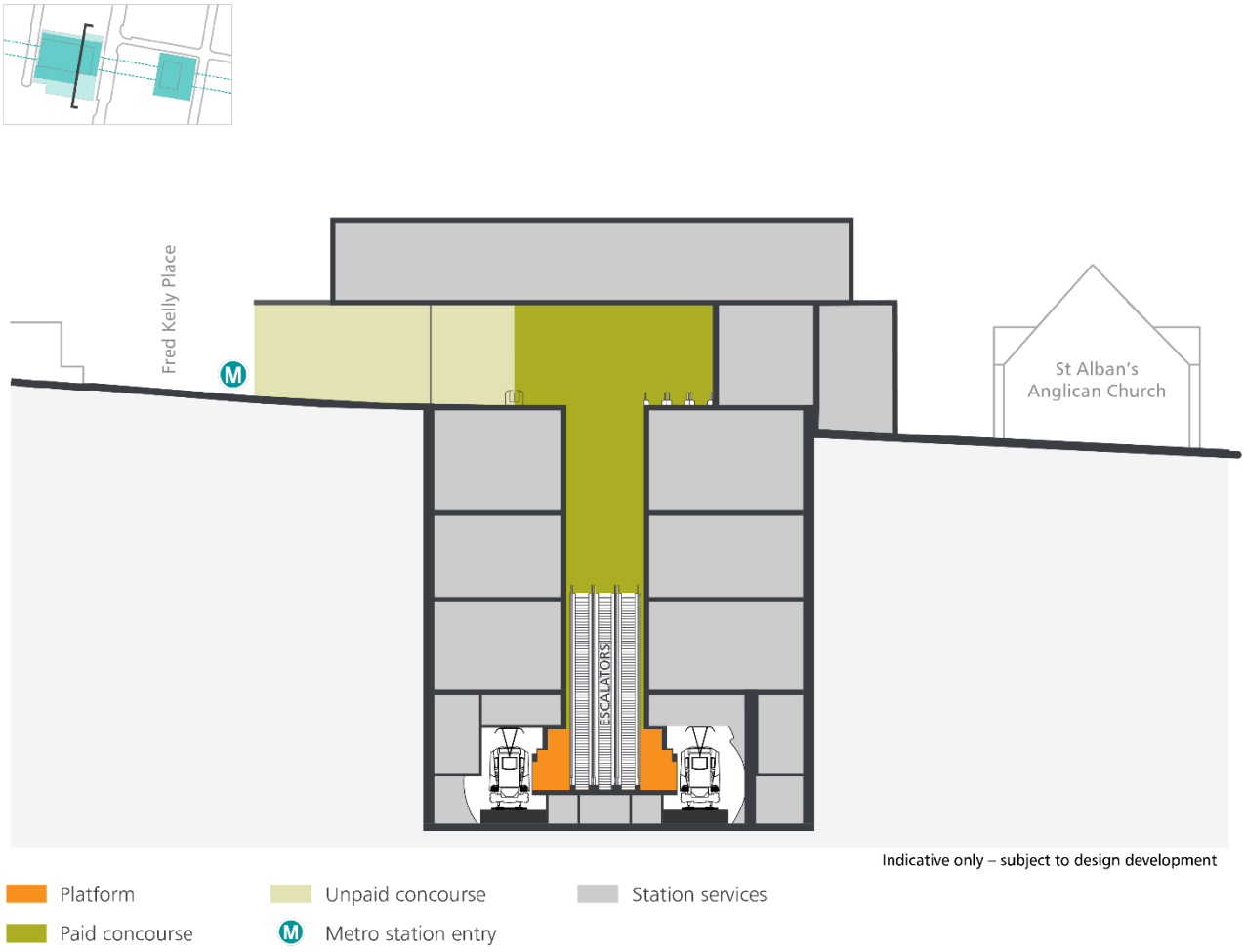

Figure 12-3 Indicative cross-section – Five Dock Station

12.2.3 Station precinct and interchange facilities

Five Dock Station would include a series of precinct and interchange elements such as:

- bicycle parking
- new bicycle path connections providing access throughout the station precinct
- bus interchange located kerbside on both sides of Great North Road
- accessible kiss and ride facility on East Street
- kiss and ride facilities on Waterview Street and on Second Avenue
- parking spaces to be converted to kiss and ride areas during peak hours on Garfield Street and on Second Avenue
- point-to-point vehicle facilities on Garfield Street
- extension of the existing Fred Kelly Place to the new station entry in the north (refer to Figure 12-1 for extent of public domain works to be delivered as part of this proposal)
- modifications to the existing signalised pedestrian crossing on Great North Road
- footpath widening on both sides of Great North Road, adjacent to proposed signalised crossings and proposed and existing bus stops
- loading area for station operations
- built elements and provision of utilities and services to provide space for future non-station uses (e.g. retail, commercial and/or community facilities), including structures connected to the eastern and western sites. Fit-out and use of these spaces would be subject to separate approval, where required. Refer to Section 5.4.3 (Structures and spaces for non-station uses) for further detail.

Sydney Metro is also investigating options for a pedestrian crossing of Second Avenue at Great North Road.

Five Dock Station would also be designed in accordance with the precinct place and design and the corridor-wide urban design principles outlined in Section 5.2 (Placemaking and design) of this Environmental Impact Statement.

12.2.4 Provisioning for over and/or adjacent station development

Over and/or adjacent station development is not proposed at Five Dock Station.

12.3 Placemaking

The vision for Five Dock Station and its surrounds is to:

Deliver a station precinct development that contributes to the character and identity of Five Dock as a revitalised, diverse and vibrant local centre, well connected to all transport modes.

12.3.1 Integration with strategic planning

The *Eastern City District Plan* (Greater Sydney Commission, 2018b) identifies Five Dock as a local centre. A number of plans and strategies have been developed, which have informed the development of Five Dock Station and would guide the future design.

This proposal has considered the objectives of Better Placed (Government Architect NSW, 2017) as outlined in Section 5.2 (Placemaking and design) of this Environmental Impact Statement. An overview of how this proposal meets the relevant transport and connectivity outcomes of the Healthy Built Environment Checklist (NSW Government, 2020a) is also provided in Appendix I (Healthy Built Environment Checklist).

City of Canada Bay Local Strategic Planning Statement

The relationship of Sydney Metro West to the City of Canada Bay Local Strategic Planning Statement (City of Canada Bay Council, 2020) is discussed in Section 7.10.6 of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a).

The Local Strategic Planning Statement highlights Five Dock Station as supporting development of the local centre focused on Great North Road and building on existing qualities. Priorities include expanding the range of services and employment opportunities and encouraging evening activities and the night-time economy.

Key actions include implementing the expansion of Fred Kelly Place and encouraging a diversity of dwellings within the vicinity of the Five Dock town centre. The planning statement also advocates for walking and cycling connections to be integrated with new metro stations. Sydney Metro West would support an increased diversity of housing near the station and would activate and expand Fred Kelly Place to the north.

Five Dock town centre revitalisation

The Five Dock town centre includes the commercial and retail area along Great North Road, with Fred Kelly Place as the focal point of the community.

The Five Dock Town Centre Urban Design Study (City of Canada Bay Council, 2013) aims to ensure that the town centre provides for the community, creates opportunities for investment, is easy to get around and provides an enhanced built environment.

Based on the Five Dock Town Centre Urban Design Study, the City of Canada Bay Council has planned and begun to deliver public domain improvements to encourage the centre's activation and enhancement. This includes an expansion of Fred Kelly Place that would be delivered as part of the metro station. The station would also support the opportunity for a new public domain to the east of Great North Road, with through-site links to Second Avenue and Waterview Street. This would create the potential for an active frontage to the eastern station services building.

12.3.2 Place and design principles

Place and design principles for Five Dock Station were identified in Section 7.10.6 of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a). The principles build on the five Sydney Metro-wide design objectives and have considered relevant local council strategies and Better Placed design objectives (refer to Section 5.2 (Placemaking and design) of this Environmental Impact Statement). Table 12-2 outlines how these principles have been achieved in the Five Dock Station design.

Table 12-2 Design responses to Five Dock Station place and design principles

Place and design principle	Design response
Facilitate improved public and active transport accessibility for the community by providing efficient access and interchange	• the station entrance would face directly onto Fred Kelly Place and be coordinated with Council's aspirations for expansion and enhancement of this plaza • bicycle parking facilities would be provided near the station entry • bus interchange immediately outside the station entry on Great North Road.
Respect and contribute to the local character and amenity of the Five Dock town centre	• the station entry would be located to encourage and contribute to the activation of the Great North Road street environment, enhance Fred Kelly Place as the community focal point and assist with greater east west access between East Street and Waterview Street • the height and scale of the station buildings are relatively low, in keeping with the local setting • the public domain and precincts work associated with the station would be integrated with and safeguard for the planned Council programs for the broader precinct. This includes the expansion of Fred Kelly Place and through-site links near the eastern station services building.
Facilitate an active ground plane along Great North Road and Fred Kelly Place	• aboveground station buildings would incorporate space for future ground floor retail activation along Great North Road and at Fred Kelly Place.

Place and design principle	Design response
Support an enhanced Fred Kelly Place, in consideration of the principles outlined in the *Five Dock Town Centre Urban Design Study*	• the station entry would face directly onto Fred Kelly Place and includes the expansion and enhancement of this plaza consistent with Council's aspirations • the public domain and precincts work associated with the station would be integrated with and safeguard for the planned Council programs for the broader precinct. This includes the expansion of Fred Kelly Place and through-site links near the eastern station services building.
Promote connectivity to and from the station through streets, lanes and public places	• the design would provide part of the future north-south connection from Second Avenue to the planned 'new town square' (to be delivered by Council) and provide opportunities for potential ground floor retail activation at the eastern station services building along the future east-west laneway (to be delivered by Council).

The key urban design strategies to support the implementation of the place and design principles are illustrated in Figure 12-4, Figure 12-5 and Figure 12-6.

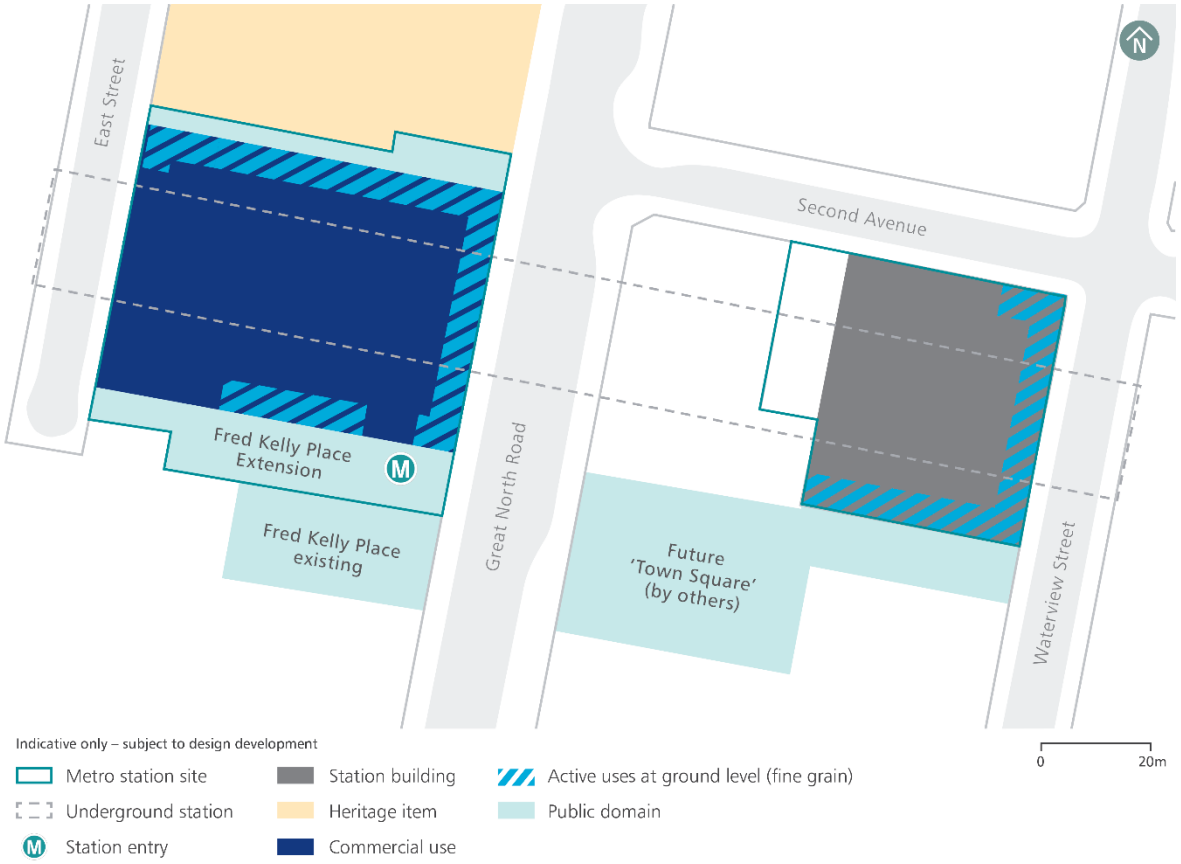

Figure 12-4 Land use and function urban design strategies – Five Dock Station

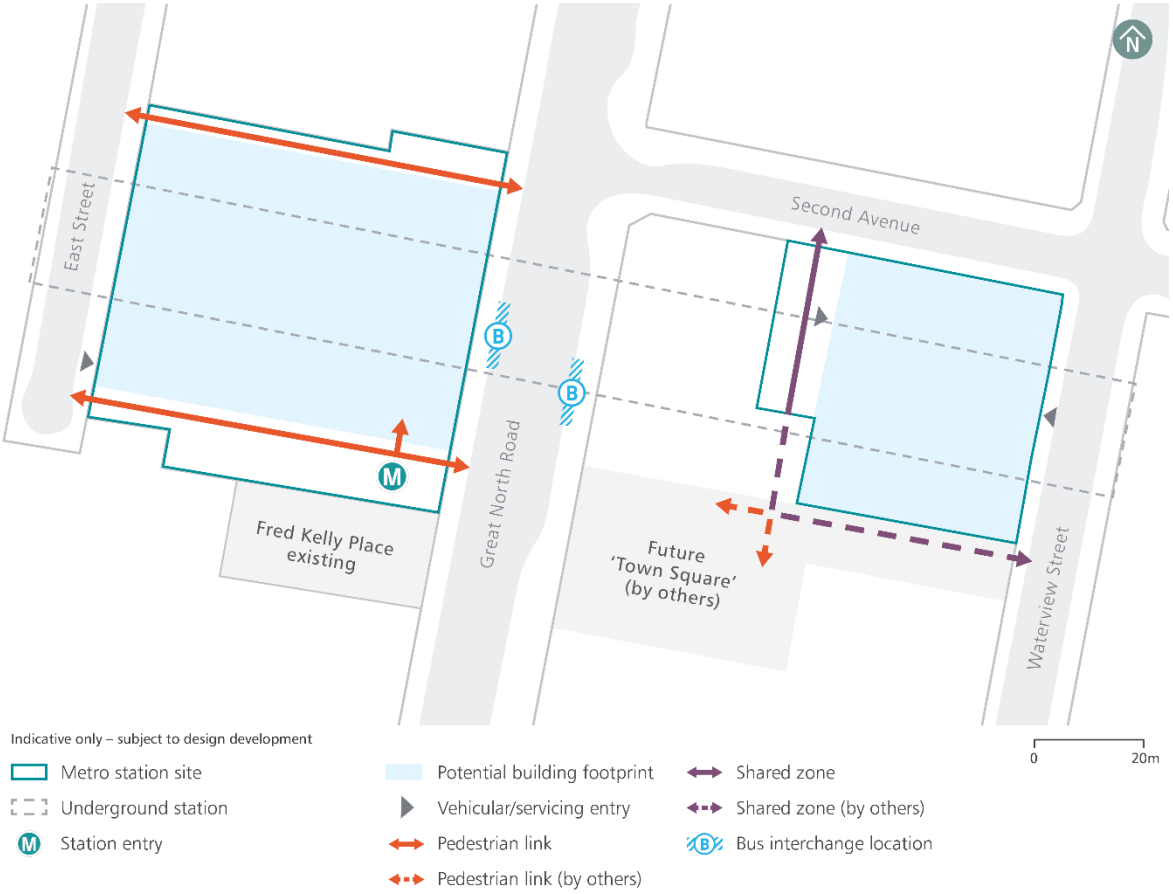

Figure 12-5 Access and connectivity urban design strategies – Five Dock Station

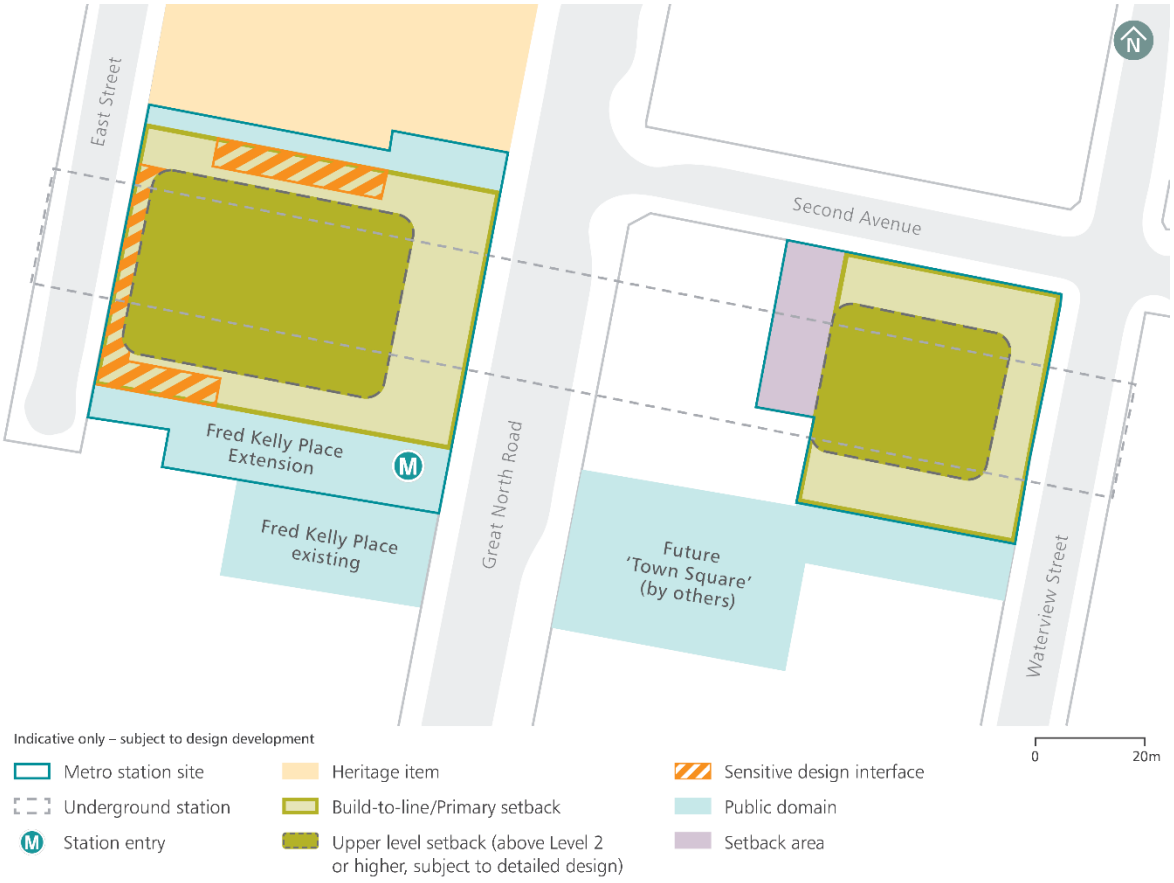

Figure 12-6 Built form urban design strategies – Five Dock Station

The Five Dock Station design includes the following key movement and place features:

- providing a station entry to, and an expansion of, Fred Kelly Place
- providing a set back of the station entry building to the adjacent St Alban's Church, improving the setting and views to this heritage item
- providing for future ground floor retail activation at the station entry fronting Fred Kelly Place and Great North Road, as well as along a part of East Street, Second Avenue and Waterview Street
- supporting Council's vision for the enhancement of the town centre by safeguarding the potential for laneways and linkages, as well as potential ground floor activation of the eastern station services building
- recognising Great North Road as a key movement corridor while balancing improved pedestrian crossing facilities near the station entry and opportunities for active uses and enhanced place outcomes.

12.3.3 Transport interchange, access and connectivity

Integration with other transport modes, including active transport, is fundamental to improving access to the public spaces and local community facilities surrounding or delivered as part of the Five Dock Station design. The delivery of a metro station provides a new mass transit to a new area. Five Dock Station would deliver public domain enhancements to optimise the interchange function and provide safe, accessible station access. It would also build on the recent and planned upgrades to Great North Road.

Examples of how the Five Dock Station design integrates with other transport modes and improves access for customers and the community include:

- creation of a high amenity, pedestrian dominated plaza environment around the station entry within an expanded Fred Kelly Place, improving access to the western catchment through Fred Kelly Place
- improved and narrower pedestrian crossing of Great North Road near the station entry
- bicycle parking near the station entry
- direct access to new and existing bus stops on Great North Road, near the station entry in Fred Kelly Place. Customers would be able to access the station entry using the upgraded mid-block signalised crossing
- an accessible kiss and ride space near the station entry on East Street
- kiss and ride spaces on Waterview Street, Second Avenue and Garfield Street and a point-to-point zone on Garfield Street in proximity to the station. Customers would be able to access the station from these facilities using the existing wide footpaths through the Five Dock town centre.

12.4 Construction description

This section provides a description of the construction activities required to complete Five Dock Station, and associated precinct work required for the operation of Sydney Metro West.

Major civil construction including station excavation and tunnelling work at Five Dock Station was assessed and approved under *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a) and does not form part of this proposal.

12.4.1 Overview

Construction of Five Dock Station would require the continued use of two construction sites (one west and one east of Great North Road) established under the previous Sydney Metro West planning application. The footprint of these construction sites will be consistent with the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a).

The Five Dock western construction site will be located between Great North Road and East Street, to the north of Fred Kelly Place and south of St Alban's Anglican Church and the Five Dock eastern construction site will be located on the corner of Second Avenue and Waterview Street.

