

Part D | Synthesis, risk analysis and conclusion

27 Synthesis of the Environmental Impact Statement

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This chapter provides a synthesis of the findings of the Environmental Impact Statement.

27.1 Secretary’s Environmental Assessment Requirements

The Secretary’s Environmental Assessment Requirements relevant to the synthesis of the Environmental Impact Statement, and reference to where they are addressed in this chapter and in the Environmental Impact Statement, are provided in Table 27-1.

Table 27-1: Secretary’s Environmental Assessment Requirements – Synthesis

Reference	Secretary’s Environmental Assessment Requirements	Where addressed
2. Environmental Impact Statement		
2.1	(q) a chapter that synthesises the environmental impact assessment and provides: <ul style="list-style-type: none">A succinct but full description of the project for which approval is sought;	Section 27.2 to 27.5
	<ul style="list-style-type: none">A description of uncertainties that still exist around footprint, construction methodologies for Stage 1 and how these will be resolved in subsequent approval stages;	Section 27.6
	<ul style="list-style-type: none">A compilation of the impacts that have not been avoided;	Section 27.7
	<ul style="list-style-type: none">For Stage 1, a compilation of the proposed measures associated with each impact to avoid or minimise (through design refinements or ongoing management during construction or during latter stages) or offset these impacts;	Section 27.8
	<ul style="list-style-type: none">A compilation of the performance outcome(s) and criteria the Proponent target and how these will be monitored; and	Section 27.9
	<ul style="list-style-type: none">The reason justifying carrying out Stage 1 as proposed, having regard to the biophysical, economic and social considerations, including ecologically sustainable development and cumulative impacts	Section 27.10

27.2 Overview

Sydney Metro West would involve a new metro line around 24 kilometres long between Westmead and the Sydney CBD. This infrastructure investment would double the rail capacity of the Parramatta to Sydney CBD corridor with a travel time target between the two centres of about 20 minutes.

The planning approvals and environmental impact assessment for Sydney Metro West will be broken down into a number of stages recognising the size of the project. This includes:

- Sydney Metro West at a Concept level
- Stage 1 – All major civil construction works between Westmead and The Bays including station excavation and tunnelling
- Stage 2 – All stations, depots and rail systems between Westmead and The Bays.
- Stage 3 - All major civil construction works including station excavation, tunnels, stations, depots and rail systems between The Bays and the Sydney CBD Station, and operation of the line.

Whilst the content of these stages may be varied, this Environmental Impact Statement covers the Concept and Stage 1 comprising all major civil construction works between Westmead and The Bays including station excavation and tunnelling.

This Environmental Impact Statement assesses the potential impacts of the Sydney Metro West Concept and Stage 1 only. Future stages, including the operation of Sydney Metro West would be assessed in future applications.

27.3 The Concept

The design and construction approach presented in this Environmental Impact Statement is based on a concept design and is indicative only. Changes may be made to the design and the construction methodology following community and stakeholder feedback provided during the Environmental Impact Statement exhibition.

The design and detailed construction methodologies may also change during the detailed design process which would progress if planning approval is obtained.

27.3.1 Key features of the Concept

The Concept is shown in Figure 27-1. The key features of the Sydney Metro West Concept are:

- About 24 kilometres of twin tunnels between Westmead and the Sydney CBD
- New metro stations at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays and Sydney CBD. The location of the Sydney CBD station will be determined following further investigations and community and stakeholder engagement. Strategic station locations at Rydalmere and Pyrmont are also under investigation
- A turn-up-and-go metro service operating early morning to late at night, between Westmead and Sydney CBD
- Pedestrian links and connections to other modes of transport (such as the existing suburban rail network and other parts of the metro network) and surrounding land uses
- Modifications to existing suburban stations and associated rail infrastructure (such as overhead wiring, signalling, access tracks/paths and rail corridor fencing) at Westmead and North Strathfield
- Services within each of the metro stations, including mechanical and fresh air ventilation equipment and electrical power substations to supply power for operation
- A stabling and maintenance facility at Clyde, including associated aboveground and belowground tracks to connect to the mainline tunnels and other operational ancillary infrastructure
- Services facilities at Rosehill (within the Clyde stabling and maintenance facility construction site), Silverwater and between Five Dock and The Bays for fresh air ventilation and emergency evacuation
- Alterations to pedestrian and traffic arrangements, and cycling and public transport (e.g. bus) infrastructure around the new stations
- Subdivision of station sites to support integrated station and precinct development and ancillary facilities
- Ancillary facilities to support construction.

The Concept is further described in Chapter 6 (Concept description).

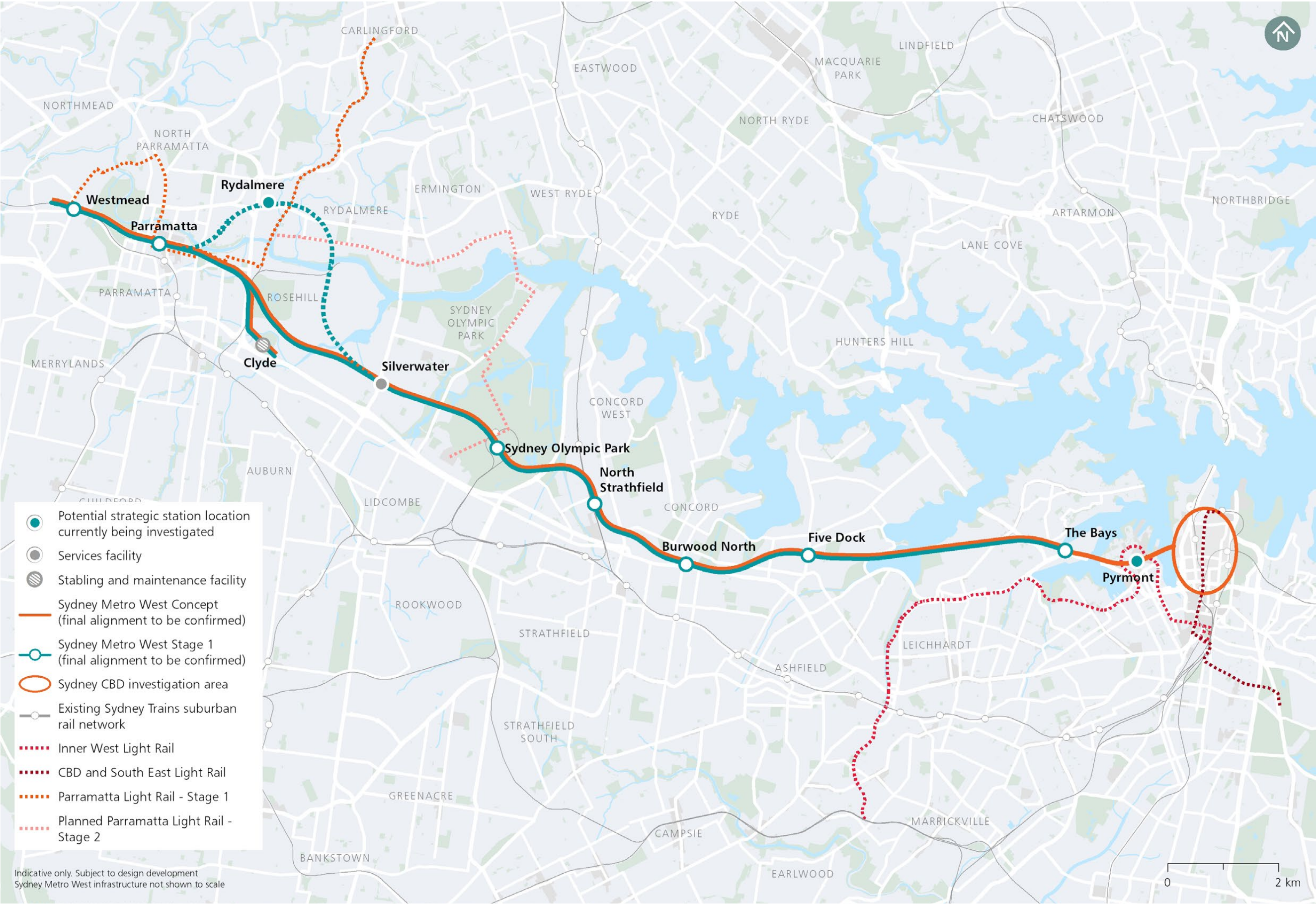


Figure 27-1: Sydney Metro West Concept

27.3.2 Concept construction elements

Key construction elements of the Concept would include:

- Enabling works
- Tunnel excavation and associated tunnelling support activities such as segment production, segment storage and spoil management
- Station construction including excavation, fit-out and aboveground building construction
- Rail interchange support works at Westmead and North Strathfield stations
- Operational ancillary infrastructure construction including excavation of shafts, fit-out and aboveground building construction
- Construction of a stabling and maintenance facility, including the dive structure and tunnel portal
- Tunnel and rail systems fit-out.

27.3.3 Key operational aspects

As indicated above, operational aspects of Sydney Metro West would be described in detail in subsequent development applications. The following summary is provided for the purposes of the assessment of the Concept. Further details are provided in Chapter 6 (Sydney Metro West concept description). Stage 1 would not include any operational elements.

Network interface, servicing and capacity

The Concept would operate as a rail line separate from the existing suburban and intercity rail network and separate from the Metro North West Line and City & Southwest line.

Demand for the service would be managed through increased service frequency. The ultimate operational capacity of the Concept is expected to be 30 trains per hour in each direction – a train every two minutes each way.

Hours of operation

Sydney Metro West would operate from early morning to late at night. Operating hours can be extended to accommodate planned special events.

Train types

All trains would be new, single-deck metro trains. They would deliver a fast, safe and reliable journey for customers with high performance standards and good customer amenities.

Design considerations

The considerations to guide the design of stations forming part of the Concept are provided in Table 27-2.

Table 27-2: Preliminary station design considerations

Station aspect	Design considerations
Customer experience	<ul style="list-style-type: none">• Escalators, platforms, passageways, mezzanines and concourses would be designed to accommodate peak customer flows and ensure stations are easy to navigate• The station and public access areas would be designed as attractive spaces and include public art and landscaping (where appropriate) and would also maximise the use of natural daylight. The design would also protect customers from weather (covered access paths, waiting shelters etc.) at stations and also at interchange areas• Furniture on station platforms would be provided to cater for a range of customers including seating and standing spaces.
Customer information and wayfinding	<ul style="list-style-type: none">• Real-time information would be delivered to customers through multiple media• An easy, intuitive and consistent wayfinding system would be developed that facilitates efficient customer movements to, from and through stations.
Operations and system requirements	<p>Stations would be designed in accordance with the operations and system requirements, including:</p> <ul style="list-style-type: none">• Maintaining customer flows at an acceptable and safe level of service standard• Securing platforms and critical infrastructure spaces from public access when services are not operating.

Station aspect	Design considerations
Safety and security	<ul style="list-style-type: none">• The safety of customers, staff and areas surrounding stations would be considered in station design in accordance with crime prevention through environmental design principles• Well-designed and efficiently controlled lighting systems, visible closed circuit television surveillance and appropriate staffing during operational hours would contribute to safe station environments. Passive station design elements that promote safety would include clear visibility lines in and around stations and the use of natural daylight and adequately wide paths to avoid blind spots.
Accessibility and functionality	<ul style="list-style-type: none">• Efficient transfer between metro and other types of transport (such as suburban network trains, walking, cycling, light rail and buses) is important to station design and supporting integrated transport network approach• The Sydney Metro network would be integrated into the Opal ticketing system• Station design would be guided by an ‘access for all’ philosophy using ‘priority of access’ principles, with pedestrians and cyclists first, followed by buses, point to point services and kiss and ride customers• Station design includes emergency exit and access facilities, such as fire stairs to allow for customer evacuation and emergency services access.
Sustainability and climate change	<ul style="list-style-type: none">• Sustainability measures at stations would include (where feasible) natural light, solar panels, reuse of rainwater, passive ventilation and shading, use of durable and low maintenance materials, and energy-efficient lighting.
Placemaking and activation	<ul style="list-style-type: none">• Sydney Metro West stations would provide a new public domain as well as integrate with the existing public realm and adjoining lands to develop and promote vibrant retail, community and other spaces as appropriate to the context and locality• Each station location would include space for retail outlets that meet customer needs (e.g. café, newsagents, etc.), as well as providing spaces for temporary activation and public art where appropriate. Station entries would be designed to make a positive contribution to the local area.

Other operational features

Other key operational features of the Concept would include:

- Pedestrian links and connections to other modes of transport (such as the existing suburban rail network and other parts of the metro network) and surrounding land uses
- Operation of a services facility at Rosehill, Silverwater and between Five Dock and The Bays for fresh air ventilation and emergency evacuation
- Traction substations to provide traction power supply. These would generally be co-located with other infrastructure where possible at Clyde stabling and maintenance facility, Burwood North Station and The Bays Station
- Operation of a stabling and maintenance facility at Clyde.

27.4 Placemaking

The approach to design and placemaking for the Sydney Metro West Concept, as well as site-specific place and design principles for each metro station and facility, are provided in Chapter 7 (Placemaking).

The approach to placemaking at each locality would be contextual, taking into consideration that metro stations would:

- Function as ‘places’ in their own right, creating focal points in the communities each station serves. The stations would attract a range of benefits and land uses, including reducing dependence on private vehicles, providing public places for gathering and human interaction supported by commercial and retail, as well as encouraging exercise by promoting walking and cycling to and from the stations
- Have a role in contributing to their surrounding environment or ‘place’ in which they are located by supporting planned growth and renewal, and acting as a catalyst for transit-oriented development within their catchments.

27.5 Stage 1

27.5.1 Key features of Stage 1

Stage 1 is shown on Figure 27-2 and would involve the major civil construction work between Westmead and The Bays, including:

- Enabling works such as demolition, utility supply to construction sites, utility adjustments and modifications to the existing transport network
- Tunnel excavation including tunnel support activities
- Station excavation for new metro stations at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock and The Bays
- Shaft excavation for services facilities at Rosehill (within the Clyde stabling and maintenance facility construction site), a location between Five Dock Station and The Bays Station construction sites (to be determined), and Silverwater
- Civil work for the stabling and maintenance facility at Clyde including earthworks and structures for crossings at A'Becketts Creek and Duck Creek
- A concrete segment facility for use during construction located at the Clyde stabling and maintenance facility construction site
- Excavation of a tunnel dive structure and associated tunnels at Rosehill to support a connection between the Clyde stabling and maintenance facility and the mainline metro tunnels.

