

Appendix D

Utilities management strategy



Roads and Maritime Services

Western Harbour Tunnel and Warringah Freeway Upgrade

Technical working paper: Utilities Management Strategy

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Prepared for

Roads and Maritime

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Abbreviations

| | |
|--------------------|--|
| CBD | Central Business District |
| CEMP | Construction environmental management plan |
| CICL | Cast Iron Cement Lined |
| DBYD | Dial Before You Dig |
| EIS | Environmental Impact Statement |
| EMF | Electric and Magnetic Fields |
| EP&A Act | Environmental Planning and Assessment Act 1979 (NSW) |
| ESUT | Ernest Street Utility Tunnel |
| IBL | Internal Bitumen Lined |
| IOF | Intercity Optic Fibre |
| ITS | Intelligent Transport Systems |
| kPa | Kilopascals |
| kV | Kilovolts |
| MVA | Megavolt amperes |
| PVC | Polyvinyl chloride |
| Roads and Maritime | Roads and Maritime Services |
| SCL | Steel Cement (mortar) Lined |
| SGW | Salt Glazed Ware |
| STS | Sub-Transmission Substation |
| V | Voltage |
| VC | Vitrified Clay |

Glossary

| | |
|------------------|--|
| CEMP | Construction Environmental Management Plan A site-specific plan developed for the construction phase of the project to ensure that all contractors and sub-contractors comply with the environmental conditions of approval for the project and that the environmental risks are properly managed |
| Reference Design | Design sufficient to support Environmental Impact Statement |
| Risk | The potential effect of uncertainty on objectives |
| Spoil | Excess excavated material |

1 Introduction

This section provides an overview of the Western Harbour Tunnel and Warringah Freeway Upgrade (the project), including its key features and location. It also outlines the Secretary's environmental assessment requirements addressed in this technical working paper.

1.1 Overview

The Greater Sydney Commission's Greater Sydney Region Plan – A Metropolis of Three Cities (Greater Sydney Commission, 2018) proposes a vision of three cities where most residents have convenient and easy access to jobs, education and health facilities and services. In addition to this plan, and to accommodate for Sydney's future growth the NSW Government is implementing the Future Transport Strategy 2056 (Transport for NSW, 2018), a plan that sets the 40 year vision, directions and outcomes framework for customer mobility in NSW. The Western Harbour Tunnel and Beaches Link program of works is proposed to provide additional road network capacity across Sydney Harbour and to improve transport connectivity with Sydney's northern beaches. The Western Harbour Tunnel and Beaches Link program of works include:

- The Western Harbour Tunnel and Warringah Freeway Upgrade project comprises a new tolled motorway tunnel connection across Sydney Harbour, and an upgrade of the Warringah Freeway to integrate the new motorway infrastructure with the existing road network and to connect to the Beaches Link and Gore Hill Freeway Connection project
- The Beaches Link and Gore Hill Freeway Connection project which comprises a new tolled motorway tunnel connection across Middle Harbour from the Warringah Freeway and Gore Hill Freeway to Balgowlah and Killarney Heights and including the surface upgrade of Wakehurst Parkway from Seaforth to Frenchs Forest and upgrade and integration works to connect to the Gore Hill Freeway at Artarmon.

A combined delivery of the Western Harbour Tunnel and Beaches Link program of works would unlock a range of benefits for freight, public transport and private vehicle users. It would support faster travel times for journeys between the Northern Beaches and south, west and north-west of Sydney Harbour. Delivering the program of works would also improve the resilience of the motorway network, given that each project provides an alternative to heavily congested harbour crossings.

1.2 The project

Roads and Maritime Services (Roads and Maritime) is seeking approval under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* to construct and operate the Western Harbour Tunnel and Warringah Freeway Upgrade, which would comprise two main components:

- A new crossing of Sydney Harbour involving twin tolled motorway tunnels connecting the M4-M5 Link at Rozelle and the existing Warringah Freeway at North Sydney (the Western Harbour Tunnel)
- Upgrade and integration works along the existing Warringah Freeway, including infrastructure required for connections to the Beaches Link and Gore Hill Freeway Connection project (the Warringah Freeway Upgrade).

Key features of the Western Harbour Tunnel component of the project are shown in Figure 1-1 and would include:

- Twin mainline tunnels about 6.5 kilometres long and each accommodating three lanes of traffic in each direction, connecting the stub tunnels from the M4-M5 Link at Rozelle to the Warringah Freeway and to the Beaches Link mainline tunnels at Cammeray. The crossing of Sydney Harbour between Birchgrove and Balls Head would involve a dual, three lane, immersed tube tunnel
- Connections to the stub tunnels at the M4-M5 Link project in Rozelle and to the mainline tunnels at Cammeray (for a future connection to the Beaches Link and Gore Hill Freeway Connection project)

- Surface connections at Rozelle, North Sydney and Cammeray, including direct connections to and from the Warringah Freeway (including integration with the Warringah Freeway Upgrade), an off ramp to Falcon Street and an on ramp from Berry Street at North Sydney
- A ventilation outlet and motorway facilities (fitout and commissioning only) at the Rozelle Interchange
- A ventilation outlet and motorway facilities at the Warringah Freeway in Cammeray
- Operational facilities including a motorway control centre at Waltham Street, within the Artarmon industrial area and tunnel support facilities at the Warringah Freeway in Cammeray
- Other operational infrastructure including groundwater and tunnel drainage management and treatment systems, signage, tolling infrastructure, fire and life safety systems, lighting, emergency evacuation and emergency smoke extraction infrastructure, CCTV and other traffic management systems.

Key features of the Warringah Freeway Upgrade component of the project are shown in Figure 1-2 and would include:

- Upgrade and reconfiguration of the Warringah Freeway from immediately north of the Sydney Harbour Bridge through to Willoughby Road at Naremburn
- Upgrades to interchanges at Falcon Street in Cammeray and High Street in North Sydney
- New and upgraded pedestrian and cyclist infrastructure
- New, modified and relocated road and shared user bridges across the Warringah Freeway
- Connection of the Warringah Freeway to the portals for the Western Harbour Tunnel mainline tunnels and the Beaches Link tunnels via on and off ramps, which would consist of a combination of trough and cut and cover structures
- Upgrades to existing roads around the Warringah Freeway to integrate the project with the surrounding road network
- Upgrades and modifications to bus infrastructure, including relocation of the existing bus layover along the Warringah Freeway
- Other operational infrastructure, including surface drainage and utility infrastructure, signage, tolling, lighting, CCTV and other traffic management systems.

A detailed description of the project is provided in Chapter 5 (Project description) and construction of the project is described in Chapter 6 (Construction work) of the environmental impact statement. The project alignment at the Rozelle Interchange shown in Figure 1-1 and Figure 1-3 reflects the arrangement presented in the environmental impact statement for the M4-M5 Link, and as amended by the proposed modifications. The project would be constructed in accordance with the now finalised M4-M5 Link detailed design (refer to Section 2.1.1 of Chapter 2 (Assessment process) of the environmental impact statement for further details).

The project does not include ongoing motorway maintenance activities during operation or future use of residual land occupied or affected by project construction activities, but not required for operational infrastructure. These would be subject to separate planning and approval processes at the relevant times.

Subject to the project obtaining planning approval, construction is anticipated to commence in 2020 and is expected to take around six years to complete.

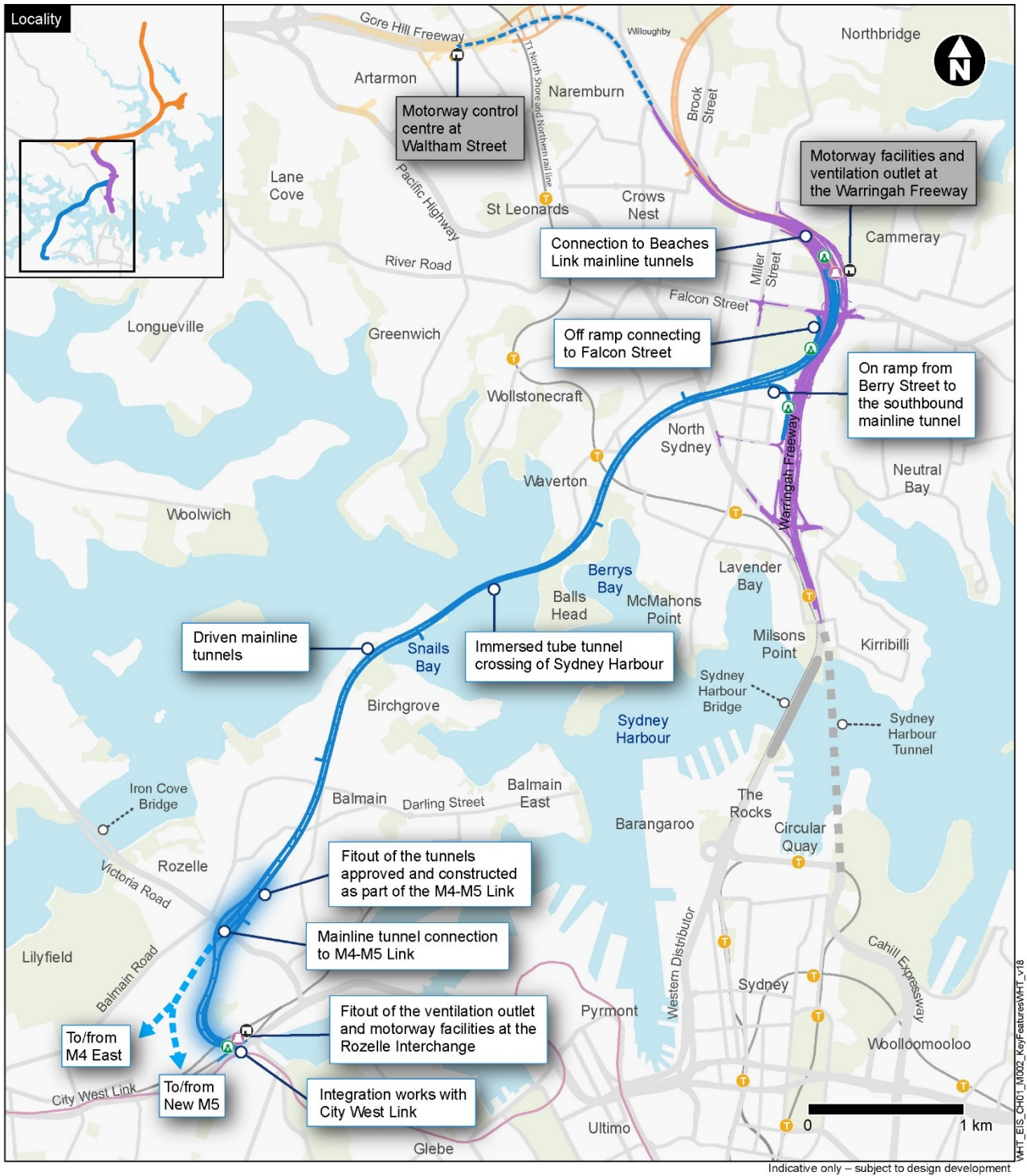
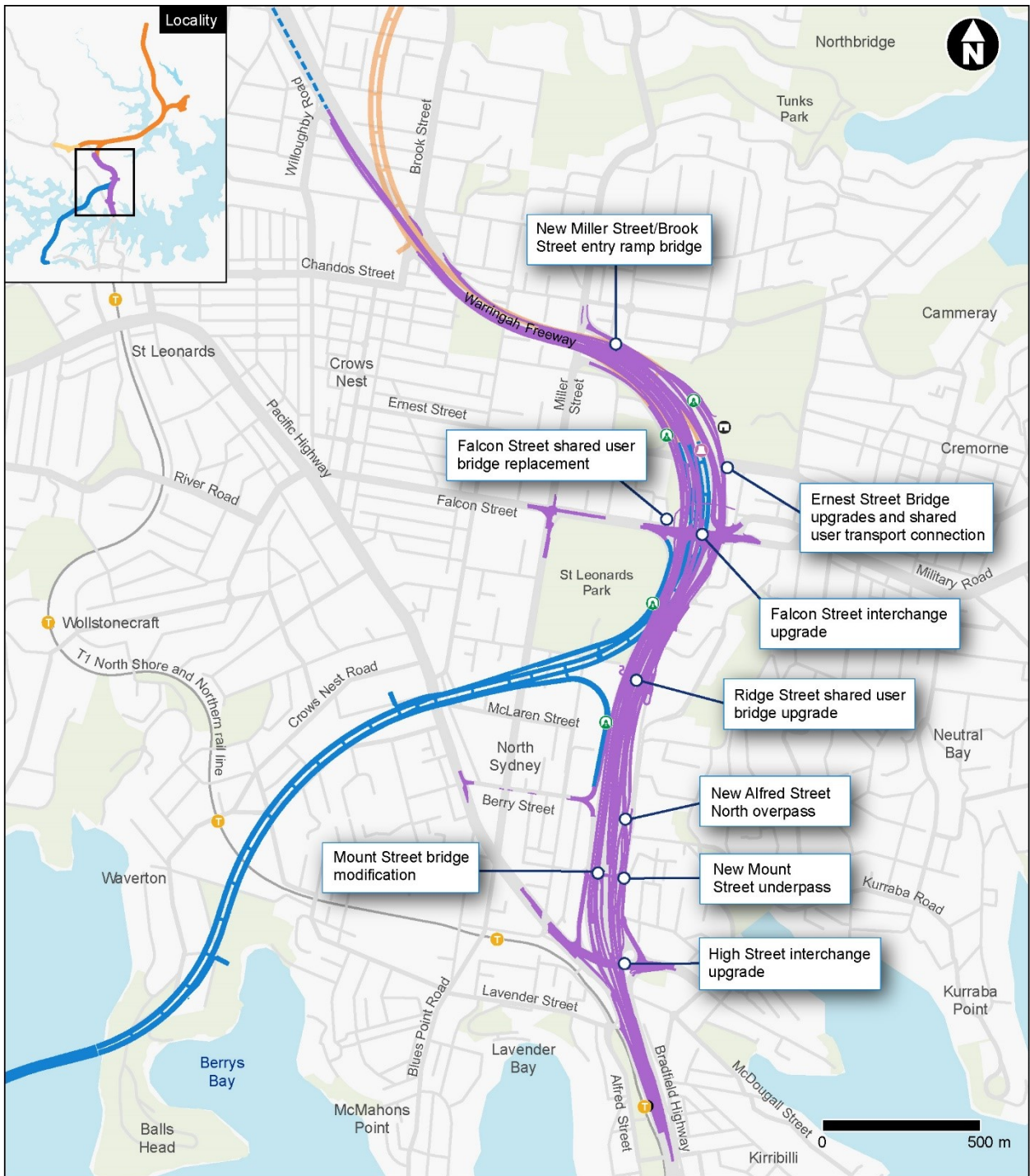