These construction sites would be levelled and excavated as a result of the work carried out under the previous Sydney Metro West planning application prior to the commencement of this proposal.

The location and indicative layout of the Five Dock construction sites are shown in Figure 12-7. Some activities would occur outside this construction footprint, such as delivery of construction equipment and station precinct and interchange work.

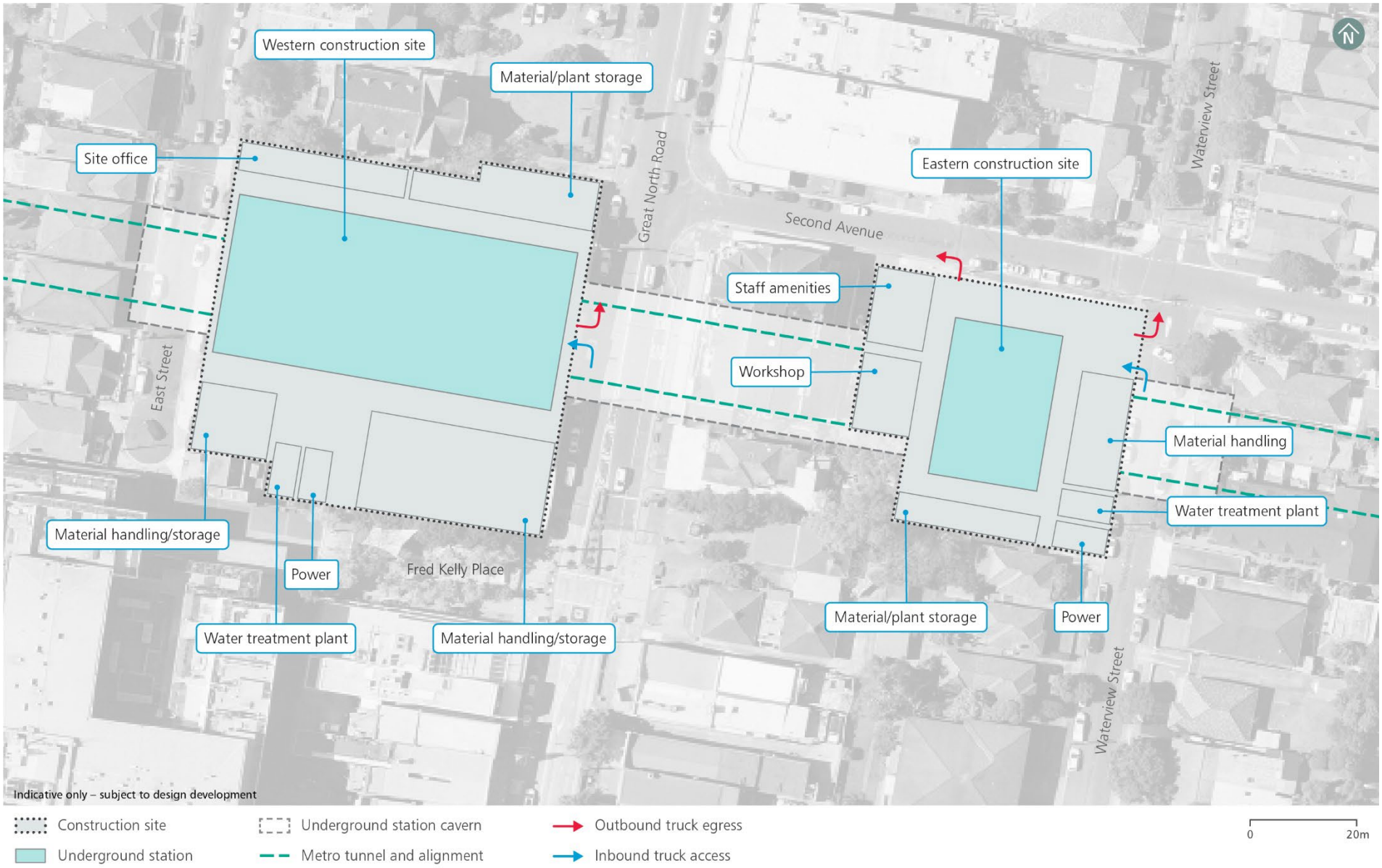

Figure 12-7 Indicative construction sites layout – Five Dock Station

12.4.2 Construction work

Key construction work at the Five Dock construction sites would include:

- enabling and site establishment work
- minor excavation for the station building
- construction of the station and structures for non-station use
- station fit-out
- construction of station precinct and interchange facilities
- finishing work, testing and commissioning.

The indicative construction program for Five Dock Station is shown on Figure 12-8.

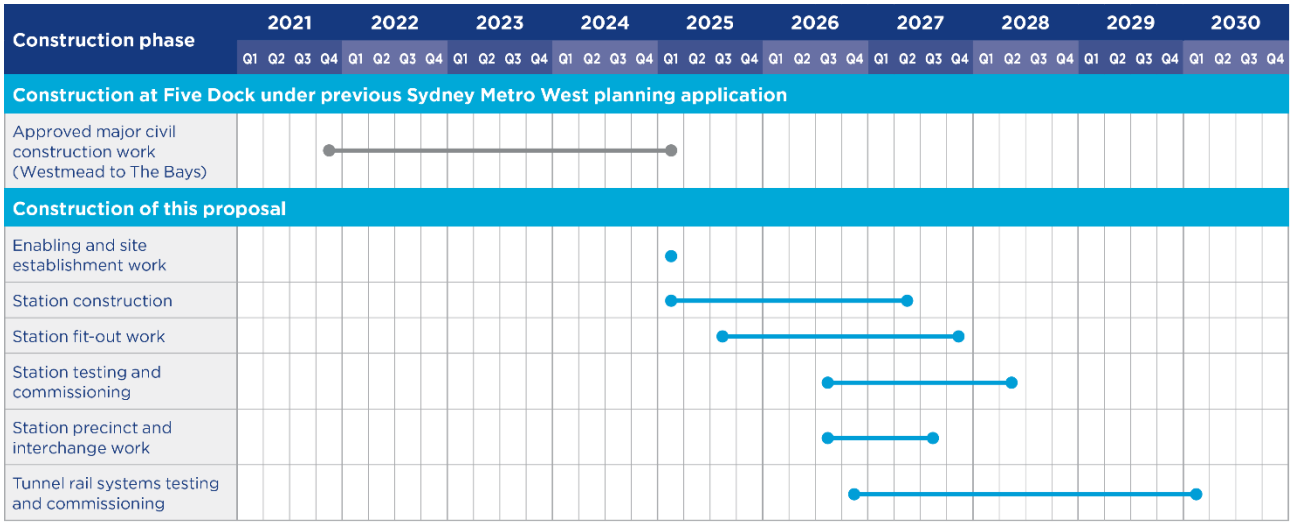

Figure 12-8 Indicative construction program – Five Dock Station

Other construction elements specific to Five Dock Station are shown in Table 12-3. Indicative construction hours, plant and equipment and workforce for Five Dock Station construction sites are provided in Section 6.5 (Other construction elements) of this Environmental Impact Statement. Key elements specific to the Five Dock Station construction sites as described in the table below, are also depicted on Figure 12-7.

Table 12-3 Other construction elements – Five Dock Station

Construction element	Description
Construction traffic access and egress	Continued access and egress arrangements established under the previous Sydney Metro West planning application that would likely be maintained during construction include: • access to the eastern construction site via left-in from Waterview Street • egress from the eastern construction site via left-out onto Second Avenue • access to and egress from the western construction site via left-in from Great North Road and left-out onto Great North Road.
	Additional and/or new access and egress arrangements likely to be required for construction of this proposal include: • egress from the eastern construction site via left-out onto Waterview Street. Additional investigations into alternate egress arrangements would be undertaken to support the construction of this proposal at Five Dock.
Peak daily traffic movements	Eastern construction site: • about 224 daily heavy vehicle movements • about 226 daily light vehicle movements. Western construction site: • about 224 daily heavy vehicle movements • about 276 daily light vehicle movements.

Construction element	Description
	Note: Movement refers to a one-way movement. A vehicle entering and then leaving a construction site represents two movements.
Transport network modifications	Continued temporary transport network modifications established under the previous Sydney Metro West planning application that would be maintained during construction include: • temporary removal of about 12 on-street parking spaces along the western side of Great North Road. These spaces would also be permanently removed for operation of the station • temporary removal of about 10 on-street parking spaces along the western side of Waterview Street and southern side of Second Avenue. Around two of these spaces would also be permanently removed for operation of the station • Waterview Street one-way northbound from main car park to Second Avenue • Second Avenue one-way westbound from Second Avenue to Great North Road.
	No additional temporary transport network modifications would be introduced as part of this proposal.

12.5 Transport

Further details of the operational and construction transport assessment, including the approach and methodology, is provided in Technical Paper 1 (Operational transport) and Technical Paper 2 (Construction transport).

Potential impacts (including benefits) at a regional level or where impacts are common across precincts are assessed in Chapter 18 (Proposal-wide) of this Environmental Impact Statement. This includes strategic transport benefits during operation, and potential impacts in relation to road user safety, construction worker parking, emergency vehicles and road condition during construction.

12.5.1 Baseline environment

The baseline transport environment described for Five Dock Station includes the existing transport environment as well as adjustments made as part of the work carried out under the previous Sydney Metro West planning application.

Active transport network

Key pedestrian facilities surrounding Five Dock Station include:

- footpaths along all roads in the vicinity of the Five Dock Station, including Great North Road
- signalised pedestrian crossings on all approaches at the Great North Road / Ramsay Road / First Avenue, Great North Road / Garfield Street, and Great North Road / Lyons Road intersections, and on three of the four approaches at the Great North Road / Queens Road / Fairlight Street intersection
- a signalised midblock crossing of Great North Road in front of Fred Kelly Place
- a raised zebra crossing near Henry Street
- a pedestrian-only area around Fred Kelly Place and Five Dock Library.

The cycle network surrounding Five Dock Station includes:

- on-road cycle routes on Lyons Road West, Henry Street, Barnstaple Road, First Avenue and Queens Road
- off-road cycle paths near two roundabouts on Lyons Road West
- a shared path along the southern side of Iron Cove Creek between Dobroyd Parade and Wolseley Street.

Public transport network

A summary of the public transport services around Five Dock Station is provided in Table 12-4.

Table 12-4 Public transport services - Five Dock Station

Mode	Description
Rail	• no rail or light rail services within 2 kilometres of the station.
Bus	• 16 bus routes servicing the local area including 4 NightRide bus routes • on demand bus services • 46 school bus routes.

Parking, loading, servicing and pick-up arrangements

The parking environment around Five Dock Station includes:

- on-street parking on both sides of Great North Road, First Avenue, Waterview Street, Second Avenue, East Street, Henry Street and Garfield Street consisting of time-restricted and unrestricted spaces
- time-restricted parking near the Five Dock town centre between Barnstaple Road and Queens Road
- a loading zone on the northern side of Henry Street near Great North Road
- a mail zone on the northern side of Garfield Street near Great North Road.

As part of the work carried out under the previous Sydney Metro West planning application, the following parking spaces will be removed:

- about 12 on-street parking spaces on the western side of Great North Road. These spaces would also be permanently removed for operation of the station
- about five on-street parking spaces on the western side of Waterview Street. Some of these spaces would also be permanently removed for operation of the station
- about five on-street parking spaces on the southern side of Second Avenue. Some of these spaces would also be permanently removed for operation of the station.

Traffic volumes and patterns

Approximate peak hour midblock volumes on key access roads surrounding Five Dock Station are shown in Table 12-5. The key access roads carry traffic volumes generally commensurate with their function.

Table 12-5 Existing peak hour traffic volumes (mid-block) by direction – Five Dock Station (2021)

Road	Direction	AM peak hour volume (vehicles per hour)	PM peak hour volume (vehicles per hour)
Lyons Road east of Great North Road	Eastbound	980	840
	Westbound	830	1,090
Parramatta Road west of Great North Road	Eastbound	1,940	1,760
	Westbound	1,320	1,550
Parramatta Road east of Great North Road	Eastbound	1,930	1,830
	Westbound	1,490	1,650
First Avenue east of Great North Road	Eastbound	380	310
	Westbound	150	140
Second Avenue east of Great North Road	Eastbound	110	90
	Westbound	60	70
Great North Road south of Lyons Road	Northbound	520	620
	Southbound	550	580

Road	Direction	AM peak hour volume (vehicles per hour)	PM peak hour volume (vehicles per hour)
Great North Road north of Garfield Street	Northbound	540	620
	Southbound	550	640
Waterview Street north of First Avenue	Northbound	90	100
	Southbound	50	90

Intersection performance

Modelled intersection performance during the AM and PM peak hours for key intersections in the vicinity of Five Dock Station is shown in Table 12-6. This modelling considers the continued road network arrangements made under the previous Sydney Metro West planning application including:

- temporary conversion of Waterview Street from two-way operation to one-way operation in the northbound direction from north of the Five Dock car park to Second Avenue
- temporary conversion of Second Avenue from two-way operation to one-way operation in the westbound direction between Waterview Street and Great North Road.

These temporary traffic network changes would minimise potential conflicts with heavy vehicle movements, improve safety and traffic outcomes for the local area and avoid the need for additional on-street parking removal along Waterview Street.

Modelled intersection performance indicates that the following intersections currently perform at level of service E or F:

- Great North Road / Ramsay Road / First Avenue during the PM peak hour, which is due to split signal phasing on the Ramsay Road and First Avenue approaches that reduce the efficiency of the intersection
- Great North Road / Lyons Road West / Lyons Road during the AM and PM peak hours, which is due to high through-movement volumes on Lyons Road and split signal phasing on the Great North Road approaches that reduce the efficiency of the intersection.

Table 12-6 Modelled peak hour baseline intersection performance – Five Dock Station (2021)

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approaches (metres)	
Parramatta Road / Great North Road (signalised)					
AM peak	4,464	53	D	NB	-
				EB	490
				SB	105
				WB	205
PM peak	4,160	27	B	NB	-
				EB	255
				SB	95
				WB	145
Great North Road / Queens Road / Fairlight Street (signalised)					
AM peak	2,369	34	C	NB	130
				EB	80
				SB	160
				WB	120

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approaches (metres)	
PM peak	2,226	30	C	NB	110
				EB	100
				SB	145
				WB	130
Great North Road / Ramsay Road / First Avenue (signalised)					
AM peak	1,657	33	C	NB	155
				EB	-
				SB	90
				WB_1	85
				WB_2	45
PM peak	1,744	64	E	NB	145
				EB	-
				SB	90
				WB_1	275
				WB_2	45
Waterview Street / First Avenue (priority controlled)					
AM peak	636	8	A	NB	<5
				EB	<5
				SB	<5
				WB	<5
PM peak	591	7	A	NB	<5
				EB	<5
				SB	<5
				WB	<5
Waterview Street / Second Avenue (priority controlled)					
AM peak	241	10	A	NB	<5
				EB	<5
				SB	<5
				WB	<5
PM peak	224	8	A	NB	<5
				EB	<5
				SB	<5
				WB	<5
Great North Road / Garfield Street (signalised)					
AM peak	1,451	25	B	NB	90
				EB	65
				SB	80
				WB	-
PM peak	1,617	24	B	NB	90
				EB	55
				SB	80
				WB	-

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approaches (metres)	
Great North Road / Second Avenue (priority controlled)					
AM peak	1,262	16	B	NB	10
				EB	-
				SB	105
				WB	<5
PM peak	1,436	18	B	NB	10
				EB	-
				SB	315
				WB	25
Great North Road / Lyons Road West / Lyons Road (signalised)					
AM peak	3,283	62	E	NB	150
				EB	200
				SB	200
				WB	220
PM peak	3,521	88	F	NB	300
				EB	215
				SB	155
				WB	>500

Notes:
1. Ramsay Road WB approach
2. First Avenue WB approach.

12.5.2 Operational impact assessment

This section outlines the transport interchange provisions proposed at Five Dock Station as shown in Figure 12-1.

The transport interchange provisions have been designed to maximise the seamless travel experience for all customer groups transferring between this proposal and other transport modes. Stations have been designed for ease of interchange from the different modes, including pedestrian and cycle facilities and to minimise disruptions to public transport users and the surrounding road network.

This section also discusses the potential impact of the transport interchange provisions on the transport network during operation.

Passenger demand

Station passenger demand forecast for the 2036 AM peak hour (8am to 9am) indicates about 2,000 customers accessing Five Dock Station and 520 customers egressing Five Dock Station during the AM peak hour. This indicates this station would be primarily used as an origin station, where most of the passengers would be using the station to get to work.

The 2036 modal breakdown of access and egress during the AM peak hour is presented in Table 12-7. Key observations from this analysis indicate that most customers would access and egress the station by walking, with bus transfers also a large proportion along with kiss and ride for station access. Customer access and egress direction is relatively evenly split from all locations.

Table 12-7 2036 forecast mode of access and egress – Five Dock Station

Mode	Walk	Cycle	Bus	Kiss and ride	Park and ride
Access	42%	2%	32%	17%	7%
Egress	77%	2%	21%	0%	0%

Integration with other transport modes

A description of how Five Dock Station would integrate with existing transport modes during operation is provided in Table 12-8. Appropriate signage and wayfinding would be provided within the precinct to provide easy customer transfer and access to the station.

Table 12-8 Network integration – Five Dock Station

Network	Description
Pedestrian network	Access to Five Dock Station would be via one entry fronting onto Fred Kelly Place. New pedestrian facilities proposed to be provided as part of the station and precinct include: • relocation of the existing signalised midblock crossing across Great North Road at Fred Kelly Place around 20 metres north of its current location, closer to the station entry, subject to ongoing consultation with Transport for NSW. This would align the crossing better with the future eastern Fred Kelly Place (proposed by the City of Canada Bay Council) and provide a more direct and safe crossing point to and from the bus interchange. Existing pedestrian facilities that would also assist with providing access to the station include: • the signalised pedestrian crossing at Great North Road / Garfield Street intersection • a raised zebra crossing near Henry Street north of the station • wide footpaths throughout the Five Dock town centre. The proposed Fred Kelly Place extension to the east of Great North Road (proposed by City of Canada Bay Council) would further attract pedestrians to access the open space and the precinct. Proposed pedestrian links (by City of Canada Bay Council) across Fred Kelly Place would provide direct pedestrian connectivity to the station. 2036 pedestrian modelling forecasts that footpaths surrounding the station would operate satisfactorily at level of service A or better in both AM and PM peak periods.
Cycle network	New bicycle parking facilities would be provided near the station entry.
Public transport network	Public transport integration at Five Dock Station would include: • existing and new kerbside bus stops in each direction on Great North Road to enable transfer between bus and metro services • the new kerbside bus stops would be supported by widened footpaths, bus shelters and other infrastructure for accessibility.
Road network	Road network changes that would be implemented as part of the station precinct include: • relocation (about 20 metres to the north) and possible widening of the existing signalised pedestrian crossing of Great North Road. Kerb-to-kerb carriageway widths along this section of Great North Road may require adjustment to accommodate the bus stop changes. This is not expected to impact traffic flow given the presence of the existing signalised crossing • kiss and ride zones on Second Avenue, Waterview Street and Garfield Street. Sydney Metro is considering the potential to provide a pedestrian crossing across Second Avenue at its intersection with Great North Road to provide a safer crossing point along this pedestrian desire line. Relatively low numbers of park-and-ride trips are forecast. No dedicated parking capacity would be provided as part of this proposal and customers who choose to drive to the station would be dependent on the availability of existing parking spaces in the local area. Parking strategies would be developed in consultation with City of Canada Bay Council to manage the potential impacts associated with customer parking near the station.

Road network performance

Intersection performance results for the '2036 without proposal' and '2036 with proposal' scenarios during the AM and PM peak hours for key intersections in the vicinity of Five Dock Station are shown in Figure 12-9.

The introduction of WestConnex and other arterial road network changes are forecast to result in reductions in annual background traffic growth on roads in the vicinity of Five Dock. Construction of this proposal would have a further positive impact on the local network due to the expected mode shift from private vehicle trips to public transport during operation. Intersection performance analysis forecasts that:

- all intersections would operate satisfactorily at level of service C or better during the weekday AM and PM peak periods with and without this proposal
- the forecast reduction in performance of the signalised mid-block crossing on Great North Road is a result of the increase in pedestrian flows even though the level of service remains the same.

Network changes proposed as part of this proposal are not expected to have a substantial impact on overall network performance and would rather enhance pedestrian and road safety with provision of wider footpaths, road safety devices and other minor road network upgrades.

Figure 12-9 Operational intersection performance – Five Dock Station (2036)

Parking and property access

Several on-street and off-street parking spaces would be removed around Five Dock Station as part of this proposal, including around:

- three spaces, including one accessible parking space on East Street, to accommodate access to the station loading dock
- around 12 spaces along the western side of Great North Road between the mid-block crossing and Second Avenue to accommodate the new bus stops (noting that these will be temporarily removed as part of work under the previous Sydney Metro West planning application)

- around two spaces along the southern side of Second Avenue west of Waterview Street to accommodate new kiss and ride zone (noting that these will be temporarily removed as part of work under the previous Sydney Metro West planning application).

A number of parking spaces would be converted into kiss and ride spaces during AM and PM peak hours only, which may be used for parking outside of these periods, including around:

- five spaces on Second Avenue (between Great North Road and Waterview Street)
- three spaces on Waterview Street (noting that these will be temporarily removed as part of work under the previous Sydney Metro West planning application)
- two spaces on Garfield Street.

Access to all nearby properties would be maintained during operation.

12.5.3 Construction impact assessment

Construction haul routes

The primary construction haul routes for the Five Dock Station construction sites are shown in Figure 12-10. Secondary haul routes may also involve the use of Waterview Street north to Barnstaple Road and Ingham Avenue; and Lyons Road west to Harris Road. Construction site access and egress locations, as well as the number of daily traffic movements anticipated at the Five Dock Station construction sites, are outlined in Section 12.4.2.