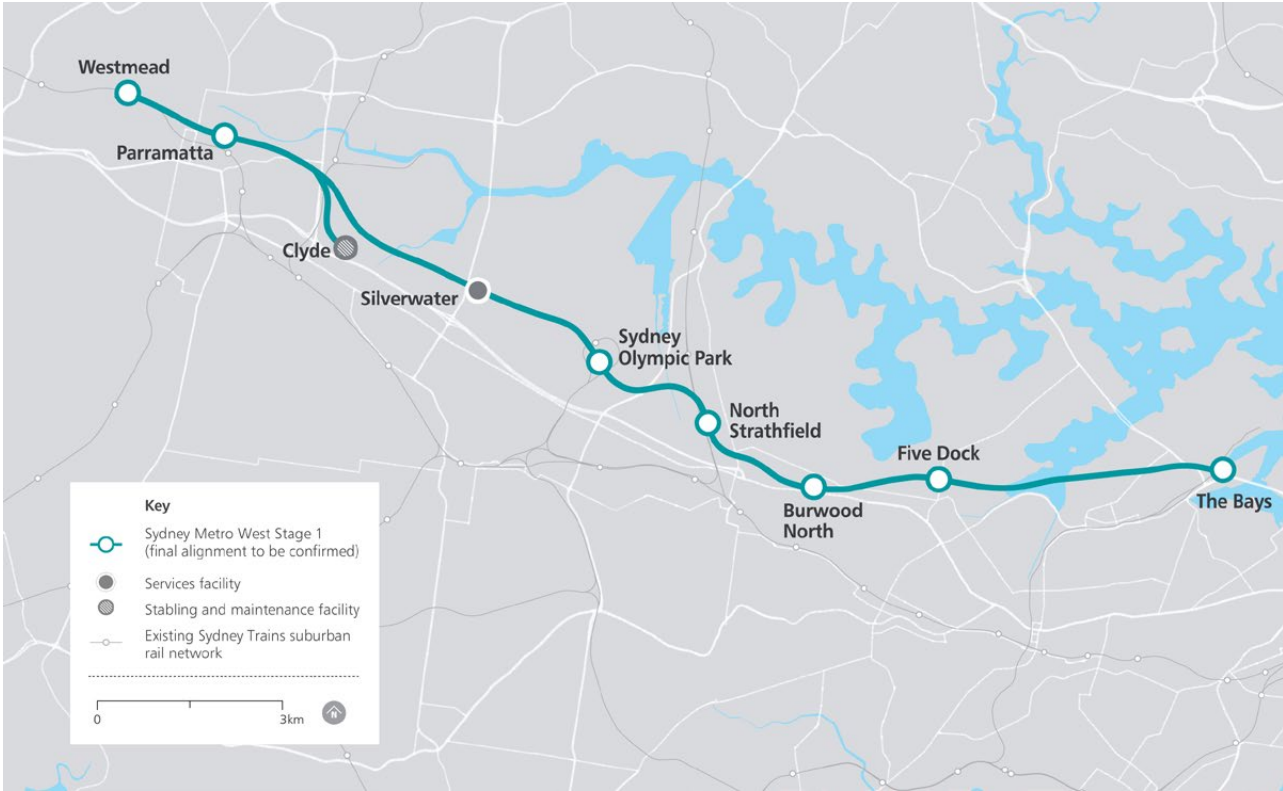


Figure 27-2: Overview of Stage 1

Tunnel location

The Stage 1 tunnel alignment (refer Figure 27-2) is indicative at this stage and has been used for the purposes of the environmental impact assessment, including all specialist investigations. During detailed design the alignment may change. Any changes to the alignment would be reviewed for consistency with the assessment contained in this Environmental Impact Statement including any relevant mitigation measures, performance outcomes and any future conditions of approval.

Construction sites and associated activities

A number of construction sites would be required for:

- Tunnel boring machine launch, support and retrieval
- Roadheader support
- Station excavation
- Services facility shaft excavation
- Civil works for the stabling and maintenance facility.

Table 27-3 shows the proposed construction sites and their uses. All construction sites would provide staff facilities such as offices, lunch rooms and amenities.

Table 27-3: Construction site activities – Stage 1

Construction site	Tunnel boring machine launch and support	Tunnel boring machine retrieval	Roadheader works and support	Spoil removal	Station excavation	Services facilities excavation	Construction staff facilities	Stabling and maintenance facility civil works	Creek crossings	Tunnel dive structure
Westmead metro station	●		●	●	●		●			
Parramatta metro station				●	●		●			
Clyde stabling and maintenance facility				●		●	●	●	●	●
Silverwater services facility				●		●	●			
Sydney Olympic Park metro station		●		●	●		●			
North Strathfield metro station				●	●		●			
Burwood North Station			●	●	●		●			
Five Dock Station			●	●	●		●			
The Bays Station	●			●	●		●			

27.5.2 Stage 1 construction methods

Table 27-4 provides an overview of the key construction methods for Stage 1.

Table 27-4: Construction methods – Stage 1

Construction activity	Construction methods
Enabling works	<p>Enabling works activities that would typically be carried out before the start of substantial construction in order to make ready key construction sites and to provide protection to the public. Enabling works are expected to include:</p> <ul style="list-style-type: none">• Construction site establishment• Demolition of buildings and structures within the proposed construction footprint• Utility adjustments and protection• Utility supply to the construction sites including power and water• Transport network modifications to roads, public transport, and pedestrian and cyclist facilities• Heritage investigations, protection and archival recordings• Additional geotechnical and contamination investigations and remediation where required.

Construction activity	Construction methods
Tunnels	<p>Tunnel boring machines would be used to excavate twin tunnels about 21 kilometres long. The two bored tunnels would have a circular cross-section with an internal lined diameter of about six metres and an excavated diameter of about seven metres.</p> <p>Roadheaders would be used to excavate caverns, stub tunnels and connection tunnels from the stabling and maintenance facility to the mainline tunnels.</p> <p>It is anticipated that tunnelling would occur from two tunnel boring machine launch and support sites:</p> <ul style="list-style-type: none">Westmead metro station construction siteThe Bays Station construction site. <p>These construction sites would provide the necessary support for the tunnelling operation including spoil storage and removal, power supply to the tunnel boring machines, fresh air ventilation, grout batching, water treatment and disposal, material storage as well as office facilities, worker amenities and parking.</p> <p>Retrieval and dismantling of the tunnel boring machines would be carried at the Sydney Olympic Park metro station construction site.</p> <p>A temporary pre-cast concrete segment production facility would be at the Clyde stabling and maintenance facility construction site to provide concrete segments for the tunnel lining.</p>
Station construction	<p>Excavation of stations would generally be carried out in the following sequence:</p> <ul style="list-style-type: none">Enabling works including protection or diversion of utilities and establishment of site access pointsDemolition of structures on the site and clearance of landscaped vegetationExcavation and structural works for station boxes and underground pedestrian passages including piled walls. This may be carried out using excavators and rock hammers, however drill and controlled blasting or penetrating cone fracture techniques may also be used.
Services facilities	<p>Vertical shafts would be constructed at Rosehill and Silverwater to house future services facilities. Stage 1 construction works for the services facilities would involve:</p> <ul style="list-style-type: none">Enabling works including protection or diversion of utilities and establishment of site access pointsDemolition of structures on the site and vegetation removalExcavation of a vertical shaft to the tunnels below. This may be carried out using excavators and rock hammers, however drill and blast or penetrating cone fracture techniques may also be usedTemporary lining and reinforcement of the shaft.
Stabling and maintenance facility	<p>Civil works for the stabling and maintenance facility would involve:</p> <ul style="list-style-type: none">Enabling works including protection or diversion of utilities and establishment of site access pointsDemolition of structures on the site and clearance of vegetation (if present)Import and placement of fill material. The stabling and maintenance facility would be designed and constructed to be protected from the one per cent Annual Exceedance Probability flood event. In some areas, this may also involve the construction of retaining wallsStructures for crossings of A'Becketts Creek and Duck Creek. <p>A temporary pre-cast concrete segment construction production facility to support tunnelling would also be located at the Clyde stabling and maintenance facility construction site.</p>
Dive structures and tunnel portals	<p>A dive structure and tunnel portal would be constructed at Rosehill (within the Clyde stabling and maintenance construction site) to facilitate a surface connection to the Clyde stabling and maintenance facility. The construction of the dive structure and tunnel portal would generally involve:</p> <ul style="list-style-type: none">Piling work along the walls of the dive structureExcavation of existing material to below future track levelPlacement of precast concrete for the cut-and-cover section and to form the tunnel portal. <p>The dive structures would be designed and constructed to be protected from the probable maximum flood level.</p>

27.5.3 Construction program

The total period for Stage 1 construction works would be around four years. An indicative construction program is shown in Figure 27-3.

The actual program and commencement of works at each construction site is subject to the final delivery strategy being confirmed.

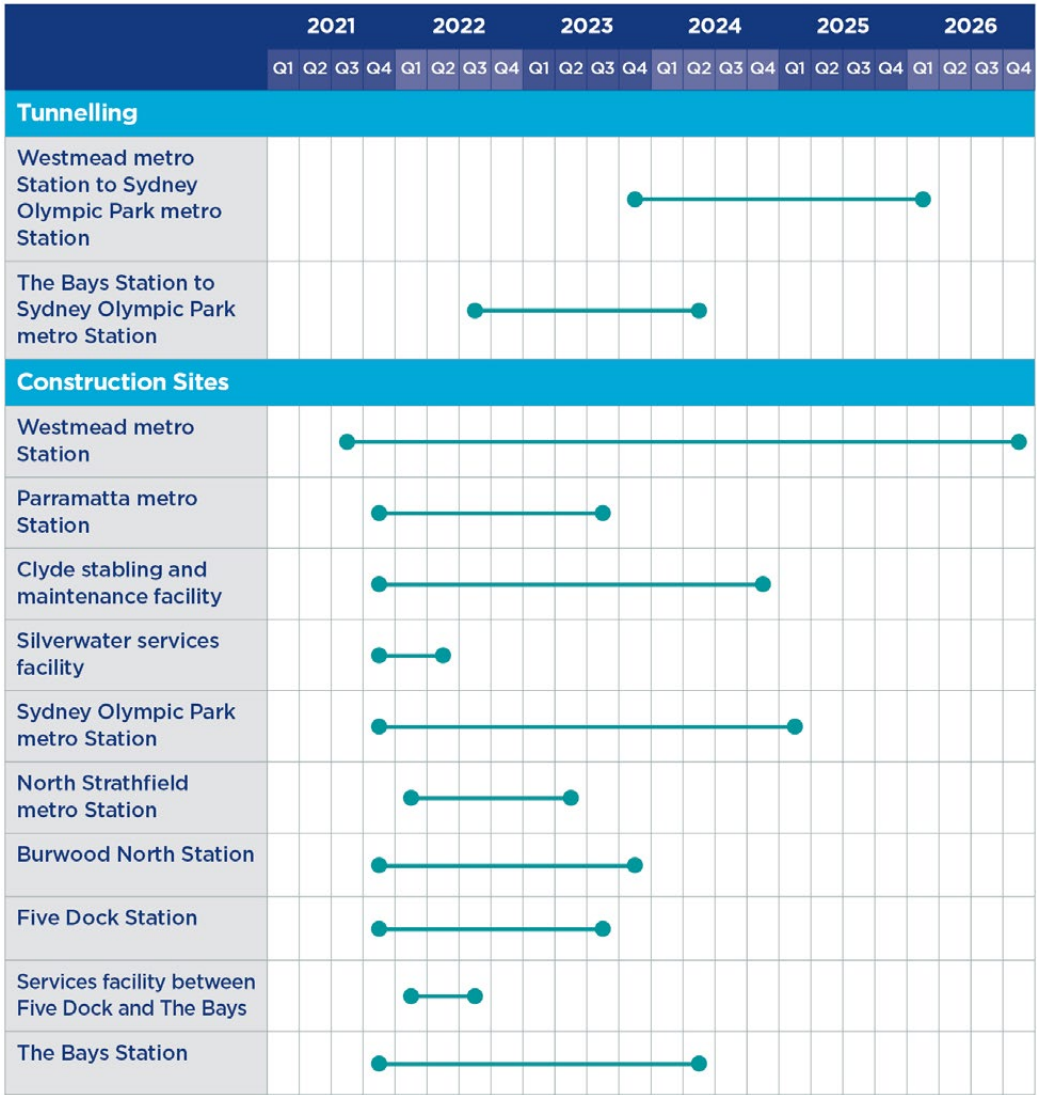


Figure 27-3: Indicative construction program

Note: This program only shows major civil works (Stage 1) indicative duration and not the total works.

27.6 Uncertainties and resolution

The design presented in this Environmental Impact Statement is conceptual and subject to further detailed design. The design as presented serves to:

- Confirm that the proposed performance and technical requirements can be achieved
- Validate the feasibility and methodology of the required construction
- Identify key risks/constraints and environmental assessment issues.

27.6.1 Concept

The following items will be resolved as part of ongoing design and assessments for future staged approvals:

- Future staging of construction of the Concept (i.e. beyond Stage 1)
- The preferred location of the metro station in the Sydney CBD
- The potential inclusion of strategic station options at Rydalmere and Pyrmont
- Station design, access, fit-out, finishes etc
- Placemaking and the integration of stations into the surrounding environment
- Tunnel and tunnel rail systems fit-out works
- Track form (and associated operational noise and vibration characteristics)
- Permanent adjustments/alterations to the transport network to facilitate transport interchange
- Long-term groundwater treatment
- Tunnel alignment (horizontal and vertical) between The Bays and the Sydney CBD
- The extent of residual land following construction of the Concept
- Provisions within the station design to allow for integrated station development.

27.6.2 Stage 1

Construction footprints for Stage 1 stations, services facilities and the stabling and maintenance facility have been developed taking into account expected future requirements for the stations, as well as considering the key construction requirements. This process is described further in Chapter 3 (Sydney Metro West development and alternatives). There is a high level of certainty regarding the location and extent of construction sites.

The construction methodology for Stage 1 has been developed to a level where environmental impacts can be appropriately identified. Aspects of the construction methodology that may be subject to further refinement (but which would be unlikely to substantially alter the predicted environmental impacts) include:

- Specific location of facilities within construction sites (including the design and siting of acoustic sheds or other acoustic measures)
- Alternative haulage routes, construction site access and/or traffic management arrangements at North Strathfield, Burwood North and Five Dock to provide improved traffic safety and reduce potential impacts in these locations
- Spoil transport by barge from The Bays Station construction site for reuse at the Clyde Stabling and maintenance facility construction site or to locations such as Port Kembla or Port of Newcastle for regional re-use opportunities
- Alternative approaches to the construction of the B-double route around the Clyde stabling and maintenance facility construction site, including potential use of an underpass instead of bridging structures to minimise flooding and visual impacts
- Sequence of construction activities
- Temporary road diversions
- Specific location of a services facility to be located between Five Dock and The Bays.

All aspects of the construction methodology would be confirmed during the detailed design and construction planning processes.

27.7 Summary of impacts that have not been avoided

27.7.1 Outline of strategies to avoid impacts

Many potential impacts have been avoided through the project development process which included input from key stakeholders and the community. In particular, locating Sydney Metro West almost completely underground would substantially reduce most major environmental impacts, including:

- Noise
- Traffic
- Property and land use
- Social impacts
- Biodiversity.

Residual environmental and social impacts have been minimised through the specific design and the construction methods chosen, as well as application of comprehensive mitigation and management measures that have been shown to be proven and effective on previous construction projects. Design development and refinements would continue to further minimise any residual impacts.

Despite this, it is not unexpected that a project of this scale and nature being constructed in a highly urbanised environment would still have potential residual impacts that are unavoidable.

This section provides a summary of these unavoidable impacts for Stage 1. The potential impacts identified for the Concept are still at a conceptual level and therefore the specific nature and extent of unavoidable impacts would be premature to identify at this stage. All impacts associated with the Concept, and not assessed in Stage 1, would be subject to further consideration and assessment.

27.7.2 Impacts that have not been avoided – Stage 1

Chapters 10 to 26 provide an assessment of the potential impacts of Stage 1. The key potential impacts requiring mitigation and management are summarised in Table 27-5.

Potential impacts would be mitigated by implementing comprehensive environmental management procedures and plans. These are described in Section 27.8.

