ES

Executive summary

January 2020

Executive Summary

Western Harbour Tunnel and Warringah Freeway Upgrade Project

Strategic context

The population of Sydney is forecast to grow from six million to eight million people over the next 40 years. To accommodate this growth, The Greater Sydney Commission's *Greater Sydney Region Plan – A Metropolis of Three Cities* (Greater Sydney Commission, 2018a) proposes a vision of three cities where most residents have convenient and easy access to jobs, education and health facilities and services.

The Western Harbour tunnel and Warringah Freeway Upgrade project is located in the Eastern City District, including the Harbour Central Business District (CBD) and the North District of the Eastern Harbour City as shown in Figure E-1. Together, the Eastern City and North Districts support 40 per cent of the population and 60 per cent of the jobs in Greater Sydney.

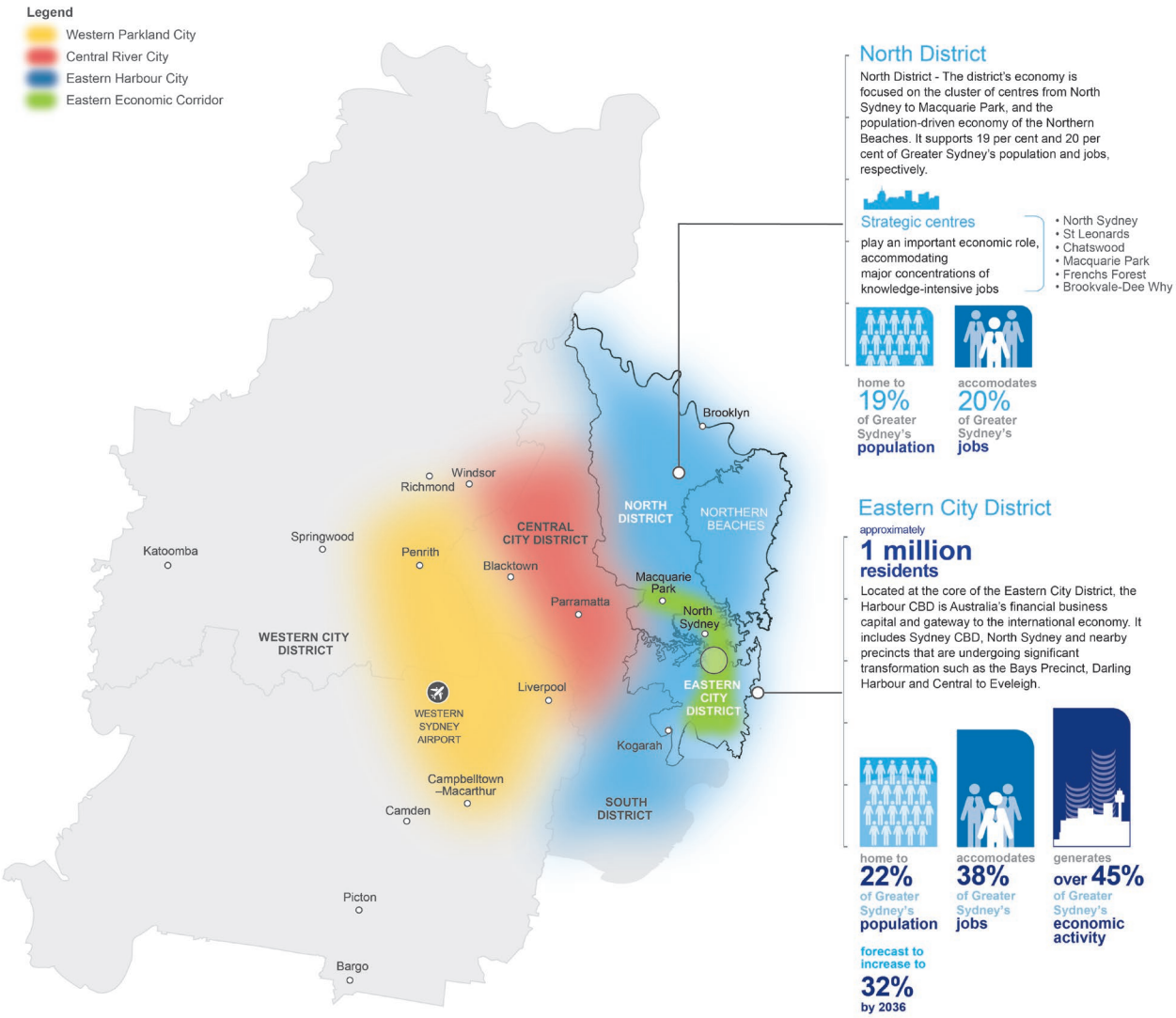


Figure E-1 Greater Sydney's Eastern City and North districts

Supporting the current needs and future growth of the Eastern Harbour City and Eastern Economic Corridor through an efficient transport network is fundamental to the liveability, productivity and sustainability of Greater Sydney. Accordingly, the *Greater Sydney Region Plan* was prepared concurrently with the *Future Transport Strategy 2056* (NSW Government, 2018) and the *State Infrastructure Strategy 2018 – 2038* (Infrastructure NSW, 2018) to align land use, transport and infrastructure outcomes for Greater Sydney.

Project need

The motorway crossings of Sydney Harbour, including the Sydney Harbour Bridge, Sydney Harbour Tunnel and ANZAC Bridge, are critical links in Sydney's motorway and arterial road network. Key metrics for the Eastern Harbour City's road transport network are shown in Figure E-2.

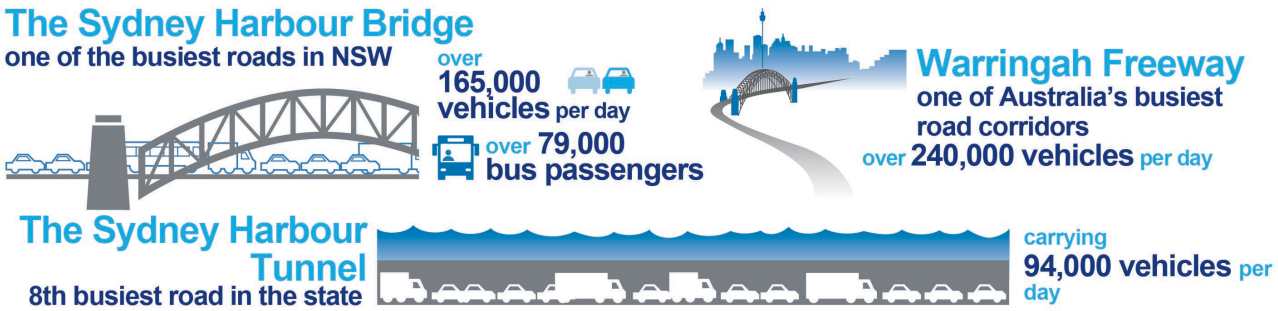


Figure E-2 Key metrics for the Eastern Harbour City's transport network

The high demand and limited capacity on the Sydney Harbour crossings result in delays and unreliable journey times for a significant number of customers who directly rely on these corridors. Furthermore, the limited number of alternate routes for crossing Sydney Harbour makes these corridors critical to the performance of the broader motorway and arterial road network. Network data demonstrates that incidents on the Sydney Harbour Bridge, Sydney Harbour Tunnel and their approaches can quickly and severely impact transport movements across Sydney.

Further to the large traffic volumes and limited alternative routes, a major contributor to congestion around the Harbour CBD is that many of the most critical road corridors – including Sydney Harbour Bridge, Sydney Harbour Tunnel, ANZAC Bridge, Western Distributor, and the Warringah Freeway – perform both bypass and access functions. The dual function of these corridors is reflected in the high proportion of vehicles that use them to travel to destinations other than Sydney CBD. These conflicting functions, combined with high traffic volumes, result in congestion and poor network performance experienced by freight, public transport and private vehicle users.

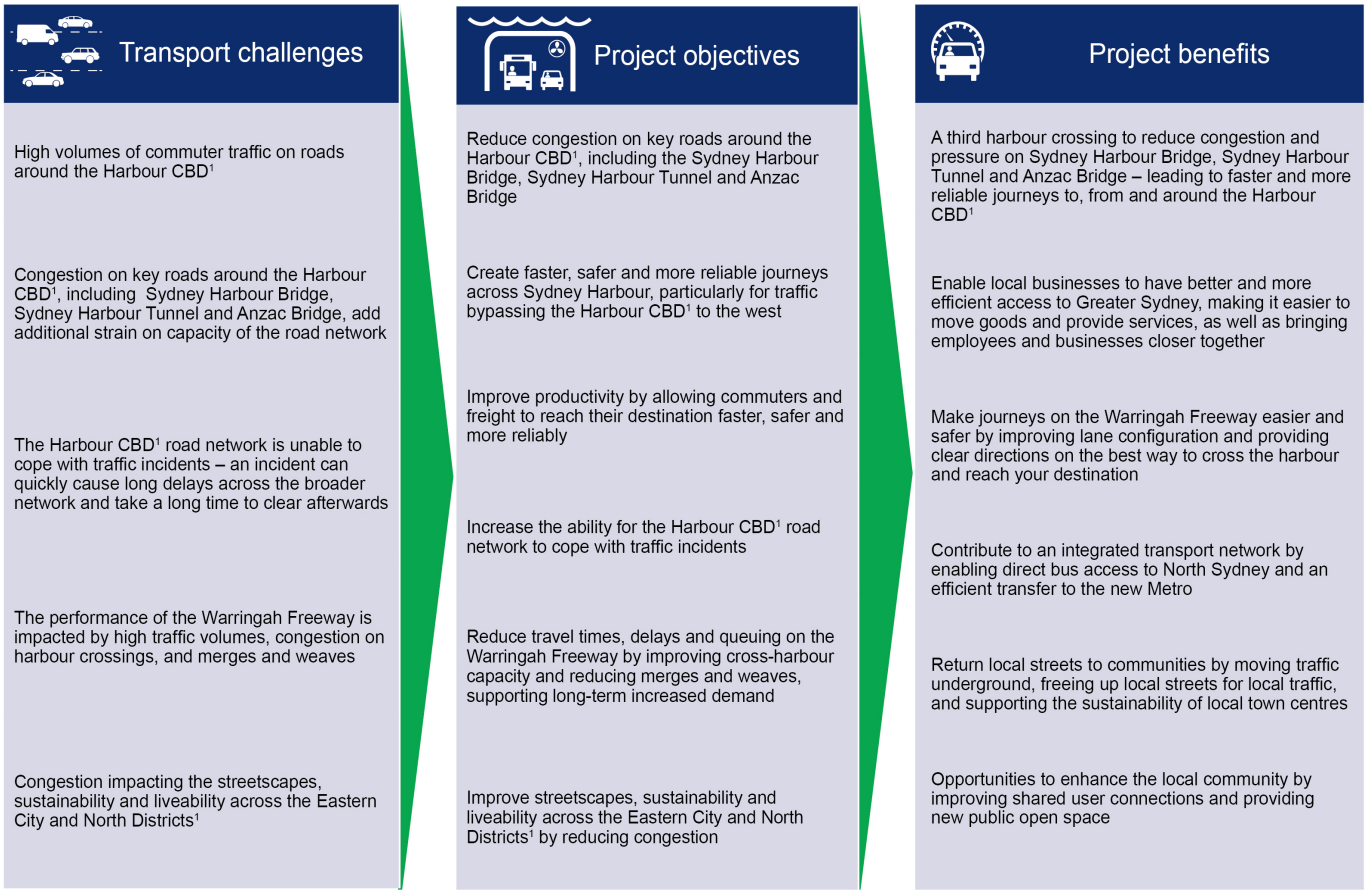
The Eastern Distributor, Sydney Harbour Bridge, Warringah Freeway and the Gore Hill Freeway corridor are among Australia's most congested road corridors, generating a congestion cost of around $65,000 per day in 2016 (Infrastructure Australia, 2019). These corridors are integral to the economic growth of Sydney's Eastern Economic Corridor. As Sydney's population and economy continues to grow, so will the pressure on access to this corridor. Demand for this corridor is forecast to increase by 17 per cent by 2037, putting substantial pressure on roads that are already operating at capacity and leading to increases in travel time along these routes. Improvements to transport networks are essential for Sydney to continue to be competitive.