Figure 1-1 Key features of the Western Harbour Tunnel component of the project



Legend

- | | | |
|--|----------------------------|------------------------------|
| Operational features | Connecting projects | Existing rail network |
| Warringah Freeway Upgrade | Beaches Link | Heavy rail |
| Western Harbour Tunnel | | Train station |
| Communications cable for motorway control centre | | |
| Surface connection | | |
| Permanent operational facility | | |
| Ventilation outlet | | |

Figure 1-2 Key features of the Warringah Freeway Upgrade component of the project

1.3 Key construction activities

The area required to construct the project is referred to as the construction footprint. The majority of the construction footprint would be located underground within the mainline tunnels. However, surface areas would be required to support tunnelling activities and to construct the tunnel connections, tunnel portals and operational ancillary facilities.

Key construction activities would include:

- Early works and site establishment, with typical activities being property acquisition and condition surveys, utilities installation, protection, adjustments and relocations, installation of fencing, environmental controls (including noise attenuation and erosion and sediment control) and traffic management controls, vegetation clearing, earthworks and demolition of structures, establishment of construction support sites including acoustic sheds and associated access decline acoustic enclosures (where required), construction of minor access roads and the provision of property access, temporary relocation of pedestrian and cycle paths and bus stops, temporary relocation of swing moorings within Berrys Bay and relocation of the historic vessels
- Construction of Western Harbour Tunnel, with typical activities being excavation of tunnel construction accesses, construction of driven tunnels, cut and cover and trough structures and construction of cofferdams, dredging activities in preparation for the installation of immersed tube tunnels, casting and installation of immersed tube tunnels and civil finishing and tunnel fitout
- Construction of operational facilities comprising of a motorway control centre at Waltham Street in Artarmon, motorway and tunnel support facilities and ventilation outlets at the Warringah Freeway in Cammeray, construction and fitout of the project operational facilities that form part of the M4-M5 Link Rozelle East Motorway Operations Complex, a wastewater treatment plant at Rozelle and the installation of motorway tolling infrastructure
- Construction of the Warringah Freeway Upgrade, with typical activities being earthworks, bridgeworks, construction of retaining walls, stormwater drainage, pavement works and linemarking and the installation of road furniture, lighting, signage and noise barriers
- Testing of plant and equipment, and commissioning of the project, backfill of access declines, removal of construction support sites, landscaping and rehabilitation of disturbed areas and removal of environmental and traffic controls.

Temporary construction support sites would be required as part of the project. This would include locations for tunnel launch and support, earthworks support, coffer dams, mooring, and workforce amenities. Construction support sites for Western Harbour Tunnel are shown in Figure 1-3 and would include:

- Rozelle Rail Yards (WHT1)
- Victoria Road (WHT2)
- White Bay (WHT3)
- Yurulbin Point (WHT4)
- Sydney Harbour south cofferdam (WHT5)
- Sydney Harbour north cofferdam (WHT6)
- Berrys Bay (WHT7)
- Berry Street north (WHT8)
- Ridge Street north (WHT9)
- Cammeray Golf Course (WHT10)
- Waltham Street (WHT11).

During the construction of the Warringah Freeway Upgrade, smaller construction support sites would be required to support the construction works (as shown on Figure 1-3). These include:

- Blue Street (WFU1)
- High Street south (WFU2)
- High Street north (WFU3)
- Arthur Street east (WFU4)
- Berry Street east (WFU5)
- Ridge Street east (WFU6)
- Merlin Street (WFU7)
- Cammeray Golf Course (WFU8)
- Rosalind Street east (WFU9).

A detailed description of construction works for the project is provided in Chapter 6 (Construction work) of the environmental impact statement.

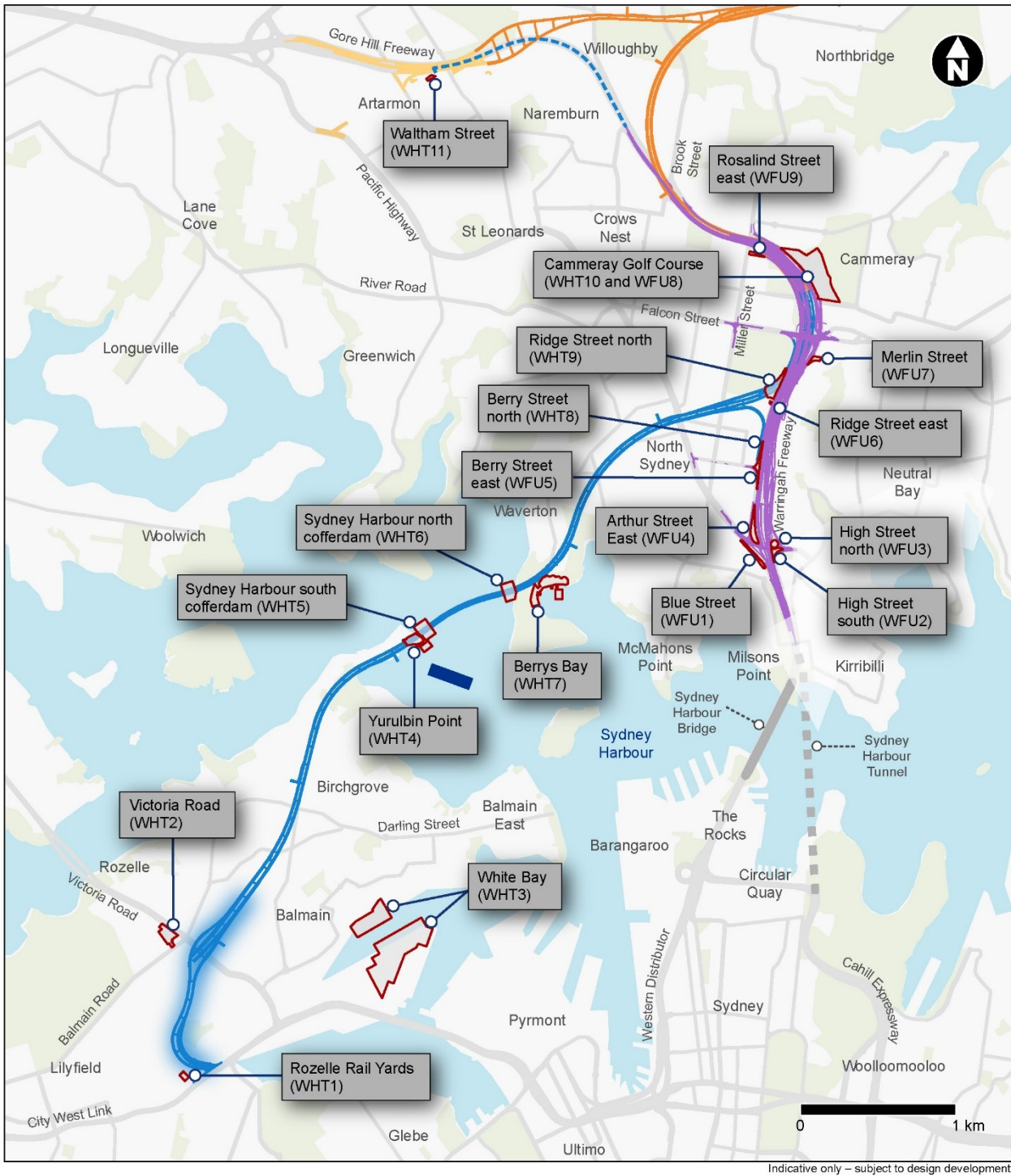


Figure 1-3 Overview of construction support sites

1.4 Project location

The project would be located within the Inner West, North Sydney and Willoughby local government areas, connecting Rozelle in the south with Naremburn in the north.

