NSW GOVERNMENT

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## Part C

Response to community submissions

**September 2020**

# C Response to community submissions

## Contents

NSW GOVERNMENT

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C1 – Introduction

SEPTEMBER 2020

# C1 Introduction

## Contents

# C1.1 Procurement

## C1.1.1 Procurement process

***Issue raised***

Submitters request that the tender process for the project be detailed and the decision process for selecting the preferred contractor be made public. Submitters also requested that tender criteria include requirements for ongoing monitoring and communication about impacts during construction.

***Response***

Procurement of the contractor for the project would be carried out in accordance with relevant NSW legislation, Transport for NSW guidelines and other NSW Government procurement policies. The selected contractor would be highly qualified and experienced.

Should the project be approved, Transport for NSW and the appointed contractor must comply with all requirements of the conditions of approval for the project. This would require the implementation of all of the environmental management measures described in Table D2-1 of this submissions report and other feasible and reasonable measures to prevent and/or minimise any harm to the environment that may result from the construction or operation of the project.

The contractor will be responsible for implementing the conditions of approval, and Transport for NSW will monitor the contractor's compliance with the conditions of approval during construction.

There would be numerous obligations on the contractor and Transport for NSW in terms of ongoing monitoring and communication of environmental impacts during construction. These (in part) are listed in Table D2-1 of this submissions report. Many of the environmental management measures require consultation with the community and stakeholders during construction. If the project is approved, the conditions of approval would prescribe compliance measures for monitoring of impacts, environmental reporting and environmental performance.

Consultation with affected residents and the community would be ongoing during further design development and construction in accordance with the Community consultation framework outlined in Appendix E (Community consultation framework). New environmental management measure SE4 advises that the consultation for the project will be in accordance with the Community consultation framework, this includes the community communication strategy (refer to Table D2-1 of this submissions report). A Community communication strategy will be developed that would set out how the community is notified of construction activities and how feedback and complaints are received and resolved during construction. The Community communication strategy will describe in detail the Transport for NSW community liaison and engagement process and activities, including mitigation and management measures and conditions of project approval for the project development, delivery, and operation.

# C1.2 Funding

***Issue raised***

Submitters raised concerns and questions regarding how the project would be funded. Particular funding concerns included:

- Request for justification of use of public funds to be published to the community
- Concerns regarding estimated cost of the project and that changes to the proposal will be needed to get support from the community and this will increase the overall cost significantly
- Concern over the economic impacts of the COVID-19 pandemic. It will be some time before a clear indication of impact is known but it is likely there will be long timeframes to subsequent recovery. Government assistance (federal and state) will be needed for the

productive part of the economy to revive and to restore our exports and industry. This project would utilise funds that will otherwise be needed to support that part of the economy.

***Response***

The Western Harbour Tunnel and Beaches Link program of works has followed the Infrastructure NSW processes to achieve investment decision. Through this process the Program has demonstrated its economic merit and successfully passed the Infrastructure NSW Assurance Review Process. In addition to independent review of the design, constructability, environmental impacts, and traffic and transport benefits, this assurance review process included a review of the economic merit of the Program. As part of this governance and rigorous review process, the Western Harbour Tunnel and Warringah Freeway Upgrade project has undergone extensive scrutiny throughout its development.

The base of the Final Business Case for the Western Harbour Tunnel and Beaches Link program of works was developed in 2016. This analysis was augmented by extensive stakeholder and community consultation, additional site investigations and design development during 2017 and 2018. This resulted in design and construction improvements to reduce stakeholder impacts and improve project outcomes where feasible. Infrastructure NSW has released a summary of the Final Business Case for the project, which is available online: *http://www.infrastructure.nsw.gov.au/media/2528/western-harbour-tunnel_bc-summary-may-2020.pdf*.

New South Wales' pipeline of infrastructure projects has been identified as one of the key levers to drive productivity and economic growth following the COVID-19 pandemic. The project is part of this pipeline.

The need for the project is identified in state planning and policy documents as it would help to deliver the transport capacity and connectivity needed to meet future urban growth expectations of Greater Sydney. The funding set aside for the project does not preclude the development of other programs.

The project would also contribute to the economy during construction and beyond by supporting the construction industry, suppliers and creating jobs across many sectors.

## C1.3 Accountability of NSW State Government

***Issue raised***

Submitters commented that projects initiated by the current NSW State Government have insufficient planning and design time with decisions made quickly with little to no consultation with the affected community or with any consideration for the community's loss of amenity in mind.

Previous projects have been considerably over budget and well over time. This complex type of project needs significant design and planning and a 'design and construct' methodology with design occurring at the same time as construction.

***Response***

The project design presented in the environmental impact statement has undergone extensive evaluation from pre-feasibility and strategic investigations through to design development and refinement. This process is detailed in Chapter 4 (Project development and alternatives) of the environmental impact statement.

Transport for NSW has followed the planning process for the assessment and approval of State significant infrastructure under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979*. The planning process requires extensive technical studies to inform an environmental impact statement which provides a detailed description of the project and its construction so that the impacts of the project can be comprehensively addressed. The NSW Minister for Planning and Public Spaces is required to determine whether or not to grant approval for the project under the

*Environmental Planning and Assessment Act 1979* following public exhibition of the environmental impact statement and consideration of submissions received.

Extensive community consultation has been carried out as part of the project development and will continue during the ongoing refinement of the design and during construction. Engagement with the community about the project commenced in March 2017 and continued throughout the preparation of, and during exhibition of, the environmental impact statement. Following the public exhibition of the environmental impact statement and consultation period, stakeholder and community submissions were collated and responded to in this submissions report. A summary of the community and stakeholder engagement process and timeline for the project is shown in Figure 7-1 and discussed in Chapter 7 (Stakeholder and community engagement) of the environmental impact statement. Table 7-7 of the environmental impact statement provides a summary of feedback from the community and how it has been considered in the design of the project to date. Issues raised by the community during community consultation on the environmental impact statement, as presented in this submissions report, will also be taken into account during further design development. Section A2 of this submissions report summarises all engagement activities carried out to date for the project. Section A2 of this submissions report outlines consultation carried out as part of the environmental impact statement development and prior to the public exhibition.

The business case for the project includes an estimated budget for the project. The project budget reflects the scale and complexity of the project as presented in the environmental impact statement. The economic analysis for the project shows that the project can be delivered within the allocated budget.

The procurement process would allow the contractor to propose the best-value solutions that meets the technical design requirements based on the project as described in the environmental impact statement, and to be consistent with the environmental management measures and conditions of approval for the project. The contractor would do this within the budget allocated to the project.

Other project budgets and delivery programs are outside of the scope of this project.

The project team would manage the engagement of suitably qualified contractors to deliver the detailed design and construction aspects of the project in accordance with relevant Government and Transport for NSW procurement policies and procedures.

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# Western Harbour Tunnel and Warringah Freeway Upgrade

## C2 – Assessment process

SEPTEMBER 2020

# C2 Assessment process

## Contents

# C2.1 Adequacy of the environmental impact statement

## C2.1.1 Adequacy of assessment

### *Issue raised*

Submitters raised concerns regarding the adequacy and integrity of the environmental impact statement in providing a detailed, consistent, justified, comprehensive and clear assessment of the environmental, social and economic impacts of the project. Submitters considered that the environmental impact statement did not adequately assess the project risks, did not provide a true assessment of the potential impacts or carry out a comprehensive community consultation process. Submitters raised the following concerns:

- The environmental impact statement does not present a timeline of project development between the Scoping Paper in 2017 to the environmental impact statement in 2019
- The environmental impact statement understates impacts and provides generic mitigation measures, stating that all the negative impacts would be manageable or acceptable, and would be clarified in the detailed design phase
- The environmental impact statement should present assessment by location, rather than by environmental aspect
- The environmental impact statement is an extremely large, complex document that is difficult to understand.

### *Response*

Project development

Following the preparation of the Scoping Report in 2017, a State significant infrastructure application was submitted to the Department of Planning and Environment (now the Department of Planning, Industry and Environment) and the Secretary's environmental assessment requirements for the project were issued in December 2017. Detailed environmental investigations have been carried out in accordance with the Secretary's environmental assessment requirements. The outcomes of these investigations are reported in the environmental impact statement.

In July 2018, a concept design for the project was released to the public and a number of community feedback sessions and stakeholder engagement activities were carried out to seek feedback on the design. The design has been further refined and developed in line with the feedback received through community and stakeholder engagement and the findings of detailed environmental investigations to avoid and minimise impacts, where possible.

Figure 7-1 of the environmental impact statement presents the key milestones in the development of the project.

Impacts and mitigation measures

The environmental impact statement was prepared using a conservative approach, which objectively and thoroughly assessed the reasonable worst case impacts and scenarios across locations directly or indirectly affected by construction and operation of the project, as relevant to the methodology of each assessment. The environmental impact statement has been prepared in consideration of all relevant legislative requirements (as set out in Chapter 2 (Assessment process)), and assesses key issue impacts during construction and operation objectively and thoroughly to provide confidence that the project would be constructed and operated within acceptable levels of impact. The assessments presented in the environmental impact statement clearly outlines the environmental receivers and communities that may be affected by the project, details the expected level of impact, applicable assessment criteria and mitigation and management measures for the identified impacts.

It is inevitable that delivery of a project of this scale within a heavily urbanised environment would have some adverse impacts, particularly during construction. Appropriate environmental management measures, identified in Table D2-1 of this submissions report, have been developed where impacts could not be avoided. Some are considered 'standard' in the sense that they would typically be applied to any project of this magnitude. Many environmental management measures are, however, highly project specific and have been informed by the detailed technical studies carried out by specialists for the environmental impact statement. The environmental management measures will minimise adverse environmental impacts during construction and operation of the project as far as is practicable. Environmental management measures have also been developed with the aim to ensure the best possible environmental outcomes are achieved and will adhere to industry standards and guidelines. The approach to environmental management will continue to be refined and made more specific as both the design and construction methods are defined in more detail.

If the project is approved, the Department of Planning, Industry and Environment will issue conditions of approval for the management of key issues. These will need to be adhered to by both Transport for NSW and the selected contractor, in addition to the environmental management measures. The methodologies and protocols to be implemented in order to comply with these requirements will be documented in a construction environmental management plan and relevant sub-plans which will be approved by the Department of Planning, Industry and Environment prior to construction commencing.

Presentation of information

The environmental impact statement provides an assessment by aspect to enable a logical reading of the document. It is appreciated that a reader may wish to focus on the impacts on their particular suburb, and with this in mind individual environmental aspect chapters are structured to assist the reader to identify impacts at a locality.

Size and complexity of environmental impact statement

The Secretary's environmental assessment requirements require the environmental impact statement to describe the project in sufficient detail to enable a clear understanding of project. This includes a description of the project and all components and activities required to construct and operate it, along with a level of assessment of the likely impacts appropriate to the degree of impact and sufficient to ensure that the Department of Planning, Industry and Environment, and other government agencies, are able to understand and assess impacts. With a project as large and complex as the Western Harbour Tunnel and Warringah Freeway Upgrade, the level of required assessment is substantial, resulting in a large environmental impact statement.

Transport for NSW adheres to a style guide which requires all documents to be written in concise, plain language in order to be understood by the general public. The environmental impact statement can also be read at differing levels of detail, ranging from the highly technical specialist working papers, through to the main document and the executive summary.

To further help the reader to navigate and understand the environmental impact statement, a summary guide to the environmental impact statement was produced. An online interactive portal was also developed, including a locality map to help readers navigate to information contained in the environmental impact statement, which was made available from the start of exhibition of the environmental impact statement. Also refer to Section C7.1.2 of this submissions report for further discussion on accessibility of the environmental impact statement.

### C2.1.2 Suitability of Secretary's environmental assessment requirements

***Issue raised***

Submitters commented that Secretary's environmental assessment requirements aligned to remediation of the contaminated sediments should have been included. The Secretary's environmental assessment requirements relate predominantly to construction and operation of the

road tunnels and related on-shore infrastructure and are not suitable to assess the excavation, transportation and treatment of contaminated sediments.

***Response***

The issuing of the Secretary's environmental assessment requirements is the responsibility of the Secretary of the Department of Planning, Industry and Environment. The requirements of the Secretary's environmental assessment requirements for the project were informed by the State significant infrastructure application, along with a Scoping Report that were submitted to the Department of Planning, Industry and Environment. The Scoping Report described the project, identified the relevant strategic and statutory context and identified the scale and nature of the impacts of the project in enough detail to assist the Department of Planning, Industry and Environment to prepare relevant and appropriate Secretary's environmental assessment requirements. Transport for NSW consulted with the Department of Planning, Industry and Environment prior to submission of the State significant infrastructure application to discuss the project and likely key issues. The Department of Planning, Industry and Environment also sought advice from relevant government agencies, including the NSW Environment Protection Authority, when preparing the Secretary's environmental assessment requirements.

The environmental impact statement has been prepared in accordance with the Secretary's environmental assessment requirements issued by the Department of Planning, Industry and Environment.

### C2.1.3 Independence of review

***Issue raised***

Submitters raised concerns about the independence of the Office of the NSW Chief Scientist & Engineer review process.

***Response***

The role of the Office of the NSW Chief Scientist & Engineer is to provide independent advice on how to address difficult policy problems that involve engineering or science, including tunnel air quality. In 2018, the NSW Government introduced the requirement for scientific review of tunnel air emissions by the Advisory Committee on Tunnel Air Quality, managed by the Office of the NSW Chief Scientist & Engineer to provide stronger protections on emissions requirements from motorway tunnels.

To maintain independence and robustness of the review process, two independent reviewers were engaged by the Office of the NSW Chief Scientist & Engineer to review the environmental impact statement in regard to tunnel air emissions. The independent reviewers were Åke Sjödin from the Air Pollution and Abatement Strategies Unit at the IVL Swedish Environmental Research Institute, and Dr Ian Longley, Principal Air Quality Scientist from the New Zealand National Institute of Water & Atmospheric Research.

### C2.1.4 Environmental assessment of Western Harbour Tunnel and Beaches Link

***Issue raised***

Submissions raised concerns that the environmental impact statement does not incorporate both the Western Harbour Tunnel and Warringah Freeway Upgrade and the Beaches Link and Gore Hill Freeway Connection projects into one report. This would ensure that the environmental and social impacts from both projects are assessed as a cumulative entity.

***Response***

The Western Harbour Tunnel and Warringah Freeway Upgrade project and the Beaches Link and Gore Hill Freeway Connection project are being assessed separately under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979* as they could be constructed and operated

independently of each other. They would however have an interrelationship if they were both constructed and therefore have been developed as an integrated program of works known as the Western Harbour Tunnel and Beaches Link program of works.

Nevertheless, Chapter 27 (Cumulative impacts) of the environmental impact statement included an assessment of key cumulative impacts and benefits of the Western Harbour Tunnel and Beaches Link program of works. This includes traffic and transport, noise and vibration, air quality and health impacts.

The Secretary's environmental assessment requirements have been issued for the Beaches Link and Gore Hill Freeway Connection project and specialist technical studies are being prepared to inform a separate environmental impact statement that will also be placed on display for community comment.

## C2.2 Approval process

### C2.2.1 Transparency of the approval process

***Issue raised***

Submitters expressed concern and raised issues regarding the approval process for the project, including:

- The project assumes that there will be a need for a future project being the Beaches Link and Gore Hill Freeway connection. This means that the Western Harbour Tunnel project is not solving the problem statement set for the overall project if more work is then required
- The government is 'locking-in' the project before it is adequately assessed. This is evidenced by its appearance in several policy documents including the State Infrastructure Strategy
- Submitters noted that there are currently jobs advertised for the project however the consultation process has not been completed and the project has not been approved yet
- Submitters feel disempowered by the environmental impact assessment process, believing their concerns raised during consultation activities had not been considered by the project.

***Response***

Any approval for the Western Harbour Tunnel and Warringah Freeway Upgrade project would be on the basis of it being able to operate independently of the Beaches Link and Gore Hill Freeway Connection project with the environmental impact statement having been prepared accordingly. Section 3.3 of the environmental impact statement outlines the Western Harbour Tunnel and Beaches Link program of works, and states objectives for the Western Harbour Tunnel and Warringah Freeway Upgrade project. Objectives include reducing congestion on distributor roads around the Harbour CBD, and creating faster, safer and more reliable journeys across Sydney Harbour by bypassing the Harbour CBD to the west. These objectives would be realised without approval of the Beaches Link and Gore Hill Freeway connection project. Notwithstanding, the Beaches Link and Gore Hill Freeway Connection project would integrate with this project and enable additional benefits to be realised.

Policy documents such as the *Building Momentum State Infrastructure Strategy 2018-2038* (Infrastructure NSW, 2018) are strategic planning documents developed to provide future planning strategy and policy framework. Listing of projects in these strategic planning documents does not guarantee the project will proceed or provide planning approval. All projects are required to follow the relevant statutory and planning approval pathways. Transport for NSW has followed the required planning process for the assessment and approval of the project, as documented in Chapter 2 (Assessment process) of the environmental impact statement.

Transport for NSW has engaged a number of professionals to support the project's ongoing development. Advertisements for these roles are placed as they are required.

An extensive community consultation and engagement program for the project was carried out by Transport for NSW. The engagement program used a diverse range of communication methods and platforms to provide local communities and stakeholders information relevant to them. All questions, comments and issues raised by stakeholders and the community that were made directly to Transport for NSW on the project during the engagement program have informed the environmental assessment and the ongoing development of the project. A summary of these issues and where they have been addressed is provided in Chapter 7 (Stakeholder and community engagement) of the environmental impact statement. Section 7.4 of the environmental impact statement provides a summary of project refinements in response to community and stakeholder feedback. This submissions report also forms part of the consultation process, and the feedback received from the community presented in this report will be considered during future design stages.

### C2.2.2 Adequacy of timing and duration of environmental impact statement exhibition

***Issue raised***

The environmental impact statement was on exhibition during the COVID-19 pandemic. Submitters raised concern that the crisis impacted on people's ability to engage with and understand this complex project. Suggestion that consultation would be far more participatory once the COVID-19 crisis has passed.

***Response***

The Western Harbour Tunnel and Warringah Freeway Upgrade environmental impact statement was in development for 18 months, with exhibition planned for January 2020 several months in advance. Unfortunately, the timing of exhibition of the environmental impact statement partially aligned with restrictions associated with the COVID-19 pandemic. The COVID-19 pandemic is unprecedented and could not be foreseen in the programming of the project.

The environmental impact statement was placed on public exhibition on 29 January 2020. The public exhibition period for the environmental impact statement was initially scheduled to be 43 days. However, following community feedback the Department of Planning, Industry and Environment extended the exhibition closing date from 12 March to 30 March 2020 (equating to a total exhibition period of 61 calendar days). This provided additional time for the community to take on board the information provided in the environmental impact statement and provide feedback on the proposal.

Transport for NSW would continue to consult with the community and other key stakeholders during further design development, with a view to further minimising impacts of the project where feasible.

## C2.3 Statutory requirements

### C2.3.1 Project compliance with legislation

***Issue raised***

Submitters raised concerns that the project does not satisfy relevant legislation and associated regulation. Specific concerns included:

- Compliance with environmental laws and regulations, specifically the *Environmental Planning and Assessment Act 1979* (section 148B) and Protection of the Environment Operations (Noise Control) Regulation 2017 (NSW)
- Compliance with NSW Environment Protection Authority licencing
- Compliance with the *Contaminated Land Management Act 1997*

- Query why the project was not referred to the Australian Minister for the Environment, as the project involves the disposal of about 750,000 cubic metres of spoil onto offshore Commonwealth land.

***Response***

Section 10.6 (formerly section 148B) of the *Environmental Planning and Assessment Act 1979* deals with false or misleading information. It requires that:

'(1) *a person must not provide information in connection with a planning matter that the person knows, or ought reasonably to know, is false or misleading in a material particular*'.

An environmental impact statement is considered information provided in connection with a matter if it is submitted in support of the matter. The environmental impact statement was developed to support the approval process for the project.

The environmental impact statement was prepared in accordance with Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979*, the Secretary's environmental assessment requirements and Part 3 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

The Protection of the Environment Operations (Noise Control) Regulation 2017 (NSW) does not apply to infrastructure projects.

Should the project be approved, Transport for NSW as the proponent of the project must comply with all requirements of the conditions of approval for State significant infrastructure set out by the Department of Planning, Industry and Environment. Environment Protection Licences issued by the NSW Environment Protection Authority would be obtained for road construction and road tunnel emissions under Chapter 3, Schedule 1 of the *Protection of the Environment Operations Act 1997.* Any conditions of Environment Protection Licences issued for the project will be complied with by both Transport for NSW and its contractor.

Compliance with the *Contaminated Land Management Act 1997* is discussed in Chapter 16 (Geology, soils and groundwater) of the environmental impact statement. As per environmental management measure SG6 (refer to Table D2-1 of this submissions report), potentially contaminated areas directly affected by the project will be investigated and managed in accordance with guidelines made or approved under section 105 of the *Contaminated Land Management Act 1997*.

As stated in Chapter 2 (Assessment process) of the environmental impact statement, it is considered that matters of national environmental significance and the environment of Commonwealth land are not likely to be significantly impacted by the project. Transport for NSW has determined that no referral is required under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. Dredged material associated with the construction of the crossing of Sydney Harbour would be eligible for offshore disposal under the Commonwealth *Environment Protection (Sea Dumping) Act 1981.* Transport for NSW has submitted an application to the Commonwealth Department of Agriculture, Water and Environment (DAWE) (formerly the Department of the Environment and Energy) for an offshore disposal permit for material that is considered suitable for offshore disposal.

### C2.3.2 Duty to report under the *Contaminated Land Management Act 1997*

***Issue raised***

Submitters commented that the environmental impact statement did not state whether the contamination in sediments had been reported to the NSW Environment Protection Authority in accordance with the requirements of the Environment Protection Authority "Guidelines on the Duty to Report Contamination under the *Contaminated Land Management Act 1997*".

***Response***

The *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (NSW EPA, 2015) were considered in Chapter 16 (Geology, soils and groundwater) of the environmental impact statement. A Stage 1 contamination investigation was carried out for the environmental impact statement. The investigation involved a review of existing land uses, geology and hydrogeology, previous contamination site investigations and searches of the NSW EPA Contaminated Sites Register, Record of Notices and the Yellow Pages business directory. Any contamination risk reported in the environmental impact statement was obtained from these searches and reviews. The methodology is provided in Appendix M (Technical working paper: Contamination).

Potentially contaminated areas directly affected by the project will be investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the *Contaminated Land Management Act 2008* (refer to Table D2-1 of this submissions report, environmental management measure SG6).

## C2.4 Post approval pathways

### C2.4.1 Clarity about post approval changes to the concept design

***Issue raised***

Submitters raised concern about possible changes to tunnel depths following approval of the project. The final design needs to be available to the community.

Requests that the route of the tunnel under Waverton not be changed from the route highlighted in Figure 20-4 of the environmental impact statement as residents have relied upon this advice in recently purchasing their respective properties.

***Response***

The process for design development following approval of the project is discussed in Chapter 2 (Assessment process) of the environmental impact statement.

Additional geotechnical investigations would be carried out during further design development for the project to confirm required tunnel depths.

Chapter 4 (Project development and alternatives) of the environmental impact statement discusses the rigorous selection process carried out to identify the preferred corridor for the project.

Any refinements to the approved project during detailed design, including changes to tunnel depths or route alignments, would be reviewed for consistency with the approval. If a design refinement is not considered consistent with the approval, an approval modification may be required to be sought from the Minister for Planning and Public Spaces in accordance with the requirements of Division 5.2 of the *Environmental Planning and Assessment Act 1979*. Any modifications would be placed on public display and community feedback sought.

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C3 – Strategic context and project need

SEPTEMBER 2020

# C3 Strategic context and project need

## Contents

# C3.1 Strategic context

## C3.1.1 Strategic planning and policy framework

### *Issue raised*

Submitters raised comments regarding the strategic need of the project, including:

Concern that the environmental impact statement does not properly demonstrate consistency with the strategic transport plans referenced in Chapter 3 (Strategic context and project need) of the environmental impact statement.

### *Response*

The project has been developed to align with the objectives of a number of strategic plans that have been prepared at a national and State level, as described in Chapter 3 (Strategic context and project need) of the environmental impact statement. An assessment of the project against these relevant NSW policies is provided in Section 3.6 of the environmental impact statement. Further details on how the project supports the objectives of transport policies and plans is provided in Section 2 of Appendix F (Technical working paper: Traffic and transport).

## C3.1.2 NSW State planning policies

### *Issue raised*

Submitters raised comments regarding NSW State planning policies, including:

- The project is contrary to the core objectives of the *Future Transport Strategy 2056* to promote more use of public transport and active transport
- The project is not consistent to planning and objectives set out by Greater Sydney Commission, specifically:
  - The 30 minute city is public transport specific and the project shows an increase in private vehicle use
  - Inconsistency with the productivity, liveability and sustainability objectives for Sydney
- The environmental impact statement has not demonstrated that the project is needed to meet the expectations of the *Greater Sydney Region Plan – A Metropolis of Three Cities* for people to be within 30 minutes of major centres by 2037. The Lower North Shore is already well serviced by bus and train and, by 2027, would benefit from the additional services of Sydney Metro. The environmental impact statement does not provide sufficient evidence in terms of travel times to the city to justify meeting the goal of achieving 30 minute travel times
- The *NSW Long Term Transport Masterplan* states that integrated approaches are required to manage congestion. The environmental impact statement does not provide evidence of scenario modelling to test the ability of different packages of integrated transport measures to achieve these outcomes.

### *Response*

Sydney is expanding and the NSW Government is committed to delivering an integrated transport system that meets the needs of customers now and in the future.

The *Future Transport Strategy 2056* (Future Transport) promotes the development of multi-modal network solutions to enable and support planned growth, identifying that investment in motorways is needed in addition to investment to public transport such as Sydney Metro, light rail, and bus projects being rolled out throughout Sydney. The project is one part of a complementary integrated multi-modal strategy being implemented by the NSW Government. The Western Harbour Tunnel and Beaches Link program of works is identified in Future Transport as a ‘Committed’ project

forming part of the vision for the future strategic road network for Greater Sydney that will support key movements by road, including public transport, private vehicles and freight.

The Western Harbour Tunnel and Beaches Link program is a major transport infrastructure program that will make it easier, faster and safer to get around Sydney. As Sydney continues to grow, faster and more reliable trips are essential to reducing congestion and providing new levels of access to jobs, recreation, and services such as schools and hospitals.

As part of an integrated multi-modal, network-wide effort to tackle Sydney's transport challenges, the project would address network underperformance and support Sydney's long-term economic growth, as outlined in sections 2.6 and 2.7 of Appendix F (Technical working paper: Traffic and transport). The project would also provide improvements to walking and cycling routes. As the project is primarily aimed at facilitating longer journeys and hence would not compete with active transport, which tends to favour shorter journeys, it is not anticipated that the project would result in any mode shift to cars from active transport.

The *Greater Sydney Region Plan – A Metropolis of Three Cities* (Greater Sydney Commission, 2018) identifies the importance of investing in and delivering efficient and effective transport systems, including road infrastructure, that would improve business to business connections and support the 30 minute city vision. One of the key roles of the plan is to provide appropriate infrastructure in the right places to support the continued growth of Greater Sydney. Objective 18 of the *Greater Sydney Region Plan – A Metropolis of Three Cities* references the Western Harbour Tunnel and Beaches Link program of works as infrastructure that would further improve accessibility to the broader Eastern City and North Districts to the Harbour CBD and reduce through traffic in the Harbour CBD ensuring the economic strength and global competitiveness of the Harbour CBD. As outlined in Section 7.1 of Appendix F (Technical working paper: Traffic and transport), traffic modelling indicates that the project would deliver substantial trip-saving benefits, with road-based trips (including buses) between strategic centres saving up to 15 minutes when crossing Sydney Harbour during peak periods.

These travel time savings would also substantially improve accessibility for these centres, increasing the catchment of residents who can travel to and from their place of work within the '30-minute city' window that is critical to maintaining the vision of a productive city promoted by the Greater Sydney Commission.

Relieving congestion on the Sydney Harbour Bridge and Sydney Harbour Tunnel would provide opportunities to improve public transport accessibility across Sydney Harbour, which is currently constrained by the existing allocation of road space, as noted in Section 2.7 of Appendix F (Technical working paper: Traffic and transport). The project (in conjunction with the Beaches Link and Gore Hill Freeway Connection project) would be consistent with the goal of the *Greater Sydney Region Plan – A Metropolis of Three Cities* to deliver a 30-minute city by facilitating greater access to jobs, schools and health care within 30 minutes of people's homes by public transport in Northern Sydney. While the project would primarily deliver these benefits for private car users and existing bus services, the project would also offer greater opportunity for express buses as a result of reduced congestion, which would substantially reduce travel times and increase the 30-minute public transport catchments for key interchange locations such as North Sydney, Rozelle and Lane Cove. Travel times are further discussed in Section C3.2.1 of this submissions report.

Section 3.3 of the environmental impact statement highlights that a key objective of the project is to reduce congestion on local roads by moving traffic underground. This would reduce through traffic in local centres, returning local streets to local traffic, with improvements for the amenity of town centres. The benefits would be widespread and relate specifically to improved streetscapes, sustainability and liveability as discussed in Section 3.5 of the environmental impact statement.

The *NSW Long Term Transport Masterplan* (Transport for NSW, 2012) (and 2014 update) has been superseded by Future Transport. The relationship of the project to Future Transport is provided in Section 3.6 of the environmental impact statement.

### C3.1.3 NSW Government agency policies

#### *Issue raised*

Submitters raised comments regarding NSW Government agency policies, including:

- The Strategic Priorities of Transport for NSW outlined in the 10 Year Blueprint of Transport for NSW, which supports the longer term *Future Transport Strategy 2056*, have not been considered in the environmental impact statement
- The project seems to be inconsistent to government policies about 'place making' and creating 'vibrant neighbourhoods'
- The environmental impact statement does not consider Transport for NSW's *Sydney's Walking Future*, connecting people and places
- Query as to what relevance the Eastern City District has to the project
- The environmental impact statement has not satisfactorily addressed nor is aligned with Transport for NSW's urban design strategy outlined in *Beyond the Pavement* (Roads and Maritime Services, 2014)
- The project conflicts with the policies and visions of the NSW State Government's 'Greener Places' vision and policy, specifically in providing greater access to quality, green, open and public spaces closer to homes
- The project does not meet a key Transport for NSW Sustainability Principle to 'minimise the air quality impacts of road projects and support initiatives that aim to reduce transport-related air emissions'.

#### *Response*

*Connecting to the future – Our 10 Year Blueprint* (Transport for NSW, 2018) outlines where Transport for NSW would focus to help deliver the *Future Transport Strategy 2056* (Future Transport) strategy and vision. The project is aligned with the primary outcomes of Connecting our customers' whole lives, Successful places and Strong economy and quality of life. The project supports the 'Successful places', 'A strong economy', 'Safety and performance', 'Customer focused' and 'Accessible services' outcomes of Future Transport as it would facilitate improvements to urban amenity by reducing through-traffic movements and relieving pressure on arterial roads connecting the broader Eastern City and North Districts to the Harbour CBD. The project would relocate a significant volume of through traffic on surface arterial roads underground. In addition to the direct benefit of moving bypass traffic underground, reduced congestion on the arterial road network offers flow-on benefits to the adjoining local network, reducing the impact of queuing on local high streets and local roads. Reduced congestion on the arterial road network would result in further improvements in amenity related to physical safety, air quality and noise levels.

*Sydney's Walking Future* (Transport for NSW, 2013) is the NSW Government's long-term plan to promote walking as a transport mode throughout Sydney and an integral component in the planning of urban growth precincts and new transport infrastructure. The project would support the objectives of *Sydney's Walking Future* by providing pedestrian facilities to encourage this mode for local trips. These links would improve connectivity between communities, open space areas, public transport modes and the existing active transport network, connecting people and places.

Active transport links, such as well-designed and attractive pedestrian bridges that provide safe access for all pedestrians and cyclists, are proposed as part of the project and are assessed in Chapter 9 (Operational traffic and transport) of the environmental impact statement. The Urban design framework commits to providing active transport links as a principle/objective (refer to Section 3.4.9 of Appendix V (Technical working paper: Urban design, landscape character and visual impact)). An objective of the urban design, landscape character and visual impact framework is to facilitate new opportunities and unlock potential for urban regeneration, landscape improvements and active transport upgrades along the project corridor.

The project is located in the Eastern Harbour City as defined by the *Greater Sydney Region Plan – A Metropolis of Three Cities*. The Eastern City District and the North District are components of the Eastern Harbour City. The Eastern City District is shown in Figure 3-1 of the environmental impact statement.

The strategic urban design framework prepared for the project (refer to Appendix V (Technical working paper: Urban design, landscape character and visual impact)) has been informed by the urban design principles in *Beyond the Pavement* (Roads and Maritime Services, 2014). Section 3.3 of Appendix V (Technical working paper: Urban design, landscape character and visual impact) outlines the urban design objectives for the project and how the key principles of *Beyond the Pavement* have been incorporated into the strategic urban design framework. An Urban Design Review Panel has been established for the project to provide independent review and advice as the landscape and urban design concept continues to be developed and refined concurrent with the further design development of the project.

Due to the limited availability of space in the project area and the desire to minimise acquisition of private property, some public land, including public recreation areas, would be required to facilitate construction of the project, resulting in the temporary occupation or permanent acquisition of public land. As outlined in Chapter 22 (Urban design and visual amenity) of the environmental impact statement, the development of the project's urban design framework has considered a number of NSW policy and planning documents. The urban design objectives of the project include "living environments" as outlined in Section 3.3.6 of Appendix V (Technical working paper: Urban design, landscape character and visual impact). As part of this objective, an urban design requirement of the project is to incorporate green infrastructure initiatives into landscape treatments where feasible to enable the objectives of the Governments Architect's policy 'Greener Places'.

Transport for NSW has identified a number of opportunities for additional public open space that have been considered in the project design. A discussion on permanent open space impacts and opportunities are summarised in Section A4.1.8 of this submissions report.

A discussion on how the project has addressed the Transport for NSW's sustainability principle to 'minimise the air quality impacts of road projects' is detailed in Section C25.3 of this submissions report.

### C3.1.4 Local government policies

#### *Issue raised*

Submitters raised comments regarding the local government policies, including:

- The environmental impact statement has not considered North Sydney Council's plans to pedestrianise Miller Street between the Pacific Highway and Berry Street, or the Ward Street Precinct Redevelopment along Berry Street. The project should be designed to support a new public square in Miller Street planned by North Sydney Council.

#### *Response*

The North Sydney Integrated Transport Program (NSITP or North Sydney Program) is an ongoing multi-agency collaboration between Transport for NSW, North Sydney Council, Greater Sydney Commission and the Government Architect of NSW, to guide future integrated transport planning and investment in the North Sydney CBD and interconnected areas. Led by Transport for NSW since around 2018, it aims to deliver a shared place-based vision for the North Sydney CBD.

The North Sydney Program considers strategic public transport connections to the North Sydney CBD, land use and public domain objectives, improved pedestrian amenity and safety, road network changes, improved access for cyclists to and through the CBD, convenient interchanges between bus and rail services, management of kerbside access to support business activity across the day and place outcomes within the CBD. As such, a key focus of the North Sydney Program is to ensure major projects, such as the Western Harbour Tunnel and Beaches Link program, integrate

with the North Sydney CBD in a manner that supports the globally connected 'Harbour CBD' and enables delivery of befitting place-based outcomes.

Development of the North Sydney Program is ongoing, with validation of the vision for North Sydney currently underway with a number of scenarios being considered to support the place-based outcomes. As part of the collaboration, the multi-agency group will ensure the future integrated transport network and place-based vision for North Sydney is supported through projects such as the Western Harbour Tunnel and Warringah Freeway Upgrade project. Refer to Section A4.1.3 of this submissions report for further information on the North Sydney Program.

### C3.1.5 Project objectives

***Issue raised***

Submitters raised comments regarding the objectives of the project, including:

- There is an opportunity with this project to set a high standard for infrastructure projects. Focus should be on factors other than just commute times. The project's key performance indicators should include improvement to local amenities and not assume that the local environment would get worse
- The environmental impact statement does not meet its stated objectives of addressing long-term traffic congestion in Sydney
- The project objective to 'increase the ability for the Harbour CBD road network to cope with traffic incidents' should be removed. City streets should not be relied on to provide abundant capacity to deal with incidents or reduce traffic congestion on the motorway network. This objective risks prioritising vehicle movement over people and places and is in direct conflict with NSW Government transport policy and international best practice
- The project does not meet the objective to improve liveability for all communities. While some areas would benefit from a reduction in through traffic volumes, others would be impacted by reduced access, increased air pollution and reduction in green space
- Query as to why there is need for an objective to increase, and speed up, freight movements.

***Response***

The Western Harbour Tunnel and Warringah Freeway Upgrade project is one part of a complementary and integrated multi-modal strategy being implemented by the NSW Government to meet the needs of customers now and in the future.

The project development considered, and integrated opportunities to improve the existing urban environment in the project area and surrounds, where these opportunities have arisen. Transport for NSW agrees that the project should aim for improvements to the urban environment. With this in mind, one of the objectives of the project, which are outlined in Section 3.3 of the environmental impact statement, is to 'improve streetscapes, sustainability and liveability across the Eastern City and North Districts by reducing congestion'. This would be achieved by relocating a significant volume of through traffic on surface arterial roads underground and would result in amenity benefits as discussed in Section C3.2.2 of this submissions report.

One of the project's main objectives is to relieve congestion on key roads around the Harbour CBD. Transport modelling indicates that the project would meet this objective by reducing congestion on the Sydney Harbour Bridge, Western Distributor and ANZAC Bridge. Further detail on the role of the project in reducing congestion is provided in Section C3.1.1 of this submissions report.

The project objective to 'increase the ability for the Harbour CBD road network to cope with traffic incidents' is not intended to imply that it is the role of CBD streets to deal with incidents or reduce traffic congestion on the motorway network. The project would improve the resilience of the Eastern

Harbour City road network to incidents by providing greater strategic road capacity and alternative transport routes, as outlined in Section 3.5.4 of the environmental impact statement. This would assist in reducing the impacts of vehicle incidents on the Sydney Harbour Bridge, Sydney Harbour Tunnel or ANZAC Bridge corridors.

The major transport corridors around the Harbour CBD are critical links in Sydney's motorway network, with incidents on these corridors impacting the performance across the wider transport network. This heavy reliance on congested corridors with limited alternative routes and little spare capacity creates a significant reliability risk for the motorway and arterial road network. Without action, it is estimated that the annual cost of incidents (excluding congestion) on the Sydney Harbour Bridge and Warringah Freeway corridor alone will be more than $66 million per annum by 2036. Creating alternatives to this corridor is necessary to increase network resilience and reduce the impact of incidents on Greater Sydney's productivity and is an important objective of the project.

The project would boost resilience through reducing demand on the Sydney Harbour Bridge, Sydney Harbour Tunnel and ANZAC Bridge, increasing their effective capacity and ability to absorb the impacts of minor accidents (eg a breakdown in a single lane). Through providing this resilience the project would enable the wider road network to operate efficiently in the event of an incident, noting that during existing peak conditions, even small incidents can create major impact as the network is heavily saturated. Given this improvement to road network resilience it is not proposed that CBD streets should be reserved to deal with traffic incidents on the motorway network, they would however benefit should an incident occur due to reduced demand on key arterial connections.

The project would provide much needed additional capacity on the busiest road corridor in Sydney, reducing through traffic in local centres and improving connectivity. The benefits that would flow from these changes would be widespread and relate specifically to improved streetscapes, sustainability and liveability, in accordance with the relevant project objective. The project would deliver a host of benefits as described in Chapter 3 (Strategic context and project need) of the environmental impact statement that outweigh its potential impacts. Any residual impacts can be managed without resulting in long term adverse effects. The environmental impact statement provides a balanced assessment of impacts and benefits for traffic, access, air quality and green space. Any residual impacts are considered effectively managed in accordance with the environmental management measures in Table D2-1 of this submissions report.

The safe and efficient movement of freight is extremely important to the economy of NSW and Australia. Beyond the movement of people between places, roads serve an important role in moving freight between the source and end markets, including the intermediary destinations in the supply chain. As outlined in Section 3.6 of the environmental impact statement, the project would address key priority areas in the *NSW Freight and Port Strategy* (Transport for NSW, 2013) including strengthening the freight industry, increasing access for freight across the road and rail network, protecting existing freight precincts and ensuring safe, efficient and suitable freight access.

## C3.2 Project need

### C3.2.1 Need for the project

***Issue raised***

Submitters raised comments regarding the need for the project, including:

- The project lacks a clear definition of the problem the initiative is addressing
- Building more transport infrastructure to fix road congestion without managing demand is financially and environmentally unsustainable
- The environmental impact statement relies on 1930s plans of an additional harbour crossing to the Northern Beaches for strategic justification. There is no compelling strategic case for this proposed harbour crossing in 2020

- Suggestion that the assessment was motivated by justifying toll roads that could then be acquired by private motorway companies
- The likelihood of car use declining due to improved public transport and other factors such as changing transport technologies
- Doubts that the project would improve the resilience of the network, as the project would not improve access to the Sydney CBD when there are accidents on the existing two crossings of the harbour (Sydney Harbour Tunnel and Sydney Harbour Bridge)
- Travel times to obscure locations have been quoted as justification in the environmental impact statement. The project is considered to 'solve' a non-existent problem. There is only a slight inconvenience travelling between Cammeray and Haberfield
- The project is not included in the "High Priority" or "Priority" project lists by Infrastructure Australia and a valid business case has not been submitted for assessment
- The context in which the project is proposed has changed since the beginning of 2020 due to the effects of COVID-19 on the economy of NSW.

***Response***

The Western Harbour Tunnel and Beaches Link program is a major transport infrastructure program that would make it easier, faster and safer to get around Sydney. As Sydney continues to grow, faster and more reliable trips are essential to reducing congestion and providing new levels of access to jobs, recreation, and services such as schools and hospitals. By creating a western bypass of the Sydney CBD, the Western Harbour Tunnel would take pressure off the congested Sydney Harbour Bridge, Sydney Harbour Tunnel and ANZAC Bridge. The Western Harbour Tunnel and Warringah Freeway Upgrade project is one part of a complementary and integrated multi-modal strategy being implemented by the NSW Government.

A description of the Eastern Harbour City's road transport challenges and their influence on the proposed design for the project is provided in Section 3.2 of the environmental impact statement.

To have a major impact on road traffic, travel demand management measures would require considerable changes in social attitudes, travel behaviour and government policy and can take many years to achieve. Further, Sydney's population is forecast to grow from six million to eight million people over the next 40 years. An expanded multi modal network – including increased road capacity – would be required to accommodate this growth, even with significantly reduced per-capita travel demand through demand management. Travel demand management, while important, is not a viable strategic alternative to the project. It is however viewed as complementary, reducing the level of demand on Sydney's road network as its population grows. The *Future Transport Strategy 2056* identifies that boosting economic performance through enabling and accommodating growth is itself a significant strategic benefit. The project through allowing for additional capacity on arterial roads, would accommodate and enable future economic growth and is a significant benefit of the project.

The reference to the 1930s plans for a new crossing of the harbour is provided for historical context (refer to Section 4.2 of the environmental impact statement). The strategic need for the project is not reliant on this. Figure 4-2 of the environmental impact statement illustrates the historical development of opportunities for additional cross-harbour capacity starting at 1930. In 1953, late 1970s, 1981, 1983 and 2012 investigations into additional harbour crossings were considered. The project need as described in Chapter 3 (Strategic context and project need) of the environmental impact statement has considered an extensive range of real world, current data and modelling of future scenarios.

The need for the project has been demonstrated through an extensive process of development and strategic analysis. The Western Harbour Tunnel and Beaches Link program of works has followed the Infrastructure NSW processes to achieve investment decision. Through this process the program of works has demonstrated its economic merit and successfully passed the Infrastructure

NSW Assurance Review Process. In addition to independent review of the design, constructability, environmental impacts, and traffic and transport benefits, this assurance review process included a review of the economic merit of the program of works. As part of this governance and rigorous review process, the project has undergone extensive scrutiny throughout its development.

This included a Final Business Case for the Western Harbour Tunnel and Beaches Link program of works which was developed in 2016. Infrastructure NSW has released a summary of the Final Business Case for the project, which is available online: *http://www.infrastructure.nsw.gov.au/media/2528/western-harbour-tunnel_bc-summary-may-2020.pdf*.

Tolling of the project is discussed in Section C30.1.5 of this submissions report.

Section 3.2.3 of the environmental impact statement highlights the need to increase the resilience of the existing Harbour CBD and Greater Sydney road transport network. The project would substantially improve the resilience of the broader Sydney road network, in part by providing an additional crossing of Sydney Harbour. Section 3.5 of the environmental impact statement concludes that the Sydney Harbour crossing capacity is a major transport constraint for all modes and the project could be used to access the CBD if existing harbour crossings were closed due to an incident. Strategic transport modelling completed by Transport for NSW indicates that there would be a need for additional road transport capacity at the crossing of the Sydney Harbour to cater for future demand post Sydney Metro City & Southwest and in conjunction with all other Transport for NSW initiatives (including public transport) to meet current and future needs. The project would boost resilience through reducing demand on the Sydney Harbour Bridge, Sydney Harbour Tunnel and ANZAC Bridge, increasing their effective capacity and ability to absorb the impacts of minor incidents (eg a breakdown in a single lane). The currency of traffic data used in the environmental impact statement is discussed in Section C9.1.2 of this submissions report.

The origins and destinations used for the travel time analysis (as presented in Chapter 9 (Operational traffic and transport) of the environmental impact statement) were selected as representative of the range of trips that would be carried out by users of the project. The modelled travel times included trips for key routes such as through the Sydney Harbour Bridge, Warringah Freeway, Sydney Harbour Tunnel and Western Distributor.