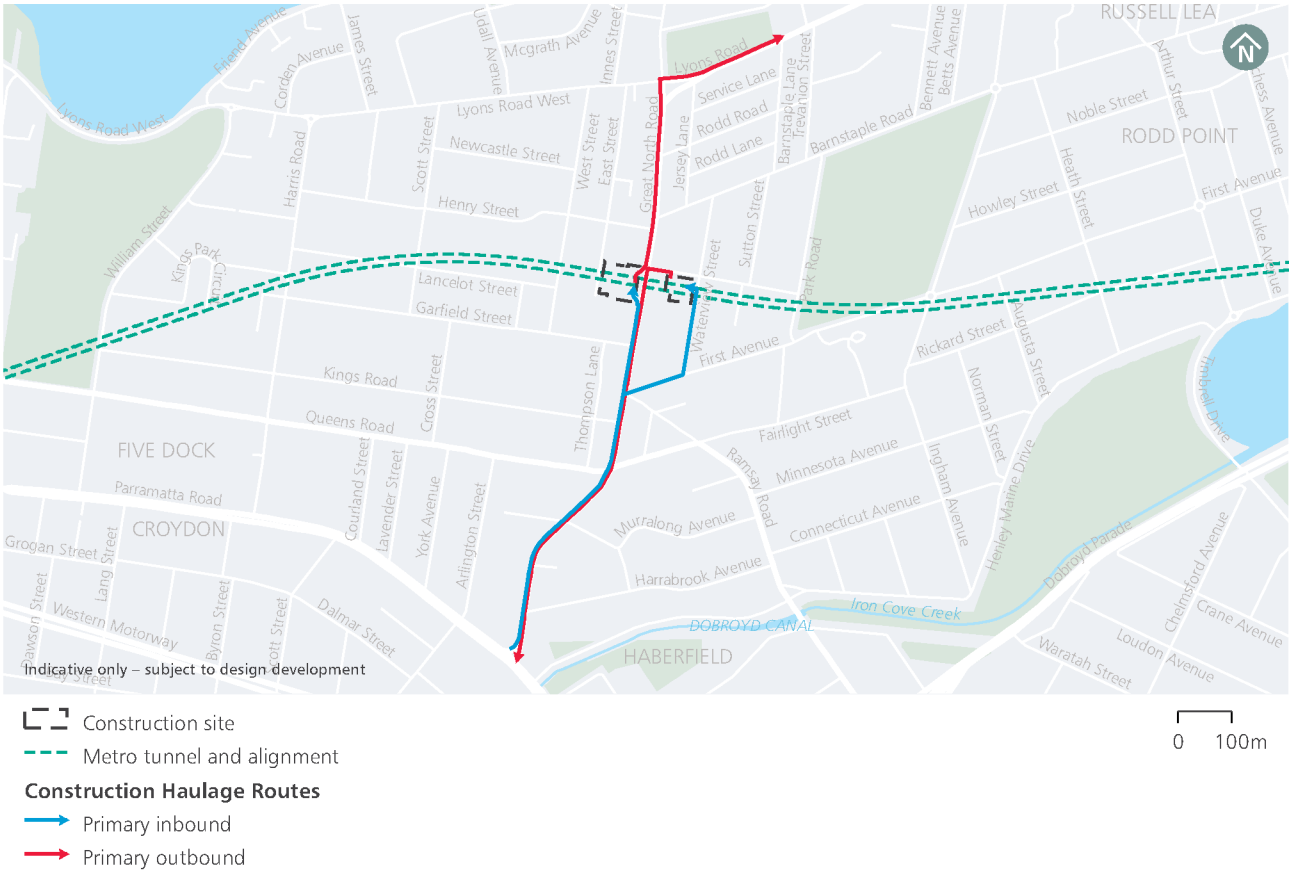

Figure 12-10 Primary construction haul routes – Five Dock Station

Active transport network

Existing pedestrian and cycle routes surrounding the Five Dock Station construction sites would be maintained throughout construction.

Construction work for the new bus stops, kiss and ride bays, point-to-point zone and other kerbside uses may require short-term closures (for around a few months) of sections of footpaths, which may result in some minor additional travel times for pedestrians. Appropriate diversions would be established to safely guide pedestrians around work zones.

Appropriate controls would be employed so that pedestrian safety is maintained during construction near Fred Kelly Place, which generates a substantial amount of pedestrian activity.

First Avenue is a designated on-road cycle route and would also be used by construction vehicles travelling to and from the construction sites. Impacts on cyclists would be minor given that cyclists would be interacting with a low number of additional heavy vehicles. To address potential conflicts, mitigation measures outlined in the CTMF would be implemented during construction.

Public transport network

Roads forming part of the construction haul vehicle route also used by buses include Parramatta Road, Great North Road, Lyons Road and First Avenue. Impacts on buses would be limited to a potential minor increase in travel time due to the additional construction vehicles on the road network. No impacts are anticipated on the operation of bus stops.

Parking and property access

Potential impacts associated with the continued removal of parking from Great North Road, Second Avenue and Waterview Street under the previous Sydney Metro West planning application would be minimal given the low number of lost parking spaces and the availability of parking on nearby streets. The majority of these spaces would also be permanently removed for operation of the station.

Potential impacts of the short-term removal (for around a few months) of some on-street parking spaces on Great North Road, East Street, Second Avenue, Waterview Street and Garfield Street for the new bus stops, kiss and ride and point-to-point zones would be minor given the short duration.

The temporary road network changes that will be implemented under the previous Sydney Metro West planning application (one-way operation of sections of both Waterview Street and Second Avenue) would continue to operate temporarily for the duration of construction of this proposal. Residents of Waterview Street between First Avenue and Second Avenue would continue to experience minor impacts due to an additional travel time of around three minutes.

There is the potential for conflict between vehicles exiting Five Dock Station western construction site and vehicles exiting the St Alban's Anglican Church driveway. Construction vehicle movements would be managed during church service times so that the potential for conflict with church patrons is minimised.

Where existing parking is removed to facilitate construction activities, a parking management plan would be developed in accordance with the requirements of the CTMF. This would include consultation with the City of Canada Bay Council to investigate opportunities to provide alternative parking facilities.

Road network performance

Intersection performance results for the ‘2026 without proposal’ (without construction vehicles) and ‘2026 with proposal’ (with construction vehicles) scenarios are shown in Table 12-8.

During the AM peak hour (7.30am to 8.30am) and PM peak hour (4.45pm to 5.45pm), it is anticipated that during the peak construction activity:

- the Five Dock Station western construction site would generate a total of 40 light vehicle movements and 28 heavy vehicle movements
- the Five Dock Station eastern construction site would generate a total of 36 light vehicle movements and 28 heavy vehicle movements.

These vehicle movement forecasts were assumed for the intersection performance modelling. Peak hours were selected to represent the times when background traffic demand is at its greatest.

Modelled intersection performance during construction indicates the following intersections would experience a deterioration in level of service:

- Parramatta Road / Great North Road during the PM peak hour from level of service D to E. This is due to additional construction vehicles turning right from Parramatta Road into Great North Road and left from Great North Road into Parramatta Road, resulting in a redistribution of green times and increased average delays on the north and east approaches
- Great North Road / Queens Road / Fairlight Street during the AM and PM peak hours from level of service D to E and C to D, respectively. This is due to additional construction vehicles travelling on Great North Road in the southbound direction, resulting in increased average delays on the north approach

- Great North Road / Ramsay Road / First Avenue during the AM and PM peak hours from level of service C to D and E to F, respectively. This is due to additional construction vehicles travelling on Great North Road in both directions and on First Avenue in the eastbound direction, resulting in an increase in average delay on the Ramsay Road approach.

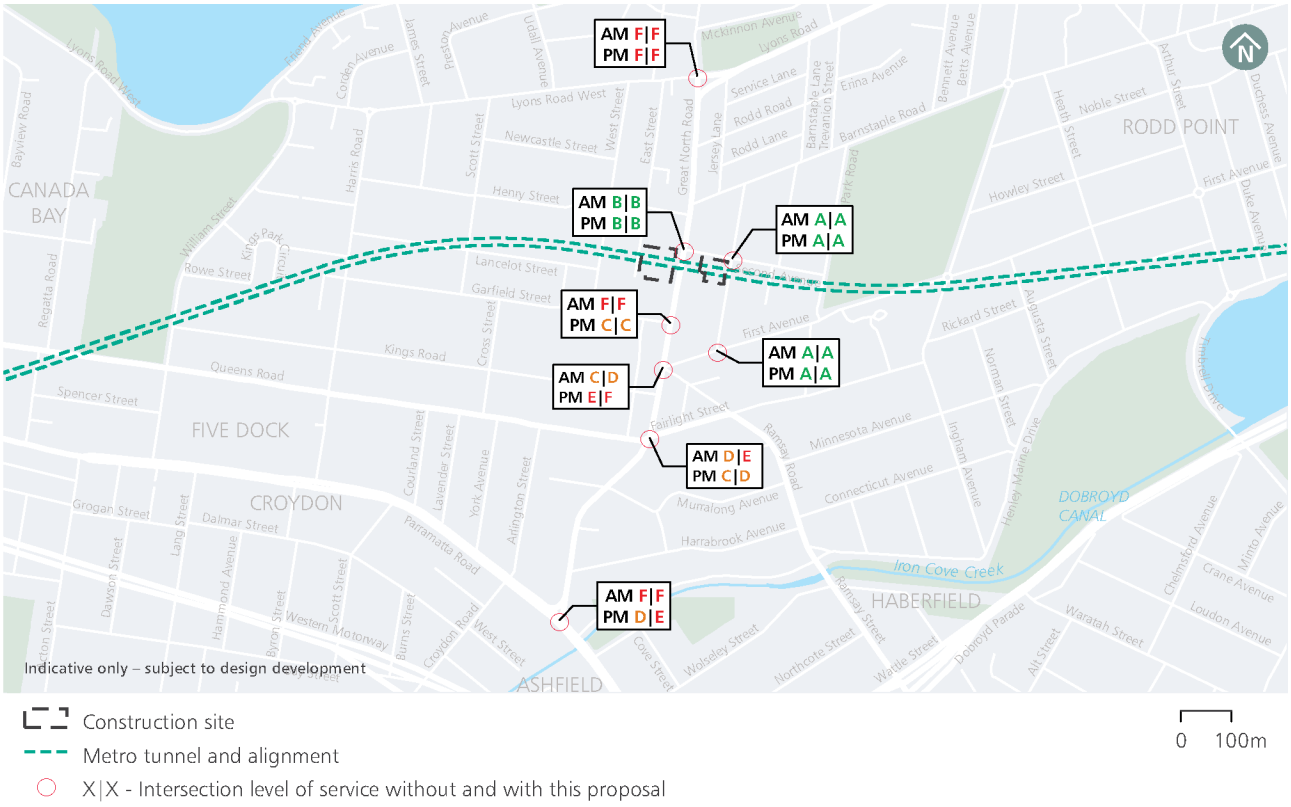

Figure 12-11 Construction sites intersection performance – Five Dock Station (2026)

12.5.4 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

The approach to transport and traffic management during the construction phase, including the process for the development of all construction traffic management plans is outlined in the CTMF, provided in Appendix G.

The CTMF provides the overall strategy and approach for construction traffic management for Sydney Metro West, and an outline of the traffic management requirements, mitigation measures and processes that would be common to each of the proposed construction sites. It establishes the traffic management processes and acceptable criteria to be considered and followed in managing roads and footpaths adjacent to construction sites.

Mitigation measures that are specific to address the operation and construction of Five Dock Station are listed in Table 12-9.

Table 12-9 Transport mitigation measures – Five Dock Station

Ref	Impact/issue	Proposed mitigation measure	Timing
Transport			
EIS-TT20	Traffic impacts to St Alban's Anglican Church during construction	Construction site traffic generated at the Five Dock Station construction sites would be managed to minimise movements during church services times at St Alban's Anglican Church.	Construction

12.6 Noise and vibration

Further details on the operational and construction noise and vibration assessment, including the approach and methodology, are provided in Technical Paper 3 (Operational noise and vibration) and Technical Paper 4 (Construction noise and vibration).

12.6.1 Baseline environment

Existing noise levels around Five Dock Station are generally controlled by road traffic noise on the surrounding road network. The area surrounding Five Dock Station is a mixture of commercial, 'other sensitive' and residential receivers, with the nearest receivers being close to the boundary of both the sites. The St Alban's Anglican Church is located directly to the north of the site.

Five Dock has been divided into six noise catchment areas (NCAs) for the construction noise assessment – NCA14 to NCA19. The site and NCAs are shown in Figure 12-12.

Figure 12-12 Location of sensitive receivers near Five Dock Station and NCAs

Unattended noise monitoring was carried out at sensitive receiver locations near Five Dock Station between March and July 2019 as part of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a). This data represents the noise environment prior to the commencement of the work carried out under the previous Sydney Metro West planning application and was used to inform this assessment.

The results of the unattended noise monitoring are summarised in Table 12-10 and indicate that background noise levels generally reflect the commercial and residential nature of the area.

Short-term attended noise monitoring was also carried out at Five Dock Station between March and July 2019. The results were generally found to be consistent with the unattended noise monitoring. Detailed observations from the attended monitoring are provided in Technical Paper 4 (Construction noise and vibration).

Table 12-10 Summary of unattended noise monitoring – Five Dock Station

Location ID	Noise logger location	Noise level (dBA)[1,2]					
		Background noise (RBL)			Average noise level (L_{Aeq})		
		Day	Evening	Night	Day	Evening	Night
B.14	3 Henry Street, Five Dock	42	41	33	58	56	51
B.15	8 Waterview Street, Five Dock	43	43 (44)[3]	38	57	56	50
B.16	11 Chapel Street, Lilyfield	36	36 (39)[3]	33	60	60	53
B.17	28 Crescent Street, Haberfield	43	43 (45)[3]	37	57	57	51
B.18	102 Henley Marine Drive, Russell Lea	48	45	37	64	61	55

Notes:

1. The RBL and L_{Aeq} noise levels have been determined with reference to the procedures in the Noise Policy for Industry (NPfI) (NSW Environment Protection Authority, 2017)
2. Daytime is 7am to 6pm, evening is 6pm to 10pm, and night-time is 10pm to 7am
3. The monitored evening level was found to be higher than the daytime. In this situation the NPfI requires that the evening level be reduced to match the daytime.

12.6.2 Operational impact assessment

The operational noise associated with the eastern and western sites for Five Dock Station has been assessed for the nearest and most noise-affected commercial and other sensitive receivers for each source type and is presented in Table 12-11 and Table 12-12 respectively.

The results indicate that the predicted noise levels would be compliant with the applicable noise criteria. Noise attenuation has been incorporated into the design to determine the predicted noise levels and includes consideration of the use of large fan attenuators, vent orientation, acoustic louvres and appropriate plant selection. These measures would be further developed throughout the detailed design phase so that compliance with the environmental noise criteria is achieved.

At Five Dock Station the sleep disturbance noise criteria is L_{AFmax} 53 dB(A). The highest predicted noise impact is L_{AFmax} 53 dB(A), which is compliant with the noise criteria. Given compliance with the applicable noise criteria is achieved, further consideration of noise attenuation is not required.

There would be no sources of vibration as part of operation of the station that would impact nearby receivers. Potential operational vibration impacts from trains operating in the tunnels are addressed in Chapter 16 (Tunnels) of this Environmental Impact Statement.

Table 12-11 Operational noise levels – Five Dock Station (eastern site)

Source	Criteria[1], dB(A)	Predicted noise level ($L_{Aeq,15min}$)
Second Avenue – residential		
Daytime	48	40
Evening	48	40
Night-time	43	40
Emergency mode	48	48
Draught relief noise impacts	53 L_{Amax}	53
Waterview Street – residential		
Daytime	48	40
Evening	48	40
Night-time	43	40
Emergency mode	48	47
Draught relief noise impacts	53 L_{Amax}	53
Waterview Street (southern) – residential		
Daytime	48	41
Evening	48	41
Night-time	43	41
Emergency mode	48	48
Draught relief noise impacts	53 L_{Amax}	53
Great North Road – residential		
Daytime	48	41
Evening	48	41
Night-time	43	41
Emergency mode	48	48
Draught relief noise impacts	53 L_{Amax}	53

Notes:
1. Criteria differs between operational noise source type (refer Technical Paper 3 (Operational noise and vibration)).

Table 12-12 Operational noise levels – Five Dock Station (western site)

Source	Criteria[1], dB(A)	Predicted noise level ($L_{Aeq,15min}$)
St Alban's Anglican Church		
Daytime	45	45
Evening	45	45
Night-time	45	44
Emergency mode	50	50
Great North Road (eastern) – residential		
Daytime	48	42
Evening	48	42
Night-time	43	40
Emergency mode	48	48

Source	Criteria[1], dB(A)	Predicted noise level ($L_{Aeq,15min}$)
Draught relief noise impacts	65 L_{Amax}	53
Fred Kelly Place (southern) – residential		
Daytime	48	42
Evening	48	42
Night-time	43	41
Emergency mode	48	46
Draught relief noise impacts	65 L_{Amax}	53
East Street (western) – residential		
Daytime	48	38
Evening	48	38
Night-time	43	37
Emergency mode	48	48
Draught relief noise impacts	65 L_{Amax}	53

Notes:
1. Criteria differs between operational noise source type (refer Technical Paper 3 (Operational noise and vibration)).

12.6.3 Construction impact assessment

The construction scenarios and anticipated working hours at the Five Dock Station construction sites are shown in Table 12-13. The estimated duration of each activity is also provided, noting that most activities would be intermittent and would not occur on a continual basis during every day of the activity.

The proposed work is anticipated to have a total duration of about four years. Refer to Figure 12-8 for the indicative construction program for Five Dock Station.

Temporary construction noise and vibration impacts would be managed through the implementation of standard and additional mitigation measures in accordance with the Sydney Metro CNVS.

Table 12-13 Construction activities and working hours – Five Dock Station

Scenario	Activity		Indicative duration (months)	Hours of work[1]			
				Std. day	Out of hours works		
					Day OOH	Evening	Night
Site establishment and public domain work	Typical	Deliveries and general work	18	✓	✓	-	-
	Peak	Construction/decommissioning of facilities and hoarding		✓	✓	-	-
Piling	Typical	Supporting work	2	✓	✓	-	-
	Peak	Bored piling with support plant		✓	✓	-	-
Station/facility construction	Typical	Internal construction and fit-out	30	✓	✓	✓	✓
	Peak 1	Installation of framing and structure		✓	✓	✓	-
	Peak 2	Concrete work		✓	✓	✓	-
Excavation	Typical	Mucking out	3	✓	✓	-	-
	Peak 1	Through soft soil/rock		✓	✓	-	-
	Peak 2	Through rock using a rockbreaker		✓	✓	-	-

Notes:
1. OOH = out-of-hours.

Airborne construction noise

The predicted airborne NML exceedances from the Five Dock Station construction sites are summarised in Table 12-14 for all residential receivers and in Table 12-15 for commercial and other sensitive receivers. The predictions are representative of the highest noise levels that would be experienced when the works are nearest to the sensitive receiver.

The number of receivers predicted to experience exceedances of the NMLs are summarised in bands of 10 dB and are separated into day, evening and night-time periods, as appropriate.

During the daytime, the highest construction noise impacts are predicted during excavation and station/facility construction when noise-intensive equipment such as rockbreakers or concrete saws would be in use. The highest impact work is expected to last for around 80 days for intermittent use of a rockbreaker for excavation (not continuous) and around 30 months for use of a concrete saw for station/facility construction concrete work, however concrete saws would only be used intermittently when concrete slabs are poured.

During the night-time, the majority of internal construction and fit-out work during station/facility construction would occur inside the built station structure and does not require noise intensive equipment. The highest impact work is expected to last for around 30 months for station/facility construction.

Table 12-14 Overview of NML exceedances (residential receivers) – Five Dock Station construction sites

Scenario	Activity	Indicative duration (months)	Number of receivers exceeding NML														
			Standard hours daytime			Out of hours											
						Daytime out of hours			Evening			Night time			Sleep disturbance		
			1 10 dB	10 20 dB	>20 dB	1 10 dB	10 20 dB	>20 dB	1 10 dB	10 20 dB	>20 dB	1 10 dB	10 20 dB	>20 dB	1 10 dB	10 20 dB	>20 dB
Site establishment and public domain work	Typical	18	28	13	2	63	23	4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Peak		75	23	6	170	32	15	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Piling	Typical	2	32	9	-	76	20	2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Peak		76	20	2	198	32	9	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Station/facility construction	Typical	30	20	2	-	32	9	-	36	10	-	96	20	7	26	5	-
	Peak 1		40	11	-	84	24	2	88	22	5	n/a	n/a	n/a	n/a	n/a	n/a
	Peak 2		278	47	11	562	98	31	621	109	31	n/a	n/a	n/a	n/a	n/a	n/a
Excavation	Typical	3	27	8	-	80	9	4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Peak 1		56	10	3	256	21	7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Peak 2		559	56	13	689	256	28	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 12-15 Overview of NML exceedances (other sensitive receivers) – Five Dock Station construction sites

Scenario	Activity	Indicative duration (months)	Number of receivers exceeding NML																								
			Commercial			Café/bars			Child care			Educational			Public building			Place of worship			Recording studio			Passive recreation		
			1 10 dB	10 20 dB	>20 dB	1 10 dB	10 20 dB	>20 dB	1 10 dB	10 20 dB	>20 dB	1 10 dB	10 20 dB	>20 dB	1 10 dB	10 20 dB	>20 dB	1 10 dB	10 20 dB	>20 dB	1 10 dB	10 20 dB	>20 dB	1 10 dB	10 20 dB	>20 dB
Site establishment and public domain work	Typical	18	1	-	-	1	-	-	1	1	-	-	-	-	1	-	-	1	1	-	-	-	-	-	1	-
	Peak		1	-	-	4	-	-	1	-	1	3	-	-	2	-	-	-	1	1	-	-	-	-	1	-
Piling	Typical	2	1	-	-	1	-	-	-	1	-	1	-	-	2	-	-	1	1	-	-	-	-	1	-	-
	Peak		1	-	-	2	-	-	1	1	-	3	-	-	2	-	-	-	1	1	-	-	-	1	-	-
Station/facility construction	Typical	30	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-
	Peak 1		1	-	-	1	-	-	1	1	-	1	-	-	2	-	-	1	-	1	-	-	-	1	-	-
	Peak 2		2	1	-	5	1	-	2	1	1	9	2	-	-	2	-	-	1	1	1	-	-	-	1	-
Excavation	Typical	3	1	-	-	2	-	-	1	1	-	2	-	-	2	-	-	1	1	-	-	-	-	1	-	-
	Peak 1		-	1	-	2	-	-	2	-	1	5	-	-	2	-	-	-	1	1	-	-	-	-	1	-
	Peak 2		12	-	1	8	2	-	1	2	1	9	5	-	-	2	-	2	-	2	1	-	-	-	-	1

The findings of the worst-case construction noise impact assessment at the Five Dock Station construction sites during the daytime indicate:

- the nearest residential receivers would be relatively close to the construction sites and impacts are predicted to be 'moderate' to 'high' during outside work, particularly when noise-intensive equipment, such as rockbreakers, is being used as part of excavation work. Rockbreakers are expected to be used intermittently throughout a three-month excavation period
- potential impacts during 'typical' work that does not require noise-intensive equipment or are inside the station are predicted to substantially reduce; however, 'moderate' to 'high' impacts are predicted at certain nearby receivers due their proximity to the site
- the 'peak' scenarios using noise intensive (or noisier) equipment would generate more noise and result in more exceedances than the 'typical' scenarios
- the nearest commercial and 'other sensitive' receivers are predicted to be impacted during some of the noisier outdoor work activities. 'High' or 'moderate' worst-case impacts are predicted at:
    - St Alban's Anglican Church, Sunshine Early Learning Centre and Fred Kelly Place, where worst-case impacts are predicted to be high
    - The Ridley Centre, Five Dock Public School, Caring 4 Kids Child Care and Kids @ Play Learning Centre, where worst-case impacts are predicted to be moderate.