Commencing at the Rozelle Interchange, the mainline tunnels would pass under Balmain and Birchgrove, then cross Sydney Harbour between Birchgrove and Balls Head. The tunnels would then continue under Waverton and North Sydney, linking directly to the Warringah Freeway to the north of the existing Ernest Street bridge.

The motorway control centre would be located at Waltham Street, Artarmon with a trenched communications cable connecting the motorway control centre to the Western Harbour Tunnel along the Gore Hill Freeway and Warringah Freeway road reserves.

The Warringah Freeway Upgrade would be carried out on the Warringah Freeway from around Fitzroy Street at Milsons Point to around Willoughby Road at Naremburn. Upgrade works would include improvements to bridges across the Warringah Freeway, and upgrades to surrounding roads.

1.5 Purpose of this report

This report has been prepared to support the environmental impact statement for the project and to address the environmental assessment requirements of the Secretary of the Department of Planning, Industry and Environment (formerly Department of Planning and Environment) ('the Secretary's environmental assessment requirements').

This report provides an overview of the principles and practices that would apply to the management of utilities during the construction of the project. It includes a list of major utilities located within or adjacent to the construction footprint that have the potential to be affected by construction of the project and outlines the approach to management of mitigation measures and adjustments to utilities.

It also outlines the options currently being considered for provision of construction power supply and the permanent operational power supply for the project. These would be subject to separate approvals where required in consultation with utility providers.

1.6 Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to this Utilities Management Strategy, and where these requirements are addressed in this report are outlined in Table 1-1 below.

Table 1-1 Secretary's environmental assessment requirements – Utilities Management Strategy

| Secretary's environmental assessment requirements | Where addressed |
|---|-----------------|
| The Proponent must assess potential impacts on utilities (including communications, electricity, gas, and water and sewerage) and the relocation of these utilities. | This document |
| Where the project is predicted to impact on utilities, the Proponent must undertake a utilities management strategy, identifying management options, including relocation or adjustment of the utilities. | This document |

2 Approach to proposed works on existing utilities

All public utility assets that are understood to be impacted and may require relocation or protection measures have been identified along the proposed tunnel alignment and Warringah Freeway Upgrade design. Most sections of the tunnels have sufficient depth of cover not to directly impact existing utility services. However, potential settlement and vibration impacts during construction of the project have also been considered in the vicinity of “High Risk” major (trunk) utilities. Areas outside the project footprint may be impacted by planned utility works, such as the route selected for the installation of construction power or permanent operational power which are required to support the project.

Utilities investigations and consultation with utility providers are currently being carried out and would continue during the ongoing project development, detailed design, and construction phases of the project.

Utility services which have been considered in this Utilities Management Strategy include: communications, gas, electricity, water, and sewerage. The Utilities Management Strategy only considers major utility services as defined in Section 2.2. Minor utility works which do not meet that definition are not considered in this strategy. Impacts to minor utilities would be addressed through standard management measures.

The information contained in this Utilities Management Strategy regarding existing utility services and proposed utility works is based on:

- Utility investigations conducted to date
- Continuing discussions with utility providers
- The reference design for the project as set out in the environmental impact statement.

The information contained in this report is likely to change over time as further investigations are carried out, discussions with utility providers’ progress, and as the design of the project and the construction methodology are refined once a contractor has been appointed. New or revised management options may also be identified in the future during the detailed design phase of the project.

This Utilities Management Strategy should be read in conjunction with the Western Harbour Tunnel and Warringah Freeway Upgrade environmental impact statement.

2.1 Utility investigations to date

Utilities information data has been obtained by carrying out Dial-Before-You-Dig (DBYD) enquiries, a combination of survey models and Work As Executed (WAE) drawings provided by Roads and Maritime, and from information provided through consultation with utility asset owners in a CAD/GIS format and PDF.

The process for gaining an understanding of the existing utilities has included:

- Discussions with utilities authorities
- Review of WAE and survey models provided by Roads and Maritime
- Potholing investigations where required
- DBYD enquiry to confirm the information presented in the models
- Identification of conflicts, surveying locations, and checking levels
- Development of a three-dimensional (3D) utilities model.

Where utilities have been identified to be at risk or impacted, these have been defined by where surface and excavation works are proposed in their vicinity.

Additional information is still being received in the form of detailed survey and from utility providers and survey investigations commissioned by Roads and Maritime. As such, details included in this report would continue to evolve and be refined as the design progresses.

2.2 Major utility services

The Utilities Management Strategy details the major (trunk) utility works proposed as part of the project. Existing major (trunk) utilities within the areas of interest include (but are not limited to):

- Ausgrid (electricity) – power cables above and below ground, pits, tunnels, substations, poles, lights
- Telecommunications (optic fibre and copper communications) – Telstra and other communications providers – cables above and below ground, tunnels, buildings, towers, pits
- Sydney Trains (electricity)
- Sydney Water (sewerage/water/stormwater) – tunnels, buildings, pipes/culverts, pits, structures
- Jemena (gas) – conduits, pipes, pit, structures
- Roads and Maritime (Intelligent Transport Systems (ITS), power, water supply and tunnels)
- Sydney Harbour Tunnel Company – utilities servicing the existing tunnel.

Utilities have been considered as a major asset based on the classifications as detailed in Table 2-1 below.

Table 2-1 Utilities major asset classification

| Public Utility | Size |
|--|---|
| Ausgrid (electricity) | Transmission network |
| Telstra, Optus, NBN (communications) and other communication providers | Major international cables Major optic fibre |
| Sydney Water (sewerage) | All |
| Sydney Water (water supply) | ≥ DN375 Heritage |
| Jemena (gas) | High Pressure – ≥ 1050 kPa |

Additional major utility services impacted by the project may be identified during future design stages in consultation with utility service providers. These utilities would also be subject to this Utilities Management Strategy.

2.3 Treatment approach to utilities

To resolve utility clashes along the proposed alignment, any or all of the following would be required:

- Where possible, redesign the works to allow retention of the utility in its current position
- Utility adjustment or relocation
- Utility protection
- Removal of redundant utilities and infrastructure
- The possibility to accommodate the utility within the proposed design.

The approach does not allow for the upgrading of utilities apart from upgrades required to manage the requirements of the project such as upgraded power supply connections. All utility works would be carried out in consultation with the relevant utility provider.

Utilities comprising asbestos materials have been identified as potentially impacted by the proposed works. All work related to these utilities would be carried out by a licenced asbestos removal company with an appropriate

asbestos management plan in place, in accordance with the specific laws about working with asbestos as per Chapter 8 of the Work Health and Safety Regulation 2017, and in accordance with SafeWork NSW practices and guidelines.

2.4 Typical construction methodology for utility works

The construction methodology would vary according to the type of utility, the scale of the work and the location. Typically the methodology for constructing an underground utility would include:

- Investigations to confirm location of existing utilities such as potholing and works to allow decision to protect or relocate utilities as required
- Establishing temporary construction facilities including storage, laydown and stockpile areas, site offices and amenities
- Securing work areas such as with fencing and hoarding
- Installing pre-construction environmental management controls
- Removing and managing/protecting vegetation as required
- Saw cutting to remove asphalt or concrete pavement
- Carrying out initial trench excavations and shoring. Note that in some circumstances tunnelling or boring techniques can be used. Launching and receiving sites are required for these techniques
- Stockpiling excavated materials for reuse or removal for off-site disposal
- Preparing sub-grade surface (e.g. crushed rock) to accommodate utilities
- Laying utilities either as pipes or conduits
- Constructing joint bays and pits
- Pulling cables through conduits
- Connecting utilities to existing systems
- Testing and commissioning of utilities
- Backfilling trenches and re-instating surface to an appropriate condition
- Removing excess stockpiles, materials and equipment
- Removing or suitably isolating redundant utilities where practical
- Rehabilitating areas disturbed by works, such as with new topsoil and vegetation
- Site clean-up and decommissioning temporary construction facilities, work areas and environmental management controls.

The work would be carried out in stages and would proceed in a manner as directed by the programme along the route. The depth and width of excavation would depend on several factors such as the type of utility, local topography, the location of existing utilities and sub-surface conditions.

3 Proposed works to existing utilities

3.1 Area of interest

The areas of interest within the project footprint include:

- The Western Harbour Tunnel component
- The Warringah Freeway Upgrade component.

The assessment of existing utilities and proposed utility works in each area of interest within the project footprint are discussed in Sections 3.2 to 3.3.

Future design phases may identify relocations that extend outside the project footprint. The impact on any existing utilities outside the project footprint would be assessed during the detailed design phase of the project.

Further development of the project design, ongoing investigations, technical requirements and outcomes of consultation with utility providers are continuing. New or revised management options may also be identified in the future during the detailed design phase of the project.

3.2 Western Harbour Tunnel

The Western Harbour Tunnel component of the project comprises a new crossing of Sydney Harbour involving twin tolled motorway tunnels connecting the M4-M5 Link at Rozelle and the existing Warringah Freeway at North Sydney. Subject to final configuration of the Rozelle Interchange, the utility impacts and proposed treatment strategies resulting from the Rozelle Interchange works would be captured and carried out by the Rozelle Interchange project under the approved M4-M5 Link environmental impact statement. The existing major (trunk) utility services at Rozelle are listed in Table 3-1 with proposed management measures.

Table 3-1 Utilities at Rozelle

| Utility service provider | Description | Existing location | Proposed treatments |
|------------------------------|--------------------------|--|---|
| Ausgrid | Electricity transmission | 132kV transmission cables along Lilyfield Road between Foucart Street and Gordon Street. | Protect. The proposed road tunnel passes under these assets. Extent of cut and cover works is limited to works within the rail yard corridor. Asset to be protected. |
| Hutchison Telecommunications | Communications | Mobile phone panels on roof top of the Balmain Leagues Club, Victoria Road. Incoming cables possibly within Telstra ducts. | To be disconnected, removed and relocated prior to the demolition of the building. Relocation to be carried out by Hutchinson. |
| Sydney Water | Sewer | 660mm x 990mm brick oviform sewer tunnel between Evans Street to Elizabeth Street. | Avoid and protect. The proposed road tunnel passes under the sewer. Settlement monitoring due to the critical nature, size and age of asset may be required. |

3.3 Warringah Freeway Upgrade

Works would be required along the proposed upgrade works to protect, adjust, or relocate utilities that are impacted by the proposed design. Some of the major (trunk) utilities impacted by the Warringah Freeway Upgrade component of the project include:

- Sydney Harbour Tunnel Hydrant Building at the exit onto the Pacific Highway would require relocation as the proposed new alignment encroaches into the existing property boundary of the building and would physically impact the existing structure
- Sydney Harbour Tunnel Hydrant Building at the corner of Mount Street and Alfred Street North would require relocation as the proposed new alignment directly impacts the existing structure
- Based on Work as Constructed plans for the Ernest Street utility tunnel (ESUT) and the reference design road alignment, the existing ESUT would be impacted by the proposed Western Harbour Tunnel portals and all existing utilities within the tunnel would require relocation. The following have been considered as options to replace the existing ESUT, particularly considering program, constructability and cost:
 - Option 1 – Relocate the existing utilities tunnel, “like for like” – reinforced concrete box culvert, and relocate the existing services via the new tunnel
 - Option 2 – Replace the existing utilities tunnel with a new bored circular tunnel and relocate the existing services through the new tunnel in a suitable location
 - Option 3 – Divert/relocate the existing services through the widened Ernest Street Bridge. The new bridge wing is to incorporate a utilities corridor and shared pathway.