The *Australian Infrastructure Plan: Priorities and Reforms for Our Nation's Future* (Infrastructure Australia, 2016) identifies priority infrastructure investments that Australia needs over the next 15 years. The latest *Infrastructure Priority List* (Infrastructure Australia, 2020) identifies the Western Harbour Tunnel and Beaches Link program of works as a priority initiative.

The full effects of the COVID-19 pandemic on the NSW economy will not be known for some time. The need for the project is not however anticipated to be greatly influenced in the long term by economic fluctuations associated with an event such as this.

### C3.2.2 Benefits of the project

***Issue raised***

Submitters raised comments and queries in regard to project benefits. Specific queries, comments and concerns include:

- Queries on the travel time benefits of the project, including:
  - There is insufficient data or evidence that the project would improve travel times. Travel time savings have not been meaningfully demonstrated or backed up by real examples
  - Questioned how motorists outside the Lower North Shore would benefit
  - There would be limited benefit for Chatswood, North Sydney and Macquarie Park, which are well served by public transport
  - Travel time benefits are misrepresented when access to the Sydney CBD is not provided via the project

  - Estimates of time savings to the airport focus on peak hours only

- Query as to the benefit of a new dedicated bus lane along the Warringah Freeway when there in an existing bus lane that is often impeded by traffic congestion
- Query as to how the project would benefit communities in North Sydney by returning roads to local communities
- The environmental impact statement does not provide information about the benefits of the project in terms of the growth and safety of communities
- Concern the project would create on-going, long term disruption in adjacent suburbs with limited or no long term benefits. The environmental impact statement does not quantify the benefits in monetary terms or provide a cost benefit analysis.

***Response***

The project would deliver significant time savings for customers, including up to 20 minutes between Leichhardt and North Sydney, 20 minutes between Sydney Olympic Park and North Sydney, and 15 minutes between North Sydney and Sydney Kingsford Smith Airport. Section 3.4 of Appendix F (Technical working paper: Traffic and transport) provides detail regarding the modelling approach that forms the basis of estimating travel times. Real world data is used to calibrate the modelling.

Sections 7 and 8 of Appendix F (Technical working paper: Traffic and transport) identify travel time savings for a range of trips, including many that would be carried out by road users outside the Lower North Shore.

Trips to and from Chatswood, Macquarie Park and North Sydney would benefit to varying degrees from the project depending on the destination of trips. Sections 7 and 8 of Appendix F (Technical working paper: Traffic and transport) provide information regarding these benefits.

The project benefits the wider road network and provision of additional direct access to the Harbour CBD is not the project's focus. However the improvements to the Warringah Freeway, including improved bus priority infrastructure and reduced traffic conflicts with the provision of a dedicated southbound bus lane separate to freeway traffic and reduced traffic demand on the Sydney Harbour Bridge by traffic using the project would substantially improve bus travel times to and from the CBD. As detailed in Section 7.5.5 of Appendix F (Technical working paper: Traffic and transport), the inclusion of the dedicated bus lane fully separated from general traffic would achieve improved travel times for southbound bus routes during both the morning and evening peak hours.

The proposed road integration works and resultant traffic performance in the North Sydney area have been developed in the context of the growing North Sydney CBD environment. The works in the area proposed by the project seek to maintain an appropriate level of traffic movement while also preserving capacity and connectivity for other customers whose needs conflict with traffic – particularly pedestrians. Options to further increase traffic performance at intersections throughout the area have been investigated. However, these alternative options would result in further impacts on other customers. The proposed works are considered to provide a balanced and integrated transport network through North Sydney. Further refinements to movement and place outcomes within the North Sydney CBD may occur as part of works associated with the North Sydney Integrated Transport Program (the North Sydney Program) which is an ongoing multi-agency collaboration between Transport for NSW, North Sydney Council, Greater Sydney Commission and the Government Architect of NSW to guide future integrated transport planning and investment in the North Sydney CBD and interconnected areas (refer to Section A4.1.3 of this submissions report for further information).

The travel time assessment conservatively focusses on the impacts during peak periods to demonstrate the impact of the project when the road network is under the most stress. Performance across the whole day is demonstrated in Sections 7.2 and 8.2 of Appendix F (Technical working paper: Traffic and transport) and expressed in terms of 'vehicle kilometres travelled' and 'vehicle hours travelled'.

The project would facilitate improvements to urban amenity by reducing through-traffic movements and relieving pressure on arterial roads connecting the broader Eastern City and North District to the Harbour CBD. This has a flow-on benefit in terms of safety for vehicle users and pedestrians. These benefits are discussed in Chapter 3 (Strategic context and project need) of the environmental impact statement. The project need in terms of supporting a growing Sydney is discussed in Section C3.1.2 of this submissions report.

Appendix F (Technical working paper: Traffic and transport) states that the project would have substantial improvements in road safety, with reduced traffic demands and conflicts along key surface road transport corridors resulting in a forecast reduction in crashes across the network. New or upgraded pedestrian and cycle infrastructure would enhance pedestrian and cyclist safety, accessibility and connectivity. This would be enhanced by the inclusion of new shared user paths, replacement of the narrow Ridge Street bridge, a new active transport bridge near Ernest Street and dedicated cycleways.

While disruption during construction is acknowledged, residents of suburbs close to the actual works would receive substantial long term benefits in terms of travel efficiency along with those across the broader Sydney road network. The long term benefits include increased road capacity and reducing through traffic, improving connectivity and productivity by relieving pressure on the critical cross-harbour road networks and saving time for freight by relocating a significant volume of through traffic on surface arterial roads underground.

An overview of the development process and options considered as part of this process are provided in Chapter 4 (Project development and alternatives) of the environmental impact statement. An overview of the strategic context and project need are provided in Chapter 3 (Strategic context and project need) of the environmental impact statement.

### C3.2.3 Economic productivity

#### *Issue raised*

Submitters raised comments regarding economic productivity, including:

- Request for clarification as to what is meant by “percentage of jobs” on Figure 3-11: ‘Change in the percentage of jobs accessible within 30 minutes in the AM peak as a result of the project by 2037’
- Suggestion that there would be benefits from the project in the creation of Northern Beaches jobs and stimulating the economy.

#### *Response*

The percentage of jobs in Figure 3-11 of the environmental impact statement refers to the percentage of jobs that are based at a given location that would be accessible by the road network (public and private transport) within 30 minutes in the AM peak by 2037. The figure provides a comparison between the percentage of jobs accessible with and without the project. The higher the number, the greater the number of jobs that would be accessible.

It is anticipated that the project would provide increased capacity, connectivity, resilience and result in a decrease in travel time between employment centres. This is anticipated to have a positive impact and encourage future development in the business centres, particularly when combined with the proposed Beaches Link and Gore Hill Freeway Connection project. The project would support forecast job growth through improved travel times across the network. Refer to Section C4.1.2 of this submission report for discussion on the Final Business Case.

It is expected the project would support up to 7500 full-time-equivalent jobs during construction.

### C3.2.4 Future planning

***Issue raised***

Submitters raised concerns regarding longer term planning issues. Specific queries, concerns and comments included:

- Concern that this project is being looked at in isolation and does not address the future. A comprehensive study on Sydney's traffic plans for the next 50 years should be initiated, and planning of specific projects should start when that is resolved
- Query as to the NSW Government's motorway strategy
- Requests that the government look at a more sustainable long-term strategy involving public transport, which is perceived as being less damaging to the health of the community and environment
- Concern that the project is not perceived to be a long-term solution, with any car travel time savings achieved in the short term considered to be cancelled out in the long term by extension of trip length, induced demand, and growing population.

***Response***

The Western Harbour Tunnel and Warringah Freeway Upgrade project is one part of a complementary integrated multi-modal strategy being implemented by the NSW Government.

The NSW *Future Transport Strategy 2056* (Future Transport) sets the 40-year vision, strategic directions and outcomes for customer mobility in NSW. The plan identifies the transport challenges that would need to be addressed to support NSW's economic and social performance and establish a number of short, medium and long term actions to address those challenges. The Western Harbour Tunnel and Beaches Link program of works is identified in Future Transport as a 'Committed' project (within the next 0 to 10 years) forming part of the vision for the future strategic road network for Greater Sydney that would support key movements by road, including public transport, private vehicles and freight.

When considering the strategic alternatives and complementary projects, it was concluded that the construction and operation of a new tunnelled motorway crossing of Sydney Harbour (the project) was the preferred solution to achieve the project objectives. It is one of a suite of transport initiatives being implemented by the NSW Government, a number of which involve major new public transport infrastructure. Section B12.3.2 and Section B12.3.3 of this submissions report discuss road based and public transport alternatives to the project, respectively.

The traffic modelling carried out for the project takes into account changing trip lengths and behaviours, induced demand, and projected population and economic growth. This is discussed in Section 3 of Appendix F (Technical working paper: Traffic and transport).

## C3.3 General comments

***Issue raised***

General comments submitters raised about the project include:

- Section 1.1 of the environmental impact statement states that "The Sydney Harbour Bridge, Warringah Freeway and Eastern Distributor have been identified as three of Australia's 30 most congested road corridors, generating a congestion cost of $65,000 per day in 2016 (Infrastructure Australia, 2019)." However, the Australian Infrastructure Audit 2019 - Supplementary report does not identify this. Query as to where these figures were obtained and their applicability to the project.

***Response***

The congestion cost of $65,000 per day in 2016 is referenced in Table 12 of *Urban Transport Crowding and Congestion, The Australian Infrastructure Audit 2019, Supplementary report* (Infrastructure Australia, 2019). The congestion cost per day is applicable to the project as the project would assist to relieve the congestion on the Sydney Harbour Bridge, Warringah Freeway and Eastern Distributer.

NSW GOVERNMENT

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C4 – Project development and alternatives

SEPTEMBER 2020

# C4 Project development and alternatives

## Contents

# C4.1 Project development

## C4.1.1 Project review and further investigations

### *Issue raised*

Submissions raised comments and requests in regard to further review of the project and additional investigations. Issues raised included:

- Request that the current design be reconsidered, and progress put on hold until further detailed, public consultation and planning process is carried out
- A feasibility study including comparative economic analysis of options, including public transport, be conducted with full public consultation and disclosure of results. The study should include comparison of all factors (ie congestion, local traffic, pollution, waste, emissions and environment) so that the current proposal can be properly assessed
- A transport study of the city, including origin/destination surveys, be carried out prior to the environmental impact statement being approved, with environmental impacts costed against all options to identify the best scheme
- The project design needs to focus on the long-term benefits to the environment, society and the economy.

### *Response*

The project design presented in the environmental impact statement has undergone extensive evaluation from pre-feasibility and strategic investigations through to design development and refinement. This process is detailed in Chapter 4 (Project development and alternatives) of the environmental impact statement, along with analysis of both the strategic and project options that were considered. Options were assessed against both technical and environmental factors, listed in Section 4.4 of the environmental impact statement.

The Western Harbour Tunnel and Beaches Link program of works has followed the Infrastructure NSW processes to achieve an investment decision. Through this process the program of works has demonstrated its economic merit and an independent review of the design, constructability, environmental impacts and traffic and transport benefits has been applied.

A detailed public consultation and planning process has been carried out as part of project development. Chapter 7 (Stakeholder and community engagement) of the environmental impact statement provides an overview of the stakeholder and community engagement activities carried out during the project's development and during the preparation of the environmental impact statement. Transport for NSW has followed the required planning process for the assessment and approval of State significant infrastructure under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979*.

Section A2.3 of this submissions report details the extensive community consultation process that was carried out for the environmental impact statement exhibition period.

As identified in Section 3.6 of the environmental impact statement, the project has also been developed to align with the objectives of a number of strategic plans for transport, freight, and city planning that have been prepared at a national and State level. In particular, it is consistent with the *Future Transport Strategy 2056*, which sets out an integrated transport plan for Sydney and NSW as a whole. These are discussed further in Section C3, above.

The project has been developed in the context of clearly identified long-term benefits to the environment, society and the economy. Chapter 3 (Strategic context and project need) of the environmental impact statement discusses the long-term benefits of the project.

### C4.1.2 Business case

***Issue raised***

Submissions raised concern that the Business Case for the project had not been released to the public and there is currently no costing available. Submitters request release of this publication.

***Response***

The Western Harbour Tunnel and Beaches Link program of works has followed the Infrastructure NSW processes to achieve an investment decision. Through this process the program of works has demonstrated its economic merit and successfully passed the Infrastructure NSW Assurance Review Process. In addition to independent review of the design, constructability, environmental impacts, and traffic and transport benefits, this assurance review process included a review of the economic merit of the program of works. As part of this governance and rigorous review process, the project has undergone extensive scrutiny throughout its development.

The base of the Final Business Case for the Western Harbour Tunnel and Beaches Link program of works was developed in 2016. This analysis was augmented by extensive stakeholder and community consultation, additional site investigations and design development during 2017 and 2018. This resulted in design and construction improvements to reduce stakeholder impacts and improve project outcomes where feasible. Infrastructure NSW has released a summary of the Final Business Case for the project, which is available online: *http://www.infrastructure.nsw.gov.au/media/2528/western-harbour-tunnel_bc-summary-may-2020.pdf*.

An overview of the development process and options considered as part of this process are provided in Chapter 4 (Project development and alternatives) of the environmental impact statement. An overview of the strategic context and project need are provided in Chapter 3 (Strategic context and project need) of the environmental impact statement.

## C4.2 Assessment of strategic alternatives

### C4.2.1 Assessment of public transport options

***Issue raised***

Submissions raised concerns that public transport alternatives have not been properly assessed. Specific queries, comments and concerns include:

- The environmental impact statement did not satisfactorily address the Secretary's environmental assessment requirements in regard to assessment of alternatives, particularly public transport options
- The project is considered a missed opportunity to transform Sydney into a world class, healthy and sustainable city with a strong public transport system. The project should be redesigned around efficient mass transit solutions
- Concern that a public transport comparison analysis was not carried out and that the alternatives considered in the environmental impact statement focus on road solutions, when public transport options could move many more thousands of people per hour in comparison to numbers that can be transported via a road
- Concern that the project is designed around old technology and would add further to pollutants and greenhouse gasses into the environment and it would not contribute to greenhouse gas emissions reduction targets. Public transport may provide better options in terms of pollution, air quality, noise, environmental impact, and often better cost-benefit outcomes

- The environmental impact statement did not consider how existing and planned projects such as Sydney Metro West and the B2 Line may remove traffic from the network and negate the need for the project
- The environmental impact statement fails to correctly reflect uptake of roads versus public transport as population increases. Recent data shows an increase in the use of public transport.

Submitters suggested a number of public transport alternatives to the project, including:

- Bus lanes with a focus on end-to-end trip times for commuters
- Suggestion that the project utilise the former tramway spur for a bus only pickup area and add a dedicated bus lane along Blue Street and the Pacific Highway and continue up to at least North Sydney Oval
- Submissions suggest that the project build a dedicated bus lane or tunnel in North Sydney CBD to service both rail stations (North Sydney and Victoria Cross)
- An alternative plan developed to the proposed extra bus lane on the Freeway near Alfred Street North to avoid the retaining wall and noise reduction wall along Alfred Street North
- Build the proposed tunnel, but as part of the passenger rail network rather than a road
- The tunnel should allow for an expansion of the metro system to the Northern Beaches, this would minimise the number of cars and related air pollution and traffic congestion
- Spending on more sustainable options, such as rail or bike lanes, reduces costs to both budget and the environment.

***Response***

Assessment of public transport alternatives

The environmental impact statement was prepared in accordance with Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979* (NSW), the Secretary's environmental assessment requirements and Part 3 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (NSW). A checklist against this regulation is provided in Appendix B of the environmental impact statement. A copy of the Secretary's environmental assessment requirements, including an indication of where they are addressed in the environmental impact statement is provided in Appendix A (Secretary's environmental assessment requirements checklist).

The project is part of a suite of current and future transport initiatives outlined in *Future Transport Strategy 2056* that would work together to provide additional cross-harbour transport capacity, as stated in Section 4.3.6 of the environmental impact statement. The array of journey patterns and trip purposes within Sydney, and the dispersed nature of origin and destination points for an individual journey, mean that roads remain a critical element in the integrated transport network, servicing bus, freight, commercial and many other journey needs.

Section 4.3.5 of the environmental impact statement describes the alternative transport modes, including bus, rail, ferry and active transport that were considered as strategic alternatives to the project. While many of these modes and upgrades are complementary to the project as part of a broader integrated transport network, none of the proposed initiatives negate the need to provide additional cross-harbour motorway capacity.

Chapter 26 (Climate change and greenhouse gas) of the environmental impact statement discusses greenhouse gas emissions. While the project would increase the number of road links across the network, it would result in fewer vehicle stop and start movements, less congestion and a greater average vehicle speed, which would further increase the efficiency of vehicles and assist in reducing emissions.

Chapter 9 (Operational traffic and transport) of the environmental impact statement considered the operational effects of public transport projects that have been approved and are under construction including Sydney Metro City & Southwest and the B-Line. The results of the modelling showed that even with the expected mode shift of some road users to public transport there would still be substantial growth in road-based trips; therefore, the project would result in substantial benefits to the traffic network once the project is operational.

Transport for NSW understands that that public transport patronage is increasing in line with population and economic growth. Subsequently, the NSW Government is investing in numerous public transport projects to support this growth. However, road traffic is also growing due to the same factors as it serves trips which public transport cannot fulfil, or is less suitable for.

Suggested alternatives

As described above, none of the proposed alternative transport options would remove the need to provide additional cross-harbour motorway capacity. The project would result in 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 line.

### C4.2.2 Travel demand alternatives

#### *Issue raised*

Submissions commented that the environmental impact statement did not consider other options to achieve a reduction in congestion and improved travel times for the relevant communities, such as congestion pricing or reduction in capacity allocated to private vehicles (in particular at peak times).

#### *Response*

Travel demand management measures were considered in Section 4.3.2 of the environmental impact statement. While congestion pricing is not specifically mentioned, a range of travel demand management initiatives were considered to reduce the number of trips during peak hours. These initiatives alone are not considered as a viable strategic alternative to the project; however, they are viewed as complementary initiatives.

### C4.2.3 Other alternatives

#### *Issue raised*

Submissions commented that the route between Cammeray and Haberfield on existing roads is only constrained at the southernmost end of the Western Distributor in peak hours where there is a one lane slip exit onto the ANZAC Bridge. Suggestion to widen this to two lanes for the last 300 metres. This would provide two lanes either way with virtually no traffic lights or any other source of delay for the entire route.

#### *Response*

The ANZAC Bridge and Western Distributor were primarily designed to provide access between the Harbour CBD and the west, rather than function as the primary arterial corridor between the Inner West and centres north of the Harbour CBD. The corridor experiences daily queues on both approaches to the Sydney Harbour Bridge despite the operation of current tidal flow arrangements to maximise the use of available roadway. Widening the exit to two lanes would not provide sufficient additional harbour crossing capacity compared to the proposal and would likely shift current pinch points further towards the ANZAC Bridge.

# C4.3 Assessment of project alternatives

## C4.3.1 Assessment of corridor alternatives

### *Issue raised*

Submissions raised concerns about the assessment of options presented in the environmental impact statement. These include:

- The environmental impact statement does not fully justify the Blue corridor alternative, noting that an option to terminate the project further north west along the Gore Hill Freeway (ie in the Artarmon Industrial zone) does not appear to extensively be investigated
- Submitters request further evidence of reasoning behind the selection of the preferred route over the Orange corridor alternative. Was the route chosen on the basis of cost, commercial viability or other factors?
- The environmental impact statement does not present any alternative options which do not require a Warringah Freeway rebuild. Alternative options should be considered for the northern end of the tunnel to be terminated away from Warringah Freeway. Streamlining of the Warringah Freeway without the tunnels and tollways should be modelled and compared rather than the 'Do something' or 'Do nothing' analysis presented by the environmental impact statement
- Concern that the Kirby Inquiry previously investigated the northern Warringah Transport Corridor and found that time savings on a similar road would be eroded by an increase in population and increased car use
- Submitters suggested that instead of providing connections from Berry Street to the Western Harbour Tunnel, a dedicated underground bypass of the North Sydney CBD should be provided to handle vehicles going south onto the Sydney Harbour Bridge and going north onto the project tunnels and going north on the Warringah Freeway.

### *Response*

Section 4.4.3 of the environmental impact statement provides justification for the selection of the Blue corridor alternative. The Orange corridor alternative, described in Section 4.4.2 of the environmental impact statement, ended at the Gore Hill Freeway. This was abandoned due to reasons such as challenging traffic staging, higher capital cost, property impacts and reduced road network connectivity.

Corridor alternatives were assessed against the evaluation criteria shown in Section 4.4.2 of the environmental impact statement. Detailed components of the preferred corridor were evaluated against a localised set of criteria that was consistent with the project objectives (refer to Section 4.5 of the environmental impact statement). These included connectivity, transport network performance, constructability, design, community, environmental and economic criteria specific to the scope item and area being considered.

Strategic options assessment involved comparison of a 'Do Nothing' option with other alternatives including a new motorway crossing of Sydney Harbour (the project). Once the motorway crossing alternative option was selected, further investigations were carried out to determine the preferred route. Two corridor alternatives were presented in the environmental impact statement that would not require an upgrade of the Warringah Freeway – the Brown corridor alternative which would bypass Warringah Freeway, and the Orange corridor alternative with the main tunnel connection at the Gore Hill Freeway near Naremburn rather than the Warringah Freeway at Cammeray. Both options were not preferred due to the additional length of the proposed tunnels. The Brown corridor alternative would also result in poorer traffic outcomes on the existing harbour crossings and increased construction complexity due to increased harbour and river crossings. The Orange corridor alternative would result in greater property impacts and increased disruption due to difficulties connecting with existing traffic operations.

The Warringah Transport Corridor Inquiry led by David Kirby was published in 1983 and while an important document at the time, Sydney has continued to evolve, and more recent studies have been carried out. The study is no longer particularly relevant to the particular transport needs addressed by the project.

As shown in Table 4-10 of Appendix F (Technical working paper: Traffic and transport), Berry Street is currently a strategic state road providing access from North Sydney to Warringah Freeway northbound and Bradfield Highway/Cahill Expressway southbound with up to four lanes in some areas. The suggested dedicated underground bypass of the North Sydney CBD would preclude Berry Street from connecting to the Western Harbour Tunnel and would therefore be incompatible with the current proposal. The suggested dedicated underground bypass would provide poorer connectivity, particularly for traffic exiting the CBD. It would be also difficult to construct and costly due to the need to avoid existing structures and obtain necessary clearance of the Sydney Metro City & Southwest tunnels. Transport for NSW will continue to work closely with North Sydney Council and other key stakeholders to investigate options to improve movement and place outcomes through the North Sydney Program (refer to Section A4.1.3 of this submissions report for further information).

### C4.3.2 Tunnelling method

***Issue raised***

Submissions stated opposition and offered alternatives to the proposed tunnel methodology, including:

- The tunnelling method provided in the environmental impact statement has not been benchmarked against other options and a request for a comparison study of a similarly operating tunnel be completed to determine the impacts of tunnels on users and communities
- Suggestion that a roadheader tunnelling option under Sydney Harbour would be preferable. The resulting grade would be comparable to other tunnels such as NorthConnex and M5 East. The environmental impact statement does not provide estimates of how this would adversely impact on vehicles, the environment or on construction costs. Request a full cost benefit analysis of the two methods of construction be released to the public
- The environmental impact statement states that the underlying sandstone is fractured, to the point that it is claimed that it is unsuitable for tunnelling. Request that the raw data from core drilling be made available for review by independent geotechnical engineers
- Suggestion that a deep excavation tunnel project would create an expanded and long-term source of infrastructure works and employment for New South Wales, capable of contributing to economic growth after the adverse effects of COVID-19 have ameliorated.

***Response***

The process for selection of the preferred tunnel construction method for the project included the development and evaluation of over fifteen different combinations of tunnelling methods, as outlined in Section 4.5.1 of the environmental impact statement. Methods considered included roadheaders, tunnel boring machines, immersed tube tunnels, cut and cover tunnels, and the drill and blast methods. These options were developed and assessed by a multidisciplinary team of design, constructability, and environmental specialists with direct experience in delivering major tunnels in international, Australian and NSW contexts. The tunnelling methods proposed for the project are commonly used around the world and have been used for numerous projects in Australia and Sydney. The benefits and risks associated with each method are well known.

While the majority of the tunnelling for the project is expected to be constructed through high quality Hawkesbury Sandstone, the section of tunnel crossing Sydney Harbour presents particular challenges and constraints. These include significant changes in elevation from Rozelle to North Sydney, the presence of the Sydney Metro City & Southwest tunnels, poor geology and rock

fracturing at harbour crossings, limited intermediate sites and cross-section issues. These are further detailed in Section 4.5.1 of the environmental impact statement.

Increased tunnel gradients associated with roadheader options would increase emissions generation by vehicles, and increase construction and operational costs. The preferred method has improved performance outcomes including safety, vehicle speeds, journey experience and long-term emissions, compared to other options.

Geotechnical testing has been conducted for the proposed harbour crossing. At the northern side of the harbour, the top of the Hawkesbury Sandstone bedrock is approximately 45 metres below the harbour surface. Unlike the bedrock either side of the harbour, this rock is generally highly fractured. This fracture zone is likely to cause significant water ingress issues during construction using a mined or bored method as seen during the construction of the Northside Storage Tunnel and Greenwich to Woolwich Cable Tunnel. Above this fractured rock are layers ranging from stiff clay through to sand and sediment. Depending on the vertical alignment of the tunnels, they may need to be constructed through rock, through sediment, or a combination of these. Generally tunnelling through sediment is undesirable as it is prone to instability. However, high-quality Hawkesbury Sandstone is very deep beneath the harbour, giving rise to the need to balance between the preference to tunnel through rock and the gradient of the tunnels – with the gradient of the tunnels affecting traffic performance, emission generation, ventilation design, and long-term operational costs for the tunnel.

The base of the Final Business Case for the Western Harbour Tunnel and Beaches Link program of works is discussed in Section C4.1.2 above.

The NSW pipeline of infrastructure projects has been identified as one of the key levers to drive economic growth following the COVID-19 pandemic. The project is part of this pipeline.

### C4.3.3 Tunnel depths and alignment

***Issue raised***

Submissions raised issues regarding depths of the tunnel, including:

- Request for deeper tunnels under Louisa Road to reduce impact on Louisa Road property owners and residents
- Request that the tunnel depth under the northern side of Bay Road be equal to or greater than 50 metres to alleviate problems of noise and vibration and potential damage of historic properties.

Submitters made a number of suggestions for alternate routes or alignments of the tunnel. Specific routes/alignments suggested for assessment include:

- Tunnelling under the White Bay industrial area and Mort Bay to reduce impact to homes and heritage properties
- Alignment be moved slightly left under Balls Head (closer to HMAS Waterhen land) to straighten the tunnel and take it under less populated areas
- Alignment be moved to the northern side of Bay Road which would provide a more direct passage and elevation
- Direct route under Snails Bay rather than Louisa Road. This would be shorter and have cost savings, as well as reduce the risk of settlement damage to properties due to increased distance from residential areas
- Realigning the route to avoid the Naremburn Conservation area
- Consideration of an alternative tunnel from Rozelle to Naremburn. This would challenge the argument in the environmental impact statement that only a floor bedded tunnel was

possible. The Rozelle to Naremburn option is around 9.5 kilometres which is not long by other tunnels proposed by Transport for NSW

- Consider tunnel routing further west through Lane Cove and surrounds
- Consider starting the Western Harbour Tunnel in the same location as the Sydney Harbour Tunnel and running it in parallel as far as Milsons Point with portals near Alfred Street, and then following a route under Millers Point, Balmain East and the White Bay Cruise Terminal. Existing ventilation outlets could be modified to serve the proposed tunnel. This would require less tunnelling, would provide greater ventilation, would not require access changes to the existing harbour crossings, and increased access to the project tunnels.

***Response***

Tunnel depths

Additional geotechnical investigations would be carried out during the next design stages to further inform the design and confirm required tunnel depths.

Worst case impacts to properties associated with settlement along the project alignment are predicted to be 'slight' and noise and vibration impacts are generally considered minor. Potential impacts will be managed with the implementation of a range of mitigation measures outlined in Table D2-1 of this submissions report. This includes development of detailed predictive settlement models in accordance with environmental management measure SG1, to guide selection of construction methodology options to minimise settlement. Where required, more detailed assessment of impacted structures will be carried out and attended vibration monitoring carried out in accordance with environmental management measure CNV6 to ensure vibration levels remain below appropriate limits for structures such as heritage properties. Two new environmental management measures, NAH24 and NAH25, have been included to specifically manage potential vibration impacts on heritage structures. These are provided in Table D2-1 of this submissions report and discussed further in Section B8 of this submissions report.

Tunnel alignment

The process for selection of the preferred tunnel alignment included consideration of 10 strategic corridors and detailed assessment of four shortlisted alternatives. This is detailed in Section 4.4 of the environmental impact statement. The preferred route provides the shortest harbour crossing, significantly reducing exposure to poor geology, reducing construction risk, cost and program duration. Future design stages may reveal the need for refinements to the tunnel alignment to further improve environmental, engineering or constructability outcomes. Any proposed changes would be considered in line with the process outlined in Section 2.3 of the environmental impact statement.

### C4.3.4 Tunnel portals

***Issue raised***

Submitters raised issues regarding locations of the tunnel portals. Specific queries, comments and concerns included:

- Relocate the tunnel portals near the North Sydney CBD further north along the Warringah Freeway. Alternative locations include at the intersection of the Pacific Highway and Warringah Freeway at North Sydney (High Street), the Pacific Highway opposite Cammeraygal High, or near the Artarmon industrial estate
- Traffic whose destination is the North Sydney CBD should enter and leave radially, perhaps via a partial or full ring road
- Request for access point into the Western Harbour Tunnel southbound from the Ernest St area (ie east of the Warringah Freeway)

- Tunnel portals be located at least 100 metres from any residential property
- Request to add a southbound tunnel connection between Beaches Link and Sydney Harbour Tunnel access lanes on the Warringah Freeway.

***Response***

Over 20 alternative arrangements were considered for the Western Harbour Tunnel connections to and from North Sydney during development of the project. Three options were short-listed for further consideration, including one with connections to and from the Pacific Highway. These are described in Section 4.5.2 of the environmental impact statement. The proposed option provides the connectivity required to service key origins and destinations in the North Sydney area, while minimising private property and business impacts.

The proposed connection in North Sydney would improve connectivity between North Sydney, surrounding areas and the project via existing State road corridors (ie Berry Street and Falcon Street), which would provide appropriate capacity while minimising impacts to local streets. This would allow traffic to efficiently enter and leave North Sydney. As discussed in Section A4.1.3 of this submissions report, the North Sydney Program is an ongoing, multi-agency collaboration between Transport for NSW, North Sydney Council, Greater Sydney Commission and the Government Architect of NSW to guide future integrated transport planning and investment in the North Sydney CBD and interconnected areas. Through the North Sydney Program, Transport for NSW will continue to work closely with North Sydney Council and key stakeholders to investigate options to improve movement and place outcomes within North Sydney, further leveraging the strategic benefits of the program of works.

Ernest Street and surrounds will continue to have good motorway access, with direct access to the Sydney Harbour Tunnel and access to the Sydney Harbour Bridge via adjacent interchanges at Miller Street and Falcon Street. The use of Miller Street or Falcon Street will continue to provide access to the same destinations as the Western Harbour Tunnel via the existing Sydney Harbour Tunnel - Western Distributor corridor which is expected to benefit from improved traffic conditions with the redistribution of other journeys in to Wester Harbour Tunnel. The predicted traffic demand from Ernest Street to Rozelle and beyond is not sufficient to warrant a direct connection to the Western Harbour Tunnel.

Due to the dense urban environment surrounding the project, locating the tunnel portals 100 metres away from all residential properties would not be possible. The location and design of the portals was developed to satisfy transport objectives while minimising potential environment, property and community impacts.

There would be no direct connection from Beaches Link tunnels to the Sydney Harbour Tunnel. Access to the Sydney Harbour Tunnel (southbound) from the proposed Beaches Link tunnels would be possible via the Warringah Freeway outer southbound carriageway. The connections from the Beaches Link tunnels would also provide access to the Cahill Expressway. Both the Sydney Harbour Tunnel and Cahill Expressway would continue to function as existing, with connections to East Sydney and the Eastern Distributor, south of the harbour.

### C4.3.5 Warringah Freeway alignment and access

***Issues raised***

Submitters raised a number of comments, and suggested alternative alignments and access arrangements for the Warringah Freeway Upgrade component of the project, including:

- Access roads to the Warringah Freeway should be placed underground
- Redesign the Brook Street/Warringah Freeway intersection to allow full access to the freeway from Brook Street, both northbound and southbound.

Submitters suggested the following surface road access arrangements:

- Add an extra sequence to the existing traffic lights at the Miller Street/Amherst Street intersection to allow right turns
- Add a right turn sequence to the Miller Street/Palmer Street traffic lights for the safety of those at Cammeray Public School
- Consider making the eastbound side of High Street between Alfred Street North and Clark Road into two trafficable lanes, by removing all parking from this section of High Street
- Consider an alternative merging option for Mount Street to remove the need for traffic lights on Alfred Street North intersection
- Allow an unimpeded right turn from Merlin Street into Military Road by synchronising the three existing traffic lights
- Reconsider the lane design at the intersection of Alfred Street North and High Street to allow two left hand turn lanes from Alfred Street North turn left (ie eastbound) into High Street.

***Response***

Underground access to Warringah Freeway

The Warringah Freeway is generally at a lower elevation than the surrounding suburbs and as such access to the Warringah Freeway would continue to be via surface ramps.

Brook Street Interchange

The Brook Street interchange arrangements are described in Section 5.3 and illustrated in figures 5-4 and 5-5 of the environmental impact statement. Ramps would connect Brook Street, Crows Nest with the Sydney Harbour Bridge via Warringah Freeway northbound (off-ramp to Brook Street) and southbound (combined on-ramp from Brook Street and Miller Street). Provision of direct access to and from the Sydney Harbour Tunnel via the Warringah Freeway would not be feasible due to property impacts, and for safety and traffic efficiency reasons. Southbound traffic entering the Warringah Freeway from Brook Street that is destined for East Sydney or the Eastern Distributor would use the Cahill Expressway instead.

Surface road access

The proposed design for the project has been developed through careful consideration ensuring efficient operation, while also balancing and minimising impacts. As per environment management measure OT1 (refer to Table D2-1 of this submissions report) a review of operational network performance will be carried out after project opening to confirm the operational impacts of the project on surrounding arterial roads and major intersections. Any proposed changes would be considered in line with the process outlined in Section 2.3 of the environmental impact statement.

### C4.3.6 Road features and amenity

***Issue raised***

Submissions made the following suggestions regarding road features and amenity:

- Consider lane-painting in different colours to aid navigation, like the publicity material provided to ease navigation on the Warringah Freeway
- Request to provide a 500 metre gap in the median strip between the northbound Sydney Harbour Tunnel and western lanes of the Warringah Freeway
- Praise was provided for the plan to simplify lane movements and clearances as part of the Warringah Freeway Upgrade component of the project. Request that concrete and tarmac layer-change boundaries are removed from the centres of lanes as they are a severe distraction to drivers and modern lane-guidance safety systems.

***Response***

Clear directional signage providing drivers with advanced warning to assist with route selection would be installed by the project. Signage would satisfy the requirements of applicable Australian and Transport for NSW standards and guidelines. Additionally, the upgrade would separate traffic on the freeway based on trip function (through-traffic, traffic for arterial distribution and traffic for local destinations), reducing the number of people taking wrong route.

The project would also include intelligent transport system technology and traffic control infrastructure including variable message signs and lane use management systems to aid in navigation.

The use of coloured lanes for navigation are not being considered as part of the project.

The provision of a 500 metre gap in the median strip between the northbound Sydney Harbour Tunnel and western lanes of the Warringah Freeway is unfeasible due to the need to separate carriageways. The Warringah Freeway Upgrade component of the project is proposed to rationalise connectivity in order to substantially improve the safety and efficiency of the freeway and arterial road interfaces. Lane configurations on the Warringah Freeway are further discussed in Section C9.4 of this submissions report.

Transport for NSW would continue to review further opportunities to improve the consistency of pavement wearing course along the Warringah Freeway during further design development. However, as the Warringah Freeway is an existing corridor it is unlikely that all legacy issues can be addressed without significant additional construction, time and cost impacts. Transport for NSW would continue to balance all these requirements during the further design development.

### C4.3.7 Active transport

***Issue raised***

Submitters requested consideration of additional or alternative active transport arrangements. These included:

- Inclusion of a pedestrian crossing on the north side of Alexander Street, at the roundabout intersection with Albany Street
- Relocation of footpaths on western side of Alfred Street North into the grassed area
- Inclusion of a pedestrian crossing to get from High Street North to High Street South
- Significantly broadening the Ernest Street overpass or other similar structures along the length of the freeway to provide greater amenity and safety for shared path users
- Inclusion of a pedestrian/cycle crossing on the western side of Ernest Street bridge onto the west side of freeway by removing the traffic lights at Merlin and Ernest Streets to connect to existing bike path between Ernest and Falcon Streets at Jeaffreson Jackson Reserve.

***Response***

The intersection of Alexander Street and Albany Street would not be impacted and any upgrades to this intersection would be outside the scope of the project.

There are no proposed changes or impacts to the footpath on the western side of Alfred Street North that runs adjacent to the vegetated area between the Ridge Street pedestrian bridge and Kurraba Road.

Signalised pedestrian crossings would be provided on the eastern side of the intersection of High Street and Alfred Street North at North Sydney.

The Ernest Street overpass is discussed in Section B14.20.5 of this submissions report. In response to various agency and community submissions, the project will investigate additional pedestrian connections across Ernest Street that would improve connectivity between paths and public open

space in the area during further design development (environmental management measure OT4, refer to Table D2-1 of this submissions report).

The project would improve active transport links through the provision of a new dedicated cycle path along the eastern side of the Warringah Freeway between Miller Street at Cammeray and Ernest Street, as well as a number of new and upgraded shared user bridges which would provide connectivity across the Warringah Freeway.

NSW GOVERNMENT

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C5 – Project description

SEPTEMBER 2020

# C5 Project description

## Contents

# C5.1 Western Harbour Tunnel component

## C5.1.1 Tunnel alignment

### *Issue raised*

Submitters raised comments with respect to the depth and gradient of the tunnels. Concerns were also raised about the proximity of the tunnel to sensitive receivers, including schools. Specific queries, comments and concerns include:

- Concerns that the Western Harbour Tunnel is too long, and that the longitudinal ventilation design is unproven in tunnels of this length
- Query as to the proposed gradient of the tunnel and the associated safety implications
- Request further information regarding the depth of the proposed tunnels and their exact location. In addition, the depth below properties should be measured from the top of the tunnel, not the bottom
- Query as to the design life of the tunnel.

### *Response*

The tunnel ventilation system conforms to international and Australian tunnel design guidelines and standards, as discussed in Section 4.5.3 of the environmental impact statement. The simplest form of ventilation for road tunnels is longitudinal ventilation. Due to the need to supply large volumes of fresh air to dilute vehicle emissions, a well-designed longitudinal ventilation system can maintain acceptable air quality in long tunnels and is considered the most efficient and effective tunnel ventilation system (Advisory Committee on Tunnel Air Quality (ACTAQ), 2019). All road tunnels longer than one kilometre built in Australia in the last 20 years have been designed and operated with longitudinal ventilation systems. This includes the NorthConnex, New M4, M8 (formerly known as New M5) and M4-M5 Link tunnels, which are under construction or operational.

Further information about tunnel ventilation and air quality is available at *www.chiefscientist.nsw.gov.au* and *nswroads.work/airquality*.

The Western Harbour Tunnel and associated ventilation systems would be built and operated in compliance with any conditions of approval set by the Department of Planning, Industry and Environment. Further, the monitoring of ventilation outlet emissions during operation would be regulated under an Environmental Protection Licence prescribed under the POEO Act. Refer to Section C12.3.2 for further discussion on ventilation outlets.

Tunnel alignment 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. Selection of the preferred corridor required consideration of various technical and environmental factors to achieve acceptable vertical gradients to achieve the desired transport product, reduce whole of life emissions, operational costs, and improve safety outcomes. The assessment considered the effect of the tunnel gradient on traffic performance, emission generation, ventilation design, and long-term operational costs for the tunnel.

The design criteria for the mainline tunnel adopts about a four per cent maximum grade as desirable, and in line with other recent major road tunnel projects. Any grades steeper than about four per cent for the mainline tunnel were considered subject to a comprehensive assessment of alternatives, including value for money, operational traffic and air quality impacts as well as passenger safety.

Figure 5-7 of the environmental impact statement shows the indicative vertical alignment of the mainline tunnels from Rozelle to Cammeray and includes indicative depths from key locations at the surface to the tunnel road surface. Figures 5-1 to 5-6 of the environmental impact statement show

the horizontal alignment of the tunnel. To identify the approximate depth of the top of the tunnel, subtract eight metres from the depth shown on the figure.

The project is designed to meet with the needs of both current and future generations with a design life of about 100 years (as noted in Table 25-5 of the environmental impact statement).

### C5.1.2 Tunnel portals

***Issue raised***

Submitters raised the following concerns regarding the location of Western Harbour Tunnel on ramp from Berry Street:

- Berry Street would be changed to four lanes of traffic to access the south bound entry to the tunnel. These changes would result in less space for pedestrians
- The location of the tunnel on ramp from Berry Street would remove a number of local connections. The design should be modified to ensure there is no loss of local traffic connectivity within North Sydney
- Request that the tunnel on ramp from Berry Street maintain connection to the Gore Hill Freeway
- Traffic travelling to Neutral Bay, Cremorne or Mosman using the new tunnel, ends up on the western side of the Warringah Freeway at Falcon Street and has to travel via local roads back across the Warringah Freeway.

***Response***

Table 5-12 of the environmental impact statement identifies the removal of some kerbside buildouts on Berry Street. The project would result in a very small reduction in space for pedestrians on Berry Street. This is expected to be offset by the intersection works at Berry Street and Miller Street which would improve pedestrian access within North Sydney by converting the existing pedestrian crossings to a scramble crossing, with a pedestrian only phase. This would allow pedestrians to access any leg of the intersection during the pedestrian only phase. Additionally, pedestrian infrastructure and in particular storage, will be enhanced in this area as part of the new Victoria Cross Sydney metro station.

The Berry Street on ramp proposed by the project would not result in loss of local connectivity. There would be no loss in connectivity within the North Sydney CBD except that traffic would no longer be able to turn right from Miller Street northbound to Berry Street eastbound (refer to Table 5-9 of the environmental impact statement). To accommodate the change in traffic distribution and access, adjustments to the Pacific Highway and Berry Street intersection have been included in the project.

Surface connections between the Western Harbour Tunnel component of the project, the Beaches Link and Gore Hill Freeway Connection project, and North Sydney are shown in Figure 5-12 and Figure 5-14 of the environmental impact statement. Table 5-9 of the environmental impact statement notes that northbound connections from the Berry Street on ramp would only be provided to the Miller Street and Brook Street off ramps. There would be no direct access to the mainline of the Warringah Freeway and on to the Gore Hill Freeway. In addition, there would no longer be access to the Warringah Freeway northbound Falcon Street off ramp, where the current arrangement requires movement across four lanes of traffic to access. This movement would be removed as part of the project to improve safety. Alternate access would be provided via the North Sydney road network to access the new High Street northbound on ramp to the Warringah Freeway, Falcon Street eastbound, or the Warringah Freeway.

Transport for NSW will continue to work closely with North Sydney Council and key stakeholders through the North Sydney Program to investigate options to improve movement and place outcomes within North Sydney (refer to Section A4.1.3 of this submissions report for further information).

Vehicles with a destination of Neutral Bay and Mosman and originating west of the Sydney CBD would be more likely to use the existing Western Distributor and Sydney Harbour Bridge, and then the Falcon Street interchange. The proposed Western Harbour Tunnel is not intended to be used as the primary access to these areas due to the operational benefits provided to the existing Western Distributor/Sydney Harbour Bridge corridor resulting from the reduction in demand on these roads from the project. Changes to access as a result of the project is discussed in Section C9.4.1 of this submissions report.

### C5.1.3 Connectivity

***Issue raised***

It is not clear which connections are being created, or removed, to ensure that the Western Harbour Tunnel functions as a bypass and does not end up being just an additional road connection between the Lower North Shore and Sydney CBD.

***Response***

The project would provide a new crossing of Sydney Harbour connecting the M4-M5 Link at Rozelle and the Warringah Freeway at North Sydney (the Western Harbour Tunnel) forming a direct link between North Sydney and the inner west region of Sydney, as described in Section 5.1 of the environmental impact statement. The motorway tunnels would form a new, motorway-standard western bypass of the Harbour CBD and improve the performance and reliability of the heavily congested ANZAC Bridge, Western Distributor and the Sydney Harbour Bridge corridor. The project would not provide direct connectivity between the Lower North Shore and Sydney CBD.

### C5.1.4 Operational and ancillary facilities

***Issue raised***

An alternative location for the operational and ancillary facilities at Cammeray has been requested, including consideration of placing the facilities underground.

***Response***

Environmental investigations and community and stakeholder feedback informed the identification of appropriate construction support sites (refer to Section 4.5.4 of the environmental impact statement). Locating construction support sites to support large scale infrastructure projects in urban environments is a complex issue, and requires consideration of a variety of issues, including:

- Minimising property acquisitions, especially private residential dwellings
- Connectivity of the site with arterial roads to minimise haulage through local streets
- Ensuring the sites are of a size to accommodate all of the work requirements, including worker parking.

In urban environments, it is difficult to achieve all of these requirements. Transport for NSW understands the importance of minimising impacts on local communities.