Table 27-5: Summary of potential impacts – Stage 1

Issue	Potential impact
Transport and traffic	<ul style="list-style-type: none">• Temporary increase in construction traffic on the local and regional road network, resulting in potentially temporary increased congestion and delays. Construction site traffic would be managed to minimise movements during peak periods and avoid school zones during pick up and drop off times• Potential temporary local traffic disruptions and short-term access restrictions and detours for road users. Directional signage and line marking would be used to direct and guide drivers and pedestrians past construction sites and on the surrounding network. This would be supplemented by variable message signs to advise drivers of potential delays, traffic diversions, speed restrictions, or alternate routes• Potential temporary decrease in road network performance resulting in delays and increased queue lengths at some intersections in Westmead, North Strathfield and Five Dock• Potential temporary access restrictions for pedestrians and cyclists within and surrounding the construction sites such as Horwood Place in Parramatta. Access to existing properties and buildings would be maintained in consultation with property owners• Potential temporary impacts to the public transport network, particularly in Westmead, North Strathfield and Burwood North, associated with the temporary relocation of bus stops and changes to bus routes resulting in minor impacts to commuters• Potential temporary pedestrian and cyclists safety impacts near construction site access and egress points where construction vehicles would interact with the public. Vehicle access to and from construction sites would be managed to maintain pedestrian, cyclist and motorist safety. Depending on the location, this may require manual supervision, physical barriers, temporary traffic signals and modifications to existing signals or, on occasions, police presence• Several on and off-street parking spaces would be temporarily unavailable to the general public for the duration of construction, with the main potential impacts at Westmead and Parramatta. The Parramatta metro station construction site would result in the loss of 850 on and off-street parking spaces particularly due to the demolition of the City Centre car park. The demolition of the City Centre multi-level car park is identified in the Draft Parramatta CBD Public Car Parking Strategy (City of Parramatta, 2017). The strategy identifies potential measures to offset this loss of car parking.
Noise and vibration	<ul style="list-style-type: none">• Given the nature and duration of works and the close proximity of receivers, airborne noise during construction is expected to temporarily exceed noise management levels at all sites – and at some sites by possibly more than 20 dBA. Noise intensive works within the construction sites at night would generally only be completed inside acoustic sheds (or once other acoustic measures have been established). Regardless, ‘moderate’ worst-case temporary impacts are expected at some receivers• Potentially temporary highly noise affected receivers (subject to noise levels of 75 dBA or greater) at Westmead metro station, Clyde stabling and maintenance facility, North Strathfield metro station, Burwood North Station and Five Dock Station construction sites• Potentially temporary high sleep disturbance impacts at Westmead metro station and Five Dock Station construction sites. Moderate sleep disturbance impacts at Sydney Olympic Park metro station and Burwood North Station construction sites• Potential temporary ground-borne noise impacts at nearby receivers associated with tunnelling and excavation works at construction sites. Less ground-borne noise and vibration intensive alternative construction methodologies may be adopted where deemed feasible and reasonable• Potential temporary exceedances of vibration criteria including cosmetic damage screening criteria, and human comfort criteria at several buildings closest to construction sites. Where vibration levels are predicted to exceed the screening criteria, a more detailed assessment of the structure and attended vibration monitoring would be carried out to ensure vibration levels remain below appropriate limits for that structure• Potential minor construction and operational traffic noise impacts to receivers near Westmead metro station construction site particularly along Grand Avenue and Alexandra Avenue. Further assessment of construction traffic would be completed during detailed design and measures would be implemented to minimise temporary traffic noise impacts.
Non-Aboriginal heritage	<ul style="list-style-type: none">• Potential moderate direct impact on one item considered to be of State heritage significance (State Abattoirs at Sydney Olympic Park). Sydney Metro is investigating the feasibility of design and construction options to avoid direct impacts to this heritage item. Archival recording would be carried out prior to the commencement of construction works that impact the item• Potential moderate indirect visual impacts on two items listed on the State Heritage Register (Roxy Theatre at Parramatta and White Bay Power Station at The Bays) and one item considered to be of State heritage significance (State Abattoirs at Sydney Olympic Park). The policies of the White Bay Power Station Conservation Management Plan would be considered in regard to visual impacts of the Stage 1 works• Potential moderate indirect visual impacts on four items of local heritage significance. Archival recording would be carried out prior to the commencement of construction works• Potential direct impact on potential archaeological resources at Parramatta and The Bays. An archaeological research design(s) would be prepared and implemented to identify the need for archaeological testing or monitoring. Mitigation measures would be recommended in accordance with Heritage Council guidelines.
Aboriginal heritage	<ul style="list-style-type: none">• Potential disturbance of a potential Aboriginal archaeological deposit of moderate to high significance and moderate to high potential for intact archaeological deposits, located within the Parramatta metro station construction site. This includes a site recorded on the AHIMS register as 45-6-3582. Archaeological test excavation (and salvage when required) would be carried out where intact natural profiles with the potential to contain significant archaeological deposits are encountered• Potential disturbance of Aboriginal archaeological deposit of moderate significance and low to moderate potential for intact archaeological deposits, located within the Parramatta metro station, Clyde Stabling and maintenance facility and The Bays Station construction sites.
Property and land use	<ul style="list-style-type: none">• Acquisition of private land and publicly owned land for construction sites. The construction sites are located where permanent operational infrastructure would also be required, to minimise property impacts and residual land holdings at the completion of construction. All acquisitions would be carried out in consultation with landowners and in accordance with the requirements of the <i>Land Acquisition (Just Terms Compensation) Act 1991</i>. Sydney Metro has appointed Personal Managers to offer residents and small businesses assistance and support throughout the acquisition process• During construction, the use of land within the Stage 1 footprint would change from its existing use to use as a construction site. Except where required for subsequent construction activities associated with future stages of the Concept, temporary use areas for construction purposes would be stabilised and appropriately rehabilitated.
Landscape character and visual amenity	<ul style="list-style-type: none">• Potential temporary visual impacts as a result of the introduction of new elements including acoustic sheds or other acoustic measures, machinery and equipment, site hoardings, partially complete structures, and other construction works. All structures (including acoustic sheds or other acoustic measures, site offices and workshop sheds) would be finished in a colour which aims to minimise their visual impact, if visible from areas external to the construction site• Removal of a portion of the Abattoir Heritage Precinct gardens which is considered a regionally sensitive landscape. Sydney Metro is investigating the feasibility of design and construction options to avoid direct impacts to this heritage item• Loss of mature street trees and vegetation providing screening and amenity and opening up views towards the construction sites such as at the Clyde stabling and maintenance facility construction site. Opportunities for the retention and protection of existing street trees and trees within the site would be identified during detailed construction planning.

Issue	Potential impact
Business impacts	<ul style="list-style-type: none">• Broad economic benefits by way of job generation• Benefits to businesses from increased demand from construction workers requiring food and beverage services and other goods• Potential temporary reduction in passing trade for vehicular and pedestrian traffic due to detours and road and footpath closures or hoarding potentially restricting visibility of businesses that are reliant on passing trade (e.g. cafes). Clear pathways and signage would be implemented around construction sites to maximise visibility of retained businesses, including sufficient lighting along pedestrian footpaths during night-time where relevant• Potential temporary impacts on servicing and delivery access due to road closures and detours• Temporary changes to the road network, including temporary parking loss has the potential to affect deliveries and convenience for business employees and customers.
Social impacts	<ul style="list-style-type: none">• Potential loss of and temporary disruption to existing social infrastructure, including open space, with associated impacts on community interactions and connectedness• The community's enjoyment of certain community facilities may potentially be temporarily reduced where they are located close to construction sites• Potential temporary changes to community character, such as changes to streetscape, access, businesses, increased numbers of workers and visitors in the area due to construction activity, resulting in changes to connections to the surrounding area• Potential temporary changes to sense of place due to impacts of construction, such as impacts to heritage items, loss of established businesses, changes to streetscape and urban fabric, resulting in potential loss of community connections to the surrounding area.
Groundwater and ground movement	<ul style="list-style-type: none">• Potential minor impacts associated with localised ground movement and/or settlement due to excavation or groundwater drawdown causing damage to infrastructure. Condition surveys of buildings and structures in the vicinity of the tunnel and excavations would be carried out prior to the commencement of excavation at each site• Minor potential impacts on two registered groundwater users, one near Westmead metro station construction site and one near Burwood North Station construction site. Further investigations would be carried out and make good provision implemented as required• Potential migration of contaminated groundwater towards, and into, station excavations, posing a potential exposure risk to site users/workers, and potentially reducing the beneficial use of the aquifer. Monitoring would occur of groundwater levels and quality of the site area before, during and after construction for potential contaminants of concern. Water level data would be regularly reviewed by a qualified hydrogeologist• Groundwater collected within site excavations and within the tunnels during construction would be discharged to the local stormwater system at each construction site. Temporary water treatment plants would treat collected groundwater so that the discharged water quality meets the requirements of any relevant environment protection licence for Stage 1 or the requirements of the <i>Protection of the Environment Operations Act 1997</i>.
Hydrology and flooding	<ul style="list-style-type: none">• Potential for inundation of construction areas during flood events particularly in areas where flooding currently occurs (such as high flood risk areas in Parramatta metro station, Clyde stabling and maintenance facility and The Bays Station construction sites). Detailed construction planning would consider flood risk at construction sites• Minor potential flooding impacts associated with the interruption of overland flow paths by installation of temporary construction site infrastructure (i.e. noise barriers, acoustic sheds (or other acoustic measures), retaining walls) and/or modifications to landforms (i.e. placement of fill materials, stockpiles). Key areas of potential flooding risk include the Parramatta metro station, Clyde stabling and maintenance facility, Silverwater services facility and The Bays Station construction sites• Minor potential increases in peak flooding levels, increases in the extent of floods and an increase in flood hazard during flooding events at Clyde stabling and maintenance facility. These potential increases are within acceptable limits. On-site stormwater detention would be provided for the Clyde stabling and maintenance facility construction site• Potential increases in flow velocity and scour potential may result where Stage 1 construction works alter flood flow patterns and significantly divert or concentrate flood flows. Flow velocities are expected to increase at the Clyde stabling and maintenance facility due to the proposed culvert crossings of A'Becketts Creek and Duck Creek and formalisation of sections of these creek channels. Further design refinement at the Clyde stabling and maintenance facility construction site would occur during detailed design to mitigate the identified potential impacts.
Biodiversity	<ul style="list-style-type: none">• Direct removal of 0.18 hectares of native vegetation including 0.15 ha of Mangrove forest at Clyde, which would be offset in accordance with the <i>Biodiversity Conservation Act 2016</i>• Potential impacts to the habitat of seven threatened fauna species however these impacts are unlikely to detrimentally effect these species on a whole• Impacts to the vegetation riparian zones of Duck Creek and A'Becketts Creek that may limit the movement of threatened fauna species in that area.
Air quality	<ul style="list-style-type: none">• Some unavoidable risks of temporary nuisance impacts from dust are expected at some locations. Best-practice dust management measures would be implemented during all construction works and additional measures would be implemented if required subject to outcomes of monitoring.
Spoil and waste management	<ul style="list-style-type: none">• Moderate potential residual impacts would include generation of unusable spoil during tunnelling due to contamination or acid sulfate soils. All waste would be assessed, classified, managed, transported and disposed of in accordance with the Waste Classification Guidelines and the Protection of the Environment Operations (Waste) Regulation 2014.
Hazards	<ul style="list-style-type: none">• Potential temporary impacts associated with the storage, use and transport of dangerous goods and hazardous substances. The method for delivery of explosives would be developed prior to the commencement of blasting (if proposed) in consultation with the Department of Planning, Industry and Environment and be timed to avoid the need for on-site storage• Potential risk of impacts to utilities (both above ground and underground) including:<ul style="list-style-type: none">• High voltage power lines located throughout the Stage 1 footprint• High pressure gas mains near the Clyde stabling and maintenance facility construction site• Gas distribution lines near all construction sites. <p>Ongoing consultation would be carried out with utility providers for high pressure gas or petroleum pipelines to identify appropriate construction methodologies to be implemented.</p>

27.7.3 Cumulative impacts

Potential temporary cumulative impacts during construction have been an important consideration given the potential overlap with a number of large infrastructure projects. Potential temporary cumulative impacts have been identified at the following locations:

- Westmead metro station construction site – potential concurrent construction of Parramatta Light Rail – Stage 1 (although the period of concurrent construction is anticipated to be minimal), major commercial and retail developments and future projects associated with strategic plans
- Parramatta metro station construction site – potential concurrent construction of Parramatta Light Rail – Stage 1 (although the period of concurrent construction is anticipated to be minimal), major commercial and retail developments and future projects associated with strategic plans
- Sydney Olympic Park metro station construction site – potential concurrent construction of the planned Parramatta Light Rail – Stage 2, major commercial and retail developments and future projects associated with strategic plans
- The Bays Station construction site – potential concurrent construction with WestConnex M4-M5 Link (although the period of concurrent construction is anticipated to be minimal), Western Harbour Tunnel and Warringah Freeway Upgrade, Sydney Metro City & Southwest (Chatswood to Sydenham).

Key potential construction stage cumulative issues are generally expected to be relatively minor and would include:

- Temporary local traffic impacts and accessibility
- Temporary noise and vibration (particularly night time works)
- Temporary visual impact and amenity effects of construction compounds and associated sites and activities
- Spoil disposal and disposal routes.

These impacts would be managed in accordance with the measures as outlined in Chapter 10 (Transport and traffic - Stage 1), Chapter 11 (Noise and vibration - Stage 1), Chapter 15 (Landscape character and visual amenity - Stage 1) and Chapter 24 (Spoil, waste management and resource use - Stage 1) respectively.

In addition, construction fatigue can potentially occur where nearby residents experience or have experienced extended periods of construction from concurrent or consecutive construction projects. This often includes where project construction activities overlap with other projects, or where there is little or no break between the activities of multiple adjacent projects. Coordination and engagement with other projects has been undertaken and would continue through construction to further manage fatigue impacts where possible.

Further opportunities to more effectively manage construction fatigue would also be considered during the design and construction. Any potential residual cumulative adverse impacts would be more than offset by the many and significant benefits of the Sydney Metro West.

As discussed in Chapter 5 (Stakeholder and community engagement), ongoing community consultation and stakeholder engagement would also be carried out so that potential cumulative impacts are better understood and reduced where possible.

A detailed assessment of cumulative impacts is provided for the Concept in Chapter 8 (Concept assessment) and for Stage 1 in Chapters 15 to 23.

27.8 Proposed measures to avoid or minimise impacts

At this stage measures to avoid or minimise impacts have been developed only for Stage 1 – which involves construction only. Measures applicable to the Concept including operation stage mitigation measures would be developed when planning approval applications are made for future stages.

27.8.1 Overall approach to environmental management

The overall approach to environmental management during construction is shown in Figure 27-4. This involves:

- Project design – measures incorporated in the design and construction planning to avoid and minimise impacts. Further information is provided in Chapter 8 (Concept environmental assessment) and Chapter 9 (Stage 1 description)
- Mitigation measures – identified as an outcome of the environmental impact assessment detailed in Chapters 10 to 27 and consolidated in Table 27-6

- Construction Environmental Management Framework – details the approach to environmental management and monitoring during construction. Further details are provided below
- Construction Noise and Vibration Standard – defines how construction noise and vibration will be managed for Sydney Metro West as a whole. Further details are provided below
- Construction Traffic Management Framework – provides the overall strategy and approach for construction traffic management for Sydney Metro West
- Design quality framework – being prepared in consultation with the Government Architect NSW to provide a high level process of how Sydney Metro ensures design quality throughout the project lifecycle, regardless of how the project is procured and delivered
- Environmental performance outcomes – future construction planning would be considered against the environmental performance outcomes provided in Section 27.9.