The actual route of the individual service relocations to and from the location of the replacement utilities crossing corridor would generally be determined and designed by the asset owner. These routes would also be influenced by the location of the proposed Cammeray Golf Course construction support site (WHT10 and WFU8) and the permanent location of the motorway facilities. The relocation design (including routes) for the gas main, and communications services would be carried out by the respective asset owners. Only the water mains relocation designs can be overseen by Roads and Maritime using a Sydney Water accredited designer.

- As part of the proposed replacement of Ridge Street pedestrian bridge the utilities running under the existing bridge would be relocated to the new bridge where the existing bridge is retained until construction is completed or investigate options for relocating them elsewhere. The utilities running under the bridge are:
 - Ausgrid low voltage electricity lines
 - Sydney Water 25 millimetre copper pipe
 - Telstra communications cables: Two pair 30 millimetre PVC conduits (P30) which feed emergency phone in the freeway itself
- The reference design widening works for Warringah Freeway Upgrade would impact existing utility services in Alfred Street North between High Street and Ridge Street pedestrian bridge, and Ridge Street pedestrian bridge to Wyagdon Street. These utilities include:
 - Ausgrid high voltage, low voltage and street lighting poles and cables
 - Sydney Water sewer and water assets
 - Jemena high and medium pressure gas mains
 - Telstra, Optus, TPG and Southern Cross owned major communications infrastructure.

The utilities tunnel running under Warringah Freeway from Lavender Street is assumed not to be impacted by the reference design for Warringah Freeway Upgrade works. The reference design has also been designed to avoid impact on the Hampden Street and Mount Street utilities tunnels.

Identified major (trunk) utilities along the reference design road alignment for Warringah Freeway Upgrade, their impact assessment and proposed treatments are listed in Table 3-2.

Table 3-2 Utilities at Warringah Freeway and proposed treatments

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|--------------------------|---|---|
| AAPT (TPG) | Communications | AAPT asset under northern footpath of Pacific Highway to the intersection with Arthur Street, to Arthur Street Park and heading into Northbound Sydney Harbour Tunnel. This is AAPT's Inter-capital Sydney to Newcastle fibre cable. | Relocate. Asset affected by Warringah Freeway widening to the west (with new retaining wall/rock wall). To be relocated under new retaining wall/rock wall. Communications pit near Warringah Freeway off ramp at Arthur St/Pacific Hwy will need to be relocated. |
| AAPT (TPG) | Communications | Optic fibre cables part through AAPT owned and part through Telstra ducts across Arthur Street from Warringah Freeway to Little Walker Street. | Relocate. Affected by surface works on Arthur Street, widening, and Arthur Street east construction support site (WFU4). Protect cables under new surface works. To be relocated with other impacted communications providers through the Sydney Harbour Tunnel run. |
| AARNet | Communications | AARNet pit in Arthur Street Park near Vocus pit just north of Arthur Street and Pacific Highway and High Street intersection. This pit links to the Vocus Pit with AARNet owned conduit, one 50mm PVC conduit, comprising of 96F optic fibre cable. | Relocate. Not affected by the works. May need protection of conduits crossing under roadway. |
| Ausgrid | Electricity Transmission | Underground transmission pilot cable along western side of Arthur Street from Mount Street to substation in Alfred Street Park. It then runs from the Alfred Street Park substation through the conduits for the Sydney Harbour Tunnel private 415 V power into Sydney Harbour Tunnel Northbound Tunnel to the Central Business District (CBD), via the Sydney Harbour Tunnel generator building. Auxiliary pilot cable (FOU006002-312F). | Relocate. Migrate section of cable impacted by Warringah Freeway northbound carriageway works to clear new High Street Bridge abutment. Impact and necessary migration discussed with Ausgrid and confirmed. |

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|----------------------------|--|--|
| Ausgrid | Electricity | Four 194 sq. mm copper three core 11kV distribution cables and five x pilot/communications cables through ESUT, crossing from Anzac Park to the west and joins asset on eastern side of Warringah Freeway. Classified as major due to 132kV cables also present through tunnel. | Relocate. Clashes with Beaches Link and Western Harbour Tunnel exit/entry portal structures and Cammeray Golf Course construction support site (WHT10 and WFU8). New crossing of Warringah Freeway has been constructed by Ausgrid between Rosalind Street and Morden Street. Provision for a new 132 kV crossing would be provided in the widened Ernest Street Bridge. |
| Ausgrid | Electricity - transmission | Legacy transmission pilot cables crossing Warringah Freeway north of Ernest Street through ESUT. Alignment of cables on either side of utility tunnel unknown and to be advised by Ausgrid. | Relocate. Affected, potential pilot cable through utility tunnel. Clashes with Beaches Link and Western Harbour Tunnel exit/entry portal structures and Cammeray Golf Course construction support site (WHT10 and WFU8) and access decline. Associated with removal or relocation of asset through ESUT, asset through Cammeray Golf Course, and asset in Cammeray Avenue on western side of Warringah Freeway. |
| Ausgrid | Electricity - transmission | Out of service (disused) gas filled 33kV transmission cables through Cammeray Golf Course east of ESUT. These disused cables are running adjacent to the 132kV live cables through Cammeray Golf Course construction support site (WHT10 and WFU8). Assumed removed through ESUT and Cammeray Avenue (as per notes on DBYD). | Remove. Gas filled cable is to be cut and drained at the perimeter of the construction zone. |

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|----------------------------|---|---|
| Ausgrid | Electricity - transmission | Ausgrid proposed underbore for 132kV transmission crossing under Warringah Freeway from Rosalind Street to Morden Street. | Protect. Passing under proposed retaining walls and over proposed Beaches Link tunnels. Final tunnel design to check and confirm clearance to road tunnels. The underbores are to be protected. It is expected for these underbores to be completed by the time of commencement of construction works for Warringah Freeway Upgrade. |
| Ausgrid | Electricity - transmission | Ausgrid optic fibre pilot cable through conduits under Warringah Freeway from Sydney Harbour Tunnel switch room connecting to the substation in Arthur Street Park. The Ausgrid fibre cable is blue in colour. | Relocate. Impacted by proposed road widening works for Warringah Freeway and would need to be relocated/adjusted. Work to be carried out as part of the migration works for the impacted communications a private power works at Arthur Street park. |
| Jemena | Gas | DN150 steel pipe, secondary main, 1050 kPa, under crossing under Alfred Street North from the Mount Street Utility Tunnel to the eastern side of Alfred Street North. It then runs to the north on the eastern side of Alfred Street North before crossing to the system pressure regulator on the western side to the north of the intersection with Kurraba Road. Includes two pits in Alfred Street North south of Mount Street. | Relocate. Affected in part and relocated section to be protected through new structure. |
| Jemena | Gas | DN200 steel pipe, secondary main, 1050 kPa, along eastern side of Merlin Street and across Military Road. | Protect. Possibly affected by new median construction works on Military Road. Gas main to be protected under proposed surface works. |

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|-------------|---|--|
| Jemena | Gas | DN200 steel pipe, secondary main, 1050 kPa, including one system pressure regulator, along western side of Alfred Street North under new Alfred Street North parking area north of Kurraba Road to Ridge Street pedestrian bridge. | Relocate. Affected by new Alfred Street North carpark pavement works and new Ridge Street Pedestrian Bridge piling works. Relocate main including system pressure regulator and bypass as affected by new kerb alignment. |
| Jemena | Gas | DN200 steel pipe, secondary main, 1050 kPa, along Alfred Street North from Ridge Street pedestrian bridge to Wyagdon Street. | Relocate. Affected by new Warringah Freeway retaining wall works, Alfred Street North surface works, and Ridge Street pedestrian bridge. Modification of pipe alignment and pit relocation to ensure adequate clearance and maintenance access. |
| Jemena | Gas | DN200 steel pipe, secondary main, 1050 kPa, along eastern side of Merlin Street from the intersection with Military Road to the intersection with Ernest Street, then heading east under Ernest Street northern footpath to the eastern side of Park Avenue. Joins the secondary gas main at the intersection with Military Road. | Protect. Not likely to be affected by surface works. |
| Jemena | Gas | DN150 steel pipe, secondary main, 1050 kPa, along southern side of Berry Street from Miller Street to Walker Street. | Protect. Likely to be affected by new kerb re-alignment works and may need protection. |

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|----------------|--|---|
| Optus | Communications | Intercity Optic Fibre (IOF) through Telstra owned conduit along Mount Street across Warringah Freeway from Arthur Street to Alfred Street North. | Protect. Affected by Mount Street Underpass at Cahill Expressway entry ramp from Alfred Street North Bridge running under Mount Street intersection. The bank of conduits is to be protected and accommodated by the bridge structure for the crossing of Alfred Street North over the proposed Mount Street Underpass ramp running under Mount Street Bridge. |
| Optus | Communications | In Telstra duct along Mount Street to Alfred Street North across Warringah Freeway, and feeds dead end side take off (possibly between Alfred Street and Warringah Freeway). | Protect. Affected by Mount Street Underpass at Cahill Expressway entry ramp from Alfred Street North Bridge running under Mount Street intersection. Utility crosses Alfred Street North. Service to be protected. |
| Optus | Communications | IOF - Intercity Optic Fibre through Optus owned conduit under Alfred Street North eastern footpath to the proposed Alfred Street North on-ramp works. Also heads east under Whaling Road northern footway. Similarly heading north from the eastern footway of Alfred Street North on-ramp to Merlin Street, then continues north to the south-eastern corner of the intersection with Ernest Street. | Relocate. Affected by road realignment work at High Street and High Street ramp, by proposed road works of Alfred Street North, and possibly by proposed surface works on Falcon Street / Merlin Street intersection. Will require relocation south of Whaling Road and along Alfred Street North. Likely to only require protection under Flacon Street / Miller Street intersection. |