The project is also identified as a priority initiative under Infrastructure Australia's *Australian Infrastructure Plan: The Infrastructure Priority List (*Infrastructure Australia, 2018) for its importance in addressing urban congestion on Sydney's road network and providing cross-harbour connectivity.

Further detail on these transport challenges and their influence on the proposed design for the Western Harbour Tunnel and Warringah Freeway Upgrade is provided in Chapter 3.

Project objectives

To ensure the design for project meets the identified transport needs, the objectives summarised in Figure E-3 have been developed for the Western Harbour Tunnel and Warringah Freeway Upgrade project.



Note 1: Refer to figure E-1 for more information about the location of the Harbour CBD, Eastern City District and North District

Figure E-3 Project challenges, objectives and benefits

Overview of the Western Harbour Tunnel and Beaches Link program

The Western Harbour Tunnel and Beaches Link program of works include:

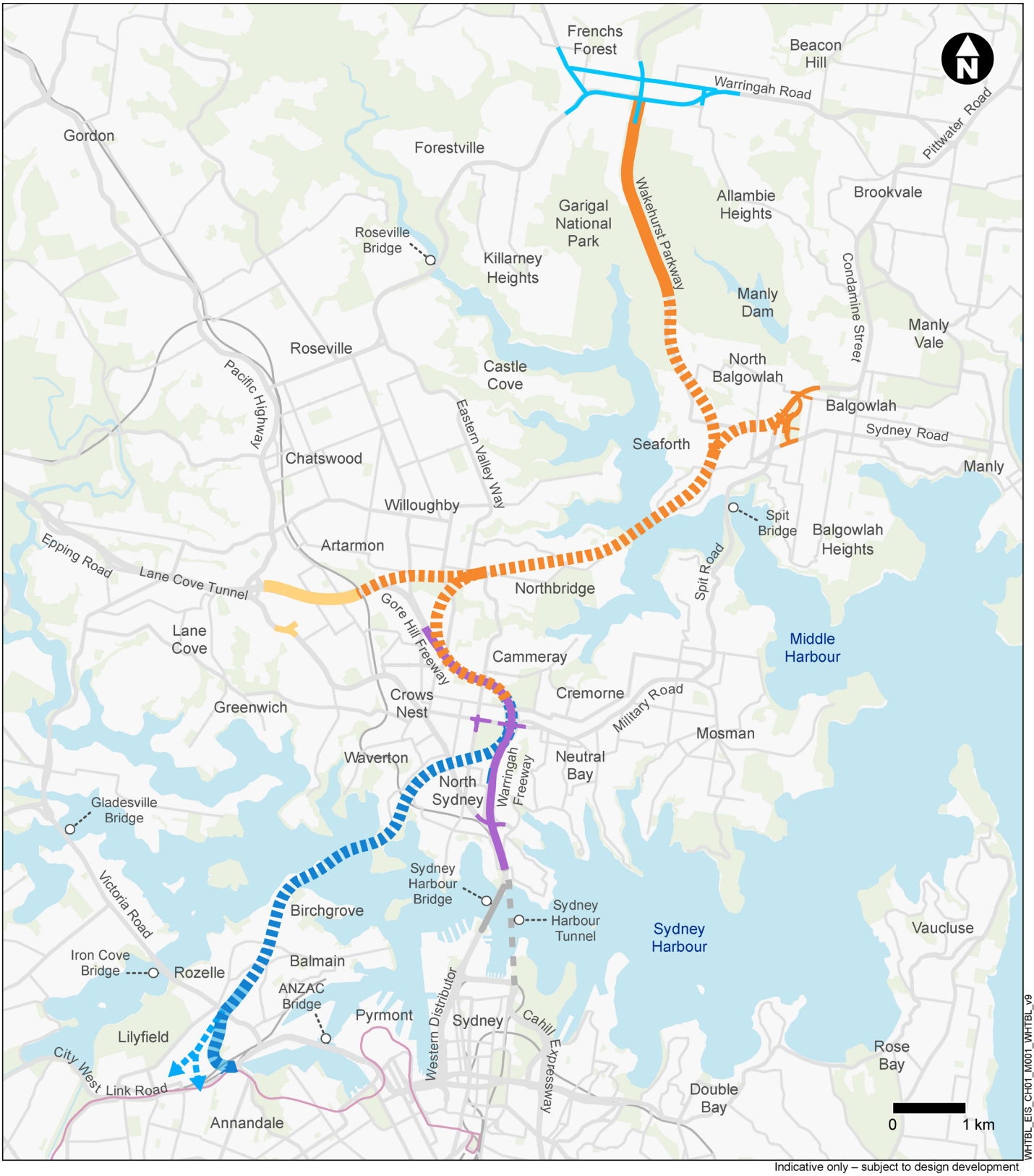
- The Western Harbour Tunnel and Warringah Freeway Upgrade project (the project) which comprises a new motorway tunnel connection across Sydney Harbour, and an upgrade of the Warringah Freeway to integrate the new motorway infrastructure with the existing road network and to enable the future connection of the Beaches Link and Gore Hill Freeway Connection project
- The Beaches Link and Gore Hill Freeway Connection project which comprises a new motorway tunnel connection across Middle Harbour from the Warringah Freeway and Gore Hill Freeway to the Burnt Bridge Creek Deviation at Balgowlah and Wakehurst Parkway at Killarney Heights. This project also includes a surface upgrade of Wakehurst Parkway from Killarney Heights to Frenchs Forest and upgrade and integration works to connect to the Gore Hill Freeway at Artarmon.

The components of the Western Harbour Tunnel and Beaches Link program of works are shown in Figure E-4.

The 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 and more reliable travel times for journeys between the strategic centres along the Eastern Economic Corridor of Sydney – an area between Port Botany and north-west that accounts for over 40 per cent of the NSW gross State product. For example, with the combined program of works, journeys from Dee Why to Sydney Kingsford Smith Airport are expected to be 56 minutes faster. Delivering the program of works would also improve the resilience of the motorway network, given that each project provides additional capacity and an alternative to heavily congested existing harbour crossings and their approaches.

The program of works would also provide an opportunity to improve existing, and introduce new, bus services between key employment and education centres, directly and reliably linking North Sydney to the Inner West region of Sydney and the Northern Beaches. This opportunity would better integrate employment, residential and education centres and provide improved road transport access to a wider range of services and facilities.

The Western Harbour Tunnel and Warringah Freeway Upgrade project and the Beaches Link and Gore Hill Freeway Connection project are subject to separate but coordinated environmental assessment and approval processes.



Indicative only – subject to design development

Legend

Operational features

- Beaches Link
- Gore Hill Freeway Connection
- Western Harbour Tunnel
- Warringah Freeway Upgrade
- M4-M5 Link tunnel fitout and commissioned as part of Western Harbour Tunnel

Connecting projects

- M4-M5 Link connections (indicative)
- Northern Beaches Hospital road upgrade

Existing rail network

- Heavy rail
- Light rail

Figure E-4 The Western Harbour Tunnel and Beaches Link program of works

The Western Harbour Tunnel and Warringah Freeway Upgrade project

This environmental impact statement relates to the Western Harbour Tunnel and Warringah Freeway Upgrade project. The project would comprise:

- A new crossing of Sydney Harbour involving twin motorway tunnels connecting the M4-M5 Link at Rozelle and the Warringah Freeway at North Sydney (the Western Harbour Tunnel)
- Upgrade and integration works along the existing Warringah Freeway, including infrastructure required for connections to and from the Western Harbour Tunnel (the Warringah Freeway Upgrade). This would also include some infrastructure required to integrate the future Beaches Link and Gore Hill Freeway Connection project to reduce ongoing disruption to the Warringah Freeway.