The findings of the worst-case construction noise impact assessment at the Five Dock Station construction sites during the evening and night-time indicate:

- 'high' to 'moderate' impacts are predicted at the nearest residential receivers, particularly those on East Street that are multistorey and overlook the site
- more distant residential receivers are predicted to have 'low' impacts or to comply with the noise management levels
- these worst-case impacts are expected to occur only during external fit-out activities, such as during the installation of cladding.

Based on current construction planning access points for tunnel fit-out and rail systems work would likely be via the Parramatta metro station, Clyde stabling and maintenance facility (including Rosehill services facility), Burwood North Station and The Bays Station construction sites. However, depending on construction staging, other construction sites would be used to access the tunnels to carry out tunnel fit-out and rail systems work. If Five Dock Station is used to support rail systems fit-out work, this would likely result in the following potential impacts:

- high exceedances of the noise management level at the nearest residential receivers during the daytime, which could be reduced to low with the use of an acoustic shed (or other acoustic measures)
- high exceedances of the noise management level at the nearest residential receivers during the night-time, which could be reduced to moderate with the use of an acoustic shed (or other acoustic measures)
- low exceedances of the noise management level at the nearest commercial receivers, which could be reduced to negligible with the use of an acoustic shed (or other acoustic measures).

The impacts presented above are based on all equipment working simultaneously in each assessed scenario. There would be periods when construction noise levels are much lower than the worst-case levels predicted and there would be times when no equipment is in use and no impacts occur.

Highly affected residential receivers

Several residential receivers are expected to be highly noise affected during the daytime and evening when rockbreakers or concrete saws are being used outside. These receivers are located on East Street, Garfield Street, Second Avenue and Waterview Street.

Sleep disturbance

A sleep disturbance screening assessment has been completed for the construction work and is summarised in Table 12-14.

'Moderate' sleep disturbance impacts are predicted at the nearest residential receivers during station/facility construction.

The number of potential sleep disturbances would depend on several factors, including the type of equipment being used and the duration of the noisy work.

During detailed construction planning, sleep disturbance would continue to be investigated to identify opportunities to minimise sleep disturbance impacts.

Vibration impacts

The predicted impacts during vibration intensive excavation indicate:

- the cosmetic damage screening criteria is predicted to be exceeded at one industrial structure (a substation) directly adjacent to the south-west boundary of the site
- the human comfort criteria are also predicted to be exceeded at three of the nearest residential buildings (to the west along East Street and to the south-west along Garfield Street (refer to Figure 38 in Technical Paper 4 (Construction noise and vibration)), meaning occupants of affected buildings may be able to perceive vibration impacts at times when vibration intensive equipment is in use nearby.

These predictions represent a worst-case situation where a large rockbreaker is in use at the boundary of the site and is in close proximity to the affected buildings. In reality, smaller equipment or alternative methodologies would likely be used as the work gets near to adjacent structures, which would control the potential impacts.

Where vibration levels are predicted to exceed the cosmetic damage screening criteria, a more detailed assessment of the structure and attended vibration monitoring would be carried out so that vibration levels remain below appropriate limits for that structure.

Ground-borne noise

Minor excavation for the station building at the Five Dock Station construction sites would be completed outdoors, meaning airborne noise levels at the nearest receivers would likely be higher than the corresponding internal ground-borne noise levels. Where airborne noise levels are higher than ground-borne noise levels, an assessment of potential ground-borne noise impacts has not been undertaken for this location.

Construction traffic noise

Construction-related traffic has the potential to temporarily increase road traffic noise levels at receivers that are adjacent to the construction sites and haul routes. The forecast construction traffic volumes outlined in Section 12.4.2 have been used to determine where potentially noticeable increases in road traffic noise (i.e. a greater than 2 dB increase above the existing noise level) is likely. Second Avenue east of Great North Road is anticipated to have a 3 dB increase above the existing noise level during the day. This is associated with the increased construction traffic and proportion of heavy vehicles during the daytime and the low existing heavy vehicle volumes. The increase represents the worst-case predicted increase in any period.

Further assessment of construction traffic would be completed during detailed design for this proposal, including consideration of the potential for exceedances of the NSW Road Noise Policy base criteria (where greater than 2 dB increases are predicted). Measures outlined in the CEMF would be implemented to manage potential impacts.

12.6.4 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

The approach to noise and vibration management during the construction phase, including the process for the development of all construction noise and vibration statements is outlined in the CNVS (Appendix H).

The CNVS provides the overall strategy and approach for construction noise and vibration management for Sydney Metro West, and an outline of the noise and vibration management requirements and processes that would be common to each of the proposed construction sites.

In addition, the CEMF (refer to Appendix F) outlines the construction noise and vibration mitigation measures to minimise impacts as relevant to this proposal as a whole. The CNVS and CEMF are discussed further in Chapter 20 (Synthesis) of this Environmental Impact Statement.

12.7 Non-Aboriginal heritage

Further details on the non-Aboriginal heritage assessment, including the approach and methodology, are provided in Technical Paper 5 (Non-Aboriginal heritage).

12.7.1 Baseline environment

The assessment of non-Aboriginal heritage impacts in Chapter 12 of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a) included a description of the existing environment. The non-Aboriginal heritage assessment for this proposal has predominantly used the baseline environment that will be established as a result of the work carried out under the previous Sydney Metro West planning application.

Areas within the Five Dock Station construction sites will have been cleared of existing structures and vegetation, with the underground tunnel constructed and station cavern excavated as part of the work carried out under the previous Sydney Metro West planning application.

Archaeological assessment undertaken in Chapter 12 of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a) has concluded that there was no potential for significant archaeological remains within the Five Dock Station construction sites. The work carried out under the previous Sydney Metro West planning application at the Five Dock Station construction sites would adhere to Sydney Metro's unexpected heritage finds procedure.

For the purpose of this heritage assessment, the study area for Five Dock Station has been defined as a 50-metre buffer around the full extent of the sites.

Existing setting

The study area comprises two sites, a western and eastern site. The existing setting surrounding the Five Dock Station western site mainly comprises mid- to late-20th century, low- to medium-density commercial development along Great North Road, within the town centre of the suburb. This includes a variety of inter-war or otherwise modern commercial buildings.

The Five Dock Station eastern site, at the corner of Second Avenue and Waterview Street, is surrounded by low-density residential buildings, including low-rise Federation style cottages and two-storey apartment blocks to the east facing Waterview Street.

The Five Dock Station study area and existing heritage items within the study area are shown in Figure 12-13.

Site history

Five Dock originally formed part of the ‘Eastern section of the District of Concord’, an area comprising foreshores within the Drummoyne Municipality. In 1806, Five Dock was subdivided, which resulted in the creation of Five Dock Farm. Great North Road was created in 1828 and ran from Parramatta Road towards Abbotsford. Large allotments were created along this alignment, which resulted in Five Dock growing rapidly as a residential area. In the 20th century, this area became an industrial hub in the Inner West. In the period since 1943, the scale of commercial and higher density mixed uses in the study area has increased.

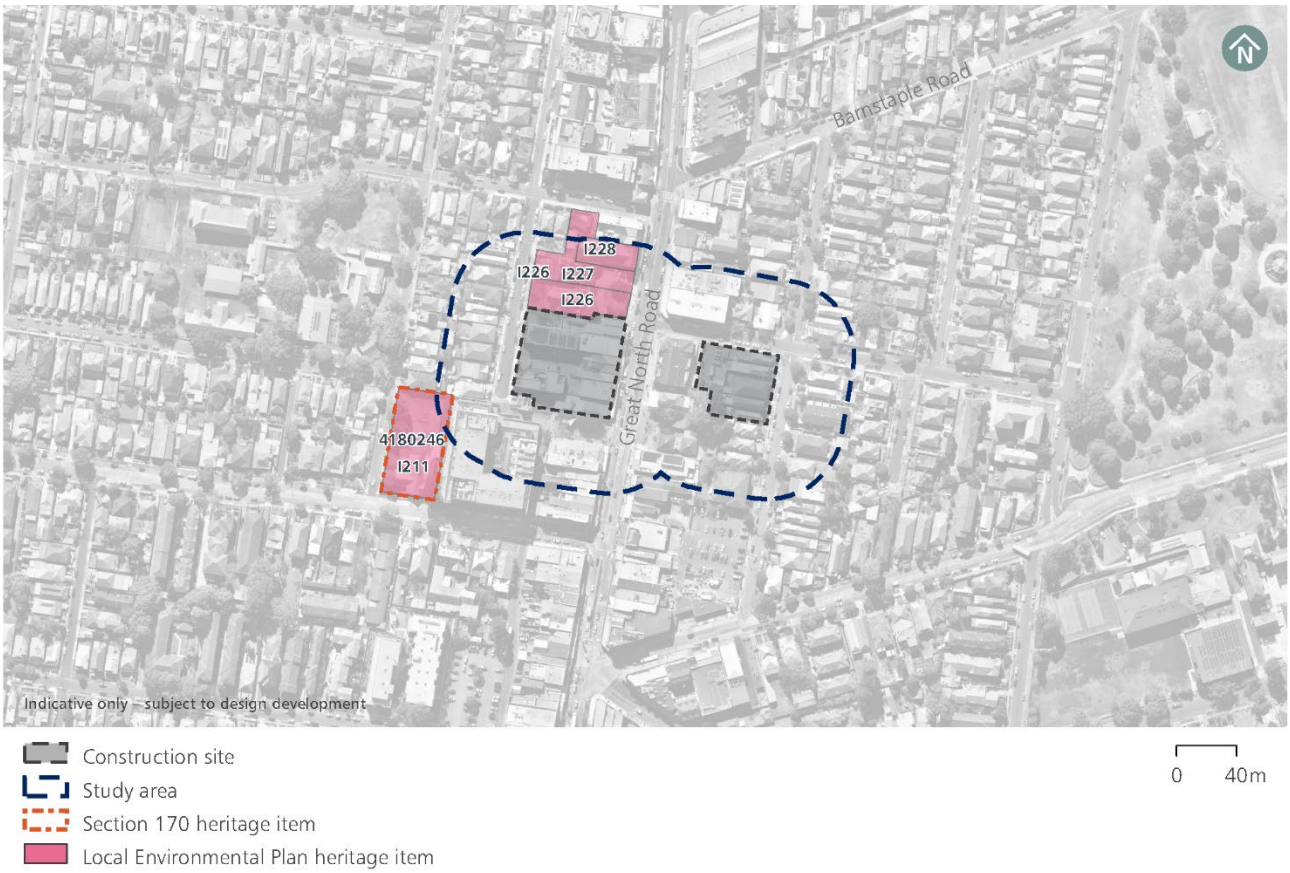

Figure 12-13 Heritage items within the study area – Five Dock Station

12.7.2 Impact assessment

Built heritage impact assessment

Table 12-16 summarises the potential impacts of construction and operation of this proposal on built heritage items within the study area at Five Dock Station.

Potential impacts to built heritage items in the Five Dock Station study area would generally be neutral or negligible. Management of potential impacts is outlined in Section 12.7.3. A draft Heritage Interpretation Strategy has been prepared for this proposal (Appendix K). Where heritage items, including significant archaeology are impacted by this proposal, they would be considered for inclusion in the Heritage Interpretation Strategy or place specific interpretation plans prepared as part of this proposal.

Table 12-16 Impacts on significance of built heritage items – Five Dock Station

Item, listing and significance	Potential impact	Magnitude
St Alban's Anglican Church Hall and Shops Canada Bay LEP Item No. I228 Local	**Direct impacts** The heritage item is part of the church group to the north and south of the heritage curtilage of the item that includes 'St Alban's Anglican Church Rectory' (Canada Bay LEP Item #I227) and 'St Alban's Anglican Church' (Canada Bay LEP Item # I226). The item is located over 30 metres north of the western construction site. No element of this proposal would be located within the heritage curtilage of the item. As such, there would be no direct (physical) impact to the item.	**Neutral**
	Settlement and vibration Vibration levels from the surrounding construction works are predicted to be below the cosmetic damage screening criteria. Potential direct impacts associated with vibration are not anticipated.	**Neutral**

Item, listing and significance	Potential impact	Magnitude
	Temporary indirect (visual) impact During construction, site hoarding, office and construction facilities and tall machinery and plant would not impede, overshadow or obstruct views of the heritage significant elements of the item fronting Great North Road, or the detailing visible on the southern elevation of the structure.	**Neutral**
	Permanent indirect (visual) impact During operation, an about five-storey aboveground station building would face Great North Road about 30 metres south of the heritage item. While this new building would be prominent within the local urban context and clearly visible from the heritage item, it would not obstruct or overshadow significant views (of the street frontage and architectural detailing on the southern façade) of the heritage item.	**Negligible**
St Alban's Anglican Church Rectory Canada Bay LEP Item No. I227 Local	**Direct impacts** The item is located over 20 metres north of the western construction site. No element of this proposal would be located within the heritage curtilage of the item. As such, there would be no direct (physical) impact to the item.	**Neutral**
	Settlement and vibration Vibration levels from the surrounding construction works are predicted to be below the cosmetic damage screening criteria. Potential direct impacts associated with vibration are not anticipated.	**Neutral**
	Temporary indirect (visual) impact During construction, site hoarding, construction facilities and tall plant and machinery would be visible from this item. However, these elements would not obscure or obstruct heritage significant views of the decorative architectural elements of the building or intrude into the significant setting of the item and its association with the two nearby heritage listed church items.	**Neutral**
	Permanent indirect (visual) impact An about five-storey station services building would be constructed facing Great North Road, about 20 metres south of the heritage item. While this new building would be prominent within the local urban context and clearly visible from the heritage item, it would not obstruct or overshadow significant views (of the decorative stonework and gabled roofing) of the heritage item.	**Negligible**
St Alban's Anglican Church Canada Bay LEP Item No. I226 Local	**Direct impacts** The item is located directly north of the western construction site. Although the western construction site is located adjacent to the item boundary, this proposal would introduce a through-site link and public domain area between the station services building and the item. These works would not be located within the heritage curtilage of the item and would not result in any adverse direct (physical) impacts to the item.	**Neutral**
	Settlement and vibration Vibration levels from the surrounding construction works are predicted to be below the cosmetic damage screening criteria. Potential direct impacts associated with vibration are not anticipated.	**Neutral**
	Temporary indirect (visual) impact Site hoarding, offices, site facilities and construction machinery would be directly visible from the heritage item and would prevent views of the southern façade of the church. However, heritage significant view lines of the church (from Great North Road and East Street, and from within the church carpark off Great North Road) that show the decorative masonry and architectural form would not be obstructed.	**Negligible**

Item, listing and significance	Potential impact	Magnitude
	Permanent indirect (visual) impact During operation, a new about five-storey aboveground station building would be about 10 metres to the south of the heritage item, and a narrow open public domain area would be developed between the station building and the heritage item. The set back of the aboveground station would allow better views of the southern side of the church and also allow clear views of the largely obscured southern elevation. The improvement in view lines towards heritage significant fabric would be somewhat offset by the introduction of the station building in close proximity to the significant grounds of the church and its neighbouring heritage listed buildings. Potential overshadowing from the proposed station would alter the heritage setting of the complex of church buildings.	**Minor**
Police station Canada Bay LEP Item No. I211; NSW Police Service s170 4180246 Local	**Direct impacts** The heritage curtilage of the item is located over 40 metres south-west of the western construction site. No element of this proposal would be located within the heritage curtilage of the item. As such, there would be no direct (physical) impact to the item.	**Neutral**
	Settlement and vibration Vibration levels from the surrounding construction works are predicted to be below the cosmetic damage screening criteria. Potential direct impacts associated with vibration are not anticipated.	**Neutral**
	Temporary indirect (visual) impact Due to the location of existing five-storey commercial and residential structures, views of construction equipment or facilities are unlikely to be present from this heritage item, and the heritage significant views to the inter-war decorative architectural elements on the southern and western side of the police station building would not be obstructed or overshadowed.	**Neutral**
	Permanent indirect (visual) impact Due to existing five-storey commercial and residential structures, views of the proposed station building would not be present from this heritage item, and the heritage significant views would not be obstructed or overshadowed.	**Neutral**

Archaeological impact assessment

The area within the Five Dock Station construction sites has been previously assessed in Chapter 12 of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a). The vast majority of excavation at this location would be carried out as part of the previous Sydney Metro West planning application. Further, significant archaeological remains were not predicted to be located at the Five Dock Station construction sites. As such, no new archaeological impacts are anticipated as a result of this proposal as potential archaeological resources would be identified and managed during the work carried out under the previous Sydney Metro West planning application.

12.7.3 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

During construction of this proposal, non-Aboriginal heritage would be managed in accordance with Sydney Metro's CEMF (refer to Appendix F). The CEMF includes heritage management objectives and mitigation measures to minimise impacts as relevant to this proposal as a whole.

12.8 Aboriginal heritage

The approach and methodology for the Aboriginal heritage assessment are provided in Chapter 4 (Methodology) of this Environmental Impact Statement. The legislative context for the assessment is provided in Appendix B (Legislative and policy context).

12.8.1 Baseline environment

The previous Sydney Metro West planning application assessed the potential impacts of the establishment of the Five Dock metro station construction sites. This section summarises the existing environment presented in the *Sydney Metro West Environmental Impact Statement – Westmead to the Bays and Sydney CBD* (Sydney Metro, 2020a) to provide context for this proposal. No additional footprint beyond is required for this proposal at the Five Dock Station construction sites.

Landscape and archaeological context

The Five Dock Station construction sites comprise two discrete sites located on the upper slope of a low-lying ridge. The ridge trends north-west, forming the Drummoyne peninsula, and is bordered to the east by Iron Cove and the west by Canada Bay (refer to Technical Paper 4 of the *Sydney Metro West Environmental Impact Statement – Westmead to the Bays and Sydney CBD* (Sydney Metro, 2020a)). Iron Cove Creek is the closest permanent fresh watercourse to the Five Dock Station construction sites, passing approximately 600 metres to the south-east.

Reference to the 1:100,000 Geological Map Sheet for Sydney (9130) indicates that the surface geology was dominated by Wianamatta Group units, comprising Ashfield Shale, Minchinbury Sandstone and Bringelly Shale, overlying the Mittagong Formation and the Hawkesbury Sandstone. Raw materials included shale (claystone and siltstone), carbonaceous claystone, laminite and fine to medium-grained lithic sandstone. Exposures of Hawkesbury Sandstone are mapped towards the north of the Five Dock construction sites, extending north along the Drummoyne peninsula.

The Five Dock Station construction sites are dominated by extensive residential development. The archaeological implication is the potential disturbance or destruction of pre-existing Aboriginal sites and archaeological deposits.

Previous Aboriginal cultural heritage assessments

Artefact Heritage Services Pty Ltd undertook an archaeological survey of the area as part of the *Sydney Metro West Environmental Impact Statement – Westmead to the Bays and Sydney CBD* (Sydney Metro, 2020a). The survey identified that the Five Dock construction sites are underlain by shallow A horizon soils that had likely been removed during urban development works. On the basis of its previous disturbance and distanced from permanent water, the area was assessed as having a low archaeological potential. The assessment did not identify site-specific cultural values in the construction sites.

Recorded Aboriginal sites

The *Sydney Metro West Environmental Impact Statement – Westmead to the Bays and Sydney CBD* (Sydney Metro, 2020) did not identify any previously recorded Aboriginal sites within the Five Dock Station construction sites. No surface sites were identified during the survey and subsurface archaeological potential was assessed as low.

An updated search of the AHIMS database was undertaken for this proposal on 21 August 2021 (Search ID 609566). There were no additional entries identified in the search results within 100 metres of Five Dock Station construction sites.

Aboriginal community consultation and cultural values

Consultation undertaken with Registered Aboriginal Parties under the previous Sydney Metro West planning application did not identify any specific cultural values at the Five Dock Station construction sites.

Registered Aboriginal Party field representatives did note that the area is part of a wider cultural landscape of high cultural significance to the local Aboriginal community. In particular, major water sources including Iron Cove Creek were of particular cultural significance.

Ongoing consultation with Aboriginal heritage knowledge holders is underway as part of design development for this proposal, including for the purposes of better understanding cultural values and addressing the Connecting with Country framework.

Field investigation results

The *Sydney Metro West Environmental Impact Statement – Westmead to the Bays and Sydney CBD* (Sydney Metro, 2020a) included a survey of the Five Dock Station construction sites undertaken with participation from Registered Aboriginal Party representatives from the Metropolitan Local Aboriginal Land Council. Further field investigation has not been undertaken at the Five Dock Station construction sites for this proposal as the land required for this proposal would be consistent with the site assessed and approved under the previous Sydney Metro West planning application.

12.8.2 Operational impact assessment

Direct impacts

No identified Aboriginal sites, objects and/or site-specific cultural heritage values would be directly impacted during operation of this proposal at Five Dock Station.

Indirect impacts

No identified Aboriginal sites, objects and/or site-specific cultural heritage values would be indirectly impacted during operation of this proposal at Five Dock Station.

During development of Sydney Metro West, consultation was undertaken with knowledge holders to inform the project development as part of the Connecting with Country Pilot program. This consultation will continue during further development of the project.