The location of operational infrastructure has been developed in consideration of existing land uses and future development to minimise permanent impacts. Refer to Section B14.20.3 of this submissions report for a discussion regarding the Western Harbour Tunnel and Beaches Link motorway facilities at Cammeray.

## C5.2 Warringah Freeway Upgrade component

### C5.2.1 Changes to the surrounding road network

***Issue raised***

Submitters questioned how many and which nearby local roads would require widening as a result of the project.

***Response***

In response to changes in the distribution of traffic as a consequence of the project, minor upgrades and changes to parts of the road network around the Warringah Freeway would be carried out. Details of these upgrades and changes are included in Table 5-12 of the environmental impact statement. Many of the upgrades would be confined to the existing road footprint which consists primarily of State or Regional roads and would not require widening.

### C5.2.2 Connectivity

***Issue raised***

Submitters raised concerns over the reconfiguration of access to and from the Warringah Freeway as part of the project. Some submitters were concerned that changes to the Warringah Freeway intersections would leave local people with less access to the existing Sydney Harbour crossing network. Specific queries, comments and concerns include:

- Objection to the removal of access to the Sydney Harbour Tunnel from Miller Street
- Request that access to the Sydney Harbour Bridge and Warringah Freeway from Ernest Street be maintained in its current form
- Request that on and off ramps at Ernest Street are removed completely and roads are restored to the local community
- Submitters objected to the closure of the Brook Street Warringah Freeway access points to traffic travelling to and from the Sydney Harbour Tunnel. This reconfiguration – along with changed ramp access at Miller Street – would put pressure on Willoughby Road and the surrounding road network
- Comment that mid North Shore motorway access should be concentrated at Brook Street to allow local roads to serve local centres
- Comment that the project would lead to the reduced accessibility of Alfred Street North/Rose Avenue, Wyagdon and Merlin Streets precinct
- Submitters believe that access changes would leave northbound traffic from the Sydney Harbour Tunnel with limited options to exit the Warringah Freeway, and would instead be funnelled onto Falcon Street and Willoughby Road. In addition, traffic seeking to travel south towards the Sydney Harbour Tunnel would have limited access options to the Warringah Freeway
- Concern that the only entry from North Sydney heading north onto the Warringah Freeway is from High Street, placing additional impact on the road network and intersections and resulting in impacts in Kirribilli and along Clark Road.

***Response***

For the Warringah Freeway Upgrade component of the project to achieve optimised connectivity for the harbour crossings, an improvement of the bypass and access/distributor functions of the road corridor is required, as outlined in Section 5.3.3 of the environmental impact statement. This would require the current access arrangements to the Warringah Freeway corridor to be modified, for streamlined connectivity and to support the growth in traffic demand. These modifications would

also result in improvements to performance, safety and wayfinding. Residents and businesses in the suburbs around the Warringah Freeway would remain connected to at least one harbour crossing.

Responses to the specific connectivity issues above are as follows:

- Table 5-9 of the environmental impact statement acknowledges that access between the Sydney Harbour Tunnel northbound and Miller Street would be removed. The Ernest Street interchange would provide connectivity between the Sydney Harbour Tunnel and Cammeray. Miller Street would also remain connected to the Sydney Harbour Bridge; the Cahill Expressway provides the same connectivity as the Sydney Harbour Tunnel
- Direct access from Ernest Street to the Sydney Harbour Bridge northbound and southbound would be removed. Adjacent interchanges to the north and south of Ernest Street would provide connectivity to Cammeray and Neutral Bay. On and off ramps would remain at this interchange providing access to and from the Sydney Harbour Tunnel
- Table 5-9 of the environmental impact statement acknowledges that access between the Sydney Harbour Tunnel and Brook Street would be removed. The impacts of this change on Willoughby Road and other local roads have been modelled and are considered to be minor. The Willoughby Road/Gore Hill Freeway interchange would dramatically improve in level of service (from LoS F to A) and average delays (from greater than 100 seconds to eight seconds) when comparing the 'Do minimum' (no project) and 'Do something' (with project) scenarios for the year 2027, with similar improvements in 2037 (refer to Appendix F (Technical working paper: Traffic and transport)). Brook Street would also remain connected to the Sydney Harbour Bridge; the Cahill Expressway provides the same connectivity as the Sydney Harbour Tunnel
- While Brook Street would perform an important function in terms of connectivity to the Warringah Freeway, concentrating the connection into this location would have major downstream traffic impacts on local streets and create inconvenience for many road users. The Warringah Freeway corridor is also narrower at Brook Street and providing additional connectivity at this location would have resulted in additional impacts to property. Further information on connection alternatives to the Warringah Freeway is provided in Section 4.5.2 of the environmental impact statement
- Table 5-9 of the environmental impact statement acknowledges that access from the southbound off ramp from Warringah Freeway to travel northbound on Alfred Street North would be removed. However, access to Alfred Street North/Rose Avenue, Wyagdon Street and Merlin Street would still be possible, via either exiting the Warringah Freeway at Falcon Street or continuing onto High Street and travelling via the local road network around Neutral Bay
- Table 5-8 of the environmental impact statement acknowledges that existing connections between the Warringah Freeway and the Sydney Harbour Tunnel would be reconfigured and reduced as part of the project. These changes would be possible as access between these locations and the Eastern Distributor would still be available via the Cahill Expressway. Local connections to Neutral Bay and Cammeray would be maintained
- Table 5-9 of the environmental impact statement identifies that vehicles wanting to travel north on the Warringah Freeway from North Sydney would be able to access the Warringah Freeway from the High Street and Falcon Street interchanges.

### C5.2.3 Falcon Street interchange

***Issue raised***

Submitters requested additional detail and raised comments about the proposed Falcon Street interchange, including:

- Request for further detail on the Falcon Street interchange and how it would work

- Many submitters commented on the changed traffic flows at the intersection of Merlin Street and Falcon Street, preventing a left-hand turn continuing westbound on Falcon Street (shown on Figure 5-27 of the environmental impact statement). Specific concerns include:
  - Submitters suggested that, in order to maintain a westbound intersection at Merlin Street, the median strip between westbound lanes 4 and 5 should be shortened to enable a normal left-hand turn, and the traffic lights at the eastern side of the Merlin Street intersection should be sequenced to prevent a build-up of westbound traffic on Falcon Street
  - Objection to the removal of a northbound access to Warringah Freeway from Merlin Street and requested that traffic be allowed to turn left from Merlin Street onto Falcon Street towards Crows Nest
  - Submitters requested clarification as to whether a right turn (eastbound) access from Merlin Street to Falcon Street would be permitted
  - Request for further information as to how residents and visitors would exit Merlin Street at the completion of works. There is a concern the design has overlooked the many residents who can only access their properties via Merlin Street
- The design would not allow access to the Cahill Expressway, which connects to the Sydney CBD and the airport
- Query as to why the southbound bus lane from the Falcon Street interchange needs to be elevated and attached to Alfred Street North
- Query whether the new southbound bus lane from the Falcon Street interchange conforms to Australian Standards
- The elevated bus lane proposed be built from the Falcon Street Interchange to the top of McIntosh Lane should be redesigned or moved further south to minimise the loss of on street parking as well as noise and visual impacts to residential properties on Merlin Street during operation
- Concern that northbound traffic on the Warringah Freeway would not have direct access to Crows Nest and southbound traffic would not have direct access to Cremorne and Mosman
- Concern that it would be difficult to get to the Falcon Street interchange (to access the Sydney Harbour Bridge) from residences on Byrnes Avenue. The alternative route through local streets to join southbound Military Road or northbound Falcon Street would also be difficult
- Freeway traffic is currently split between the Pacific Highway and Falcon Street off ramps. Removal of the Warringah Freeway (northbound) Falcon Street off ramp would push all traffic bound for Crows Nest and Chatswood down Pacific Highway and through North Sydney CBD
- Submitters were concerned about the access from the Warringah Freeway (southbound) Alfred Street North off ramp to travel northbound on Alfred Street North which would be removed as part of the project. Submitters commented that this would reduce access to residents along Merlin Street, Alfred Street North, Rose Avenue and Wyagdon Street and requested that this change be reconsidered.

***Response***

Detail on the Falcon Street interchange is provided in Section 5.3.4 and Figure 5-27 of the environmental impact statement. A video showing the Falcon Street interchange orbit is also available on the Transport for NSW project site (accessed from: *https://v2.communityanalytics.com.au/rms/wht/gallery*). Transport for NSW will provide updates to the community as the design of this interchange develops.

Merlin Street/Falcon Street access

The design presented in the environmental impact statement does not allow a left turn from Merlin Street onto Falcon Street or onto the Warringah Freeway northbound. Vehicles travelling from Merlin Street to Crows Nest would do so on the Pacific Highway via the High Street interchange. Transport for NSW recognises this is an important local connection and is currently investigating opportunities to provide a similar level of connectivity to the existing arrangement while managing the wider traffic network impacts and safety issues. Vehicles wishing to travel eastbound on Falcon Street from Merlin Street would be able to do so.

Residents at Merlin Street would be able to travel north to Falcon Street to travel south on Warringah Freeway via the Falcon Street interchange. Residents travelling north or east would still be able to turn right to access Falcon Street to travel east (via Military Road), however would no longer be able to turn left from Merlin Street onto Falcon Street to directly access Crows Nest (as discussed above). Residents travelling south would be able to access Alfred Street North before entering the High Street interchange providing connections to the east and west via High Street, or north via the Warringah Freeway.

Access to Sydney CBD and Sydney Airport

The project would result in changes to some existing connections to the Warringah Freeway from the surrounding road network. The Falcon Street interchange provides access to the Warringah Freeway for eastbound and westbound traffic travelling along Falcon Street. Access from the Falcon Street southbound on ramp to the Cahill Expressway would be removed. Access would be maintained from the Falcon Street southbound on ramp to the Sydney Harbour Tunnel, providing connectivity to the Sydney Airport, Sydney CBD and the Eastern Suburbs.

Southbound bus lane

The project would provide a dedicated southbound bus lane on the Warringah Freeway between Miller Street and the Sydney Harbour Bridge, with upgraded bus lane connections at Falcon Street and Mount Street. This would remove direct interaction between buses and general traffic on the approach to the Sydney Harbour Bridge, improving southbound bus operations. The bus lane would be elevated as it would constitute the easternmost lane of the Warringah Freeway and would maintain grade separation from the general traffic travelling to North Sydney and the Cahill Expressway in order to prevent buses and general traffic from mixing.

The bus lane is designed and would be developed further in detailed design according to relevant Australian, and Transport for NSW guidelines and standards.

The design of the elevated ramp from the Falcon Street interchange has considered the potential noise and visual impacts. Figure 5-9 of the environmental impact statement shows an existing noise wall between the Warringah Freeway and Merlin Street which would remain. A detailed noise assessment identified areas where permanent noise barriers would be located to reduce noise impacts to nearby residences. No new noise barriers were considered necessary at this location. Environmental management measures ONV1 and ONV2 (refer to Table D2-1 of this submissions report) require the operational noise performance of the project to be reviewed both during detailed design and within 12 months of operation of the project. Additional operational noise mitigation will be implemented in accordance with relevant policies and guidelines as required.

Table 8-17 of the environmental impact statement acknowledges that the project would result in the permanent removal of about 47 parking spaces on Alfred Street North between Wyagdon Street and Ridge Street, and about 49 parking spaces on Alfred Street North between Ridge Street and Whaling Road. The need to remove these spaces is due to the widening of Warringah Freeway rather than the new elevated bus ramp. Opportunities to reduce or offset the permanent loss of long stay parking spaces along Alfred Street North will be investigated during further design development in accordance with new environmental management measure OT3 (refer to Table D2-1 of this submissions report).

Crows Nest, Cremorne and Mosman access

As identified in Table 5-9 of the environmental impact statement, northbound traffic on Warringah Freeway would no longer be able to access Crows Nest via Falcon Street. Transport for NSW recognise this is an important local connection and is currently investigating opportunities to provide a similar level of connectivity to the existing arrangement while managing the wider traffic network impacts and safety issues.

Alternative access to Crows Nest would be via the Ernest Street interchange, Miller Street interchange, Brook Street interchange or Willoughby Road interchange (depending on which harbour crossing was utilised). Southbound traffic travelling along Warringah Freeway would still have direct access to Military Road eastbound for those travelling to Cremorne and Mosman.

It is further noted that vehicles originating from the west of the Sydney CBD would still be able to access Crows Nest from Falcon Street via the Western Harbour Tunnel.

Access from Byrnes Avenue

Access to the Falcon Street interchange from Byrnes Avenue would be via Military Road and Tramway Lane as per the current arrangement. From the Falcon Street interchange, it would be possible to access the Sydney Harbour Bridge (Bradfield Highway). Access to the Cahill Expressway would be restricted from the Falcon Street interchange, however access to east Sydney would be possible via the Sydney Harbour Tunnel. Alternatively, access to the Cahill Expressway southbound would be possible from the High Street, Mount Street or Miller Street interchanges.

Traffic on the Pacific Highway

Table 5-9 of the environmental impact statement acknowledges that access from the Warringah Freeway northbound to Falcon Street westbound would be removed to accommodate the Falcon Street off ramp from the Western Harbour Tunnel. The adjacent interchanges to the north and south of Falcon Street would provide similar connectivity to that currently provided by Falcon Street. Vehicles wishing to travel to Chatswood would continue to travel along the Warringah Freeway onto the Gore Hill Freeway and exit onto the Pacific Highway at Artarmon.

Alfred Street North access

As identified in Table 5-9 of the environmental impact statement, left turn access into Alfred Street North from the Warringah Freeway off ramp would no longer be possible due to a grade separation, as Alfred Street North would be raised above the existing off ramp. Traffic would be required to exit the Warringah Freeway at Falcon Street or continue onto High Street and travel via the local road network around Neutral Bay to access Alfred Street North.

It is acknowledged that this would result in an increase in travel times for some residents, however there would be no loss of access to properties on Merlin Street, Alfred Street North, Rose Avenue or Wyagdon Street due to the operation of the project.

## C5.3 Public and active transport

***Issue raised***

Submitters raised concerns about impacts to public and active transport due to the project. Specific queries, comments and concerns include:

- Query why there is no dedicated bus lane or public transport lanes within the tunnel as part of the project to reduce the number of cars. It is currently unclear what provisions for public transport would be made in the tunnel
- Query as to whether a dedicated cycle path would be constructed between Naremburn and the Sydney Harbour Bridge part of this project

- Request for upgrades to major pedestrian crossings at Miller Street, Walker Street, Mount Street, High Street and Berry Street. The environmental impact statement illustrates very limited improvements of pedestrian links
- Concern that existing active transport routes may be removed through the widening of local streets and roads either directly, or through changes to parking arrangements and clearways
- Figures in the environmental impact statement show a motorway facility building and noise barriers, but no markings for the section of cycle path along the Warringah Freeway between Naremburn shops and the Brook Street off ramp to West Street via Amherst Street
- Objection to the permanent removal of the following infrastructure:
  - Underpass from Merlin Street South to Merlin Street North
  - Miller Street, Cammeray to Ernest Street cycleway along the Warringah Freeway
  - Shared path on Ernest Street, in the vicinity of the Warringah Freeway
  - Falcon Street shared pedestrian and cycle bridge
  - Ridge Street shared pedestrian/cycle bridge and ramp access to Alfred Street North
  - Pedestrian bridge connecting Miller Street with Neutral Bay Shops.

***Response***

Provisions for public transport

The tunnels have been designed to allow use by buses including the taller double-decker bus services. Each tunnel would provide three traffic lanes with a posted speed limit of 80 kilometres per hour. The number of buses likely using the Western Harbour Tunnel component of the project does not justify the reduction in tunnel capacity that would result from the creation of dedicated bus lanes. Further, the provision of designated bus lanes generally occurs in parts of the network where capacity is constrained to enable buses to bypass general traffic congestion. The project would improve traffic flows, removing the need for priority infrastructure.

Active transport connectivity

Generally, there are no changes to active transport links as a result of the project in the 'Rozelle and surrounds', and 'Gore Hill Freeway and Artarmon' study areas. Changes are proposed in the 'Warringah Freeway and surrounds' study area where the project would improve cycle connectivity. Current cycle facilities along the fragmented Warringah Freeway corridor are a combination of off-road and on-road paths. A new dedicated cycle path would be provided along the eastern side of the Warringah Freeway between Miller Street at Cammeray and Ernest Street at North Sydney. This dedicated cycle path would allow onward connectivity to the Sydney Harbour Bridge via existing cycle and shared user paths. Additionally, a new shared user bridge would be provided to the north of Ernest Street at Cammeray to connect the Cammeray Golf Course site with ANZAC Park. Replacement/renewed facilities seek to provide a like-for-like replacement, and in some cases an improvement of, existing facilities in terms of connectivity and serving existing desire lines.

Additional cycle paths are outside the scope of this project. The North Sydney Integrated Transport Program is a multi-agency collaboration between Transport for NSW, North Sydney Council, Greater Sydney Commission and the Government Architect of NSW, which outlines initiatives to improve access for cyclists to and through the CBD (refer to Section A4.1.3 of this submissions report for further information). Further, the proposed scope of the project complements other active transport planning being carried out by Transport for NSW. Councils can apply for funding for cycleways under the NSW Government's Walking and Cycling Program. In line with the NSW Government's *Future Transport Strategy 2056*, this program focuses on improving the convenience of walking and cycling for short trips to key destinations and within centres, and making walking and

cycling safe and reliable by prioritising infrastructure that supports pedestrian and cycling movement. Further information is available at *transport.nsw.gov.au*.

The existing pedestrian crossing at the intersection of Berry Street and Miller Street would be converted to a scramble crossing, with a pedestrian only phase. This would allow pedestrians to access any leg of the intersection during the pedestrian only phase. The signalised pedestrian crossing at High Street would also be upgraded as part of the project. These are described further in Chapter 5 (Project description) of the environmental impact statement.

Pedestrian crossing upgrades at Walker Street and Mount Street are outside the scope of the project.

While some existing active transport infrastructure may be impacted, the project commits to upgrading, replacing and providing new active transport infrastructure. Table 5-13 of the environmental impact statement outlines the pedestrian and cyclist infrastructure to be provided as part of the Warringah Freeway upgrade. Impacts to active transport were assessed as part of the traffic and transport assessment, as discussed in Appendix F (Technical working paper: Traffic and transport).

Figures 5-30 to 5-32 of the environmental impact statement show upgrades to surface features. As shown on Figure 5-32 of the environmental impact statement, there would be no impacts to the active transport infrastructure along the Warringah Freeway between Naremburn shops and the Brook Street off ramp to West Street via Amherst Street. The additions and upgrades to the existing noise barriers would remain to the north east of the cycle path.

The removal of the pedestrian underpass at the eastern side of the Falcon Street bridge would result in additional travel time however, pedestrian and cycle surveys indicate that this underpass is currently underutilised (as per Table 4-16 of Appendix F (Technical working paper: Traffic and transport). There are existing alternative routes available for pedestrians and cyclists to access the Falcon Street shared user bridge which would be maintained during operation of the project. Pedestrians and cyclists would also have the opportunity to use the existing zebra and signalised pedestrian crossings spanning Falcon Street and Military Road.

As shown on Figure 5-4 of the environmental impact statement, the shared path along Ernest Street to the east of the Warringah Freeway would not be removed as part of the project, however due to the addition widening of the existing bridge and the addition of an access road to the motorway facilities, modifications would be required.

As discussed above, the project would include the replacement of the Falcon Street and Ridge Street shared user bridges. As noted in Table 5-3 of the environmental impact statement, capacity and configuration works along Alfred Street North would be required, including the realignment of Alfred Street North between Wyagdon Street and the Ridge Street shared user bridge. A new bridge for pedestrian and cyclists including suitable access, would be constructed immediately to the south of the existing Ridge Street bridge. The construction sequence would be developed such that the new bridge would be constructed and operational prior to demolition of the existing bridge, ensuring that there would be no loss of connectivity through construction.

## C5.4 Structural elements

### C5.4.1 General comments

***Issue raised***

Submitters raised comments in regard to proposed structural elements of the project including overpasses, retaining walls and stormwater drainage. Specific queries, comments and concerns include:

- Request for a new retaining wall to support the new lane where the shared user ramp is now on Falcon Street

- Concern that lane dividers would be used to separate traffic lanes on the Warringah Freeway.

***Response***

It is expected that with the removal of the Falcon Street bridge pedestrian underpass there would be sufficient support from the existing rock cutting, such that significant further treatment would not be required. Further consideration to the final treatment in this area would occur during further design development.

The reconfigured Warringah Freeway would provide further separation between traffic lanes which would improve functionality of the Warringah Freeway corridor. Lane dividers would be used where appropriate in accordance with relevant guidelines to improve safety for road users and traffic performance.

NSW GOVERNMENT

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C6 – Construction work

SEPTEMBER 2020

# C6 Construction work

## Contents

## C6.1 Construction management

***Issue raised***

Submitters raised questions and concerns that the project lacks a plan to manage impacts (noise, dust, construction traffic etc) during the six year construction phase (and continuing with the Beaches Link and Gore Hill Freeway Connection project).

***Response***

If approved, Transport for NSW and the contractor for the project would be required to comply with the conditions of approval and requirements of Environment Protection Licences that would be set out by the Department of Planning, Industry and Environment. This would include the development of an approved construction environmental management plan for the project (refer to Section 28.5 of the environmental impact statement and Section D1 of this submissions report).

The potential impacts identified in the environmental impact statement would be managed in accordance with the environmental management measures identified in Table D2-1 of this submissions report and the construction environmental management plan would articulate how the environmental management measures would be implemented. The construction environmental management plan would be prepared prior to construction of the project and would be reviewed and approved by Transport for NSW and the Department of Planning, Industry and Environment, prior to the commencement of any on-site work. The contractor for the project would be responsible for managing impacts from construction activities, in accordance with the approved construction environmental management plan.

Opportunities to further reduce impacts from the project would be refined during further design development and construction planning.

The project would interface with the proposed Beaches Link and Gore Hill Freeway Connection project, as part of the overall Western Harbour Tunnel and Beaches Link program of works. The specific impacts associated with the construction of the Beaches Link and Gore Hill Freeway Connection project are beyond the scope of this project, and will be subject to a separate planning assessment and approval process. However, the cumulative impacts that may arise due to the construction of both projects are considered in specific environmental impact statement chapters for key issues such as noise, traffic and air quality and summarised in Chapter 27 (Cumulative impacts) of the environmental impact statement.

## C6.2 Construction program and staging

***Issue raised***

Submitters raised questions and concerns with respect to the proposed construction program and staging. Specific questions and concerns included:

- The need for more detail regarding construction duration and the associated construction periods, including when the project would commence in each suburb and the cumulative construction phases of the Western Harbour Tunnel and Beaches Link program of works
- The duration of dredging associated with immersed tube tunnel construction.

***Response***

An indicative construction program for the project is shown in Table 6-3 of the environmental impact statement. More specific construction detail would be made available once construction contracts are awarded and detailed construction planning is carried out by the contractor. Communication and consultation with stakeholders and the community during construction would be managed by the contractor.

The Beaches Link and Gore Hill Freeway Connection project is subject to a separate planning assessment and approval process. An indicative construction program for the Beaches Link and Gore Hill Freeway Connection project was not available during preparation of the environmental impact statement for the project.

Construction of the Western Harbour Tunnel and Warringah Freeway Upgrade will commence before the Beaches Link and Gore Hill Freeway Connection project. The key interface between the program of works at Cammeray has been considered in the design and construction methodology for the project to minimise the extent of additional surface road works being required in the future. If both projects are approved there may be the opportunity to further coordinate works or deliver elements of the Beaches Link and Gore Hill Freeway Connection project alongside the project to maximise construction efficiency and minimise ongoing disruption to the community in certain areas.

The design and construction methodology for the project has been developed with consideration of cumulative impacts, and aims to mitigate impacts where possible. Multi-party engagement and cooperation will be established prior to construction to ensure nearby projects are working together to minimise adverse impacts or enhance benefits, as required by environmental management measure Cl1 (refer to Table D2-1 of this submissions report). Cumulative impacts of the program of works are considered in Chapter 27 (Cumulative impacts) of the environmental impact statement.

Table 6-18 of the environmental impact statement sets out an indicative construction program for dredging activities for construction of the immersed tube tunnels. Dredging of the trench for the immersed tube tunnels would be anticipated to occur over a period of about 12 months, commencing in late 2023. To maximise their efficiency and continuity, dredging activities may be carried out up to 24 hours per day, seven days per week.

## C6.3 Construction activities

### C6.3.1 Tunnelling methods

***Issue raised***

Submitters raised questions and concerns regarding tunnelling methods. Specific questions and concerns included:

- The appropriateness of immersed tube tunnels under the harbour as opposed to the use of roadheaders. Suggestion that modern day technology should mean that it is possible to develop a safe road tunnel beneath the harbour without using an immersed tube tunnel on the harbour floor and that alternative construction methods would result in less impacts on water quality in Sydney Harbour
- Lack of detail regarding underground blasting
- Need for more detail regarding excavation of the access decline under Rozelle Public School
- Suggestion that the immersed tube tunnel could be constructed off site at Port Kembla and barged to site
- The results of the geotechnical drilling program conducted prior to the completion of the environmental impact statement have not been included in the environmental impact statement. The method of drilling vertical holes does not enable the mapping of vertical structures in the bedrock.

***Response***

<u>Immersed tube tunnel</u>

Immersed tube tunnels are proposed for the project to cross the Sydney Harbour. This method has been applied to over 150 major road and rail tunnels around the world, including the existing Sydney

Harbour Tunnel, to overcome similar combinations of geological, topographical and cross-sectional challenges.

The process for the selection of the preferred tunnel construction method for the crossing of Sydney Harbour included the development and evaluation of over 15 different combinations of tunnelling methods, as well as considerations of different methods to cross the Harbour(refer to Section 4.5.1 of the environmental impact statement). In assessing the tunnelling methods, various technical and environmental factors were considered, and advice was sought from design, construction, transport planning, and environmental specialists with national and international experience.

The advantages of the immersed tube tunnel method (as described in Table 4-3 of the environmental impact statement) include:

- Provides the shallowest possible tunnel alignment at the Sydney Harbour crossing, enabling the best possible approaching gradient and associated performance outcomes (eg safety, vehicle speeds, journey experience, long-term emissions)
- Minimises tunnelling risks by reducing exposure to tunnelling through poor geology and reducing the time workers need to spend in high risk tunnelling environments
- Minimises logistics and the size of waterside sites when compared to those required to launch roadheaders or large diameter tunnel boring machines
- Significantly reduces haulage on land when compared to tunnel boring machine or roadheader solutions
- Takes advantage of marine logistics to minimise heavy haulage on roads.

Potential environmental impacts were taken into account as part of the evaluation and selection process for the preferred tunnel construction method and development of the project design. Assessments of the potential impact of construction of the project on marine water quality and marine ecology have been carried out as part of the environment impact statement (refer to Appendix Q (Technical working paper: Marine water quality) and Appendix S (Technical working paper: Biodiversity development assessment report). As described in Table 6-4 of the environmental impact statement, the dredging methodology has been designed to minimise impacts on the marine environment by tailoring the specific approaches to the material being dredged. Management and monitoring of dredging operations will be carried out as required by environmental management measure WQ6 (refer to Table D2-1 of this submissions report) and included in a dredge management plan (refer to Section D1 of this submissions report).

Section 6.4.2 of the environmental impact statement provides an outline of the construction methodology for the two mainline tunnels. While the majority of the tunnelling work for the mainline tunnels would be carried out using roadheaders, controlled underground blasting may be used for discrete elements during construction to improve the efficiency of excavation activities and shorten the overall excavation program. The methodology for construction of the mainline tunnels, including the extent of controlled underground blasting, would be refined during further design development and construction planning for the project.

Controlled blasting

If controlled blasting is required, a Blast Management Strategy will be prepared and implemented for the project, as required by environmental management measure CNV9 (refer to Table D2-1 of this submissions report). The Blast Management Strategy will be prepared in consultation with the NSW Environment Protection Authority and SafeWork NSW in accordance with all relevant guidelines. It will include management measures to be implemented to minimise any impacts associated with blasting and details of community consultation requirements prior to commencing blasting.

Tunnel access decline under Rozelle Public School

Indicative timing for construction of the access decline at Victoria Road construction support site (WHT2) is provided in Table 6-12 of the environmental impact statement. At its shallowest point, the

top of the access decline tunnel would be around 20 metres beneath Rozelle Public School. The access decline would be constructed by a roadheader launched from Victoria Road construction support site (WHT2), and descend in a north easterly direction beneath Victoria Road, the Chapel Hill Presbyterian Church, and the playground of Rozelle Public School. The natural topography, which rises to the east and north, is favourable in that it allows the roadheader to quickly achieve sufficient depth of cover to mitigate any ground-borne noise or vibration.

There would be some tunnelling related noise impacts at Rozelle Public School, as indicated in Table 5-30 of Appendix G (Technical working paper: Noise and vibration); however, ground-borne noise impacts due to the construction of the access decline tunnel are not expected, as indicated in Table 5-36 of Appendix G (Technical working paper: Noise and vibration).

No vibration impacts would occur as a result of construction of the access decline within noise catchment area NCA6.3 which includes Rozelle Public School, as indicated in Table 10-11 of the environmental impact statement.

Immersed tube tunnel construction

Construction of the immersed tube tunnel elements at Port Kembla is an option. The substantial difference, however, is in the cost of constructing the immersed tubes at Port Kembla, when a viable facility could be established in proximity to the harbour crossing. This led to the decision to select White Bay as the immersed tube construction site over Port Kembla. The site used for the Sydney Harbour Tunnel at Port Kembla is no longer available.

Geotechnical drilling program

The geotechnical drilling program carried out to date is considered appropriate for the current concept design stage. Additional geotechnical drilling would be carried out during further design development.

### C6.3.2 Construction activities within Sydney Harbour

***Issue raised***

Submitters raised concerns over the impacts resulting from the proposed construction activities within Sydney Harbour. Specific queries, concerns and comments include:

- The environmental impact statement does not provide supporting documentation from experienced consultants and contractors for the preferred method for excavating and treating contaminated sediments
- Additional environmental protection measures should be considered to prevent migration of suspended potentially contaminated sediments into the western arm of Sydney Harbour during construction
- Concerns about the immersed tube tunnel construction methodology due to environmental risks from potentially contaminated sediment disturbance and the use of shallow silt curtains instead of long curtains
- Request alternative construction methods that stabilise harbour sediments before excavation are considered to minimise the mobilisation of contaminated sediments in water or when the dredged material is exposed to air.

***Response***

The construction method for excavating and treating contaminated sediments has been developed by appropriately qualified engineers with extensive experience in the dredging of contaminated sediments.

A backhoe dredge (BHD) with a closed environmental clamshell bucket supported by silt curtains has been proposed for removal of the surface layer of material with elevated levels of contaminants. These buckets have been specifically designed for dredging material with elevated levels of

contaminants and provide three significant advantages compared to conventional open buckets, including minimisation of suspended sediments during contact with the harbour bed, minimisation of spill as the bucket is raised through the water column, and precision (accurate dredging). Chapter 6 (Construction work) of the environmental impact statement describes the dredging methodology proposed for the project.

Backhoe dredging operations would be completed within a floating silt curtain enclosure (or 'moon pool') that is secured to the dredge barge, as discussed in Appendix P (Technical working paper: Hydrodynamics and dredge plume modelling). This would comprise a fixed or floating boom upon which a shallow-draft (two to three metres deep) silt curtain is attached to provide a controlled area for the dredge operator to work within. Silt curtains would also be deployed around any sensitive aquatic habitats that could be potentially impacted by dredging activities.

Use of deep draft (eg 12 metre) silt curtains is not possible, due to tidal currents and operational constraints associated with working in the channel. Deep silt curtains would also cause increased turbidity on the bed of the harbour due to the restriction of tidal flows (creating localised increases in tidal currents around and below the silt curtains); the placement, progressive relocation and ultimate removal of curtain anchoring devices on the harbour bed (eg anchors and chains); and the general movement of the curtains with the currents.

The use of the proposed silts curtains combined with the environmental clamshell bucket, together with other environmental control measures such as no overflow from transport barges and restricted working hours (thereby minimising the rate of sediment disturbance), is considered an effective dredging methodology.

Localised increases in suspended sediment concentrations may result from dredging and construction activities, however modelling indicates that suspended sediments would be rapidly dispersed in Sydney Harbour and there would be limited impact on water quality. Chapter 17 (Hydrodynamics and water quality) of the environmental impact statement describes the potential impacts of construction of the project on marine water quality.

The option of treating sediments prior to bed of the harbour excavation (ie in situ), outside of the cofferdams, would require some form of moveable bottom-sealed filter barrier anchored to the seafloor, then mixing with lime, cement or other substance. This alternate in situ option is likely to release larger amount of sediments into the water column than the backhoe dredger fitted with a closed environmental clamshell bucket methodology proposed for the project. The proposed methodology for the project has proved to be effective for removal of contaminated sediments. Hydrodynamic and plume modelling has been carried out to predict water quality and ecological impacts associated with this methodology as outlined in Appendix P (Technical working paper: Hydrodynamics and dredge plume modelling).

Section C17 (Hydrodynamics and water quality) of this submissions report provides more details on the proposed dredging methodology and process, in response to specific questions raised in submissions on this topic. Further information is also provided in Appendix C.1 and C.2 of this submissions report.

### C6.3.3 Impacts of cofferdam construction

#### *Issue raised*

Submitters commented that the method being proposed for excavation as part of construction of the cofferdam off Balls Head needs review. Submitters believed cofferdam construction would use a surface skirt (silt curtain) and a clamshell bucket and that these would not be adequate as pollution control mechanisms, particularly during a high tide or swell, and result in sediments being released into the harbour.

#### *Response*

The cofferdam structure would be made up of a series of interlocking, tubular piles. Each pile would be driven from a flat top barge (or similar barge) using a crane fitted with a hydraulic hammer,

offshore pile driving hammer and/or a similar piece of construction equipment. Once the cofferdam piles are installed and the cofferdam dewatered, excavation of the bed sediments and underlying rock would be contained within the cofferdam and this would avoid any potential water quality impacts outside the cofferdam. Shallow silt curtains would be installed adjacent to ecologically sensitive areas to provide additional protection to these areas.

The cofferdam construction methodology is described in Section 6.4.4 of the environmental impact statement.

### C6.3.4 Construction support sites

***Issue raised***

Submitters raised questions and concerns over the impacts resulting from construction support sites required for the project. Specific questions and concerns include:

- The type of activities to be carried out at each of the project construction support sites generally, and Ridge Street north construction support site (WHT9) and at Cammeray Golf Course construction support sites (WHT10/WFU8) specifically
- Request assurance that there would be no vehicle access to Yurulbin Point construction support site (WHT4) from Louisa Road
- Request that temporary noise and light barriers be installed on both sides of Warringah Freeway to prevent noise and light impacts to nearby residences.

***Response***

Sections 6.7.2 and 6.7.3 of the environmental impact statement provide summaries of the key features and construction activities for the construction support sites for the project.

During construction, access to Yurulbin Point construction support site (WHT4) would be via Sydney Harbour only (refer to Table 6-15 of the environmental impact statement). Access via Louisa Road would be for emergencies only. While it is acknowledged that Section 6.8.2 of the environmental impact statement states there may be a requirement for access to the Yurulbin Point construction support site (WHT4) via Louisa Road during early works and site establishment, there will be no heavy vehicle road access to Yurulbin Point during construction. A clarification is provided in Section A4.2 of this submissions report.

A range of noise and vibration mitigation measures would be implemented for construction works that occur along the Warringah Freeway. Indicative locations of noise barriers for construction support sites have been provided in Section 6 of Appendix G (Technical working paper: Noise and vibration). These will be further refined as part of the preparation of the construction noise and vibration management plan, as required by environmental management measure CNV1 (refer to Table D2-1 of this submissions report). This will include the use of noise barriers where feasible and reasonable. In accordance with environmental management measure V5 (refer to Table D2-1 of this submissions report), construction site lighting will be designed to minimise glare issues and light spillage into adjoining properties and be generally consistent with the requirements of Australian Standard *AS 4282 – 2019 Control of the obtrusive effects of outdoor lighting.*

NSW GOVERNMENT

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C7 – Stakeholder and community engagement

SEPTEMBER 2020

# C7 Stakeholder and community engagement

## Contents

# C7.1 Environmental impact statement

## C7.1.1 Exhibition and submissions process

### *Issue raised*

Submitters raised issues and concerns about the length of the exhibition period for the environmental impact statement. Specific issues, concerns and comments include:

- Concern about the level of notification given by the Department of Planning, Industry and Environment to the community for the exhibition of the environmental impact statement
- The exhibition period was not long enough for the community to review and provide submissions on the environmental impact statement
- Concern the submissions process is not impartial and would favour Transport for NSW
- The method of submitting responses on the environmental impact statement is not fair to everyone as people have different levels of access to computers and different levels of computer skills.

### *Response*

The exhibition process was carried out by the Department of Planning, Industry and Environment in line with the *Environmental Planning and Assessment Act 1979* and its Community Participation Plan (November 2019).

Under the *Environmental Planning and Assessment Act 1979*, the statutory duration for the public exhibition period for an environmental impact statement is a minimum of 30 calendar days. The Secretary of the Department of Planning, Industry and Environment is responsible for deciding the timing and duration of public exhibition periods for an environmental impact statement. The community participation approach is provided in more detail in the Department of Planning, Industry and Environment's Community Participation Plan (November 2019). Following community feedback, the Secretary of Department of Planning, Industry and Environment extended the project's public exhibition period to a total of 61 calendar days (29 January to 30 March 2020).

The Department of Planning, Industry and Environment manages the submissions process under the *Environmental Planning and Assessment Act 1979,* which removes the direct involvement of Transport for NSW. Submitters are also able to request that their private details are not disclosed to Transport for NSW, when making a submission. This approach is consistent across all development sectors. The new online Major Projects Register has increased transparency in the exhibition and assessment process by providing project specific notification alerts. Additionally, following the close of exhibition, online submissions made by public authorities, organisations and the general public were published online. Stakeholders and the community were notified about the exhibition of the environmental impact statement as outlined in Section A2.3 of this submissions report.

During the exhibition period, submissions could be made to the Department of Planning, Industry and Environment through the Major Projects website, or through physical submissions via post or hand delivery to one of the Department's offices. A project information phone number and email address were also made available for the community and stakeholders.

## C7.1.2 Accessibility of the environmental impact statement document

### *Issue raised*

Submitters raised issues with the accessibility of the environmental impact statement, including:

- Difficulties accessing the websites containing information about the project

- The online files for the environmental impact statement are extremely large, and should be reduced in size to avoid downloading issues and minimise impact to computer storage space
- Residents in White Bay raised concern that sensitive receivers did not receive printed copies of the environmental impact statement
- A navigation pane should be linked to the report to allow the reader to access a detailed overview of the information and a search function which allows the user to search for a specific location or issue
- Figures and numbers within the environmental impact statement were difficult to read. There should be a scale bar, both horizontal and vertical
- Transport for NSW should explain operational traffic modelling in a format that can be understood by the community by using interactive animations.

***Response***

The environmental impact statement was available:

- On the Department of Planning, Industry and Environment's Major Projects website in parts (larger files including multiple chapters in one document) and individual chapters (smaller file size) to increase accessibility. Large technical working papers were broken into parts to reduce file size
- On Transport for NSW's project portal (individual chapters and technical working papers, with large technical working papers broken into parts)
- On three screens installed in shopping centres along the project alignment at Cammeray, North Sydney and Birkenhead Point, which provided access to the project portal
- As a hard copy at 10 exhibition locations (details of exhibition locations are provided in Section A2.3 of this submissions report)
- As hard copies at community information sessions held during the exhibition period.

Each chapter of the environmental impact statement was made available with the chapter number and name included in the file name to make it simpler for readers to find the issues they are concerned about. Depending on the version of pdf reader used, there is generally a navigation pane and search function available within each document downloaded. The table of contents was presented as a separate file to assist in navigating the document.

The 'Guide to the environmental impact statement' was also provided as an overview to support the more detailed descriptions and assessments provided in the full environmental impact statement.

The text displayed in the environmental impact statement figures and tables is a smaller font than the regular text to help display a large amount of information. Where required, figure sets were provided to break down the information into smaller sub-sets to show a greater level of detail while still being readable. Where appropriate, scale bars were included on figures.

The environmental impact statement, including Appendix F (Technical working paper: Traffic and transport) provides an explanation of the traffic modelling carried out to support this project. This is considered to be at a level of detail that is accessible to the community, while still providing sufficient technical detail. Traffic specialists associated with the assessment also attended the community information sessions to provide opportunities for the community to ask questions about the modelling.

An interactive map tool was developed for the project (available on the project online interactive portal), which allows users to search for impacts to individual properties in proximity to the project. This includes information on changes in operational traffic as a result of the project. The interactive

portal also provides videos and animations, including “driver views” for journeys using the Warringah Freeway Upgrade.

## C7.2 Consultation during design development and environmental impact statement preparation

### C7.2.1 Previous submissions

***Issue raised***

Submitters raised concerns that issues raised during consultation prior to the environmental impact statement had not been addressed. These include:

- Consultation with the community did not occur prior to the decision to propose a motorway option over a sustainable public transport solution
- Section 7.3.1 of the environmental impact statement summarises the feedback and references where in the environmental impact statement information is included. It does not actually address or respond to community feedback
- The community believes that the 11,000 objection signatures submitted by the community on the project as part of a petition in May 2019 have not been considered. Request for the petition to be accepted by the NSW Government and Transport for NSW, and its recommendations fully analysed and if relevant, accepted.

***Response***

The NSW Government’s vision for Sydney is one of an integrated, multi-modal road and public transport network that has higher capacity and gives everyone the freedom to choose how and when they get around, no matter where they live and work. Roads, motorways, rail, light rail, ferries and buses are all part of an integrated transport solution for Sydney. In conjunction with other road, rail, bus and light rail projects, the Western Harbour Tunnel and Beaches Link program of works has been developed to meet the current and future transport needs of Sydney. This is discussed further in Section C3 of this submissions report. The need for the project is outlined in Section A1.3 of this submissions report.

An overview of the development process and options considered as part of this process are provided in Chapter 4 (Project development and alternatives) of the environmental impact statement. An overview of the strategic context and project need are provided in Chapter 3 (Strategic context and project need) of the environmental impact statement. Refer to Section C3.2.1 of this submissions report for further details on the Infrastructure NSW process followed by the project to achieve an investment decision.

The environmental impact statement process has provided the opportunity to comment on the project and the alternatives which were considered. Section 7.3.1 of the environmental impact statement summarises feedback received during the 2017 and 2018 engagement periods for the Western Harbour Tunnel and Beaches Link program of works. Feedback and issues identified during the engagement program by stakeholders and the community have informed the environmental assessment and the ongoing development of the project, which is included in the relevant sections of the environmental impact statement. Section 7.4 of the environmental impact statement provides a summary of specific project refinements which have occurred as a result of community and stakeholder feedback.

Section A2.3 of this submissions report summarises the consultation carried out during the exhibition period. Section A2.4 of this submissions report summarises the consultation carried out during the preparation of this submissions report. Future consultation and engagement proposed for the project is outlined in Section 7.5 of the environmental impact statement and Section A2.5 of this submissions report.

The petition referred to in the submission has been accepted by the NSW Government and was debated in parliament in July 2020. The NSW Government's response to the submission is available on the NSW Parliament website: *https://www.parliament.nsw.gov.au/la/petitions/Pages/tabled-paper-details.aspx?pk=77772*.

### C7.2.2 Consultation during design development and environmental impact statement preparation

***Issue raised***

Submitters raised issues and concerns about the extent of community consultation carried out during design development and environmental impact statement preparation. These include:

- Request for further consultation with property owners along the eastern side of Warringah Freeway. Property owners were not aware of the potential property impacts until the environmental impact statement was made available. In some cases, specific impacts to individual properties have not been identified in the environmental impact statement
- The community in Waverton are concerned they have not been sufficiently consulted on the project
- The environmental impact statement stated that community consultation was used to inform the placement of construction support sites. Residents who live next to Merlin Street construction support site (WFU7) expressed concerns about the level of consultation they experienced
- Further consultation has been requested to allow residents within the Whaling Road Heritage Conservation area and surrounds (including Kurraba Road, Bray Street, Neutral Street, Darley Street, Rawson Street, Eaton Street, Whaling Road, Nook Avenue, Alfred Street North, Little Alfred Street and Doris Street) to provide feedback on the project.

***Response***

Further consultation with impacted property owners would be carried out throughout the next stages of project development in line with the project conditions of approval and environmental management measures outlined in Table D2-1 of this submissions report.

Extensive consultation has been carried out with the community throughout the project's development, prior, during and after the public exhibition of the environmental impact statement. This has included the communities in Waverton, Merlin Street and around Whaling Road, North Sydney. Specific consultation in these areas during the exhibition of the environmental impact statement included, but was not limited to, access to online tools and materials, advertisements, postcard letterbox drop, doorknocking to areas next to construction sites, information sessions and location specific factsheets. Section 7.2.6 of the environmental impact statement and Section A2 of this submissions report summarises all engagement activities carried out to date for the project.

Community and stakeholders would continue to be consulted throughout further project stages in line with Appendix E (Community consultation framework) and the environmental management measures listed in Table D2-1 of this submissions report.

## C7.3 Consultation during environmental impact statement exhibition

### C7.3.1 Community consultation and engagement

***Issue raised***

Submitters raised issues and concerns about the extent of community consultation carried out during the exhibition of the environmental impact statement. These include:

- Consultation with the community has not been conducted in an open, proactive and transparent manner. Request for a more thorough process, in addition to letterbox drops and notices in newspapers
- Information provided at the community engagement sessions required more detail. Responses to questions were often deferred to information contained within the environmental impact statement
- The environmental impact statement was on exhibition during the COVID-19 pandemic, community meetings were cancelled due to social distancing restrictions
- Project and community updates were difficult to understand and used many generalities. This led to confusion amongst community members regarding certain elements of the project, such as whether ventilation outlets were going to be filtered.