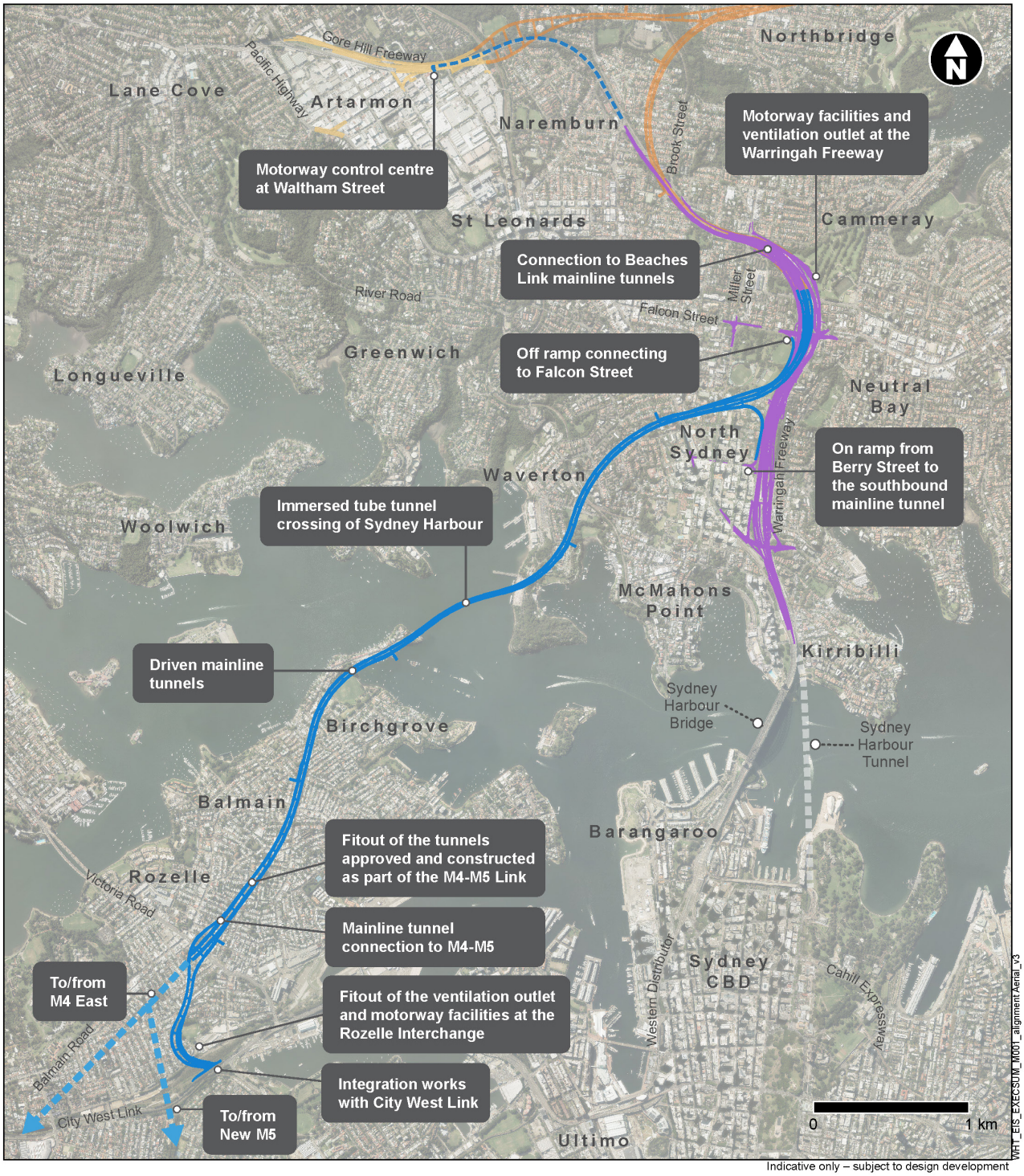
Key features of the Western Harbour Tunnel component of the project are shown in Figure E-5 and would include:

- Twin mainline tunnels about 6.5 kilometres long connecting the M4-M5 Link at Rozelle to the Warringah Freeway, near Cammeray
- An immersed tube tunnel crossing of Sydney Harbour between Birchgrove and Balls Head
- Underground connections to the M4-M5 Link project beneath Rozelle
- Tunnelled ramps and 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
- Tunnelled stubs for future underground connections to the Beaches Link and Gore Hill Freeway Connection project under the Warringah Freeway near Cammeray
- Fitout and commissioning of a ventilation outlet and motorway facilities at the Rozelle Interchange
- Construction of a ventilation outlet and motorway facilities at the Warringah Freeway in Cammeray
- Operational facilities including a motorway control centre at Waltham Street, in 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 E-6 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, 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, and improvements to the geometry and connectivity of the existing southbound bus lane
- Other operational infrastructure, including surface drainage and utility infrastructure, signage, tolling, lighting, CCTV and other traffic management systems.



Legend

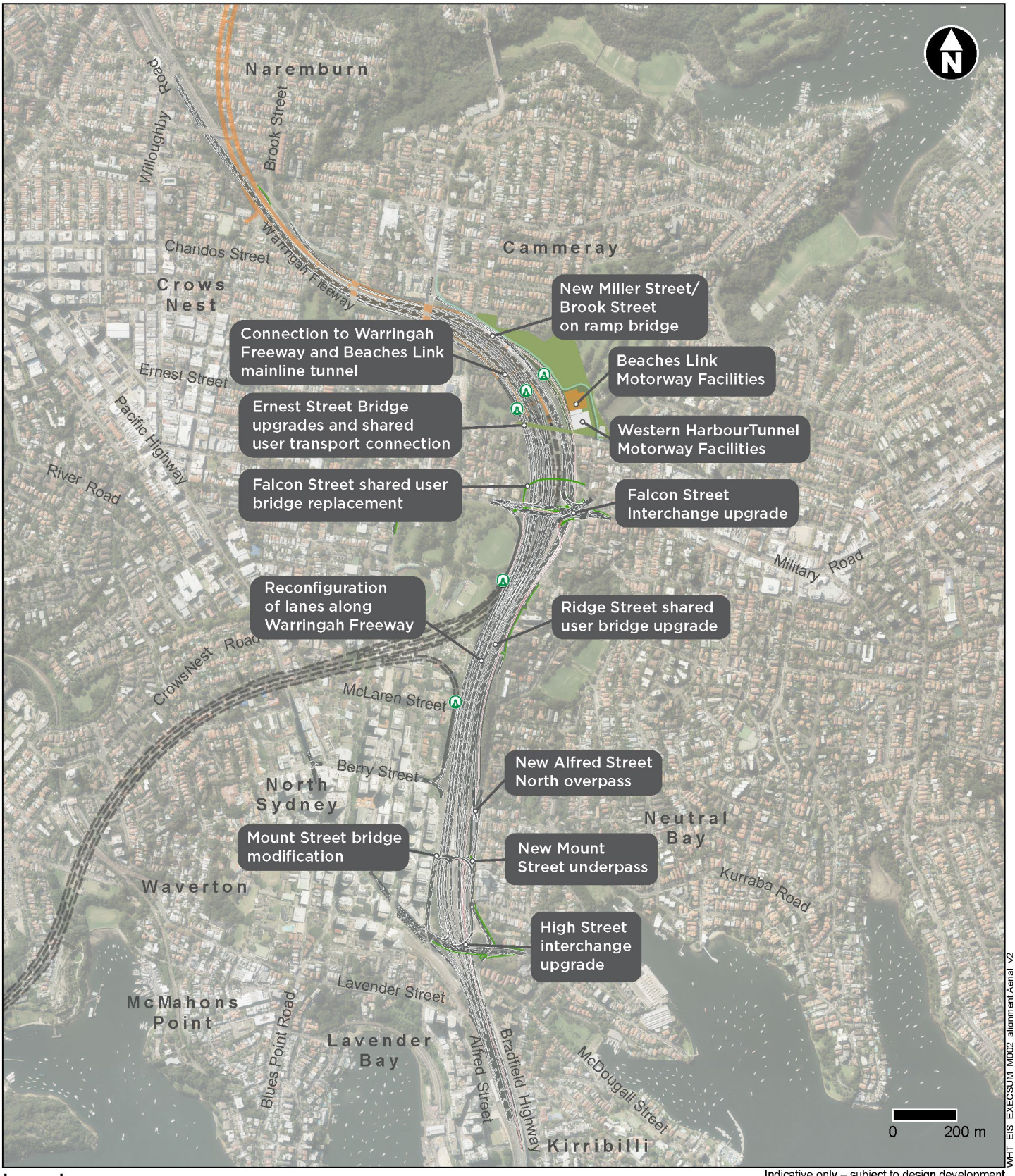
Operational features

- Western Harbour Tunnel
- Warringah Freeway Upgrade
- Communications cable for motorway control centre

Connecting projects

- Beaches Link
- Gore Hill Freeway Connection
- M4-M5 Link connections (indicative)

Figure E-5 Key features of the Western Harbour Tunnel component of the project



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Legend

Tunnels

- Western Harbour Tunnel driven tunnel
- Surface connection

Surface features

- Surface road
- Bus lane
- Cycleway
- Pedestrian / shared user path

Operational infrastructure

- Operational facilities and ancillary infrastructure

Connecting projects

- Beaches Link and Gore Hill Freeway Connection project

Figure E-6 Key features of the Warringah Freeway Upgrade component of the project

Major transport benefits

The project would provide vital additional capacity on the busiest road corridor in Sydney, improving liveability and amenity for local communities who would benefit from reduced through traffic and congestion at surface and improved connectivity. It would also deliver meaningful productivity benefits for NSW.

The project would leverage the underground WestConnex network to deliver a new western bypass of the Harbour CBD, significantly increasing the efficiency and capacity of the transport crossings of Sydney Harbour. The additional core motorway capacity delivered by this project would significantly improve journey times and journey time reliability for about 2.5 million trips for people who use the Sydney Harbour Bridge and Sydney Harbour Tunnel road crossings every week, as well as users of many arterial roads whose performance is affected by these crossings.

The Warringah Freeway Upgrade would connect the new tunnel with the existing road corridor and streamline traffic movements to optimise the future use of the three harbour crossings.

This new western bypass of the Sydney CBD would serve through journeys between the south and west of Sydney, including the international gateways of Sydney Airport and Port Botany, and strategic centres north of the harbour including North Sydney, St Leonards, Chatswood and Macquarie Park. Increased road network capacity and connectivity as a result of the project would also result in travel time savings for freight movements, further serving the growth of Sydney's Eastern Economic Corridor.