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|----------------|--|--|
| Optus | Communications | Fibre optic cables through Telstra duct under northern footpath of Falcon Street/Military Road. | Relocate. Affected by structural works on northeast corner of Falcon Street Bridge impact existing communications corridor under existing footpath. Would be impacted by structural modifications to northeast corner of the Falcon Street bridge deck. |
| Optus | Communications | Optic fibre through Telstra owned duct. Running east-west under southern footway of Falcon Street, then running south under eastern footway/through park along Miller Street. | Protect. Not affected by the proposed intersection re-configuration works on Miller Street and the Telstra conduits and pit remain within the footway area. However, the communications conduits may be required protection under the footpath regrading works. |
| Optus | Communications | Fibre optic network runs under Berry Street west of the entry ramp to Arthur Street, and under entry ramp onto Warringah Freeway. One 50mm PVC conduit. | Protect. Affected by surface works of entry ramp from Warringah Freeway. Protection of the communications line may be required due to surface works. |
| Optus | Communications | Runs along western side of Arthur Street between Pacific Highway and Mount Street to a Telstra pit at the north-eastern corner of Pacific Highway and Arthur Street. Shown as being through their own duct on DBYD; however, Optus optic fibre cable through Telstra conduits as advised by Optus. | Protect. Likely to require protection in part due to kerb realignment and regrading and new surface works for Arthur Street western footpath. |

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|----------------|---|---|
| Optus | Communications | Optus owned conduit and cable crossing under Falcon Street running north-south from Telstra M/H in Falcon Street northern footpath to an Optus pit in the southern footpath. | Relocate. Affected by structural works on northeast corner of Falcon Street Bridge impact existing communications corridor under existing footpath. Would be impacted by structural modifications to northwest corner of the Falcon Street bridge deck. |
| Optus | Communications | Optus owned conduit running along northern side of Falcon Street from Rodborough Avenue to the intersection of Miller Street and Falcon Street, then connects to possible Telstra's duct along northern side of Falcon Street to Warringah Freeway. | Relocate. Affected due to the proposed kerb and footpath adjustment works on Miller Street southbound around the intersection with Falcon Street providing for an additional left turn lane. The conduits and pits would need to be relocated outside the traffic lane and to suit the new footpath alignment. |
| Optus | Communications | Asset not shown on DBYD search however confirmed by Optus asset is present through Arthur Street Park. S2SJ Installation of a Single Lead-in Cable, 36F cable through an Optus bored duct under Arthur Street from a Telstra maintenance hole at the north-western corner of Arthur Street and Pacific Highway intersection, then through Arthur Street Park in new Optus duct to run along the existing cable tray on High Street Bridge. It continues along the existing cable tray then continues on the roof of the Sydney Harbour Tunnel control building and enters the building via existing penetration. | Relocate. Affected by proposed surface works on Arthur Street, road widening works, High Street Bridge upgrade works, and proposed Arthur Street east construction support site (WFU4). To be migrated with other communication assets through the Sydney Harbour Tunnel run. |

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|----------------|--|---|
| Pipe Networks (TPG) | Communications | Under footpath at corner of Arthur Street and High Street/Pacific Highway, through Arthur Street Park, under High Street Bridge and into Northbound Sydney Harbour Tunnel. | Relocate. Affected by Warringah Freeway widening to west (with new retaining wall/rock wall) would impact asset. Asset would need to be adjusted to suit new retaining wall and by proposed Arthur Street east construction support site (WFU4). |
| Powertel (TPG) | Communications | Fibre optic cables through Telstra duct along Falcon Street/Military Road. | Relocate. Affected by structural works on northeast corner of Falcon Street Bridge impact existing communications corridor under existing footpath. Would be impacted by structural modifications to northeast corner of the Falcon Street bridge deck. As a result, assets would be offset further north under new verge. |
| Powertel (TPG) | Communications | Optic fibre through Telstra owned duct. Running east-west under southern footway of Falcon Street, then running south under eastern footway/through park along Miller Street. | Protect. Not affected by the proposed intersection re-configuration works on Miller Street and the Telstra conduits and pit remain within the footway area. However, the communications conduits may be required protection under the footpath regrading works. |
| Powertel (TPG) | Communications | Optic fibre communications cables owned by Powertel (TPG) from Arthur Street Park, under High Street Bridge, and into Northbound Sydney Harbour Tunnel via the Sydney Harbour Tunnel Control Room under High Street Bridge. Asset information to be updated upon receipt of further asset information from Powertel. | Relocate. Affected by proposed surface works on Arthur Street, road widening works, High Street Bridge upgrade works, and proposed Arthur Street east construction support site (WFU4). |

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|----------------|--|--|
| Southern Cross | Communications | <p>Major optic fibre. Through Southern Cross owned duct(s) from under northern footway of High Street through the park and along eastern side of Alfred Street North, transitioning over to the carriageway and to Alfred Street North on-ramp works.</p> <p>Also, from Alfred Street North on-ramp, along the eastern side of Alfred Street North to eastern footway of Merlin Street, then under southern footway of Ernest Street until Park Avenue.</p> <p>Note: Southern Cross communications are being run and managed by Optus.</p> | <p>Relocate. Affected in part along its route. Impacted south of Whaling Road through the park and High Street due to proposed road and ramp re-configuration and widening works, by proposed road works and narrowing of Alfred Street North between the Ridge Street Pedestrian Overbridge to Wyagdon Street, and possibly by proposed surface works on Falcon Street / Merlin Street intersection. Would require relocation south of Whaling Road and along Alfred Street North narrowing. Likely to only require protection under Ernest Street footpath regrading works and Falcon Street / Miller Street intersection as already under traffic lanes.</p> |

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|-------------|--|--|
| Sydney Water | Sewer | <p>Sewer size 660 x 990mm in tunnel - size varies, brick oviform. Depth obtained from Sydney Water Hydra System from the maintenance hole in Warringah Freeway south of High Street Bridge. It runs under Warringah Freeway and under Alfred Street North to a maintenance hole at eastern end of Mount Street Utilities Tunnel, then under Alfred Street North Street and north of Bent Street where it crosses under Warringah Freeway to Falcon Street west, and under Warringah Freeway heading north-east to Cammeray Golf Course.</p> <p>In tunnel – 812 x 1219mm brick oviform running along Alfred Street North from Mount Street to Kurraba Road.</p> | <p>Adjust. There is no impact on the sewer carrier. Asset structures, i.e. maintenance holes, along the asset alignment are impacted in part and would require adjustments.</p> <p>Adjustment works to be carried out by the Main Works contractor.</p> |
| Sydney Water | Sewer | DN300 Salt Glazed Ware (SGW) sewer under Mount Street carriageway from a maintenance hole at the north-eastern corner of Mount Street and Arthur Street intersection. | Adjust. Affected by proposed median widening works. Top of sewer maintenance hole to be adjusted to suit new median levels. |
| Sydney Water | Sewer | DN225 Vitrified Clay (VC) sewer under Whaling Road carriageway and through public reserve between Alfred Street North, Whaling Road and Little Alfred Street connecting to asset at Hight Street and another asset at Alfred Street North. | Adjust. An existing sewer maintenance hole in the park opposite the south-western corner of the tennis courts is impacted by proposed new ramp alignment work. |
| Sydney Water | Sewer | DN225 VC sewer under High Street carriageway from near east limit of works connecting to maintenance hole under High Street Bridge. | Adjust. Affected by proposed works. Top of sewer maintenance hole in High Street to be adjusted to suit new road levels. |
| Sydney Water | Sewer | DN300 VC sewer crosses under High Street just east of the junction with Alfred Street North. | Protect. Service may need protection from road construction machinery due to proposed road upgrade works. |

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|-------------|--|--|
| Sydney Water | Sewer | DN225 VC sewer under Berry Street carriageway between Miller Street and Little Walker Street. | Adjust. Affected by proposed works Top of sewer maintenance hole to be adjusted to suit new road levels. |
| Sydney Water | Sewer | DN400 VC sewer under Alfred Street North and Mount Street intersection. From maintenance shaft at Mount Street Utilities Tunnel to a maintenance hole under Alfred Street North. Depth obtained from Sydney Water Hydra. | Adjust. Affected by proposed works. The sewer maintenance hole adjacent to Mount Street Utility Tunnel shaft would require significant modification/adjusted to suit new road levels and sewer main may need protection when excavating the Mount Street Underpass. |
| Sydney Water | Sewer | DN225 VC sewer under westbound traffic lanes in Ernest Street to a junction near Lytton Street. | Adjust. This sewer flows west in reverse direction to pick up local properties on south side of Ernest St from Warringah Freeway to Lytton Street, where it drops into existing sewer and flows back east to deep trunk sewer. The sewer line is to be protected and three maintenance hole covers may need adjustment to suit revised road levels. |
| Sydney Water | Sewer | DN225 sewer along western verge of Warringah Freeway from Berry Street to Ridge Street connecting midway to Hampden Street Utility Tunnel sewer. | Relocate. Impacted by trough structure for Western Harbour Tunnel Berry Street southbound on-ramp, and possibly by the retaining walls on eastern and western sides of the Warringah Freeway Corridor, and shared path on eastern side. |

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|-------------|--|--|
| Sydney Water | Sewer | DN300 VC sewer crossing under Warringah Freeway north of ESUT from Cammeray Avenue to Bells Avenue. | Relocate. Affected by proposed cut and cover works within Warringah Freeway corridor and stormwater detention basin works within Cammeray Golf Course. Sewer to be relocated outside the extent of cut and cover works for the tunnels. |
| Sydney Water | Sewer | DN225 VC sewer runs north under Cammeray Golf Course from Ernest Street (west of Merlin Street). | Relocate. Affected by proposed Cammeray Golf Course construction support site (WHT10 and WFU8) works. Sewer to be relocated to avoid construction support site. |
| Sydney Water | Sewer | DN225, unknown pipe type, sewer runs along Alfred Street North from Bent Street to Rose Avenue. | Relocate. Impacted by Alfred Street North narrowing works and would need to be relocated. |
| Sydney Water | Sewer | DN150 and DN225 sewer line of varied pipe material at eastern side of Warringah Freeway portal and behind the properties along Morden Street, connecting to the sewer across Warringah Freeway to Cammeray Golf Course. Includes stub line from the first maintenance hole on the line to a rodding point. | Remove. Stub line to rodding point at start of sewer line impacted by new fill batter for Warringah Freeway widening works. |
| Sydney Water | Water | DN500 Steel Cement (mortar) Lined (SCL) water main In Mount Street Utility Tunnel crossing Warringah Freeway south of Mount Street from Alfred Street to Arthur Street North including water main under Alfred Street. | Protect / Relocate. The existing water main outside the Mount Street Utility Shaft riser is impacted by the cut for the Mount Street Underpass and the water main is to be relocated and protected/concrete encased over to pass over the Mount Street Underpass. |

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|-------------|--|---|
| Sydney Water | Water | DN500 Cast Iron Cement Lined (CICL) water main to the east of Merlin Street, between south side of eastbound Military Road and south side shoulder of westbound Military Road. | Relocate. Proposed kerb realignment of westbound Military Road likely to impact bypass and control valve set. |
| Sydney Water | Water | DN375 CICL water main under far eastbound traffic lane in Falcon Street towards eastern bridge approach and then as concrete encased pipe under north footway of Falcon Street Bridge over Warringah Freeway to eastbound Military Road. It then heads east in southern shoulder of eastbound Military Road. | Relocate. Significant bridge and road surface works. The water main would likely require protection under proposed median construction works and where Falcon Street Bridge northern footpath gets converted to a traffic lane, and fittings adjustment including a valve chamber. |
| Sydney Water | Water | DN600 SCL Internal Bitumen Lined (IBL) water main through ESUT crossing Warringah Freeway north of Ernest Street. | Relocate. ESUT to be removed. Existing water main to be relocated through the new widening of Ernest Street Bridge. |
| Sydney Water | Water | DN500 SCL IBL water main through ESUT crossing Warringah Freeway north of Ernest Street. | Relocate. ESUT to be removed. Existing water main to be relocated through the new widening of Ernest Street Bridge. |
| Sydney Water | Water | DN500 CICL water main under southern footpath of Falcon Street then through north-western corner of St Leonard Park at intersection of Falcon Street and Miller Street. | Protect. Fitting already in road. Assumed deep enough as part already under traffic lane and would not require relocation / lowering. Likely to require protection of the water main at the lane widening, retaining wall, and kerb re-alignment extent of works. |