***Response***

An extensive community consultation and engagement program was carried out during the environmental assessment process, using a diverse range of communication methods and platforms to achieve a significant reach. Details on community and stakeholder engagement carried out for the project prior to, during, and after the public exhibition of the environmental impact statement is provided in Section A2 of this submissions report.

The project held eight community engagement sessions while the environmental impact statement was on display. In line with the restrictions around large gatherings due to COVID-19, the project was unable to proceed with the ninth and final information session in North Sydney. An alternative option for one-on-one video meetings was offered to community members, in addition to engagement over the phone and email. Section A2.3 of this submissions report further details on the community engagement activities that were carried out during the exhibition period.

Community engagement sessions were attended by the program team and technical specialists. The aim of the community engagement sessions was to answer questions from members of the community, provide a high level understanding of the project, and guidance as to how to navigate the environmental impact statement document. If questions could not be immediately answered they were taken on notice and a response was emailed or a follow up phone call was provided.

Project and community updates have been released at various stages of the project which intended to provide a brief overview of the project or latest developments, and to facilitate further engagement with the community. Community updates always include references to additional resources for further information, for example the project website and portal, in addition to contact details so the community can get in touch should they require clarification or more detailed information. The community updates and brochures prepared by the project have not stated that ventilation outlets would be filtered, rather that the project will be designed to meet stringent air quality standards.

### C7.3.2 Consultation with stakeholders

***Issue raised***

Several submitters raised concerns over consultation with stakeholders. Specific issues, concerns and comments include:

- Extent of consultation with North Sydney Council:
  - Submitters raised concerns the environmental impact statement did not clearly present the engagement carried out with North Sydney Council to provide better road access. The community is aware that the NSW Government and North Sydney Council worked collaboratively on a plan for the North Sydney CBD over several years as part of the project development and the Sydney Metro City & Southwest project. However, the results of this collaboration are not clear in the environmental impact statement

  - Extent of stakeholder involvement and risk management

- Consultation with the NSW Environment Protection Authority about contaminated marine sediments and the relevance of the *Contaminated Land Management Act 1997*
- The NSW Government should ensure as part of transport projects that direction is taken from key stakeholders, both internal and external, on initiatives that improve places.

***Response***

North Sydney Council

Section 7.2.1 of the environmental impact statement describes the engagement and consultation carried out with Commonwealth, State and local government agencies. Feedback on specific design, environmental or socio-economic matters provided by agency and local government stakeholders has informed the design development of the Western Harbour Tunnel and Beaches Link program of works, including the project.

From 2017 to now, North Sydney Council has been updated on a range of issues, including project design and the integration with the North Sydney CBD, as well as opportunities and impacts to the North Sydney area. Further detail is provided in Table 7-3 of the environmental impact statement.

As stated in the environmental impact statement, the North Sydney Integrated Transport Program (the North Sydney Program) is a collaboration between Transport for NSW, North Sydney Council, Greater Sydney Commission and the Government Architect of NSW to guide transport planning and investment in the North Sydney CBD and interconnected areas over the next 20 years and beyond. This program will support and facilitate the outcomes envisaged by the *Greater Sydney Region Plan* and *Future Transport Strategy 2056*. The development of the North Sydney Program is ongoing and as part of the collaboration, the Western Harbour Tunnel and Warringah Freeway Upgrade program of works will ensure opportunities for a future integrated and multi-modal transport network in the area.

Transport for NSW will continue to work closely with North Sydney Council and other key stakeholders to investigate options to improve movement and place outcomes through the North Sydney Program. Refer to Section A4.1.3 of this submissions report for further information on the North Sydney Program. The response to the North Sydney Council submission regarding the improvement of movement and social amenity is in Section B14.2 of this submissions report.

If the project is approved, a Community communication strategy would be developed, as outlined in Section 5.1 of Appendix E (Community consultation framework). This strategy would describe community liaison and engagement processes and activities, including mitigation measures and conditions of project approval for the project development, delivery, and operation. This would include a risk assessment and proposed actions to mitigate or minimise the impact to stakeholders and the community. New environmental management measure SE4 advises that the consultation for the project will be in accordance with the Community consultation framework (refer to Table D2-1 of this submissions report).

Environment Protection Authority

Table 7-3 of the environmental impact statement outlines consultation with Commonwealth, State and local government agencies including the NSW Environment Protection Authority. Engagement to date with the NSW Environment Protection Authority has included consultation on the project as a whole as well as on the management of contaminated marine sediments. The NSW Environment Protection Authority submission and responses about contamination are in Section B1.4 of this submissions report.

Environmental management measure SG6 (refer to Table D2-1 of this submissions report) requires that potentially contaminated areas directly affected by the project will be investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the *Contaminated Land Management Act 1997.*

Consultation regarding place outcomes (including social and urban amenity)

The project would facilitate improvements to place and urban amenity by relocating a large volume of through traffic from surface roads to underground within the tunnel. In addition to the direct benefit of moving bypass traffic underground, reduced congestion on the arterial road network offers flow-on benefits to the local road network (eg reducing queuing) and further improvements in amenity linked to physical safety, air quality and noise levels. The reduced congestion provided by the project would also provide opportunities for other Transport for NSW divisions and other stakeholders to investigate local road improvements. As outlined above, Transport for NSW would continue to work closely with North Sydney Council and other key stakeholders through agreed governance structures to investigate options to improve movement and place outcomes through the North Sydney Program (refer to Section A4.1.3 of this submissions report for further information).

The project will also continue to consult with local Councils and other key stakeholders, as outlined in Appendix E (Community consultation framework).

Transport for NSW understands the importance of open space to the community. The NSW Government is committed to returning the Berrys Bay area as public open space once Western Harbour Tunnel is complete, with new facilities funded by the NSW Government. In line with environmental management measure LP2 (refer to Table D2-1 of this submissions report), public open space temporarily used by the project will be rehabilitated in consultation with the relevant council and/or landowner. The community's input on the future of Berrys Bay would be sought separately to this planning approval process. As part of this process, Transport for NSW and the Department of Planning, Industry and Environment would jointly establish a reference group , which would include representation from key stakeholders, including North Sydney Council, the community and independent experts, to consider feedback and support the development of the final layout of Berrys Bay.

Transport for NSW is also working with Mr Bruce Mackenzie AM, the original landscape architect of Yurulbin Park. He is assisting with the site layout to protect key features of the park during construction as well as its refurbishment after construction, to realise his original vision for the park.

Refer to Section C22 of this submissions report for further information on urban design and visual amenity.

## C7.4 Future consultation

***Issue raised***

Submitters requested ongoing consultation and transparent provision of information to interested groups and residents. Specific submitters and their issues are detailed below:

- Request the establishment of a White Bay Residents Consultation and Liaison Committee to allow regular opportunities to be consulted and to provide comments and feedback, as well as direct consultation with the Department of Planning, Industry and Environment
- Request that consultation with key cycling stakeholders be carried out prior to approval of the project
- Request that a detailed survey, of randomly selected households in all of the suburbs directly affected by the project, be carried out to understand the level of support/objection for the project before the project is approved
- Request for community representation on the independent panels assessing any damage claims to properties
- Request for the establishment of an advisory committee to assist with the rehabilitation of foreshore construction sites post construction
- A 24-hour hotline has been requested where residents can report incidents that are not consistent with the environmental impact statement or the conditions of approval.

***Response***

White Bay Residents Consultation and Liaison Committee

Transport for NSW has identified the Glebe Island and White Bay Community Liaison Group as a community and interest group and has engaged with this group since 2018. This forum is chaired by the Port Authority of NSW and includes community representatives from Balmain, Rozelle and Pyrmont areas who have a significant interest in the local environment, business and community amenity issues in the precinct. Table 6-1 of Appendix E (Community consultation framework) outlines the planned method of engagement for key stakeholder groups identified for the project, including the Glebe Island and White Bay Community Liaison Group.

Consultation with key cycling stakeholders

Key cycling stakeholders have had opportunity to provide feedback on the project to date in line with the engagement activities listed in Section A2 of this submissions report. Consultation with the cycling community would be ongoing as the project is further developed. A clarification has been included in Section A4.2 of this submissions report to clarify that Bike North and Bicycle Working Group and Bike User Group – Inner West (council) have been included as key stakeholders in Appendix E (Community consultation framework) of the environmental impact statement.

Request for survey

The engagement activities carried out for the project are summarised in Section A2 of this submissions report. The extensive engagement carried out to date is considered sufficient to enable an informed decision on the approval of the project. An additional survey would be unlikely to provide new information.

Community representation on the independent panels

The role of the Independent Property Impact Assessment Panel is to provide an objective technical review of condition survey reports, resolution of any property damage disputes and establish any ongoing monitoring requirements. Therefore, community involvement in this panel is not appropriate. There would be other forums and/or groups which the community would have representation on, where these and other local matters can be raised and discussed. These opportunities are detailed in Appendix E (Community consultation framework).

Advisory committee to assist with the rehabilitation of foreshore construction sites

As outlined in Section C7.3.2, community feedback would be sought regarding the future use of the Berrys Bay area (which would be used as Berrys Bay construction support site (WHT7)) as public open space. As part of this process, Transport for NSW and the Department of Planning, Industry and Environment would jointly establish a reference group, which would include representation from key stakeholders, including North Sydney Council, the community and independent experts, to consider feedback and support the development of the final layout of Berrys Bay.

Transport for NSW is also working with Mr Bruce Mackenzie AM, the original landscape architect of Yurulbin Park. He is assisting with the site layout to protect key features of the park during construction as well as its refurbishment after construction, to realise his original vision for the park.

24-hour hotline

For the duration of construction, a toll-free 24-hour telephone number would be made available to register complaints and enquiries, as outlined in Appendix E (Community consultation framework).

A complaints management system would be in place during construction (see Section 7.5.4 of the environmental impact statement). This would include the recording of complaints and how the complaint has been addressed. Complainants would be contacted within 24 hours to follow up and respond to their complaint. Complaint management tools for the project are outlined in Appendix E (Community consultation framework). The complaint management system would be compliant with the project's conditions of approval and would incorporate approaches outlined by the NSW Ombudsman.

NSW GOVERNMENT

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C8 – Construction traffic and transport

SEPTEMBER 2020

# C8 Construction traffic and transport

## Contents

# C8.1 Construction traffic and transport

## C8.1.1 General impacts

### *Issue raised*

Submitters raised concerns and queries about the impacts that construction vehicles (both heavy vehicles and others) would have on local roads and communities, including:

- The large number of construction vehicle movements that are estimated in the environmental impact statement which would travel on the local road network
- Existing local traffic congestion would be exacerbated by construction vehicles using local roads, presenting difficulties to local residents accessing their homes
- Adverse impacts due to traffic congestion and delay, rat-running, noise, emissions, loss of amenity and reduced safety as a result of increased truck movements
- Concern about night time traffic levels including the use of trucks to and from local areas
- Potential for disruption, inconvenience and noise created by truck marshalling during construction
- Request for details on truck numbers expected to be idling per day waiting to enter the White Bay construction support site (WHT3) for the removal of waste
- Long time frame for construction – the program is scheduled to last five to six years causing extended disruption to road users, residents, businesses and schools in the vicinity of the work
- The analysis did not consider all truck movements and restricted local road access – particularly related to the movement of contaminated spoil through local streets
- The potential damage to local roads by construction vehicles
- Query as to what measures would be implemented to mitigate the impact of construction vehicles.

### *Response*

<u>Construction traffic impacts to local roads</u>

A worst case scenario was modelled for construction traffic which considers the period when construction traffic movements (light and heavy vehicles) for the project are expected to be at their highest (ie the single busiest construction day in the year). Detailed traffic modelling was carried out to determine the impacts of construction traffic at key access points to construction support sites. The modelling found that with the construction traffic included on the road network, all intersections and interchanges would operate at the same level of service as the base scenarios (without the project or any construction traffic) (refer to Table 5-11 of Appendix F (Technical working paper: Traffic and transport assessment)). This would occur as the increase in traffic due to construction vehicles in the morning and evening peak hours would be relatively small when compared with the existing background traffic volumes.

Table 5-9 of Appendix F (Technical working paper: Traffic and transport) identifies the proposed access routes to construction support sites for the project. Construction support sites have been located to minimise heavy vehicles travelling through local streets. The majority of construction support sites have direct access to the motorway, the arterial road network, or the harbour (for transport via barge).

Environmental management measures have been developed to minimise impacts to the community. Where there is the potential for queueing, traffic and access disruptions in the vicinity of construction support sites, truck marshalling areas will be identified and used where feasible and reasonable, in

accordance with environmental management measure CTT11 (refer to Table D2-1 of this submissions report). Further, as required by environmental management measure CTT6 (refer to Table D2-1 of this submissions report), construction traffic will be managed to minimise movements during peak periods. With the implementation of these measures, the potential for construction traffic to significantly increase the likelihood of congestion is low.

Impacts from construction vehicle movements

Impacts to local roads are discussed above. Section 5 of Appendix F (Technical working paper: Traffic and transport) notes that network performance within the study areas are not expected to change significantly due to construction vehicle movements.

Road safety is addressed in Section C8.4 of this submissions report below.

The air quality impacts from construction vehicles are addressed in Section C12.2.2 of this submissions report.

Construction traffic impacts to amenity are discussed in Section C21.2 of this submissions report.

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), for the majority of the construction support sites (refer to chapter 10 (Construction noise and vibration) of the environmental impact statement). This change represents a minor impact that is likely to be barely perceptible. This is discussed in more detail in Section C10.5 of this submissions report.

Construction traffic at night

Spoil haulage would be carried out during standard construction hours (7am to 6pm Monday to Friday, 8am to 1pm Saturday, no construction works on Sundays or public holidays), as outlined in Table 6-23 of the environmental impact statement. Some deliveries to and from a number of the construction support sites would be required outside of standard construction hours to support construction activities. However, this is unlikely to impact the surrounding road network performance due to the low volume of other vehicles using these routes at night. Noise impacts due to construction traffic at night are discussed further in Section C10.5 of this submissions report.

Chapter 6 (Construction work) of the environmental impact statement outlines construction work hours required for the project.

Truck marshalling

Truck marshalling would be carried out in designated areas away from sensitive receivers, where possible, to minimise potential noise impacts. At the White Bay construction support site (WHT3) this would be carried out within the site. Truck marshalling will be managed in accordance with environmental management measure CTT11 (refer to Table D2-1 of this submissions report) to minimise potential queueing and traffic and access disruptions in the vicinity of construction support sites.

All drivers would be required to comply with existing road rules and the Heavy Vehicle Code of Conduct, as stated in Section 10.8.2 of the environmental impact statement, which would include noise management methods such as limiting idling and compression braking, and traffic management practises to minimise noise emissions from vehicles entering and leaving truck marshalling areas. The Heavy Vehicle Code of Conduct would be included in the construction environmental management plan.

Duration of construction

While the indicative overall construction program would be about five years, different construction activities would take place over different periods as shown in Table 6-3 of the environmental impact statement. As a result, any potentially impacted areas are not likely to experience impacts for the entire duration of construction and, as discussed above, construction traffic is not expected to have a significant impact on network performance.

It is important to note the construction traffic and transport assessment is conservatively focused on the impacts during peak construction activities, to reflect the greatest potential impact of the project (as discussed in Section 8.2.1 of the environmental impact statement). For example, the quantitative assessment of road network performance is for the highest potential construction site traffic generation per hour. These peak construction activities would only occur for a small proportion of the overall construction program. Generally, typical site traffic generated per hour would be lower than the peak site traffic numbers assessed.

Construction fatigue is addressed in Sections 7.5.3 and 27.3.5 of the environmental impact statement. Construction fatigue may be experienced by receivers near concurrent or consecutive project construction activities where the activities overlap or have little or no break between the activities of one project, or multiple adjacent projects. As outlined in Section 27.3.5 of the environmental impact statement, work would be coordinated between the various project construction sites, where feasible and reasonable, to minimise construction fatigue. During construction of the project, the project team would build a working relationship with the other major project teams to identify stakeholders or community members who may be susceptible to construction fatigue. Multi-party engagement and cooperation will be established prior to construction to manage fatigue impacts from multiple projects (refer to environmental management measure CI2 in Table D2-1 of this submissions report).

Environmental management measure CI4 (refer to Table D2-1 of this submissions report) also requires that complaints are managed as outlined in Chapter 7 (Stakeholder and community engagement) of the environmental impact statement. The project team would ensure the expectations of these stakeholders or community members are managed for the project. Ongoing communication and stakeholder engagement would be guided by Appendix E (Community consultation framework) of the environmental impact statement.

Transport of spoil

The final destination(s) for excess spoil from construction of the project would be confirmed during construction planning (as outlined in Section 6.8.4 of the environmental impact statement). Truck movements and routes would be confirmed based on the destination.

As described in Appendix P (Technical working paper: Hydrodynamics and dredge plume modelling), dredging of soft sediment material that is not suitable for offshore disposal would be barged to the White Bay transfer site to be made spadeable (a consistency which allows the material to be spaded or shovelled). Spadeable material would then be transported via covered trucks to be disposed of at a land-based licenced waste disposal facility.

Construction support sites have been located to minimise heavy vehicles through local streets and generally have direct access to the arterial road network. Potential traffic impacts associated with the transport of contaminated spoil would be minimal when compared to existing traffic levels within the arterial network.

Damage to local roads

As required by environmental management measure CTT1 (refer to Table D2-1 of this submissions report), a road dilapidation report will be prepared, in consultation with relevant councils and road owners, identifying existing conditions of local roads and mechanisms to repair damage to the road network caused by heavy vehicle movements associated with the project.

Construction traffic environmental management measures

A range of environmental management measures have been developed to manage impacts during construction. These are presented in Table D2-1 of this submissions report. Environmental management measures related to construction traffic will also be included in a construction traffic management plan as part of the construction environmental management plan for the project, as outlined in Section D1 of this submissions report. These plans provide a framework for establishing how management measures would be implemented and who would be responsible for their implementation. The construction environmental management plan would be prepared prior to

construction of the project and reviewed and approved by Transport for NSW and the Department of Planning, Industry and Environment.

## C8.2 Location specific impacts

### C8.2.1 Warringah Freeway and surrounds

***Issue raised***

Submitters expressed concerns about traffic changes caused by the construction of the upgraded Warringah Freeway. Specific concerns associated with these works include:

- Night closures of sections of the Warringah Freeway, diverting traffic to Pacific Highway and local roads at North Sydney, Cammeray and Neutral Bay
- Safety risks associated with the use of Bent Street, Neutral Bay as a diversion during the closures of Warringah Freeway during construction. The environmental impact statement modelling shows that traffic during closures would go from 30 vehicles per hour to 280 vehicles per hour. Bent Street is a narrow, residential, one-way street made even more narrow with the recent instalment of bike paths
- Congestion at busy intersections, including: Miller Street/Falcon Street, Miller Street/Ernest Street, Miller Street/Amherst Street, Military Road/Ben Boyd Road, Berry Street/Pacific Highway, Berry Street/Miller Street.

***Response***

The potential short-term closure of the Warringah Freeway will generally be carried out during nights with restricted access in accordance with environmental management measure CTT12 (refer to Table D2-1 of this submissions report). Partial or full closures of Warringah Freeway will be carried out in consultation with Transport Coordination within Transport for NSW (per environmental management measure CTT13 in Table D2-1 of this submissions report). To minimise the impacts of any closure, an extensive communication strategy will be implemented including the requirements of environmental management measure CTT5 (refer to Table D2-1 of this submissions report) to notify the community and affected motorists of the closures and the recommended detour routes.

Table 5-13 of Appendix F (Technical working paper: Traffic and transport) shows potential peak volumes of detoured traffic due to Warringah Freeway closures. For all scenarios modelled (including a full closure of Warringah Freeway, which would be a very rare event) the analysis shows that Bent Street and Alfred Street southbound would have sufficient capacity to safely accommodate additional traffic resulting from closure detours, even under a full closure scenario.

Active traffic management would also be in place during any closures to guide motorists to appropriate detours via arterial roads and manage capacity where necessary to maintain traffic flows on key routes and limit the impacts of any closures (as per Section 5.3.4 of Appendix F (Technical working paper: Traffic and transport)). This is discussed further in Section C8.5.3 below.

As noted in Section 5.3.4 of Appendix F (Technical working paper: Traffic and transport), a worst case scenario for intersection performance during construction has been assessed. Many of the intersections in this area are already operating at a poor level of service. With construction traffic included on the road network, all intersections and interchanges would operate at the same level of service as the base scenarios (without construction vehicles), as the project would not materially add to existing background traffic levels.

### C8.2.2 North Sydney

***Issue raised***

Submitters raised concerns about the increase of construction vehicles in North Sydney. Specific concerns include:

- Potential for increased congestion as construction traffic competes with local and commuter traffic on already busy roads, and the potential for drivers to use local streets around North Sydney to avoid congested areas and delays
- Request that heavy vehicles be diverted away from Miller Street when accessing North Sydney, and that no construction trucks be allowed down residential streets (Lytton Street specifically noted).

***Response***

Assessment of the performance of key locations in the road network affected by construction activities indicates the performance of the road network in the Warringah Freeway and surrounds study area (including North Sydney) would not materially change under construction conditions, and that the impacts of construction on traffic operation would be manageable. This is outlined in Section 5.3.4 of Appendix F (Technical working paper: Traffic and transport). The Miller Street/Falcon Street intersection and the Warringah Freeway/Falcon Street interchange would perform at capacity before and during construction activities. Midblock volumes on Falcon Street and Ernest Street would not materially change as a result of the project. As per environmental management measure CTT6 (refer to Table D2-1 of this submissions report), construction road traffic will be managed to further minimise movements during peak periods.

As outlined in Appendix F (Technical working paper: Traffic and transport), access to most construction support sites would be via State and Regional roads (this includes Miller Street) with some exceptions where unavoidable. As shown on Figure 5-20 of Appendix F (Technical working paper: Traffic and transport), access to construction support sites via Lytton Street is not proposed.

### C8.2.3 Neutral Bay

***Issue raised***

Submitters raised concerns about the traffic impacts of construction around Alfred Street North and Merlin Street, particularly as this work would be ongoing for several years. Key issues raised include:

- Restricted access:
  - For local residents in the southern section of Alfred Street North between Winter Avenue and Wyagdon Street due to the removal of a right U-turn from Bent Street to Alfred Street North. Submitters commented that there were very few alternative routes in the area
  - To McIntosh Lane
  - On Merlin Street which only has one exit to Military Road
- The narrowness, gradient, one-way arrangements and prevalence of tight corners on Alfred Street North, Bent Street and surrounding streets make these streets unsuitable for large numbers of construction trucks and any increase in traffic would cause congestion, delays and safety issues
- The possible re-routing of traffic and construction vehicles onto Bent Street – a one-way residential street, instead of along major roads, was mentioned by submitters as a major concern
- Very poor sight distance for traffic entering and exiting the Merlin Street construction support site (WFU7). Two right angle bends in Alfred Street North/Merlin Street present a risk of collision with through traffic
- Submitters raised concerns that about the number of construction vehicle movements per day on Merlin Street (with reference to 2000 movements). Clarification was requested about how this street would support this number of movements and the impacts to local residents.

***Response***

Although the temporary long-term closure of sections of Alfred Street North would be required during construction, access to properties along Alfred Street North would be maintained throughout construction via existing U-turn facilities or alternative routes on the local road network (refer to Table 8-17 of the environmental impact statement). Where impacts to private property access is unavoidable during construction, property owners will be consulted in advance to develop appropriate alternative access arrangements (refer environmental management measure LP3 in Table D2-1 of this submissions report) to ensure suitable access is maintained at all times. Access for emergency services would be maintained at all times.

Similarly to Alfred Street North, access to McIntosh Lane would be maintained during construction via either Merlin Street or Alfred Street North, depending on required road closures and diversions.

The majority of construction vehicle movements would be on arterial roads. However, some construction traffic would need to travel on local roads during construction of the project. The majority of construction support sites would be used for occasional works, generating low construction traffic volumes and therefore traffic impacts on local roads in the Warringah Freeway and surrounds area would be relatively low (as per Section 5.3.4 of Appendix F (Technical working paper: Traffic and transport)). Alfred Street North would be used to access the High Street North construction support site (WFU3). Access to the Merlin Street construction support site (WFU7) would be via Merlin Street; Alfred Street North and Bent Street are not proposed to be used to access this site. In accordance with environmental management measure CTT5 (refer to Table D2-1 of this submissions report), the community will be notified in advance of proposed transport network changes. Safety on Bent Street during construction is discussed further in Section C8.2.1 of this submissions report.

Vehicle access to and from construction support sites, including the Merlin Street construction support site (WFU7), will be managed to ensure pedestrian, cyclist and motorist safety (refer to environmental management measure CTT7 in Table D2-1 of this submission report). This may require manual supervision, physical barriers, temporary traffic signals and modifications to existing signals or, on occasion, police presence. Further, environmental management measure CTT8 (refer to Table D2-1 of this submissions report) notes that directional signage, barriers and/or linemarking will be used as required to direct and guide drivers, cyclists and pedestrians past construction sites and on the surrounding network. A construction traffic management plan would also be prepared as part of the construction environmental management plan for the project, as outlined in Section D1 of this submissions report.

As outlined in Table 6-37 of the environmental impact statement, the vehicle movements on Merlin Street would be minimal. There would be 40 light vehicle movements during AM peak hours and 35 during PM peak hours. No heavy vehicle movements would be required along Merlin Street. Under a worst case scenario, the site would generate up to 150 light vehicle movements per day on Merlin Street south of Falcon Street. The number of daily light vehicle movements on Merlin Street south of Falcon Street would be low, so performance impacts on Merlin Street are anticipated to be minor (as per Table 8-7 of the environmental impact statement).

Issues relating to potential safety and amenity impacts of planned construction traffic arrangements are discussed in Section C21 of this submissions report.

### C8.2.4 Waverton

***Issue raised***

Submitters raised concerns about the increase of construction vehicles in Waverton, which would travel down Bay Road and Balls Head Road to the Berrys Bay construction support site (WHT7). Other issues raised include:

- Bay Road already has significant traffic due to the HMAS Waterhen, as well as to the former Coal Loader and Balls Head Reserve

- Access for local residents using Bay Road and Balls Head Road
- Any additional heavy traffic would increase safety hazards for road users and impact already congested roads such as the Pacific Highway between Bay Road to Miller Street
- Request to include speed bumps and restrict heavy vehicle movements to business hours on Bay Road and Balls Head Road for vehicles accessing the Berrys Bay construction support site (WHT7).

***Response***

Bay Road and Balls Head Road are local roads that would provide access to the Berrys Bay construction support site (WHT7). The low volume of vehicle construction traffic generated by this site is not expected to substantially impact Bay Road and Balls Head Road. Tunnel spoil haulage would be carried out via marine transport to reduce the number of heavy vehicle movements along Balls Head Road (as outlined in Section 5.3.4 of Appendix F (Technical working paper: Traffic and transport)). Impacts to access for local residents using Bay Road and Balls Head Road would be minimal.

Traffic on Bay Road and Balls Head Road generated by visitors of the former Coal Loader, Balls Head Reserve and the HMAS Waterhen (operated by the Royal Australian Navy), located at the western side of Balls Head, has been considered in the traffic modelling.

As shown in Table 5-12 of Appendix F (Technical working paper: Traffic and transport), midblock performance during peak hours for Bay Road west of the Pacific Highway would be unchanged from 'base' (without construction vehicles) and 'construction' (with construction vehicles and proposed intersection modifications during construction) scenarios. The level of service on the Pacific Highway south of Bay Road would be unchanged in the morning and evening peak periods during construction. Regardless, impacts could be mitigated by considered and tailored construction traffic planning based on actual traffic conditions and confirmed cumulative activities at the time of construction, the details of which would be included in the construction traffic management plan (refer to Section D1 of this submissions report). Road safety is addressed in Section C8.4 of this submissions report.

The need for detailed traffic management measures such as speed bumps and heavy vehicle restrictions would be considered during detailed design and construction planning for the project.

### C8.2.5 Rozelle, Balmain and Birchgrove

***Issue raised***

Submitters raised the following concerns regarding construction vehicle movements in the Balmain, Birchgrove and Rozelle area:

- Submitters queried how 600 construction vehicle movements a day in and out of the Victoria Road construction support site (WHT2) could occur without causing significant delays on Victoria Road
- Submitters raised concerns regarding number of construction vehicle movements (predicted 700 heavy vehicle, and 530 light vehicle trips a day) to and from the White Bay construction support site (WHT3)
- Combined effects of traffic to the White Bay (WHT3) and the Victoria Road (WHT2) construction support sites, potentially creating traffic congestion
- Increased congestion on local roads due to additional construction vehicles and traffic detours related to the Yurulbin Point construction site (WHT4) at Birchgrove
- Potential for construction vehicle movements along Louisa Road leading to Yurulbin Point
- Impacts to access for residents along Louisa Road

- The environmental impact statement advises that Louisa Road, Birchgrove is only proposed to be used by the project under emergency conditions. Submitters requested a greater definition of 'emergency'
- Discrepancies in the documentation about references to delivery vehicles, construction vehicles and workers using local streets to access the Sydney Harbour south cofferdam (WHT5).

***Response***

The construction traffic impact assessment considers the worst-case construction vehicle movements to and from the Victoria Road (WHT2) and White Bay (WHT3) construction support sites. This is the period when traffic impacts (light vehicle and heavy vehicle movements) are expected to be at their peak (ie during peak construction). Potential impacts of this magnitude would only occur for a small portion of the overall construction program. The City West Link/The Crescent intersection and The Crescent/James Craig Road intersection would continue to operate at a comparable level of service during both the AM and PM peak periods. These intersections are already operating above capacity during peak periods and this would not substantially change with the addition of the forecast construction traffic. Midblock traffic volumes on City West Link, The Crescent and Victoria Road would not materially change as a result of the project (as outlined in Section 5.2.4 of Appendix F (Technical working paper: Traffic and transport).

As outlined in Section 8.4.1 of the environmental impact statement, construction of the project would result in additional construction vehicles travelling on the road network around Rozelle, which would marginally increase travel times given the congested nature of the networks in this area. Potential construction impacts would be managed in line with environmental management measure CTT6 (refer to Table D2-1 of this submissions report) to minimise movements during peak periods.

Access to Yurulbin Point (WHT4) and Sydney Harbour south cofferdam (WHT5) construction support sites would be via marine transport. A clarification of Table 6-15 of the environmental impact statement has been provided in this submissions report (refer to Section A4.2 of this submissions report) to clarify that there would be no heavy vehicle road access to Yurulbin Point construction support site (WHT4) during construction.

During construction road emergency access from Yurulbin Point construction support site (WHT4) has been provided to Louisa Road, Birchgrove. An emergency would be a serious or unexpected situation requiring immediate attention.

## C8.3 Impacts to schools

***Issue raised***

Many submissions noted that the project extends through a large education district with a high number of preschools, childcare centres, primary and secondary schools. Specific concerns include:

- The modelling did not take into account the large growth in pedestrian and road traffic due to the opening of ANZAC Park Public School in 2019, or the additional growth that is anticipated to take place as the school grows to full capacity
- The assessment underestimated the size of the schools and childcare centres within the project area
- Construction vehicles would impact routes to ANZAC Park Public School which is in the near vicinity of intersection upgrade work on the Warringah Freeway
- Heavy vehicles would pass North Sydney Demonstration School along Bay Road, Waverton which is one of only three local roads that heavy trucks would use to access the Berrys Bay construction support site (WHT7)

- Rozelle Public School is close to the Victoria Road construction support site (WHT2) and would be impacted by increased construction and other traffic along Victoria Road
- Request further detail on actions that would be taken to restrict construction vehicle movements close to schools. There should be strict conditions on truck movements near schools including a ban on construction vehicles travelling alongside schools, a ban on trucks idling near schools, and restrictions on the times of day that trucks can travel near schools or in school zones
- Concern over the impacts of increasing traffic flows on children walking to school
- The potential loss of parking around schools could hinder access for pick up and drop off.

***Response***

School traffic

The potential impacts of the project on road network performance were assessed through strategic traffic demand forecasting and operational traffic modelling (as discussed in Section 8.2.2 of the environmental impact statement), which is standard practice for road traffic project analysis. Given the timing of the traffic modelling for the environmental impact assessment, intersection performance was based on 2016 traffic demand, with traffic surveys carried out to verify this data. The model considers future traffic demand based on inputs from land use projections and demographics to enable existing and future traffic and transport conditions and road network performance to be characterised, both with and without the project.

Potential impacts will be managed through the implementation of a construction traffic management plan and in accordance with environmental management measures CTT6 and CTT7 (refer to Table D2-1 of this submissions report) to minimise construction traffic movements during peak periods, and ensure pedestrian, cyclist and motorist safety.

Construction traffic and heavy vehicles

Access to ANZAC Park Public School is not anticipated to be materially impacted during construction of the project. Indicative construction vehicle routes to construction support sites at the Warringah Freeway and surrounds are shown on figures 5-18 to 5-20 of Appendix F (Technical working paper: Traffic and transport).

Heavy vehicle traffic movements from the Berrys Bay construction support site (WHT7) have mostly been avoided through the use of barges to transport spoil and materials to and from site. The low volume of road traffic generated by the Berrys Bay construction support site (WHT7) is not expected to substantially impact Bay Road and Balls Head Road. Any impacts to the North Sydney Demonstration School would be minor.

Access to the Rozelle Public School would not be materially impacted by construction vehicle movements with construction traffic resulting in only a marginal increase in overall traffic in Rozelle.

Vehicle access to and from construction sites will be managed in accordance with environmental management measure CTT7 (refer to Table D2-1 of this submissions report) to ensure pedestrian, cyclist and motorist safety. This may include manual supervision, physical barriers, temporary traffic signals and modification to existing signals or, on occasion, police presence.

Pedestrian traffic near schools

Potential impacts to pedestrians, including in the vicinity of the numerous schools located in the North Sydney area, are discussed in Section 8.4.3 and displayed in Figure 8-12 of the environmental impact statement. Potential signal conflicts between pedestrians, cyclists and other road users would be generally managed as per the existing arrangement such that pedestrians would be given priority and protection at traffic signals. Traffic modelling carried out for assessment of the project, including modelling of pedestrian movements, has followed the processes and procedures detailed in the *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013). This

includes appropriate calibration and validation of the base model to ensure it accurately represents the existing situation.

Local schools have been identified in Table 6-1 of Appendix E (Community consultation framework) as key stakeholders and would be engaged throughout the construction period via phone calls, emails, letters, meetings and briefings. The project team would provide information at key project milestones. As per environmental management measure SE3 (refer to Table D2-1 of this submissions report), ongoing engagement will be carried out with schools near to surface construction works and construction support sites about the timing and duration of construction works and management of potential impacts.

Access to school drop off and pick off zones would be maintained throughout construction.

## C8.4 Road safety during construction

***Issue raised***

Submitters raised the following concerns regarding construction traffic impacts to road safety:

- The cumulative impact of large trucks using James Craig Road and City West Link may cause safety issues. The ANZAC Bridge currently has safety issues from traffic merging to turn on to Victoria Road
- Impacts of construction traffic travelling into and out of the Victoria Road construction support site (WHT2) and onto the already busy Victoria Road. Submitters commented that the site configuration did not have a lot of space to safely allow road traffic and heavy vehicle traffic to merge
- Query how construction traffic would enter and exit construction sites on Warringah Freeway when passing traffic usually travels at 80 kilometres per hour. Submitters noted that the Ridge Street north construction support site (WHT9) would be on a bend and the Cammeray Golf Course construction support site (WHT8/WFU10) site on a corner, requiring passing traffic speed limits to be lower than the 60 kilometres per hour imposed in similar situations during the construction of NorthConnex project
- Access for emergency vehicles:
  - Balls Head Road, Waverton is also the only access for North Sydney's State Emergency Service and is very vulnerable to interruption and delay in the case of an accident
  - Unclear on how emergency vehicles would access Alfred Street North, Neutral Bay following its partial closure during construction
  - Concern that emergency services along Louisa Road would be impacted by the use of the construction support sites.

***Response***

<u>Safety on James Craig Road, City West Link and Victoria Road</u>

Assessment of the performance of key locations in the road network affected by construction activities indicates that the road network in the Rozelle and surrounds study area would perform marginally worse under construction, with no noticeable impact when compared to traffic conditions without the project. As there would be minimal impact to traffic conditions, it is unlikely that the additional construction traffic would cause safety issues. Impacts from construction traffic will be managed through proposed environmental management measures (refer to Table D2-1 of this submissions report) ensuring appropriate traffic management and safety measures are in place.

Construction support site safety

Construction vehicles and provision of site access at Victoria Road/Wellington Street for the Victoria Road construction support site (WHT2) would have minimal impact on the overall performance of the intersection, which would operate at a satisfactory level of service. The Victoria Road/Wellington Street intersection would be modified during construction, with an additional approach allowing vehicles to exit the Victoria Road construction support site (WHT2) onto Victoria Road southbound. This additional traffic would have minimal impact on Wellington Street as construction vehicles would be signal controlled and required to give way to vehicles turning left from Wellington Street when exiting the construction support site, and would not conflict with vehicles turning right (as per Section 5.2.4 of Appendix F (Technical working paper: Traffic and Transport)).

Vehicle access to and from construction sites along the Warringah Freeway would be designed and implemented according to relevant standards and guidelines to ensure pedestrian, cyclist and motorist safety. Environmental management measure CTT7 (refer to Table D2-1 of this submissions report) outlines measures likely to be implemented depending on the location, including manual supervision, physical barriers, temporary traffic signals and modifications to existing signals or, on occasion, police presence. In accordance with environmental management measure CTT8 (refer to Table D2-1 of this submissions report), directional signage, barriers and/or linemarking will be used as required to direct and guide drivers, cyclists and pedestrians past construction sites and on the surrounding network. This will be supplemented by Variable Message Signs to advise drivers of potential delays, traffic diversions, speed restrictions, or alternative routes. These measures would be implemented as appropriate to all construction support sites to ensure pedestrian, cyclist and motorist safety, and would be outlined in a construction traffic management plan for each work site.

Access for emergency vehicles

As required by environmental management measure CTT4 (refer to Table D2-1 of this submissions report), ongoing consultation will be carried out with emergency services (as relevant to the location) to minimise traffic and transport impacts during construction.

Bay Road and Balls Head Road are local roads that would provide access to the Berrys Bay construction support site (WHT7). However, the low volume of vehicular construction traffic generated by this site is not expected to substantially impact Bay Road and Balls Head Road. Tunnel spoil haulage would be carried out via marine transport to reduce the number of vehicle movements along Balls Head Road (as per Section 5.3.4 of Appendix F (Technical working paper: Traffic and transport)). Access for local residents and emergency vehicles using Bay Road and Balls Head Road would not be impacted.

As discussed in Section 5.1.3 of Appendix F (Technical working paper: Traffic and transport), for each construction support site, temporary partial or complete road closures of local streets would be required. These closures would generally be short-term and subject to local traffic management. In the instances of localised road closures, access for general traffic and emergency vehicles would be provided either by an alternative detour route, or under traffic control. Management of these day to day road closures and associated traffic management measures would be outlined in a construction traffic management plan for each work site.

In particular, during temporary closure of some sections of Alfred Street North, access to properties would be maintained throughout construction via existing U-turn facilities or alternative routes on the local road network.

Access for emergency vehicles along Louisa Road would be maintained at all times during construction.

## C8.5 Public and active transport

### C8.5.1 Closure of Birchgrove Ferry Wharf

***Issue raised***

The closure of Birchgrove Ferry Wharf during construction was raised as a key issue for submitters living on the Birchgrove Peninsula. Key concerns include:

- The wharf would be closed for approximately two years, removing a vital transport service for local residents. Closure of the wharf reduces local public transport options in the community; this is not aligned with community values which favour public transport. The closure is posed as temporary, but the long construction duration means that the closure would be more permanently felt in the community
- No additional bus services are proposed during the wharf's closure, particularly for bus routes 441 and 442 from Birchgrove Park. It is unreasonable to require residents to walk 1.7 kilometres to the Balmain Ferry Wharf
- Closure of the wharf a year after it was upgraded would not be an efficient use of public funds
- Proposals to investigate opportunities to relocate the wharf during construction are unclear in the environmental impact statement.

***Response***

Birchgrove Ferry Wharf would be temporarily closed (around two years) during construction activities and would affect the operation of ferry services; specifically, the F3 Parramatta River route, the F8 Cockatoo Island route and the Lane Cove to City Captain Cook Cruises service.

In accordance with environmental management measure CTT3 (refer to Table D2-1 of this submissions report), a replacement service for commuters impacted by the temporary closure of Birchgrove Ferry Wharf will be determined during construction planning. The temporary closure of the Birchgrove Ferry Wharf will not occur until the replacement service is operational. This is further discussed in Section A3.3.1 of this submissions report.

### C8.5.2 Changes to bus routes and services

***Issue raised***

Submitters commented on proposed changes to bus routes, services and infrastructure during construction. Key concerns include:

- The proposed rerouting of B-Line buses off the Warringah Freeway at Kirribilli to North Sydney Station, Victoria Cross Station, up Miller Street to Falcon Street and then Military Road would cause traffic issues in North Sydney CBD
- The effect of the project on traffic flows of the B1 bus link to the Northern Beaches, and the proposed B2 bus link between Dee Why, Chatswood and the North-West Metro
- Closure of the bus interchange at Miller Street would remove a central transport hub for locals
- Concern that changes to public transport arrangements, including changes during construction to access to bus stops and the new Victoria Cross metro station, may discourage sustainable transport choices
- Impacts if the bus "layover" on Warringah Freeway is removed. This is used to manage timing of buses meaning removal may impact reliability of these services

- The reliability of buses travelling to and from the Balmain peninsula would be affected by increased construction traffic travelling to and from the White Bay construction support site (WHT3)
- Concern that there would be negative impacts on bus routes and stops on Victoria Road.

***Response***

Impacts to public transport are outlined in Section 8.4.3 and shown on Figure 8-11 of the environmental impact statement. The B-Line buses are not proposed to be rerouted during or after the construction of the project. There would be no impact on the proposed B2 bus link between Dee Why, Chatswood and the North-West Metro due to the project. Potential modifications to existing bus lanes may be required for short periods during construction of the Warringah Freeway Upgrade component of the project; however, buses can use the adjacent general traffic lanes available. Impacts due to the temporary closure of the bus lanes would be minor and managed during the short periods that these bus lanes would not be in operation.

The project does not propose to close or otherwise impact the bus interchange at Miller Street.

There is potential for delays to bus services due to construction activities, however these would be minor and temporary. Potential construction impacts on bus services will be minimised through the implementation of environmental management measure CTT4 (refer to Table D2-1 of this submissions report) which requires that consultation be carried out with bus operators to minimise traffic and transport impacts. As required by environmental management measure CTT10, any adjustments to existing bus stops will be determined in consultation with relevant stakeholders including other divisions of Transport for NSW and advanced notification will be provided to affected bus customers. Relocations will be as close as feasible and reasonable to their existing position. Impacts associated with the small change in travel distance would be negligible.

The construction of the project would not have a material impact on the operation of Sydney Metro, including the Victoria Cross Metro station.

Access to existing public transport would be maintained during construction. Temporary changes to access may be required, however these will be carried out in accordance with environmental management measures CTT5, CTT6 and CTT7 (refer to Table D2-1 of this submissions report) to ensure that the community is notified in advance of any changes and to ensure clear, safe access direction and signage is provided.

As discussed in Section 8.4.3 of Appendix F (Technical working paper: Traffic and transport), bus priority infrastructure and layover facilities on the Warringah Freeway in the southbound direction would be maintained during construction and operation. Potential strategies to be implemented include the use of temporary routes on approach to the Sydney Harbour Bridge, the use of temporary bus layover facilities within Cammeray Golf Course, and a new layover facility within the existing Sydney Harbour Bridge Northern Toll Plaza area.

Section 8.4.1 of the environmental impact statement presents discussion of impacts on public transport in the Rozelle area. Project construction would result in additional construction vehicles travelling on the road network around Rozelle, which could incrementally increase bus travel times given the congested nature of networks in these areas. However, the project does not propose any changes to bus stop locations on Victoria Road.

### C8.5.3 Impact on active transport

***Issue raised***

Submitters raised the following concerns regarding construction impacts to active transport routes and infrastructure:

- The environmental impact statement does not identify all existing cycle routes affected by the project including routes along the Warringah Freeway between Naremburn/Cammeray and North Sydney

- Objection to the number of cycle routes that would be impacted during construction, in particular impacts to shared paths along Victoria Road
- Conditions should be placed on the project to ensure any temporary or permanent impacts on cycling facilities is minimised. The project should identify and address all breaks in cycle access in consultation with cycling stakeholders and local government authorities. Any cycling infrastructure that is removed during construction be re-instated or replaced with alternative provision to the same level of safety, continuity and directness
- Request that the detour to the east of the cycle access link through Cammeray Golf Course is completed to standard prior to closing the existing path, access to the Cammeray on ramp cycle lane is retained throughout construction and operation, the path is constructed to Austroads standards and has acceptable grades, and the path is subject to cycling stakeholder consultation
- Concern over the impact on pedestrians of changed traffic conditions and temporary road changes at locations such as
  - North Sydney CBD
  - Ridge Street which divides the Ridge Street North and Ridge Street East construction sites
  - Waverton, particularly along Woolcott Street, Bay Road and Crows Nest Road
  - Berrys Bay, foreshore access
- Submitters sought assurance that cycling routes and detours around construction sites would be safe for cyclists and cited concerns about the safety of detours for other construction projects such as the Rozelle Interchange and Sydney Light Rail
- Concern that large trucks pose a visual barrier for cyclists and pedestrians, making it hard to see around them on narrow streets. These risks are already present due to other construction projects in the city. However, concerns were raised that they would worsen as a consequence of the project
- Submitters requested further details on how impacts to pedestrians and cyclists would be mitigated during construction.