The increase in harbour crossing capacity and efficiency delivered by the project would also remove a major bottleneck that constrains the road transport capacity of areas north of the harbour, including the Northern Beaches area. This enables future connections, such as the Beaches Link and Gore Hill Freeway Connection project, which would deliver significant benefits for public transport, freight and other road users over an increased catchment.

The major transport benefits of the project include:

- A third harbour crossing to reduce congestion on the Sydney Harbour Bridge, Sydney Harbour Tunnel and ANZAC Bridge – leading to faster and more reliable journeys to, from and around the Harbour CBD
- Return local streets to communities by moving traffic underground, freeing up local streets for local traffic, and supporting the sustainability of local town centres
- Make journeys on the Warringah Freeway easier and safer by improving lane configuration and providing clear directions on the best way to cross the harbour and reach your destination
- Enable local businesses to have better and more efficient access to Greater Sydney, making it easier to move goods and provide services, as well as bringing employees and businesses closer together
- Contribute to an integrated transport network by enabling direct bus access to North Sydney and an efficient transfer to the new Metro
- Opportunities to enhance the local community by improving shared user connections and providing new public open space.

Project construction

Construction for the Western Harbour Tunnel component of the project would include works underground, underwater and at the surface. The majority of the tunnel for the project would be constructed using roadheaders. The combination of the high quality Sydney Sandstone beneath most of the city, and the wide cross section required for road tunnels make this the most efficient and common method for constructing road tunnels in Sydney.

The poorer geology at the Sydney Harbour crossing and the large elevation change to North Sydney requires the use of a different methodology to cross Sydney Harbour. An immersed tube tunnel, similar to the existing Sydney Harbour Tunnel, has been selected as the preferred solution as it would reduce the risk of deep tunnelling through poor geology and deliver the best transport product by providing the lowest possible gradient for the connections to the Warringah Freeway.

This section of the tunnel would be constructed by dredging a trench across the bed of the harbour between Birchgrove and Waverton and installing pre-fabricated tunnel units to form the harbour crossing. The immersed tube tunnel units would be fabricated at a construction support site at White Bay and transported by tug boats to a temporary mooring at Snails Bay in Sydney Harbour before being placed.

Temporary cofferdams would be constructed within Sydney Harbour off Yurulbin Point and Balls Head near the Coal Loader. The cofferdams would be used to build underground adaptors, called transition structures, which are required to connect the immersed tube tunnels to the mainline driven tunnels.

Although the majority of construction works for the Western Harbour Tunnel component of the project would be underground, surface works would also be required to support tunnelling activities and to construct the construction support sites, surface connections, tunnel portals and operational facilities. Construction activities for the Warringah Freeway Upgrade would generally include surface earthworks, bridgeworks, construction of retaining walls, installation of stormwater drainage and pavement construction.

Construction of the Western Harbour Tunnel and Warringah Freeway would require around 20 construction support sites including tunnelling and tunnelling support sites, civil surface sites, cofferdams, mooring sites, wharf and berthing facilities, laydown areas, parking and workforce amenities. About seven of these sites are areas within the existing Warringah Freeway corridor. An overview of these sites is provided in Figure E-7.

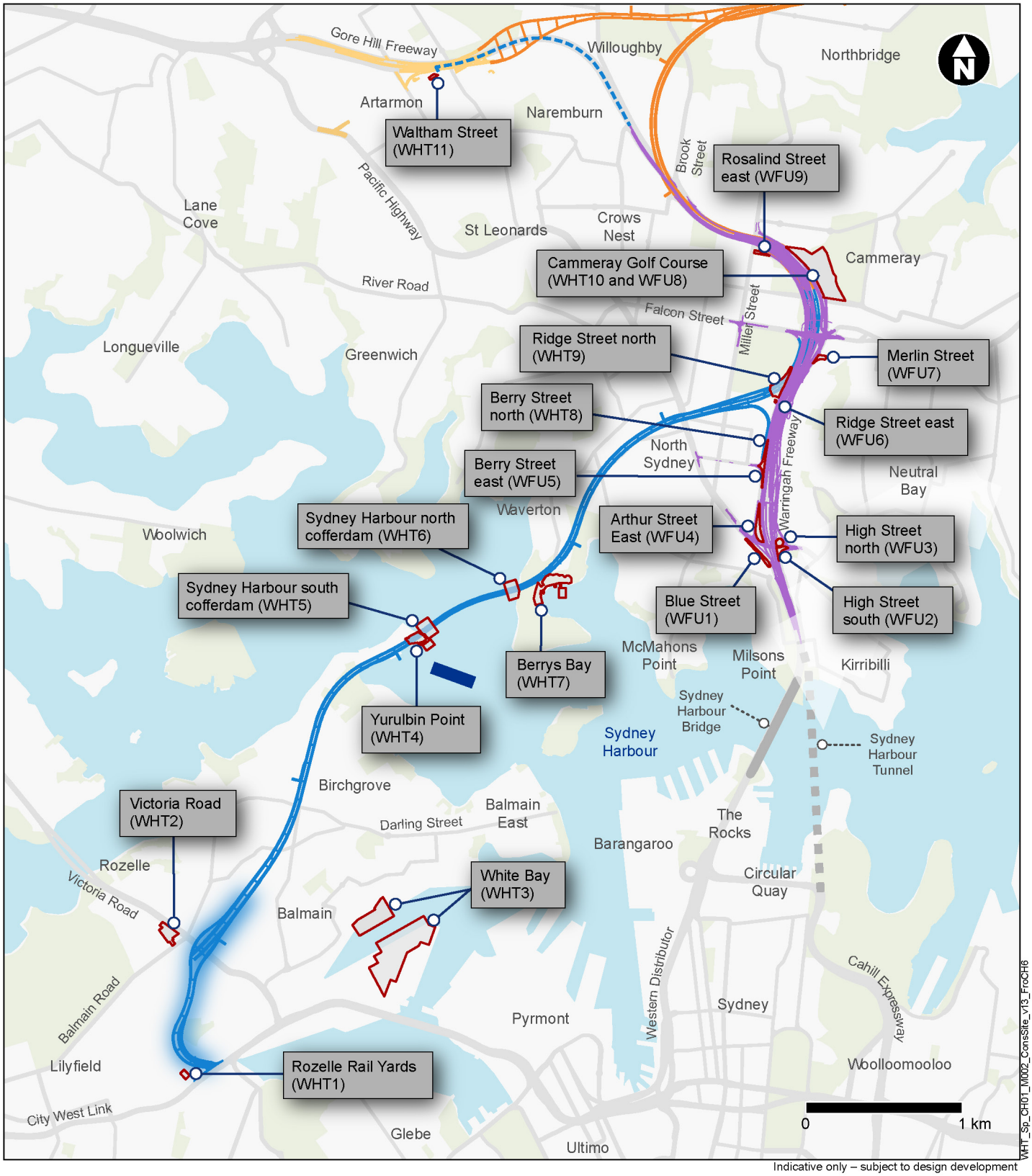
Tunnel spoil generated by the driven tunnels would be removed from acoustic sheds at tunnelling construction support sites. Most of the construction support sites have direct access to the arterial road network, and spoil would generally be removed using trucks. The Yurulbin Point and Berrys Bay construction support sites would use barges to remove spoil to reduce haulage impacts on narrow local streets.

Most of the material dredged for the immersed tube crossing would be transported to the existing designated offshore disposal site managed by the Commonwealth Department of Energy and Environment in accordance with the *Environment Protection (Sea Dumping) Act 1981.* This disposal site is over 20 square kilometres in area, about 120 metres deep, and non-dispersive, meaning that material disposed of stays within the disposal site. The disposal site is currently active and receiving material under permit from other marine maintenance and capital projects. An application for the project to dispose of suitable dredged material at the offshore disposal site has been submitted to the Department of the Environment and Energy.

Dredged materials not suitable for offshore disposal would be transported by barge to White Bay and stabilised, transferred to trucks and transported to a licensed facility. This would be a similar process to the Garden Island works carried out in 2019, which also stabilised and transferred material not suitable for offshore disposal at Glebe Island.

Subject to planning approval, construction of the project is planned to commence in 2020, with completion of construction anticipated in 2026.

For further details on the construction aspects of the project refer to Chapter 6.



Indicative only – subject to design development

Legend

Construction features

- Western Harbour Tunnel
- Warringah Freeway Upgrade
- Communications cable for motorway control centre
- Fit out and commissioned as part of Western Harbour Tunnel, constructed as part of WestConnex M4-M5 Link
- Construction support sites
- Mooring site

Connecting projects

- Beaches Link
- Gore Hill Freeway Connection

Figure E-7 Overview of the construction support sites for the project

Alternatives considered

The need for additional core motorway capacity at the crossings of Middle and Sydney Harbour was identified as key to development of an appropriate multi-modal Sydney transport network in the *NSW Long Term Transport Master Plan* (Transport for NSW, 2012) and subsequent *Future Transport Strategy 2056* (NSW Government, 2018).

Considering the requirements identified within the *NSW Long Term Transport Master Plan* and the *Future Transport Strategy 2056*, a number of strategic alternatives were considered for delivering the required road capacity at the crossing of Sydney Harbour. The project has undergone extensive evaluation of alternatives from pre-feasibility and strategic investigations through to design development and refinement. The process of developing and assessing project alternatives is outlined in Figure E-8.

Following identification of a new motorway tunnel as the preferred strategic alternative, a design development process was carried out to determine the most appropriate alignment and construction method to deliver the tunnel. The process for selection of the preferred tunnel alignment and construction method included consideration of ten strategic corridors and over fifteen different combinations of tunnelling methods.

Options were developed and assessed by a multidisciplinary team including design engineers, construction engineers, transport planners and environmental advisors with direct experience in delivering major transport infrastructure in NSW, Australia and internationally.