In accordance with Concept condition of approval CB4 and CB5, a draft Heritage Interpretation Strategy has been prepared for this proposal (Appendix K) which details how Aboriginal heritage values would be interpreted and reflected within the design of this proposal.

Further details regarding Sydney Metro's approach to Connecting with Country, and heritage and archaeology design guidelines are provided in the station and precinct design guidelines in Appendix E (Design Guidelines).

12.8.3 Construction impact assessment

Direct impacts

No registered sites were identified within the construction sites and archaeological potential was assessed as low. This proposal also does not require any additional footprint areas at the Five Dock Station construction sites. The construction sites would be cleared as part of the work carried out under the previous Sydney Metro planning application.

Therefore, no identified Aboriginal sites, objects and/or site-specific cultural heritage values would be directly impacted during construction of this proposal at the Five Dock Station construction sites.

Indirect impacts

No identified Aboriginal sites, objects and/or site-specific cultural heritage values would be indirectly impacted during construction of this proposal at the Five Dock Station construction sites.

12.8.4 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

During construction of this proposal, Aboriginal heritage would be managed in accordance with Sydney Metro's CEMF (Appendix F). The CEMF management objectives and mitigation measures to minimise impacts as relevant to this proposal as a whole.

12.9 Landscape and visual amenity

Further details on the landscape and visual amenity assessment, including the approach and methodology, are provided in Technical Paper 6 (Landscape and visual amenity).

12.9.1 Baseline environment

Five Dock Station would be made up of two sites, one located between Great North Road and East Street (the western site), and the other on the corner of Waterview Street and Second Avenue (the eastern site).

All buildings on the sites will be removed under the previous Sydney Metro West planning application. As part of these works, shaft and station cavern excavation and hoarding will be present around the site, including at the northern boundary of Fred Kelly Place.

Five Dock is a vibrant town centre located on Great North Road, including a mix of commercial, retail, community, residential and civic open space uses. Great North Road comprises a mix of contemporary and heritage buildings, which create a continuous line of low-rise built form with similar setbacks and building scale. Remnant heritage buildings, such as the local heritage listed Five Dock Hotel and St Alban's Anglican Church (c.1923), contribute to the character of the street.

The town centre is surrounded by low-rise detached residential properties, apartments and townhouse buildings together with a mix of schools, including the Five Dock Public School, a heritage item of local heritage significance. Five Dock Park to the east of the town centre is also an item of local heritage significance and an important civic open space in the vicinity of the site.

Five Dock town centre is intended to be revitalised into a vibrant destination with a diverse mix of uses under the *City of Canada Bay Development Control Plan* (City of Canada Bay Council, 2018). Section 12.3 provides further discussion of the intended future character local strategic plans relevant to Five Dock. A detailed review of local planning guidance relevant to landscape and visual context is provided in Technical Paper 6 (Landscape and visual amenity).

Landscapes and public realm areas

The landscapes and public realm areas potentially impacted by this proposal, and the landscape sensitivity level for these areas, are outlined in Table 12-17.

Table 12-17 Landscapes and public realm areas – Five Dock Station

Location	Baseline environment	Landscape sensitivity level
Great North Road streetscape	Great North Road is a busy main street that forms a central spine for the Five Dock town centre and access for the residential area of Five Dock. The legibility of the town centre is reinforced by the low-rise building scale, reduced building setbacks and generally fine-grained built form character of the street. The street comprises a mix of modern and heritage. Wide footpaths to both sides of the street, intermittent street trees and continuous lengths of awnings provide shade and comfort for pedestrians. Recent streetscape improvement works have been carried out at the northern end of Great North Road, including new street trees, gardens, street furniture and footpath treatments.	Local
East Street, Second Avenue and Waterview Street streetscapes	East Street is a narrow neighbourhood street with footpaths on either side, adjoining the western construction site. This street provides service access and car parking areas for the mixed-use development fronting Great North Road, the main access for detached residential properties on the western side of the street, and the main access for the childcare centre at the end of East Street. It also provides a pedestrian link for nearby residents accessing the Five Dock Library and Five Dock town centre via Fred Kelly Place. Second Avenue forms the northern boundary of the eastern construction site. It includes mixed-use development in the vicinity of the town centre and transitions into a mix of medium and low-density residential uses near Five Dock Park. It has continuous footpaths, and intermittent street trees on the eastern side of the road in the vicinity of the site. Waterview Street borders the eastern construction site to the east and is lined by predominantly one to two-storey detached properties and low-rise multistorey residential apartment blocks. There are no street trees on the verge of Waterview Street in the vicinity of the eastern construction site; however, there are intermittent street trees to the front of residential properties along the remainder of Waterview Street.	Local

Location	Baseline environment	Landscape sensitivity level
Fred Kelly Place	Fred Kelly Place forms a major activity hub for the town centre and is activated by adjoining cafes, shops and commercial uses. The Five Dock Library is located at the western end of the square. The square provides access between Great North Road and the residential areas to the west, along East Street and to Garfield Street via a narrow laneway.	Local

Representative viewpoints

Eight representative viewpoints that have been selected to inform the daytime visual impact assessment are shown in Figure 12-14. These viewpoints are of local sensitivity.

While the impact ratings for all eight viewpoints are provided, the following four have been selected as the most representative for this station to be discussed in this section. These take into account the degree of sensitivity and potential operational and construction elements of this proposal that would be visible:

- **viewpoint 2: view south-east along East Street** – presents potential impacts to residences along East Street
- **viewpoint 3: view south-west along Great North Road** – presents potential impacts to the local heritage listed St Alban's Anglican Church, as well as commercial buildings on Great North Road
- **viewpoint 4: view north along Great North Road** – presents potential impacts to Fred Kelly Place
- **viewpoint 5: view south-east from corner of Great North Road and Second Avenue** – presents potential impacts to mixed-used development facing Great North Road and residential buildings on Second Avenue.

These viewpoints are assessed in further detail in this section. A detailed assessment of all viewpoints is provided in Technical Paper 6 (Landscape and visual amenity).

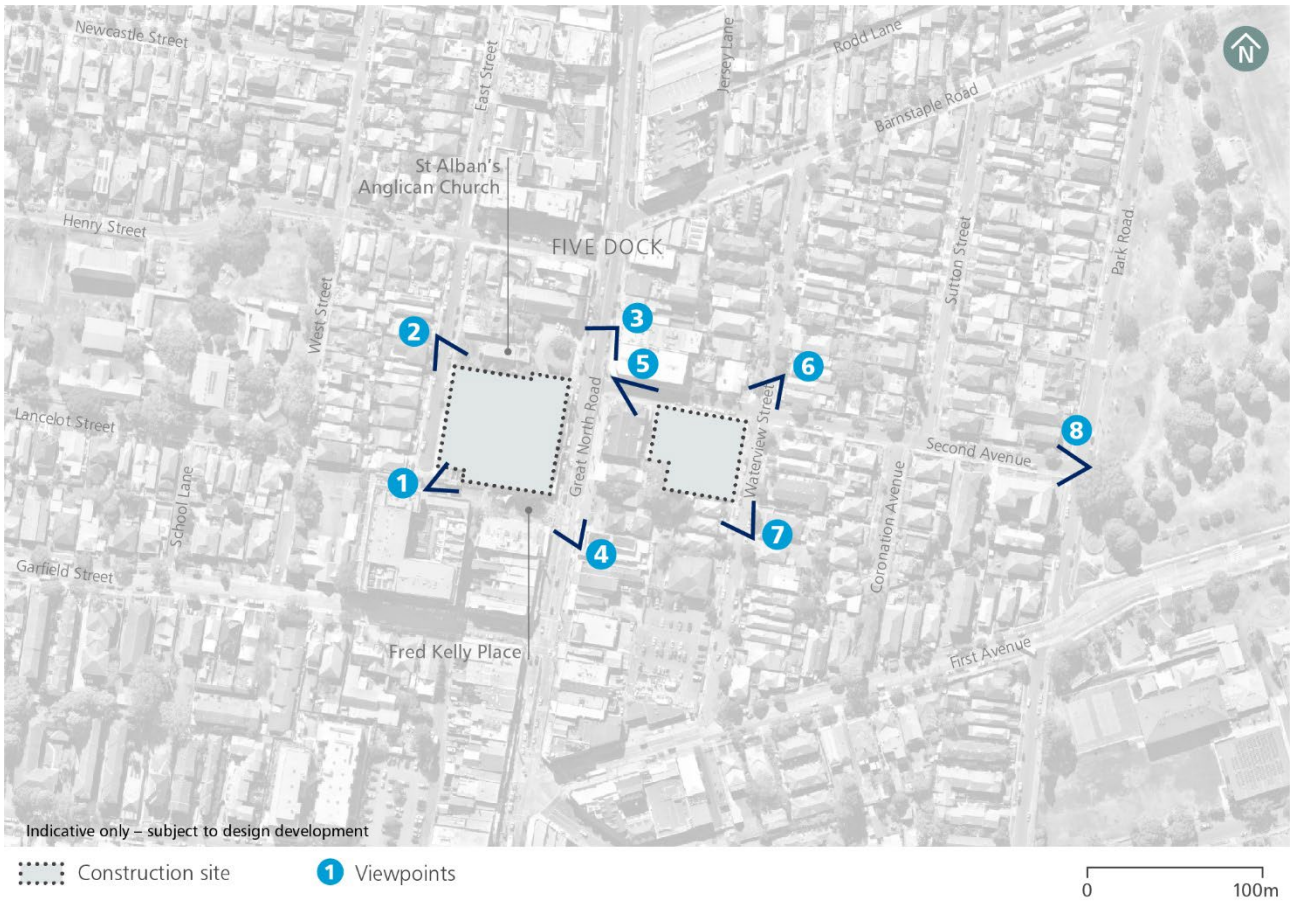

Figure 12-14 Representative viewpoints – Five Dock Station

Night-time visual sensitivity

The setting of the Five Dock Station construction sites is an area of medium district brightness (A3) that is of low sensitivity. This is due to the moderately lit town centre, with commercial and retail buildings up to four storeys intermixed with multistorey residential properties. Headlights from vehicle traffic, traffic lights and streetlights contribute to the night-time lighting levels. Existing street trees along Great North Road and adjacent streets would assist with reducing light spill from the Five Dock town centre to adjacent residential areas. There will be some security lighting remaining at the sites from the work carried out under the previous Sydney Metro West planning application.

12.9.2 Operational impact assessment

Operation of this proposal at Five Dock Station would comprise underground and surface elements. The key elements that would be visible are described in Section 12.2.

Landscape impact

Landscape impacts anticipated as a result of the operational of this proposal are summarised in Table 12-18.

The operation of this proposal would generally result in minor to moderate beneficial impacts at Five Dock Station, due to improvements in public domain and the quality of the surrounding streetscape.

The station entry at the western station building would be located on Great North Road and there would be several bus stops adjacent to it. Proposed areas of public domain (refer to Figure 12-1 for extent of public domain work for this proposal) would expand Fred Kelly Place to the north. This would contribute to achieving the recommendations outlined in the *Five Dock Town Centre Urban Design Study* (City of Canada Bay Council, 2013) for this public place (refer to Section 12.2.3 for further detail). The northern edge of Fred Kelly Place would have a new frontage activated by the station entry and non-station uses.

These changes would improve the amenity for road users, cyclists and pedestrians. The station entry and bus stops on Great North Road would also improve the legibility and accessibility of public transport in this centre.

The areas of East Street, Second Avenue and Waterview Street impacted during construction would be reinstated and there would be new kiss and ride facilities with improved footpaths in areas impacted by the eastern and western sites. These improvements would further support the accessibility of the precinct.

The western aboveground station building would step down in scale at the northern edge of the new expanded public domain, to reduce the potential for overshadowing. At the western site, the aboveground station building would cast a shadow on the new expanded Fred Kelly Place throughout the day in mid-winter. This would include shadows extending about halfway across Fred Kelly Place at midday. A large useable area of Fred Kelly place would receive sunlight throughout the day, as the building height for this proposal would be generally consistent with local planning controls in the *City of Canada Bay Development Control Plan* (City of Canada Bay Council, 2018).

At about 2pm this proposal would also begin to overshadow the eastern footpath of Great North Road and parts of the open space surrounding the post office. There would also be additional overshadowing of the existing childcare centre and residential property on East Street at around 9am, however, this area would continue to receive two hours of sunlight during mid-winter.

Residences to the east of Waterview Street would be separated from the aboveground station building by the road (about 16 metres wide) and a four to six metre setback. Several dwellings would experience an overshadowing effect in the afternoon. This late afternoon shadow would be reasonably expected from future development on lots to the south of this proposal. The east facing residential properties in the medium density building (110 Great North Road) would not experience any material overshadowing from this proposal.

Overall, due to the existing setting of medium and high-density development, and future scale of development proposed for this location, there would be relatively small areas of additional shading of Fred Kelly Place and a negligible change to surrounding residential buildings and surrounding public realm. This impact is considered to result in a minor adverse landscape impact. Further detail on the potential overshadowing impact is provided in Technical Paper 6 (Landscape and visual amenity).

Table 12-18 Landscape impacts during operation - Five Dock Station

Location	Landscape sensitivity level	Magnitude of change	Impact rating
Great North Road streetscape	Local	Noticeable improvement	Minor beneficial
East Street, Second Avenue and Waterview Street streetscapes	Local	Noticeable improvement	Minor beneficial
Fred Kelly Place	Local	Considerable improvement	Moderate beneficial

Daytime visual amenity impact

Visual amenity impacts anticipated as a result of the operation of this proposal are summarised in Table 12-19. Management of potential impacts is discussed in Section 12.9.4. An artist's impression of Five Dock Station during operation is shown in Figure 12-15. Potential station finishes would be identified as part of design development and would be consistent with the principles and outcomes presented in Appendix E (Design Guidelines).

Table 12-19 Daytime visual impacts during operation – Five Dock Station

Location	Sensitivity rating	Magnitude of change	Impact rating
Viewpoint 1: view north-east from entry to the Five Dock Library	Local	Noticeable improvement	Minor beneficial
Viewpoint 2: view south-east along East Street	Local	Noticeable improvement	Minor beneficial
Viewpoint 3: view south-west along Great North Road	Local	Noticeable improvement	Minor beneficial
Viewpoint 4: view north along Great North Road	Local	Considerable improvement	Moderate beneficial
Viewpoint 5: view south-east from corner of Great North Road and Second Avenue	Local	Considerable reduction	Moderate adverse
Viewpoint 6: view south-west along Waterview Street	Local	Noticeable reduction	Minor adverse
Viewpoint 7: view north-west along Waterview Street	Local	Noticeable reduction	Minor adverse
Viewpoint 8: view west along Second Street from Five Dock Park	Local	No perceived change	Negligible

As noted in Section 12.9.1, the most representative viewpoints have been described in detail in this section. Potential impacts from these viewpoints would include the following:

- **viewpoint 2: view south-east along East Street** – during operation, there would be a minor beneficial impact to this view, as the visual prominence of the St Alban's Anglican Church would be maintained and the setting improved by new public domain. The rear of the proposed western aboveground station building would be seen in the middle ground, rising above the St Alban's Anglican Church, in the centre of view. The western station building would be set back from the northern boundary of the site. This built form would step up from the height of the church and be filtered through existing trees within the church gardens. There is potential for non-station uses (fit-out and use subject to separate approval, if required), facing the church. There would also be a new area of public domain, creating a laneway extending east to Great North Road. A service entry for the western station building would also be seen in the middle ground, set back from the view

- **viewpoint 3: view south-west along Great North Road** – during operation, there would be a minor beneficial impact to this view, due to the new public domain areas and improvements to the setting of the St Alban's Anglican Church and Great North Road streetscape. A new western station building would be seen in the middle ground, with the potential for non-station uses (subject to separate approval, if required) at street level to activate Great North Road. The new western station building would be set back from St Alban's Anglican Church, stepping up gradually, and there would be a new area of public domain along the northern boundary of the site. The station building would rise several storeys above the streetscape, with station services rising up to about five storeys and stepped back from the street and church (left of view). The new station would be contemporary in style, having a built form that is generally consistent with the height of the former commercial terrace buildings facing Great North Road, and stepping up to the background of the view
- **viewpoint 4: view north along Great North Road** – there would be a moderate beneficial impact to this view, due to the expanded public domain, and built form that would be stepped back from Fred Kelly Place. A new metro station entrance would be seen in the middle ground of this view, facing an expanded Fred Kelly Place. The station entry would present an open and active façade to Fred Kelly Place and non-station uses (subject to separate approval, if required) would address Great North Road. The western station building would include station services, which would rise about five storeys above the station entry and be set back from this view, reducing the perceived scale of the additional building height. The station entry would have a high architectural finish and would be of a scale and character that would complement the new public domain and Great North Road streetscape
- **viewpoint 5: view south-east from corner of Great North Road and Second Avenue** – during operation, there would be a moderate adverse impact to this view, due to the scale of the proposed eastern station services building, which would be visible in the middle ground of this view at the corner of Second Avenue and Waterview Street. The eastern station building would be larger in scale than the former low-rise residential dwellings, rising about five storeys high in the middle ground, stepping down to about three to four storeys at Waterview Avenue, and having a continuous frontage to the street. There would be some compatibility in terms of massing between the new services building and the adjacent medium-density residential building, which is also of a larger scale than the residential areas to the east. Similarly, the proposed services entry would be adjacent to the existing car parking area associated with the medium-density residential building.

The existing views and photomontages of this proposal during operation at viewpoints 2 and 5 are provided in Figure 12-16 to Figure 12-19.

Indicative only – subject to design development

Figure 12-15 Artist's impression of Five Dock Station during operation

Figure 12-16 Existing view from viewpoint 5 (view south-east from corner of Great North Road and Second Avenue) – Five Dock Station. Extent of demolition under the previous Sydney Metro West planning application is shown in orange

Indicative only – subject to design development

Figure 12-17 Photomontage from viewpoint 5 (view south-east from corner of Great North Road and Second Avenue) – Five Dock Station

Figure 12-18 Existing view from viewpoint 3 (view south-west along Great North Road) – Five Dock Station. Extent of demolition under the previous Sydney Metro West planning application is shown in orange

Indicative only – subject to design development

Figure 12-19 Photomontage from viewpoint 3 (view south-west along Great North Road) – Five Dock Station

Night-time visual amenity impact

The anticipated night-time visual impacts during operation are summarised in Table 12-20.

The proposed station, interchange and public domain areas would be brightly lit to provide for customer safety. There would also be lighting at the service entries to the services buildings, at Second Avenue and East Street. The existing and new street trees would contain some lighting, and all lighting would be designed to minimise light spill and skyglow.

This additional light would be absorbed into this area, which is of medium district brightness and set within an area intended for increased development density.

Table 12-20 Night-time visual amenity impacts during operation – Five Dock Station

Location	Sensitivity rating	Magnitude of change	Impact rating
Five Dock Station	A3: Medium level brightness	Noticeable reduction	Minor adverse

12.9.3 Construction impact assessment

Construction of Five Dock Station would require the continued use of two construction sites (one west and one east of Great North Road) established under the previous Sydney Metro West planning application. The main elements that would be seen include the proposed works, construction site features, equipment and vehicle access routes described in Chapter 6 (Proposal description – construction) of this Environmental Impact Statement and Section 12.4.

Landscape impact

Landscape impacts anticipated as a result of the construction of this proposal are summarised in Table 12-21. Management of potential impacts is discussed in Section 12.9.4.

Construction would generally result in temporary minor to moderate adverse impacts at the Five Dock Station construction sites, due to the continued presence of construction activities.

The western construction site would continue to border the northern edge of Fred Kelly Place and potentially impact the level of comfort for recreational users and pedestrians. Existing trees within Fred Kelly Place would reduce some of the amenity impacts from the adjacent construction work associated with this proposal. Fred Kelly Place would remain open, maintaining activation in this part of the streetscape.

The installation of the station precinct and interchange facilities would require temporary use of part of the Great North Road streetscape, including the potential narrowing and diversion of the adjacent footpath during some periods of construction. Construction vehicles would continue to use the Great North Road site frontage for construction site access, potentially limiting north-south pedestrian connectivity in this area.

Work at the eastern construction site may at times require the diversion of the adjacent footpaths along Second Avenue and Waterview Street, to enable site access. This would continue to reduce pedestrian connectivity between the town centre, Five Dock Park and the surrounding residential areas of Five Dock at times. Construction of the station services building at the corner of Second Avenue and Waterview Street would require use of large-scale machinery and vehicles, impacting upon the level of amenity and the streetscape character in this location.

Although the Five Dock Station construction sites would continue to be enclosed by hoarding, use of large-scale machinery and vehicles would decrease the level of comfort and amenity in the surrounding area, and continue to temporarily change the streetscape character in this location.

Table 12-21 Landscape impacts during construction – Five Dock Station

Location	Landscape sensitivity level	Magnitude of change	Impact rating
Great North Road streetscape	Local	Considerable reduction	Moderate adverse
East Street, Second Avenue and Waterview Street streetscapes	Local	Considerable reduction	Moderate adverse
Fred Kelly Place	Local	Noticeable reduction	Minor adverse

Daytime visual amenity impact

Visual amenity impacts anticipated as a result of construction are summarised in Table 12-22. Viewpoints would generally experience temporary moderate to minor adverse visual impacts during construction, due to the continued presence of construction sites and scale of the works, which would rise above the existing streetscape.