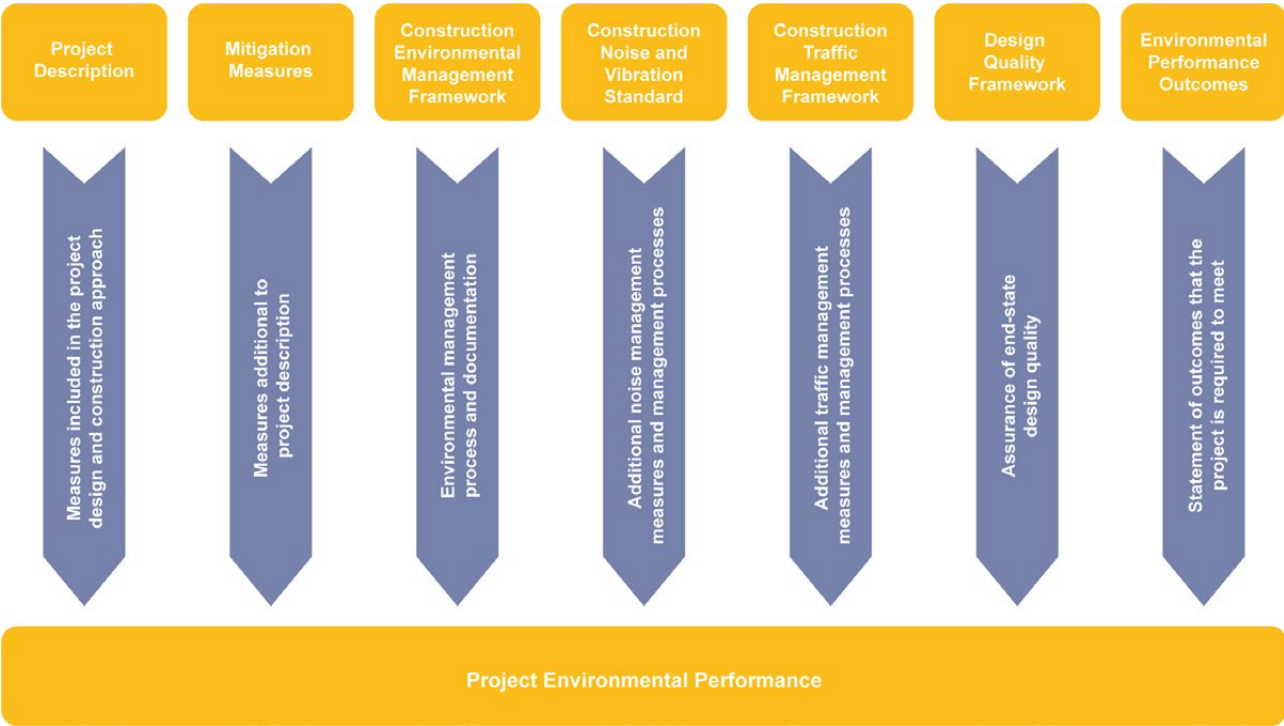


Figure 27-4 Approach to environmental mitigation and management

Construction Environmental Management Framework

The Sydney Metro Construction Environmental Management Framework (Appendix D) details the approach to environmental management and monitoring during construction. The framework is a linking document between planning approval documentation and construction environmental management documentation, which would be developed by the construction contractors.

The Construction Environmental Management Framework details the environmental, stakeholder and community management systems and processes for the construction of the project. Specifically, it details the requirements in relation to the Construction Environmental Management Plan, sub-plans and other supporting documentation for each specific environmental aspect.

Construction Noise and Vibration Standard

The Sydney Metro Construction Noise and Vibration Standard (Appendix E) defines how construction noise and vibration would be managed for Sydney Metro West as a whole. The Construction Noise and Vibration Standard provides guidance for managing construction noise and vibration impacts to provide a consistent approach to management and mitigation across all Sydney Metro projects.

The Construction Noise and Vibration Standard identifies the requirements and methodology to develop construction noise and vibration impact statements. These would be prepared prior to specific construction activities, based on a more detailed understanding of construction methods, including the size and type of construction equipment.

The Construction Noise and Vibration Standard also identifies standard mitigation measures that would be adopted during construction, and the framework and thresholds for the implementation of any additional mitigation measures during periods of noisy works.

Construction Traffic Management Framework

The Construction Traffic Management Framework provides the overall strategy and approach for construction traffic management for Sydney Metro West, and an outline of the traffic management requirements 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.

27.8.2 Environmental management measures

Table 27-6 provides a compilation of the measures to avoid, mitigate and/or manage the potential impacts of Stage 1 as identified in Chapters 10 to 26. The measures described in the chapters and compiled in this table were developed to take into account the findings of all the assessments carried out for the Environmental Impact Statement.

The mitigation measures compiled in Table 27-6, together with the approach to environmental management described in Section 27.8.1, provide Sydney Metro’s commitments for Sydney Metro West. The mitigation measures may be revised in response to submissions raised during public exhibition and/or any design changes made following exhibition. A revised list of mitigation measures would be provided in the submissions/preferred infrastructure report. If Stage 1 is approved, the conditions of approval, which would include references to the final mitigation measures, would guide subsequent stages of Sydney Metro West. Stage 1 would be carried out in accordance with the conditions of approval and the revised list of mitigation measures.

Table 27-6: Environmental management measures – Stage 1

Reference	Impact/issue	Mitigation measure	Application location(s) ¹
Traffic and transport			
TT1	Changes to the network	The community would be notified in advance of proposed road and pedestrian network changes through appropriate forms of community liaison.	All
TT2	Traffic incidents	In the event of a traffic related incident, coordination would be carried out with Transport for NSW, including Transport Coordination and/or the Transport Management Centre’s Operations Manager.	All
TT3	Emergency vehicles access	Access to properties for emergency vehicles would be provided at all times.	All
TT4	Road safety	Vehicle access to and from construction sites would be managed to maintain pedestrian, cyclist and motorist safety. Depending on the location, this may require manual supervision, physical barriers, temporary traffic signals and modifications to existing signals or, on occasions, police presence.	All
TT5	Road safety	Additional enhancements for pedestrian, cyclist and motorist safety near the construction sites would be implemented during construction. This would include measures such as: <ul style="list-style-type: none">Assessing the suitability of construction haulage routes through sensitive land use areas with respect to road safetyDeployment of speed awareness signs in conjunction with variable message signs near construction sites to provide alerts to driversProviding community education and awareness about sharing the road safely with heavy vehiclesSpecific construction driver training to understand route constraints, safety and environmental considerations such as sharing the road safely with other road users and limiting the use of compression brakingRequiring technology and equipment to improve vehicle safety, eliminate heavy vehicle blind spots, and monitor vehicle location and driver behaviour.	All
TT6	Road safety	All trucks would enter and exit construction sites in a forward direction, where feasible and reasonable.	All
TT7	Congestion	Construction site traffic would be managed to minimise movements during peak periods.	All
TT8	Congestion	Construction site traffic immediately around construction sites would be managed to minimise vehicle movements through school zones during pick up and drop off times.	WMS, PMS, BNS, FDS
TT9	Congestion	Opportunities to minimise impacts at the Alexandra Avenue/Bridge Road intersection would be determined in consultation with Transport for NSW.	WMS
TT10	Loss of parking	Where existing parking is removed to facilitate construction activities, consultation would occur with the relevant local council to investigate opportunities to provide alternative parking facilities.	All
TT11	Loss of parking	Construction sites would be managed to minimise the number of construction workers parking on surrounding streets by: <ul style="list-style-type: none">Encouraging workers to use public or active transportEncouraging ride sharingProvision of alternative parking locations and shuttle bus transfers where feasible and reasonable.	All
TT12	Change of bus stop locations	Any relocation of bus stops and kiss-and-ride facilities would be carried out in consultation with Transport for NSW including Transport Coordination (for relevant locations), the relevant local council and bus operators. Wayfinding and customer information would be provided to notify customers of relocated bus stops.	WMS, NSMS, BNS
TT13	Bus priority	Opportunities to improve bus priority along the temporary detour at Westmead metro station construction site would be investigated during detailed design.	WMS
TT14	Active transport	Pedestrian and cyclist access would be maintained during the temporary closure of Alexandra Avenue. Wayfinding and customer information would be provided to guide pedestrians and cyclists to alternative routes.	WMS
TT15	Impacts on active transport	Where existing cyclist facilities (e.g. bicycle parking) would be temporarily unavailable to facilitate construction activities, suitable replacement facilities would be provided for this duration.	WMS, PMS
TT16	Taxi relocation	Any relocation of taxi ranks would be carried out in consultation with Transport for NSW, the relevant local council and taxi operators. Wayfinding and customer information would be provided to notify customers of relocated taxi ranks.	SOPMS

Reference	Impact/issue	Mitigation measure	Application location(s) ¹
TT17	Impacts on special events	During major special events, impacts to the transport and traffic network would be reduced by (as necessary): <ul style="list-style-type: none"> Minimising the level of construction activity, and if necessary, ceasing all construction activity Maintaining appropriate access to all areas within the event precinct Erection of hoardings, site fencing and gates at key locations within the construction site boundary to permit pedestrian movements adjacent to the construction site and separate pedestrians from construction vehicles Scheduling deliveries to the construction site outside of event periods. For special events that require specific traffic measures, those measures would be developed in consultation with Transport for NSW, including Transport Coordination (for relevant locations) and the organisers of the event.	PMS, CSMF, SOPMS
TT18	Property access	Access to existing properties and buildings would be maintained in consultation with property owners.	All
TT19	Construction vehicle impacts	Traffic control measures required at the Parramatta metro station construction site access on George Street would be determined in consultation with Transport for NSW.	PMS
TT20	Construction vehicle impacts	Adjustments to site access arrangements and the local road network would be explored during detailed design to minimise conflicts with heavy vehicle movements.	NSMS, FDS
TT21	Construction vehicle impacts	Construction site traffic generated at the Five Dock Station construction site would be managed to avoid or minimise travel during the evening peak period.	FDS
TT22	Construction vehicle impacts	Construction site traffic generated at the Five Dock Station construction site would be managed to minimise movements during church service times at St Albans Anglican Church.	FDS
TT23	Construction vehicle impacts	Opportunities to provide vehicle access and egress directly to Parramatta Road and minimise the use of Loftus Street at the Burwood North Station construction site would be explored during detailed design.	BNS
TT24	Cumulative construction traffic impacts	Co-ordination of traffic management arrangements between major construction projects would occur in consultation with Transport for NSW including Transport Coordination.	TBS
Noise and vibration			
NV01	Community preference for noise mitigation and management	Further engagement and consultation would be carried out with: <ul style="list-style-type: none"> The affected communities to understand their preferences for mitigation and management measures. 'Other sensitive' receivers such as schools, medical facilities or places of worship to understand periods in which they are more sensitive to impacts. Based on this consultation, appropriate mitigation and management options would be considered and implemented where feasible and reasonable to minimise the impacts.	All
NV02	Alternative construction methodologies	Alternative construction methodologies and measures that minimise noise and vibration levels during noise intensive works would be investigated and implemented where feasible and reasonable. This would include consideration of: <ul style="list-style-type: none"> The use of hydraulic concrete shears in lieu of hammers/rock breakers Sequencing works to shield noise sensitive receivers by retaining building wall elements Locating demolition load out areas away from the nearby noise sensitive receivers Providing respite periods for noise intensive works Minimising structural-borne noise to adjacent buildings including separating the structural connection prior to demolition through saw-cutting and propping, using hand held splitters and pulverisers or hand demolition Installing sound barrier screening to scaffolding facing noise sensitive neighbours Using portable noise barriers around particularly noisy equipment, such as concrete saws Modifying demolition works sequencing / hours to minimise impacts during peak pedestrian times and / or adjoining neighbour outdoor activity periods. 	All
NV03	Construction noise – respite periods	Appropriate respite would be provided to affected receivers in accordance with the Sydney Metro Construction Noise and Vibration Standard. This would include consideration of impacts from Stage 1 utility and power supply works when determining appropriate respite periods for affected receivers. When determining appropriate respite, the need to efficiently undertake construction would be balanced against the communities' preferred noise and vibration management approach.	All
NV04	Construction noise – out of hours work	The use of noise intensive equipment at construction sites with 'moderate' and 'high' out-of-hours noise management level exceedances would be scheduled for standard construction hours, where feasible and reasonable. Where this is not feasible and reasonable, the works would be undertaken as early as possible in each work shift.	All
NV05	Night-time noise impacts	Air brake silencers would be used on heavy vehicles that access construction sites multiple times per night or over multiple nights.	All
NV06	Sleep disturbance impacts from heavy vehicles	Perimeter site hoarding would be designed with consideration of on-site heavy vehicle movements with the aim of minimising sleep disturbance impacts.	All
NV07	Noise emissions from equipment	Long term construction site support equipment and machinery would be low noise emitting and suitable for use in residential areas, where feasible and reasonable. Examples include: <ul style="list-style-type: none"> Low noise water pumps for use in water treatment facilities Low noise generators and compressors Low noise air conditioner units for use of amenities buildings. 	All

Reference	Impact/issue	Mitigation measure	Application location(s) ¹
NV08	Acoustic sheds	For all sites where acoustic sheds are proposed, the sheds would be designed and constructed to minimise noise emissions. This would likely include the following considerations: <ul style="list-style-type: none">• All significant noise producing equipment that would be used during the night-time would be inside the shed, where feasible and reasonable• Noise generating ventilation systems such as compressors, scrubbers, etc, would also be inside the shed and external air intake/discharge ports would be appropriately acoustically treated• The door of the acoustic shed would be kept closed during the night-time period, where feasible and reasonable. Where night-time vehicle access is required, the doors would be designed and constructed to minimise noise breakout.	WMS, SOPMS, BNS, FDS, TBS
NV09	Ground-borne noise	Feasible and reasonable measures would be implemented to minimise ground-borne noise where exceedances are predicted. This may require implementation of less ground-borne noise and less vibration intensive alternative construction methodologies.	All
NV10	Ground-borne noise – cross passages	The proximity of cross passages to nearby receivers and the corresponding construction ground-borne noise and vibration impacts during the excavation works would be considered when determining locations. Relocation of cross passages to be further away from sensitive receivers to mitigate potential construction impacts would be considered, where feasible and reasonable.	Metro rail tunnels
NV11	Ground-borne noise – underground rockbreaking	An activity specific Construction Noise and Vibration Impact Statement (in accordance with the requirements of the Construction Noise and Vibration Standard) would be developed for rockbreaking in the tunnel and at cross passages, specifically addressing the activity where it is required between 10pm-7am.	Metro rail tunnels
NV12	Blasting Management Strategies	Blasting would be planned during hours that would cause the least disruption and disturbance to the nearest receivers. Notification protocols prior to blasting for the nearest sensitive receivers would be established.	WMS, PMS, SSF, SOPMS, NSMS, BMS, FDS, TBS
NV13	Blasting Monitoring	Attended vibration and overpressure measurements would be completed at the start of any blasting activities to confirm that vibration levels are within the blasting criteria.	WMS, PMS, SSF, SOPMS, NSMS, BMS, FDS, TBS
NV14	Construction traffic noise	Further assessment of construction traffic would be completed during detailed design, including consideration of the potential for exceedances of the NSW Road Noise Policy base criteria (where greater than 2 dB increases are predicted). The potential impacts would be managed using the following approaches, where feasible and reasonable: <ul style="list-style-type: none">• On-site spoil storage capacity would be maximised to reduce the need for truck movements during sensitive times• Vehicle movements would be redirected away from sensitive receiver areas and scheduled during less sensitive times• The speed of vehicles would be limited and the use of engine compression brakes would be avoided• Heavy vehicles would not be permitted to idle near sensitive receivers.	All
NV15	Noise impacts to horses at Rosehill Racecourse Stables	Consultation with the owners and operators of the horse stables near the Clyde stabling and maintenance facility construction site would be carried out so that potential impacts to horses are appropriately managed.	CSMF
NV16	Construction vibration	Where vibration levels are predicted to exceed the screening criteria, a more detailed assessment of the structure (in consultation with a structural engineer) and attended vibration monitoring would be carried out to ensure vibration levels remain below appropriate limits for that structure. For heritage items, the more detailed assessment would specifically consider the heritage values of the structure in consultation with a heritage specialist to ensure sensitive heritage fabric is adequately monitored and managed.	All
NV17	Building condition surveys – construction vibration	Condition surveys of buildings and structures near to the tunnel and excavations would be undertaken prior to the commencement of excavation at each site, where appropriate. For heritage buildings and structures the surveys would consider the heritage values of the structure in consultation with a heritage specialist.	All
NV18	Cumulative construction noise impacts	The likelihood of cumulative construction noise impacts would be reviewed during detailed design when detailed construction schedules are available. Co-ordination would occur between potentially interacting projects to minimise concurrent or consecutive works in the same areas, where possible. Specific mitigation strategies would be developed to manage impacts. Depending on the nature of the impact, this could involve adjustments to construction program or activities of Sydney Metro West or of other construction projects.	All
NV19	Operational road traffic noise impacts	Further assessment of operational road traffic noise mitigation would be undertaken for receivers identified as being eligible for consideration of treatment. The mitigation would likely include at-property treatment. Receivers that are identified as requiring at-receiver noise mitigation would be identified and, where possible, offered treatment prior to the start of construction works which have the potential to affect them.	WMS
Non-Aboriginal heritage			
NAH1	Archival recording	Archival recording and reporting of the following heritage items would be carried out in accordance with the NSW Heritage Office's How to Prepare Archival Records of Heritage Items (1998), and Photographic Recording of Heritage Items Using Film or Digital Capture (2006): <ul style="list-style-type: none">• Shops (and potential archaeological site)(Parramatta LEP Item No. I703)• Kia Ora (and potential archaeological site) (Parramatta LEP Item No. I716)• RTA Depot (Parramatta LEP Item No. I576)• State Abattoirs (SEPP Listing No. A)• White Bay Power Station (SHR Listing No. 01015)	PMS, CSMF, SOPMS, TBS
NAH2	Demolition	A method for the demolition of existing buildings and/or structures at specified construction sites would be developed to minimise direct and indirect impacts to adjacent and/or adjoining heritage items.	PMS, CSMF, SOPMS, TBS