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|-------------|--|--|
| Sydney Water | Water | DN600 SCL IBL water main from western end of ESUT through Anzac Park to Ernest Street. | Relocate. Affected because it would need to be relocated to tie into the relocation of the water main through the existing ESUT through the widened Ernest Street Bridge. |
| Sydney Water | Water | DN500 CICL water main from western end of ESUT through Anzac Park to Ernest Street. | Relocate. Affected because it would need to be relocated to tie into the relocation of the water main through the existing ESUT through the widened Ernest Street Bridge. |
| Sydney Water | Water | DN500 CICL water main in Park Avenue roadway then westbound Ernest Street roadway connecting to a DN600 SCL IBL main at Ernest Street then through Cammeray Golf Course to eastern end of ESUT. | Relocate. Affected through Cammeray Golf Course by proposed Cammeray Golf Course construction support site (WHT10 and WFU4) works and would need to be relocated. Relocation works carried out as part of the relocation of the water main through the existing ESUT. |
| Sydney Water | Water | DN450 and DN500 CICL water main in Park Avenue roadway then westbound Ernest Street roadway connecting to a DN500 SCL IBL main at Ernest Street then through Cammeray Golf Course to eastern end of ESUT. Tee connection to asset under Ernest Street. | Relocate. Affected through Cammeray Golf Course by proposed Cammeray Golf Course construction support site (WHT10 and WFU4) works and would need to be relocated. Relocation works carried out as part of the relocation of the water main through the existing ESUT. |
| Sydney Water | Water | DN300 and DN375 CICL water main under parking lane / eastern side of Alfred Street North from Whaling Road to a junction with another main to the north of Kurraba Road. | Protect. Mount Street Underpass works avoid the service however rework of Alfred Street North created an impact. To be protected. |

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|----------------|---|--|
| Sydney Water | Water | DN375 CICL water main under parking lane / eastern side of Alfred Street North from junction with another water main at north of Kurraba Road to the intersection with Bent Street. | Adjust. Water main may need protection and fittings to be adjusted to suit new levels. |
| Telstra | Communications | Bank of 24 x DN100 AC (asbestos) conduits under northern side of bridge. Multiple fibres up to 144F, 2 pits along Mount Street to Alfred Street North across Warringah Freeway. Also feeds Sydney Harbour Tunnel control room. Twenty four asbestos conduits under north side of bridge. | Relocate. Affected by Mount Street Underpass at Cahill Expressway entry ramp from Alfred Street North Bridge running under Mount Street intersection. The bank of conduits is to be protected and accommodated by the bridge structure for the crossing of Alfred Street North over the proposed Mount Street Underpass ramp running under Mount Street Bridge. |
| Telstra | Communications | Bank of 28 x DN100 AC (asbestos) conduits. Includes Australia Japan Cable (AJC). Alignment shown on plans based on a combination of Level B and Level D level of data. Major Fibre + Copper, multiple fibres up to 120F, and multiple communications providers through these Telstra conduits. Runs under north side of Falcon Street Bridge also on north side of watermain, along Falcon Street to Miller Street, then heads south along Miller Street to Pacific Highway, east along Pacific Highway to a pit near Alfred Street before it crosses under the railway corridor and head south along Alfred Street to the harbour. | Relocate. Conduits may need protection to the west of Falcon Street Bridge due to proposed structural modifications to the north-western corner of the Falcon Street bridge deck. As a result, assets would be offset further north under new verge. |

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|----------------|--|---|
| Telstra | Communications | Running east-west under southern footway of Falcon Street, then running south under eastern footway/through park along Miller Street. | Protect. Not affected by the proposed intersection re-configuration works on Miller Street and the Telstra conduits and pit remain within the footway area. However, the communications conduits may be required protection under the footpath regrading works. |
| Telstra | Communications | Combination of major and local distribution network comprising of optic fibre cables in varied conduits and direct buried cables configuration under western footway of Miller Street and under the intersection with Falcon Street to the north-western corner of the intersection. | Relocate. Affected by proposed realignment of the left turn lane. The pit ends up in a trafficked lane and would need to be relocated |
| Telstra | Communications | Optic fibre, CC network along westbound verge of Warringah Freeway between Chandos Street and Brook Street, from a communications panel attached to an electrical pole along back of houses and flats at dead-end of Chandos Street to left turn slip lane onto Brook Street. | Adjust. Fibre feeding mobile phone relay panel mounted on a Roads and Maritime owned street light. Entire run in existing verge impacted by Warringah Freeway widening. |
| Telstra | Communications | Multiple fibres up to 24F, CC and DA network. Telstra mains cable 4x100mm AC, 2x100mm PVC. Telstra mains cable 20x100mm AC crossing High Street from Arthur Street to beginning of Pacific Highway exit ramp. Varied conduits types including asbestos conduits. | Relocate. Affected by proposed surface works on Pacific Highway and new retaining wall for widening under High Street Bridge. The maintenance hole in the median south of High Street Bridge is affected by the proposed retaining wall, and the maintenance Hole at the intersection of Arthur Street / High Street / Pacific Highway and would need to be relocated. |

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|----------------|--|--|
| Telstra | Communications | Communications network under both eastern and western side along Cammeray Avenue including services to emergency phones in Warringah Freeway. NBN present through the Telstra ducts along the western side on Cammeray Avenue. | Protect and relocate. Affected by proposed surface works and conduits/cables are to be protected. |
| Telstra | Communications | From the Telstra pit at the crossing under Arthur Street opposite Arthur Street Park, heading south through Arthur Street Park towards High Street. Optus optic fibre cable through Telstra conduits as advised by Optus. | Relocate. Affected by surface works on Arthur Street, widening, and proposed Arthur Street east construction support site (WFU4). Cables under new surface works to be protected. |
| Telstra | Communications | CC network along eastern side of Alfred Street North from Whaling Road then crossing to the western side of Alfred Street North south of Darley Street to Ridge Street Bridge. | Relocate. Affected in part by ramp and surface work and new Ridge Street pedestrian bridge works. |
| Telstra | Communications | Optic fibre cables along eastern side of Pacific Highway, north of the intersection with Berry Street and along northern side of Berry Street | Protect. May require protection under proposed kerb realignment works at the north-eastern corner of the Berry Street and Pacific Highway intersection. |
| Telstra | Communications | Combination of local area and major cables network along eastern side of Alfred Street North from Ridge Street pedestrian overbridge to Wyagdon Street. | Relocate. Affected by the proposed road works and narrowing of Alfred Street North between the Ridge Street pedestrian overbridge to Wyagdon Street. |

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|----------------|---|---|
| Uecomm | Communications | Optic fibre through conduit in ESUT crossing under Warringah Freeway from Cammeray Avenue to Cammeray Golf Course north of Ernest Street Bridge. Note, DBYD notes it as Optus asset however Optus has confirmed likely to be Uecomm as they don't have any Optus assets through the ESUT. | Relocate. Clashes with Beaches Link and Western Harbour Tunnel exit/entry portal structures. ESUT to be demolished. |
| Uecomm | Communications | Optic fibre cables run through Anzac Park to the west of the ESUT, through the ESUT crossing under Warringah Freeway, and then through Cammeray Golf Course to the north towards Bells Avenue. | Relocate. Affected due to the removal of ESUT and it clashes with the Beaches Link and Western Harbour Tunnel exit/entry portal structures, and with the proposed Cammeray Golf Course construction support site (WHT10 and WFU8). |
| Uecomm | Communications | Optic fibre through own duct under northern footway of Falcon Street from the north-western corner of Miller Street/Falcon Street intersection to east of Bardsley Gardens. | Adjust. Affected due to the proposed kerb and footpath adjustment works on Miller Street southbound around the intersection with Falcon Street providing for an additional left turn lane. The conduits would need to be adjusted/lowered to suit new pavement levels. |
| Uecomm | Communications | Uecomm owned optic fibre cables and ducts along eastern side of Warringah Freeway heading south from ESUT towards Ernest Street and then heading east under northern footway of Ernest Street to Park Avenue. | Relocate. Affected by trough structure works at Cammeray Golf Course. Section of asset would require relocation due to trough structure, and Cammeray Golf Course construction support site (WHT10 and WFU8). Would require protection under proposed construction support site entry into Cammeray Golf Course off Ernest Street. |

| Utility service provider | Description | Existing location | Proposed treatments |
|--------------------------|----------------|---|--|
| Uecomm | Communications | Optic fibre communications cables from Arthur Street Park, under High Street Bridge, and into Northbound Sydney Harbour Tunnel via the Sydney Harbour Tunnel Control Room under High Street Bridge. Note, United Energy are owned by Uecomm. Asset information to be updated upon receipt of further asset information from Uecomm. | Relocate. Affected by proposed surface works on Arthur Street, road widening works, High Street Bridge upgrade works, and proposed Arthur Street east construction support site (WFU4). To be migrated with other communication assets through the Sydney Harbour Tunnel run. |
| Uecomm | Communications | Uecomm owned pit and conduit section in footpath at south-western corner of Miller Street and Falcon Street intersection. | Relocate. Affected by proposed kerb and footpath adjustment works on Miller Street southbound around the intersection with Falcon Street. The pit would end up in a trafficked lane and would need to be relocated. |
| Verizon | Communications | Optic fibre cables from Sydney Harbour Tunnel control room in Warringah Freeway, through Arthur Street Park, crossing under Arthur Street to Little Walker Street under Pacific Highway southbound footpath. | Relocate. Affected by surface works on Arthur Street, widening, and proposed Arthur Street east construction support site (WFU4). Relocate with Sydney Harbour Tunnel run. |
| Vocus | Communications | Communications cables from Arthur Street Park north of High Street Bridge and through Sydney Harbour Tunnel. | Relocate. Affected by proposed surface works on Arthur Street, road widening works, and possible proposed Arthur Street east construction support site (WFU4). To be relocated with other communication assets through the Sydney Harbour Tunnel run. |

4 Utility connections

4.1 Construction and operational power supply overview

The Ausgrid System Planning group has completed a planning study to investigate the proposed connection of four construction power supplies for the Western Harbour Tunnel and Warringah Freeway Upgrade project. Ausgrid has also completed a planning study detailing possible routes for the tunnel operational power supply.

Construction power supply would be via a temporary 11 kV connection to enable tunnel construction while the operational power supply demands are dependent on the power demand during the tunnel operation.