Table 12-22 Daytime visual impacts during construction – Five Dock Station

Location	Sensitivity rating	Magnitude of change	Impact rating
Viewpoint 1: view north-east from entry to the Five Dock Library	Local	Noticeable reduction	Minor adverse
Viewpoint 2: view south-east along East Street	Local	Noticeable reduction	Minor adverse
Viewpoint 3: view south-west along Great North Road	Local	Noticeable reduction	Minor adverse
Viewpoint 4: view north along Great North Road	Local	Noticeable reduction	Minor adverse
Viewpoint 5: view south-east from corner of Great North Road and Second Avenue	Local	Considerable reduction	Moderate adverse
Viewpoint 6: view south-west along Waterview Street	Local	Considerable reduction	Moderate adverse
Viewpoint 7: view north-west along Waterview Street	Local	Considerable reduction	Moderate adverse
Viewpoint 8: view west along Second Street from Five Dock Park	Local	No perceived change	Negligible

As noted in Section 12.9.1, the most representative viewpoints have been described in detail in this section. Potential temporary impacts from these viewpoints for the duration of construction would include the following:

- **viewpoint 2: view south-east along East Street** – during construction, there would be a minor adverse temporary visual impact to this view, due to the continued presence of the eastern construction site, visible on the eastern side of East Street. St Alban's Anglican Church and the church gardens would be retained, and hoarding would be located along the northern site boundary, beyond the church. Construction of the metro station would be seen in the middle ground of this view, set back from church. This would include large construction equipment and activity rising above the site hoarding, which would contrast in character with the adjacent heritage church buildings and gardens. The trees within the church property would provide some filtering of this view to this construction activity
- **viewpoint 3: view south-west along Great North Road** – during construction, there would be a minor adverse temporary impact to this view, due to the continued presence of the eastern construction site, which would be prominent. Construction of the metro station would be set back from Fred Kelly Place and the church, and include large equipment rising above the site. Some of the on-street parking spaces would be removed, and trucks would be seen accessing and egressing the construction site, along Great North Road. Existing trees within the church property would assist with reducing the scale difference of the emerging metro station and the adjacent church. As this view would contain an existing construction site, the ongoing use of the site would be somewhat absorbed into this view and the temporary adverse impacts would minor
- **viewpoint 4: view north along Great North Road** – during construction, there would be a minor adverse temporary impact to this view, due to the continued use of the construction site visible along the western side of Great North Road. In this view, the construction of the proposed metro station would be prominent, centred in the site and set back from Fred Kelly Place, including large equipment rising above the site. The pedestrian crossing to Fred Kelly Place and adjacent streetscape planting would be retained. The trees within Fred Kelly Place would contribute to partially screening the edge of the construction site. Construction traffic would be seen in the foreground of this view, accessing and egressing the site via an entry on Great North Road

- **viewpoint 5: view south-east from corner of Great North Road and Second Avenue** – during construction, there would be a moderate adverse temporary impact to this view, due to the continued use of the eastern construction site and prominent construction of station services. From this view, construction of the station services building, including machinery and equipment, would rising above the hoarding and adjacent buildings. The staff amenities and workshop area would be located along the western site boundary, at the former car park, in the centre of the view. The site would continue to be enclosed by hoarding to the street boundary, screening ground level views into the site. The existing leafy character in the centre of the view would be unchanged, as there would be no additional tree removal.

To manage these potential impacts, management and mitigation measures are provided in Section 12.9.4 and Chapter 20 (Synthesis) of this Environmental Impact Statement. These sections include measures to locate elements of construction sites to minimise visual impact, where feasible and reasonable.

Night-time visual amenity impact

The anticipated night-time visual impacts as a result of the construction of this proposal are summarised in Table 12-23.

Night work would be required at both construction sites during construction. This would include brightly lit task lighting, lighting at key areas of the construction sites, and additional headlights from heavy vehicles accessing the sites. This would increase the light levels within the construction sites, seen from adjacent residences and commercial properties on East Street, Great North Road and Fred Kelly Place, and also on Second Avenue and Waterview Street.

This additional lighting would be seen within an area of medium district brightness where there is lighting associated with the town centre, and headlights on Great North Road and surrounding streets. Proposed construction activities would increase lighting within the vicinity of the residences overlooking the eastern construction site. All lighting within the construction sites would be designed to minimise light spill and directed away from neighbouring property.

Table 12-23 Night-time visual amenity impacts during construction – Five Dock Station

Location	Sensitivity rating	Magnitude of change	Impact rating
Five Dock Station	A3: Medium level brightness	Noticeable reduction	Minor adverse

12.9.4 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

During construction of this proposal, landscape and visual amenity impacts would be managed in accordance with Sydney Metro's CEMF (Appendix F). The CEMF includes landscape and visual amenity management objectives and mitigation measures to minimise impacts as relevant to this proposal as a whole.

The design of this proposal would also be consistent with the principles and outcomes presented in Appendix E (Design Guidelines).

Mitigation measures that are specific to the operation and construction of Five Dock Station to address potential impacts are listed in Table 12-24.

Table 12-24 Landscape and visual amenity mitigation measures – Five Dock Station

Ref	Impact/issue	Mitigation measure	Timing
Landscape and visual amenity			
EIS-LV15	Activation of streetscapes	Opportunities to provide temporary activation during construction in the vicinity of the Parramatta metro station construction site and the Five Dock Station western construction site would be explored in consultation with the City of Parramatta Council and City of Canada Bay Council respectively.	Construction

Ref	Impact/issue	Mitigation measure	Timing
EIS-LV16	Landscape impacts	Any new temporary structures facing Fred Kelly Place and Richard Johnson Square would be designed with a suitable urban design and/or landscape treatment to minimise visual amenity and landscape character impact where feasible and reasonable.	Construction

12.10 Soils, contamination and groundwater

Further details on the contamination assessment, including the approach and methodology, are provided in Technical Paper 7 (Contamination). The approach and methodology for the soils and groundwater assessments are provided in Chapter 4 (Methodology) of this Environmental Impact Statement and Appendix D (Detailed assessment methodologies). The legislative context for the assessment is provided in Appendix B (Legislative and policy context).

12.10.1 Baseline environment

The baseline environment as relevant to soils, contamination and groundwater is discussed in the following sections.

Prior to the commencement of this proposal, buildings and other infrastructure on the land required for the Five Dock Station construction sites will be demolished, and bulk excavation work for the station will have occurred as part of the work carried out under the previous Sydney Metro West planning application. Minor excavation is also required for the station building at the Five Dock Station construction sites as part of this proposal.

Soils

The existing soils environment is described in detail in Chapter 19 of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a) and is summarised in the following sections.

Soil and geology types

The geological units expected to be encountered at the Five Dock Station construction sites include Quaternary deposits (zero to four metres below ground level), Ashfield Shale and Mittagong Formation (four to 13 metres below ground level) and Hawkesbury Sandstone (greater than 13 metres below ground level).

The *Soil Landscapes of Sydney 1:100,000 Sheet* (Chapman et al., 2009) and *Penrith 1:100,000 Sheet* (Bannerman et al., 2010) identify Blacktown (strongly acidic and hard setting soils) soil units in the vicinity of Five Dock Station.

Soil salinity

Chapter 19 of the *Sydney Metro West Environmental Impact Statement – Major civil construction Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a) identified there is the potential to encounter saline soils at Five Dock Station.

Acid sulfate soils

Potential acid sulfate soils risk maps obtained from the former Office of Environment and Heritage (now part of NSW Department of Planning and Environment) were reviewed to assess the probability of potential acid sulfate soils being present in proximity to Five Dock Station. No potential acid sulfate soils were identified within the construction sites and immediate vicinity. Areas of ‘disturbed terrain’ were located around 360 metres north of the Five Dock Station construction sites (see Figure 12-21), which are often located on reclaimed land or land subject to dredging or mining, with the potential presence of acid sulfate soils. These areas are associated with fill and/or alluvium that extends from harbour shores up local drainage lines.

Contamination

The work carried out under the previous Sydney Metro West planning application will include the investigation and remediation of soil and/or groundwater contamination where required in accordance with the applicable mitigation measures and conditions of approval.

Areas of environmental interest identified in Chapter 20 of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a) at the Five Dock Station construction sites are described (as relevant to this proposal) as follows:

- AEI 46 – Embalming chemicals (north and south of the construction sites) – moderate risk of groundwater contamination from hydrocarbons and solvents
- AEI 47 – Hazardous building materials (within the construction sites) – low risk of surface soil contamination from heavy metals, hydrocarbons, pesticides and asbestos
- AEI 48 – Chamber substation (outside of the construction sites) – very low risk of surface soil contamination from leaks and spills of poly-chlorinated biphenyls
- AEI 49 – Former service station (outside of the construction sites) – low risk of groundwater contamination from leaks and spills of hydrocarbons from underground storage tanks
- AEI 50 – Surrounding historical commercial industrial land uses (outside of construction sites) – moderate risk of groundwater contamination from heavy metals, hydrocarbons and volatile organic compounds.

AEIs that were ranked as moderate risk or above following completion of the work carried out under the previous Sydney Metro West planning application are shown in Figure 12-20.

Overall, the risk of shallow soil contamination or encountering previously dumped construction waste within the existing construction sites is expected to be low as it would have been removed or managed during the work carried out under the previous Sydney Metro West planning application prior to construction of this proposal. The ingress of contaminated groundwater to subsurface infrastructure is expected to be partially or fully mitigated through remediation performed during the work carried out under the previous Sydney Metro West planning application. An additional review of residual contaminant concentrations and rates of inflow would be required for this proposal to determine the requirements for any additional groundwater remediation.

The conceptual site model and risk ranking for the areas of environmental interest at Five Dock Station are detailed in Appendix C of Technical Paper 7 (Contamination).

Figure 12-20 Areas of environmental interest (moderate risk or above) – Five Dock Station

Groundwater

The work carried out under the previous Sydney Metro West planning application includes the excavation of:

- two untanked access shafts (excavation that allows groundwater to flow into the structure), one at the western construction site and at one at the eastern construction site
- a tanked station (mined cavern constructed with an impermeable casing/membrane that minimises groundwater inflows to negligible rates).

Groundwater predictive modelling carried out under the previous Sydney Metro West planning application assessed a tanked binocular mined cavern station (two smaller caverns, one for each platform, with mined adits for pedestrian transfer between platforms and to access the surface). The design for Five Dock Station under the previous Sydney Metro West planning application now incorporates a single tanked cavern structure rather than two smaller tanked cavern structures with mined pedestrian adits.

The internal size of the single station cavern design is larger than the binocular design, however the total excavation volume and internal surface area will be comparatively less. It is anticipated that potential groundwater impacts (inflow, drawdown and extent) will likely remain consistent with, or be improved by, adopting the single tanked cavern design. The reduction in the surface area for the single mined cavern would likely decrease the overall groundwater inflow volumes, and consequently decrease groundwater drawdown impacts. The seepage inflow rate of groundwater predicted (1.7 litres per second) for the single cavern structure is expected to be about the same, or slightly reduced, when compared with the binocular cavern structure.

The baseline groundwater environment for this proposal is described further in Table 12-25, and shown in Figure 12-21.

Table 12-25 Groundwater baseline environment – Five Dock Station

Aspect	Description
Groundwater levels and flow	As a result of the work carried out under the previous Sydney Metro West planning application, the groundwater level within the immediate station area is predicted to reduce to about 30 metres below ground level (Sydney Metro, 2020a) (refer to Figure 12-21 for groundwater drawdown extent). This groundwater level is assumed to remain consistent or slightly improve at the commencement of construction of this proposal, as groundwater inflow volumes to the single cavern station would be less than the binocular mined cavern design assessed in the groundwater modelling carried out under the previous Sydney Metro West planning application. The station cavern would be tanked as part of the preceding approved major civil construction work between Westmead and The Bays under the previous Sydney Metro West planning application, and as such, groundwater inflows would be minimised. The predicted groundwater inflows to the access shafts (untanked) of about 1.7 litres per second (litres per second) is expected at the commencement of construction for this proposal. As a result, localised groundwater flow is expected to be towards the untanked shafts.
Groundwater quality	The baseline groundwater quality may be impacted by a change in the groundwater flow direction, towards the untanked access shafts (which has the potential to induce groundwater seepage). Potential contaminants of concern include heavy metals, hydrocarbons, solvents (namely formaldehyde) and volatile organic compounds as detailed in Chapter 20 of the Sydney Metro *West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a) as a result of the work carried out under the previous Sydney Metro West planning application. As such, the baseline groundwater quality for this proposal is expected to be consistent with that defined for the work carried out under the previous Sydney Metro West planning application.

Aspect	Description
	Saline intrusion modelling predicted that the freshwater-saltwater interface could advance inland from Kings Bay by about 100 metres at depths of less than five metres below ground level (Sydney Metro, 2020a). The potential impacts to sensitive receptors are discussed in Section 5.10.8 of Technical Paper 7 (Hydrogeology) of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a) and form the baseline environment for this proposal. Groundwater supply bores and groundwater dependent ecosystems were not identified in this area. The likelihood of environmental impact due to saline intrusion in the groundwater is therefore considered to be low.
Groundwater users	One registered bore, GW112143, reported to be used for monitoring purposes is expected to have a reduced groundwater level as a result of the work carried out under the previous Sydney Metro West planning application. No registered water supply bores were identified within the predicted groundwater drawdown extent. As such, potential impacts to groundwater users as a result of this proposal are not expected and have not been discussed further.
Groundwater dependent ecosystems	Figure 12-21 shows one groundwater dependent ecosystem identified within the baseline groundwater drawdown extent (Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion) located around 350 metres to the east of the construction sites. There is a low potential for groundwater drawdown of about 15 metres at this groundwater dependent ecosystem.
Surface water and groundwater interaction	The interaction between surface water and groundwater in proximity to the Five Dock Station sites is considered limited due to the altered nature of the area. The primary interactions include: • surface water acting as recharge to underlying groundwater units, where hydraulic gradients and modified environments (e.g. concrete-lined waterways/channels) allow • groundwater discharging to surface water as baseflow, especially in areas of low elevation (where hydraulic gradients and modified environments allow) • induced flow of surface water into groundwater due to the predicted groundwater drawdown resulting from the work carried out under the previous Sydney Metro West planning application • the surrounding area is highly urbanised with predominantly impervious surfaces across the catchments prior to the commencement of work for this proposal, which reduces possible surface water infiltration into soils and underlying groundwater. Groundwater drawdown (about two metres) is expected in proximity to Iron Cove Creek and Barnwell Park Canal at the commencement of construction for this proposal (see Figure 12-21). These are both concrete-lined channels located 600 metres south and 600 metres west of the construction sites, respectively. The potential impacts to these surface water features are discussed in Section 5.10.8 of Technical Paper 7 (Hydrogeology) of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a).

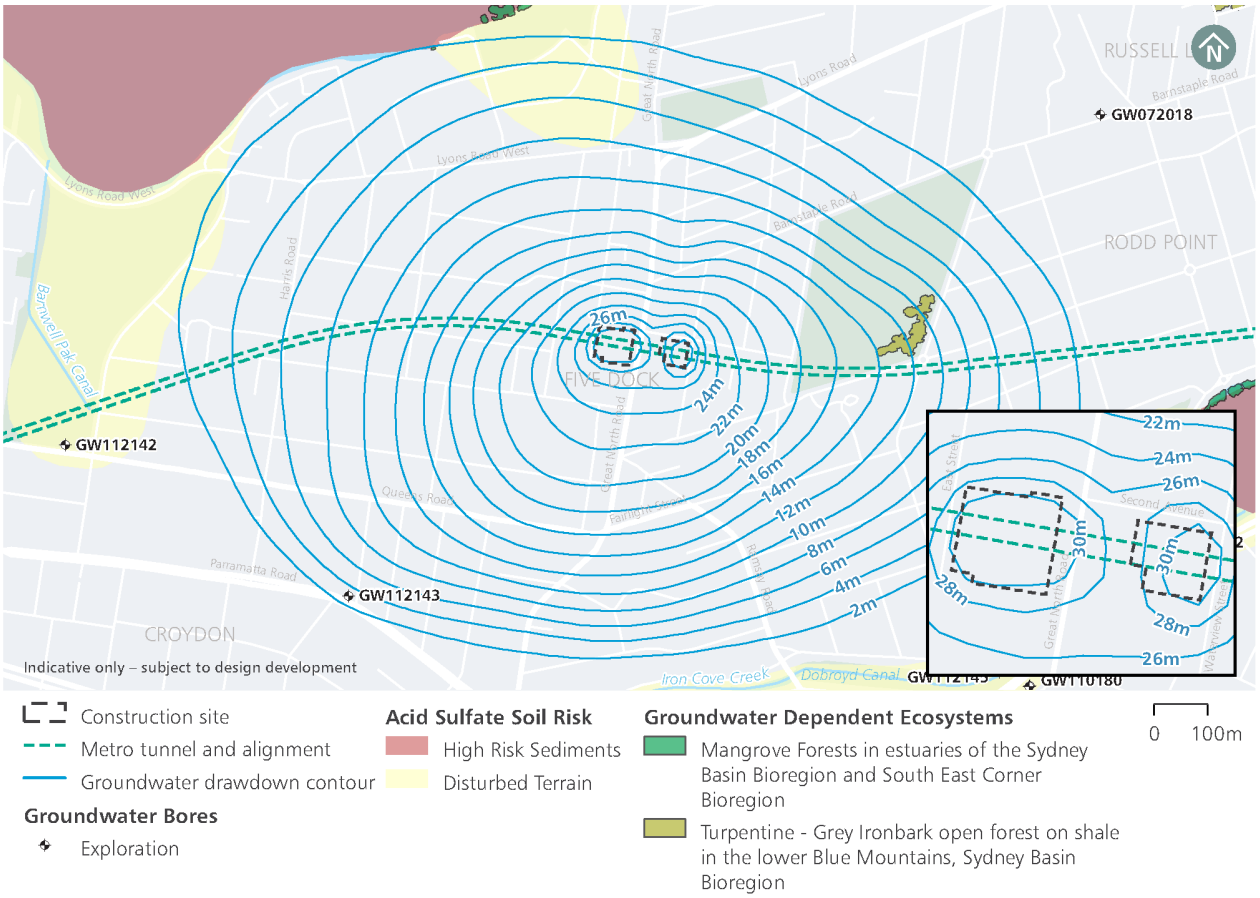

Figure 12-21 Groundwater baseline environment – Five Dock Station

12.10.2 Operational impact assessment

Soils

The operation of Five Dock Station is not expected to have any further impact on soils, including from saline soils, as there would be no excavation after completion of construction. Acid sulfate soil investigations would be undertaken under the previous Sydney Metro West planning application within the zone of groundwater drawdown to assess potential impacts and decide whether an Acid Sulfate Soils Management Plan (ASSMP) is required for operation of this proposal.

Contamination

Soil and/or groundwater contamination within the construction sites, if present, is expected to be investigated and remediated during the work carried out under the previous Sydney Metro West planning application in accordance with the relevant mitigation measures and conditions of approval. There are no anticipated operation phase contamination impacts at Five Dock Station. The two untanked access shafts may result in contaminated groundwater inflow requiring collection and treatment prior to discharge in accordance with the water quality requirements outlined in Section 18.9 (Hydrology and water quality) of this Environmental Impact Statement. The station cavern would be tanked and therefore contaminated groundwater inflows are expected to be negligible.

Operation of Five Dock Station would require limited use and storage of chemicals, oils or fuels. There are no significant sources of contamination or impacts anticipated from the operation of the station or public domain. Management measures associated with the use and storage of chemicals during operation would be implemented (refer to Chapter 20 (Synthesis) of this Environmental Impact Statement).

Groundwater

Potential impacts to groundwater during operation at Five Dock Station are described further in Table 12-26.

Table 12-26 Potential impacts to groundwater during operation – Five Dock Station

Potential impact	Discussion
Groundwater recharge	The surface area of impervious surfaces at Five Dock Station is not expected to significantly increase due to the operational elements for this proposal, as the construction site prior to commencement of work for this proposal would comprise predominately paved (impervious) surfaces.
Groundwater levels, inflows, and flow patterns	The groundwater inflow rate for operation of this proposal would be consistent with the inflow rate identified as part of the baseline environment (refer to Table 12-25). This inflow rate is deemed to be a conservative representation of long-term inflow rates for operation of this proposal. There is not anticipated to be any change to the overall regional groundwater flow patterns as a result of operation of this proposal. Further groundwater modelling to confirm the impacts and flow patterns would be undertaken for the work carried out under the previous Sydney Metro West planning application in accordance with condition of approval D122. This groundwater modelling report would be reviewed and updated as required for this proposal.
Groundwater quality	Groundwater quality impacts during operation are expected to remain consistent with the baseline conditions (refer to Table 12-25). However, the volume of potentially contaminated groundwater to be managed during the operation of this proposal would be less than the volume predicted for the work carried out under the previous Sydney Metro West planning application. This is due to the access shafts and cavern excavations being tanked at commencement of this proposal. This would reduce the groundwater drawdown and associated inflow volumes. Any long-term groundwater inflows would be collected, pumped to the operational water treatment plant at the Clyde stabling and maintenance facility and discharged in accordance with the water quality requirements outlined in Section 18.9 (Hydrology and water quality) of this Environmental Impact Statement.
Groundwater dependent ecosystems	Potential operation phase impacts on the identified groundwater dependent ecosystem (terrestrial vegetation) in proximity of Five Dock Station is expected to be reduced compared to the construction phase of this proposal because groundwater levels within the vicinity of the tanked station cavern would re-establish during operation.
Surface water – groundwater interaction	Groundwater acting as baseflow to surface water features is considered to be a minor component of recharge in the area surrounding Five Dock Station. Iron Cove Creek and Barnwell Park Canal are concrete lined and are unlikely to receive groundwater baseflow. The potential for groundwater drawdown as a result of this proposal to impact on the groundwater recharge to surface water is expected to be negligible.
Policy compliance	The minimal harm criteria in the NSW Aquifer Interference Policy (NSW Department of Primary Industries, 2012) and Water Sharing Plan rules (NSW Department of Industry, 2011) adopted under the previous Sydney Metro West planning application would be carried through and complied with during operation. Impacts from the alteration of groundwater levels and flow regime are likely to be reduced during operation.

12.10.3 Construction impact assessment

Soils

There is the potential for temporary minor soil erosion from the exposure of soil to water runoff and wind during minor excavation works required for this proposal. This would be adequately managed with the implementation of standard erosion and sediment controls.

There is the potential to disturb saline soils at the Five Dock Station construction sites. Any potential salinity impacts would be managed in accordance with *Book 4 Dryland Salinity: Productive Use of Saline Land and Water* (NSW Department of Environment and Climate Change, 2008b).

There is potential for acid sulfate soils within the predicted groundwater drawdown extent during construction. The exposure of acid sulfate soils during construction could result in the release of acid sulfates, which could pollute downstream watercourses. Further investigation of potential acid sulfate soils would be undertaken under the previous Sydney Metro West planning application. This would be reviewed for this proposal to identify the potential need for further measures to manage acid sulfate soils, if present.

Contamination

Existing contamination

AEIs 47 and 48 are likely to be remediated during the work carried out under the previous Sydney Metro West planning application and are not anticipated to present a risk during construction of this proposal.