Reference	Impact/issue	Mitigation measure	Application location(s) ¹
NAH3	Salvage	Prior to commencement of demolition of heritage elements at White Bay Power Station within The Bays construction site, significant heritage fabric would be identified for salvage and reuse opportunities for salvaged fabric considered.	TBS
NAH4	Visual impacts	The policies of the White Bay Power Station Conservation Management Plan would be considered in regard to visual impacts of the Stage 1 works, particularly the acoustic shed (or other acoustic measures) and any temporary structures. Significant view lines would be retained during Stage 1 works.	TBS
NAH5	Heritage interpretation	Where heritage items, including significant archaeology are impacted by Stage 1 works, consideration would be given to their inclusion in the Heritage Interpretation Plan for future stages.	All
NAH6	Archaeology	An archaeological research design(s) would be prepared and implemented identifying archaeological testing or monitoring requirements, which would be carried out in accordance with Heritage Council guidelines, and where appropriate supervised by a suitably qualified Excavation Director with experience in managing State significant archaeology.	All
NAH7	Archaeology	An Archaeological Excavation Report would be prepared by the Excavation Director and be provided to the NSW Heritage Division within two years of the completion of archaeological excavations specified in the archaeological research design(s).	All
NAH8	Archaeology	In the event that State significant archaeology associated with early convict occupation is located at Parramatta metro station: <ul style="list-style-type: none"> • In situ conservation would be considered. If in situ conservation is not feasible and reasonable, a strategy to mitigate impacts would be prepared in consultation with the NSW Heritage Council (or delegate) • An Archaeological Method Statement would be prepared in consultation with the NSW Heritage Council (or delegate) for management of the archaeological remains, whether for conservation or archaeological investigation and recording • An accessible publication would be prepared within two years of archaeological excavations to document the archaeological investigations • Sydney Metro would provide for the meaningful curation, display and public access of any artefacts collected. This may involve partnerships with museums, local heritage centres and/or universities. 	PMS
NAH9	Direct heritage impacts	The impacted gardens within the State Abattoirs would be reinstated with sympathetic landscaping that is in keeping with the provisions of the Conservation Management plan	SOPMS
Aboriginal heritage			
AH1	Consultation	Aboriginal stakeholder consultation would be carried out in accordance with the NSW Department of Planning, Industry and Environment's (Environment, Energy and Science Group), Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010.	All
AH2	Test excavation	Archaeological test excavation (and salvage when required) would be carried out where intact natural profiles with the potential to contain significant archaeological deposits are encountered at the specified construction sites and the Parramatta power supply route. Excavations would be conducted in accordance with the methodology outlined in the Aboriginal cultural heritage assessment report.	PMS, CSMF, TBS and PSR
AH3	Aboriginal heritage interpretation	If Aboriginal archaeological remains are recovered during Stage 1, results would be incorporated into Aboriginal heritage interpretation for the Concept in consultation with registered Aboriginal parties.	All
AH4	Unexpected finds	In the event that a potential burial site or potential human skeletal material is exposed during construction, the Sydney Metro Exhumation Management Plan would be implemented.	All
Property and land use			
LU1	Temporary use	Except where required for subsequent construction activities associated with future stages of the Concept, temporary use areas for construction purposes would be stabilised and appropriately rehabilitated as soon as feasible and reasonable following completion of construction. This would be carried out in consultation with the relevant landowner.	All
Landscape character and visual amenity			
LV1	Visual impacts	Where feasible and reasonable, the elements within construction sites would be located to minimise visual impacts (for example storing materials and machinery behind fencing).	All
LV2	Visual impacts	The design and maintenance of construction site hoardings would aim to minimise visual amenity and landscape character impact.	All
LV3	Visual impacts	Graffiti would be removed promptly from hoardings and any other aspects of construction sites.	All
LV4	Visual impacts	All structures (including acoustic sheds or other acoustic measures, site offices and workshop sheds) would be finished in a colour which aims to minimise their visual impact, if visible from areas external to the construction site. This finish is to be applied to all visible fixtures and fittings (including exposed downpipes).	WMS, PMS, SOPMS, SNMS, BNS, FDS
LV5	Lighting impacts	Lighting of construction sites would be orientated to minimise glare and light spill impacts on adjacent receivers.	All
LV6	Public art	Public art would be adopted on temporary hoarding, particularly around future station precincts. Implementation would be as soon as feasible and reasonable after the commencement of construction, and any public art would remain for the duration of the construction period.	All
LV7	Visual impacts affecting events	Works would be coordinated with the Department of Planning, Industry and Environment to manage the potential impact of construction on sporting events in other areas of Sydney Olympic Park.	SOPMS
LV8	Visual impacts affecting events	Works would be coordinated with City of Canada Bay Council to manage the potential impact of construction on sporting events at Concord Oval.	BNS
LV9	Overshadowing	Where feasible and reasonable the location and height of the acoustic shed at the Five Dock Station (if required) would be designed to minimise overshadowing of Fred Kelly Place between 10am and 3pm in mid-winter.	FDS

Reference	Impact/issue	Mitigation measure	Application location(s) ¹
LV10	Activation of streetscapes	Opportunities to provide temporary activation in the vicinity of the Five Dock Station western construction site during construction would be explored in consultation with the City of Canada Bay Council.	FDS
LV11	Trees	Opportunities for the retention and protection of existing street trees and trees within the site would be identified during detailed construction planning.	All
LV12	Trees	Existing trees to be retained would be protected prior to the commencement of construction in accordance with Australian Standard AS4970 the Australian Standard for Protection of Trees on Development Sites and Adjoining Properties.	All
LV13	Trees	Trees removed by Stage 1 would be replaced to achieve no net loss to tree numbers and/or canopy in proximity to the site as a minimum in the long term (and part of future stages of Metro West).	All
LV14	Trees	Opportunities would be investigated with the relevant local council to provide plantings in proximity to the impacted areas prior to construction commencing where feasible and reasonable.	All
Business impacts			
BI1	General business impacts	Small business owner engagement would be undertaken to assist small business owners adversely impacted by construction.	All
BI2	Power and utility interruptions	Planned power and utility interruptions would be scheduled to before or after typical business hours where feasible and reasonable. Prior notice would be provided to all affected business owners of the interruptions.	All
BI3	Business visibility and accessibility	Hoarding and screening impacting the visibility of business would be minimised where feasible and reasonable, without compromising public safety or the effective management of construction airborne noise. Clear pathways and signage would be implemented around construction sites to maximise visibility of retained businesses, including sufficient lighting along pedestrian footpaths during night-time where relevant.	All
Social impacts			
S1	Impacts on social infrastructure	Consultation would be carried out with managers of social infrastructure located near construction sites about the timing and duration of construction works and management of potential impacts, with the aim of minimising potential disruptions to the use of the social infrastructure from construction activity.	WMS, PMS, CSMF, SSF, SOPMS, NSMS, BNS, FDS, TBS
S2	Loss of social infrastructure	Engagement would be carried out with Parramatta City Council to identify alternative locations for the Parramatta Artist Studios to provide opportunities for facilitating local creative and cultural activities.	PMS
S3	Social impacts	A Community Benefit Plan would be developed to guide the development of community benefit initiatives (by Principal Contractors) during construction of Stage 1 to make a positive contribution to the potentially affected community. The key objectives of the plan would include: <ul style="list-style-type: none"> Identify opportunities to create environmental and community benefits and provide positive social outcomes Respond to community priorities and needs in the locality of each relevant construction site. 	WMS, PMS, SOPMS, NSMS, BNS, FDS, TBS
S4	Impacts on events or festivals	In addition to mitigation measure TT17, consultation would be carried out with festival and event organisers in proximity to construction sites to mitigate potential impacts on the operation of the festival or event.	PMS, FDS
S5	Promote local cultural and identity	In addition to mitigation measure LV16, consultation would be carried out with stakeholders to identify opportunities for public art to reflect community values, culture and identity of the local community.	WMS, PMS, SOPMS, NSMS, BNS, FDS
S6	Activation of streetscapes	In addition to mitigation measure LV10, potential temporary activation in the vicinity of the Five Dock Station western construction site would include opportunities to provide spaces and places for the community to gather and meet each other, culture and identity.	FDS
Groundwater and ground movement			
GW1	Loss of groundwater available to existing groundwater (bore supply) users	Site inspection would be carried out on private domestic supply bore GW305646 to confirm the current viability of that bore. If found to be viable, the bore would be monitored throughout construction. Make good measures would be implemented if a loss of yield were to occur.	BNS
GW2	Potential reduced baseflow to Toongabbie Creek, Domain Creek, A'Becketts Creek, Duck Creek, Haslams Creek, Powells Creek and the Mason Park wetlands, Bicentennial Park wetlands, Brickpit and Powells Creek Reserve	A review of additional geotechnical and hydrogeology data would be undertaken to confirm the geological and groundwater conditions and determine, based on these local conditions, whether predicted groundwater drawdown from Stage 1 is likely to occur in the vicinity of these creeks. Where the additional data review shows local conditions and predicted groundwater drawdown are likely to cause surface water/groundwater interaction, then additional site investigations (in accordance with GW3) would be undertaken for those creeks or surface water bodies.	WMS, CSMF, SOPMS, NSMS

Reference	Impact/issue	Mitigation measure	Application location(s) ¹
GW3	Potential reduced baseflow to Toongabbie Creek, Domain Creek, A'Becketts Creek, Duck Creek, Haslams Creek, Powells Creek and the Mason Park wetlands, Bicentennial Park wetlands, Brickpit and Powells Creek Reserve Requirements for baseline monitoring of hydrological attributes	Additional site investigations would be carried out at creeks or surface water bodies where the additional data review in GW2 shows there is a likely surface water/groundwater interaction. This would involve baseline monitoring of creek flows (streamflow gauging) prior to construction, and baseflow streamflow analysis to confirm the existing groundwater baseflow contribution to streamflow for each creek. Where a significant reduction in baseflow is predicted due to Stage 1, design responses would be implemented at station and shaft excavations to reduce potential baseflow loss.	WMS, CSMF, SOPMS, NSMS
GW4	Requirements for baseline monitoring of hydrological attributes. Migration of contaminants in groundwater and reduction in beneficial uses of aquifers	Monitoring of groundwater levels and quality at the site area would occur before, during and after construction. This would also include monitoring of potential contaminants of concern. Groundwater level data would be regularly reviewed during and after construction by a qualified hydrogeologist.	WMS, PMS, CSMF, SSF, SOPMS, NSMS, BNS, FDS, TBS
GW5	Ground movement and settlement	A detailed geotechnical model for Stage 1 would be developed and progressively updated during design and construction. The detailed geotechnical model would include: <ul style="list-style-type: none">Assessment of the potential for damage to structures, services, basements and other sub-surface elements through settlement or strainPredicted changes to groundwater levels, including at nearby water supply works. Where building damage risk is rated as moderate or higher (as per the CIRIA 1996 risk-based criteria), a structural assessment of the affected buildings/ structures would be carried out and specific measures implemented to address the risk of damage. Where a significant exceedance of target changes to groundwater levels are predicted at surrounding land uses and nearby water supply works, an appropriate groundwater monitoring program would be developed and implemented. The program would aim to confirm no adverse impacts on groundwater levels or to appropriately manage any impacts. Monitoring at any specific location would be subject to the status of the water supply work and agreement with the landowner.	Where required
GW6	Ground movement and settlement	Condition surveys of buildings and structures in the vicinity of the tunnel and excavations would be carried out prior to the commencement of excavation at each site.	Where required
Soils			
SSWQ1	Acid sulfate soils	Prior to ground disturbance in areas of potential acid sulfate soil occurrence, testing would be carried out to determine the presence of actual and/or potential acid sulfate soils. If acid sulfate soils are encountered, they would be managed in accordance with the <i>Acid Sulfate Soil Manual</i> (ASSMAC, 1998)	PMS, CSMF, TBS
SSWQ2	Soil salinity	Prior to ground disturbance in high probability salinity areas, testing would be carried out to determine the presence of saline soils. If salinity is encountered, excavated soils would not be reused or it would be managed in accordance with Book 4 Dryland Salinity: Productive Use of Saline Land and Water (NSW DECC 2008). Erosion controls would be implemented in accordance with Blue Book (Landcom, 2004).	All
Surface water quality			
SSWQ3	Erosion and sedimentation	Erosion and sediment measures would be implemented at all construction sites in accordance with the principles and requirements in Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom 2004) and Volume 2D (NSW Department of Environment, Climate Change and Water 2008), commonly referred to as the 'Blue Book'. Additionally, any water collected from construction sites would be appropriately treated and discharged to avoid any potential contamination or local stormwater impacts. Temporary sediment basins would be designed in accordance with Managing Urban Stormwater: Soils and Construction and Managing Urban Stormwater, Volume 2D: Main Road Construction (DECC, 2008).	All
SSWQ4	Working in waterways and surrounding low lying areas	Works in waterways and surrounding low lying areas would be carried out in accordance with progressive erosion and sediment control plans.	CSMF
SSWQ5	Wastewater discharge	The water treatment plants would be designed so that wastewater is treated to a level that is compliant with the ANZECC/ARMCANZ (2000) and ANZG (2018) default guidelines for 95 per cent species protection.	All
SSWQ6	Water quality monitoring	A surface water monitoring program would be implemented to observe any changes in surface water quality that may be attributable to Stage 1 and inform appropriate management responses. The program would be developed in consultation with the EPA and relevant Councils. The program would consider monitoring being undertaken as part of other infrastructure projects such as the WestConnex M4 East monitoring. Monitoring would occur during pre-construction and during construction at all waterways with the potential to be impacted. Monitoring sites could be located upstream and downstream of the potential discharges and would include sampling for key indicators of concern.	All
SSWQ7	Local stormwater capacity	Further design development would confirm the local stormwater system capacity to receive construction water treatment plant inflows. In the event there is a stormwater infrastructure capacity issue with existing infrastructure, mitigation measures such as storage detention to control water outflow during wet weather events would be implemented.	All