***Response***

Cycling routes

All existing cycle routes within the study area are included in Section 4.2.8 (Rozelle and surrounds), Section 4.3.8 (Warringah Freeway and surrounds) and Section 4.4.8 (Gore Hill Freeway and Artarmon) of Appendix F (Technical working paper: Traffic and transport).

The cycle network in the Warringah Freeway and surrounds study area consists mostly of on-road cycle routes on local, collector and sub-arterial roads. The cycle network in the Gore Hill Freeway and Artarmon study area consists of a mixture of off-road shared user paths and on-road cycle routes on local and collector roads. The regional strategic cycle network provides connections between the study area and the Sydney CBD, St Ives, Castle Cove, Willoughby, Chatswood, St Leonards, Lane Cove and Macquarie Park.

Changes to active transport routes

Transport for NSW recognises that the proposed changes to existing shared user paths to facilitate construction may increase distances and travel times, and adversely affect path amenity for users. Transport for NSW notes that it is generally not possible to provide temporary diversions that do not involve some increase in distance and/or travel time. Transport for NSW has minimised the length of temporary diversion wherever practicable.

Section 5.5.2 of Appendix F (Technical working paper: Traffic and transport) outlines impacts on the active transport network during construction, including provision of cycling detours. The assessment of construction activity impacts on the active transport network indicates that impacts would be minor and manageable with existing connectivity generally maintained. The project has been developed to minimise impacts on the existing active transport network where possible. Opportunities to further minimise the project's impacts on the active transport network would be considered throughout further design development and construction planning. Environmental management measure CTT19 (refer to Table D2-1 of this submissions report) aims to minimise direct impacts to existing shared user paths. Any detours and adjustments will be designed with consideration of user safety and convenience.

The shared user paths on Victoria Road within the vicinity of the Victoria Road construction support site (WHT2) would be maintained throughout construction. Construction vehicles entering and exiting site would give way to pedestrians and cyclists using the shared user path on the western side of Victoria Road. This would be facilitated through the modification of the traffic signals at the Victoria Road/Wellington Street intersection with a new south approach for construction vehicles and controlled shared user crossings across the site exit.

Prior to the closure of the Miller Street cycleway in Cammeray that connects to Warringah Freeway, Transport for NSW would establish a temporary alternate route to ensure that continuous access is maintained throughout construction. During construction, access to the Cammeray on ramp cycle lane would not be maintained due to potential direct conflicts with proposed construction traffic. This access would be re-established as soon as reasonable and feasible once construction activities in this location are complete, although there may be differences in its alignment.

Transport for NSW is committed to engaging with cycle and community groups regarding potential alternative cycling arrangements. A traffic and transport liaison group would be established, including representatives from appropriate councils, as well as motorist, cyclist and pedestrian stakeholders to manage ongoing local road, footpath and park closures along with any diversions for construction activities and to discuss traffic management and road safety (as per Section 7.1 of Appendix E (Community consultation strategy)). Environmental management measure CTT5 (refer to Table D2-1 of this submissions report) also requires advance community notification of proposed transport network changes.

All new and reinstated shared user paths would be designed and constructed in accordance with Transport for NSW and Australian standards and guidelines, as a minimum.

Pedestrian activity

Transport for NSW recognise the importance of maintaining pedestrian routes across the project corridor and particularly within the North Sydney local government area. Pedestrian impacts within the North Sydney CBD would be limited and alternate access arrangements or detours maintained during construction.

During early works and site establishment, construction vehicle access may be required on the northern side of Ridge Street adjacent to the Ridge Street shared user bridge until the Warringah Freeway site access is operational. Pedestrians would access the western end of the bridge from the footpath on the southern side of Ridge Street, near the Ridge Street east construction support site (WFU6) access. Although this presents a conflict between pedestrians and vehicles, construction volumes generated at the site would be low, with about 70 light vehicle and 20 heavy vehicle movements per day. Given that there is no footpath on the northern side of Ridge Street, minimal impacts on pedestrians are anticipated. Construction traffic volumes at all other construction support sites established for the Warringah Freeway Upgrade component of the project are also low, with minimal impacts expected on the active transport network.

Pedestrians would be separated from construction traffic along Bay Road/Balls Head Road up to Waterhen Drive, where there is a footpath provided on each side of the road. Most pedestrians and cyclists access Balls Head Reserve via Waterhen Drive and their interaction with construction traffic would be negligible (as per Section 8.4.3 of the environmental impact statement).

While the existing foreshore access path at Berrys Bay would be temporarily closed, there is an additional, existing higher level path that links Carradah Park and Balls Head Road. This existing path would be used as the alternative path during construction.

Cyclist and pedestrian safety

Environmental management measure CTT7 (refer to Table D2-1 of this submissions report) requires that vehicle access to and from construction sites be managed to ensure pedestrian, cyclist and motorist safety. Depending on the location, this may require manual supervision, physical barriers, temporary traffic signals and modifications to existing signals or, on occasion, police presence. As outlined in environmental management measure CTT8 (refer to Table D2-1 of this submissions report), directional signage, barriers and/or line marking will be used as required to direct and guide drivers, cyclists and pedestrians past construction sites and on the surrounding network. This will be supplemented by Variable Message Signs to advise drivers of potential delays, traffic diversions, speed restrictions, or alternative routes.

Mitigation

Environmental management measures CTT7 and CTT8, discussed above, have been developed to minimise impacts to pedestrians and cyclists and ensure safety. These are presented in Table D2-1 of this submissions report. A construction traffic management plan would also be developed as part of the construction environmental management plan for the project, as outlined in Section D1 of this submissions report.

## C8.6 Parking

***Issue raised***

Many submitters highlighted concerns about loss of parking during construction. Key concerns include:

- Parking in many suburbs around the project is already constrained. Concern that the addition of workers each day to some construction sites would put a strain on local parking, taking availability from the local community. Appropriate residential parking schemes must be implemented to ensure that worker parking impacts are mitigated
- There is scepticism that commitments to mitigate the effects of worker parking would be followed, based on experience from the WestConnex project. Many submitters feel that, despite promises by contractors to bus in workers or encourage public transport usage, WestConnex workers make extensive use of on-street parking around major construction sites. Fines should be imposed on construction workers for parking in contravention of agreements
- There is support for the proposed shuttle buses between the construction sites and nearby transport hubs to make construction workers' commute by public transport feasible. However, questions were raised about how use of this service would be encouraged
- The impacts on on-street parking should be suitably addressed prior to Gateway Determination being issued. It is not sufficient to address them later in a future Construction Transport Management Plan as an intervention may be required to protect on-street parking
- The removal of parking spaces as a result of construction would create knock on effects at North Sydney, Neutral Bay and Cammeray, as commuters and visitors would seek alternative parking arrangements on residential streets. North Sydney Council should be given additional funding to police parking requirements
- Loss of on-street, metered parking spaces during construction at Alfred Street North

- Changes to the availability of parking spaces (either temporary or permanent) would increase pressure on local areas, encourage illegal and unsafe parking, and reduce the local amenity
- The removal of short-term parking and kiss and ride areas which would affect local business deliveries and encourage people to double park or stop illegally.

***Response***

The project would aim to provide sufficient onsite parking to accommodate the construction workforce, as outlined in Appendix F (Technical paper: Traffic and transport). However, construction site layouts and requirements at this stage are indicative and would be further defined during subsequent design phases. Environmental management measure CTT9 (refer to Table D2-1 of this submissions report) states that where provision of construction on-site parking cannot accommodate the full construction workforce, feasible and reasonable management measures that minimise impacts on parking on local roads will be identified and implemented. Depending on the location, management measures may include workforce shuttle buses and the use of public transport. Transport for NSW is committed to minimising the potential impacts of construction worker parking on the local community and would encourage the construction workforce to utilise other forms of transport to access the site. Impacts would be managed through the implementation of environmental management measures detailed in Table D2-1 of this submissions report. Refer to Section A4.1.1 of this submissions report for further details on for further detail on construction worker parking.

North Sydney Council currently police parking requirements in North Sydney, Neutral Bay and Cammeray; changed parking conditions would not change this arrangement.

Transport for NSW acknowledge the loss of parking along Alfred Street North and the limited alternative parking. Generally, projects involving surface road upgrade works will result in impacts to parking during the construction period. Opportunities to reduce or offset the permanent loss of long stay parking spaces along Alfred Street North due to the project will be investigated during further design development in accordance with environmental management measure OT3 (refer to Table D2-1 of this submissions report).

While there would be some loss of parking near construction support sites, lost parking spaces would generally be offset by alternative parking availability in the surrounding local road network, and therefore parking impacts would be minor and manageable (with the exception of Alfred Street North, discussed above).

## C8.7 Maritime traffic

### C8.7.1 General

***Issue raised***

Submitters raised the following issues regarding marine traffic:

- There was support in submissions for maximising the use of barges and marine transport to move workers, spoil and machinery. This was a common comment by submitters in Waverton who are concerned about construction traffic along Balls Head Road
- Dredging of the shipping channel would result in restriction to commercial vessel movements and local amenity. The environmental impact statement simply states that sailing clubs, marine rescue, commercial vessel operators and other impacted parties “would be consulted”. This consultation should happen and be reported on in the environmental impact statement. The environmental impact statement does not analyse economic impacts related to increased transit time due to partial harbour closures and maritime speed restrictions, but just says they would be “relatively minor” and unavoidable

- To reduce impact to maritime traffic, it was suggested that dredging could be halted for short periods, and that a small section of cofferdam could be done at any one time. They also felt construction could be worked around tidal currents
- Potential increase in emergency response time of Marine Rescue NSW located at Birkenhead Point due to construction activities in harbour.

***Response***

Transport for NSW acknowledges the community support for maximising use of marine transport during construction. The project has included the use of barges and marine transport to support construction support sites at Yurulbin Point (WHT4) and Berrys Bay (WHT7), including the transport of spoil from these sites to the White Bay construction support site (WHT3) by barge. Section 5.3.4 of Appendix F (Technical working paper: Traffic and transport) notes that tunnel spoil haulage would be carried out via marine transport from the Berrys Bay construction support site (WHT7) to reduce the number of heavy vehicle movements along Balls Head Road. The low volume of vehicular construction traffic is not expected to substantially impact Bay Road or Balls Head Road.

As provided by environmental management measure CTT14 (refer to Table D2-1 of this submissions report), haulage of spoil by barge will be further considered as an alternative to road based haulage from White Bay construction support site (WHT3). Project-related heavy vehicle routes and any associated restrictions of use would be documented in a construction traffic management plan as part of the construction environmental management plan (see Section D1 of this submissions report for further discussion). This will include the identification of spoil haulage routes.

A construction impact assessment was carried out for marine businesses, which concluded that while there may be temporary impacts on some maritime businesses during construction, lasting impacts on businesses are not expected (refer to Section 6.5.2 of Appendix U (Technical working paper: Socio-economic assessment)). Overall, construction of the project would have short term negative effects at an individual business level, with no discernible changes to the broader maritime business environment.

Consultation was carried out throughout project development and the preparation of the environmental impact statement including with marine stakeholders and waterway users. In accordance with environmental management measures BU2 and BU3 (refer to Table D2-1 of this submissions report), specific consultation will be carried out with any marine businesses potentially impacted by construction of the project. Consultation will aim to identify specific potential construction impacts for individual businesses. Based on consultation, specific feasible and reasonable measures would be identified and implemented to minimise these impacts. As per environmental management measure CTT17 and CTT18 (refer to Table D2-1 of this submissions report), harbour closures scheduling will be carried out in consultation with Port Authority of NSW, other divisions of Transport for NSW and other relevant stakeholders. Construction vessel movements will be managed so that they will not interfere with port operations or the navigation of seagoing ships and ferries, unless prior approval has been obtained from the Harbour Master.

Marine Rescue NSW would not be directly impacted by the construction activities. However, the construction activities may increase its emergency response time in the outer harbour or offshore. Marine Rescue NSW operates a facility at Middle Harbour in addition to Birkenhead Point. Marine Rescue NSW would be consulted about increasing patrols operating out of Middle Harbour that could service the outer harbour and offshore during periods when construction activities may impact the response time of Marine Rescue NSW located at Birkenhead Point (as per 8.4.2 of the environmental impact statement).

Transiting past the construction areas within the harbour at high speed would need to be restricted during construction. However, these speed restrictions would not apply to Marine Rescue in an emergency situation in accordance with the *Marine Safety Regulation 2016* (as per Section 5.5.3 of Appendix F (Technical working paper: Traffic and transport).

### C8.7.2 Impacts on leisure maritime traffic

#### *Issue raised*

Community-based sailing and boating organisations raised concerns about the impact that construction vessel movements would have on sailing and leisure crafts on the harbour. Key issues/comments include:

- A significant impact on sailboat racing is likely during excavations for the cofferdams, due to the encroachment of these structures, and their associated on-water vessels, into what is already a fairly narrow stretch of water. Potential restrictions on sailing and other aquatic activities between Yurulbin Point and Balls Head may mean that clubs would not be able to sail in this area for extended periods during construction
- The construction program would result in a large amount of barge traffic between Yurulbin Point/the Coal Loader, and out to both the main harbour and around to White Bay. This barge traffic would be in addition to the usual commercial water traffic. Submitters suggested that it would require attention and skill for boats to sail safely around this additional water traffic. Towed barges would have limited maneuverability and speed and would likely have extended exclusion zones around them while they are moving. Some submitters felt this issue was not adequately addressed in the environmental impact statement
- An exclusion zone around the cofferdams and associated vessels which would further restrict sailing. Further restrictions on navigable areas of the harbour would further compress vessel traffic and increase the risk of collisions and incidents, particularly during the busy summer months
- Altering courses is not a reasonable alternative for sailing clubs. Breezes west of Birchgrove are generally much lighter and more unpredictable than those from Birchgrove to Goat Island, particularly during the period of twilight racing
- The impact and the potential relocation of construction on moorings in the vicinity of the construction activity. Submitters asked for further information on where moorings might be relocated to.

#### *Response*

The inner harbour (between Birchgrove and Waverton) would not be closed to community groups and clubs other than during the placement of the immersed tube tunnel, as addressed in Section 8.4.2 of the environmental impact statement. Navigation restrictions posed by construction equipment such as dredgers and cofferdams combined with the proximity and frequency of marine construction traffic, which may have limited manoeuvrability, could result in unfavourable sailing conditions. Environmental management measure CTT16 (refer to Table D2-1 of this submissions report) advises that construction marine traffic activities will be scheduled to avoid times and locations of high recreational marine traffic where feasible and reasonable. However, sailing clubs impacted by the proposed works will be consulted and encouraged to alter sail racing courses that would be impacted by the works. Environmental management measure CTT17 (refer to Table D2-1 of this submissions report) also requires that the scheduling of harbour closures is carried out following consultation with relevant stakeholders (including sailing clubs).

Maritime movements and activities are addressed further in Section 5.5.3, and Annexure A (Navigation Impact Assessment) of Appendix F (Technical working paper: Traffic and transport); this includes navigation restrictions.

The impact on navigation at the construction support sites at White Bay (WHT3), Berrys Bay (WHT7) and Yurulbin Point (WHT4), and on the approaches thereto, are considered acceptable. The peak period for marine traffic would be during construction of transition structures, when there would be up to 100 barge movements between White Bay and the cofferdams per day. However, the duration of these works would be relatively short, and this part of the harbour has been retained

as a 'working harbour'. In addition, vessels significantly larger than the marine construction vessels currently transit the Inner Harbour. Waterway users would be required to maintain a proper lookout and abide by the navigation rules.

The impact on navigation in the vicinity of the harbour crossing is considered acceptable. The impact on navigation in this area would be more severe than other parts of the Harbour. The transit time for vessels past the location of the harbour crossing would increase. With the exception of the Harbour City Ferries and Captain Cook Cruises, which would experience timetabling delays due to the increased transit time, the works would have minimal impact on other commercial business (eg charter companies and commercial fishing fleets). Oil tanker movements to and from the Gore Bay Terminal would be accommodated. Provided waterway users maintain a proper lookout and abide to the navigation rules the impact on navigation would be manageable. Exclusion zones would be set up around the Sydney Harbour south and north cofferdams, thereby temporarily reducing navigation width. These zones would be marked by lit yellow buoys as specified by the Harbour Master, to clearly identify the exclusion zones and facilitate the safe passage of all vessels travelling within the vicinity of the cofferdams.

It is acknowledged that Sydney Harbour is highly congested on most weekends during summer, particularly between 12pm and 5pm when a number of clubs hold their weekly sailing races. Events held in Sydney Harbour such as paddling events in February and yacht races including the Sydney to Hobart in December generally occur in the outer harbour. Marine construction traffic in the outer harbour on weekends would be limited to the dredge transiting to and from the offshore disposal grounds about every four to five hours. The impact on navigation in the outer Harbour would be considered negligible. This is due to the relatively wide waterway widths and infrequent movement of marine construction vessels. This would not have any substantial impact on other outer harbour users. As per environmental management measure CTT16 (refer to Table D2-1 of this submissions report), construction marine traffic activities will be scheduled to avoid times and locations of high recreational marine traffic where feasible and reasonable.

The contractor would manage barge movements to ensure that the impacts on inbound and outbound marine traffic are minimised, which would be detailed in the construction environmental management plan. As per environmental management measure CTT17 and CTT18 (refer to Table D2-1 of this submissions report), harbour closures scheduling will be carried out in consultation with Port Authority of NSW, other divisions of Transport for NSW and other relevant stakeholders. Construction vessel movements will be managed so that they will not interfere with port operations or the navigation of seagoing ships and ferries, unless prior approval has been obtained from the Harbour Master.

Moorings within the vicinity of the Berrys Bay construction support site (WHT7) would require temporary relocation. Alternative arrangements will be determined in consultation with the vessel owners (refer to environmental management measure CTT2 in Table D2-1 of this submissions report). Impacts on any relocated moorings are expected to be relatively minor.

## C8.8 Suggested additional management measures

***Issue raised***

Submitters suggested additional measures to mitigate impacts from construction traffic. These include:

<u>Construction traffic</u>

- Development of a construction transport plan with each local council ie Inner West, North Sydney and Willoughby
- Drivers should be certified for the project. All vehicles should be clearly identified and GPS tracking on vehicles

- Construction vehicles should be monitored in real time to ensure they keep to designated construction traffic routes.

Parking

- Parking management plans should be made available to the community before work starts, outlining how dedicated parking would be provided for people working on the project.

***Response***

A construction traffic management plan would be prepared by the contractor, in consultation with councils and relevant transport stakeholders, as part of the construction environmental management plan and would be made publicly available.

All other suggested management measures would be considered by Transport for NSW for inclusion during development of the construction environmental management plan. Further details on the construction environmental management plan and sub-plans is provided in Section D1 of this submissions report.

NSW GOVERNMENT

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C9 – Operational traffic and transport

SEPTEMBER 2020

# C9 Operational traffic and transport

## Contents

# C9.1 Adequacy and accuracy of assessment

## C9.1.1 Traffic model

### *Issue raised*

Submitters raised issues relating to the traffic and transport modelling used as the basis of the assessment. Specific queries, comments and concerns include:

- The environmental impact statement does not contain a statement on the level of accuracy and reliability of the traffic modelling process
- Request that the traffic modelling be independently audited and reported on, and that traffic forecasts are prepared by an independent organisation to assess the project need
- The environmental impact statement does not provide detail on how the Sydney Strategic Travel Model and the Sydney Motorway Planning Model used for the analysis were designed, or what inputs and outputs were adopted
- Comment that the Sydney Motorway Planning Model which was developed to assess infrastructure improvements associated with new motorway projects, is not fit for purpose
- Request clarification as to how traffic flow estimates in the environmental impact statement were calculated.

### *Response*

The traffic and transport assessment in Appendix F (Technical working paper: Traffic and transport), has been prepared to address the Secretary's environmental assessment requirements. An overview of the modelling methodology used in the assessment of the project is provided in Figure 9-1 of the environmental impact statement.

The modelling approach adopted for the project is the standard NSW Government approach, which has been endorsed and applied for all recent major transport projects. Traffic modelling carried out for assessment of the project has followed the processes and procedures detailed in the *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013), in addition to other Transport for NSW, Austroads and NSW Government guidelines. This includes acceptance of typical assumptions and limitations.

A multi-tiered transport modelling approach was adopted to carry out a comprehensive assessment of the current and future performance of the road network, as outlined in Section 3.3 of Appendix F (Technical working paper: Traffic and transport). This approach is considered appropriate for the determination of traffic demands for the project. The process for the project has been implemented by Transport for NSW and broader industry subject matter experts, and has been independently reviewed by internal subject matter experts and external independent peer reviewers.

The Sydney Strategic Travel Model (STM), developed and operated by Transport for NSW, is the primary source for the extraction of region-wide trip patterns and travel demand on the transport network across Sydney, Newcastle and the Illawarra. The STM was used to forecast road traffic demands for more detailed modelling using the Sydney Motorway Planning Model (SMPM). The SMPM forecasts strategic future traffic patterns under different land use, transport infrastructure and pricing scenarios. This approach included assessment of the model calibration and validation by independent peer reviewers and agreement that the model was suitable for this purpose.

The strategic road demand forecasts developed as part of the SMPM are used as inputs to more detailed operational traffic modelling. The operational traffic modelling was carried out to provide a more accurate understanding of the forecast performance of the road network with and without the project.

The extent of the operational traffic modelling is shown on Figure 9-2 of the environmental impact statement and is considered sufficient to identify operational traffic impacts of the project on the surrounding road network, based on the outcomes of SMPM strategic modelling.

Traffic flow estimates are refined through the modelling process summarised above, from broader regional and strategic estimates of the STM and SMPM to more detailed local forecasts derived from detailed operational modelling. Further detail is provided in Section 3.3 of Appendix F (Technical working paper: Traffic and transport).

### C9.1.2 Traffic volumes and movements

***Issue raised***

Submitters raised issues relating to traffic volumes used as the basis of the assessment. Specific queries, comments and concerns include:

- Submitters questioned the accuracy of the projected traffic volumes, which are believed to be well above the physical capacity of the road network
- Concerns that the strategic model uses traffic volume inputs that cannot be accommodated in the road interchanges and feeder routes
- Concern that the following matters were not considered:
  - All the currently approved high-rise unit development at St Leonards
  - Forecast increase in population on the Northern Beaches
  - Existing traffic on the City West Link
  - Traffic flows and pinch points
- Concern about the currency of the traffic data used in the modelling and the use of 2016 as the baseline year. Submitters raised concerns that the data may over predict and under predict traffic levels
- Recommendation that traffic volumes should be compared to the Sydney Harbour Tunnel with an additional lane in either direction
- Comment that the traffic assessment has not taken proper account of the influx of traffic into North Sydney, or modelled access from North Sydney to the arterial road system nor alternative routes for local traffic once the restrictions are in place, or potential delays and congestions at key intersections due to these changes
- Concern that the traffic assessment does not provide an analysis identifying the origins and destinations of travelers, including the time of day they travel, and preferred mode of transport.

***Response***

<u>Traffic volumes</u>

As discussed in Section C9.1.1 above, the modelling approach is a robust process which has been used for recent major transport projects and has been endorsed by internal and external subject matter experts. The assessment methodology is discussed in further detail in Section 3 of Appendix F (Technical working paper: Traffic and transport), including key data inputs and assumptions. Models of existing conditions use surveyed data as inputs, including traffic counts, travel times, and trip pattern and other behavioural data. Models of future conditions reflect planned future land use developments and multi-modal transport initiatives. Traffic demand data contained within the traffic and transport assessment was taken from the SMPM following assessment of the model calibration and validation by independent peer reviewers.

It is acknowledged in Section 3.4.4 of Appendix F (Technical working paper: Traffic and transport), that the SMPM is not able to fully reflect the effect of capacity constraints on traffic demand during

the peak period and demand forecasts from SMPM can exceed the road network capacity at specific locations. When the demand for travel exceeds the capacity of the road network, drivers may change their behaviour, often travelling at a different time, by a different route or mode, or not making their trip at all. This is a standard limitation of strategic traffic forecasting, and is addressed through supplementary analyses including detailed operational (microsimulation) modelling. As discussed in Section C9.1.1 above, the traffic modelling is adequate and has followed appropriate guidelines.

Data inputs

Data inputs into the SMPM included forecast population and employment data consistent with demographics released by NSW Department of Planning and Environment in 2017 (DP&E, 2017), traffic volume counts and road travel time data, along with recently completed and future infrastructure project lists. These are used to establish existing and future traffic volumes based on data available at the time, within standard assumptions and limitations. Inputs are discussed further in Section 3.3.2 of Appendix F (Technical working paper: Traffic and transport).

The 2016 baseline year is considered appropriate as the traffic and transport assessment commenced in 2017 and represents transport network conditions at the time of assessment. Ongoing and continuous traffic surveys carried out by Transport for NSW indicate that there is little material difference between 2016 and existing (2020) traffic conditions in the project area.

Sydney Harbour Tunnel

The Sydney Harbour Tunnel was within the modelled areas, as shown on Figure 9-2 of the environmental impact statement. One of the main objectives of the project was to provide additional cross-harbour motorway capacity, to reduce congestion on the existing harbour crossings. A comparison of the predicted traffic volumes for the project against increased lane capacity on the Sydney Harbour Tunnel is therefore not appropriate as it does not support this objective. The project is, however, forecast to substantially reduce traffic demands and improve travel times on the Sydney Harbour Tunnel.

North Sydney

The analysis of operational traffic impacts was based on the modelled data. The Warringah Freeway and North Sydney area is shown as one of the operational modelled areas on Figure 9-2 of the environmental impact statement. Therefore, the changes in traffic movements within North Sydney has been considered in the traffic and transport assessment. Further, this operational model area encompasses many connecting roads to the Warringah Freeway, for which a detailed assessment has been provided in sections 7.5 and 8.5 of Appendix F (Technical working paper: Traffic and transport).

Travel behaviour

The origins and destinations of travellers, including the time of day they travel, and preferred mode of transport are all discussed in detail in Section 4 of Appendix F (Technical working paper: Traffic and transport). This information is a key input to the traffic modelling process.

### C9.1.3 Demand for the project

***Issue raised***

Submitters raised issues relating to demand for the project in the assessment. Specific queries, comments and concerns include:

- The analysis was focused on fitting the project into other parts of WestConnex (such as the M4-M5 Link) rather than properly considering impacts and benefits to community and road users and the project's performance against the stated aim of reducing congestion
- Comment that Table 9-4 of the environmental impact statement indicates predicted traffic demand for the project but gives no sources for the estimates

- Submitters objected to the use of extrapolated toll data to assume increased road usage
- The assessment does not consider the changing behaviours in relation to car travel versus public transport and the larger-than-expected public acceptance of public transport with provision of services such as the B-line buses
- The social and technological trends affecting future transport use, such as driverless, electric cars and delivery drones
- The effect of the COVID-19 virus and the potential for a recession to reduce private car usage
- Submitters raised concern that induced demand had not been properly considered in the traffic assessment. The modelling did not seem to consider how the project may cause an increase in traffic flows due to induced demand, nor does it compare these modelled outcomes with either a 'do nothing' option or alternative low pollution transport options.

***Response***

Focus of the traffic assessment

Strategic traffic modelling of the project indicates he project would deliver substantial benefits to traffic travelling on the road network, with trips between strategic centres saving up to 15 minutes when crossing Sydney Harbour during peak periods (refer to Section 7.1 of Appendix F (Technical working paper: Traffic and transport)). These travel time savings would substantially increase accessibility for these centres, increasing the catchment of residents within the '30-minute city' window that is critical to maintaining the vision of a productive city promoted by the Greater Sydney Commission. Further detail on the role of the project in reducing congestion is provided in Section C3.1.1 of this submissions report.

The traffic and transport assessment considers a number of operational scenarios. The two project scenarios ('Do something' and 'Do something cumulative') reflect the road network conditions once the project is built, both on its own and in conjunction with other proposed projects. The approved M4-M5 Link is included within the 'Do minimum' operational scenarios (ie without the project), as it was under construction at the time of the assessment.

The M4-M5 Link project is a key consideration in the traffic and transport assessment as it would provide surface connectivity between the M8 and M4 corridors to Victoria Road, The Crescent, City West Link, ANZAC Bridge and underground motorway to motorway connectivity to and from the project. Appendix F (Technical working paper: Traffic and transport) contains a thorough assessment of the Western Harbour Tunnel and Warringah Freeway Upgrade's impacts on road network performance and alignment with the project objectives outlined in Section 3.3 of the environmental impact statement (including reducing congestion). While the connection to the M4-M5 Link project is a key consideration, the environmental impact statement and technical working papers provide appropriate consideration to all aspects of the project, with the same level of analysis carried out both north and south of Sydney Harbour. This includes consideration of the significant upgrades to the Warringah Freeway and surrounds.

Traffic demand

The data included in Table 9-4 of the environmental impact statement is sourced from the strategic traffic modelling (SMPM) carried out for the traffic and transport assessment in Appendix F (Technical working paper: Traffic and transport).

Tolling data was not used to determine future traffic demand. As stated in Section 3.3 of Appendix F (Technical working paper: Traffic and transport), the SMPM toll choice assignment model was developed to test impacts of toll and infrastructure strategies and provide resultant project traffic forecasts. The model is designed to forecast the traffic choosing to use tolled and non-tolled routes for the representative peak and inter-peak periods of the day. The development of the toll choice

assignment model included survey analysis to investigate people's willingness to use toll roads based on market research surveys.

Public transport

Relevant public transport infrastructure projects including the Northern Beaches B-Line and the Sydney Metro City & Southwest have been considered in the traffic modelling and assessment as per sections 2.3 and 2.4 of Appendix F (Technical working paper: Traffic and transport).

Changes in driver behaviour

As described in Chapter 3 (Strategic context and project need) of the environmental impact statement, the project was designed to provide a transport solution that aligns with the following integrated transport and land use policies and plans of which social and technological trends affecting future transport use has been a key consideration (see Section C3.1 of this submissions report for further discussion):

- *Future Transport Strategy 2056* (NSW Government, 2018)
- *State Infrastructure Strategy 2018–2038* (Infrastructure NSW, 2018)
- *A Metropolis of Three Cities – the Greater Sydney Region Plan* (Greater Sydney Commission, 2018)
- *NSW Freight and Ports Plan 2018–2023* (Transport for NSW, 2018).

At the time of writing this submissions report, road traffic levels on most roads in Sydney have nearly returned to the levels experienced before NSW Government restrictions for COVID-19 were put in place. Further easing of restrictions such as reopening workplaces and continuing to reinstate public transport capacity may impact road traffic levels; however, it is not certain to what extent. Notwithstanding, the project (and associated traffic modelling) has been developed with a long-term view; as such, relatively short-term effects such as recessions are not expected to change the long-term growth (need) which will drive demand for this and other strategic transport projects.

Induced demand

As acknowledged in Section 3.3 of Appendix F (Technical working paper: Traffic and transport) traffic growth on new or upgraded roads is generally a result of the following influences:

- Regional increase in number of trips due to population growth and increased economic activity
- Trips attracted from competing routes or modes as a result of improved travel times on the new or upgraded road
- Induced demand (new trips) as a result of improved travel times between homes and destinations, such as workplaces, shopping centres and education facilities, which cause changes to region-wide trip patterns.

Even with no growth in regional population and economic activity, a new or substantially upgraded road can result in changes in trip patterns, which then appear as induced traffic demand. The SMPM includes the changes in traffic associated with all three of the above factors.

The SMPM develops forecast growth in traffic on the road network including growth in future car travel, based on forecasts for future multi-modal travel demand in Sydney as produced by the Sydney Strategic Travel Model (STM). Future growth in car travel in the SMPM fully recognises that people can choose to change their method of travel when and where costs of road travel increase, as is forecast through the mode choice processes of the STM.

The analysis of induced demand for the project at opening (2027) incorporates a completed WestConnex and Sydney Gateway motorway. Induced demand in the future 2037 scenario, which equates to about 0.3 per cent additional daily trips in the Sydney metropolitan area, would result in a negligible impact to the traffic network.

## C9.2 Impacts to strategic road network

### *Issue raised*

Submitters raised concerns/questions regarding the performance of the broader strategic road network. These include:

- Concerns that the project would not fix existing bottlenecks
- Queried how the project would impact on traffic flows at Sydney Harbour Bridge and Sydney Harbour Tunnel
- Concern that the project would increase local travel times and comment that the environmental impact statement should demonstrate meaningful travel time improvements
- Query about how places bypassed by traffic would benefit from the project
- Request a greater understanding of traffic benefits the project would provide in the future. The proposed project does not demonstrate a net improvement in traffic outcomes across the area
- Traffic impacts in areas such as Willoughby, Naremburn and Northbridge, and on key roads such as Military Road, Willoughby Road, Eastern Valley Way and High Street were not considered
- Concerns about rat running along local roads caused by drivers avoiding tolls or trying to avoid congestion caused by increased or altered traffic movements on main roads
- No plan for how “freed” capacity on the road network would be used to realise place-making opportunities
- Clarification requested on whether or not the government would take a policy position that queuing in motorway tunnels is not acceptable, and how this would be managed.

### *Response*

Traffic flows and congestion

One of the key objectives of the project is to provide a viable alternative harbour crossing, thereby improving traffic conditions on the road network. The increase in harbour crossing capacity and efficiency delivered by the project would also remove a major bottleneck that currently constrains the road transport capacity between areas north and south of the harbour (as per Section 3.5 of the environmental impact statement). Ongoing transport network improvement strategies and other key motorway connections across the Sydney network would be required to address the pressures of Sydney’s growing population over the longer term.

Under the ‘Do something’ scenario, the project is forecast to substantially reduce traffic demands and improve travel times on the Sydney Harbour Bridge, the Sydney Harbour Tunnel, ANZAC Bridge, and connecting road corridors (refer to Section 9.4.1 of the environmental impact statement). The project would provide an attractive alternative to the current Western Distributor and Sydney Harbour Bridge route, particularly for trips across Sydney Harbour between Rozelle and North Sydney (and the Lower North Shore). The trip distribution strategy between the Sydney Harbour Tunnel, Sydney Harbour Bridge and proposed Western Harbour Tunnel and Beaches Link program of works can be seen in Figure 5-17 of the environmental impact statement.

By moving bypass traffic underground, the Western Harbour Tunnel would reduce congestion on the motorway and arterial road network, which would offer flow-on benefits to the adjoining local network by reducing the impact of queuing on local high streets and local roads.

Benefits of the project and travel times

Strategic traffic modelling of the project indicates that the project would deliver substantial benefits to traffic travelling on the strategic road network, with trips between strategic centres saving up to 15

minutes when crossing Sydney Harbour during peak periods (refer to Section 7.1 of Appendix F (Technical working paper: Traffic and transport)). These travel time savings would substantially increase accessibility for these centres, increasing the catchment of residents who can travel within the '30 minute city' window that is critical to maintaining the vision of a productive city promoted by the Greater Sydney Commission.

The project would substantially improve travel times across Sydney Harbour. The greatest benefits would be for trips travelling between North Sydney and Rozelle. This trip is currently circuitous, requiring travel via ANZAC Bridge, Western Distributor and Sydney Harbour Bridge. The project would allow the bypass of these three highly congested sections of motorway and reduce travel times by up to 75 per cent, as outlined in Section 7.2.1 of Appendix F (Technical working paper: Traffic and transport).

The reduction in demand, congestion, and queuing on strategic corridors (due to the project) is expected to improve network performance on adjacent and connecting road links including local roads. This is demonstrated in the analysis of network performance in Section 7.5.1 of Appendix F (Technical working paper: Traffic and transport), which shows that average travel speeds through the Warringah Freeway and surrounds study area would increase, and the number of stops would substantially decrease as a result of the project. This would in turn improve the operation of the connecting road network given that existing queuing and congestion on the freeway frequently flows back and impacts on the surrounding road network.

Impacts on connecting suburbs and main roads

Traffic assessment study areas are shown in Figure 4-14 and Figure 4-29 of Appendix F (Technical working paper: Traffic and transport). Northbridge is not included in these areas because strategic modelling has been used to determine strategic impacts, which consequently defined the study areas for operational modelling and other analyses. The areas of Willoughby and Naremburn which are located within the study areas are assessed in sections 7 and 8 of Appendix F (Technical working paper: Traffic and transport).

Operational traffic impacts on Military Road, Willoughby Road and High Street can be found in sections 7.5 and 8.5 of Appendix F (Technical working paper: Traffic and transport), and is further discussed in Section C9.4.2 below. Eastern Valley Way is not located within the project study area because strategic modelling demonstrates that it would not be materially impacted by the project.

Rat running

While drivers may choose to avoid tolls, the SMPM toll choice assignment model was developed to model the range of driver behaviour and was adjusted to match the observed patronage on existing toll facilities. As a result, the modelling analysis has factored in potential toll avoidance behaviour. Section 7.2.4 of Appendix F (Technical working paper: Traffic and transport) states that tolling would be equalised across the Western Harbour Tunnel, Sydney Harbour Bridge, and Sydney Harbour Tunnel. As a consequence, there is no real potential for "rat running" toll avoidance.

Overall, forecast demands across Sydney Harbour show the project would allow for growth in cross harbour trips while also reducing traffic demands and consequent congestion on the existing crossings without any substantial impacts from toll avoidance behaviour (refer to Section 7.2.1 of Appendix F (Technical working paper: Traffic and transport)).

Traffic forecasting and analysis carried out for the project indicates it is unlikely the project would lead to a significant increase in traffic on lower order roads. Impacts would generally be confined to the Warringah Freeway and immediate surrounds.

Freed capacity and placemaking

Due to a general reduction in traffic and congestion, the project would provide the opportunity for Transport for NSW and other stakeholders, such as local councils, to investigate alternative uses for road space or carry out additional surface road improvements. A review of operational network performance will be carried out 12 months and five years from the opening of the project to confirm

the operational impacts of the project on surrounding arterial roads and major intersections (refer to environmental management measure OT1 in Table D2-1 of this submissions report). The assessment will be based on updated traffic data at the time and the methodology used will be comparable with this assessment. Any proposed updates arising from this review would be carried out in consultation with relevant stakeholders including local councils.

Queuing in motorway tunnels

Due to the direct benefit of moving bypass traffic underground, the project would result in reduced congestion on the surface arterial road network, which offers flow-on benefits to the adjoining local network, reducing the impact of queuing on regional and local roads. Although there is expected to be a general reduction in strategic demand and congestion on the road network, Transport for NSW would continue to monitor and manage strategic road network congestion and queuing as appropriate to the location.

## C9.3 Rozelle and surrounds

***Issue raised***

Submitters raised the following concerns and questions regarding traffic changes at Rozelle and surrounding areas:

- Submitters noted that predicted traffic on the ANZAC Bridge and the Gladesville Bridge would not decrease as a result of the project
- The project would not substantially improve network performance in Rozelle as shown by the modelled unreleased traffic in the 'Do something cumulative 2037' (morning peak) scenario and forecast increase in traffic demand in 2037. Submitters expressed concern that traffic demand would increase further with the completion of the Beaches Link and Gore Hill Freeway Connection project
- Concerns about a stated worsening of intersections on roads approaching the ANZAC Bridge
- The additional capacity on the Sydney Harbour Bridge and the ANZAC Bridge would cause an increase in vehicles entering Sydney CBD from the north and Rozelle area, which would cause significant downstream impacts to the city
- Comments were also received about the increased traffic on local roads throughout Rozelle, Lilyfield and Leichhardt and particularly at the intersection of City West Link and The Crescent, and Victoria Road and The Crescent
- Queried how many additional vehicles are projected along key corridors connecting to the CBD, specifically, ANZAC Bridge, Western Distributor, Druitt/Market/King/Harris/Wattle Streets.

***Response***

When operational, the project would substantially improve vehicle travel times along key traffic routes through Rozelle, resulting from a reduction in traffic demands and patterns with trips using the Western Harbour Tunnel component of the project in preference to existing surface routes including City West Link, ANZAC Bridge, and the Western Distributor.

While traffic demand is predicted to increase in both the 'Do something' and 'Do something cumulative' scenarios, average travel speeds through the Rozelle and surrounds area would improve by up to 60 per cent as a result of the project, despite the increase in demand, as described in Section 9.4.2 of the environmental impact statement and Section 8.4.2 of Appendix F (Technical working paper: Traffic and transport). This is a result of the large volume of traffic that would be diverted from the ANZAC Bridge and Western Distributor to the project, substantially reducing delays on this part of the existing motorway network. Furthermore, the number of stops would

decrease significantly as a result of the reduction in demand and congestion on the ANZAC Bridge and Western Distributor.

While the project would reduce traffic demand and congestion on the Sydney Harbour Bridge and the ANZAC Bridge (thereby increasing effective capacity), the project would also establish traffic bypass routes to move traffic around the Sydney CBD and thereby reduce congestion in the Sydney CBD.

This is supported by the modelled reduction in demand (refer to Table 7-3 of Appendix F (Technical working paper: Traffic and transport)) and indicates that downstream impacts to the Sydney CBD would therefore be unlikely. The reduction in demand, congestion, and queuing on strategic corridors surrounding Sydney CBD is expected to improve network performance on adjacent and connecting road links, including those within Sydney CBD.

The Rozelle and surrounds study area extends west to the intersection of City West Link/Balmain Road, which includes Lilyfield and is at the border between Lilyfield and Leichhardt. Increased traffic would largely be confined to the City West Link corridor and not on local roads in the Lilyfield and Leichhardt area. Further, as discussed above, improved traffic flow on strategic corridors is expected to similarly benefit connecting roads.

As described in Section 9.4.2 of the environmental impact statement, the intersection of The Crescent and City West Link would experience relatively minor increased delays in the PM peak as a result of the project, due to the additional movements introduced by the inclusion of the project tunnel portal at this location. Queuing at the intersection of City West Link and The Crescent would affect the intersections of City West Link with James Craig Road, Catherine Street and Balmain Road during the busiest peak periods; however, these intersections would still perform acceptably. The intersection of Victoria Road and The Crescent would also perform at a similar level under the ‘Do something’ and ‘Do something cumulative’ scenarios when compared to the ‘Do minimum’ scenario. While it is acknowledged there would be some localised delays at these intersections at peak times, this would be offset by the large travel time benefits provided by the project at the broader network level.

The modelled traffic demands on the ANZAC Bridge and Western Distributor are provided in Appendix F (Technical working paper: Traffic and transport). Given that traffic volumes decrease in the ‘Do something’ scenario for both 2027 and 2037 when compared to the ‘Do minimum’ scenario (ie without the project), it is anticipated that traffic impacts to the Sydney CBD would be a slight positive (refer to Section 7.2 of Appendix F (Technical working paper: Traffic and transport)). As discussed in Section B13.4.3 of this submissions report, the reduction in demand, congestion, and queuing on strategic corridors surrounding Sydney CBD is expected to improve network performance on adjacent and connecting road links, including those within Sydney CBD. Traffic volumes for Sydney CBD streets including Druitt Street, Market Street, King Street, Harris Street and Wattle Street were included in the model but not assessed in detail as they are expected to benefit rather than be impacted by the project.

## C9.4 Warringah Freeway and surrounds

### C9.4.1 Access

***Issue raised***

Submitters raised concerns about the changes in access to and from the Warringah Freeway, potentially causing more drivers to use the surrounding local road network to gain access. Specific comments include:

- Concern that a full and proper model of traffic impacts on local roads caused by the reconfiguration of access points on and off the Warringah Freeway has not been provided

- Concern that the reconfiguration of the Warringah Freeway would limit the flexibility to access exits, with specific mention to the use of lane dividers to prevent the crossing of freeway lanes
- Concern about access from the Warringah Freeway (southbound) Alfred Street North off ramp to travel northbound on Alfred Street North which would be removed as part of the project. The alternative access option is to take the High Street exit of Warringah Freeway and travel over the Mount Street Bridge via North Sydney, or take the Falcon Street exit and then go down Bent Street, or Ben Boyd Road and through North Sydney. Submitters were concerned that this could add twenty minutes or more onto a trip during peak traffic times. In addition, using Bent Street and Winter Avenue to access Alfred Street North would cause major congestion in narrow, one-way, winding and steep roads
- Objections to restricted turns from Amherst Street into Miller Street during peak periods and commented that traffic would most likely use the Palmer Street/Miller Street intersection to turn right which passes Cammeray Public School.

***Response***

Impacts on local roads due to changed access

Operational road modelling included the local road network surrounding the Warringah Freeway, as shown on Figure 9-2 of the environmental impact statement. Details of potential impacts are described in Section 7.5 of Appendix F (Technical working paper: Traffic and transport) and summarised in Section 9.4.4 of the environmental impact statement.

Key findings of the analysis include:

- Peak period traffic demand through the Warringah Freeway and surrounds study area would increase by 10 per cent in the morning peak and six per cent in the evening peak by 2037
- Average travel speeds through the Warringah Freeway and surrounds study area would increase as a result of the project due to the transfer of demand to the Western Harbour Tunnel
- The number of stops would decrease substantially as a result of the project. This would be a result of the large shift in traffic demand from the Sydney Harbour Bridge and Sydney Harbour Tunnel to the Western Harbour Tunnel, where traffic flows would be largely uninterrupted.

Changed access arrangements, including some restrictions, are proposed to support project design features and network performance. The access restrictions would improve the efficiency and flow of traffic on the Warringah Freeway. This would in turn improve the operation of the connecting road network given that existing queuing and congestion on the freeway frequently flows back and impacts on the surrounding road network. The strategic and operational traffic modelling indicate that the project design including proposed access restrictions would improve traffic conditions for the majority of road transport customers.

Access flexibility

For the Warringah Freeway Upgrade component of the project to achieve optimised connectivity for the harbour crossings to support the growth in traffic demand, an improvement of the bypass and access/distributor functions of the road corridor is required. This would require the current access arrangements to the Warringah Freeway corridor to be modified.