Following preliminary technical and environmental analysis, four corridor alternatives were shortlisted for a new tunnelled motorway connection between Rozelle and the northern side of Sydney Harbour (refer to Figure E-9). Selection of the preferred corridor required consideration of various technical and environmental factors, including:

- Strategic traffic demands and how they define the required connectivity to achieve transport outcomes
- Results of geotechnical, groundwater and contamination investigations
- Basements and foundations of major structures in North Sydney
- Marine heritage, biodiversity and marine ecology
- Turbidity and hydrodynamic monitoring and modelling for Sydney Harbour
- Opportunities for viable temporary intermediate tunnelling sites that minimise community, environmental and heritage impacts
- Physical and operational interfaces with other major infrastructure (eg Sydney Metro Tunnels, Rozelle Interchange, the Warringah Freeway)
- Integration with the proposed Beaches Link and Gore Hill Freeway Connection project in the future
- Horizontal alignments and waterway crossing methodologies that allow the tunnel to achieve acceptable vertical gradients to achieve the desired transport product, reduce whole of life emissions, operational costs, and improve safety outcomes
- Interfaces with commercial and recreational maritime traffic
- Construction and operational costs.

The blue corridor was selected as the preferred corridor alternative for the new motorway (refer to Figure E-9). This corridor was selected based on its superior performance on a number of assessment criteria. Further development of this corridor then considered tunnelling methods (land-based and the preferred harbour crossing), surface connections, ventilation alternatives (including outlet locations), construction support site alternatives, and spoil transport, reuse and disposal alternatives in detail. Community and stakeholder engagement was carried out throughout the process of developing the design to identify key issues to be considered.

For further details on the development of the preferred design and the alternatives considered refer to Chapter 4.

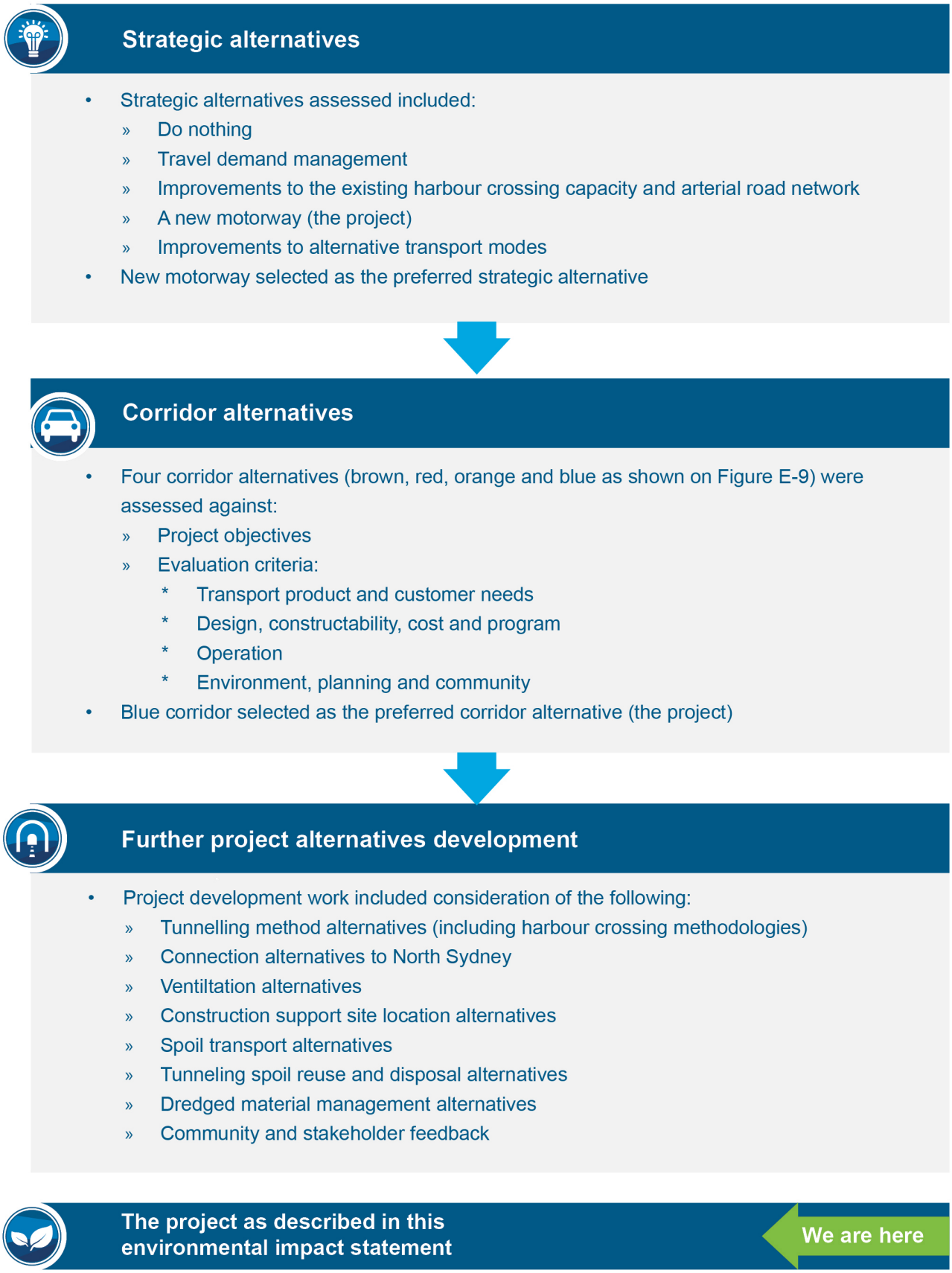
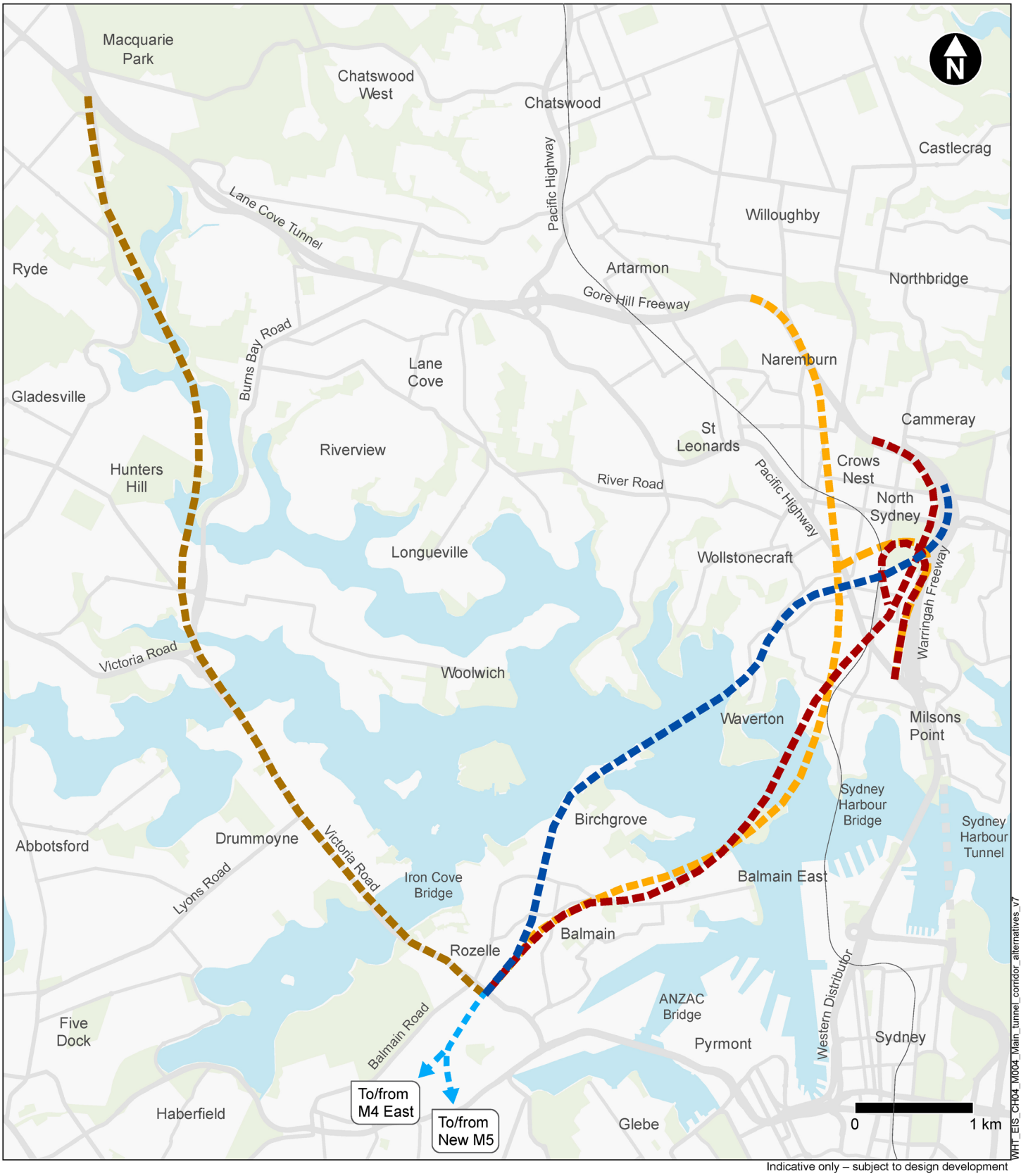


Figure E-8 Alternatives development process



Indicative only – subject to design development

Legend

- Western Harbour Tunnel Blue corridor alternative
- Western Harbour Tunnel Brown corridor alternative
- Western Harbour Tunnel Orange corridor alternative
- Western Harbour Tunnel Red corridor alternative
- WestConnex M4-M5 Link (indicative)
- Sydney Metro

Figure E-9 Shortlisted main corridor alternatives

The proponent

The proponent for the project is Transport for NSW (formerly Roads and Maritime Services). Transport for NSW is the lead agency of the NSW transport portfolio, with primary responsibility for:

- Transport coordination
- Transport policy and planning
- Transport services
- Transport infrastructure.

As of 1 December 2019, legislation came into effect (*Transport Administration Amendment (RMS Dissolution Bill) 2019*) such that all functions of Roads and Maritime Services are now performed by the integrated Transport for NSW organisation. However, due to the timing of the preparation of this environmental impact statement, there are still references to Roads and Maritime in some of the appendices to the environmental impact statement. All references to Roads and Maritime are legally taken to mean Transport for NSW.

Transport for NSW would manage the planning, procurement and delivery of the project.

Planning approval process

Transport for NSW formed the opinion that the construction and operational impacts of the project would require an environmental impact statement, in accordance with clause 1 of Schedule 3 of State Environmental Planning Policy (State and Regional Development) 2011. Transport for NSW requested the Minister for Planning and Public Spaces to declare the project as critical State significant infrastructure under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979*.