Reference	Impact/issue	Mitigation measure	Application location(s) ¹
Contamination			
C1	Management of low risk contamination	For sites where potential contamination risk is moderate, high or very high, a further review of data would be performed. Where the additional data review provides sufficient information to confirm that contamination is likely to have a very low or low risk, the site would then be managed in accordance with the Soil and Water Management Plan. This would typically occur where there is minor, isolated contamination that can be readily remediated through standard construction practices such as excavation and off-site disposal.	All
C2	Detailed Site Investigation	Where data from the additional data review (mitigation measure C1) is insufficient to understand the risk of contamination, a Detailed Site Investigation would be carried out in accordance with the National Environment Protection Measure (2013) and other guidelines made or endorsed by the NSW EPA. The sites requiring a Detailed Site Investigation would be confirmed following the additional data review (mitigation measure C1), however on the basis of the Stage 1 assessment, it is anticipated that Detailed Site Investigations would be required at the specified application locations.	CSMF, SSF, SOPMS, TBS
C3	Remediation	Where data from the additional data review (mitigation measure C1) or the Detailed Site Investigation (mitigation measure C2) confirms that contamination would have a moderate, high or very high risk, a Remediation Action Plan would be developed for the area of the construction footprint. Each Remediation Action Plan would detail the remediation works required to mitigate risks from contamination throughout and following completion of construction. The Remediation Action Plan would be prepared in accordance with relevant NSW EPA guidelines and where applicable, detail remediation methodologies in accordance with Australian Standards and other relevant government guidelines and codes of practice. Remediation would be performed as an integrated component of construction and to a standard commensurate with the proposed end use of the land. The sites requiring Remediation Action Plans and remediation would be confirmed following the additional data review (mitigation measure C1) and Detailed Site Investigation (mitigation measure C2), however on the basis of the Stage 1 assessment, it is anticipated that Remediation Action Plans and remediation could be required at the specified application locations.	CSMF, SSF, SOPMS, TBS
C4	Site Audit Statement	Where contamination is highly complex, such as significant groundwater contamination; contamination associated with vapour; contamination that requires specialised remediation techniques; or contamination that requires ongoing active management during and beyond construction, an accredited Site Auditor would review and approve the Remediation Action Plan, and would develop a Site Audit Statement and Site Audit Report upon completion of remediation. The sites requiring Site Audit Statements would be confirmed following the preparation of Remediation Action Plans (mitigation measure C3), however on the basis of the Stage 1 assessment, it is anticipated that Site Audit Statements would be required at the specified application locations.	CSMF, SOPMS, TBS, and as applicable
C5	Residual contamination following construction	Ongoing management and monitoring measures would be documented in an appropriate form and implemented for any areas where minor, residual contamination remains following construction.	As applicable
Hydrology and flooding			
HF1	Flooding behaviour impacts	Detailed construction planning would consider flood risk at construction sites. This would include: <ul style="list-style-type: none"> • Identification of measures to not worsen flood impacts on the community and on other property and infrastructure during construction up to and including the one per cent AEP flood event • Provide flood-proofing to excavations at risk of flooding or coastal inundation during construction, where feasible and reasonable, such as raised entry into shafts and/or pump-out facilities to minimise ingress of floodwaters into shafts and the dive structure • Review of site layout and staging of construction works to avoid or minimise obstruction of overland flow paths and limit the extent of flow diversion required. This includes design of site hoardings to minimise disruption to flow paths (if possible). Not worsen is defined as: <ul style="list-style-type: none"> • A maximum increase in flood levels of 50mm in a one per cent AEP flood event • A maximum increase in time of inundation on one hour in a one per cent AEP flood event • No increase in potential soil erosion and scouring from any increase in flow velocity in a one per cent AEP flood event. 	PMS, CSMF, SSF, NSMS, TBS
HF2	Flooding behaviour impacts	On-site stormwater detention would be provided for the Clyde stabling and maintenance facility to manage peak site runoff rates and volumes due to increased imperviousness of the site.	CSMF
HF3	Flooding behaviour impacts	Further design refinement at the Clyde stabling and maintenance facility construction site would occur during detailed design to mitigate the identified potential impacts including: <ul style="list-style-type: none"> • The increases in flood levels of up to 0.08 metres in Duck Creek and adjacent properties in the one per cent AEP flood event • Increases in flow velocities and the potential increased risk of scour at the proposed creek crossings and in the downstream channels • The potential flooding impacts from filled features including the road overbridge approach. 	CSMF
HF4	Flooding behaviour impacts	Drainage at construction sites would be designed, where feasible and reasonable, to mitigate potential alterations to local runoff conditions due to construction sites.	All
HF5	Flooding behaviour impacts	Detailed construction planning for The Bays Station construction would aim to minimise changes to existing levels in relation to potential impacts on flood behaviour, along the north-western side of site adjacent to low-lying property, to minimise reduction in floodplain storage.	TBS
HF6	Flood protection	Consultation would occur with the proponent of the Camellia Town Centre redevelopment to understand potential flood impacts from the redevelopment on Stage 1 and to identify any additional flood protection (if required).	PMS
HF7	Flooding emergency management	Construction planning regarding flooding matters would be carried out in consultation with the NSW State Emergency Service and the relevant local council.	PMS, CSMF, TBS
HF8	Impacts to flood mitigation works	Detailed construction planning for The Bays Station construction site would aim to avoid conflicts with the potential construction of flood mitigation works in Robert Street, in consultation with Inner West Council.	TBS

Reference	Impact/issue	Mitigation measure	Application location(s) ¹
Biodiversity			
B1	Impacts to fish passage	During construction, sufficient flow and fish passage would be maintained similar to current conditions during in-stream works where feasible and reasonable.	CSMF
B2	Impacts of proposed creek crossings	The A'Becketts Creek and Duck Creek crossings would be designed to: <ul style="list-style-type: none"> • Provide sufficient fish passage in accordance with Policy and guidelines for fish habitat conservation and management Update 2013 (DPI (Fisheries NSW) 2013) • Incorporate suitable scour protection • Avoid worsening existing flow velocities downstream from the crossing locations • Incorporate a vegetated riparian zone within the realigned open channel sections where feasible and reasonable. 	CSMF
B3	Impacts to groundwater dependent ecosystems	Additional investigations and assessment would be completed to confirm the potential for impacts to groundwater dependant ecosystems due to groundwater drawdown, and to identify any required mitigation through design.	WMS, CSMF, NSMS, BNS, FDS
Air quality			
AQ1	Dust impacts	The following best-practice dust management measures would be implemented during all construction works: <ul style="list-style-type: none"> • Regularly wet-down exposed and disturbed areas including stockpiles, especially during dry weather • Adjust the intensity of activities based on measured and observed dust levels and weather forecasts • Minimise the amount of materials stockpiled and position stockpiles away from surrounding receivers • Regularly inspect dust emissions and apply additional controls as required • Implement all relevant measures listed in the UK IAQM corresponding to the highest level of risk determined around each Stage 1 construction site. 	All
AQ2	Exhaust emissions from the combustion of fossil fuels	Plant and equipment would be maintained in a proper and efficient manner. Visual inspections of emissions from plant would be carried out as part of pre-acceptance checks.	All
AQ3	Odour emissions	The following best-practice odour management measures would be implemented during relevant construction works: <ul style="list-style-type: none"> • The extent of opened and disturbed contaminated soil at any given time would be minimised • Temporary coverings or odour suppressing agents would be applied to excavated areas where appropriate • Regular monitoring would be conducted during excavation to verify that no offensive odours are being generated. 	All
Spoil, waste management and resource use			
WR1	Compliance with legislative and policy requirements	All waste would be assessed, classified, managed, transported and disposed of in accordance with the Waste Classification Guidelines.	All
WR2	Disposal of hazardous materials	A hazardous material survey would be completed for those buildings and structures suspected of containing hazardous or special waste materials (particularly asbestos) prior to their demolition. If hazardous waste or special waste (e.g. asbestos) is encountered, it would be handled and managed in accordance with relevant legislation, codes of practice and Australian standards.	All
WR3	Waste minimisation	Construction waste would be minimised by accurately calculating materials brought to the site and limiting materials packaging.	All
WR4	Reuse and recycling	Waste streams would be segregated to avoid cross-contamination of materials and maximise reuse and recycling opportunities.	All
WR5	Reuse on Sydney Metro West sites	A materials tracking system would be implemented for material transferred between Sydney Metro West sites and to offsite locations such as licensed waste management facilities.	All
Hazards			
HA1	Risks to people, property and the environment associated with transport and storage of explosives	The method for delivery of explosives would be developed prior to the commencement of blasting (if proposed) in consultation with the Department of Planning, Industry and Environment and be timed to avoid the need for on-site storage.	All
HA2	Impacts on underground utilities	Dial before you dig searches and non-destructive digging would be carried out to identify the presence of underground utilities.	All
HA3	Impacts on underground utilities	Ongoing consultation would be carried out with utility providers for high pressure gas or petroleum pipelines to identify appropriate construction methodologies to be implemented. Any interaction with high pressure gas or petroleum pipelines would comply with the relevant standards, including AS 2885 Pipelines – Gas and Liquid Petroleum.	All
Sustainability and climate change			
SCC1	Sustainability implementation	Sustainability initiatives would be incorporated into the detailed design and construction to support the achievement of the Sydney Metro West sustainability objectives.	All
SCC2	Sustainability implementation	Best practice level of performance would be achieved using market leading sustainability rating tools during design and construction.	All
SCC3	Climate change risks	Climate change risk treatments would be confirmed and incorporated into the detailed design.	All
SCC4	Greenhouse gas emissions	An iterative process of greenhouse gas assessments and design refinements would be carried out during detailed design and construction to identify opportunities to minimise greenhouse gas emissions. Performance would be measured in terms of a percentage reduction in greenhouse gas emissions from a baseline inventory calculated at the detailed design stage.	All

Reference	Impact/issue	Mitigation measure	Application location(s) ¹
SCC5	Greenhouse gas emissions	25 per cent of the greenhouse gas emissions associated with consumption of electricity during construction would be offset.	All
Cumulative impacts			
CI1	Occurrence of Cumulative impacts	<p>Co-ordination and consultation with the following stakeholders would occur where required to manage the interface of projects under construction at the same time:</p> <ul style="list-style-type: none">• Other parts of Transport for NSW including Transport Coordination• Department of Planning, Industry and Environment• Sydney Trains• NSW Trains• Sydney Buses• Sydney Water• Port Authority of NSW• Sydney Motorways Corporation• Emergency service providers• Utility providers• Construction contractors. <p>Co-ordination and consultation with these stakeholders would include:</p> <ul style="list-style-type: none">• Provision of regular updates to the detailed construction program, construction sites and haul routes• Identification of key potential conflict points with other construction projects• Developing mitigation strategies in order to manage conflicts. Depending on the nature of the conflict, this could involve:<ul style="list-style-type: none">• Adjustments to the Sydney Metro construction program, work activities or haul routes; or adjustments to the program, activities or haul routes of other construction projects• Co-ordination of traffic management arrangements between projects.	All

Note 1: WMS: Westmead metro station; PMS: Parramatta metro station; CSMF: Clyde stabling and maintenance facility; SSF: Silverwater services facility; SOPMS: Sydney Olympic Park metro station; NSMS: North Strathfield metro station; BNS: Burwood North Station; FDS: Five Dock Station; TBS: The Bays Station; Metro rail tunnels: Metro rail tunnels not related to other sites (e.g. tunnel boring machine works); PSR: Power supply routes.

27.9 Performance outcomes

The Secretary’s Environmental Assessment Requirements identified a number of desired performance outcomes. These desired performance outcomes outline the broader objectives to be achieved during design, construction, and operation and are separate to the performance outcomes identified for the Concept.

Table 27-7 identifies the Sydney Metro West performance outcomes and outlines how Stage 1 addresses these outcomes. Future design development and any design changes would also be considered against these environmental performance outcomes.

Table 27-7: Desired performance outcomes and project outcome

Desired performance outcome from Secretary’s Environmental Assessment Requirements	Sydney Metro West Concept Performance Outcomes	How Stage 1 addresses performance outcomes
Place and design		
<p>The project provides healthy, responsive, integrated, equitable and resilient places.</p> <p>The project provides an increase in tree plantings and tree canopy.</p> <p>The project minimises adverse impacts on the visual amenity of the build and natural environment (including public open spaces)</p>	<ul style="list-style-type: none">• The design reflects the Sydney Metro Design Objectives and the place and design principles• The Sydney Metro Design Quality Framework is implemented• Metro stations contribute positively to the surrounding urban environment and provide a sense of place• No net loss of tree numbers and tree canopy.	<p>Stage 1 works would allow for the implementation of the Sydney Metro Design Objectives and place and design principles as part of the design process for future stages of Sydney Metro West.</p> <p>Stage 1 includes a commitment to achieve no net overall loss in tree number and/or canopy, and where feasible and reasonable increase the number of trees near Stage 1 construction sites in consultation with relevant local councils.</p>