Estimates of the power demands are discussed in the sections below; however, the actual power demands are subject to final construction methodologies and requirements would be confirmed during future design phases of the project.

Based on the supply capacities of sub-transmission substations (STSs) and the portal locations, Ausgrid would allocate the appropriate high voltage power supply connection points. The locations for Western Harbour Tunnel substations would then be determined. Ausgrid may need to conduct enabling works at their STSs to allow for the additional capacity required for the tunnel maximum demand.

4.1.1 Construction power supply

Several construction support sites are proposed along the project as detailed in Section 1 of this report. Major construction power would be required at sites where tunnelling would be carried out by roadheaders. Construction power supply to other construction support sites would be arranged by the contractor and is likely to be provided either from local supplies or by generators.

The proposed connection of four construction supplies for the Western Harbour Tunnel and Warringah Freeway Upgrade projects are regarded as temporary 11kV connection points.

The projected estimate of maximum power demands is shown in Table 4-1. The maximum power demand has been conservatively calculated to allow for larger or additional roadheaders. Target power connection dates are indicative only and would be reviewed during detailed design in consultation with Ausgrid. The actual requirements would be confirmed in future design phases.

Roads and Maritime has appointed a Level 3 Accredited Service Provider (ASP3) to carry out the detailed designs for the construction power supply for the four sites as noted in Table 4-1. The construction power supplies are proposed to be installed along existing road and pathways corridors where feasible to minimise environmental impacts and minimise the visual impact of utility works to the surrounding community. An existing services search would be carried out to determine if there is potential impact on existing utilities. If there is potential to impact on existing utilities, alternative routes may need to be considered.

Table 4-1 Estimate of construction power supply demand

| Project | Construction support Site Location | Temporary Power Requirement (MVA) | Timing |
|------------------------|--|--|-------------------|
| Western Harbour Tunnel | Victoria Road (WHT1) Victoria Road, Rozelle | 8.5 | Q2 2020 – Q3 2024 |
| | Yurulbin Point (WHT4) Intersection of Numa Street and Louisa Road, Birchgrove | 4 | |
| | Berry's Bay (WH17), Waverton | 5 | |
| | Cammeray Golf Course (WHT10 and WFU8) Near Cammeray Golf Course, Cammeray | 7 (1 x 5 MVA and 1 x 2 MVA High voltage customers (HVC) connections) | |

4.1.2 Operational power supply

The permanent loads for the Western Harbour Tunnel are designed to allow for single outage (n-1) supply contingency. This means that the complete tunnel can either be supplied directly from one end by a STS using separate bus-bars, or both ends of the tunnel from different supply yards.

The estimates in Section 4.1.2.1 are based on inputs from ventilation, power, drainage, and auxiliary design loads based on previous tunnel projects.

4.1.2.1 Western Harbour Tunnel

In addition to the substations at the Rozelle and Warringah Freeway portals, the power supply network is set to consist of an additional five substations within the tunnel with the main supplies coming from the Rozelle portal substation.

Power during operation of the tunnel is required for exhaust fans, air supply fans, fire hydrant pumps, fire sprinkler pumps, CCTV monitoring and other operational requirements. Preliminary findings show that the power required for the Western Harbour Tunnel is approximately 32 MVA. The maximum demand is based on the worst case operating scenario defined by the tunnel ventilation system.

To meet the estimated maximum demand loads, further discussions with Ausgrid would be required to determine suitable power strategies. Based on the supply capacities of their STSs and the portal locations, Ausgrid would allocate the appropriate high voltage power connection points. The locations for Western Harbour Tunnel substations would then be determined.

Ausgrid may need to conduct enabling works at their STSs to allow for the additional capacity required for the tunnel maximum demand.

The following option is considered by Ausgrid for the connection of the permanent supply at the Rozelle portal for the Western Harbour Tunnel:

- Two new 33 kV feeders from the STS.

The proposed Ausgrid supply substations for Western Harbour Tunnel have been selected based on their proximity to the proposed portal supply substation.

High level investigation has been carried out to develop a possible cables route for the permanent power supply from the Rozelle STS to the Western Harbour Tunnel portal at Rozelle Rail Yards. The proposed cables

route comprises of two 33 kV cables starting at the Rozelle STS, passing through Callan Park to Balmain Road with a short run heading south-west along Balmain Road, then heading south along Alberto Street and Ryan Street to Lilyfield Road, and finally heading east along Lilyfield Road to the Rozelle Rail Yards. This route is the shortest path to the proposed supply points and may vary from routes taken by Ausgrid's existing assets in the vicinity. Roads and Maritime may prefer to follow existing Ausgrid routes or develop alternates.

An existing services search has not been carried out along the proposed routes nor has an easement assessment been done. The intent of this preliminary route selection is to provide a high-level assessment to indicate the order of magnitude required for possible power supply feeder routes.

Upon the selection of a preferred operational power supply route, an existing services search would be carried out to assess impact on existing utilities. Subject to the utilities impact assessment, alternative routes may need to be considered.

4.1.2.2 Warringah Freeway Upgrade

There are no specific power supply requirements for the Warringah Freeway Upgrade project outside of the standard power supply provisions for infrastructure such as road lighting and CCTV.

Power to the Cammeray tunnel support site which includes substations for both the Western Harbour Tunnel and Beaches Link Tunnel would be supplied via the two proposed 33 kV permanent power supply routes from the Rozelle STS, and the two proposed 33 kV permanent power supply routes from the Warringah STS.

4.2 Utilities route options considerations

For some of the proposed utility works there may be several potential route options which are available. In determining a preferred route option, the following would be considered as relevant:

- The requirements of the relevant utility provider
- Minimising commercial and schedule risk
- The location of existing utilities in relation to the project infrastructure and surrounding existing utilities
- Allowing ease of access for both construction and maintenance
- Locating infrastructure in areas of previous disturbance such as road reserves or infrastructure corridors
- Adopting the shortest feasible route (all other considerations allowing)
- Where possible, avoiding or minimising impacts on:
 - Sensitive environmental areas (e.g. watercourse crossings)
 - Known areas of contamination or acid sulphate soils
 - Heritage Conservation Areas and listed heritage items
 - Areas of public open space
 - Visibility of, and access to, commercial businesses
 - Residential and other sensitive receivers
 - Major roads which are heavily trafficked
- Cumulative impacts with other concurrent or overlapping projects.

5 Stakeholder and community coordination

5.1 Community consultation and notification

Any notification of proposed utility works would be as per the requirements of the asset owner, community consultation, and notification periods in accordance with the contractors' environmental management plans (CEMPs) as appropriate.

Where there are no alternate feasible route options for the utility adjustment, then the local community who may be affected would be given prior notification of the works, at least five days prior to the works commencing.

5.2 Co-ordination of utility works

To ensure that the potential cumulative environmental impacts associated with proposed utility works are effectively managed it is essential that various individual utility works are co-ordinated.

The Western Harbour Tunnel project interfaces with two other major infrastructure projects- the M4-M5 Link and Sydney Metro City & Southwest. It is proposed that a quarterly Utility Co-ordination Committee be established by the Contractor. Utility Authorities would be invited to attend and provide updates on any upcoming utility upgrade or new utility works that may interface with this project to facilitate better planning for, and co-ordination of, utility works.

It is proposed that the Utility Co-ordination Committee comprise representatives from the following organisations:

- Roads and Maritime
- Sydney Motorway Corporation
- Sydney Metro
- Sydney Harbour Tunnel Authority
- Ausgrid
- Jemena
- Sydney Water
- Telstra and other telecommunications providers
- Local government authorities
- The contractors for other interfacing projects such as M4-M5 Link, Navigable harbour traffic and Sydney Metro City & Southwest as appropriate.

6 Environmental management

6.1 Environmental management process

Utility works would be carried out to meet a series of environmental objectives. These objectives have been identified to be consistent with environmental performance measures in the environmental impact statement but provide more specific content relevant to utility works where appropriate.

Under the planning approval for the project utility works may or may not fit within the definition of construction. If works fall within the definition of construction, a range of additional approvals are required before the works can commence, including approval of the CEMP by the Secretary of the Department of Planning, Industry and Environment. In many cases it is envisaged that utility works (because they are relatively small scale) would not fall within the definition of construction, and would generally require internal Roads and Maritime approval and/or the approval of the Environmental Representative. These two different pathways are summarised on Figure 6-1.

Irrespective of the pathway required to enable commencement, environmental management measures would be identified to meet the environmental objectives and in response to an environmental risk assessment.

In some cases (for example major utility connections) additional planning approval may be required. In those situations, the works would be subject to requirements specific to those approvals. Roads and Maritime would however work with relevant utility providers to ensure consistency with the environmental management outcomes identified in this strategy.

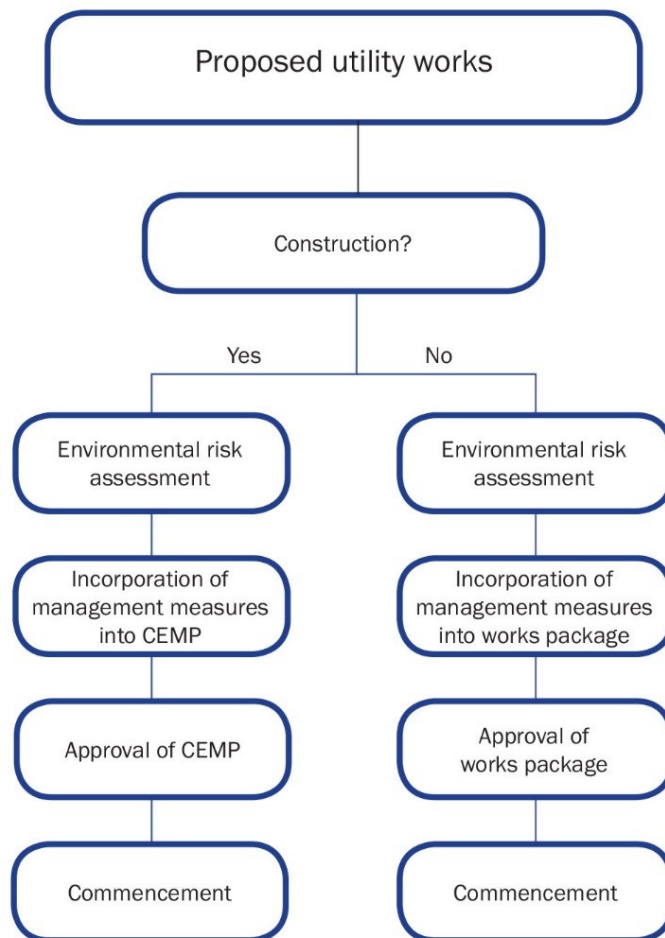


Figure 6-1 Utilities works – environmental management process

6.2 Potential impacts to be managed

Typical environmental impacts associated with anticipated utilities works during the construction phase of the project are identified in Table 6-1. This list is not intended to limit the range of environmental aspects to be considered, but rather provides a guide for likely matters to consider.