This environmental impact statement is publicly exhibited to provide the community, government agencies and stakeholders with an understanding of what is proposed and to invite comment. Transport for NSW will consider the comments and submit to the Department of Planning, Industry and Environment (the Department) a submissions report that documents and responds to issues raised during the exhibition period. The Department will prepare an assessment report for the Minister for Planning and Public Spaces who will then determine whether to grant project approval and specify project conditions.

The assessment and approval process is shown in Figure E-10.

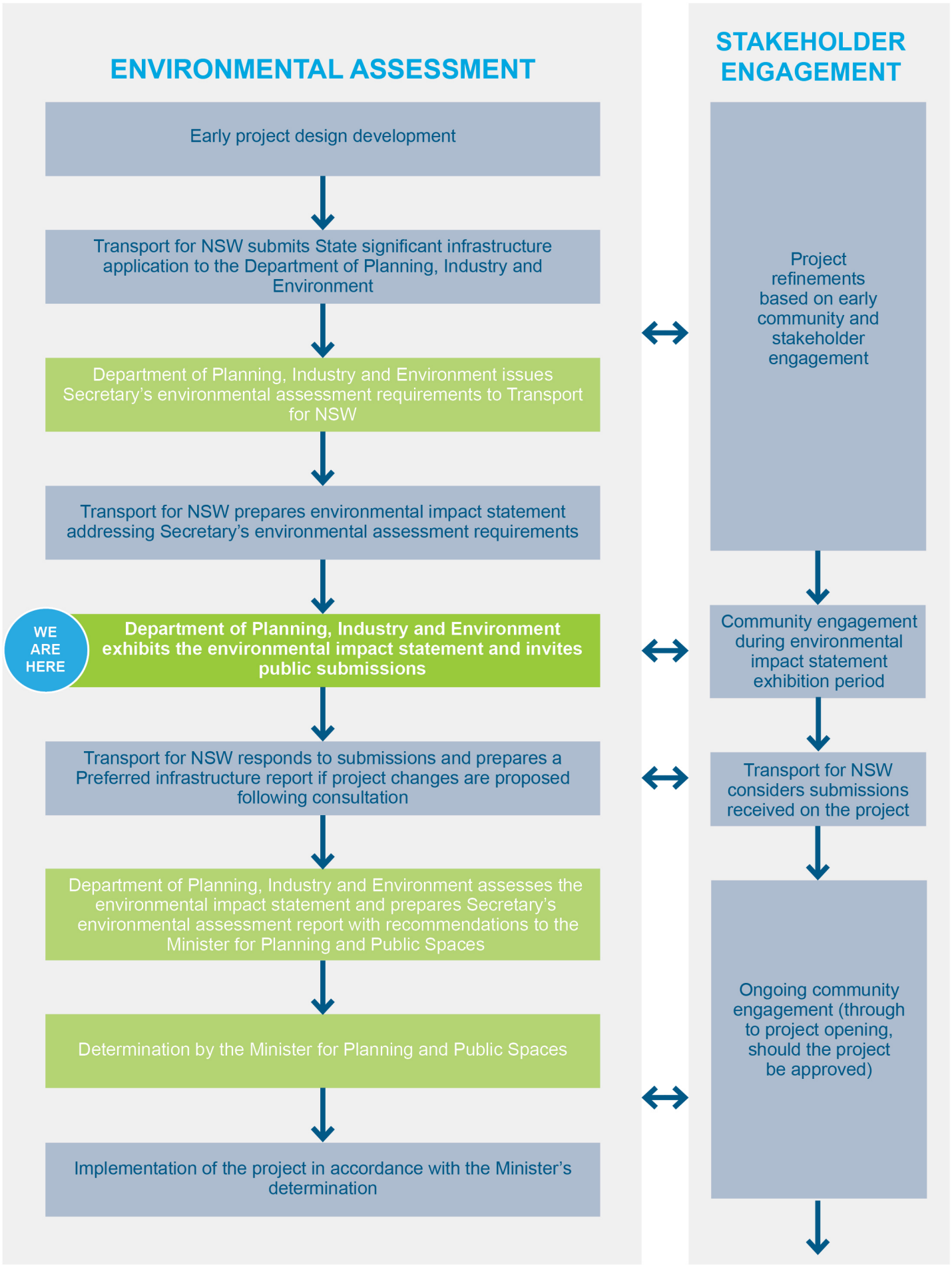


Figure E-10 The assessment and approval process for the project

Environmental assessment

This environmental impact statement has been prepared in accordance with the provisions of Part 5.2 of the *Environmental Planning and Assessment Act 1979*. In particular, it addresses the requirements of the Secretary of the Department of Planning, Industry and Environment. It also includes consideration of the issues raised by the community and stakeholders during the development of the project.

It is inevitable that delivery of a project of this scale within a heavily urbanised environment would have some adverse impacts, particularly during construction. These impacts need to be considered within the context of the overall objectives of the project and the significant transportation and other benefits it would provide over the medium to longer term, and for future generations.

Key environmental issues have been considered throughout the design and development process. Consultation has been carried out with affected stakeholders to identify potential impacts at an early stage. Where possible, these would be avoided or appropriate management measures developed. These considerations have resulted in a number of design changes and refinements that have mitigated many of the potential significant impacts.

Some project impacts would be largely temporary and confined to the construction period.

The following sections provide an overview of the benefits and impacts identified within the environmental assessment.

Traffic and transport

Traffic and transport beneficial outcomes

Beneficial outcomes from the project would include:

- Significant improvements to the capacity and reliability of the critical cross harbour road corridors near the CBD, reducing the impacts of incidents on these links across the broader Sydney road network
- A reduction in traffic demands on the Sydney Harbour Bridge, Sydney Harbour Tunnel, Gladesville Bridge and the Victoria Road corridor southbound with a corresponding reduction in travel times – up to 75 per cent between North Sydney and Rozelle during peak periods
- Returning local streets to communities by moving traffic underground, freeing up local streets for local traffic, and supporting the sustainability of local town centres
- Improvements to the efficiency of the city's critical bus network, by reducing pressure on key surface roads and delivering opportunities for new connections, and enabling direct bus access to North Sydney and an efficient transfer to the new Metro. Travel times for buses from Gore Hill Freeway to the Sydney Harbour Bridge would be substantially reduced, particularly southbound in the morning peak. Travel times for buses to and from Falcon Street, and travelling along the ANZAC Bridge corridor would also improve
- Substantial travel time savings for freight and service vehicles travelling along the Eastern Economic Corridor, improving their productivity and increasing the efficiency of the freight network, particularly for trips that currently use the Sydney Harbour Bridge
- Generally improved vehicle travel times along the key traffic routes through Rozelle, resulting from changes in traffic patterns with trips using the Western Harbour Tunnel in preference to ANZAC Bridge and Western Distributor
- Substantial improvements to road safety, with reduced traffic demands along key road transport corridors, resulting in a forecast crash rate reduction across the network of around 375 vehicles per year
- Make journeys on the Warringah Freeway easier and safer by improving lane configuration and providing clear directions on the best way to cross the harbour and reach your destination

Substantial improvements in journey times and journey time reliability between the Lower North Shore and centres south of Sydney Harbour

- Delivering core capacity that would allow future strategic connections to the north, including the Beaches Link, which would provide significant travel time and reliability improvements for busses, freight, services and private vehicles travelling to and from the Northern Beaches region.

Traffic and transport impacts during construction

During construction, temporary impacts would include:

- Increased heavy vehicle movements. The impacts associated with the increase in heavy vehicles would be minimised through scheduling of haulage and deliveries outside of peak periods (where feasible and reasonable), using construction sites with direct or proximate arterial road access, and through the use of barges to move spoil by water where appropriate
- Temporary full or partial closures of the Warringah Freeway for short periods of time to carry out key construction activities. Any closure of the Warringah Freeway would generally only be carried out at night and in accordance with an extensive consultation strategy to notify the community and affected residents of the closures and detour routes
- Temporary increase in travel times and reduction in bus speeds, particularly along bus routes in North Sydney
- Changes to access in and around North Sydney. Impacts would be minimised by ensuring all properties have alternative routes to maintain their access
- Impacts on recreational, commercial and passenger maritime traffic caused by marine construction activities in Sydney Harbour during the construction of the immersed tube tunnel. There would also be an increase in maritime traffic movements in Sydney Harbour as a result of the movement of boats and barges for the transportation of construction workers and movement of spoil from water-based construction support sites.

For further information on construction traffic and transport, refer to Chapter 8.

Traffic and transport impacts during operation

During operation of the project, potential localised negative impacts include:

- Localised delays in North Sydney and surrounds, resulting from increased traffic demands and changes to road network operations. The Western Harbour Tunnel and Warringah Freeway Upgrade project would deliver works to improve pedestrian safety and amenity around the future Victoria Cross metro station in North Sydney CBD, by reconfiguring road traffic movements in the North Sydney CBD. Transport for NSW is continuing to develop the North Sydney Integrated Transport Program to improve multi-modal transport outcomes in this area
- Increased demand on the Gore Hill Freeway to the north/west of the project, leading to localised increases in travel times. Potential management options for this impact include the early delivery of Gore Hill Freeway Connection integration works to increase network efficiency in the Artarmon area
- Potential for increased local traffic on the local road network in Rozelle and surrounds, as a result of reduced through traffic in the area. An increase in local traffic movements could impact network efficiency and travel times in the area
- While some localised impacts are possible, they are expected to be significantly outweighed by travel time and reliability benefits on the broader strategic transport network, resulting in net benefits for the majority of future road transport customers.

For further information on operational traffic and transport, refer to Chapter 9.

Noise and vibration impacts

Noise and vibration impacts during construction

Proposed construction support sites and activities have been designed to minimise noise and vibration impacts on sensitive receivers. Design considerations to reduce noise and vibration impacts include the proximity of construction support sites to sensitive receivers, construction of acoustic sheds and noise barriers, and positioning of vehicle entrances and exits to allow access directly to the arterial road network where possible.