As discussed in Section 5.3 of the environmental impact statement, the Warringah Freeway Upgrade component of the project has been designed to improve wayfinding and separate traffic on the freeway depending on different trip functions (through traffic, traffic for arterial road distribution and traffic for local destinations). To achieve the outcomes of the trip distribution strategy, the

project includes upgrades to existing interchanges with High Street and Falcon Street, the provision of new, upgraded and relocated road bridges, and upgrades to the surrounding road network. Lane dividers would be used where appropriate to improve safety (in accordance with relevant guidelines).

These modifications would also result in improvements to performance, safety and wayfinding. Residents and businesses in the suburbs around the Warringah Freeway would remain closely connected to at least one harbour crossing, and in most cases have good access to multiple harbour crossing options.

A community communication fact sheet was released in March 2020 to help the community understand the new Warringah Freeway access arrangements provided by the project. This visual aid can be accessed here: *nswroads.work/whtportal-WFaccess*.

Alfred Street North

The access from the southbound off-ramp to travel northbound on Alfred Street North would be removed and traffic would be required to exit the Warringah Freeway at Falcon Street or continue onto High Street and travel via the local road network around Neutral Bay to access Alfred Street North, as outlined in Table 5-9 of the environmental impact statement.

This movement is currently used by one vehicle per minute during peak periods (it is a very low demand movement), and the alternative routes are not expected to significantly increase travel times.

Miller Street and Amherst Street

There are no turn restrictions proposed as part of the project at the intersection of Miller Street and Amherst Street.

### C9.4.2 Network performance of surrounding roads

***Issue raised***

Submitters raised concern that the network performance of roads surrounding the Warringah Freeway would worsen as a result of the project. Specific comments include:

- Concern that intersections surrounding the Warringah Freeway would have an unsatisfactory level of service, or would get significantly worse due to the large influx of additional traffic. Intersections along Miller Street through to Cammeray already carry high traffic and congestion and are predicted to get worse
- Concern that changed intersections on the Warringah Freeway may cause adverse traffic impacts and impact network performance on main traffic arteries such as Berry Street, Miller Street, Military Road and Willoughby Road
- Submitters believe the project should be modified to ensure additional traffic is kept out of the North Sydney CBD streets, such as Miller Street, Walker Street, Ridge Street, Berry Street and Maclaren Street
- Concern about the adverse effects the project would have on broader connecting traffic flows, for example pushing traffic to the Lower North Shore
- Concern that improvements to cross-city trips would be to the detriment of more local trips to and from Sydney CBD, the Lower North Shore, areas surrounding the Warringah Freeway and between the Lane Cove Tunnel/Longueville Road and the Gore Hill Freeway
- Concern that parking restrictions on Ben Boyd Road (as outlined in Chapter 5 (Project description), Table 5-12 of the environmental impact statement) would not reduce wait times at the Military Road/Ben Boyd Road intersection as the wait times are generated by the current complexities in turning left and right from Ben Boyd Road and the lack of a clear pathway for through traffic

- Confirmation requested that less traffic down Kurraba Road from Alfred Street North is expected with the project.

***Response***

Network performance

The planning and design of the project has adopted a holistic network traffic performance approach, focused on maximising benefits for the majority of customers' overall journeys. The planning and design process, including proposed interchange and intersection works, are also cognisant of broader aspects and constraints, for example:

- Considering the effects that major intersection works can introduce on upstream and downstream network elements
- Adopting a Movement and Place philosophy, minimising the potential to induce traffic on lower order roads by focusing on upgrades to strategic routes
- Avoiding property impacts where possible.

Primary metrics such as network and corridor speeds are provided in the environmental impact statement to demonstrate overall strategic customer benefits. Intersection metrics are provided for completeness to demonstrate potential localised impacts, but do not capture the majority of strategic benefits of the project.

Strategic traffic modelling of the project indicates that the project would deliver substantial benefits to traffic travelling on the strategic road network, with trips between strategic centres saving up to 15 minutes when crossing Sydney Harbour during peak periods (refer to Section 7.1 of Appendix F (Technical working paper: Traffic and transport)). These travel time savings would substantially increase accessibility for these centres.

Network statistics for the Warringah Freeway and surrounds study area show that the project and associated network changes would not impact overall network performance, despite an increase in demand of 10 per cent in the AM peak and six per cent in the PM peak by 2037. Average travel speeds through the Warringah Freeway and surrounds would improve as a result of the project. This is due to the transfer of traffic to the Western Harbour Tunnel which would also result in reduced congestion on the Sydney Harbour Bridge and Sydney Harbour Tunnel, again improving conditions on connecting regional and local roads.

Section 7.5.3 of Appendix F (Technical working paper: Traffic and transport) notes that while the project would not resolve localised performance issues at a number of intersections, it would generally improve network performance for surrounding roads and would facilitate an overall net increase in the efficiency of traffic flows and average network speeds.

Impacts to arterial roads

*North Sydney*

Proposed road integration works and resultant traffic performance in the North Sydney area have been developed in the context of the growing North Sydney CBD environment. Options to further increase traffic performance at intersections throughout the area have been investigated. However, these alternative options would result in impacts on other stakeholders, including pedestrians, and the potential need for major property acquisitions. This is discussed in Section 7.5.3 of Appendix F (Technical working paper: Traffic and transport).

The proposed works are considered to provide a balanced and integrated transport network while minimising potentially wide-ranging impacts through and surrounding North Sydney. Further refinements and changes to network operations within the North Sydney CBD may occur as part of the North Sydney Integrated Transport Program (the North Sydney Program), a multi-agency collaboration. As part of the collaboration, the multi-agency group will ensure the future integrated transport network and place-based vision for North Sydney is supported through projects such as

the Western Harbour Tunnel and Warringah Freeway Upgrade project (refer to Section A4.1.3 of this submissions report for more details).

Berry Street already contains four lanes in some sections and provides access from North Sydney to Warringah Freeway northbound and Bradfield Highway/Cahill Expressway southbound, as outlined in Table 4-10 of Appendix F (Technical working paper: Traffic and transport). It is also noted that the four lane arrangement along Berry Street is only proposed during peak periods through the implementation of clearways – at other times of the day, Berry Street would remain as per existing with two trafficable lanes and parking lanes on both kerbsides.

Section 7.5.2 of Appendix F (Technical working paper: Traffic and transport) identified that travel from Berry Street to Amherst Street, along Miller Street, would be subject to localised delays due to changes in demand and traffic patterns under the 'Do something' scenario. Table 9-7 of the environmental impact statement shows there would be delays of up to four minutes in the northbound direction in the evening peak under the 'Do something 2037' scenario (when compared with the 'Do minimum' scenario). These impacts would be relatively minor compared to the broader strategic benefits and network improvements.

Under the 'Do something' (with project) scenario, the proposed phasing and access changes around the intersection of Miller Street and Berry Street would simplify the operation and increase the capacity of these roads to offset potential travel delays during the AM peak (refer to Section 9.4.4 of the environmental impact statement). Due to the predicted growth in North Sydney in the future, intersection performance during the PM peak would be poor under both the 'Do minimum' (without project) and 'Do something' (with project) scenarios at the Miller Street and Berry Street intersection. Other key intersections in North Sydney, such as at Miller Street/Falcon Street and Pacific Highway/High Street/Arthur Street, would see improved performance or no change under the 'Do something' scenario.

It is also noted in Section 7.5.3 of Appendix F (Technical working paper: Traffic and transport) that although the project would not resolve localised performance issues at a number of intersections in the North Sydney area, the project would improve the efficiency of traffic flows and consequently average network speeds in North Sydney. This is considered a balanced and acceptable outcome.

*Military Road*

Under the 'Do something 2027' scenario, it is acknowledged the intersection of Ben Boyd Road and Military Road would operate with higher delays as a result of the project (when compared with the 'Do minimum' scenario) due to changes to access and travel patterns at the Ernest Street and Falcon Street interchanges (refer to Section 9.4.4 of the environmental impact statement). However, as outlined in Table 9-8 of the environmental impact statement there would only be an average delay of about one minute at this intersection under this scenario.

The works in the area proposed by the project seek to maintain an appropriate level of traffic movement while also preserving capacity and connectivity for other customers whose needs conflict with traffic, particularly pedestrians. Additionally, minor delays at local intersections would be offset by the substantial travel time savings on the broader network (via the Warringah Freeway and Sydney Harbour crossings).

*Willoughby Road*

The intersection level of service at the Willoughby Road/Gore Hill Freeway interchange would substantially improve during peak hours under the 'Do something' (with project) scenario compared to the 'Do minimum' (without project) scenario, as outlined in Table 7-23 of Appendix F (Technical working paper: Traffic and transport).

The project is not anticipated to result in a substantial increase in traffic volumes along Willoughby Road through Crows Nest village and surrounding streets.

Traffic flows and travel times

It is acknowledged the traffic movement that would be facilitated by the project may also increase traffic demands at either end of the project, where it would integrate with the existing road network. There would be some residual localised delay surrounding these interface precincts, however, the additional delay would be offset by the large travel time benefits provided by the project at the broader network level. Project integration works have been developed to minimise the impact of additional travel facilitated by the project and ensure that the competing needs of customers (including private vehicles, public transport passengers, cyclists and pedestrians) have been incorporated into a balanced, equitable outcome (as per Section 7.1 of Appendix F (Technical working paper: Traffic and transport)).

Eastbound travel times from the Lane Cove Tunnel and Longueville Road to Gore Hill Freeway would increase with the project during the morning peak, as outlined in Section 7.6.2 of Appendix F (Technical working paper: Traffic and transport). This is due to the potential increased traffic demands from both Longueville Road and the Pacific Highway to the Gore Hill Freeway. Evening peak eastbound travel times from Longueville Road to Gore Hill Freeway would also increase, although not to the extent of the morning peak. Travel times for other trips along the Gore Hill Freeway would remain largely unchanged as a result of the project. Although eastbound traffic would be impacted by a localised increase in travel times approaching Gore Hill Freeway, modelling of the Warringah Freeway indicates that this traffic would generally benefit from substantial travel time savings on the Warringah Freeway and Sydney Harbour crossings. Consequently, traffic impacted on the Gore Hill Freeway is still anticipated to receive a net benefit due to downstream efficiency improvements delivered by the project.

Ben Boyd Road

Table 5-12 of the environmental impact statement describes the network changes required to support changes in the distribution of traffic as a result of the project. The table does not propose that the parking restrictions on Ben Boyd Road would reduce wait times at the intersection of Military Road/Ben Boyd Road. The works in the area proposed by the project seek to maintain an appropriate level of traffic movement while also preserving capacity and connectivity for other customers whose needs conflict with traffic, as outlined in Section 7.5.3 of Appendix F (Technical working paper: Traffic and transport).

Kurraba Road

Removal of access from the Alfred Street North southbound off ramp to Alfred Street North in the northbound direction would result in a reduction of traffic on Kurraba Road between Alfred Street North and Clark Road.

### C9.4.3 High Street interchange upgrade

***Issue raised***

Submitters raised the following questions and concerns regarding the High Street interchange upgrade:

- Questioned the performance of the High Street/Clark Road intersection under the ‘Do something cumulative’ scenario during the AM peak hour and raised concern about the intersection performance
- Submitters noted that the roundabout to the east of the High Street bridge acts as an efficient regulator of traffic, controlling traffic merging from High Street and Alfred Street, regulating the queueing of traffic proceeding down to Clark Road, and allowing traffic returning to North Sydney to flow freely. Submitters raised concerns about changes to the intersection of High Street and Alfred Street commenting that current traffic problems at this intersection are actually a function of traffic issues at the corner of High Street and Clark Road and would not be improved by the changes

- The proposed design removes a dedicated turning lane into Whaling Road. Submitters raised concerns that as a result, any traffic which needs to turn into Whaling Road would be stuck behind the usual long queue of turning traffic which goes down High Street to Clark Road.

***Response***

It is acknowledged that the level of service of the High Street/Clark Road intersection would worsen under the 'Do something cumulative 2027' scenario (as per Table 9-8 of the environmental impact statement) when compared with the 'Do minimum 2027' scenario. Modelling results indicate that there would be an increase in delay from 18 seconds to 32 seconds in the morning peak. However, modelling shows that under the 'Do something cumulative 2037' scenario, the intersection performance would improve when compared with the 'Do minimum' scenario with average delays decreasing from 55 seconds to 38 seconds.

Overall these delay differences at the High Street/Clark Road intersection are small when considered in the context of a typical road users journey across the broader road network during peak periods, and would be offset by broader network benefits (as demonstrated by the network statistics provided in Section 9.4.1 of the environmental impact statement).

Access to Whaling Road from Alfred Street North would be maintained as per the existing arrangement, as shown on Figure 5-26 and Table 5-10 of the environmental impact statement. Traffic modelling carried out shows that there would not be queues impacting the High Street/Clark Road intersections.

### C9.4.4 Falcon Street interchange upgrade

***Issue raised***

Submitters raised the following concerns and objections to the Falcon Street interchange upgrade:

- The diamond arrangement at the upgraded Falcon Street intersection would make east-west routes more time consuming, as it sees east-west traffic crossing paths twice
- Submitters commented on the current delays and tailbacks on the Falcon Street ramps, noting that the right-hand turn towards Neutral Bay is often queued back down the Warringah Freeway. This impacts traffic trying to travel straight ahead. Submitters note the environmental impact statement indicates delays would still be common after the intersection is upgraded and question whether the project would improve congestion
- Submitters were concerned that the changed traffic flows at the intersection of Merlin Street and Falcon Street, preventing a left-hand turn continuing westbound on Falcon Street, and a right hand turn eastbound along Falcon Street (shown on Figure 5-27 of the environmental impact statement), would increase travel time.

***Response***

The Falcon Street interchange would be upgraded to a diverging diamond interchange configuration as part of the Warringah Freeway Upgrade component to integrate with, and manage the redistribution of traffic as a consequence of the Western Harbour Tunnel and Beaches Link program of works, as discussed in Section 5.3.4 of the environmental impact statement.

Diverging diamond interchanges are characterised by cross-over intersections at each end of the interchange, which temporarily swap the directional carriageways across the bridge. In doing so, this swap converts the traditional conflicting right turn movements to free-flow right turn movements (as per Table 5-10 of the environmental impact statement).

Northbound travel times along Warringah Freeway to Falcon Street would generally improve as a result of the project. This is partially due to the increased capacity provided by the reconfiguration of the Falcon Street interchange to a diverging diamond configuration, which would reduce conflicts

between traffic exiting the freeway and through-traffic on Falcon Street, as outlined in Section 9.4.4 of the environmental impact statement.

The design does not allow a left turn from Merlin Street onto Falcon Street or onto Warringah Freeway northbound (refer to Section C5.2.3 of this submissions report). Vehicles travelling from Merlin Street to Crows Nest could do so via various alternative routes, including use of the Pacific Highway via the High Street interchange, turning right from Merlin Street onto Falcon Street and then performing a U-turn via Tramway Lane, or using Ben Boyd Road to access Ernest Street. Transport for NSW recognises that this is an important local connection and is currently investigating opportunities to provide a similar level of connectivity to the existing arrangement while managing the wider traffic network impacts and safety issues. Vehicles wishing to travel eastbound on Falcon Street from Merlin Street would be able to do so.

### C9.4.5 Ernest Street interchange

#### *Issue raised*

Submitters raised concerns regarding changes to the Ernest Street interchange to allow access to and from the Sydney Harbour Tunnel and removal of existing connectivity to the Sydney Harbour Bridge. Submitters raised the following concerns regarding these changes:

- Submitters from the Middle North Shore raised concerns about the impacts of changing the on ramp at Ernest Street to provide access to Sydney Harbour Tunnel only. The environmental impact statement shows that the Ben Boyd Road/Military Road intersection at Neutral Bay would perform poorly under both the project and with the additional Beaches Link and Gore Hill Freeway Connection project. Submitters were concerned that poor performance of that intersection in the traffic modelling demonstrates that rat running through Mosman and Cremorne would increase, and traffic would continue to back up to Spit Bridge along Military Road
- New northbound access between Sydney Harbour Tunnel and Ernest Street would require journeys of up to two kilometres along local roads in school zones, residential areas and shopping centres in North Sydney and Crows Nest (Ernest Street, Miller Street, West Street, Alexander Street)
- Currently westbound Sydney Harbour Bridge traffic is split between the Falcon and Ernest Street ramps. Diverting all traffic to Falcon Street would put strain on the already-congested Military Road. This could cause rat running in Mosman, Cremorne and Neutral Bay as drivers using the Ourimbah Road route to the Warringah Freeway find alternate ways to access Military Road to get to Falcon Street. This would also cause significant travel delays for vehicles making right turn movements at intersections onto Military Road from Ben Boyd, Winnie Streets and Cowles Road
- Comment that proposed changes to Ernest Street on and off ramps would encourage drivers heading east or west on Ernest Street to use both Lytton and Moody Streets in Cammeray as shortcuts to access Falcon Street (and from there the Sydney Harbour Bridge).

#### *Response*

Access from Ernest Street to the Sydney Harbour Bridge (Bradfield Highway only) southbound would be removed, as outlined in Table 5-9 of the environmental impact statement. However, adjacent interchanges to the north and south of Ernest Street would provide similar, alternative connectivity to that currently provided by Ernest Street. Similarly, access to Ernest Street from the Sydney Harbour Bridge (Cahill Expressway and Bradfield Highway) northbound would be removed, and adjacent interchanges to the north and south of Ernest Street would provide similar, alternative connectivity to that currently provided by Ernest Street.

While the connectivity between Ernest Street and the Sydney Harbour Bridge would be removed, the Ernest Street interchange would be changed to allow access to and from the Sydney Harbour

Tunnel (shown on Figure 5-18 of the environmental impact statement). Trips between Ernest Street and the Sydney Harbour Tunnel would not require journeys through local streets. Modelling indicates that vehicles currently travelling from Mosman and the surrounding areas to the Sydney CBD and Eastern Sydney would either use Military Road and Sydney Harbour Bridge via the Falcon Street Interchange or travel along Ourimbah Road and access Sydney Harbour Tunnel via the Ernest Street Interchange, rather than rat running through local roads. As a result of the increased flexibility and additional options for travel provided by the project, there are not expected to be major impacts at a local level where traffic is forced to use a single access point.

It is acknowledged the intersection of Ben Boyd Road and Military Road would also operate with longer delays as a result of the project due to changes to access and travel patterns at the Ernest Street and Falcon Street interchanges. The increase in delay at this intersection is relatively small and would be offset by the large travel time benefits provided by the project at the broader network level, as shown by traffic modelling results.

Overall, although the project would generally improve network performance for roads surrounding North Sydney and Neutral Bay, it would not resolve localised performance issues at a number of intersections. However, considering that the project would facilitate an overall net increase in traffic efficiency and average network speeds in North Sydney, this is considered a balanced and acceptable outcome. Further refinements and changes to network operations within the North Sydney CBD may occur as part of the North Sydney Integrated Transport Program (refer to Section A4.1.3 of this submissions report for further information)

The concern about some drivers using Lytton Street and Moodie Street to access Falcon Street is acknowledged. Given the overall network benefits and availability of alternative motorway interchanges it is not expected that the project would materially increase the potential for this to occur. As outlined in environmental management measure OT1 (refer to Table D2-1 in this submissions report), a review of operational network performance will be carried out 12 months and five years from the opening of the project to confirm the operational impacts of the project on surrounding arterial roads and major intersections. The assessment will be based on updated traffic data at the time and the methodology used will be comparable with that used in this assessment.

### C9.4.6 Gore Hill Freeway and Artarmon

#### *Issue raised*

Submitters raised the following concerns regarding the project in the vicinity of the Gore Hill Freeway and Artarmon:

- Submitters questioned what actions would be taken to reduce pressure on the Gore Hill Freeway pinch point at Naremburn
- Concerns about increased congestion on Reserve Road and Dickson Avenue in Artarmon. More information is requested for comment by the community before the project is approved.

#### *Response*

It is recognised that growth in traffic demand along the Gore Hill Freeway corridor would be constrained at either end (Lane Cove Tunnel and Warringah Freeway), as outlined in Section 7.6.1 of Appendix F (Technical working paper: Traffic and transport).

Road integration works associated with the Beaches Link and Gore Hill Freeway Connection project could facilitate additional traffic travelling through the corridor at a generally similar or reduced level of delay than under the ‘Do minimum’ scenario. Components of that project could be brought forward and carried out alongside the project to improve traffic conditions under the ‘Do something’ scenario (subject to obtaining relevant approvals). The road network would be monitored to determine if and when the network integration works proposed by the Beaches Link and Gore Hill Freeway Connection project should be delivered by Transport for NSW to maintain efficient network operations in this area. Although considered unlikely, if the project did materially impact

performance in this area, conversion of transit lanes to regular lanes along Gore Hill Freeway will be considered if there is a traffic performance requirement/benefit in peak times (refer to OT2 in Table D2-1 of this submissions report).

Modification of the signal phase arrangements at the Reserve Road interchange would reduce delays at this intersection and improve the operation of adjacent intersections, particularly at the Reserve Road/Barton Road intersection during the morning peak under the 'Do something' scenario (refer to Section 7.6.3 of Appendix F (Technical working paper: Traffic and transport)).

The intersection level of service at Reserve Road/Dickson Avenue would not substantially change during the morning peak and evening peak periods under the 'Do something' scenario when compared with the 'Do minimum' scenario, as shown in Tables 7-33 and 7-34 of Appendix F (Technical working paper: Traffic and transport).

## C9.5 Road safety

### C9.5.1 Motorist safety

***Issue raised***

Submitters raised several safety concerns regarding the project. Specific concerns include:

- Local commuters would be required to use on and off ramps alongside large trucks and vans
- The re-routing of traffic as a result of the interchange upgrades would create dangerous conditions as traffic flows through local streets increase to get to altered access points
- Increased traffic speeds along High Street as a result of the proposed design for the High Street interchange would increase the danger for residents turning into and coming out of their garages and carports
- Concern that the provision of a southbound entry point to the Western Harbour Tunnel and introduction of a fourth lane on Berry Street would encourage commuters to drive faster through the intersections and lights as they approach the entry point
- Concern about safety at the proposed right turn access from Merlin Street to Falcon Street eastbound (as part of the Falcon Street interchange upgrade). The traffic island could be widened to allow for safe turning, or lights could be synchronised prior to the entrance lane to stop the main flow of traffic and allow vehicles to safely proceed northbound from Merlin Street turning right into Military Road
- Concerns about safety due to the removal of access from the Alfred Street North southbound off ramp to travel northbound on Alfred Street North:
    - Increased safety risks as people may reverse down Alfred Street North the wrong way and emergency vehicles would have greater difficulties accessing the street
    - Result in the need to travel along Warringah Freeway southbound, up the Falcon Street eastward ramp, along Tramway Lane and then across Falcon Street to reach the far south lane of Falcon Street, before finally turning left into Merlin Street, is potentially very dangerous due to the need to cross four lanes of traffic on Falcon Street.

***Response***

The project has been designed to provide efficient, free flowing traffic conditions with capacity to safely accommodate forecast traffic volumes. The project design incorporates all feasible and reasonable traffic safety measures including those related to geometry, pavement, lighting, signage and shared user facilities consistent with current Australian Standards, road design guidelines and industry best practice. In doing so, the design of the project inherently minimises the likelihood of incidents and accidents.

The Western Harbour Tunnel would substantially change the volume of traffic travelling on arterial roads at the metropolitan level, as discussed in Section 7.2.6 of Appendix F (Technical working paper: Traffic and transport). Trips through the Western Harbour Tunnel on the motorway network would be on a higher standard of road than urban arterial roads. Once the Western Harbour Tunnel is in operation, traffic volumes on the arterial roads would decrease and a corresponding decrease in crashes would be expected. The road safety assessment indicates that overall crashes across the network would decrease by up to 375 crashes per year as a result of the Western Harbour Tunnel.

In addition to these likely road safety benefits associated with a reduction in the number of crashes, the project would substantially reduce the volumes of trucks travelling on arterial road corridors. This would also increase road safety on these arterial corridors and potentially reduce the severity of crashes, which would be less likely to involve heavy vehicles.

While it is acknowledged that the project would result in changes to entry and exit points, overall it would improve network performance and provide more flexibility and options to road users. As a result of the increased connectivity provided by the project, road users would have multiple travel options, and traffic would disperse through the local road network leading to improvements in traffic conditions rather than forcing road users to a single access point.

Concerns regarding traffic speeds on High Street and Berry Street are acknowledged, however drivers using the local road network would be required to follow driving rules and regulations, including travelling at or below the posted speed limit and following regulatory signage and pavement markings.

Traffic travelling north along Merlin Street would be able to safely turn right on to Falcon Street (eastbound) via the signalised intersection.

The removal of the existing direct connection from the Warringah Freeway off ramp to Alfred Street North is required as there would be grade separation between the off ramp and Alfred Street North to improve traffic efficiency. Traffic would be required to use alternative routes, for example exiting the Warringah Freeway at Falcon Street and travelling to Alfred Street North via Merlin Street. This alternative route is an existing movement which is safely performed by vehicles every day. Alternatively, road users could continue on the Warringah Freeway to High Street and travel via the connecting road network around Neutral Bay to access Alfred Street North.

### C9.5.2 Pedestrian and cyclist safety

***Issue raised***

Submitters raised general concerns regarding the impact of the project on pedestrian and cyclist safety. Specific concerns included:

- Increased traffic in North Sydney and Cammeray caused by the project would increase risk to pedestrians and cyclists particularly around schools
- Concern about the safety of pedestrians and cyclists crossing Brook Street at grade vehicles on the Brook Street on-ramp. Submitters queried as to what the safety threshold requirements might be to warrant dedicated pedestrians/cyclist bridge
- Concern removal of parking would expose pedestrians to safety risks from traffic. Request short crossings at intersections in North Sydney to keep parked cars in the streets to separate traffic from footpaths
- Concern that the removal of kerb build outs at the intersection of Berry Street/Miller Street would increase safety risks for pedestrians using Victoria Cross Metro Station
- Concern that increased traffic volumes in Crows Nest Village due to changes in access to Warringah Freeway will impact pedestrian safety.

***Response***

Overall, the project would result in a number of safety benefits for pedestrians and cyclists. The project would result in a decrease in traffic on arterial roads, reducing potential for interactions between vehicles and pedestrians or cyclists. The project would also reduce the potential severity of these interactions as they would be less likely to involve heavy vehicles.

Table 8-22 of the environmental impact statement indicates that the project would improve the performance of the Brook Street on ramp resulting in decreased congestion and traffic delays. The project is not anticipated to result in a substantial increase in traffic volumes along the Brook Street on ramp, and as such would not result in increased risks to pedestrians and cyclists travelling on Brook Street.

The removal of parking would not substantially increase risks to pedestrian safety. Limiting or restricting parking along roads is common practice in NSW, particularly within dense urban areas, and is not considered a safety issue.

The project would include changes to the intersection of Berry Street and Miller Street near Victoria Cross Metro Station. This would include the conversion of the existing pedestrian crossings to a scramble crossing, with a pedestrian only phase. This would allow pedestrians to safely access any leg of the intersection during the pedestrian only phase. Changes to kerbing at this intersection would be designed to minimise potential safety risks to pedestrians. Transport for NSW will continue to work closely with North Sydney Council and other key stakeholders through agreed governance structures to investigate options to improve movement and place outcomes through the North Sydney Program (refer to Section A4.1.3 of this submissions report for further information).

The project is not anticipated to result in a substantial increase in traffic volumes along Willoughby Road through Crows Nest village, and as such would not result in increased risks to pedestrian safety.

## C9.6 Public and active transport

### C9.6.1 Public transport

***Issue raised***

Submitters have raised general concerns that the project would impact on the operation of existing public transport. Specific concerns included:

- Chapter 9 (Operational traffic and transport) of the environmental impact statement and Appendix F (Technical working paper: Traffic and transport) state that Military Road bus travel would remain unchanged, which is contrary to project claims in Chapter 3 (Strategic context and project need) of the environmental impact statement, that users of bus services would benefit along the route
- Comment that the environmental impact statement does not offer a separate analysis for buses, and that only a limited number of bus trips were modelled
- Comment that the environmental impact statement does not name the bus routes servicing Cammeray which also service North Sydney
- Submitters commented that peak bus trip times in the environmental impact statements shows an increase in travel time journeys overall, with several trips between the Sydney Harbour Bridge and locations in North Sydney up to 10 minutes slower in ten years compared to now. Submitters believe any improvements are marginal and that there would be a net degradation of services which does not meet project objectives
- Submitters commented that bus travel times would be adversely affected, despite speedier travel times in the tunnel, by the lack of dedicated bus lanes before and after

- The environmental impact statement has not assessed changes to bus service reliability. Submitters are particularly concerned over the removal of the bus 'layover' on Warringah Freeway. This is used to manage timing of buses meaning the service would become less reliable and push people to commute privately
- Submitters objected to the removal of the bus stops on Miller Street as this would remove a central transport hub for locals changing buses to reach their place of work or home.

***Response***

Military Road bus travel

The Western Harbour Tunnel and Beaches Link program of works would create a connected and integrated road and public transport network. This includes providing opportunities for new and improved express bus services to Sydney CBD and North Sydney for interchange with the Sydney Metro and Sydney Trains.

By reducing pressure on existing arterial road corridors, the program would provide benefits to users of surface bus services on Warringah Road and Military Road. This is confirmed in Section 8.5.1 of Appendix F (Technical working paper: Traffic and transport) which discusses the network performance under the 'Do something cumulative' scenario. Peak northbound traffic in the evening peak would benefit from the improved capacity provided by the proposed Beaches Link and Gore Hill Freeway Connection, which would provide an alternative route to existing congested corridors including Military Road. A clarification has been provided in Section A4.2 of this submissions report to confirm the benefits to bus services along Military Road.

Assessment of buses

A separate analysis of public transport impacts (ie bus travel times) is included for each study area in Section 7 and 8 of Appendix F (Technical working paper: Traffic and transport). All bus routes that pass through the project area are stated in Section 4 of Appendix F (Technical working paper: Traffic and transport). Key bus routes were modelled through each study area to understand the benefits and impacts of the project on bus performance.

The existing bus routes servicing Cammeray are shown on Figure 8-7 of the environmental impact statement and discussed in further detail in Section 4.3.7 of Appendix F (Technical working paper: Traffic and transport). All routes potentially impacted by the project have been considered in Appendix F (Technical working paper: Traffic and transport) and subsequently summarised in Chapter 9 (Operational traffic and transport) of the environmental impact statement.

Travel times

Section 7.1 of Appendix F (Technical working paper: Traffic and transport) notes that overall, the project would deliver substantial benefits to traffic travelling on the Sydney road network, with trips between strategic centres saving up to 15 minutes when crossing Sydney Harbour during peak periods. Existing bus services would save up to 20 minutes of travel time crossing Sydney Harbour as a result of improved bus priority and reduced traffic conflicts on Warringah Freeway.

Modelled future bus travel times for key routes in the Warringah Freeway and surrounds study area under the 'Do minimum' (without the project) scenario, indicates that southbound bus travel times through North Sydney CBD, either via Pacific Highway or Miller Street, would increase in the future due to planned growth in the area (as discussed in Section 6.4.3 of Appendix F (Technical working paper: Traffic and transport)). Under the 'Do minimum' scenario, for buses travelling into Sydney CBD, increased queues from the additional traffic travelling through the Cahill Expressway via Sydney Harbour Bridge would result in queuing across the bus lane south of Falcon Street and south of High Street. This would substantially increase travel times to the Sydney CBD from Gore Hill Freeway and North Sydney, as these queues are likely to block access for buses travelling along this lane.

Modelled future (2027 and 2037) bus travel times for key routes through the Warringah Freeway and surrounds study area under the 'Do something' (with project) scenario are presented in Table 7-

27 and Table 7-28 of Appendix F (Technical working paper: Traffic and transport). Analysis of the times indicates:

- Travel times for buses from Gore Hill Freeway to the Sydney Harbour Bridge would improve substantially, particularly southbound during peak periods. This is due to the reconfiguration of the southbound bus lane between Miller Street and the Cahill Expressway, which has been separated from the general traffic lanes. Northbound bus travel times would also improve due to a reduction in traffic demand and congestion on the Sydney Harbour Bridge as a result of an additional harbour crossing (Western Harbour Tunnel)
- Travel times for buses travelling to and from Falcon Street would improve as a result of the reconfiguration of the southbound bus lane and reduced congestion on the Sydney Harbour Bridge and surrounds
- Travel times on bus routes through North Sydney via Miller Street would generally be maintained, although some localised delays could occur during the busiest peak periods
- Travel times on bus routes through North Sydney from Pacific Highway would increase during the busiest peak periods. This is due to the increase in demand and congestion between Berry Street and Miller Street as a result of redirecting traffic from Miller Street (resulting from the removal of the existing right turn from Miller Street northbound to Berry Street eastbound).

The project itself could also facilitate the operation of express buses that would provide direct access between major centres on the Lower North Shore and Inner West. Alignment with project objectives is discussed in detail in Section C3.1.5 of this submissions report.

The North Sydney Program is an ongoing, multi-agency collaboration that considers strategic public transport connections to the North Sydney CBD including the provision of bus priority lanes. The provision of bus priority lanes within the North Sydney CBD would need to be balanced against the impacts to the movement of other transport customers and placemaking considerations as part of this process. Refer to Section A4.1.3 of this submissions report for further information.

Bus layover facilities on Warringah Freeway

As discussed in Section 8.4.3 of Appendix F (Technical working paper: Traffic and transport), bus priority infrastructure and the capacity of layover facilities on the Warringah Freeway in the southbound direction would be maintained during both construction and operation. Table 5-3 of the environmental impact statement advises that the project includes relocation of the existing bus layover on the Warringah Freeway from north of Ernest Street to within the widened section of the Warringah Freeway near the Cammeray Golf Course and on the Cahill Expressway at Milsons Point.

Bus stop relocation

Figure 5-31 of the environmental impact statement shows the proposed upgrades and changes to the surrounding road network of the Warringah Freeway Upgrade component of the project the project scope does not include changes to bus stops at Miller Street. It may be necessary to temporarily relocate the bus stops on Miller Street at the intersection with the Pacific Highway and at Miller Street at the intersection with Falcon Street in both the northbound and southbound directions during construction of the project. Disruption to bus customers will be minimised by relocating the bus stops to the closest practical alternative. Any adjustments to existing bus stops will be determined in consultation with relevant stakeholders including other divisions of Transport for NSW, and advanced notification will be provided to affected bus customers. Relocations will be as close as feasible and reasonable to their existing position (refer to environmental management measure CTT10 in Table D2-1 of this submissions report). Advanced notification will be provided to affected bus customers. These arrangements will be temporary and will not continue during operation of the project.

### C9.6.2 Active transport

#### *Issue raised*

Submitters have raised concerns regarding the impact to pedestrian and cycle infrastructure, connectivity and access. Specific concerns include:

- Comment that the environmental impact statement lacked detail about how pedestrians would navigate changed intersections, easily and safety. The figures in the environmental impact statement show very limited improvements to pedestrian links
- Comment that the environmental impact statement is inaccurate in its description of the pedestrian and cycle network in the Rozelle precinct in the Victoria Road area. The environmental impact statement suggests that the pedestrian bridge over Victoria Road at Lilyfield Road is open when in fact it is closed
- Concern that cycling times around Naremburn may be increased due to the changed intersection of West Street and Amherst Street
- Concern about possible impacts on the freeway overbridge on West Street which is used by pedestrians, including school children and dog walkers accessing St Thomas Rest Park
- Concern that the replacement Ridge Street overpass would be located further away from North Sydney and Miller Street bus stops, adding time to foot journeys
- Concerns that Berry Street becoming a four-lane route would discourage pedestrians and cyclists
- Concerns that increased traffic from the tunnel would impact on trials by North Sydney Council of 30 kilometre speed zones and investment in walking and cycling infrastructure
- Request for the retention of the traffic light pedestrian crossing at the Bayer building on Alfred Street North over the Mount Street overpass. These lights provide essential access for residents including many older residents to North Sydney
- Suggestion to set traffic lights to prioritise pedestrians and cyclists over traffic.

#### *Response*

Active transport infrastructure to be provided is outlined in in Chapter 5 (Project description) of the environmental impact statement (in particular Table 5-13, Figure 5-3 and Figure 5-4). This includes both cycleways and pedestrian/shared paths. Refer to Section C9.9 below for discussion on the designed safety and accessibility of new and upgraded pedestrian and cycle infrastructure.

While some existing active transport infrastructure may be impacted, the project commits to upgrading, replacing and providing new infrastructure. Table 5-13 of the environmental impact statement outlines the pedestrian and cyclist infrastructure to be provided as part of the Warringah Freeway Upgrade component of the project. Impacts to active transport were assessed as part of the traffic and transport assessment, as discussed in Appendix F (Technical working paper: Traffic and transport).

Section 4.2.8 of Appendix F (Technical working paper: Traffic and transport) identifies two shared user bridges spanning Victoria Road. It is acknowledged that as part of the M4-M5 Link project, changes have been made to one of these bridges since the environmental impact assessment was prepared. The Western Harbour Tunnel and Warringah Freeway Upgrade project does not include any surface works in the Rozelle/Bays area, with all surface integration works, including active transport upgrades, being delivered as part of the approved and under construction M4-M5 Link project. Potential impacts of surface works in the Rozelle/Bays area were assessed and approved in the environmental impact statement for the M4-M5 Link project. The project would not directly interact with active transport upgrades being carried out as part of the approved M4-M5 Link project, nor would additional surface works be required post-completion of the M4-M5 Link works.

There would be no changes to the intersection of West Street/Amherst Street as part of the project (as shown on Figure 5-32 of the environmental impact statement). Additionally, impacts to cycling times in Naremburn are not anticipated as per sections 7.5.6 and 7.6.6 of Appendix F (Technical working paper: Traffic and transport).

As shown on Figure 5-32 of the environmental impact statement, there would be no changes to the West Street overbridge as part of the project.

As shown on Figure 5-29 of the environmental impact statement, the new Ridge Street shared user bridge would connect to Ridge Street in the same location as the existing pedestrian bridge. The narrow Ridge Street pedestrian bridge would be replaced and upgraded to provide a wider dedicated pedestrian path and cycle lane, enhancing pedestrian and cyclist safety, accessibility and connectivity. Distance from the bridge to North Sydney and Miller Street bus stops would therefore be unchanged.

As outlined in Table 4-10 of Appendix F (Technical working paper: Traffic and transport), Berry Street already contains four lanes in some sections and provides access from North Sydney to Warringah Freeway northbound and Bradfield Highway/Cahill Expressway southbound. Capacity and configuration works would be carried out by providing of a fourth eastbound lane to a small section of Berry Street (from the west of the Berry Street and Miller Street intersection to around west of Denison Street) during peak periods, typically 7am to 9am and 4pm to 6pm. Outside of peak periods Berry Street would continue to operate with two continuous trafficable lanes and kerbside parking on both sides of the road.

The North Sydney Program is a multi-agency collaboration between Transport for NSW, North Sydney Council, Greater Sydney Commission and the Government Architect of NSW, to guide future integrated transport planning and investment in the North Sydney CBD and interconnected area. The North Sydney Program considers strategic public transport connections to the North Sydney CBD, improved pedestrian amenity and safety, road network changes, improved access for cyclists to and through the CBD, convenient interchanges between bus and rail services, and management of kerbside access to support business activity across the day. The development of the North Sydney Program is ongoing and as part of the collaboration, the Western Harbour Tunnel and Beaches Link program of works will ensure opportunities for a future integrated and multi-modal transport network. The project would not limit any plans by North Sydney Council to implement speed zones within the North Sydney CBD, or prevent investment in walking and cycling infrastructure. Refer to Section A4.1.3 of this submissions report for further information.

As outlined in Table 5-3 of the environmental impact statement, the project would include modification and minor widening of the Mount Street bridge. The traffic light pedestrian crossing at the Bayer building at the intersection of Alfred Street North and Mount Street would be maintained.

The project does not propose changes to existing priority operations for traffic signals. The design is considered to provide an appropriate balance between pedestrian and traffic movements.

## C9.7 Parking

***Issue raised***

Submitters raised concerns about the permanent loss of parking as a result of the project. Specific concerns include:

- Concern about loss of parking in areas already suffering from a shortage of public parking spaces such as North Sydney, Crows Nest and Neutral Bay
- Objection to the permanent loss of 47 car spaces along Alfred Street North between Wyagdon St and Ridge Street, 49 on Alfred Street between Ridge Street overpass and Whaling Road, and 10 on Merlin Street
- Request no net reduction of parking spaces in North Sydney

- Request unrestricted resident parking be provided
- Requested that parking restrictions in Kurraba Road be maintained once the project was operational to prevent overspill parking on local streets
- Suggest no on street parking in Blue Street and Miller Street, south of the North Sydney Oval, to discourage driving and encourage inter-modal shifts in transport once the Victoria Cross metro station is open
- Concern that residents would not be able to park on the streets or take deliveries
- Concern that loss of parking would impact on local businesses and school drop offs in Rozelle and North Sydney
- Concern that removing parking encourages people to double park or stop illegally.

***Response***

As outlined in Section 3.2 of Appendix F (Technical working paper: Traffic and transport), impacts to parking were assessed through an analysis of lost parking spaces and availability of comparable alternative parking in nearby locations to determine the qualitative impacts of parking overflow to parking in nearby locations.

Much of the parking impacted by the construction of the project would be reinstated or reconfigured during operation. Where parking is unable to be reinstated during operation, the assessment has concluded the impacts associated with that loss of parking would generally be minor and could be absorbed by the surrounding network. Table 8-17 of the environmental impact statement advises that alternative parking on surrounding local roads would mitigate the loss of parking on Ridge Street, Ernest Street and Merlin Street.

It is acknowledged that the project would require the permanent removal of about 47 parking spaces on Alfred Street North between Wyagdon Street and Ridge Street, and about 49 parking spaces on Alfred Street North between Ridge Street and Whaling Road. However, these lost parking spaces would be partially offset through the provision of about 23 new parking spaces following completion of works. These are on-street metered parking spaces (up to nine hours) serving commuters working in North Sydney.

The loss of parking on Alfred Street North has been raised by North Sydney Council (refer to Section B15.8.2 of this submissions report). As per environmental management measure OT3 (refer to Table D2-1 of this submissions report), opportunities to reduce or offset the permanent loss of long stay parking spaces along Alfred Street North due to the project will be investigated during further design development.

Resident parking is a matter for local Councils and outside the scope of this project.

Parking restrictions would mostly be limited to State and Regional roads during peak periods to maintain the integrity of the road network; there would still be parking in close proximity on local roads in most locations. Access to private properties and businesses for deliveries would be maintained.

Parking restrictions on Miller Street northbound between Pacific Highway and Berry Street would be implemented as part of the project. Additional restrictions on Miller Street and Blue Street are not proposed as part of this project. The design of the Western Harbour Tunnel and Beaches Link program of works has been carried out to provide opportunities for interchange with metro and rail services. Active and public transport connections to Victoria Cross Station would be developed as part of the Sydney Metro City and Southwest project. Further information is provided here: *https://www.sydneymetro.info/station/victoria-cross-station*.

As outlined in Section 21.5.6 of the environmental impact statement, localised impacts on passing trade at the North Sydney CBD are expected to be negligible with the level of sensitivity low and the magnitude of change negligible. The net increase in traffic flows and improved strategic accessibility

to North Sydney throughout the day would also contribute to offsetting any potential impact. The project is expected to have long term positive impacts for businesses in the Rozelle area due to increased access to a broader customer catchment (refer to Table 6-4 of Appendix U (Technical working paper: Socio-economic assessment)).

School drop off areas and/or parking in proximity of schools would be maintained.

Drivers using the local road network would be required to follow driving rules and regulations. Drivers must not double park and must observe kerbside signs indicating where parking is and is not allowed.

## C9.8 Integration with other transport projects

***Issue raised***

Submitters raised concerns regarding integration of the project with other transport projects, particularly the Sydney Metro City & Southwest, currently under construction. Specific concerns include:

- The journeys of commuters using the Sydney Metro at Victoria Cross would be delayed by increased traffic on Miller Street in both the morning and evening peak hours caused by traffic from the Falcon Street exit and to the Berry Street entry
- The opening of Victoria Cross metro station would increase pedestrian traffic through the North Sydney CBD so it would be important to protect and retain infrastructure for commuters walking to and from the station.

***Response***

As outlined in Section 2.4 of Appendix F (Technical working paper: Traffic and transport), the continuing development of the Sydney Metro network will facilitate a mode shift from private cars to public transport. The design of the Western Harbour Tunnel and Beaches Link program of works has been carried out with this mode shift in mind to provide opportunities for interchange with metro and rail services, and facilitate the movement of trips that do not have the option to travel by rail.

It is acknowledged that the project would also increase traffic demands at either end of the project, where it would integrate with the existing transportation network. However, the localised delay associated at these locations would be offset by the large travel time benefits provided by the project at the broader network level. As stated in Section C9.4.2 of this submissions report, travel times along Miller Street would experience localised delays in the evening peak of up to four minutes in the northbound direction due to changes in demands and traffic patterns. However, overall network speeds through the Warringah Freeway and surrounds would improve as a result of the project.

The integration works proposed by the project have been developed to minimise the impact of additional travel facilitated by the project and ensure that the competing needs of customers (including private vehicles, public transport passengers, cyclists and pedestrians) have been incorporated into a balanced, equitable outcome (as per Section 7.1 of Appendix F (Technical working paper: Traffic and transport)).

The North Sydney Program is an ongoing multi-agency collaboration between Transport for NSW, North Sydney Council, Greater Sydney Commission and the Government Architect of NSW to further guide future integrated transport planning and investment in the North Sydney CBD and interconnected areas.