Desired performance outcome from Secretary’s Environmental Assessment Requirements	Sydney Metro West Concept Performance Outcomes	How Stage 1 addresses performance outcomes
Spoil, waste management and resource use		
Spoil generated during the construction is effectively stored, handled, treated (if necessary), reused, and/or disposed of lawfully and in a manner that protects environmental values.	<p><i>Operation</i></p> <ul style="list-style-type: none">The use of potable water for non-potable purposes is avoided if non-potable water is availableThe reuse of water is maximised, either on site or off site. <p><i>Construction</i></p> <ul style="list-style-type: none">100 per cent of useable spoil is reused in accordance with the spoil reuse hierarchyA minimum 95 per cent recycling target is achieved for construction and demolition wasteProducts made from recycled content are prioritisedThe use of potable water for non-potable purposes is avoided if non-potable water is availableThe reuse of water is maximised, either on site or off site.	<p>The design of Stage 1 tunnels and station excavations and the preferred construction methodology has taken into consideration the waste hierarchy by aiming to reduce the volume spoil generated, as far as practical. Opportunities to further reduce the generation of spoil through tunnel and station optimisation would be considered during future design.</p> <p>Spoil would be classified in accordance with Waste Classification Guidelines (NSW Environment Protection Authority, 2014). Spoil that is classified as virgin excavated natural material, excavated natural material, subject to a resource recovery order/resource recovery exemption under the Protection of the Environment Operations (Waste) Regulation 2014 or is otherwise reusable would be reused (consistent with the 100 per cent beneficial reuse performance outcome).</p> <p>Stage 1 would adopt a construction waste recycling target of 95 per cent. Waste streams would be segregated to avoid cross-contamination of materials and maximise recycling opportunities. Stage 1 would minimise water use and use non-potable water where feasible consistent with adopted sustainability initiatives and targets – refer to Section 8.20 (Sustainability and climate change – Concept).</p>
Socio-economic, land use and property		
The project minimises adverse social and economic impacts and capitalises on opportunities potentially available to affected communities. The project minimises impacts to property and business and achieves appropriate integration with adjoining land uses, including maintenance of appropriate access to properties and community facilities, and minimisation of displacement of existing land use activities, dwellings and infrastructure. The project minimises impacts on and achieves appropriate integration with adjoining land uses.	Social	
	<p><i>Operation</i></p> <ul style="list-style-type: none">Negative impacts on customers and the community (including transport services, amenity, noise and vibration, water management and air quality) are minimisedImpacts on the availability and quality of public open space and social infrastructure are avoidedAccess to local facilities, services and destinations is improved, supporting opportunities for community interaction and improving social cohesionPlacemaking at stations provides a focal point for the community improving social connections and connection to placeLegacy projects are delivered to benefit local communities. <p><i>Construction</i></p> <ul style="list-style-type: none">Negative impacts on customers and the community (including transport services, amenity, noise and vibration, water management and air quality) are minimisedAffected communities are communicated with in a clear and timely manner to enhance community benefits, reduce disruption and address community concerns.	<p>The design of Stage 1 has aimed to avoid and minimise impacts on the availability and quality of public open space and social infrastructure.</p> <p>There would be some direct impacts on community assets (such as the loss of the premises for Parramatta Artist Studios at Parramatta and the Figtree Convention Centre at Sydney Olympic Park), while indirect impacts (such as on ease of access an amenity) could affect some public open space areas including at Five Dock and Burwood North. Mitigation measures have been proposed to address these impacts.</p> <p>The relocation of the Sydney Speedway (located on government owned land) to Eastern Creek would have an impact on the accessibility of this type of recreation infrastructure. This may be both positive or negative for different speedway spectators.</p> <p>The assessment of Stage 1 has also considered a range of potential social impacts including those relating to way of life, community, culture, health and wellbeing, concerns and aspirations. Mitigation measures have been developed to address these issues where required.</p> <p>Further details on social impacts and mitigation is provided in Chapter 17 (Social impacts – Stage 1).</p> <p>Community engagement activities carried out to date and the framework for future community engagement is detailed in Chapter 5 (Stakeholder and community engagement).</p> <p>Improved access to local facilities, services and destinations would be realised during future stages of Sydney Metro West.</p>
	Business	
	<p><i>Operation</i></p> <ul style="list-style-type: none">Potential impacts to businesses are minimisedConnectivity is improved to, from and between businesses in Greater Parramatta, the Sydney CBD and other centres. <p><i>Construction</i></p> <ul style="list-style-type: none">Potential impacts to businesses are minimisedAffected businesses are communicated with in a clear and timely manner to reduce disruption and address concernsAccess to businesses for employees and customers is maintainedAssistance is provided to businesses that are adversely impacted.	<p>The design development of Stage 1 aimed to avoid or minimise potential business impacts by minimising the amount of privately owned land needed for construction sites to reduce direct impacts on businesses (where possible). This included avoiding direct impacts on businesses at Westmead and North Strathfield. The design also aimed to maintain customer and vehicular delivery access for existing businesses.</p> <p>Stage 1 would include a program to assist small business owners adversely impacted by construction and measures to help maximise the visibility of business during the construction period</p> <p>Further details on business impacts and mitigation is provided in Chapter 16 (Business impacts – Stage 1).</p>
	Land use and property	
	<p><i>Operation</i></p> <ul style="list-style-type: none">Future land use opportunities within metro station precincts are developed in cooperation with (as relevant) the Department of Planning, Industry and Environment, the Greater Sydney Commission, and local councilsTransport infrastructure is effectively integrated with land use planning. <p><i>Construction</i></p> <ul style="list-style-type: none">Acquisition of privately owned land is minimised by limiting the extent of construction sites and using existing Government owned land where possibleResidual land at the completion of construction is minimisedThe need for partial acquisitions is minimised.	<p>Stage 1 construction sites have been located to maximise use of Government owned land where possible (such as at North Strathfield and The Bays). Construction sites have also been optimised taking into account expected future operational requirements for the stations, as well as considering the key construction requirements for the tunnel and stations. In all cases, Stage 1 construction footprints have been reduced as much as practicable to minimise the need for land acquisition and temporary property impacts.</p> <p>Stage 1 construction sites have also been located within existing property boundaries. This has minimised the need for partial acquisitions, with only one potential partial acquisition identified for Stage 1 (at the Burwood North Station construction site).</p> <p>Station locations have been selected to link houses, jobs, education, health and other services. Stations also create opportunities for integrated station and precinct developments that provide for community needs including consideration of relevant planning controls and local character.</p> <p>Further details on property and land use impacts and mitigation is provided in Chapter 14 (Property and land use – Stage 1).</p>

Desired performance outcome from Secretary's Environmental Assessment Requirements	Sydney Metro West Concept Performance Outcomes	How Stage 1 addresses performance outcomes
Noise and vibration		
<p>The project ensures the compatibility of the Concept with the adjoining noise environment.</p> <p>The project minimises adverse impacts on acoustic amenity of the surrounding community by effectively managing construction noise and vibration (including airborne noise, ground-borne noise and blasting).</p> <p>Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimise adverse impacts on the structural integrity of buildings and items including Aboriginal places and environmental heritage.</p>	<p><i>Operation</i></p> <ul style="list-style-type: none"> Operational noise and vibration levels comply with the rail noise trigger levels in the Rail Infrastructure Noise Guidelines (Environment Protection Authority, 2013) and external noise criteria in the Noise Policy for Industry (Environment Protection Authority, 2017), where applicable. <p><i>Construction</i></p> <ul style="list-style-type: none"> Construction noise and vibration impacts on local communities are minimised by controlling noise and vibration at the source, on the source to receiver path and at the receiver Structural damage to buildings and heritage items from construction vibration is avoided. 	<p>The design development of Stage 1 aimed to avoid or minimise potential construction noise and vibration impacts. This included locating some facilities in industrial areas with fewer noise sensitive receivers (such as the Clyde Stabling and maintenance facility and the Silverwater services facility).</p> <p>Stage 1 would construction noise minimise impacts to the local community by:</p> <ul style="list-style-type: none"> Controlling noise and vibration at the source Controlling noise and vibration on the source to receiver transmission path Implementing practicable and reasonable measures to minimise the noise and vibration impacts of construction activities on local sensitive receivers. This includes provision of acoustic sheds (or other acoustic measures) where night works are proposed. <p>Stage 1 would minimise impacts to structures by:</p> <ul style="list-style-type: none"> Controlling vibration at the source Controlling vibration on the source to receiver transmission path Implementing practicable and reasonable measures to minimise vibration impacts of construction activities on structures. <p>Further details on noise and vibration impacts and mitigation is provided in Chapter 11 (Noise and vibration – Stage 1).</p>
Transport and traffic		
<p>The project minimises adverse transport and traffic impacts and optimises transport and traffic functioning.</p> <p>The project minimises and manages impacts to network connectivity, safety and efficiency of the transport system during construction.</p>	<p><i>Operation</i></p> <ul style="list-style-type: none"> The modal access hierarchy is implemented at stations Sufficient customer capacity in stations and station plazas is provided to limit crowding or queuing in accordance with Fruin's Level of Service C (for 2056 demand) Stations and interchanges are fully accessible and compliant with the Disability Discrimination Act 1992 and the Disability Standards for Accessible Public Transport 2002. <p><i>Construction</i></p> <ul style="list-style-type: none"> Construction traffic and transport impacts on special events are minimised Safe routes for pedestrians and cyclists are provided around construction sites Safe access to properties is maintained Road occupancy is minimised, particularly in the Parramatta and Sydney CBDs Changes to the travel paths of road users, including bus routes, are minimised Affected emergency services and public transport operators are provided early communication on changes in traffic conditions Loss of on-street parking and loading zones is minimised Heavy vehicle routes are developed in consultation with Transport for NSW, including Transport Coordination The use of local roads by heavy vehicles is minimised Safe access and egress is provided to and from construction sites. 	<p>The design development of Stage 1 has included a focus on minimising the need for works in existing rail corridors (at Westmead, Parramatta and North Strathfield) and avoiding direct impacts to major roads where possible.</p> <p>Impact on existing parking would be minimised by limiting the extent of construction sites, hiving dedicated access/egress points and by encouraging workers to use public transport. Where more substantial loss of existing parking is expected, such as at Parramatta, there is a commitment to work with the local council to investigate opportunities to provide alternative parking facilities.</p> <p>Stage 1 would include measures maintain pedestrian, cyclist and motorist safety around construction sites, including safe access to properties.</p> <p>Construction vehicle routes for Stage 1 were developed in consultation with relevant sections of Transport for NSW, including Transport Coordination to minimise the use of local roads and use the most efficient route to the arterial road network.</p> <p>Left in left out or straight through access-egress is proposed at most construction sites. Where this is not practicable (such as at Sydney Olympic Park metro station and North Strathfield Station constructions sites) traffic volumes and sight distances allow for safe right turns.</p> <p>Stage 1 allows for future integration with existing and future local and regional transport infrastructure and planning strategies.</p> <p>Further details on transport and traffic impacts and mitigation is provided in Chapter 10 (Transport and traffic – Stage 1).</p>
Aboriginal heritage		
<p>The long-term protection, conservation and management of the heritage significance of Aboriginal objects and places.</p>	<p><i>Operation</i></p> <ul style="list-style-type: none"> The design of stations include Aboriginal heritage interpretation in consultation with registered Aboriginal parties. <p><i>Construction</i></p> <ul style="list-style-type: none"> Impacts on areas of moderate or higher archaeological potential and significance are avoided or minimised, where feasible and reasonable Accidental impacts to heritage items are avoided. 	<p>Impacts to Aboriginal heritage have been minimised by avoiding direct impacts to previously recorded Aboriginal sites where possible, and by locating most of the Parramatta metro station construction site outside of the known extent of the Parramatta Sand Body, which has demonstrated archaeological potential.</p> <p>One known Aboriginal site (at Parramatta metro station construction site) and areas of archaeological sensitivity at Clyde stabling and maintenance facility, and The Bays Station construction sites would be directly affected by Stage 1.</p> <p>Options for heritage interpretation would be considered as part of future stages of Sydney Metro West. Further details on Aboriginal heritage impacts and mitigation is provided in Chapter 13 (Aboriginal heritage – Stage 1).</p>

Desired performance outcome from Secretary’s Environmental Assessment Requirements	Sydney Metro West Concept Performance Outcomes	How Stage 1 addresses performance outcomes
Non-Aboriginal heritage		
The long-term protection, conservation and management of the heritage significance of items of environmental heritage.	<p><i>Operation</i></p> <ul style="list-style-type: none">Design is sympathetic to retained and adjacent heritage itemsAppropriately qualified and suitably experienced heritage architect and relevant stakeholders are consulted during designThe design of stations include non-Aboriginal heritage interpretation. <p><i>Construction</i></p> <ul style="list-style-type: none">Direct impacts on World Heritage and National Heritage List items are avoidedImpacts on State Heritage Register items are avoided or minimised so that the overall heritage value of the item is maintainedImpacts to non-Aboriginal heritage items and archaeology are avoided or minimised where feasible and reasonableAccidental impacts to heritage items are avoided.	<p>The Stage 1 design is sympathetic to the historic significance of surrounding listed heritage items, and where practicable, avoids and minimises impacts to heritage.</p> <p>The Stage 1 tunnel alignment was developed to avoid potential direct impacts to the World Heritage listed Old Government House within Parramatta Park.</p> <p>Stage 1 construction sites were selected to avoid direct impacts to State and local heritage items where possible, including State heritage listed Parramatta Station and Roxy Cinema (Parramatta), St Alban’s Church (Five Dock), and the White Bay Power Station and Glebe Island Silos (The Bays).</p> <p>The design and mitigation strategies are reviewed by the Sydney Metro Design Review Panel.</p> <p>Further details on Aboriginal heritage impacts and mitigation is provided in Chapter 14 (Non-Aboriginal heritage – Stage 1).</p>
Contamination and soils		
The environmental values of land, including soils, subsoils and landforms, are protected. Risks arising from the disturbance and excavation of land and disposal of soil are minimised, including disturbance to acid sulfate soils and site contamination. Land must be (or be made) suitable for intended future use.	Soils	
	<p><i>Construction</i></p> <ul style="list-style-type: none">Impacts on aquatic environments from the disturbance of acid sulfate soils are avoidedPollution of surface water is minimised through the implementation of appropriate erosion and sediment controls.	<p>Stage 1 would effectively manage acid sulfate soils in accordance with the Acid Sulfate Soil Manual (Acid Sulfate Soil Management Advisory Committee, 1998). The manual includes procedures for the investigation, handling, treatment and management of such soils.</p> <p>Erosion and sediment measures would be implemented at all construction sites in accordance with the principles and requirements in Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom 2004) and Volume 2D (NSW Department of Environment, Climate Change and Water 2008), commonly referred to as the ‘Blue Book’.</p> <p>Further details on soil impacts and mitigation is provided in Chapter 19 (Soils and surface water quality – Stage 1).</p>
	Contamination	
	<p><i>Operation</i></p> <ul style="list-style-type: none">Residual contamination does not pose a risk to Sydney Metro customers or staff. <p><i>Construction</i></p> <ul style="list-style-type: none">Contamination risks to human health and ecological receivers are minimised through effective management of existing contaminated landContaminated land is remediated to be suitable for the intended future land use.	<p>The Stage 1 design has aimed to avoid or minimise potential interaction with known contaminated sites. This has included avoiding the former Shell Clyde Refinery site (Durham Street, Rosehill), where there is known groundwater contamination.</p> <p>Stage 1 would include measures to better understand contaminated related risks and management/ remediation requirements.</p> <p>Further details on contamination impacts and mitigation is provided in Chapter 20 (Contamination – Stage 1).</p>
Water – hydrology and flooding		
Long term impacts on surface water and groundwater hydrology (including drawdown, flow rates and volumes) are minimised. Minimise adverse impacts on existing flooding characteristics.	Hydrology and flooding	
	<p><i>Operation</i></p> <ul style="list-style-type: none">Increases in flood levels are minimised, particularly within private properties, during events up to and including the one per cent annual exceedance probabilityNo additional private properties are affected by flood events up to and including the 1% annual exceedance probabilityThe potential for soil erosion and scouring is minimised for events up to and including a 1% annual exceedance probability eventDedicated evacuation routes are not impacted in flood events up to and including the probable maximum floodThe performance of the downstream drainage network is maintained. <p><i>Construction</i></p> <ul style="list-style-type: none">Dedicated evacuation routes are not impacted in flood events up to and including the probable maximum flood.	<p>Construction would be carried out in a manner that minimises the potential for adverse flooding impacts, through staging of works and the implementation of mitigation measures. The following criteria would be met for Stage 1:</p> <ul style="list-style-type: none">A maximum increase in flood levels of 50mm in a 1% annual exceedance probability flood eventA maximum increase in time of inundation on one hour in a 1% annual exceedance probability flood eventNo newly-affected properties in the 1% annual exceedance probability eventNo increase in potential soil erosion and scouring from any increase in flow velocity in a 1% annual exceedance probability flood event. <p>Stage 1 would avoid impacts to dedicated evacuation routes in flood events up to and including the probable maximum flood (during construction) at most sites. Mitigation measures have been proposed to address increase in flood depths in Robert Street near The Bays Station construction site.</p> <p>Further details on hydrology and flooding impacts and mitigation is provided in Chapter 21 (Hydrology and flooding – Stage 1).</p>