AEIs 46 and 50 (moderate risk) and AEI 49 (low risk) are identified as off-site groundwater contamination sources requiring monitoring and management due to the ongoing need to manage groundwater de-watering during construction of this proposal. In accordance with condition of approval D122 for the previous Sydney Metro West planning application, a Groundwater Modelling Report will be developed to assess impacts from groundwater drawdown. Specific mitigation and monitoring recommended in this report, including where required for groundwater contamination, would be reviewed, and as applicable adopted during construction of this proposal.

New contamination

With the exception of the use and storage of chemicals associated with construction activities (e.g. fuels and oils associated with the operation of plant and equipment), construction activities for this proposal are unlikely to represent a significant source of contamination. Management measures associated with the use and storage of chemicals during construction activities would be implemented (refer to Chapter 20 (Synthesis) of this Environmental Impact Statement).

Groundwater

Potential impacts to groundwater during construction at the Five Dock Station construction sites are outlined in Table 12-27.

Table 12-27 Potential impacts to groundwater during construction – Five Dock Station

Potential impact	Discussion
Groundwater recharge	Almost all of the surface area within the Five Dock Station construction sites is expected to be impervious surfaces at the commencement of this proposal and therefore the net impact on regional groundwater recharge as a result of construction of this proposal is considered negligible.
Groundwater levels, inflows, and flow patterns	Overall, the potential impacts on groundwater levels, inflows and flow regime from construction of this proposal are expected to be reduced compared to baseline levels. The tanked station cavern would minimise groundwater inflows and promote a partial reduction in groundwater drawdown and associated inflows over time (compared with baseline conditions). The untanked access shafts would maintain the groundwater inflows modelled for the previous Sydney Metro West planning application (identified in Table 12-25) throughout construction of this proposal. Potential groundwater impacts of this proposal would be managed through the implementation of mitigation measures outlined in the CEMF and Chapter 20 (Synthesis) of this Environmental Impact Statement. This would include the development of a Groundwater Construction Monitoring Program that would be consistent with the requirements of condition of approval C17 for the previous Sydney Metro West planning application. Further groundwater monitoring to confirm groundwater quality and groundwater modelling to confirm potential groundwater flow patterns would be carried out under the previous Sydney Metro West planning application. This would be further reviewed and updated as required for this proposal (refer to the mitigation measures in Chapter 20 (Synthesis) of this Environmental Impact Statement).
Groundwater quality	Groundwater quality is expected to remain consistent with the baseline conditions. However, the volume of potentially impacted groundwater to be managed during construction of this proposal would be reduced by comparison to the volume predicted for the work carried out under the previous Sydney Metro West planning application due to the tanked station cavern. Groundwater inflows would be collected and treated at the construction water quality treatment plant and discharged in accordance with the water quality requirements outlined in Section 18.9 (Hydrology and water quality) of this Environmental Impact Statement.

Potential impact	Discussion
	Construction of Five Dock Station is not expected to result in any negative environmental impacts from saltwater intrusion.
Groundwater dependent ecosystems	Given that tanking of the station cavern as part of the work carried out under the previous Sydney Metro West planning application would promote partial recovery of groundwater levels around the cavern over time, additional impacts on identified groundwater dependent ecosystems (terrestrial vegetation) in proximity of Five Dock Station are not anticipated to occur during construction of this proposal. Mitigation measure B3 under the previous Sydney Metro West planning application identified that further investigations and assessment during design development may confirm the likelihood and significance of potential impacts to groundwater dependent ecosystems due to groundwater drawdown. Where further investigations confirm a substantial reduction in baseflow, further review of opportunities to reduce groundwater drawdown would occur (for example, this may include additional grouting at the station). Refer to mitigation in Section 12.10.4 for further detail.
Surface water – groundwater interaction	Groundwater acting as baseflow to surface water features is considered to be a minor component of recharge in the area surrounding Five Dock Station. Iron Cove Creek and Barnwell Park Canal are concrete lined and are unlikely to receive groundwater baseflow. Potential for groundwater drawdown to impact on recharge to surface water features during construction of this proposal is considered unlikely.
Policy compliance	The minimal harm criteria in the NSW Aquifer Interference Policy (NSW Department of Primary Industries, 2012) and Water Sharing Plan rules (NSW Department of Industry, 2011) adopted under the previous Sydney Metro West planning application would be complied with into construction of this proposal. Impacts from the alteration of groundwater levels and flow regime are expected to be partially reduced for this proposal compared to the baseline.
Ground movement	The potential for further ground movement (and therefore potential impacts to buildings and structures) as a result of construction is comparatively reduced due to the excavation of the station cavern and access shafts being carried out under the previous Sydney Metro West planning application. As such, the extent of ground movement is considered to be negligible as a result of construction of this proposal.

12.10.4 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

During construction of this proposal, soils, contamination and groundwater would be managed in accordance with Sydney Metro's CEMF (Appendix F). The CEMF includes soil, contamination and groundwater management objectives and mitigation measures to minimise impacts as relevant to this proposal as a whole.

Mitigation measures that are specific to the operation and construction of Five Dock Station to address potential impacts are listed in Table 12-28.

Table 12-28 Soils, contamination and groundwater mitigation measures – Five Dock Station

Ref	Impact/issue	Mitigation measure	Timing
Soils, contamination and groundwater			
EIS-GW3	Groundwater dependent ecosystems	Additional investigations and assessment completed under the previous Sydney Metro West planning application (mitigation measure B3) would be reviewed and updated for this proposal, to confirm the potential for impacts to groundwater dependent ecosystems due to groundwater drawdown, and to identify any required mitigation through design.	Construction

12.11 Flooding

Further details on the flooding assessment, including the approach and methodology, are provided in Technical Paper 8 (Hydrology, flooding and water quality). The legislative context for the assessment is provided in Appendix B (Legislative and policy context).

12.11.1 Baseline environment

Five Dock Station would be located on a ridge with land sloping to the north towards Hen and Chicken Bay. The site drainage discharges to Canada Bay, about 750 metres north of the site. The site ranges from around 16.5 to 20 metres Australian Height Datum (AHD).

Flood study mapping and the previous Sydney Metro West planning application identified that there is minor overland flooding potential contained within the roadway adjacent to the Five Dock Station sites during the one per cent Annual Exceedance Probability (AEP) and Probable Maximum Flood (PMF) event.

At the eastern site, shallow flood depths of up to 0.05 metres are present along the kerb and gutter of the adjacent roads, Waterview Street and Second Avenue. This stormwater does not affect the proposed site during the five per cent AEP (with climate change) and one per cent AEP (with climate change) events, however it may affect access to the site during rare flood events such as the PMF.

At the western site, shallow flood depths of up to 0.1 metres are contained within the kerb and gutter along each side of the construction site on Great North Road and East Street. On East Street, the overland flow discharges into the existing carpark on the site. The filling of this area associated with the work carried out under the previous Sydney Metro West planning application will have resulted in negligible increases in flood level along East Street. The kerb and gutter flow along the adjacent streets may affect access to the western site during rare flood events.

Flood hazard in the five per cent AEP (with climate change), one per cent AEP and one per cent AEP (with climate change) flood events would be low within the sites and generally low within the adjacent roadways. In the PMF event, flood hazard adjacent to the site is high, which would be hazardous to pedestrians and vehicles.

There are no mainstream flooding or coastal inundation risks relevant to the sites and immediate surrounds.

Modelling suggests that several private properties would already experience inundation during the baseline five per cent AEP (with climate change), one per cent AEP (with climate change) and PMF events. This includes one property on Henry Street and two properties fronted by both East Street and Great North Road.

The station cavern and shafts at Five Dock Station will have been excavated during the work carried out under the previous Sydney Metro West planning application.

The previous Sydney Metro West planning application identified that impacts to existing flooding behaviour at the Five Dock Station eastern and western construction sites and immediate surrounds are unlikely.

12.11.2 Operational impact assessment

The flood protection levels for Five Dock Station are driven by the one per cent AEP (with climate change) flood event (plus 0.3 metres of freeboard), which is 20.0 metres AHD at Great North Road and 18.5 metres AHD at Waterview Street. The existing surface levels of the station would be at 20.25 metres and 19.19 metres AHD respectively. Therefore, the design level of the station is above the flood protection level which indicates the station is unlikely to be affected by flooding during this flood event.

Operational flood impact criteria established for this proposal are described in Section 3.1.4 of Technical Paper 8 (Hydrology, flooding and water quality). An assessment of potential flooding impacts at Five Dock Station is provided in Table 12-29 and shown in Figure 12-22. The operational flooding assessment considers the flooding extent for the one per cent AEP (with climate change) and PMF events. The five per cent AEP (with climate change) is also considered in Technical Paper 8 (Hydrology, flooding and water quality). Figures showing the modelling for a range of flooding events are provided in Appendix B and C of Technical Paper 8 (Hydrology, flooding and water quality).

Potential impacts during operation of this proposal at Five Dock Station are generally expected to be minor in all flooding events. Mitigation measures to manage potential impacts are outlined in Section 12.11.4.

Table 12-29 Potential flooding impacts for the modelled one per cent AEP and PMF flood events – Five Dock Station

Potential impact	Description
Change in peak flooding levels	• during both the one per cent AEP and PMF events, potential minor increases in flood depth up to about 0.1 metres are predicted in sections of Great North Road within the vicinity of the western site, associated with modifications to the road as part of this proposal. Isolated areas within the kerb and gutter would also experience increases in depth up to about 0.2 metres • during the PMF event, minor increases in flood level on East Street of up to about 0.1 metres are predicted • as set out in the mitigation measures (refer to Section 12.11.4), further design refinement would occur to manage potential local flooding impacts.
Change in flood extent	• during both the one per cent AEP and PMF events, potential increases in flood extent are predicted on areas of Great North Road, generally adjacent to the western site, due to modifications to the road as part of this proposal. This is shown on Figure 12-22 for the one per cent AEP event.
Compatibility with the flood hazard of the land	• flood risk and potential impacts from this proposal are considered manageable and therefore are considered compatible with the flood hazard of the site • during the one per cent AEP event, small, localised areas with elevated flow velocities in East Street and Great North Road would result in some increases to the high flood hazard extent. Access and evacuation routes would be readily available via the adjacent streets • during the PMF flood event, the hazard along streets adjacent to the sites would increase to high hazard, except for Second Avenue which would continue to be low hazard. Five Dock Station would provide shelter in place arrangements during extreme flood events
Change in duration of inundation	• change in duration of inundation would be negligible in all flood events.
Potential property impacts	• there would be no newly flood-affected private properties as a result of this proposal.
Consistency with floodplain risk management	• no floodplain risk and stormwater management plans were available for the sites. The sites are not within the Canada Bay Local Environmental Plan 2013 flood planning area.
Potential impacts to critical infrastructure or emergency management arrangements for flooding	• no potential flooding impacts to the major road transport routes identified in the South West Metropolitan Emergency Management Plan (South West Metropolitan Regional Emergency Management Committee, 2017) would occur as a result of this proposal given the distance of the routes from the site.
Potential social and economic costs from flooding impacts	• given the generally low flood affectation at Five Dock Station and the expected low impact on flood behaviour on surrounding properties and infrastructure as a result of this proposal, the potential social and economic costs from flooding impacts are considered low.

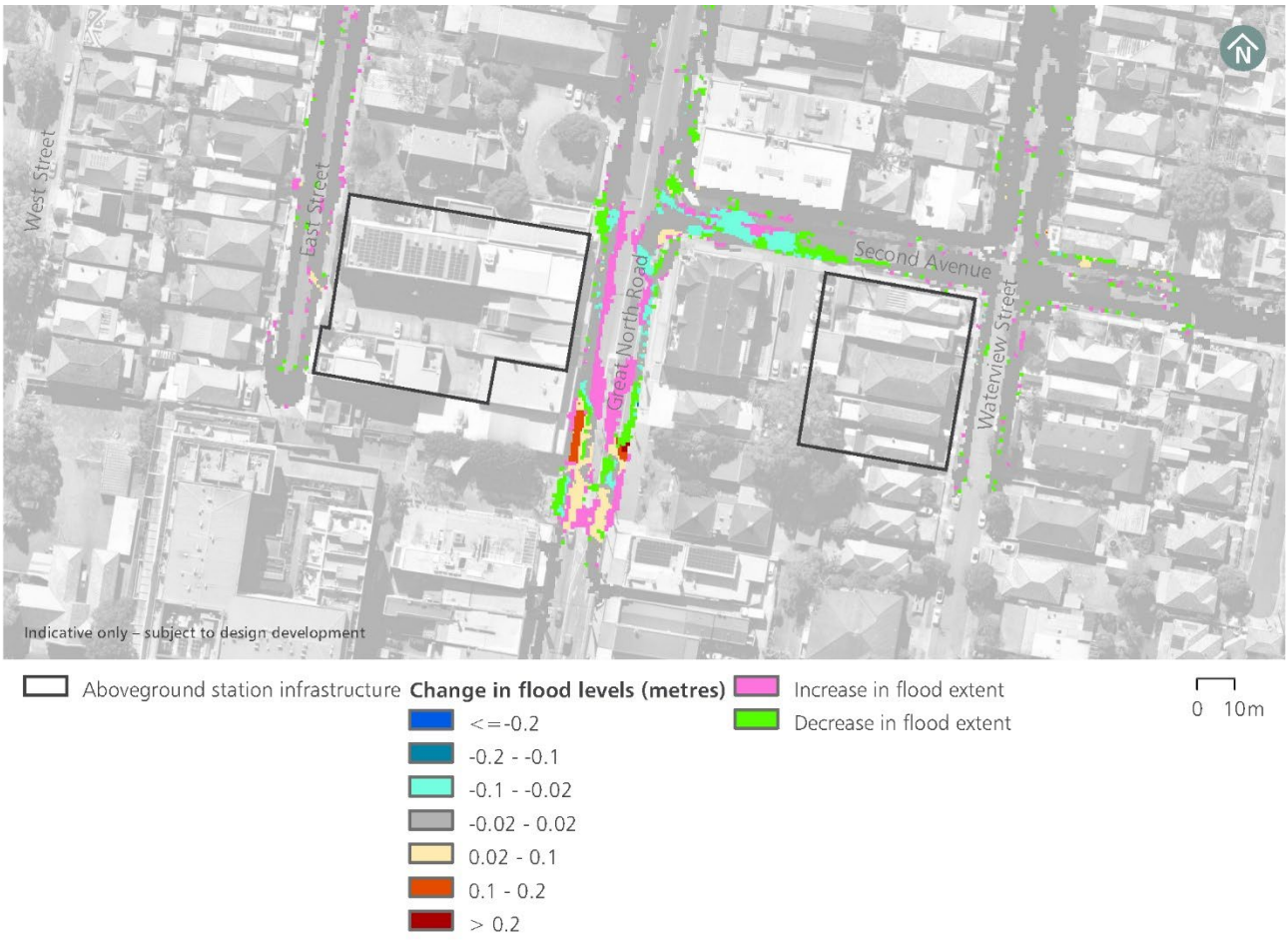

Figure 12-22 Potential change in flood levels (one per cent AEP event) – Five Dock Station

12.11.3 Construction impact assessment

The duration of construction at the Five Dock Station construction sites would be about four to five years (see Figure 12-8). In general, the potential construction phase flood risks would be a continuation of the potential flooding risks associated with the work carried out under the previous Sydney Metro West planning application, that is, impacts to existing flooding behaviour at the construction sites and immediate surrounds are unlikely because the sites are located outside of the flooding extents in both the five per cent AEP (with climate change) and one per cent AEP (with climate change) events. The potential impacts on flood behaviour from the previous Sydney Metro West planning application that would continue during construction of this proposal include:

- direct intense rainfall onto the site may cause nuisance flooding and drainage issues
- continued potential interruption of overland flow paths by installation of temporary construction site infrastructure (i.e. noise barriers, acoustic sheds, retaining walls) and/or modifications to landforms (i.e. placement of fill materials, stockpiles)
- continued increase in runoff volumes following rainfall events due to an increase in impervious surfaces (i.e. construction sites)
- the potential interruption or diversion of existing flood routes away from the location of bunding or spoil within construction activities in roadways, resulting in a reduction of flood storage and an increased flood risk to adjacent areas
- disruption of street kerb and gutter at construction site vehicle entry locations which may result in localised ponding
- potential blocking of drainage networks through increased sedimentation of surface water
- flow of water into excavation areas (for this proposal, this would be minor excavation for station construction).

The CEMF (Appendix F) requires the preparation of a Soil and Water Management Plan that would include consideration of surface water and flooding measures and progressive erosion and sediment control plans to manage potential impacts.

Compatibility of construction sites with flood conditions

The previous Sydney Metro West planning application identified that the Five Dock Station construction sites are considered to be compatible with flood conditions due to low flood risk within the sites in five per cent AEP and one per cent AEP events (both with climate change).

Consistency with floodplain risk management plans

There was no floodplain risk or stormwater management plan available for the study area at Five Dock. Therefore, no conflicts or inconsistencies with proposed management measures were identified.

Potential impacts to emergency management arrangements for flooding

There are no nearby major road transport routes identified in the South West Metropolitan Emergency Management Plan (South West Metropolitan Regional Emergency Management Committee, 2017) area that would be impacted by flood flows in the vicinity of the Five Dock construction sites.

Potential social and economic costs from flooding impacts

Similar to the operations phase, potential social and economic costs from flooding impacts during construction at Five Dock as a result of this proposal are considered low given the low flood affectation during the five per cent AEP and one per cent AEP events (both with climate change) and the expected low impact on flood behaviour on surrounding properties and infrastructure. The CEMF (Appendix F) requires the preparation of a Soil and Water Management Plan that would include consideration of surface water and flooding measures and progressive erosion and sediment control plans to manage potential impacts.

12.11.4 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

Potential flood risks during construction of this proposal would be managed in accordance with Sydney Metro's CEMF (Appendix F). The CEMF includes flooding management objectives and mitigation measures to minimise impacts as relevant to this proposal as a whole.

12.12 Social impacts

Further details on the social impact assessment, including the approach and methodology, are provided in Technical Paper 9 (Social impacts). A discussion of potential broader proposal-wide and regional social impacts (both benefits and disbenefits) are provided in Chapter 18 (Proposal-wide) of this Environmental Impact Statement.

12.12.1 Baseline environment

The characteristics of the communities within the social locality is described as the social baseline. The social baseline has been analysed by considering the human, social, economic, physical, and natural capital present around Five Dock Station.

Statistical analysis of the social baseline has been carried out by considering the primary geographical areas of interest as defined by the Australian Bureau of Statistics (ABS). These areas of interest have been termed as:

- **the proximal area:** Statistical Area level 1 (SA1s) have been chosen as the closest approximation of each of the localities along the corridor
- **suburb:** Statistical Area level 2 (SA2s) have been chosen to prepare community profiles for this proposal corridor
- **region:** the Greater Sydney area has been chosen to assist with the assessment of the broader social impacts. It has also been used for comparative purposes.

A summary of each type of community capital related to Five Dock Station is discussed in Table 12-30. This summary considers the proximal area of analysis only. A discussion of potential broader corridor-wide and regional social benefits (both benefits and disbenefits) is provided in Chapter 18 (Proposal-wide) of this Environmental Impact Statement.

Table 12-30 Community capitals summary – Five Dock Station

Capital	Summary
Human	In 2016, the Five Dock locality had the oldest population across all the localities, with 60 per cent of the population over the age of 34 and 16.7 per cent over the age of 65. A relatively lower share of residents was attending an educational institution (including either preschool, infants/primary and secondary school, university, TAFE or other educational facilities) compared to the other localities across the corridor, which is reflective of the ageing population.
Social	A majority of households reported speaking only English at home, which was relatively high compared to the corridor as a whole, second only to The Bays locality. The second most dominant language in the locality was Italian (15.6 per cent) Households in the Five Dock locality were primarily family households, with a fairly high share of couple families with children (36.5 per cent). There was also a relatively high share of one parent families (10.2 per cent), which was among the highest across all the localities. The Five Dock locality also had one of the highest shares of lone person households across all localities (23.6 per cent). The stability of residences in the Five Dock locality was also the highest of all localities, with 62.3 per cent of residents living in the same address as they were five years ago. Five Dock also had similar levels of volunteerism as North Strathfield. 18 per cent of the population volunteered through an organisation – reflecting a higher level of community cohesion when compared to other localities.
Economic	Overall, households in Five Dock were relatively well off compared to other localities, with almost 40 per cent of households earning above $2,500 per week The highest proportion of households were owned outright in this locality across the whole corridor (35.2 per cent) with a further 31.1 per cent owned with a mortgage. It also had the highest portion of mortgage repayments in the highest quartile (55.4 per cent paying greater than $2518 per month). Unemployment levels were one of the lowest across all localities (4.2 per cent of the eligible working age population with 12.2 per cent employed in professional, scientific and technical services). Unemployment levels are calculated based on those of eligible age (between the ages of 16 and 65), who are not engaged in secondary education and who are able to work. Weekly rents were also relatively high compared to other localities, with 73.3 per cent of households paying greater than $443 per week.
Physical	In 2016, around half of dwellings were separate houses at 54.2 per cent, the second highest across all localities. The average household size was 2.5 persons per household, which was slightly lower when compared to the other localities. Residents were highly car dependent with over half travelling to work via car while only 15.1 per cent of residents travelled to work via train or bus. This was the second lowest locality in terms of public transport use, which suggests limited public transport access for residents to get to their workplaces. There are a number of man-made parks nearby, including Concord Oval, Barnwell Park Golf Club and St Luke's Park.
Natural	The Parramatta River is in close proximity to Five Dock Station.

12.12.2 Operational impact assessment

Social impacts would be experienced at different geographies or spatial extents. A large proportion of operational social impacts associated with Five Dock Station would be felt at a regional and a suburb level; however, some would be experienced at a proximal level. This section focuses on the operational impacts at the proximal level, while a region- and suburb-based analysis, including potential beneficial social impacts, is provided in Chapter 18 (Proposal-wide) of this Environmental Impact Statement.

An assessment of the potential social impacts, both positive (benefits) and negative (disbenefits), of the operation of Five Dock Station is outlined in Table 12-31. The identified potential impacts are unmitigated and would be appropriately managed through the implementation of the mitigation measures outlined in Section 12.12.4 and through the performance outcomes detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. Sydney Metro would also develop a Community Benefit Plan to guide the development of community benefit initiatives (by Principal Contractors).

A residual impact rating has been assigned to each pre-mitigated impact in Table 12-31 to quantify the impacts after mitigation measures have been applied.