The North Sydney Program considers strategic public transport connections to the North Sydney CBD, improved pedestrian amenity and safety, road network changes, improved access for cyclists to and through the CBD, and convenient interchanges between bus and rail services. As part of the collaboration, the Western Harbour Tunnel and Beaches Link program of works will ensure

opportunities for a future integrated and multi-modal transport network. Refer to Section A4.1.3 of this submissions report for further information.

The Warringah Freeway Upgrade component of the project would provide a positive contribution to the local area by providing new and upgraded active transport infrastructure that would improve connectivity across the Warringah Freeway including connections to and from the North Sydney commercial centre and Victoria Cross metro station. This would include the conversion of the multiple existing pedestrian crossings at the intersection of Miller Street and Berry Street to a single scramble crossing, with a pedestrian only phase. This would allow pedestrians to access any leg of the intersection during the pedestrian only phase. The right turn from Miller Street northbound to Berry Street eastbound would also be banned for general traffic but permitted for buses. This would reduce traffic movements and improve pedestrian amenity adjacent to the main station access on Miller Street. Pedestrian movement across Miller Street for access to the future Victoria Cross metro station would be controlled by existing traffic signals at various intersections along Miller Street.

## C9.9 Monitoring and mitigation

***Issue raised***

Submitters made the following recommendations and requests for further monitoring and mitigation in relation to operational traffic impacts:

- Regular road network performance review of the motorway after opening to assess its impacts and whether changes are required
- Continuation of all existing cycling infrastructure or an alternative provided to the same level of safety, continuity and directness
- Ensure there is safe, usable access for pedestrians and bicycles on Ernest Street shared path.

***Response***

Traffic impacts

As required by environmental management measure OT1 (refer to Table D2-1 of this submissions report), Transport for NSW will carry out a review of operational network performance at 12 months and five years from the opening of the project to confirm the operational impacts of the project on surrounding arterial roads and major intersections. The assessment will be based on future updated traffic data at the time and the methodology used will be comparable with that used in this assessment.

Active transport

As noted in Appendix F (Technical working paper: Traffic and transport), the provision of new or upgraded pedestrian and cycle infrastructure has been designed to enhance pedestrian and cyclist safety, accessibility and connectivity. Further, the traffic assessment followed relevant guidelines (outlined in Section 3.1 Appendix F (Technical working paper: Traffic and transport)), including the *Planning Guidelines for Walking and Cycling* (Department of Infrastructure, Planning and Natural Resources, 2004). One of the key objectives of this guideline is to deliver projects that make walking and cycling safe, comfortable and convenient transport modes that are accessible to a wide range of users.

As outlined in Appendix V (Technical working paper: Urban design, landscape character and visual impact), the urban design framework includes urban design requirements to ensure the delivery of well-designed and attractive shared user bridges that provide safe access for all pedestrians and cyclists. The urban design framework would be used to inform further design development to ensure high quality links. Replacement/renewed facilities seek to provide a like-for-like replacement, and in some cases an improvement of, existing facilities in terms of connectivity and serving existing desire lines. This has been designed to provide at a minimum, the same level of active transport service

that currently exists. The urban design and landscape plan would further refine built infrastructure to ensure they match desire lines to the greatest extent feasible.

As per environmental management measure CTT19 (refer to Table D2-1 of this submissions report), direct impacts to existing shared user paths will be minimised where reasonable and feasible. Any detours and adjustments will be designed with consideration of user safety and convenience.

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C10 – Construction noise and vibration

SEPTEMBER 2020

# C10 Construction noise and vibration

## Contents

## C10.1 General

***Issue raised***

General queries, comments and concerns related to construction noise and vibration included:

- A number of submitters were of the opinion that the noise and vibration impact assessment was not adequate in relation to the following matters:
  - Airborne noise impacts at residential receivers that live in close proximity to the construction sites
  - Noise management level is not defined, and the assessment does not identify or apply weightings for modifying factors (eg annoying factors, or tonal noise)
  - Ground-borne noise and vibration assessment, including tunnel declines and impacts to property due to vibration
  - Blasting impacts
- Submitters noted noise levels from tunnelling, heavy vehicles, barge movements and rock breaking would impact a very large number of residences located adjacent to construction areas and above the tunnels. Submitters believed such high levels of noise would be inconsistent with the requirements of the *Protection of the Environment Operations Act 1997*
- Submitters were of the opinion that potential noise impacts at night on receivers in apartment buildings was not adequately addressed because entire strata complexes are identified as one property
- Submitters were of the opinion that the environmental impact statement did not map where changes in construction noise would occur to enable residents to identify individual impacts, query where more information about the impact to individual buildings can be found, and if noise and vibration testing has been conducted to confirm impacts
- Concern with extended construction hours for the project as described in the environmental impact statement as it may occur on an unspecified number of days, or could occur every day across the six years of construction
- Queries on the definition of feasible and reasonable mitigation measure and objection on its use.

***Response***

Transport for NSW will use a range of measures to reduce the impact of construction work when working close to communities.

A thorough noise and vibration assessment was carried out for the environmental impact statement examining the potential impact when the tunnels are built.

The assessment involved identifying areas which may experience changed levels of noise or vibration as a result of construction work, assessing the types and significance of the impact and how they would be managed.

While the project is being built the contractor would monitor noise and vibration to make sure noise levels meet the appropriate guidelines detailed in the conditions of approval and the Environment Protection Licence. A range of measures to reduce the impact of construction work would be implemented as appropriate such as using temporary noise barriers and acoustic sheds, using quieter equipment, staging work to avoid extended periods of disruption and providing respite periods and alternative accommodation if required.

Transport for NSW would engage with community to help minimise the impact of the construction work, in accordance with the Community communication strategy which would be prepared based

on the framework developed and included in Appendix E (Community consultation framework). This strategy would guide the project team's interactions with the community and stakeholders and set standards for proactive engagement.

Methodology and adequacy

The noise and vibration assessment was prepared by a team of suitably qualified professionals in accordance with the Secretary's environmental assessment requirements for the project, as issued by the NSW Department of Planning, Industry and Environment (refer to Appendix G (Technical working paper: Noise and vibration). The assessment was based on the proposed construction methodology (refer to Chapter 6 (Construction work) of the environmental impact statement) developed by the project team with appropriate construction experience.

The methodology and criteria adopted for the assessment are consistent with relevant construction noise and vibration assessment guidelines which are accepted by regulators and are considered adequate for environmental impact statement purposes. This includes:

- *Interim Construction Noise Guideline* (DECC, 2009)
- *Assessing Vibration: a technical guideline* (DECC, 2006), *German Standard DIN 4150: Part 3-1999 Structural vibration - Effects of vibration on structures and British Standard 7385: Part 2-1993 Evaluation and measurement for vibration in buildings Part 2*
- *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016)
- *NSW Road Noise Policy* (DECCW, 2011) *and Noise Criteria Guideline* (Roads and Maritime Services, 2015) for construction traffic noise impacts.

For construction airborne noise impacts at construction support sites, the assessment has considered a reasonable worst case scenario, when all equipment is operating simultaneously within a 15 minute period and in the worst case orientation. This is a conservative assumption and is unlikely to typically occur.

For surface works both a potential 'typical case' and 'worst case' scenario have been assessed to account for the changing noise characteristics and location of these works. The 'typical case' considers plant that are more likely to be in use for longer periods of time and are typically less noisy (eg excavator with bucket compared to excavator with rock hammer) while the 'worst case' includes the loudest plant items (eg excavator with rock hammer or road saw). Further information on the location of residential receiver buildings predicted to be highly noise affected is presented in Appendix F.1 and Appendix F.2 of this submissions report and a clarification on the assumptions and inputs to support this mapping has been provided in Section A4.1.4 of this submissions report.

Noise management levels for airborne noise are set by the *Interim Construction Noise Guideline* (DECC, 2009). They are set as a level above the rating background level or as a fixed value (eg highly noise affected, or internal noise levels for educational facilities). Noise management levels for residential receivers are typically established based on monitored noise levels in representative noise catchment areas (areas with a similar acoustic environment). The noise catchment areas adopted for this project are shown in Figures 2-1 to 2-3 in Appendix G (Technical working paper: Noise and vibration). The noise monitoring results are provided in Table 2-2 of Appendix G (Technical working paper: Noise and vibration). The noise management levels for each relevant noise catchment area are included in the tables in Section 5.2 of Appendix G (Technical working paper: Noise and vibration).

Potential structural building damage was assessed based upon limits and standards set in the *British Standard 7385: Part 2* and *German Standard DIN 4150-3*. A screening assessment was completed for the most vibration intensive works that could occur as part of the project. This assessment has assumed that the most vibration intensive works could occur anywhere across the construction areas. The data relied on in this assessment was taken from the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016), a database of vibration levels measured at various sites or obtained from other sources such as BS 5228-2:2009.

All the above assessments considered impacts from the vibration intensive construction activities at surface work areas as well as the construction of access declines, ventilation tunnels and mainline tunnels. Vibration impacts associated with tunnels excavated by the M4-M5 Link on behalf of the project were not included as these works are being completed as part of the M4-M5 Link approval.

Controlled blasting for tunnelling would be investigated during detailed design, if the selected construction contractor proposes to use this method of construction. Any potential vibration and air blast overpressure impacts from controlled blasting would be managed primarily through site and blast-specific assessments once these are set by the construction contractor. A blast management strategy would be prepared in consultation with the NSW Environment Protection Authority to demonstrate that all controlled blasting and associated activities would be carried out to not generate unacceptable noise and vibration impacts or pose a significant risk to nearby structures and sensitive receivers (refer to environmental management measure CNV9 in Table D2-1 of this submissions report).

It is noted that the assessment presented in the environmental impact statement is based on an indicative construction methodology. This assessment approach and level of detail is considered appropriate for this stage of the project. Noise and vibration levels during construction would be dependent upon the detailed construction methodology, which would be developed by the contractor engaged to deliver the project. The contractor would prepare a construction noise and vibration management plan and would be required to assess the potential noise and vibration impacts of their proposed methodology. This process would ensure that appropriate mitigation measures are implemented, and noise and vibration impacts are appropriately managed in accordance with relevant guidelines and the project conditions of approval.

Impacts

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. As presented in Chapter 10 (Construction noise and vibration) of the environmental impact statement:

- Airborne noise from the project construction support sites would be generally within the noise management levels, except for early works, site establishment and site restoration work, 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, except for 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 feasible and reasonable 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 impacts on receivers during the more sensitive evening and night period
- Vibration for the majority of tunnelling works from the operation of roadheaders are predicted to be below the vibration limits for human disturbance at all receivers. There is the potential for some receivers 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 Services, 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). According to *NSW Road Noise Policy* (Environment Protection Authority, 2011) a change less than 2 dB(A) represents a minor impact and is likely to be barely perceptible. Use of barges has been proposed to minimise movements on local roads.

Further, the airborne assessment presents a reasonable worst case scenario, and actual noise levels would vary greatly depending on a range of factors, including the location of construction work, the distance to the receiver, the noise intensity of the works and the time of day.

All construction works would be reviewed during further design development as part of the site-specific Construction Noise and Vibration Impact Statements (refer to environmental management measure CNV2 in Table D2-1 of this submissions report), and to revaluate proposed mitigation and management responses. This would include 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.

Transport for NSW recognises that certain activities would be above noise management levels and that a number of works would need to occur outside standard construction hours, such as works along the Warringah Freeway. Transport for NSW is currently preparing a Construction Noise Management Framework document in consultation with both the Department of Planning, Industry and the Environment and the NSW Environment Protection Authority. Further detail is provided below.

As identified in Chapter 2 (Assessment process) of the environmental impact statement, an Environment Protection Licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* would be obtained for the project construction. The project would need to comply with the relevant conditions of approval issued by the NSW Planning Minister, and the Environment Protection Licence.

Multi-dwelling receiver buildings

Construction noise levels at a given apartment within a receiver building would be influenced by the:

- Location/distance of the plant/equipment with respect to the apartment
- On/off time of the plant/equipment
- Intensity with which the plant/equipment is working.

Night time construction noise levels are predicted for every floor level and every facade of a receiver building. The floor level and facade most exposed to construction noise (ie with the highest predicted noise level) is selected as the representative location to assess construction noise impact on the receiver building.

Predicted night time construction noise levels are taken from the representative locations for all receiver buildings, as presented in Appendix G (Technical working paper: Noise and vibration). The highest representative noise level for receiver buildings within each noise catchment area are presented in the predicted construction noise level tables in Section 5 of Appendix G (Technical working paper: Noise and vibration).

The predicted night time noise levels at a height of 1.5 metres above the local ground level in noise contour format provide an indication of the extent of predicted noise impacts and how buildings shield construction noise, making some facades and floor levels more impacted than others (shown in Annexure H of Appendix G (Technical working paper: Noise and vibration)). This conservative approach is in accordance with the NSW Environment Protection Authority *Interim Construction Noise Guideline* (DECC, 2009).

Further information on individual buildings

Further information on construction noise and vibration impacts to individual buildings would be developed after the construction contractor is selected and the construction noise model refined to

better reflect the construction methods to be used. The Construction Noise and Vibration Impact Statements to be prepared for all of the project construction support sites and major construction works prior to the commencement of construction (refer to environmental management measure NV2 in Table D2-1 of this submissions report) would document this process.

Airborne noise contour maps for key construction stages at construction support sites and highest noise envelopes for surface road works are provided in Appendix H of Appendix G (Technical working paper: Noise and vibration), and are also provided on the interactive portal for the project (*nswroads.work/whtportal*). Further clarification has been provided in Section A4.1.4 and appendices F.1 and F.2 of this submissions report on the location of residential receiver buildings predicted to be highly noise affected during standard working hours and out of hours.

Section 4.2.1 of Appendix G (Technical working paper: Noise and vibration) presents examples of how construction noise levels may be experienced at different facades or floor levels of a building, depending on the location of the set of construction works relative to the building, acoustic shielding provided by the building itself or by other nearby buildings.

Proposed out of hours work

As discussed above, all construction works would be reviewed during further design development to revaluate proposed mitigation and management responses for noise. This would include 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.

Transport for NSW recognises that certain activities would be above noise management levels and that a number of works would need to occur outside standard construction hours, such as works along the Warringah Freeway. Transport for NSW is currently preparing a Construction Noise Management Framework document in consultation with both the Department of Planning, Industry and the Environment and the NSW Environment Protection Authority.

The project preference is to work within standard construction hours. However, some construction activities would need to be extended during out of hours work. These include:

- Tunnelling, underground excavation and ground support, and tunnel fitout (including tunnelling support at construction support sites) would be carried out 24 hours a day given relatively low noise impacts and the substantial program savings that would result
- Dredging and excavation of the bed of the harbour with a trailer suction hopper dredge would be carried out 24 hours a day to minimise the time taken to complete this activity. Dredging is predicted to exceed noise management levels at up to 46 residential receivers by 1 to 5 dB(A) and seven residential receivers are predicted to be noise affected by 6 to 15 dB(A). However, the dredging would typically occur only three times a night for around 25 minutes at a time, with travel time to the offshore disposal site for the marine spoil transportation by barge taking up the rest of the time
- Immersed tube tunnel installation to be completed during harbour closures to allow work to take place safely without impacting normal harbour traffic. It would typically take between 24 and 48 hours to safely sink each of the five tunnel units. When these activities occur out of hours, up to 138 residential receivers are predicted to exceed noise management levels; however, the majority of the exceedances would be less than 5 dB(A). Maximum noise levels at night could exceed the sleep disturbance screening level at up to 102 receiver buildings across several noise catchment areas from the immersion of tube tunnel units. Seven of these receivers are predicted to be exposed to maximum noise levels above the awakening reaction level
- Barge movements for transport of immersed tube tunnel units may occur out of hours to support the placement and installation of the tunnel units during harbour closures. These are not predicted to exceed noise management levels
- Warringah Freeway upgrade works (discussed further below).

Noisy construction activities associated with these works, such as rock hammering and road sawing, would be programmed for periods before midnight, where feasible and reasonable, although in some cases these noisy activities may need to be carried out after midnight. Further consultation with the community would take place if these works were required after midnight.

Road occupancy licences for works on major roads such as the Warringah Freeway would typically specify hours during evening and night time periods. In these circumstances and where feasible and reasonable, high noise works (eg road sawing and rock hammering) would be programmed to the earlier part of the night period, before 11pm, as recommended in the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016) or before 12am, to minimise the impacts on nearby residential receivers.

The frequency of respite is an important consideration to manage impacts to the community and in managing the duration of construction impacts. A construction noise and vibration management plan would be prepared in accordance with environmental management measure CNV1 (refer to Table D2-1 of this submissions report) and would include standard and additional mitigation measures from the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016). This guideline includes respite provisions that limit the numbers of nights per week on which a sensitive receiver can be exposed to noise levels in excess of the relevant amenity criteria.

The potential impacts to the community would depend on the construction activity and the location at which the activity occurs. Where noise management levels are exceeded, standard mitigation measures would be reviewed and adopted where required and feasible and reasonable as part of the preparation of a Construction Noise and Vibration Impact Statement developed during further design development in accordance with environmental management measure CNV2 (refer to Table D2-1 of this submissions report).

Section 6.8.1 of the environmental impact statement summarises the construction hours for the project.

Construction Noise Management Framework for Warringah Freeway upgrade works

Surface works on the Warringah Freeway would generally need to be minimised during standard working hours to maintain peak traffic capacity, provide safety for road users and construction workers, and minimise impacts to journey times. This would minimise the overall duration of construction, including associated noise impacts. As there is a high population density along the Warringah Freeway, including many apartment buildings, there are a large number of potentially affected receivers resulting from carrying out works outside of hours.

Transport for NSW is currently preparing a Construction Noise Management Framework which describes the approach the project will take to mitigating and managing construction noise impacts for works outside of standard construction hours for the Warringah Freeway Upgrade surface works. The Construction Noise Management Framework would ensure that there is a consistent approach to the management of noise impacts along this corridor, so this is clear to the community. The Construction Noise Management Framework is being prepared in consultation with the Department of Planning, Industry and Environment as well as the NSW Environment Protection Authority. The Construction Noise Management Framework will be publicly available during construction.

General site activities at construction support sites for the Warringah Freeway would be carried out during standard construction hours (7am to 6pm Monday to Friday, 8am to 1pm Saturday and no construction works on Sundays or public holidays). However, some construction activities (eg bridgeworks and surface works) supported by these sites would require out of hours work. This means that there would be periods throughout the construction program where works at the construction support sites for Warringah Freeway would occur outside of standard construction hours.

Feasible and reasonable definition

The Environment Protection Authority's *Interim Construction Noise Guideline* (DECC, 2009) outlines how 'feasible' and 'reasonable' mitigation and management measures is a key component of the

guideline. Section 6.1 of Appendix G (Technical working paper: Noise and vibration) also describes feasible and reasonable construction noise and vibration mitigation and management.

'Feasible' is explained as: work practice or abatement measure (that) is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements.

While 'reasonable' is a more complex issue, which is explained as: Selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure. To make such a judgement, consideration may be given to:

- Noise level impacts (for example, how many people would be impacted by noise levels above the noise management level? How long would these noise impacts last?)
- Noise mitigation benefits (for example, would the mitigation measures result in an overall noticeable reduction at receivers? Would the mitigation help many people or just one?)
- Cost effectiveness of noise mitigation (for example, are there more effective mitigation measures for a similar cost? Is the cost of the mitigation equitable based on the extent of mitigation provided and/or number of receivers benefited?)
- Community views (for example, liaising with the community to gain preferences on where noise mitigation is installed and what it may look like. Liaising with commercial receivers to locate mitigation that would not interfere with their access. Consulting with the community to determine if they would prefer managed night works and/or more traffic/transport distribution resulting in a longer construction program; or weekend work and/or louder night activities resulting in a shorter construction program).

It is appropriate to consider whether a mitigation measure is feasible and also if it is reasonable in relation to specific circumstances. This approach, which has been adopted by the project, is consistent with the management approaches outlined in the relevant guidelines that apply to construction noise and vibration.

## C10.2 Airborne noise impact

### C10.2.1 General

***Issue raised***

Submitters raised concerns over construction airborne noise impact. Specific queries, comments and concerns included:

- Disagreement with the categorisation of Warringah Freeway Upgrade construction support sites as being 'minor' sites given the duration of use and, in some cases, comparative 'noisy' activities to that conducted at Cammeray Golf Course construction support sites (WHT10/WFU8)
- Construction noise impacts would be widely felt due to the topography and large construction area, particularly at night
- Potential for sleep disturbance, noting the predicted exceedances at night
- Operation of a 24 hours seven days a week concrete batching plant would exceed acceptable noise levels
- Query on what measures would be implemented to minimise noise in the vicinity of schools, including construction traffic, and request that construction work should not occur during school lunch periods or during examination periods. Further, works outside standard construction hours should not be permitted ahead of and during school examination periods to ensure students are not impacted by sleep disturbance.

***Response***

Transport for NSW would use a range of measures to reduce the impact of construction work when working close to communities. The range of measures, as appropriate, would include using temporary noise barriers and acoustic sheds, using quieter equipment, staging our work to avoid extended periods of disruption and providing respite periods and alternative accommodation if required.

Transport for NSW would engage with community to help minimise the impact of the construction work, in accordance with the Community communication strategy which would be prepared based on the framework developed and included in Appendix E (Community consultation framework). This strategy would guide the project team's interactions with the community and stakeholders and set standards for proactive engagement.

Construction support sites

The classification of construction sites as 'minor' reflects the size and function of the construction support site. All potential impacts associated with each support site have been identified and assessed regardless of whether they have been classified as 'minor'.

Topography and impacts

The assessment of potential construction noise is based on a noise model that includes the local topography. The local topography was measured using a LiDAR scanner which uses lasers to measure the distance to nearby objects and develops a 3-D representation of the surrounding environment. The model has also considered the propagation of sound in accordance with ISO 9613-2:1996 *Attenuation of sound during propagation outdoors – Part 2*.

Sleep disturbance

The noise impact assessment has identified a number of receivers that are predicted to experience construction noise levels above the sleep disturbance criterion and, in certain instances, above the awakening criterion. This is particularly evident in areas along the Warringah Freeway due to the need to carry out noise intensive activities outside standard construction hours to maintain the operational functionality of the road network, protect safety and avoid significant traffic disruption during peak times.

This assessment is based on the current understanding of the design and construction methodology and reflects a conservative assessment (a worst case scenario), as discussed, in Section C10.1 of this submissions report. The potential for sleep disturbance due to construction activities would depend on the particular activity and the location at which is occurs. The detailed construction methodology would be developed by the contractor engaged to deliver the project.

Transport for NSW recognises that there is the potential for noise impacts during evening and night time periods, primarily where surface works and supporting works are required. Transport for NSW is committed to minimising construction noise impacts and the project team would look to progress the operational noise treatment program as early as possible, including treatments to eligible properties before construction starts in an area where practical. This would allow eligible residents along the alignment to have the benefits of at-property noise treatments and walls during construction as well as operation.

The contractor would prepare a construction noise and vibration management plan in accordance with environmental management measure CNV1 (refer to Table D2-1 of this submissions report) and would be required to assess the potential noise and vibration impacts of their proposed construction methodology to ensure that appropriate mitigation measures are identified and implemented, and noise and vibration impacts are appropriately managed in accordance with relevant guidelines and the conditions of approval. There will remain the potential for residual noise impacts for certain activities after all measures have been implemented. In these instances, additional management approaches would need to be implemented. The mitigation measures to be considered would include providing respite as appropriate to minimise the frequency at which a

sensitive receivers might be subjected to noise levels likely to result in sleep disturbance or providing alternative accommodation if required.

Transport for NSW is currently preparing a Construction Noise Management Framework document which describes the approach the project will take to mitigating and managing construction noise impacts for works outside of standard construction hours for the Warringah Freeway upgrade surface road works, as stated in Section C10.1 of this submissions report. The Construction Noise Management Framework would describe details around the approach to respite periods.

Batching plant operation

The project does not propose the operation of a concrete batching plant during construction. Required construction materials such as concrete and asphalt would be transported to site in trucks from off-site batching plants.

Impacts to schools

Transport for NSW would consult with educational establishments to identify specific needs and tailor mitigation measures accordingly where feasible and reasonable.

Where construction near educational establishments has the potential to result in noise and vibration levels above the relevant amenity criteria, the contractor would be required to prepare a location and activity specific Construction Noise and Vibration Impact Statement based on the proposed detailed construction methodology. This Impact Statement would identify likely noise and vibration levels and propose measures that would be implemented to manage them, with consideration of the guidance and mitigation measures in the *Construction Noise and Vibration Guidelines* (Roads and Maritime Services, 2016).

The project would require a substantial amount of work in locations on busy roadways such as Warringah Freeway, and those works would be required outside standard construction hours when traffic volumes are low. Given the close proximity of residences to these work locations, it is not feasible to carry out the works required outside standard construction hours in a manner that entirely avoids potential amenity impacts for residents, including students that might be studying for assessments. Appropriate respite would, however, be provided where appropriate feasible and reasonable. In addition, there would be the option for affected residents to contact the project and discuss their concerns. Transport for NSW and the contractor would consider all matters raised by the community and would implement additional mitigation measures to address the matters raised wherever feasible and reasonable, as outlined in Appendix E (Community consultation framework).

### C10.2.2 Victoria Road construction support site (WHT2)

***Issue raised***

The following concerns were raised and request was made in relation to noise impacts at the Victoria Road construction support site (WHT2):

- Submitters raised concerns about construction noise impacts to residential receivers and Rozelle Public School associated with the establishment and operation of the construction support site. In particular, concern was raised on the use of rock breakers, the high number of residential receiver buildings above noise management levels (including 27 highly noise affected receiver buildings), as well as 210 residential receiver buildings above the sleep disturbance screening criterion
- Request that the noise and vibration assessment be revised to assess impacts to Little Zak's Academy. Noise intensive works would be completed during daytime hours which would adversely affect Little Zak's Academy and adjoining residential receiver buildings are predicted to be highly noise affected. Daytime hours are the most sensitive for this type of receiver and the predicted exceedances at this receiver would have a significant impact
- The exit route from the acoustic shed at the Victoria Road construction support site (WHT2) should be enclosed to minimise construction noise.

***Response***

Construction noise impacts

The outcomes of the airborne noise assessment for the Victoria Road construction support site (WHT2) are summarised in Section 10.6.4 of the environmental impact statement. Transport for NSW acknowledge the demolition of existing buildings and the establishment of the construction support site would generate noise above noise management levels, and some receivers would be highly noise affected.

Rozelle Public School is located within noise catchment area NCA6.3 and is predicted to experience noise levels up to 28 dB(A) above the noise management level. Impacts include:

- Construction noise levels 25-28 dB(A) above the noise management level during early works, site establishment and tunnel commission and site rehabilitation
- During piling for decline and acoustic shed and surface level decline the predicted construction noise levels are between 14 and 16 dB(A) above the noise management level
- Predicted noise levels during the acoustic shed construction, tunnel construction and tunnel fitout within 2-10 dB(A) above the noise management levels
- Below the noise management levels outside standard construction hours.

Noise impacts would vary across the Rozelle Public School grounds. Some school buildings would be highly noise affected during early works, site establishment, tunnel commission and site rehabilitation during standard construction hours.

It is important to acknowledge that the predicted noise levels are based on a reasonable worst case scenario, with all plant operating. In reality, noise levels would vary throughout the day. When rock breakers are not in use, predicted noise levels reduce by up to 8dB(A). Early works and site establishment would occur for about six months commencing from around mid-2021.Table 5-30 of Appendix G (Technical working paper: Noise and vibration) presents the level by which the predicted noise level exceeds the noise management level in the vicinity of the Victoria Road construction support site

The activities of longer duration, being tunnel construction and fitout, are predicted to have a lower impact. Around 11 residential receiver buildings would be impacted during standard construction hours, where predicted noise levels are up to 10 dB(A) above noise management levels. Outside standard construction hours predicted noise levels at all receiver buildings are below the noise management levels.

Night time heavy vehicle deliveries associated with tunnelling works have the potential to generate noise levels above the sleep disturbance screening level and in some instances, exceed the awakening reaction level. Since the number of heavy vehicle movements generated by night time deliveries is small compared to existing traffic numbers on Victoria Road, it is unlikely there would be a substantial increase in the number of maximum noise events at nearby receiver buildings.

Further feasible and reasonable mitigation and management measures would be explored during further design development to minimise the predicted exceedances at sensitive receivers, as well as disruption due to out of hours activities (refer to environmental management measures CNV1, CNV2 and CNV3 in Table D2-1 of this submissions report).

Little Zak's Academy

As part of the submissions, it was identified that 6-8 Waterloo Street, Rozelle, had been redeveloped and was now a childcare centre called Little Zak's Academy. The receiver building had been identified as a commercial receiver in Appendix G (Technical working paper: Noise and vibration). The centre is expected to be open and taking enrolments from mid-2020.

To reflect this change in use, an assessment of the noise and vibration impact to this receiver building has been carried out and has been presented as a clarification in Section A4.1.4 of this submissions report.

Enclosure of acoustic shed access

Construction-related road traffic noise impacts at the Victoria Road construction support site (WHT2) are considered in Section 5.3.3 of Appendix G (Technical working paper: Noise and vibration).

Vehicle access to the Victoria Road construction support site (WHT2) would be directly from the northbound lanes of Victoria Road. To exit, heavy vehicles would turn right out of the site and travel south along Victoria Road before heading west along the City West Link. Road traffic noise levels at receiver buildings directly exposed to traffic noise from Victoria Road are predicted to potentially increase by less than 0.5 dB(A) during day and night periods as a result of the site's construction traffic.

Maximum noise levels ($L_{Amax}$) from night period heavy vehicle movements have been predicted to exceed both the sleep disturbance screening level and the adopted awakening reaction level at receiver buildings along Victoria Road. Since the night time heavy vehicle movements from this site would be limited to one vehicle per hour, and Victoria Road has relatively high existing night time heavy vehicle movements, it is unlikely there would be a substantial increase in the number of maximum noise events at nearby receiver buildings. As such the need to enclose the entry and exit point from the Victoria Road construction support site (WHT2) on to Victoria Road is considered to be unnecessary.

### C10.2.3 White Bay construction support site (WHT3)

***Issue raised***

Submitters raised concerns about construction noise associated with the operation of the White Bay construction support site (WHT3), including:

- Submitters raised concerns about the noise impacts to nearby residents associated with the casting and fitout of the immersed tunnel tube units on the western side of Glebe Island, out of hours construction work as well as heavy vehicle movements and barge movements. This included impacts to residential areas in Ultimo and Pyrmont
- Submitters were of the opinion that the NSW Government should acquire properties impacted by noise from construction activities
- Submitters stated the environmental impact statement does not include any mitigation to protect residents from noise impacts associated with the construction of the immersed tube tunnel units.

***Response***

General site activities at the White Bay construction support site (WHT3), including casting and fitout of the immersed tube tunnel units, would be carried out during standard construction hours, as detailed in Chapter 6.7.2 of the environmental impact statement. Some deliveries would be required outside standard construction hours to support the casting of the immersed tube tunnel units as well as construction activities at the Yurulbin Point (WHT4) and Berrys Bay (WHT7) construction support sites (eg concrete deliveries). Immersed tube tunnel installation at the harbour crossing would be completed outside of normal working hours and is discussed in Section C10.1 of this submissions report.

Table 10-12 of the environmental impact statement identifies the number of residential receiver buildings that are predicted to be above noise management levels during construction activities at the White Bay construction support site (WHT3). Modelling assumes four heavy vehicle deliveries per night at the Glebe Island portion of the White Bay construction support site (WHT3) to the furthest north east wharf on the site.

This identifies that:

- Noise from the casting and fitout of the immersed tube tunnel units is not predicted to exceed noise management levels during standard construction hours
- No residential receiver building is predicted to be subject to construction noise that exceeds noise management levels for activities conducted outside standard construction hours
- Predicted instantaneous noise levels are up to $L_{Amax}$ 59 dB(A), which is above the sleep disturbance screening level at five receiver buildings. However, this is below the awakening reaction criterion. The five receiver buildings are located in Pyrmont (noise catchment area 10.1). Measures would be implemented to minimise or eliminate these noise events as part of the construction noise and vibration management plan, in accordance with environmental management measure CNV1 (refer to Table D2-1 of this submissions report).

An out of hours works protocol would be developed and implemented, which would identify mitigation and management measures, including respite, to be implemented where appropriate (environmental management measure CNV3 in Table D2-1 of this submissions report).

Road traffic noise levels at receiver buildings directly exposed to traffic noise on The Crescent, City West Link and James Craig Road are predicted to increase by less than 0.5 dB(A) during the day and night as a result of the addition of the construction traffic, which represents a minor impact. Maximum noise levels ($L_{Amax}$) from night time heavy vehicle movements have been predicted and exceed both the sleep disturbance screening level and the adopted awakening reaction level at receiver buildings along Victoria Road. Since night time heavy vehicle movements from this site would be limited to one vehicle per hour, and The Crescent and City West Link already has relatively high existing night time heavy vehicle movements, a substantial increase in the number of maximum noise events is unlikely.

Standard mitigation measures would be reviewed and adopted where required and feasible and reasonable as part of the preparation of a Construction Noise and Vibration Impact Statement for the White Bay construction support site (WHT3) during detailed design in accordance with environmental management measure CNV2 (refer to Table D2-1 of this submissions report).

### C10.2.4 Yurulbin Point construction support site (WHT4)

#### *Issue raised*

Submitters raised concerns about construction noise associated with the operation of the Yurulbin Point construction support site (WHT4), including:

- Concern that nine residential dwellings in Louisa Road, Birchgrove are predicted to experience night time noise above the awakening reaction level
- Submitters recommended that the construction support site noise barriers should be around the full perimeter of the site. Submitters were of the opinion that the construction noise barrier arrangement shown in the environmental impact statement would result in noise being transmitted across Snails Bay.

#### *Response*

Transport for NSW would use a range of measures to reduce the impact of construction work when working close to communities. The range of measures, as appropriate, would include using temporary noise barriers and acoustic sheds, using quieter equipment, staging our work to avoid extended periods of disruption, and providing respite periods and alternative accommodation if required.

Transport for NSW would engage with community to help minimise the impact of the construction work, in accordance with the Community communication strategy which would be prepared based on the framework developed and included in Appendix E (Community consultation framework). This

strategy would guide the project team's interactions with the community and stakeholders and set standards for proactive engagement.

It is important to acknowledge that the predicted noise levels presented in the noise assessment are based on a reasonable worst case scenario, with all expected plant operating simultaneously, at a worst case intensity, and with a worst case orientation during a 15 minute period. This is a conservative assumption and is unlikely to typically occur.

Sleep disturbance

The Yurulbin Point construction support site (WHT4) would consist of a combined land and water-based site, located at the end of Louisa Road in Yurulbin Park, Birchgrove. This site would be used to support excavation of the mainline tunnels (including for connection to the immersed tube tunnel crossing). Access for plant and equipment required to excavate the tunnels would be via an access shaft constructed on the lower portion of the site and located within an acoustic shed.

Section 5.5.2 of Appendix G (Technical working paper: Noise and vibration) shows that during night time tunnel construction and tunnel fitout works, up to 79 receiver buildings surrounding the Yurulbin Point construction support site (WHT4) are predicted to be exposed to maximum noise levels above the sleep disturbance screening levels (up to $L_{Amax}$ 69 dB(A)). From these, up to nine receiver buildings are predicted to be exposed to maximum noise levels above the awakening reaction level due to loading and unloading activities. $L_{Amax}$ is the maximum A-weighted sound pressure level measured over a given period.

While predicted $L_{Amax}$, noise levels are greater than the screening level, sleep disturbance impacts are unlikely to typically occur as:

- The limited number of delivery barge movements (four barge movements) during the night would result in minimal $L_{Amax}$ noise events
- $L_{Amax}$ noise events would be from metal-on-metal bangs during the barge deliveries, which can be mitigated and managed through both work practice and physical mitigation (eg use of belt fasteners instead of chains).

During further design development, all feasible and reasonable mitigation from the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016) would be confirmed and incorporated to minimise residual noise impacts in accordance with the development of the noise and vibration management plan (refer to environmental management measure CNV1 in Table D2-1 of this submissions report). This would be further outlined in detailed Construction Noise and Vibration Impact Statements (environmental management measure CNV2) and the out of hours protocol (environmental management measure CNV3) included in Table D2-1 of this submissions report.

Construction noise barrier arrangement

Indicative noise treatment measures and management methods have been identified for the Yurulbin Point construction support site (WHT4) based on the preliminary site layout and the reasonable worst-case plant/equipment operating to assist in attenuating and managing noise emissions from the construction activities. Access for plant and equipment required to excavate the tunnels at Yurulbin Point would be via an access shaft constructed on the lower portion of the site and located within an acoustic shed.

The indicative noise treatment measures included the installation of temporary noise barriers around the northern and western side of the Yurulbin Point construction support site (WHT4) and on the western side of the temporary wharf to provide noise attenuation for receivers near the site (refer to Figure 6-29 of the environmental impact statement for the location of indicative temporary noise barriers). Installation of temporary noise barriers along the southern and eastern site boundaries was found to not be feasible or reasonable because it would restrict site access along the waters edge. Further, as the barriers would be located at lower ground height to the nearest receivers, the noise reduction provided by the barriers is low to negligible.

Reflection from noise barriers has been considered in the noise impact assessment for the site. The noise prediction model considers noise propagation as discussed in Section 4.2.1 of Appendix G (Technical working paper: Noise and vibration).

Detailed design refinements to the Yurulbin Point construction support site (WHT4) layout, equipment, construction methods or construction hours may require specific mitigation and management measures that are different from those outlined in the environmental impact assessment. Construction noise and vibration mitigation and management measures including the need for and layout of construction noise barriers would be reviewed during further design development to determine what is feasible and reasonable, with consideration of cumulative and consecutive construction impacts.

Detailed Construction Noise and Vibration Impact Statements would be prepared for all construction support sites and major construction works, in accordance with environmental management measure CNV2 (refer to Table D2-1 of this submissions report. The Statements will consider the proposed site layouts and noise and vibration generating activities that will take place during all major stages of the construction support site, assess predicted noise and vibration levels against the relevant management levels, and incorporate feasible and reasonable mitigation and management measures in accordance with the requirements of the *Interim Construction Noise Guideline* (DECC, 2009) and the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016).

### C10.2.5 Sydney Harbour south cofferdam (WHT5), Sydney Harbour north cofferdam (WHT6) and Sydney Harbour crossing

#### *Issue raised*

Submitters noted Chapter 6 (Construction work) of the environmental impact statement described the dimensions of the cofferdams to be about 50 metres wide and 25 metres long. Figure 6-30 of the environmental impact statement described the Sydney Harbour cofferdam at Yurulbin Point and Waverton Coal Loader to be about 120 metres wide and 100 metres long and the working platform within the cofferdam to have dimensions of about 50 metres by 20 metres. The discrepancy in the dimensions of the cofferdams would have a substantial noise impact.

#### *Response*

The noise and vibration assessment of the Sydney Harbour south cofferdam (WHT5) and the Sydney Harbour north cofferdam (WHT6) was based on the footprint depicted in Figure 6-30 of the environmental impact statement. Within the red boundary (site boundary) depicted in Figure 6-30 the cofferdam's dimensions are about 50 metres wide and 25 metres long shown as a grey box within the construction support site (cofferdam). The yellow depicts an indicative marine exclusion zone surrounding the cofferdam, working platform and a barge point that allows for movement and access to the cofferdam. The cofferdam does not extend to the full extent of the construction support site shown in red on Figure 6-30 of the environmental impact statement.

Transport for NSW notes that the noise assessment is based on a concept construction methodology. Actual noise levels associated with the installation, use and removal of the cofferdams may differ based on the contractor's detailed construction methodology. A Construction Noise and Vibration Impact Statement would be prepared where noise levels associated with cofferdam installation, use and removal have the potential to exceed relevant noise management levels and sleep disturbance criteria at adjacent sensitive receivers, in accordance with environmental management measure CNV2 (refer to Table D2-1 of this submissions report). The Construction Noise and Vibration Impact Statement would describe and consider the proposed construction activities, identify potential noise impacts and proposed mitigation measures that would be implemented to address the predicted impacts.

Transport for NSW would engage with community to help minimise the impact of the construction work, in accordance with the Community communication strategy which would be prepared based on the framework developed and included in Appendix E (Community consultation framework). This

strategy would guide the project team's interactions with the community and stakeholders and set standards for proactive engagement.

### C10.2.6 Berrys Bay construction support site (WHT7)

#### *Issue raised*

Submitters raised concerned about construction noise associated with the operation of the Berrys Bay construction support site (WHT7). Submitters raised queries, concern and comments about specific locations and activities, including:

- Objection to the use of Berrys Bay for this project due to the predicted high exceedances of noise management levels over five years and the use of the site 24 hours a day, seven days a week
- Concern that existing high background noise levels was not taken into account
- Concern that the noise and vibration modelling for Berrys Bay is inadequate as the noise contours do not reflect the position of certain site establishment activities
- Concern that the assessment does not address activities such as piling for temporary wharfs, construction of the access decline, use of barges and the use of certain plant (tunnel ventilation and water treatment plants) which would operate 24 hours, seven days a week. Request that the noise modelling is updated to reflect all reasonably anticipated noise sources, and that an acoustic shed is constructed before the decline is excavated
- The noise and vibration impacts from the connection proposed at Waverton Park as depicted in Figure 5-2 of the environmental impact statement was not assessed
- At Berrys Bay construction support site (WHT7), request for a 'no wash' zone on the whole of Berrys Bay to avoid excessive speeds for vessel movements and request for construction vehicles using Bay Road to be limited to 30 kilometres per hour to minimise noise impacts.

#### *Response*

Transport for NSW would use a range of measures to reduce the impact of construction work when working close to communities. The range of measures, as appropriate, would include using temporary noise barriers and acoustic sheds, using quieter equipment, staging our work to avoid extended periods of disruption, providing respite periods and alternative accommodation if required.

Transport for NSW would engage with community to help minimise the impact of the construction work, in accordance with the Community communication strategy which would be prepared based on the framework developed and included in Appendix E (Community consultation framework). This strategy would guide the project team's interactions with the community and stakeholders and set standards for proactive engagement.

It is important to acknowledge that the predicted noise levels presented in the noise assessment are based on a reasonable worst case scenario, with all expected plant operating simultaneously, at a worst case intensity, and with a worst case orientation during a 15 minute period. This is a conservative assumption and is unlikely to typically occur.

<u>Noise exceedances</u>

As detailed in Section 6.7.2 of the environmental impact statement, Berrys Bay construction support site (WHT7) would provide tunnelling support to the project and would operate 24 hours, seven days a week. However, limited activities would occur outside standard construction hours and would be carried out within acoustic sheds, where possible. These activities would include:

- Spoil handling and loading of barges within the acoustic sheds and enclosed conveyor. Barges would only arrive/depart the construction support site during standard construction hours

- Tunnel support activities associated with tunnelling and fitout, which would be carried out within the acoustic shed or underground
- Some limited deliveries to the site at night, via Balls Head Road, to support tunnelling and fitout activities.

These activities are required to minimise the overall duration of construction, including associated noise impacts, or are required to ensure tunnelling can be conducted safely.

As stated above, the assessment has considered reasonable worst case scenarios, when all equipment is operating simultaneously within a 15 minute period and in the worst case orientation. This is a conservative assumption and is unlikely to typically occur.

Existing noise levels have been taken into account in the assessment. Background noise levels were measured at Waverton, McMahons Point and Greenwich in 2017 (refer to Figure 10-5 of the environmental impact statement) to establish the Rating Background Level (RBL). Noise management levels for the construction support site were determined based on the rating background levels. The rating background levels for each location was determined based on the quietest period of the day, evening or night assessment period in accordance with the *Noise Policy for Industry* (NSW Environment Protection Authority, 2017). Background noise levels are typically less than the average noise levels. Noise management levels set based on background noise levels typically set more stringent outcomes for noise performance than existing average noise levels.

An acoustic shed and barge shed would be established at the construction support site during early works and site establishment prior to the major construction activities commencing. Out of hours activities proposed to be carried out within an acoustic shed such as spoil handling and tunnel excavation would not start until the acoustic shed has been constructed.

As detailed in Table 10-18 of the environmental impact statement:

- During standard construction hours, up to 92 residential receiver buildings in Waverton and McMahons Point (noise catchment areas 14.1 and 15.2) are predicted to experience noise levels above the noise management level mostly during early works and piling for acoustic sheds; however, the majority of receivers (80 per cent) would experience increases of less than 10 dB(A). These activities would occur intermittently for around 12 months. As discussed above, this represents a reasonable worst case scenario that is unlikely to typically occur
- Once the acoustic shed is constructed, exceedances are predicted to be less than 10 dB(A) at around four residential buildings during standard construction hours
- Outside standard construction hours, one residential receiver building is predicted to experience noise levels less than 5 dB(A) above the noise management level
- Maximum noise levels at night could exceed the sleep disturbance screening level at up to 25 receiver buildings from occasional deliveries during tunnel construction and fitout. Up to two of these receivers are predicted to be exposed to maximum noise levels above the awakening reaction level.

Construction traffic noise impacts are discussed in Section C10.5 of this submissions report.

Where noise management levels are predicted to be exceeded, there is a requirement to implement feasible and reasonable noise mitigation. Measures to avoid, minimise and mitigate the potential noise impacts from construction works are provided in Table D2-1 of this submissions report.

Assessment scenarios

The construction noise assessment considered a range of scenarios to reflect the expected stages of activity at the Berrys Bay construction support site (WHT3). Section 5.7 of Appendix G (Technical working paper: Noise and vibration) outlines the scenarios considered in the assessment, which includes but is not limited to:

- Site establishment
- Acoustic shed construction, including the piling for temporary wharves
- Surface level and underground activities associated with the construction of access decline
- Tunnelling support activities at the surface, such as spoil handling (including the transfer of spoil onto barges), and tunnel fitout
- Restoration of the site.