Most of the surface construction for the Western Harbour Tunnel component of the project would be carried out between 7am and 6pm Monday to Friday and between 8am and 1pm on Saturdays. Tunnelling activities would be carried out 24 hours a day, seven days a week underground, supported by activities within purpose-built acoustic sheds. Spoil haulage from the Western Harbour Tunnel construction support sites would occur between 7am and 6pm Monday to Friday and between 8am and 1pm on Saturdays.

Construction of the Warringah Freeway Upgrade surface road works would require extensive out of hours work, to minimise traffic disruptions and maintain safety for workers and road users.

Key results of construction noise modelling include:

- Airborne noise from the project construction support sites would be generally within the noise management levels, with the exception of early works, site establishment and site restoration works, when noise management levels may be exceeded at some receivers for short periods
- Airborne noise levels from surface road works would generally be within the relevant noise management levels, with the exception of the operation of high noise generating equipment such as rock-hammers or concrete saws or when noisy works occur close to sensitive receivers. Where airborne noise management levels are exceeded, there would be a requirement to implement reasonable and feasible noise mitigation
- Most of the ground borne noise generated by roadheader tunnelling would be within the noise management levels. The use of rock-hammers for tunnelling activities has the potential to exceed noise management levels at various locations; however, such activities would be scheduled outside evening and night time periods (where feasible and reasonable) to avoid or reduce ground borne noise level exceedances on receivers
- Vibration from tunnelling works is predicted to be below the vibration limits for human disturbance at all receivers. Some receivers have the potential to experience vibration levels above the human comfort criteria when rock-hammers are operating nearby. For these receivers, mitigation measures from the *Construction Noise and Vibration Guideline* (Roads and Maritime, 2016) would be implemented, and may include notification and respite provisions
- Construction road traffic management and vehicle movements associated with the project are unlikely to increase road traffic noise levels by more than 2 dB(A). This change represents a minor impact that is likely to be barely perceptible. The number of maximum noise events from construction traffic that could disturb sleep are not likely to substantially increase, because the maximum number of truck movements generated by the project at night would be small compared to existing truck movements along the proposed haulage routes

Construction noise and vibration impacts would be managed using reasonable and feasible mitigation and management measures including scheduling of works, noise reduction measures for plant and equipment, and provision of respite periods or offers of alternative accommodation for sensitive receivers if appropriate. Temporary noise barriers or solid hoarding would be used at construction support sites where required to minimise noise impacts on residential receivers.

For further information on construction noise and vibration, refer to Chapter 10.

Noise and vibration impacts during operation

The project has been designed to include traffic noise mitigation measures where feasible and reasonable. When Western Harbour Tunnel and the Warringah Freeway Upgrade are operational the noise assessment indicates that:

- The project is predicted to reduce traffic noise for about 57 per cent of receivers within the study areas
- About 42 per cent of receivers within the noise study areas are predicted to experience traffic noise level increases of less than 2 dB(A), which is a minor impact and likely to be barely perceptible.
- One per cent of receivers within the noise study areas are predicted to experience increases in traffic noise of more than 2 dB(A) as a result of the project
- The Warringah Freeway Upgrade component of the project is predicted to reduce traffic noise levels at a substantial number of receiver buildings (around 75 per cent), mainly due to traffic diverting to the new tunnels

For permanent operational infrastructure (such as the motorway facilities and ventilation outlets, wastewater treatment plants etc), no noise criteria would be exceeded. For further information on operational noise and vibration, refer to Chapter 11.

Air quality

Air quality impacts during construction

Air quality modelling has been carried out to assess the potential air quality impacts that construction of the project may generate. Air quality impacts during construction would typically include dust and the effects of airborne particles on human health and amenity as well as potential odour emissions from dredging activities. Spoil handling within acoustic sheds would minimise dispersion of dust at tunnelling sites. A comprehensive range of mitigation measures would be used so that any residual dust and associated human health impacts would be negligible.

Odour impacts from handling dredged material at the White Bay construction support site (WHT3) would be undetectable for all sensitive receivers near the site. This is consistent with the outcomes of stabilisation and transfer of material dredged from Garden Island at Glebe Island earlier in this year.

Air quality impacts during operation

Extensive air quality modelling has been carried out to assess the project's in-tunnel and ambient air quality outcomes.

The tunnel ventilation system would be designed to maintain in-tunnel air quality within applicable criteria for nitrogen dioxide (NO_2), carbon monoxide and visibility for all modelling scenarios including a worst case trip scenario.

The ventilation system would be designed so that there would be no emissions from tunnel portals. All emissions would be via ventilation outlets.

The ventilation outlets would be designed to effectively disperse emissions from the tunnels. The heights of the ventilation outlets have been optimised to provide the most effective dispersion. For some short-term air quality measures (1-hour NO_2 and 24-hour PM_{10} and $PM_{2.5}$), exceedances of the criteria are predicted to occur both with and without the project. However, the project would result in a better outcome for ambient air quality than conditions without the project.

For $PM_{2.5}$, the background levels are already at or slightly above the criterion for both the annual and 24 hour means at some community receivers. The project would result in a reduction to these levels because of the reduction in surface road traffic caused by diversion to the tunnels.

For further information on air quality, refer to Chapter 12.

Human health impacts

As the project would deliver an underground motorway, there would be a redistribution of vehicle emissions associated with a reduction of traffic on surface roads. For much of the community this would result in no change or a small improvement to local air quality (ie reduced concentrations and fewer health impacts); however, for some areas located near key surface roads, a small increase in pollutant concentration may occur. Potential health impacts associated with changes in air quality (specifically nitrogen dioxide and particulates) within the local community have been assessed and are considered to be acceptable.

Concentrations of pollutants from vehicle emissions would be higher within the tunnel (compared to outside the tunnel). With the completion of a number of tunnel projects (approved or proposed), there is the potential for exposures to occur within a network of tunnels over varying periods of time. However, exposure to nitrogen dioxide inside vehicles is expected to be well within the current health guidelines.

Congestion inside the tunnels is not considered likely to result in adverse health effects, due to the operation of the tunnel ventilation systems and the temporary nature of the potential exposure. For motorcyclists, there is the potential for higher levels of exposure to nitrogen dioxide but these exposures, under normal conditions, are not expected to result in adverse health effects.

For further information on human health, refer to Chapter 13.

Social and economic impacts

The *Australian Infrastructure Audit 2019* (Infrastructure Australia, 2019) lists the Eastern Distributor, Sydney Harbour Bridge, Warringah Freeway and the Gore Hill Freeway corridor among Australia's most congested road corridors, generating a congestion cost of $65,000 per day in 2016. If no action is taken, this is forecast to rise to $98,000 per day by 2031. As congestion on these corridors increases so too will the costs. Infrastructure for NSW has estimated that the economic risk to growth and productivity posed by traffic congestion in the Eastern City District is about $5 billion a year, and is forecast to increase to about $8 billion annually by 2020. Infrastructure NSW has observed that, "*without corrective action, congestion will worsen – and the costs to business and the community will escalate – as the city's population grows*" (Infrastructure NSW, 2014).

As traffic demands for the Sydney Harbour Bridge and Warringah Freeway corridor continue to increase, so too will the costs associated with incidents on these critical links. Without action, it is estimated that the annual cost of incidents (excluding congestion) on this corridor alone will be more than $66 million per annum by 2036. Creating alternatives to this route is necessary to increase network resilience and reduce the impact of incidents on Greater Sydney's productivity.

Augmenting capacity and reducing the conflict between access and bypass functions for the Sydney Harbour Bridge, Sydney Harbour Tunnel, ANZAC Bridge and Western Distributor is thus a key element of the integrated transport network required to support the productivity of the Eastern Economic Corridor and its connections with international gateways and their surrounds.

When operational, the project would:

- Relieve pressure on the critical cross harbour road network and thus reduce the cost of freight, provision of goods and services, and other business travel along and through the Eastern Economic Corridor and around the Harbour CBD. The combination of freight and business travel time savings as a result of the project would generate significant productivity benefits for the Harbour CBD
- Enable local businesses to have better and more efficient access to Greater Sydney, making it easier to move goods and provide services, as well as bringing employees and businesses closer together
- Improve access and connectivity to local and regional infrastructure through improved and more reliable travel times to facilities

- Reduce the impact of incidents on the critical cross harbour transport corridor by increasing capacity and providing a viable underground bypass route
- Improve pedestrian and cyclist accessibility and connectivity of active transport routes, which would bring long-term benefits for community cohesion.

For further information on socio-economics, refer to Chapter 21.

Non-Aboriginal heritage impacts

The proposed Western Harbour Tunnel component of the project would pass beneath the harbour-side suburbs of Balmain, Birchgrove and Waverton, which are generally highly urbanised areas with narrow residential streets. This presents a significant challenge to establishing viable intermediate construction support sites that are required to deliver the mainline tunnels.

The construction strategy for the Western Harbour Tunnel component of the project aims to mitigate impacts to communities along the proposed alignment by:

- Minimising the number of intermediate sites whilst maintaining a viable construction program
- Avoiding major spoil haulage through harbour-side communities by adopting water-based spoil handling for intermediate tunnelling sites with poor arterial road access
- Prioritising temporary impacts to public open space over direct impacts to residential properties where reasonable
- Minimising the volume of spoil being removed through selection of an efficient tunnelling technique.

This strategy requires the establishment of intermediate tunnelling sites close to the proposed alignment with direct access to Sydney Harbour for barging spoil, materials and major equipment. The temporary use of an area at Yurulbin Park in Birchgrove as a construction support site (WHT3) for the project would enable efficient delivery whilst minimising private property acquisition and haulage through local streets.

Yurulbin Park has local heritage significance and it has been identified that the proposed works within Yurulbin Park would be of medium-large scale and moderate intensity. As such, the level of impact on the heritage item overall would be major.

The design of the project works at Yurulbin Park have been developed in consultation with Bruce MacKenzie AM, the original designer of the park. This has resulted in a design that minimises impacts to significant features and changes to the permanent landform at Yurulbin Park. Some mature trees within the park would be directly impacted, but areas of exclusion have been identified and replacement plantings would be provided on completion of construction as part of the redesign. Opportunities to temporarily remove, store and reinstate certain elements such as stone flagging, stone walls and steps would be investigated and implemented if these elements need to be temporarily removed.