Table 12-31 Summary of operational social impacts – Five Dock Station

Pre mitigation impact	Social impact category	Impact type	Residual impact rating
Increased access to jobs, businesses, education, services, and social facilities improving social cohesion and social health for the whole community, including vulnerable persons. These improved travel times would lead to greater equity for transport uses, particularly for groups that currently experience transport or mobility difficulties such as older people, youth, people experiencing disability, non-drivers or people without access to a private vehicle. It would improve accessibility to employment, education and other social facilities.	Health and wellbeing Way of life Accessibility Livelihoods	Positive	Very high
Social amenity and placemaking benefits, including improvements to the aesthetic value of the area by creating attractive and active public spaces that reflect the existing or desired future scale and character of local areas. The Five Dock community is already a connected local community, that would likely be further enhanced with the operation of Sydney Metro West through the creation of a hub for the community. The Five Dock Station precinct could also be a destination for community events, activities and celebrations that reinforce a friendly community feeling for residents and visitors alike. While there is some concern within the community that Five Dock Station may change the social fabric of the area by changing community gathering spaces like Fred Kelly Place, the design is responsive to the existing environment and maintaining the current community value. Technical Paper 6 (Landscape and visual amenity) found that due to the expansion of Fred Kelly Place and an improved northern interface, there would be improvement in the amenity and functioning of this plaza and a moderate beneficial landscape impact.	Surroundings	Positive	High
Potential decline in how people experience their living environments due to light spill for the adjacent residential areas at night. The new station and public domain areas would be brightly lit to provide for customer safety. While the existing trees would screen some lighting from the station there would still be additional lighting seen from adjacent residential areas and therefore there would be a noticeable reduction in the amenity of this area at night for these residents.	Way of life	Negative	Low
Potential decline in social amenity and ability to experience surroundings in the way the community have done in the past to due to operational noise for some receivers along Great North Road, East Street and Fred Kelly Place.	Way of life	Negative	Low

Overall, the assessment found that similar to Burwood North Station, Five Dock Station would provide access to public transport in an area that is not currently serviced by the existing Sydney Trains suburban rail network. During engagement, the community noted that current public transport options were lacking and poorly connected, with bus trips to the Sydney CBD taking up to an hour. With the operation of Sydney Metro West, the Five Dock precinct would experience the greatest travel time saving of any of the precincts in terms of access to the Sydney CBD, with a travel time saving of 35 minutes (a trip on Sydney Metro West expected to take less than 10 minutes).

Additionally, during engagement, the community prioritised better transport and connectivity options for the precinct and supporting Five Dock's walkability and active modes of transport. During the operation, this proposal would provide a range of enhancements that would improve access, including a bus interchange located kerbside on both sides of Great North Road, an accessible kiss and ride facility on East Street, and footpath widening on both sides of Great North Road, adjacent to proposed signalised crossings and proposed and existing bus stops. Sydney Metro would also deliver bicycle parking facilities within the proposed station precinct to facilitate customers who wish to interchange to the Five Dock Station. Sydney Metro would discuss opportunities to connect the Five Dock Station with the existing and planned City of Canada Bay Council bicycle routes with relevant stakeholders, separate to this proposal.

The assessment indicates that the longer term and ongoing negative social impacts of this proposal would be in relation to way of life – particularly with respect to operational lighting. There would be some residual negative social impacts with respect to these impacts; however, these would be managed to an acceptable level through the mitigation measures as identified in Chapter 20 (Synthesis) of this Environmental Impact Statement.

12.12.3 Construction impact assessment

Construction activities would be carried out within the same construction sites required for the work carried out under the previous Sydney Metro West planning application. Anticipated construction impacts are expected to be similar and would be a continuation of those from work carried out under the previous Sydney Metro West planning application. During this proposal, local amenity impacts such as noise, vibration, and air quality would reduce compared to the work carried out under the previous Sydney Metro West planning application due to the nature of the construction activities for this proposal.

An assessment of the potential social impacts of constructing this proposal at Five Dock Station are outlined in Table 12-32. The potential impacts are unmitigated and would be appropriately managed through the implementation of the mitigation measures outlined in Section 12.12.4 and through the performance outcomes detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. Sydney Metro would also develop a Community Benefit Plan to guide the development of community benefit initiatives (by Principal Contractors).

A residual impact rating has been assigned to each pre-mitigated impact to quantify the impacts after these mitigation measures have been applied.

Table 12-32 Summary of construction social impacts – Five Dock Station

Pre mitigation impact	Social impact category	Impact type	Residual impact rating
Continued reduction in amenity due to ongoing construction and associated impacts on traffic, parking, access, noise, vibration and air quality impacts. This may change how people experience the area, including Fred Kelly Place, the local library, places of worship, childcare centres and other civic spaces. Vulnerable communities, such as residents requiring assistance with mobility and communication, may be disproportionately impacted.	Way of life	Negative	Medium
Continued impacts on connection to place associated with ongoing construction, including reduced access to the local retail village centre and community gathering areas. This is within an established residential neighbourhood with a relatively higher proportion of older residents.	Community Culture Accessibility	Negative	Medium
Potential psychosocial impacts as a result of inherent changes to the social fabric or the local area and resistance to change.	Health and wellbeing	Negative	Medium

Pre mitigation impact	Social impact category	Impact type	Residual impact rating
Potential wellbeing impacts associated with ongoing construction activity for vulnerable community members, including those who require assistance with mobility and communication, the elderly, low-income households, culturally diverse households and community members sensitive to noise and vibration.	Health and wellbeing	Negative	Medium

The assessment indicates that the social impacts of this proposal would effectively represent a continuation of the impacts from work carried out under the previous Sydney Metro West planning application, though generally at a lower level of intensity and extent. Key negative impacts would be largely related to community, culture, health and wellbeing, and way of life and would be temporary and short term in nature. These impacts would be managed to an acceptable level through proven mitigation measures as identified in Chapter 20 (Synthesis) of this Environmental Impact Statement.

12.12.4 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

During construction of this proposal, social impacts would be managed in accordance with Sydney Metro's CEMF (Appendix F). The CEMF includes social impact management objectives and mitigation measures to minimise impacts as relevant to this proposal as a whole.

The OCCS (Appendix C) also specifies that a Community Communication Strategy would be prepared and implemented during construction which would define the location specific measures to be implemented to minimise impacts on people during construction.

Design refinements that have occurred to avoid or minimise social impacts, and to respond to stakeholder feedback are provided in Technical Paper 9 (Social impacts). Monitoring commitments during the operation and construction of this proposal, including adaptive management measures, are provided in Technical Paper 9 (Social impacts).

Mitigation measures that are specific to address the operation and construction of Five Dock Station are listed in Table 12-33.

Table 12-33 Social mitigation measures – Five Dock Station

Ref	Impact/issue	Proposed mitigation measure	Timing
Social			
EIS-S2	Potential impacts on school infrastructure	Ongoing engagement would be undertaken with NSW Department of Education to continue to investigate feasible and reasonable mitigation measures related to construction traffic, pedestrian safety, construction noise and vibration, and air quality.	Construction
EIS-S3	Activation of streetscapes	In addition to temporary activation measures outlined in the Construction Environmental Management Framework, temporary activation considered in the vicinity of the Five Dock Station western construction site and Parramatta metro station construction site would include opportunities to provide spaces and places for the community to gather and meet each other.	Construction

12.13 Local business impacts

The approach and methodology for the local business assessment are provided in Chapter 4 (Methodology) of this Environmental Impact Statement. The legislative context for the assessment is provided in Appendix B (Legislative and policy context).

12.13.1 Baseline environment

The Five Dock Station construction sites will be established under the previous Sydney Metro West planning application. The Environmental Impact Statement for the previous Sydney Metro West planning application included a description of the existing environment as it relates to this local business impacts assessment, based on ABS Census 2016 data (Sydney Metro, 2020a). As updated census data is not yet available, the broad existing environment described in Chapter 16 of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CB*D (Sydney Metro, 2020a) is considered to remain largely relevant to this assessment.

To verify this, a desktop gap analysis was carried out with respect to any new data available and the specific scope of this proposal including operation. The baseline environment is summarised in the sections below and more detail is provided in Chapter 16 of the *Sydney Metro West Environmental Impact Statement - Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a).

Local business profile

The Five Dock Station sites are located within the Five Dock town centre extending along Great North Road, which is where the majority of businesses in the study area are located.

The Five Dock local business impacts study area provides a wide range of local businesses including retail, health, education, banks, commercial offices, cafes and restaurants.

Broadly speaking the health, education, commercial offices and retail businesses would differ in their mode of interaction with customers, suppliers and the community. Most health, education and commercial offices businesses in this area would be expected to interact with customers by appointment or pre-determined schedule. Conversely, retail businesses would be expected to have a greater reliance on visibility and passing trade, particularly from foot traffic. Interactions with suppliers and other businesses would be highly business-specific and dependent on other factors such as location or accessibility (or need) for deliveries.

Table 12-34 identifies the types of existing businesses within the local business impacts study area.

Table 12-34 Businesses within the local business impacts study area – Five Dock Station

Impact area	Types of businesses	Approximate number of businesses
Within 100 metres of the site	Retail, commercial services, educational and health	80 to 100
Between 100 and 400 metres of the site	Retail, commercial services, educational and health	100 to 150

Employment

At the 2016 Census, about 3,060 people were employed within the 'destination zones' relevant to the Five Dock local business impacts study area. Destination zones are the spatial unit used to code 'place of work' by the Australian Bureau of Statistics. About 44.1 per cent of these jobs were in the household services sector, with a large number of these jobs associated with the provision of health care services.

The sub-category of health care and social assistance accounted for the highest number of jobs in the local business study area (16.3 per cent). This is followed by retail trade and professional, scientific and technical services which accounted for the second and third highest number of jobs in the study area.

Travel patterns

Australian Bureau of Statistics 2016 Census data indicates workers within the area are highly dependent on car to get to and from work, with 75.7 per cent of residents using a car (as driver). Compared to other locations, this proportion is relatively high, suggesting that businesses are dependent on good access to the road network to access labour markets within the region.

12.13.2 Operational impact assessment

A qualitative assessment of the potential indirect operational impacts to local businesses at Five Dock Station is provided in Table 12-35. There are no direct impacts anticipated for local businesses during operation. Potential opportunities for local businesses during operation are also provided in Table 12-35.

Five Dock Station would increase the use of Sydney's public transport network, as the area is currently not serviced by the existing suburban rail network. Five Dock Station would significantly improve Five Dock's access to major employment centres and education facilities. With the operation of Sydney Metro West, the Five Dock precinct would experience the greatest travel time saving of any of the precincts in terms of access to the Sydney CBD, with a travel time saving of 35 minutes, with the trip on Sydney Metro West expected to take less than 10 minutes. Due to this increased accessibility and therefore greater access to labour markets and more customers, business investment would likely be attracted to the area.

Table 12-35 Local business impacts during operation – Five Dock Station

Potential impact operation	Risk assessment	
	Likelihood	Significance
Potential opportunities		
Increased passing trade for businesses Some businesses (such as retail, cafes and restaurants) may benefit from an increase in passing trade from customers accessing Five Dock Station.	Likely	Moderate positive
Improved accessibility Some businesses may experience increased accessibility (both those reliant on passing trade and destination businesses, for example those that are visited by appointment) bringing in new customers who previously could not easily access the area. Additionally, pedestrian safety will be increased around the station by relocating the existing midblock crossing across Great North Road at Fred Kelly Place to around 20 metres north of its current position. Furthermore, integration of the station into the future extension of Fred Kelly Place (proposed by the City of Canada Bay Council) would attract further foot traffic to access the precinct.	Likely	Large positive
Improved amenity Improved amenity (such as visual amenity and urban design) around Five Dock Station would make the area a more attractive place. This could contribute to improved customer experiences (for a range of business types) throughout the area and increased foot traffic for those businesses reliant on passing trade.	Likely	Moderate positive
Potential indirect impacts		
Impacts on accessibility Some businesses may experience reduced accessibility due to altered parking conditions. Changed traffic arrangements could collectively restrict and hinder servicing, delivery and customer access opportunities, resulting in time and vehicle related costs. Approximately 15 car parking spaces would be removed during operation; however, approximately 12 of these would be converted into kiss and ride spaces and could be used as short-term parking during off-peak times.	Unlikely	Slight negative

12.13.3 Construction impact assessment

A qualitative assessment of potential indirect construction impacts to local businesses at Five Dock Station is provided in Table 12-36. There are no direct impacts anticipated for local businesses during construction. Potential opportunities for local businesses during construction are also provided in Table 12-36.

Additionally, anticipated construction impacts are expected to be similar and would be a continuation of those from work carried out under the previous Sydney Metro West planning application. During this proposal, local amenity impacts such as noise, vibration, and air quality would reduce compared to under the previous Sydney Metro West planning application due to the nature of this proposal's activities.

Table 12-36 Local business impacts during construction – Five Dock Station

Potential impact construction	Risk assessment	
	Likelihood	Significance
Potential opportunities		
Continued increase in passing trade from construction workforce Some businesses may continue to benefit from an increase in the number of customers (construction workers), buying goods and services from retail, cafes and restaurants, in comparison to pre-construction numbers.	Possible	Slight positive
Continued redistribution of trade As a result of the work carried out under the previous Sydney Metro West planning application, some local customers could have redistributed their trade towards similar locally serving businesses within other parts of the business study area or the surrounding area which would be positive for those businesses that potentially experience an increase in trade. This redistribution of trade could continue during construction of this proposal.	Unlikely	Slight positive
Potential indirect impacts		
Continuation of redistribution of trade As a result of the work carried out under the previous Sydney Metro West planning application, some local customers could have redistributed their trade towards similar locally serving businesses within other parts of the business precinct or the surrounding area which would be negative for those businesses that potentially experience a reduction in trade. This redistribution of trade could continue during construction of this proposal.	Unlikely	Slight negative
Continuation of temporary traffic congestion and increased travel times Some businesses surrounding the construction sites may have experienced impacts associated with traffic congestion and increased travel times during the work carried out under the previous Sydney Metro West planning application. These impacts may continue during construction of this proposal. Potential temporary impacts to businesses associated with construction traffic would be minimised through measures such as reducing movements in network peak periods. Temporary increases in traffic congestion and travel times could affect workers journey to work times. Servicing and deliveries for businesses within the local business area may also be affected by temporary increases in traffic congestion and travel times around the precinct.	Likely	Slight negative
Continued impacts on parking and access Some businesses surrounding the construction sites may have experienced impacts associated with temporary loss of parking during the work carried out under the previous Sydney Metro West planning application. This proposal would result in the continuation of these impacts to parking along Great North Road, Waterview Street and Second Avenue. In addition, there may be short term closures of some on-street parking spaces on Great North Road, East Street, Second Avenue, Waterview Street, and Garfield Street. The loss of parking could reduce convenience for some customers visiting businesses within the area around the Five Dock Station construction sites.	Almost certain	Slight negative

Potential impact construction	Risk assessment	
	Likelihood	Significance
The temporary road network changes (one-way operation of sections of both Waterview Street and Second Avenue) that will be implemented under the previous Sydney Metro West planning application would continue to operate temporarily during construction of this proposal. There is the potential for conflict between vehicles exiting the Five Dock Station western construction site and vehicles exiting the St Alban's Anglican Church driveway. Construction vehicle movements would be managed during church service times so that the potential for conflict with church patrons is minimised.		
Temporary loss of power and utilities Unplanned power and utility interruptions could result in business impacts during interruptions. Given most utility works would be completed under the previous Sydney Metro West planning application, any substantial impact from unplanned power and utility interruptions is very unlikely.	Almost unprecedented	Slight negative
Continuation of temporarily reduced local amenity Some businesses surrounding the construction sites may have experienced impacts associated with reduced local amenity and visibility during the work carried out under the previous Sydney Metro West planning application. These impacts may continue during construction of this proposal. Businesses located close to the construction sites may temporarily experience reduced amenity or visibility, although this would be minimised through measures such as the design of hoardings around the site and appropriate signage. Some businesses along Great North Road may also experience continued reduced local amenity due to heavy vehicle movements on Great North Road, as this is the primary inbound and outbound route. The access and egress pattern of construction vehicles, however, will aim to minimise this impact by limiting the overall number of heavy vehicle movements during peak periods. As a local neighbourhood centre, amenity is an important attribute for some local businesses particularly the nearby childcare, cafes and restaurants around Fred Kelly Place.	Almost certain	Moderate negative
Continuation of reduced safety and security impacts There is potential for businesses to experience a temporary reduction in patronage due to perceptions related to safety and security when travelling through the local business study area. Safety and security could relate to the perception of potentially becoming a victim of crime. These perceived impacts are likely to be limited to retail and cafes and restaurants located near the Five Dock Station construction sites that would normally continue trading into the evening. This is because safety and security impacts tend to become more prevalent outside of daylight hours when any reduction in visibility decreases surveillance and the ability to see and navigate hazards.	Unlikely	Slight negative

12.13.4 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

During construction of this proposal, local business impacts would be managed in accordance with Sydney Metro's CEMF (Appendix F).

The OCCS (Appendix C) also specifies that a Community Communication Strategy would be prepared and implemented during construction and include requirements related to small business engagement. The Community Communication Strategy would define the location specific measures to be implemented to minimise impacts on individual businesses during construction, taking into account the commercial character of the locality, its general trading profile (daily and annually), and information gained from the business profiling.

12.14 Biodiversity

The approach and methodology for the biodiversity assessment are provided in Chapter 4 (Methodology) of this Environmental Impact Statement. The legislative context for the assessment is provided in Appendix B (Legislative and policy context).

12.14.1 Baseline environment

Site context

The area immediately surrounding the proposed location of Five Dock Station is highly urbanised, with a history of clearing and development over the past 200 years. This includes the previous use of the area for agriculture, with subsequent redevelopment for residential and commercial land uses. The area is relatively flat, with a landform generally draining north-west towards the Parramatta River.

The nearest area of native vegetation is the mangroves adjacent to Halliday Park, approximately 680 metres to the north-west.

Vegetation characteristics

Vegetation in the area surrounding the proposed location of Five Dock Station is limited to landscape and ornamental plantings only. No remnant native vegetation is present. All vegetation within the Five Dock Station construction sites will be removed during the work carried out under the previous Sydney Metro West planning application.

Vegetation in the surrounding area is similarly comprised solely of landscape planting and street trees and is not remnant. This vegetation would not be affected by this proposal.

Threatened ecological communities

There are no threatened ecological communities (TECs) present within the Five Dock Station construction sites.

Groundwater dependent ecosystems

There are no groundwater dependent ecosystems within the Five Dock Station construction sites.

As identified in Section 12.10.1, one groundwater dependent ecosystem (Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion) od located around 350 metres to the east of the Five Dock Station construction sites

Threatened flora species

There are no threatened flora species present within the Five Dock Station construction sites.

Threatened fauna species

The Five Dock Station construction sites will have been cleared of existing structures and vegetation, with the underground tunnel constructed and station cavern excavated as part of the work carried out under the previous Sydney Metro West planning application. As such, at the commencement works associated with this proposal, no roosting habitat would be present for microbats, threatened or otherwise. No potential impacts to microbats are therefore anticipated and impacts have not been assessed further.

Migratory species

There is no habitat associated with migratory species present within the Five Dock metro Station construction sites.

Aquatic ecology

There is no aquatic habitat present within the Five Dock Station construction sites.

12.14.2 Operational impact assessment

Direct impacts

Direct impacts related to the operation of Five Dock Station would be limited to the disruption of fauna due to noise, light and human activity. As the majority of activity would be underground at this location, impacts would only include those associated with surface activities such as people moving in and out of the station, additional street-level lighting and the increased movement of private vehicles, buses and taxis. In the context of the locality including substantial residential and retail development, as well as movements associated with the existing station, these impacts would be minor.

Indirect impacts

Indirect impacts associated with the operation of Five Dock Station would be limited to the management of stormwater runoff and its impacts to local waterways. This may include changes in the quantity and quality of stormwater runoff leaving the Five Dock Station site, resulting in subsequent impacts to nearby aquatic systems such as the Parramatta River. Biodiversity impacts associated with such changes include temporary or permanent inundation of wetland habitat, changes in water chemistry affecting sensitive breeding habitat (such as pH changes affecting amphibian breeding and foraging habitat) and changes in turbidity affecting the overall health and productivity of aquatic plants and animals.

Potential impacts to groundwater dependent ecosystems during operation are discussed in Section 12.10.2.

This proposal is located within an area that is already highly urbanised and the existing stormwater systems are likely to already be providing some degree of the impacts described above. This proposal would seek to manage operational stormwater effectively and manage the quantity and quality of water leaving Five Dock Station (refer to Chapter 18 (Proposal-wide) of this Environmental Impact Statement).

12.14.3 Construction impact assessment

Direct impacts

As described in Section 12.14.1, construction activities associated with Five Dock Station would take place entirely within the Five Dock Station construction sites established under the previous Sydney Metro West planning application. As such, no removal of vegetation at the Five Dock Station construction sites is anticipated for this proposal.

Construction of the Five Dock Station would also result in disruption to fauna due to noise, light and human activity. In the context of the highly urbanised local context including a mixed commercial and residential area, the impact of this direct disturbance is not anticipated to be significant.

Indirect impacts

Potential changes to the quantity and quality of stormwater runoff leaving the Five Dock Station construction sites, sediment-laden runoff and spills could result in indirect adverse impacts to nearby aquatic systems such as the Parramatta River. Biodiversity impacts associated with this would include temporary or permanent inundation of wetland habitat, changes in water chemistry affecting breeding habitat (such as pH changes affecting amphibian breeding and foraging habitat) and changes in turbidity affecting the overall health and productivity of aquatic plants and animals.

Potential impacts to groundwater dependent ecosystems during construction are discussed in Section 12.10.3.

The mobilisation of sediment and contaminants from the construction sites would be managed through the implementation of mitigation measures outlined in Appendix F (Construction Environmental Management Framework). Potential water quality and quantity impacts would be managed through the measures included in Chapter 18 (Proposal-wide) of this Environmental Impact Statement. As such the potential for indirect downstream biodiversity impacts is expected to be low.

12.14.4 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

During construction of this proposal, biodiversity would be managed in accordance with Sydney Metro's CEMF (Appendix F). The CEMF includes biodiversity management objectives and mitigation measures to minimise impacts as relevant to this proposal as a whole.