Table 6-1 Potential impacts to be managed during utilities works

| Environmental aspect | Typical impacts to be managed |
|-------------------------|--|
| Traffic and access | <ul style="list-style-type: none"> • Additional construction related traffic resulting in changes/disruptions to traffic movements • Traffic-related safety incidents during construction (workers and road users) • Changes/disruption to property access • Changes/disruption to bus services/routes • Changes/disruption to pedestrian and cyclist movements • Temporary reduction in available car parking. |
| Noise and vibration | <ul style="list-style-type: none"> • Vibration depending on type of utility works/installation technique (eg horizontal directional drilling or trenching) • Road traffic noise due to construction vehicle movements/haulage routes and changes in traffic movements associated with detours • Construction noise associated with physical works and type of plant and equipment proposed. • Construction vibration on retained and re-laid utilities |
| Air quality | <ul style="list-style-type: none"> • Dust from construction works (e.g. from exposed surfaces, spoil stockpiles or spoil haulage) • Exhaust emissions from equipment, machinery and construction vehicles. |
| Non-Aboriginal heritage | <ul style="list-style-type: none"> • Direct impacts from works within heritage curtilage or heritage conservation area • Potential indirect impacts to views and vistas associated with heritage items/conservation areas • Potential impacts to heritage buildings/fabric from vibration • Unexpected impacts on unknown heritage items (e.g. archaeological items) during utility relocation/adjustment works. |
| Aboriginal heritage | <ul style="list-style-type: none"> • Potential disturbance to registered sites or areas of potential archaeological deposits • Unexpected finds during utility relocation/adjustment works. |
| Soils and water | <ul style="list-style-type: none"> • Erosion of soils resulting in offsite sedimentation • Potential disturbance, handling and disposal of contaminated material including acid sulphate soils. |

| Environmental aspect | Typical impacts to be managed |
|--|--|
| Flooding | <ul style="list-style-type: none"> • Potential impacts on construction activities due to flooding. |
| Biodiversity | <ul style="list-style-type: none"> • Removal of vegetation and/or trees • Impact to tree protection zones • Loss of habitat such as trees and other vegetation types causing habitat fragmentation • Noise and vibration impacts to fauna. |
| Land use and property | <ul style="list-style-type: none"> • Potential leasing of property for construction works • Potential changes to, or requirements for, easement arrangements for utility. |
| Social and economics | <ul style="list-style-type: none"> • Loss of community facilities/open space • Changes to access during construction • Potential impacts to businesses as a result of changes in traffic, access, parking and amenity. |
| Landscape character and visual amenity | <ul style="list-style-type: none"> • Adverse visual and landscape character impacts due to construction related activities (e.g. trenching, stockpiling of materials, parking/use of construction plant and vehicles, fencing etc.) • Light spill from out-of-hours works during construction • Rehabilitation of land (potential replanting etc.) following relocation/adjustment works. |
| Hazard and risk | <ul style="list-style-type: none"> • Transport and storage of hazardous substances and dangerous goods • Potential rupture of, or interference with, underground utilities • Risk of bushfires • Utilities comprising of asbestos materials have been identified as potentially impacted by the proposed works. |
| Resource use and waste management | <ul style="list-style-type: none"> • Increased demand on electricity and water supply • Increased demand on local and regional resources • Increased diesel use • Impacts associated with poor waste management • Impacts associated with unexpected waste volume or types. |
| Sustainability | <ul style="list-style-type: none"> • Emissions of greenhouse gases as a result of construction activities. |
| Cumulative impacts | <ul style="list-style-type: none"> • Construction noise and traffic associated with other construction support sites in proximity to the works. |

6.3 Environmental objectives for utility works

Environmental objectives for utility works are listed below. These objectives would be required to be met and would be an important input in the detailed design of utility works and in the development of specific management measures. This list to be subject to ongoing review to remain aligned to environmental performance measures and mitigation measures in the environmental impact statement.

Table 6-2 Environmental objectives for utility works

| Environmental aspect | Management objectives for utility works |
|--|---|
| Traffic and transport | <ul style="list-style-type: none"> • Minimise disruption to traffic operation, road users pedestrians, cyclists and access to adjoining properties (private and public) • Maximise the safety for workers by isolating work areas from traffic flows, applying low exposure work methods, education and the installation of appropriate traffic control • Minimise use of on-street parking by site workers • Minimise disruption to traffic operation, road users, pedestrians, cyclists and access to adjoining properties (private and public) • Limit obstructions and restrictions, and when required, provide alternatives to maintain access for local community, transport operators (buses) including over-dimension load movements and commercial developments • Encourage sustainable transport options by site workers. |
| Noise and vibration | <ul style="list-style-type: none"> • Minimise noise and vibration impacts on residents and businesses • Develop construction methodologies to avoid structural damage to any existing buildings, infrastructure or heritage items as a result of construction vibration • Keep the community notified of works. |
| Air quality | <ul style="list-style-type: none"> • Minimise dust and vehicle emissions from construction activities as far as practicable. |
| Non-Aboriginal and Aboriginal heritage | <ul style="list-style-type: none"> • Avoid impacts on items or places of heritage value • Avoid accidental impact on heritage items • Maximise worker's awareness of indigenous and non-indigenous heritage. |
| Soils and water quality | <ul style="list-style-type: none"> • Prevent pollution of surface water through appropriate erosion and sediment control • Maintain existing water quality of surrounding watercourses • Prevent the pollution of groundwater through appropriate controls • Minimise the potential for impact on groundwater dependent ecosystems. |
| Flooding | <ul style="list-style-type: none"> • Minimise the potential for permanent utility infrastructure to impact flood behaviours • Minimise the potential for flooding to impact utility infrastructure. |

| Environmental aspect | Management objectives for utility works |
|--|---|
| Biodiversity | <ul style="list-style-type: none"> • Minimise impacts on flora and fauna • Retain existing flora and fauna habitat wherever possible • Appropriately manage the spread of weeds and plant pathogens. |
| Landuse and property | <ul style="list-style-type: none"> • Minimise impacts to private property during utility works. |
| Social and economics | <ul style="list-style-type: none"> • Maintain access to residences and businesses during utility works • Plan utility works to be carried out at the same time as other project construction works to minimise disturbance more than necessary in one location. |
| Landscape character and visual amenity | <ul style="list-style-type: none"> • Minimise the visual impact of utility works to the surrounding community. |
| Hazard and risk | <ul style="list-style-type: none"> • Continue investigations and consultation with utility providers to avoid potential risks to existing utilities and services during construction of the project. |
| Resource use and waste management | <ul style="list-style-type: none"> • Use recycled materials • Avoid unnecessary resource consumption • Recycle and reuse materials onsite • Use water efficient construction methods and equipment. |
| Sustainability | <ul style="list-style-type: none"> • Minimise energy use and carbon emissions during construction • Encourage subcontractors and materials suppliers to adopt sustainability objectives in their works and procurement. |
| Cumulative impacts | <ul style="list-style-type: none"> • Coordinate utility works and other project construction works to minimise cumulative impacts such as traffic, parking, noise and vibration, land use, air quality and visual. |

6.4 Risk based environmental assessment process

A risk based environmental assessment process would be carried out prior to the development of environmental management measures (refer to Figure 6-2). The environmental risk assessment would be consistent with relevant Australian and international standards.

It is also intended that the environmental risk assessment would be carried out in an iterative manner with the detailed design of utility works to maximise the opportunity for environmental objectives to be met. The risk based environmental assessment would be carried out whether a particular utility relocation package is deemed to fall within the definition of construction.

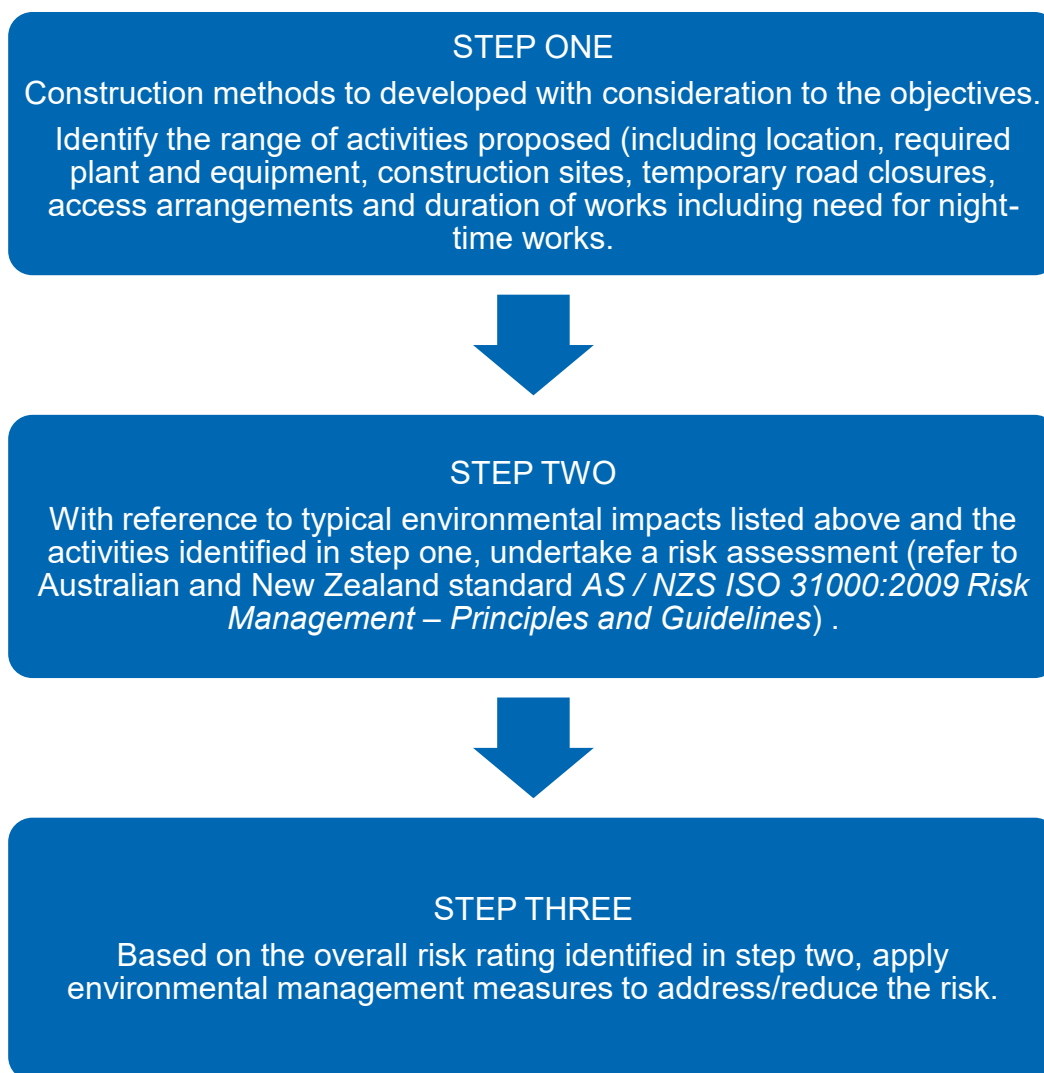


Figure 6-2 Risk based environmental assessment process