While permanent impacts would occur to areas of archaeological potential during site establishment, specialist investigations would provide an opportunity to obtain information about the archaeology and history of the site not available from other sources. Reinstatement works following the completion of construction would be designed in consultation with Bruce MacKenzie. The new design would seek to retain and enhance the existing character and the original design intent as much as possible. These works would also improve the quality and long-term viability of landscaping and useability of the park.

For further information on non-Aboriginal heritage, refer to Chapter 14.

Biodiversity (terrestrial and marine) impacts

The majority of the project footprint and surrounding area is highly modified and disturbed, and contains exotic species, weeds and planted native or non-indigenous species. Most of the project

footprint is considered to be in a poor ecological condition, with little ecological value and unlikely to have any native resilience or recovery potential. Construction of the project would require removal of about 7.29 hectares of vegetation which comprises native plantings, planted medians, non-native species or weeds. The project would not have a significant impact on any threatened flora species, or vegetation consistent with any plant community types or threatened ecological communities.

No riparian vegetation would be removed as part of the project and no instream works would be carried out in the waterways traversed by the project.

There is potential for noise and vibration impacts on roosting Eastern Bentwing-bats (*Miniopterus schreibersii oceanensis*) within the coal loader tunnels at Waverton during construction. Adaptive management strategies would be developed in consultation with the Department of Premier and Cabinet (Heritage), Department of Planning, Industry and Environment and/or an appropriately qualified expert in microbat biology and behaviour, and implemented to minimise potential adverse impacts as required. The project would not have a significant impact on any other threatened fauna species.

Potential direct impacts on threatened marine species in Sydney Harbour, such as the Black Rock Cod and White's Seahorse, would be low. Potential impacts on marine mammals and marine turtles would also be low.

Potential underwater noise impacts on marine mammals, reptiles and sharks may occur through dredging and piling activities. Noise modelling carried out for the project indicates that impacts would largely be limited to the immediate location of piling and dredging activities. Visual monitoring from the harbour surface would be carried out to identify any underwater noise related impacts on fish, and appropriate protection measures would be considered, where required.

For further information on biodiversity, refer to Chapter 19.

Hydrodynamics and water quality impacts

Site investigations and hydrodynamic modelling has been completed to assess and refine the construction methodology for works required within Sydney Harbour for the immersed tube tunnel. Dredge plume modelling indicates that the dredging would not have a significant impact on marine water quality. Dredging and construction activities for the project are likely to cause localised increases in suspended sediment concentrations, but due to the rapid dispersion in Sydney Harbour it is not likely to result in significant water quality impacts. Monitoring during dredging would assess the compliance of the activities associated with the project. Where appropriate, silt curtains would be installed to mitigate potential impacts on ecologically sensitive areas.

The behaviour of sediment-bound contaminants when re-suspended into the water column has been previously assessed (Geotechnical Assessments, 2015) for other construction projects (Sydney Metro City & Southwest). These assessments have determined that contaminants are likely to remain bound to sediment particles and not be released into the water column. As an additional control, a backhoe dredge with a closed environmental bucket would be used to remove areas of sediments with elevated levels of contaminants (about the top 1.5 metres of sediment in some areas). This would reduce the potential for release of contaminated sediments into the water column, and it is therefore unlikely that marine water quality would be significantly impacted by contaminants.

For further information on hydrodynamics and water quality, refer to Chapter 17.

Land use and property impacts

The project has been designed to minimise the need for property acquisition. The need to reduce these impacts has been balanced with temporary and permanent impacts to areas of open space.

For the Western Harbour Tunnel component of the project, four properties would require permanent acquisition and three properties would require temporary lease. Of the four properties

that would be permanently acquired, all would be full acquisitions. Of the three properties required temporarily, one would be a full property lease and two would be partial leases.

For the Warringah Freeway Upgrade component of the project, 20 properties would be permanently acquired and one property would be temporarily leased. Of the 20 properties to be permanently acquired, 16 would be full acquisitions and four would be partial acquisitions.

Any compulsory property acquisitions required for the project would be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* (NSW) and the land acquisition reforms announced by the NSW Government in 2016.

Temporary land use changes (loss of open space) would occur during establishment and operation of temporary construction support sites and other construction areas at Yurulbin Park, ANZAC Park, St Leonards Park and Cammeray Golf Course.

Permanent land use changes would occur at Cammeray Golf Course, for widening of the Warringah Freeway and where the motorway facilities would be established within the Cammeray Golf Course next to the Warringah Freeway. The golf course would be reconfigured to ensure it remains operational.

For further details on properties impacted by the project refer to Chapter 20 (Landuse and Property).

When completed, the project would deliver new and improved public spaces at Berrys Bay and Yurulbin Park to improve urban amenity.

The proposed Berrys Bay construction support site would be located on Government owned land, formally used as an industrial site. In addition to the construction efficiency and reduction in community impacts that use of this waterside site provides, the proposed site at Berrys Bay provides a significant opportunity for Transport for NSW, North Sydney Council and other relevant stakeholders to rehabilitate this residual industrial location to create an area of high quality public space for the wider community following completion of construction.

The project has engaged Mr Bruce Mackenzie AM, a renowned Australian landscape architect who was responsible for creation of Yurulbin Park in the mid-1970's when the site was rehabilitated following its use as a shipyard. This work has informed the plan for establishment of the temporary construction support site to minimise major long-term impacts to key features of the site. Bruce Mackenzie has also provided the guiding principles for rehabilitation of the site post-construction to ensure that the final form of the park remains a sustainable high quality pubic space long into the future.

The final form of these sites, and other areas to be rehabilitated post construction, would be subject to consultation with local councils, stakeholders and the local community.

For further information on land use and property, refer to Chapter 20.

Cumulative impacts

When completed, the Western Harbour Tunnel and Beaches Link program of works is expected to deliver beneficial cumulative impacts including significant improvements to travel speeds through sections of the surface road network, increased reliability and a reduction in average travel times.

Adverse cumulative impacts could occur when impacts from the project interact or overlap with impacts from other projects, potentially resulting in a larger overall impact. Cumulative impacts may also occur when projects are constructed consecutively, resulting in construction fatigue for local receivers.

The implementation of environmental management measures for the project would avoid, to the greatest extent possible, cumulative impacts with surrounding development. Project design has carefully considered minimising construction fatigue as far as practical. The intent is to reduce the overall cumulative or consecutive impacts on the community over a longer period.

For further information on cumulative impacts, refer to Chapter 27.

Management of impacts

This environmental impact statement identifies comprehensive environmental management measures to avoid, manage, mitigate, offset and/or monitor impacts during construction and operation of the project. These include best practice construction environmental planning and management techniques, urban design and landscaping treatments and noise mitigation measures. Further mitigation opportunities are likely to be identified during detailed design and construction planning and in consultation with communities and relevant stakeholders.

The design, construction and operation of the project would be carried out in accordance with extensive environmental management commitments identified in this environmental impact statement, as well as any additional measures identified in the conditions of approval for the project.

Stakeholder and community engagement

Since the initial project announcement in March 2017, there has been extensive and ongoing community and stakeholder engagement. This has included:

- Toll free community information line
- Project email
- Project website
- Interactive web feedback map
- Project database to record correspondence relevant to the project, including contact details and issues raised during the life of the project
- Community update newsletters and letters to residents
- Community information sessions, information displays and staffed pop-ups
- Registered stakeholder database email updates
- Stakeholder briefings, meetings, workshops and presentations
- Interest group correspondence including letters and phone calls
- Face-to-face meetings and doorknocks with individual property owners and residents of properties which may be affected by the project
- Advertisements and proactive media articles in the local press
- Letterbox drops
- Media events at key milestones of the project.

The design has been continually refined throughout the community engagement to improve transport, environmental, amenity, community, heritage and sustainability outcomes.

The project team has developed a community and stakeholder engagement program to continue to proactively engage with local communities, key stakeholders and government agencies.

Next steps

Transport for NSW is seeking approval from the Minister for Planning and Public Spaces for the construction and operation of the project. Steps in the process include:

- Exhibition of the environmental impact statement for a minimum of 28 days in accordance with statutory requirements and invitation for the community and stakeholders to make submissions
- Consideration of submissions. Submissions received by the Secretary of Department of Planning, Industry and Environment would be provided to Transport for NSW and any relevant public authorities. Transport for NSW may then be required to prepare and submit:
  - A submissions report, responding to issues raised in the submissions

- A preferred infrastructure report, outlining any proposed changes to the project to minimise its environmental impacts or to deal with any other issues raised

- Determination of the environmental impact statement. The Minister for Planning would then make a decision on the project and, if approved, set conditions of approval.

Consultation with the community and stakeholders would continue throughout the detailed design and construction phases as required.

The NSW Department of Planning, Industry and Environment will make this environmental impact statement publicly available for a minimum period of 28 days. During the exhibition period, the environmental impact statement will be available for viewing at the following locations:

- The Department of Planning, Industry and Environment major project planning portal: www.planningportal.nsw.gov.au/major-projects
- The Transport for NSW project website: https://nswroads.work/whtbl
- Electronically at NSW Services centres: www.service.nsw.gov.au/
- The Transport for NSW office in Milsons Point, selected local council offices and libraries in the Inner West, North Sydney and Willoughby local government areas
- Various staffed displays.

Details of the location and opening hours of staffed displays would be provided through a community update, letters to interest groups who have registered for the project, email notifications to registered stakeholders, information on the project website and advertisements in local and metropolitan media.

During the exhibition period, a project information line (1800 931 189) and email address (whtbl@rms.nsw.gov.au) will be available for the community and stakeholders.

Written submissions can be made to the Secretary of the Department of Planning, Industry and Environment. All submissions received will be placed on the Department of Planning, Industry and Environment website.

Submissions can be made by creating an account at www.planningportal.nsw.gov.au/major-projects/have-your-say. This allows you to save a submission in progress and stay up to date with the progress of an application.

If you are unable to make a submission online, you can send a physical copy to the Department by post or hand deliver it to one of the Department's offices. Your submission must include:

- Your name and address, at the top of the letter only
- The name of the application and the application number
- A statement on whether you support or object to the proposal
- The reasons why you support or object to the proposal
- A declaration of any reportable political donations made in the previous two years.

Written postal submissions are to be directed to:

Director, Transport Assessments

Department of Planning, Industry and Environment

Application number SSI-8863

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