Desired performance outcome from Secretary’s Environmental Assessment Requirements	Sydney Metro West Concept Performance Outcomes	How Stage 1 addresses performance outcomes
	<p>Groundwater and ground movement</p> <ul style="list-style-type: none">Groundwater supply for licenced groundwater users is not significantly affected by groundwater drawdownThe groundwater accessible to groundwater dependent ecosystems is not significantly reducedStructural damage to buildings from ground movement associated with excavation, tunnelling or groundwater drawdown is avoided.	<p>The Stage 1 has minimised potential groundwater impacts by:</p> <ul style="list-style-type: none">Tanking of stations at Parramatta, Five Dock and The Bays to avoid ongoing groundwater inflowTanking of tunnels to avoid ongoing groundwater inflow. <p>Stage 1 includes a commitment to implement make good measures in relation to any potential loss of yield for existing groundwater (bore supply) users due to construction.</p> <p>Stage 1 includes a commitment to further groundwater monitoring to better understand potential impacts on groundwater dependant ecosystems and inform mitigation as part of the design process.</p> <p>The specific risk to most buildings and structures due to ground movement associated with Stage 1 would be negligible, with superficial damage to buildings unlikely.</p> <p>Where building damage risk is rated as moderate or higher (as per the CIRIA 1996 risk-based criteria), a structural assessment of the affected buildings/structures would be carried out and specific measures implemented to address the risk of damage.</p> <p>Further details on groundwater impacts and mitigation is provided in Chapter 18 (Groundwater – Stage 1).</p>
Water – Quality		
<p>To protect the NSW Water Quality Objectives where they are currently being achieved and contribute towards achievement of the Water Quality Objectives over time where they are currently not being achieved, including downstream of the project to the extent of the project impact including estuarine and marine waters (if applicable).</p>	<p><i>Operation</i></p> <ul style="list-style-type: none">The water quality criteria for water discharge, determined in consultation with NSW Environment Protection Authority, is met. <p><i>Construction</i></p> <ul style="list-style-type: none">The discharge water quality requirements outlined in applicable environment protection licence(s) are metExisting water quality of receiving surface watercourses is maintained.	<p>Wastewater from Stage 1 tunnelling activities would be treated, and standard erosion and sediment control measures would be implemented for all surface works areas to minimise pollutant loading to the downstream waterways during construction. Wastewater would be treated to comply with the ANZECC/ARMCANZ (2000) and ANZG (2018) guidelines and runoff from construction works would be designed to meet the standards outlined in the Blue Book.</p> <p>With these management measures, pollutant loading to the receiving waterways would be low with the possibly of better quality where existing water quality does not meet the ANZECC/ARMCANZ (2000) and ANZG (2018) guidelines.</p> <p>Discharges from construction water treatment plants would be monitored for compliance with the discharge criteria in environmental protection licence(s) issued to Stage 1.</p> <p>Further details on water quality impacts and mitigation, and an assessment of Stage 1 against NSW water quality objectives, is provided in Chapter 19 (Soils and surface water quality – Stage 1).</p>
Biodiversity		
<p>The avoidance and minimisation of impacts on terrestrial and aquatic biodiversity.</p> <p>Offsets and/or supplementary measures are assured which are equivalent to any remaining impacts of project construction and operation.</p>	<p><i>Construction</i></p> <ul style="list-style-type: none">Impacts on biodiversity are avoided (where possible) and minimised, including the clearing of native vegetationSignificant impacts to flow regimes in receiving waterways are avoidedDesign of waterway modifications and crossings incorporates best practice principlesThe Concept does not contribute to key threatening processes associated with weeds and pathogensBiodiversity impacts are offset in accordance with the <i>Biodiversity Conservation Act 2016</i>.	<p>The Stage 1 construction footprint is predominantly set in built up areas. The limited amount of native vegetation to be disturbed by Stage 1 is of poor to moderate quality and threatened species habitats are very limited. Impacts to threatened species and communities were assessed as not significant.</p> <p>As most construction sites are not located within or adjacent to major overland or mainstream flow paths, there is a low potential to impact downstream velocity and scour. Mitigation measures have been proposed to address predicted increases in flow velocities during the 1% AEP event as a result of proposed culvert crossings of A’Becketts Creek and Duck Creek and formalisation of sections of these creek channels.</p> <p>Stage 1 includes a commitment to further groundwater monitoring to better understand potential impacts on groundwater dependant ecosystems (including from any changes to the baseflow in nearby watercourses) and inform mitigation as part of the design process.</p> <p>The likelihood of Stage 1 contributing key threatening processes key threatening processes associated with weeds and pathogens was assessed as low. The Construction Environmental Framework includes a requirement to implement weed management measures and mitigation measures to prevent introduction and spread of amphibian chytrid fungus, <i>Phytophthora cinnamomi</i> and exotic rust fungi.</p> <p>Biodiversity credit obligations were calculated using the Biodiversity Assessment Method Calculator. A total of six credits would be required associated with impacts to Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion (Plant community type 920) and Southern Myotis (<i>Myotis macropus</i>). The NSW Department of Primary Industries Policy and Guidelines for Fish Habitat Conservation and Management (NSW Department of Primary Industries, 2013) are applicable and the 0.15 hectares of impacted Mangrove Forest would be offset at a 10:1 ratio due to impacts on a mapped Coastal Wetland area.</p> <p>Further details on biodiversity impacts and mitigation is provided in Chapter 22 (Biodiversity – Stage 1).</p>

Desired performance outcome from Secretary’s Environmental Assessment Requirements	Sydney Metro West Concept Performance Outcomes	How Stage 1 addresses performance outcomes
Sustainability		
Operating costs are reduced. Effective and efficient use of resources. Conservation of natural resources is maximised.	<ul style="list-style-type: none">The construction and operation of Sydney Metro West is consistent with the Sydney Metro Environment and Sustainability PolicySustainability initiatives are incorporated into the planning, design and construction of the ConceptInfrastructure Sustainability Council of Australia (ISCA) IS rating of 75 – Version 1.2 (or equivalent) and a 5-Star Green Star rating are achieved during design and construction for appropriate componentsDesign of stations and stabling buildings achieve at least a 15 per cent improvement over performance requirements set out in Section J of the National Construction Code.	Stage 1 would be consistent with the directions identified in the Sydney Metro Environment and Sustainability Policy and has adopted sustainability principles, initiatives and targets that will be incorporated in a Sydney Metro West Sustainability Plan. Stage 1 includes a commitment to achieving an equivalent or improved level of sustainability performance compared to previous metro projects. This would include achieving a minimum Infrastructure Sustainability Council of Australia (ISCA) IS rating of 75 – Version 1.2 (or equivalent) and a 5-Star Green Star rating (or equivalent) depending on the specific Stage 1 component. Stage 1 would mandate a minimum 15 per cent improvement on the current (2019) minimum performance requirement stipulated in the National Construction Code/Building Code of Australia. Further details on sustainability is provided in Section 8.20 (Sustainability and climate change – Concept) and Chapter 26 (Sustainability and climate change – Stage 1).
Other issues		
No desired performance outcome from Secretary’s Environmental Assessment Requirements	Air quality <ul style="list-style-type: none">Air quality impacts are minimised during construction and operation.	Stage 1 includes a commitment to implementing best practice dust and odour management measures. Further details on air quality impacts and mitigation is provided in Chapter 23 (Air quality– Stage 1).
	Hazards <ul style="list-style-type: none">Dangerous goods are transported, stored and used so as to not cause a hazardous event.	Potential hazards associated with the on-site storage, use and transport of chemicals, fuels and materials used during Stage 1 would be managed in accordance with the Construction Environmental Management Framework, <i>Work Health and Safety Act 2011</i> , the Work Health and Safety Regulation 2017, the Storage and Handling of Dangerous Goods Code of Practice (WorkCover NSW, 2005) and Applying SEPP 33 (Department of Planning, 2011).
	Climate change and greenhouse gas	
	Operation <ul style="list-style-type: none">Comprehensively address climate change risks during the design life of Sydney Metro West for all risks rated ‘medium’ or higher100 per cent of the greenhouse gas emissions associated with consumption of electricity during operation are offset. Construction <ul style="list-style-type: none">25 per cent of the greenhouse gas emissions associated with consumption of electricity during construction are offset.	Climate change risk treatments would be confirmed and incorporated into the detailed design for Stage 1. Stage 1 includes a commitment to offset 25 per cent of the greenhouse gas emissions associated with consumption of electricity during construction.
	Cumulative impacts	
	Construction <ul style="list-style-type: none">Cumulative impacts are minimised through co-ordination of construction activities and communication processes with nearby projects.	Stage 1 includes a commitment to coordinating and consulting with relevant stakeholders to manage the interface of projects under construction at the same time. This would include: <ul style="list-style-type: none">Provision of regular updates to the detailed construction program, construction sites and haul routesIdentification of key potential conflict points with other construction projectsDeveloping mitigation strategies in order to manage conflicts. Depending on the nature of the conflict, this could involve:<ul style="list-style-type: none">Adjustments to the Sydney Metro construction program, work activities or haul routes; or adjustments to the program, activities or haul routes of other projectsCoordination of traffic management arrangements between projects.

27.10 Project justification

27.10.1 Addressing the need

Sydney is Australia’s financial and economic capital, housing half of the country’s globally competitive service sector jobs. The Greater Parramatta to Sydney CBD corridor is one of three key economic corridors nominated in the Greater Sydney Region Plan (Greater Sydney Commission, 2018a). The corridor is of national economic significance and contains nearly 620,000 high productivity jobs, which is around 20 per cent of the jobs in Greater Sydney and generates eight per cent of the nation’s Gross Domestic Product per year.

Recognising the importance of the corridor, several land use planning and development initiatives have commenced in Westmead, Parramatta, Sydney Olympic Park, The Bays and the Sydney CBD. These initiatives are expected to account for more than 60 per cent of planned population growth and more than 80 per cent of planned jobs growth in the corridor by 2036.

Sydney’s growing population will continue to increase demand on the existing transport network and by 2056, NSW transport networks will need to accommodate 28 million trips per day (Transport for NSW, 2018). The existing rail network is congested, with customers on most rail lines often experiencing significant crowding on trains and station platforms during the morning and evening peaks. Despite planned upgrades and more services which will provide some short term relief, the T1 Western Line is expected to reach capacity in 2024 and the T9 Northern Line is expected to reach capacity in 2027.

As train and station crowding reduces service reliability, this results in fewer services operating in a given time period and in turn leads to further crowding. Reliability impacts in the Sydney CBD cause network-wide impacts, reducing network capacity and increasing crowding on trains and platforms.

There is a strong link between public transport and land use change. Transport accessibility and amenity are critical to supporting employment, housing supply and urban renewal opportunities and ultimately to support Sydney’s economic and population growth. Transport accessibility and amenity issues, including crowding and capacity constraints within the Greater Parramatta to Sydney CBD corridor, as well as traffic congestion from high levels of car use, are limiting the achievement of planned growth because these areas are less attractive to households and developers.

Sydney Metro West would address this substantial need by more than doubling rail capacity from Parramatta to the Sydney CBD. At ultimate capacity, Sydney Metro West would be able to move more than 40,000 people an hour in each direction and would complement the suburban and intercity services between Parramatta and the Sydney CBD. Sydney Metro would result in numerous transport benefits including:

- Substantially improving the public transport networks accessibility to key economic centres across the Greater Parramatta to Sydney CBD corridor
- Reducing crowding on trains and on station platforms
- Increasing the reach and use of Sydney’s public transport network by providing new station locations at Burwood North, Five Dock and The Bays and by providing a direct connection to Sydney Olympic Park
- Improving travel times for commuters
- Providing an alternative to the suburban rail network with additional capacity to reduce the impacts of scheduled maintenance and major unavoidable incidents
- Providing the opportunity for mode shift from car to public transport, which could result in road user travel time savings.

By improving the connections between key economic centres, Sydney Metro West would foster significant growth in jobs, including directly supporting the creation of new jobs within the corridor particularly at key precincts including Westmead, Parramatta, Sydney Olympic Park and The Bays.

Sydney Metro West would provide city-shaping benefits as the significant increase in transport connectivity, capacity and amenity in the Greater Parramatta to Sydney CBD corridor, would boost the economic productivity of Sydney and facilitate planned land use outcomes in the CBDs, planned precincts and urban renewal areas.

Sydney Metro West would also provide a fast, reliable and frequent connection between Greater Parramatta and the Sydney CBD and would:

- Relieve the congested T1 Western Line, T9 Northern Line and T2 Inner West and Leppington Line
- Provide travel time savings for customers in Western Sydney and along the Greater Parramatta to Sydney CBD corridor
- Reduce station crowding at some stations
- Provide rail transport to areas where it is currently not available
- Connect Greater Parramatta and the Sydney CBD to support the vision for a metropolis of three cities
- Support delivery of the ‘30-minute city’ as identified in Future Transport Strategy 2056
- Reinforce the role of Greater Parramatta as the Central River City
- Improve connectivity to major attractions and key precincts located along the corridor, including Sydney Olympic Park and The Bays
- Support urban renewal and increased housing supply
- Increase accessibility across Sydney and provide customers with a new world-class metro service.

27.10.2 Biophysical, economic and social considerations including the principles of ecologically sustainable development

Comprehensive investigations have been carried out in the preparation of the Environmental Impact Statement to assess the biophysical, economic and social impacts. The key potential impacts that cannot be avoided are summarised above in Section 27.7. As described in Section 27.8, the project would incorporate environmental management and design features so that any unavoidable potential impacts are managed and mitigated as far as feasible and reasonable and to an acceptable level.

Biophysical, economic and social considerations have also been assessed in the context of the principles of ecologically sustainable development. The EP&A Act adopts the definition of ecologically sustainable development contained in the Protection of the *Environment Administration Act 1991*. An assessment of the biophysical, economic and social impacts of Sydney Metro West in the context of the principles of ecologically sustainable development is provided below.

Precautionary principle

The environmental risk analysis documented in Chapter 29 (Environmental risk analysis) addresses the potential impacts of the Concept and Stage 1. That analysis, together with the detail assessment carried out in preparing this Environmental Impact Statement indicates that there would be no threat of serious or irreversible damage to the environment.

In addition, the lack of full scientific certainty has not been used as a reason for postponing measures to prevent environmental degradation. As detailed in each impact assessment chapter, mitigation measures have been proposed to manage identified risks/threats of environmental damage.

The assessments carried out are consistent with accepted scientific and assessment methodologies and have considered relevant statutory and agency requirements. The assessments have applied a conservative approach with regard to proposed construction and operational arrangements, and the modelling used has been carried out in collaboration with key stakeholders and relevant statutory and agency requirements.

Intergenerational equity

The objectives of Sydney Metro West are essentially around ensuring an efficient and reliable public transport network. This would benefit current and future generations. Once operational, Sydney Metro West would leave a positive legacy for future generations. It would provide long term benefits by strengthening connections and access across Sydney, providing improved connectivity on the rail network and improving the capacity, reliability and efficiency of the transport system. The Concept would address emerging issues with respect to capacity and congestion which otherwise would be more difficult to address at a future stage. The Concept would improve the quality of the transport experience for customers.

In addition to the broader Sydney transport operational benefits, the ‘door-to-door’ experience provided by Sydney Metro West could also result in long-term health benefits with the creation of safer and more appealing conditions for pedestrians, cyclists and other transit users. These benefits would also flow through to future generations.

Sydney Metro West would result in a greater demand on electricity however operational electricity use would be fully offset. Significant changes to carbon and energy policy (and legislation) are currently occurring in Australia which aim to shift electricity generation from coal fired to renewable sources. As more electricity is generated from renewable sources, the climate change benefits of using electric rail would be improved. A range of measures to mitigate greenhouse gas emissions have been developed and would be implemented.

Conservation of biological diversity and ecological integrity

Conservation of biological diversity and ecological integrity has been considered throughout the project development and design stages (refer Chapter 26 (Sustainability)). The construction footprint has been developed to avoid or minimise impact to areas of high ecological value. Detailed assessments have been carried out to identify flora and fauna impacts and a range of mitigation measures identified for implementation. Impacts on biological diversity and ecological integrity have been assessed as minor.

Improved valuation and pricing of environmental resources

Economic appraisal of Sydney Metro West draws on a number of established methodologies which provide for the valuation of externalities, including environmental externalities, and their inclusion in the appraisal process. Environmental parameters which can be valued include air pollution, greenhouse gas emissions, noise pollution, water run-off, nature and landscape and urban separation. Valuations typically adopt broad average values.

The value placed on the environment was inherent in the development of the design. In addition, the costs associated with the planning and design of measures to avoid/minimise adverse environmental impacts and the costs to implement them have been built into the overall project costs. Ongoing and detailed design together with specific issue-based management plans would represent further commitment to the recognition of the value of protecting environmental resources.