Noise contours were presented for the loudest early works and site establishment stages (utility connection/reconnection works) and the longer term tunnelling support stages only. The noise contours emanate from the areas where such work is likely to occur.

Annexure E of Appendix G (Technical working paper: Noise and vibration) identifies the plant and equipment assumed to be operating for each scenario. This includes the operation of the water treatment plant and ventilation for the acoustic shed. The water treatment plant would be acoustically treated or placed in an acoustic enclosure, and plant items (including ventilation fans) would be selected or acoustically treated.

Surface work for the tunnel decline can only occur concurrent to the construction of the acoustic shed. The tunnelling of the access decline would occur once the acoustic shed is constructed.

Transport for NSW notes that the noise assessment is based on a concept construction methodology. Actual noise levels associated with the establishment and use of the Berrys Bay construction support site (WHT3) may differ based on the contractor's detailed construction methodology. The contractor would be required to prepare a Construction Noise and Vibration Impact Statement to consider proposed site layouts and noise and vibration generating activities in accordance with environmental management measure CNV2 (refer to Table D2-1 of this submissions report). The Construction Noise and Vibration Impact Statement would identify where noise levels associated with installation and use of the construction support site have the potential to exceed relevant noise management levels and sleep disturbance criteria at adjacent sensitive receivers. The Construction Noise and Vibration Impact Statement would describe and consider the proposed construction activities, identify potential noise impacts and proposed mitigation measures that would be implemented to address the predicted impacts.

Impacts at Waverton Park

There is no proposed connection at Waverton Park. The feature shown in Figure 5-2 of the environmental impact statement is an indicative location of a breakdown bay that would be located within the tunnel.

Construction vessels, no wash zone and construction traffic noise

Construction-related water traffic noise is considered in Section 4.2.7 of Appendix G (Technical working paper: Noise and vibration). The assessment concluded that noise impacts associated with the operation of construction vessels would not cause substantial amenity or sleep disturbance impacts. Environmental management measure CTT15 requires construction vessels to operate in a manner that minimises wash to areas of the shoreline. Further, restrictions of the NSW Marine Safety Regulation 2016 would apply, such as further reduction in speeds when in proximity to moored vessels or fixed structure (refer to Table D2-1 of this submissions report).

Additional mitigation would be implemented to reduce construction traffic noise levels along Balls Head Road and Bays Road, as discussed in Section C10.5 of this submissions report. Section 5.3.4 of Appendix F (Technical working paper: Traffic and transport) notes that tunnel spoil haulage would be carried out via marine transport from the Berrys Bay construction support site (WHT7) to reduce the number of heavy vehicle movements along the narrow Balls Head Road. The low volume of vehicle construction traffic means that any impacts on receivers along Bay Road or Balls Head Road is expected to be manageable. Additional mitigation and management to minimise construction traffic noise is discussed in Section C10.5 of this submissions report.

### C10.2.7 Cammeray Golf Course construction support sites (WHT10 and WFU8) and construction works within Warringah Freeway

***Issue raised***

Submitters raised concerned about construction noise associated with the project along the Warringah Freeway and the operation of the construction support sites. Submitters raised queries, concern and comments about specific locations and activities, included:

- Concerns regarding predicted noise levels and exceedances:
  - Significant impacts to residential receivers located close to the Warringah Freeway Upgrade between Willoughby Road and Merlin Street and within the vicinity of the Cammeray Golf Course (WHT10 and WFU8) and Merlin Street (WFU7) construction support sites. Residents within 500 metres of the Cammeray Golf Course would experience noise levels of 60-75 dB(A)
  - Noise impacts associated with out of hours construction on Merlin Street, Alfred Street North between Wyagdon Street and Rose Street
  - Construction in the vicinity of High Street, Falcon Street, Ernest Street, Willoughby Road and Miller Street and the operation of the Merlin Street construction support site (WFU7) would cause noise impacts at night and adversely affect receivers
  - Noise exceedances from out of hours works at the Rosalind Street East construction support site (WFU9)
  - Request for rock breaking, rock excavation and other noise intensive activities for the Mount Street overpass, Alfred Street North overpass and the new bus lane near Kurraba Road to be completed during standard day time hours only
  - Impacts to residential receivers immediately adjacent to the tunnelling works and the Warringah Freeway Upgrade. It is considered there would be excessive noise and vibration levels for up to five years, which may lead to sleep disturbance
- Submitters raised concern that it is unclear what the predicted noise impacts are at any one location with simultaneous construction activities and sites including the 12 construction support sites, traffic noise, tunnelling, rock hammering, blasting and surface works occurring across the project
- Existing background noise levels are high in the Cammeray area and construction works would further exacerbate noise impacts
- Concerns regarding the Cammeray Golf Course construction support sites (WHT10 and WFU8):
  - The construction support sites would be required to support the construction activities outside standard construction hours however does not identify a timeframe, the likely noise and vibration impacts or how the impacts would be mitigated to reduce adverse impact to receivers
  - The noise and vibration impacts from the construction support sites are not adequately addressed or how impacts would be mitigated or monitored
  - Concern that the environmental impact statement does not adequately assess the impact to residents on Morden Street and Bells Avenue. While most work would be carried out within the acoustic shed, this does not mitigate noise associated with work carried out external to the acoustic shed
- Concern about recreational receivers:
  - Impacts to St Leonards Park, which is widely used by a number of students that attend local schools or preschools. This has underestimated the impacts as the number of

users have not been accounted for. Further, the environmental impact statement incorrectly states that there are alternative venues available

- The negative noise impacts on recreational areas including St Leonards Park, Flat Rock Gully, Tunks Park and Cammeray Park. Local schools also use recreational facilities including Green Park, Cammeray Golf Course and tennis courts and noise impacts would disrupt these facilities
- Objection due to impacts to Cammeray Park, which is predicted to be noise affected by up to 18 dB(A).

***Response***

Transport for NSW would use a range of measures to reduce the impact of construction work when working close to communities. The range of measures, as appropriate, would include using temporary noise barriers and acoustic sheds, using quieter equipment, staging our work to avoid extended periods of disruption, providing respite periods and alternative accommodation if required.

Transport for NSW would engage with community to help minimise the impact of the construction work, in accordance with the Community communication strategy which would be prepared based on the framework developed and included in Appendix E (Community consultation framework). This strategy would guide the project team's interactions with the community and stakeholders and set standards for proactive engagement.

It is important to acknowledge that the predicted noise levels presented in the noise assessment are based on a reasonable worst case scenario, with all expected plant operating simultaneously, at a worst case intensity, and with a worst case orientation during a 15 minute period. This is a conservative assumption and is unlikely to typically occur.

Predicted noise levels and exceedances

The construction airborne noise impacts associated with the Cammeray Golf Course construction support sites (WHT10 and WFH8) are described in Section 5.8.2 of Appendix G (Technical working paper: Noise and vibration). During site establishment and site restoration, noise impacts are predicted to be up to 20 dB(A) above the noise management levels during standard construction hours at residential receiver buildings. Tunnelling support activities at the site, which occur for the majority of the construction duration, are predicted to comply with the noise management levels for residential receivers during all hours. Noise impacts are similar for other sensitive receivers (eg childcare centres, educational facility, recreation areas), whereby predicted noise levels are up to 20 dB(A) above noise management levels during site establishment and site restoration and within 10 dB(A) of noise management levels during tunnelling support works.

Section 10.7 of the environmental impact statement, and Section 5.9 of Appendix G (Technical working paper: Noise and vibration) present predicted construction noise impacts for the areas between Willoughby Road and Merlin Street, within the vicinity of the Cammeray Golf Course; in the vicinity of High Street, Falcon Street, Ernest Street, Willoughby Road and Miller Street, Merlin Street; Alfred Street north between Wyagdon Street and Rose Street; and Rosalind Street East, between Rosalind Street East and the Miller Street off ramp.

The assessment for the surface road works along the Warringah Freeway has considered both typical and reasonable worst case scenarios when assessing construction noise levels, where for both cases all equipment is operating simultaneously within a 15 minute period and in the worst case location. This is a conservative assumption and is unlikely to typically occur. Receivers are predicted to be noise affected at different times during the construction program. Noise intensive activities such as rock hammering and road sawing would occur only for small periods of time.

Noisy construction activities that have the potential to affect the amenity of sensitive receivers typically require justification to allow them to occur outside standard daytime construction hours, in accordance with guidance in the *Interim Construction Noise Guidelines* (DECC, 2009). When they

are required and justified outside standard daytime construction hours they would be scheduled for less sensitive time periods such as before midnight where feasible and reasonable.

To maintain the operational functionality of the road network and avoid significant traffic disruption during peak times and to protect the safety of workers and road users, a large amount of road work would be carried out during night time road closures as well as weekend closures during non-peak periods.

Construction noise impacts from works within the Warringah Freeway are presented in Section 5.9 of Appendix G (Technical working paper: Noise and vibration). The assessment predicts residential receiver buildings closer to the works to be highly noise affected during standard construction hours. Residential receiver buildings close to the works may experience noise levels that exceed the night time noise management level by more than 25 dB(A) where works are required and justified to be carried out outside of standard construction hours. This would be considered highly intrusive. Instantaneous maximum noise level events generated by night time construction activity may exceed sleep disturbance and awakening reaction levels. The predicted noise levels will not impact the same receivers for the duration of the Warringah Freeway Upgrade works. When highly noise intensive equipment such as excavators with rock hammers or road saws are not in use, and when works occur further away from receivers, predicted noise levels are lower.

Recognising that certain activities would be above noise management levels, Transport for NSW is currently preparing a Construction Noise Management Framework document, which describes the approach the project will take to mitigating and managing construction noise impacts for works outside of standard construction hours for the Warringah Freeway upgrade surface road works, as stated in section C10.1 of this submissions report. Where noise management levels are exceeded, there is a requirement to implement feasible and reasonable noise mitigation. A range of options and methods have been identified and developed to mitigate and manage the noise impacts from the project. The management of these noise impacts would be further considered in detailed design as part of the project construction noise and vibration management plan, out of hours works protocol and site-specific Construction Noise and Vibration Impact Statements to refine the management measures outlined in the Appendix G (Technical working paper: Noise and vibration).

The noise assessment presented in the environmental impact statement is based on a concept construction methodology. Actual noise levels in the vicinity of the project site may differ based on the contractor's detailed construction methodology. The contractor would be required to prepare Construction Noise and Vibration Impact Statements to mitigate and monitor noise levels due to construction with the potential to exceed relevant noise management levels and sleep disturbance criteria at adjacent sensitive receivers In accordance with environmental management measures CNV2 and CNV4 (refer to Table D2-1 of this submissions report).

Cumulative impacts

Cumulative impacts to sensitive receivers was considered where receivers would be impacted by surface road works and construction support sites for the project at the same time, as detailed in Section 5.9.2.14 of Appendix G (Technical working paper: Noise and vibration).

When construction works are carried out in more than one major work area at the same time and the works are predicted to exceed the noise management level in the same noise catchment area, then there is potential for cumulative noise impact in receiver buildings.

Potential consecutive or concurrent construction noise impacts would be managed to minimise cumulative construction impacts (refer to environmental management measure CNV10 in Table D2-1 of this submissions report). Where construction activities are predicted to exceed noise management levels at receivers, detailed programming and respite protocols would be implemented where feasible and reasonable, in accordance with environmental management measure CNV8 (refer to Table D2-1 of this submissions report). Feasible and reasonable measures to address cumulative impacts would be incorporated in the construction noise and vibration management plan (refer to environmental management measure CNV1 in Table D2-1 of this submissions report). Further, a multi-party engagement and cooperation would be established to manage potential

construction fatigue impacts (refer to environmental management measure CI2 in Table D2-1 of this submissions report).

Existing background noise levels

Noise management levels for the assessment of construction noise are derived from measurements of existing noise levels in an area.

Existing background noise levels in the Cammeray area and along the Warringah Freeway are presented in Section 2 of Appendix G (Technical working paper: Noise and vibration). Background noise levels at these locations are mostly influenced by traffic noise from the Warringah Freeway as well as local transport activities. The relatively consistent traffic noise from the Warringah Freeway can mask noise from construction activities, particularly for construction sound sources that do not generate distinctly audible characteristics, or when works are taking place further away from an affected community.

Cammeray Golf Course construction support sites (WHT10 and WHT8)

The Cammeray Golf Course construction support sites (WHT10 and WFU8) would operate for about five years. During this time, out of hours of work would occur for the following activities:

- Warringah Freeway surface road works support
- Tunnel construction and fit out
- Tunnel spoil handling inside the acoustic shed

The assessment has considered the concurrent operation of both construction support sites.

Table 5-114 and Table 5-116 of Appendix G (Technical working paper: Noise and vibration) details the predicted exceedances due to activities that would be carried out at these construction support sites. The results for Morden Street and Bells Avenue residential receiver buildings are reflected in the results for noise catchment areas 28.1 and 29.1. It should be noted that a translation error was identified in Table 10-20 of the environmental impact statement with regard to the number of residential receiver buildings above noise management levels, which has been corrected (refer to Section A4.2 of this submissions report).

The assessment identified that:

- Up to 12 residential receiver buildings are predicted to be highly noise affected (ie predicted noise levels greater than 75 dB(A)) during site establishment while vegetation is being removed on the southern end of the site during standard construction hours. Some of these residential receiver buildings are located along Morden Street and Bells Avenue. These works would be temporary and limited to the initial stages of the project
- Exceedances of relevant noise management levels of up to 20 dB(A) are predicted during site establishment activities at around 242 residential receiver buildings during standard construction hours located in areas surrounding the construction support sites (noise catchment areas 23.1, 23.2, 24.1, 25.1, 26.1, 27.1, 28.1 and 29.1, as depicted in Figure 10-7 of the environmental impact statement)
- No exceedances of noise management levels are predicted once the acoustic shed has been constructed and is in use both during and outside standard construction hours
- The assessment is based on the peak construction period for the project, which represents the tunnelling period of construction. No construction support sites are likely to increase road traffic noise levels by more than 2 dB(A). According to *NSW Road Noise Policy* (Environment Protection Authority, 2011) increases of 2 dB(A) and below. This change represents a minor impact that is likely to be barely perceptible. Maximum noise levels at night could exceed the sleep disturbance screening level (the ‘screening criterion’ noise goal is rating background level +15 dB(A)) at up to 95 receiver buildings from occasional heavy vehicle movements in and out the construction support site and from occasional

clangs and bangs from general site activities. Up to two of these receivers are predicted to be exposed to maximum noise levels above the awakening reaction level. Some of these residential receiver buildings are located along Morden Street and Bells Avenue.

Where noise management levels are exceeded, there is a requirement to implement feasible and reasonable noise mitigation. All construction works and construction support sites would be reviewed during further design development as part of the site-specific Construction Noise and Vibration Impact Statements (refer to environmental management measure CNV2 in Table D2-1 of this submissions report), and to revaluate proposed mitigation and management responses. This would include 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. In accordance with environmental management measure CNV4 (refer to Table D2-1 of this submissions report), construction noise and vibration impacts would be monitored periodically throughout all stages of the construction support site's operation.

An Environment Protection Licence would be obtained from the NSW Environment Protection Authority for the purposes of managing and regulating noise levels across the site. The NSW Environment Protection Authority will apply the noise management levels from the *Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2009), with provisions for restricted works above noise management levels outside standard construction hours in certain circumstances. Measures will have to be implemented to ensure general noise from ancillary facility operation complies with noise management levels outside standard construction hours (including plant such as diesel generators). Noise monitoring would be carried out periodically during construction to confirm that actual noise levels are consistent with the predictions and that appropriate mitigation measures are being implemented.

Recreational receivers

The assessment criteria for recreational areas is established in the *Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2009). The noise management level is set by the type of recreational area (passive or active recreation) and not by frequency of use or user groups. The noise management levels for recreational areas reflect the temporary use of the areas by sensitive receivers and only apply when the area is in use. A more stringent level is set for passive recreational areas. Passive and active noise management levels have been assigned to different locations within St Leonards Park.

Construction noise exceedances at the Flat Rock Gully (NCA38.1) are not expected from activities at the Cammeray Golf Course construction support sites (WHT10 and WFU8) or from surface works along the Warringah Freeway.

Exceedances of the relevant noise management levels of up to 18 dB(A) are predicted at Cammeray Park (NCA26.2) up to 6 dB(A) at Greens Park (NCA28.1) and ANZAC Park (NCA25.1) due to activities associated with the Cammeray Golf Course construction support sites (WHT10 and WFU8). Such exceedances would occur only during site establishment and when noise intensive equipment is in use. No exceedances are predicted during other construction stages.

The Cammeray tennis courts (NCA26.2) and Green Park (NCA28.1) are predicted to exceed the noise management levels by up to 10 dB(A) when the Cammeray Golf Course (WHT10 and WFU8) construction support sites are being established, when noise intensive equipment is in use, and when the site is decommissioned/rehabilitated. No exceedances are predicted during other construction stages.

St Leonards Park (NCA23.2) is predicted to experience exceedances of noise management levels during noise intensive construction activities (typically when excavators with rock hammers, road saws or pavement laying machines are in use) between 2 dB(A) and up to 20 dB(A) in the following works areas:

- Falcon Street interchange upgrade (up to 16 dB(A) above the noise management level)

- Warringah Freeway southbound widening (up to 7 dB(A) above the noise management level)
- Falcon Street to Miller Street construction works (up to 7 dB(A) above the noise management level)
- Western Harbour Tunnel Falcon Street off ramp cut and cover (up to 8 dB(A) above the noise management level).

The assessment has considered reasonable worst case scenarios, when all equipment is operating simultaneously within a 15 minute period and in the worst case locations. This is a conservative assumption and is unlikely to typically occur.

Appendix I (Technical working paper: Health impact assessment) discusses that the temporary loss of directly impacted open space areas would occur and that loss of access to these directly impacted areas would have minimal impacts to community health. This is because alternative green spaces are available in the project area that would remain accessible to the general public.

## C10.3 Ground-borne noise and vibration during construction

### C10.3.1 Ground-borne noise and vibration impacts

***Issues raised***

Submitters raised concerns over the ground-borne noise and vibration impacts from tunnelling. Queries, comments and concerns included:

- Concerns regarding ground-borne noise and vibration impacts to residents and people:
  - Concern due to the potential for high levels of ground-borne noise and vibration where the tunnel is shallow
  - Belief that residents above the tunnel alignment would be exposed to significant ground-borne noise from impact hammers and roadheaders. The use of large rock hammers for benching should not be allowed. If impact hammers must be used then it is requested that they are only used during standard working hours
- Concern that the extent of potential impact has not been accurately determined. A number of submitters were of the opinion that WestConnex demonstrated that far more residents were impacted by vibration than were initially predicted in the environmental impact statement and are concerned the project would have similar impacts
- Concern about the disruption to students at Rozelle and Birchgrove public schools due to noise and vibration impacts during tunnelling, which would occur 24 hours, seven days a week.

***Response***

The ground-borne noise and vibration impacts assessment considers ground-borne noise and vibration from tunnelling of the mainline tunnels, access shafts, ventilation shafts and vibration intensive works at the surface. A conservative approach was taken to predicting these impacts. The impacts are summarised in Section 10.6 of the environmental impact statement. Further detail is available in Section 5 of Appendix G (Technical working paper: Noise and vibration).

Transport for NSW would consult with the potentially affected community regarding tunnelling activities and potential ground-borne and vibration impacts. Monitoring would also be conducted to confirm ground borne noise levels as required in consultation with the affected parties (refer to environmental management measure CNV1 in Table D2-1 of this submissions report).

Individuals can detect building vibration values that are well below those that can cause any risk of damage to the building or its contents, as per the NSW Environment Protection Authority *Assessing*

*Vibration; a technical guideline* (DECC, 2006). As such, the level of vibration that affects amenity is lower than that associated with building damage.

Transport for NSW understand and acknowledge the concern about the potential for vibration and settlement from tunnelling to cause damage to homes. Building condition surveys will be prepared for properties along the tunnel alignment in accordance with environmental management measure SG4 (refer to Table D2-1 of this submissions report). Any damage caused by the project will be rectified.

Ground-borne noise impacts to residential receivers

Ground-borne noise levels are dependent on many factors, including the actual plant being used, its operation and the intervening geology between the activity and the receiver building.

Generally, tunnelling work under properties would occur for around one week for roadheader tunnelling and one week for tunnel bench removal.

Transport for NSW would notify affected receiver buildings in advance of tunnelling occurring near the property and advise noise levels may be audible during these works.

The majority of residential buildings predicted to exceed the relevant ground-borne noise screening criteria would be located near where the tunnels would be at shallow depths depending on the tunnelling method.

The levels are predicted only when the activities are close to these receivers. The ground-borne noise level is expected to drop away as the tunnelling moves further away from these receiver buildings.

For ground-borne noise generated during mainline tunnelling, the assessment identified:

- During roadheader tunnelling, up to 23 residential buildings could experience ground-borne noise above the night time noise management level of 35 dB(A) by up to 10 dB(A). Thirteen of these buildings are in Waverton, where the buildings are typically two storey apartment buildings. The remainder are in North Sydney (north west), where there are five stand-alone dwellings, five multi-storey apartment buildings (four storeys or more). The ground-borne noise level is expected to drop away as the tunnelling moves further away from the receiver
- During rock hammer tunnelling, up to 1507 residential buildings could experience ground-borne noise levels above the night time ground-borne noise management level of 35 dB(A) by over 10 dB(A). The majority are located in Rozelle, Balmain, Birchgrove and Waverton. The residential buildings are low to medium density in Rozelle, Balmain and Birchgrove; and in Waverton they are mostly low density south of Woolcott Street and medium to high density north of Woolcott Street
- Rock-hammering work would not be programmed during evening and night time periods to avoid or reduce ground-borne noise level exceedances on sensitive receivers' buildings where feasible and reasonable.

For other tunnelling activities (eg access declines and ventilation tunnels), a number of additional receivers are predicted to experience ground-borne noise levels that would exceed the night-time noise management level (ie above 35 dB(A)). In some cases, a limited number would experience exceedances above the night time noise management level by over 10 dB(A).

Feasible and reasonable measures would be implemented to minimise ground-borne noise where exceedances are predicted (refer to environmental management measure CNV7 in Table D2-1 of this submissions report).

As airborne and ground-borne noise have the potential to exceed amenity criteria for nearby sensitive receivers, including outside standard daytime construction hours, the contractor would prepare a Construction Noise and Vibration Impact Statement for tunnelling activities in accordance with environmental management measure CNV2 (refer to Table D2-1 of this submissions report).

Where predictions indicate that the relevant amenity criteria are likely to be exceeded, and in accordance with the standard mitigation measures in the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016), the Construction Noise and Vibration Impact Statement would consider the use of construction plant and methods that generate less vibration, scheduling of potentially disruptive activities during less sensitive time periods and appropriate respite.

Vibration impacts to residential receivers

During construction, some properties located above or near the tunnel alignment may experience short-term vibration impact due to the use of equipment such as rock hammers and roadheaders. For most properties, vibration levels would generally be below levels that may cause potential risk to buildings or structures. However, there is potential for cosmetic damage risks to a small number of properties closest to vibration intensive construction activities.

Final vibration levels are dependent on many factors, including the actual plant being used, its operation and the intervening geology between the activity and the receiver building. Appendix G (Technical working paper: Noise and vibration) has considered the most vibration intensive works that could occur anywhere across the construction areas and identifies where further investigation is required during detailed design.

As vibration levels have the potential to exceed amenity criteria for nearby sensitive receivers and cosmetic damage criteria for structures, the contractor would identify and address potential impacts in a Construction Noise and Vibration Impact Statement for tunnelling activities in accordance with environmental management measure CNV2 (refer to Table D2-1 of this submissions report). Where predictions indicate that the relevant amenity and cosmetic damage criteria are likely to be exceeded, and in accordance with the standard mitigation measures in the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016), the Construction Noise and Vibration Impact Statement would consider the use of construction plant and methods that generate less vibration.

Building condition surveys will be prepared for properties (and heritage assets) where the project has the potential to cause cosmetic or structural damage prior to the commencement of construction, as per environmental management measure SG4 and SG3 (refer to Table D2-1 of this submissions report). As mentioned above, for most properties, vibration levels would generally be below levels that may cause potential damage. Within three months of the completion of construction, a post-construction survey will then be offered to property owners of buildings where a pre-construction survey was carried out. Any damage caused by the project will be rectified.

An Independent Property Impact Assessment Panel comprising geotechnical and engineering experts will be established prior to the commencement of works to independently verify building condition survey reports, resolve any property damage disputes relating to construction and establish ongoing settlement and vibration monitoring requirements.

Predicted extents of impact

No structures are identified within the cosmetic damage minimum working distances for all tunnelling methodologies, with the exception of tunnel bench removal using a rock hammer. There are five heritage items potentially within minimum working distances for tunnel bench removal using a rock hammer. The extent of cosmetic damage from vibration is presented in Section 5.11.2 of Appendix G (Technical working paper: Noise and vibration).

Vibration and its associated effects are usually classified as continuous, impulsive or intermittent. Continuous vibration can give rise to dynamic magnifications due to resonances and so the adopted vibration limits have been halved to account for this, as per British Standard BS 7385: *Part 2 Evaluation and measurement of vibration in buildings*. The most vibration intensive equipment used for tunnelling would be rock hammers, which are an intermittent source of vibration. As such, the adopted vibration limit is a conservative approach for identifying the potential extent of impacts.

In regard to the extent of impacts for human response, a number of receiver buildings are identified within the human response minimum working distance when rock hammers are used to remove the tunnel bench at various stages during the tunnelling.

Individuals can detect building vibration values that are well below those that can cause any risk of damage to the building or its contents, as per the NSW Environment Protection Authority *Assessing Vibration; a technical guideline* (DECC, 2006). As such, the level of vibration that affects amenity is lower than that associated with building damage.

In general, satisfactory or 'acceptable' magnitudes of vibration for human response limits are related to the probability of adverse comments from building occupants. In dwellings, adverse comments often arise when occupants perceive the vibration and assume that the vibration has potential to damage their building or contents. In dwellings, the magnitudes of vibration considered 'acceptable' to most people are barely above thresholds of perception. However, people do exhibit wide variations of vibration tolerance. In addition, acceptable values of human exposure to continuous and impulsive vibration are dependent on the time of day and the activity taking place in the occupied space (eg workshop, office, residence or a vibration-critical area).

Minimum working distances that have been used in the assessment of tunnelling impacts are independent of time period and are based upon acceptable vibration levels for a continuous vibration source for the night period, and so are conservative for assessing the extent of impacts during the daytime. In the case of tunnelling activities outside of standard construction hours, for vibration sources such as rock hammers, ground-borne noise levels generated within properties by this activity will likely reach the ground-borne noise management levels and trigger the associated mitigation and management levels when vibration levels are much lower than the acceptable human response vibration levels.

Ground-borne noise and vibration impacts to schools and management measures

Ground-borne noise levels from roadheader and rock hammer mainline tunnelling at the Rozelle Public School and Birchgrove Public School are predicted to be below the ground-borne noise management levels and the vibration human and cosmetic damage screening criteria.

The construction of the Victoria Road construction support site (WHT2) access decline is not predicted to result in ground-borne noise levels above the noise management level or vibration levels above the vibration human and cosmetic damage screening criteria at Rozelle Public School and Birchgrove Public School. Use of rock hammers at the Victoria Road construction support site (WHT2) do have the potential to generate vibration levels above the human response level at some Rozelle Public School buildings, if they are required at the worst case locations (refer to Section 5.3.5.3 of Appendix G (Technical working paper: Noise and vibration)).

The ground-borne noise and vibration assessment from mainline tunnelling works is presented in Section 5.11 of Appendix G (Technical working paper: Noise and vibration).

## C10.4 Property impacts due to vibration

***Issue raised***

A number of submitters were concerned about impacts to property due to vibration generated by tunnelling or surface road works, including:

- Query how sensitive buildings were identified, and what the minimum and maximum expected vibration levels are for structures above the near the tunnel alignment during construction
- Impacts to older houses, some of which are heritage listed or are located in heritage areas, noting these homes do not have sound footings and/or have been constructed using materials that make them more susceptible to vibration damage. Request a more stringent process to be applied to pre-construction settlement assessment

- Opinion that shallow tunnels present significant risks to heritage properties, and would cause irreversible damage from vibration
- Surface works along the Warringah Freeway would create vibration risk of potential damage to homes
- Belief that long term vibration intensive activities can cause damage at a greater distance based on WestConnex experience (up to 300 metres). Query on how vibration would be monitored, and owners compensated for condition survey expenses or damage to properties. Concern was expressed around experiences of property owners with WestConnex and compensation claims.

***Response***

In the unlikely event of property damage caused by construction, the damage would be rectified by the construction contractor to its pre-construction condition at no cost to the property owner.

As described in Section C10.3.1 above, a conservative approach was taken to predicting vibration impacts. The vibration assessment did not predict minimum and maximum vibration levels at a given structure. Rather, it predicted whether vibration would exceed the relevant screening level. Section 3.4.5.2 of Appendix G (Technical working paper: Noise and vibration) presents the structural damage to buildings criteria and assessment limits. The project adopted two conservative screening levels to determine the potential risk to property for cosmetic damage due to vibration intensive activities:

- 7.5 millimetres per second for buildings. This criterion reflects a conservative assumption that structures are unreinforced or light framed structures
- 2.5 millimetres per second for heritage structures. This criterion conservatively assumes that all heritage structures are unsound.

Heritage structures were identified based on heritage items listed on statutory registers.

The vibration assessment did identify that some properties, including listed heritage items, would exceed the screening criterion, specifically:

- Tunnelling by roadheader or by rock hammer would not exceed the 7.5 millimetres per second criterion. Five heritage listed structures (located in the Waverton and North Sydney areas) may exceed the more conservative 2.5 millimetres per second when rock hammers are in use
- Other vibration intensive activities would exceed either screening criteria, depending on the activity and equipment in use, classification of the structure, and proximity of the structure to the construction activity. An example is the use of large rock-hammers during surface road works.

The recommended minimum working distances for construction plant considers both human comfort and impacts on structures, and are referenced from the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016) and German Standard DIN 4150: *Part 3-1999 Structural vibration - Effects of vibration on structures*. Table 10-6 of the environmental impact statement identifies the following safe minimum working distances for the operation of roadheaders and rockhammers associated with tunnel construction:

- The minimum working distance for potential cosmetic damage impacts for structurally sound and structurally unsound buildings for a roadheader is five metres
- For a hydraulic hammer, the minimum working distance for potential cosmetic damage for structurally sound buildings and structurally unsound buildings is 10 metres and 20 metres respectively.

Where specified construction equipment is used at greater distances from receiver locations than the specified safe working distance, there is negligible risk of structural damage or impacts on

human comfort outside of the construction site, as stated in Section 10.4.4 of the environmental impact statement. Vibration impacts from tunnelling activities are not likely to be experienced where construction occurs outside the safe working distances identified.

Where this screening level is exceeded or construction equipment would be used within the minimum working distances, it does not necessarily reflect that there would be an impact. Rather, as detailed in environmental management measure CNV6 (refer to Table D2-1 of this submissions report), the following would be carried out based on the final construction methodology:

- A more detailed analysis of the building structure and vibration levels would be carried out during detailed design to determine the applicable safe vibration level and approach to construction near the structure
- Attended vibration monitoring would be carried out to ensure vibration levels remain below appropriate limits for that structure
- For heritage items, the more detailed assessment would specifically consider the heritage values of the structure in consultation with a heritage specialist to ensure sensitive heritage fabric is adequately monitored and managed.

The following environmental management measures will also be implemented (refer to Table D2-1 of this submissions report):

- Environmental management measure SG4 - Pre-construction building/structure condition surveys will be prepared for properties (and heritage assets) within the zone of influence of tunnel settlement (for example within the 5 millimetre predicted surface settlement contour and within 50 metres of surface works) and within the minimum working distances for cosmetic and structural damage due to vibration. The surveys will be carried out by a suitably qualified person prior to the commencement of the tunnelling and vibration-intensive activities in the vicinity with the potential to affect the building/structure.

  Within three months of the completion of construction activities that have the potential to impact on the subject surface/subsurface structure, all property owners of buildings for which a pre-construction building condition survey was carried out will be offered a second building condition survey. Where an offer is accepted, post-construction building condition surveys will be carried out by a suitably qualified person. The results of the surveys will be documented in a post-construction building condition survey report for each building surveyed.

  Copies of building condition survey reports will be provided to the owners of the buildings surveyed within one (1) month of the survey being completed.

  Any property damage caused by the project will be rectified.
- Environmental management measure SG3 - An Independent Property Impact Assessment Panel, comprising geotechnical and engineering experts, will be established prior to the commencement of works to independently verify building condition survey reports, resolve any property damage disputes and establish ongoing settlement and vibration monitoring requirements.

Building condition surveys would be completed by the construction contractor, on behalf of Transport for NSW.

## C10.5 Construction traffic noise

***Issue raised***

Submitters raised concerns over the noise impacts from construction traffic. Specific queries, comments and concerns included:

- Concerns about the noise impacts from construction traffic:
  - The environmental impact statement does not adequately address noise generated by trucks accessing the construction support sites or during haulage of spoil
  - Scheduling haulage and deliveries outside peak traffic periods to minimise traffic disruptions will result in increased construction traffic noise at all other periods that usually have low existing background noise
  - Noise from construction traffic during school hours would adversely impact student's education, specifically Anzac Park Public School, Cammeraygal High School, Rozelle Public School and North Sydney Public School
  - Construction traffic on Brook Street Naremburn and construction traffic travelling to Balls Head Road via Woolcott Street or Bay Road resulting in increased noise from traffic
- Concerns about the noise impacts from road closures:
  - Impacts associated with traffic diversions during Warringah Freeway closures is not well documented or assessed
  - Warringah Freeway closures would result in traffic diversions on Bent Street and Berry Street. Traffic is expected to increase during diversions
  - Road closures during construction would redirect traffic onto other nearby local streets, increasing traffic noise.

***Response***

Construction traffic noise

Construction-related road traffic noise assessments were carried out using conservative assumptions, where predictions were based on the loudest vehicle, with corrections applied to account for varied road gradient considering sustained engine load for heavy vehicles. However, these noise levels may not result depending upon actual heavy vehicle noise levels, driving methods, and a range of site specific factors (ie no engine load when travelling downhill, and reduced load when travelling empty up hill on departure).

Construction support sites, where feasible, have been selected to minimise heavy vehicles on local roads by selecting sites that provide access and egress via arterial roads or provide maritime transport opportunities. Only low numbers of heavy construction vehicles would access or depart construction support sites during the night time period. This would typically consist of one heavy vehicle movement per hour in the night time period with a maximum of typically four to five construction vehicles per night.

Vehicle numbers have been distributed onto the local road network based on the proposed access roads. Where a vehicle accesses the site by one road and leaves by another, one vehicle movement is counted along each road once. Where a vehicle accesses and leaves the site by the same road, two vehicle movements are counted on that road. Further, the majority of the construction support sites supporting the Warringah Freeway Upgrade component of the project would be used for occasional works, generating low construction traffic volumes.

Section 10.6 and Section 10.7 of the environmental impact statement includes a construction traffic noise assessment for each corresponding construction support sites. Further detail is available in Section 5 of Appendix G (Technical working paper: Noise and vibration). The assessment is based on the peak construction period for the project, which represents the tunnelling period of construction. All construction support sites are unlikely to increase road traffic noise levels by more than 2 dB(A) with the exception of Berrys Bay construction support site (WHT7). According to *NSW Road Noise Policy* (Environment Protection Authority, 2011) increases of 2 dB(A) and below represent a minor impact that is likely to be barely perceptible.

The tunnelling works and subsequent deliveries required to ensure the tunnel is stable and potential ground movement is minimised would occur 24 hour per day, seven days a week. The final section of the route to the Berrys Bay construction support site (WHT7) is along the local roads of Balls Head Road and Bay Road.

Road traffic noise levels associated with Berrys Bay construction support site (WHT7) could potentially exceed the local road noise criteria by up to 6 dB(A) during the daytime period and up to 7 dB(A) for the night time period during the peak construction period. The number of maximum noise events that could disturb sleep are predicted to exceed the sleep disturbance screening level and the awakening reaction level at receivers along Balls Head Road and Bay Road. Woolcott Street would not be used as a construction haulage route (refer to Figure 5-18 of Appendix F (Technical working paper: Traffic and transport)).

These movements are associated with concrete deliveries that are required to support tunnelling (shotcreting) and tunnel fitout for materials. The frequency of these movements over any night or week would vary based on the underground construction activities, however this would typically be three to four concrete deliveries per night while shotcreting activities are underway.

Due to the predicted exceedances associated with Berrys Bay construction support site (WHT7), further assessment would be carried out based on actual heavy vehicle noise sources and site specific measurements which would inform feasible and reasonable mitigation and management methods. To minimise noise impacts from construction vehicles on surrounding streets, mitigation and management measures will be considered during further design development during the development of the site specific Construction Noise and Vibration Impact Statements (environmental management measure CNV2) and the construction noise and vibration management plan (environmental management measure CNV1) detailed in Table D2-1 of this submissions report. This will include, but not be limited to:

- Investigating delivery vehicle noise levels, where construction vehicle routes are required along sensitive local roads outside of standard construction hours, especially considering site-specific parameters (ie road gradients and load state when operating along that road) to:
  - Determine potential noise levels from actual vehicle types to be used and the impacts on receivers adjacent to the construction vehicle routes on sensitive local roads
  - Determine driving techniques considering site-specific parameters that would minimise noise emissions and inform driver inductions for the specific site
  - Determine if there are any additional feasible and reasonable management measures that could be implemented where practicable, noting the number of delivery vehicles would likely only be three to four concrete deliveries per night
  - Implement a site specific drivers' protocol, based on the outcomes of this investigation
- Requiring delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible
- Limiting the use of engine compression brakes at night and in residential areas
- Vehicles should be fitted with a silencer that complies with the National Transport Commission's 'In-service test procedure' and standard.
- Investigating the use of larger concrete agitators to reduce the number of required heavy vehicle movements.

Elsewhere, where feasible and reasonable, construction vehicle movements will not occur on local roads beyond those required for direct access to construction sites unless compliance with the relevant traffic noise criteria can be achieved, or alternative arrangements have been agreed with affected receivers (environmental management measure CNV5 in Table D2-1 of this submissions report).

Warringah Freeway temporary closure detours

Transport for NSW is currently preparing a Construction Noise Management Framework document which describes the approach the project will take to mitigating and managing construction noise impacts for works outside of standard construction hours for the Warringah Freeway upgrade surface road works, as stated in Section C10.1 of this submissions report.

Due to the safety risks associated with working next to live traffic, a full closure of the Warringah Freeway would be beneficial for short periods, allowing for construction activities such as resheeting, installation of bridge spans and demolition of kerbs and medians, which would be carried out more efficiently and with less disruption to traffic. These closures would be carried out during off-peak periods, generally during the evening and night.

Predicted increases in road traffic noise levels at receivers next to key roads and ramps where traffic would be diverted are presented in Table 10-36 of the environmental impact statement. The predictions show:

- Under the full closure scenario, road traffic noise levels are predicted to increase by more than 2 dB(A) at all locations
- Under other closure scenarios, road traffic noise increases greater than 2 dB(A) are predicted at some locations only
- Road traffic noise levels increases greater than 2 dB(A) would be more frequent at two way road locations than at one way road locations.

Warringah Freeway closures would be implemented during construction and would be unavoidable, however would be temporary. Diverted road traffic noise impacts would be minimised with the implementation of detailed Construction Noise and Vibration Impact Statements, an out of works protocol and limiting construction vehicle movements on local roads where feasible (environmental management measures CNV2, CNV3 and CNV5 in in Table D2-1 of this submissions report).

Traffic through the Warringah Freeway corridor could be reduced through demand management, which would also minimise additional volumes on local and collector roads.

An extensive communication strategy would be implemented to notify the community and affected motorists of closures and the recommended detour routes (refer to Appendix E (Community Consultation Framework)).

There would be a requirement for short-term partial and full road closures in parts of the road network. These would be carried out outside of peak periods or during night time to minimise the impact of these activities on the road network where feasible and reasonable (environmental management measure CTT12 in Table D2-1 of this submissions report). A substantial change in the traffic volumes would be required to reach a 2 dB(A) change, noting that typically for traffic noise to increase by more than 2 dB(A), road traffic on a street would need to increase by more than 60 per cent. This is not considering existing high traffic noise levels, in which case the traffic volume change would likely need to be greater than this for a 2 dB(A) change to result. Transport for NSW acknowledge that traffic noise levels would be altered in the vicinity of affected roads, however the impact would be temporary and short-lived (ie during the diversions), and as road and lane closures are required to safely carry out construction, these impacts are largely unavoidable.

Section 10.7.6 of the environmental impact statement assesses construction traffic noise impacts from the temporary closure of the Warringah Freeway.

## C10.6 Environmental management measures and monitoring

### C10.6.1 General environmental management measures

***Issue raised***

Submitters made the following requests in regard to environmental management measures to mitigate construction noise and vibration impacts:

- Noise mitigation and management measures during construction:
  - Request for all mitigation measure identified in the environmental impact statement to form conditions of approval
  - Queried what noise mitigation would be provided for residents that are in the direct vicinity of construction works and highly impacted by construction, and that details of specific mitigation are provided before the project is approved
  - Queried what additional mitigations that can be put in place to mitigate the risk of damage to properties from tunnelling
- Request confirmation on mitigation measures that would be implemented to reduce impacts to residents during prolonged noise intensive periods such as tunnelling directly under private property
- Request to restrict construction work hours:
  - Restrict noise and vibration intensive activities to standard construction hours
  - Limit night work to no more than two nights per week at a site
- Request for community and stakeholder engagement for impacted receivers, particularly receivers during intensive noise and vibration construction activities and receivers impacted by changes in traffic volumes. Queries or requests were also made for:
  - Community engagement around out of hours work
  - A 24 hour phone line must be operational for the duration of the project
  - Submitters requested clear information for how complaints can be made and how they will be managed and responded to
- Request for restrictions on heavy vehicle movements and idling near or outside schools, nursing homes, childcare centres and hospitals to reduce noise impacts
- Respite periods to be provided at locations where noise is expected to be exceeded
- Disagrees that the environmental management measures would be effective in minimising impacts to highly noise affected receivers.

***Response***

<u>Conditions of approval</u>

Should the project be approved, Transport for NSW and the appointed contractor must comply with all requirements of the conditions of approval for the project that would be issued by the Department of Planning, Industry and Environment. This would require the implementation of all of the environmental management measures described in Table D2-1 of this submissions report and other feasible and reasonable measures to prevent and/or minimise any harm to the environment that may result from the construction and operation of the project.

The contractor will be responsible for implementing the conditions of approval, and Transport for NSW will monitor the contractor's compliance with the conditions of approval during construction.

Construction noise and vibration environmental management measures

Construction noise and vibration management approaches are outlined in Table D2-1 of this submissions report. Specific mitigation and management responses would be detailed in the Construction Noise and Vibration Management Plan (Environmental management measure CNV1) and detailed Construction Noise and Vibration Impact Statements (Environmental management measure CNV2) and out of hours works protocol (Environmental management measure CNV1). This includes approaches to:

- Manage impacts where noise management levels cannot be achieved
- Manage impacts to highly noise affected receivers
- Monitoring the effectiveness of the mitigation measures.

Further detail on these approaches is provided in Section 6 of Appendix G (Technical working paper: Noise and vibration).

In addition, the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a) includes a number of standard and additional mitigation measures that would be adopted for the project. These measures are provided would be detailed in the construction noise and vibration management plan and are listed in Annexure G of Appendix G (Technical working paper: Noise and vibration).

The assessment and management approaches detailed in the environmental impact statement are based upon the current level of design development, and presents a reasonable worst case assessment of construction noise. When relevant noise and vibration criteria has the potential to be exceeded, including outside standard construction hours, the construction contractor would be required to prepare detailed location and site specific Construction Noise and Vibration Impact Statements, which would identify potentially affected receivers and propose specific mitigation measures to address the predicted impacts with consideration of the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016). Specific noise impacts would be considered and addressed where feasible and reasonable, and where residual impacts remain, additional management approaches, such as alternative accommodation would be required.

Environmental management measures for potential ground-borne noise and vibration impacts during construction are listed in Table D2-1 of this submissions report. The following environmental management measures will be implemented to mitigate vibration:

- CNV1 – A construction noise and vibration management plan will be developed for the project
- CNV2 – Detailed Construction Noise and Vibration Impact Statements will be carried out for all construction support sites and major construction works required for the project prior to the commencement of construction
- CNV4 – Construction noise and vibration impacts will be monitored periodically throughout all stages of the construction support sites
- CNV6 – Vibration generating activities will be managed through the establishment of minimum buffer distances to achieve screening levels. Where vibration levels are predicted to exceed the screening levels, a more detailed assessment of the impacted structure and attended vibration monitoring will be carried out to ensure vibration levels remain below appropriate limits for that structure.

Where building occupants could potentially be impacted by vibration from mainline tunnelling at levels exceeding those identified in the assessment, additional mitigation measures would be provided in accordance with the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016). Options for additional mitigation of vibration impacts include notification and respite. Where impacts occur outside standard construction hours, specific notification and alternative accommodation may be offered.

Hours of construction

The majority of noise and vibration intensive activities would be carried out during standard working hours, such as the establishment and initial excavation of tunnel declines. In accordance with relevant construction noise and vibration guidelines, construction activities likely to result in amenity impacts to sensitive receivers are typically only justified during the evening and night-time periods when they cannot be carried out during standard daytime construction hours (for example to minimise significant and widespread traffic disruption during peak periods).

Road occupancy licences for works on major roads would typically specify hours during evening and night time periods. In these circumstances and where feasible and reasonable, high noise works (eg road sawing and rock hammering) would be programmed to the earlier part of the night period, before 11pm, as recommended in the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016) or before 12am, to minimise the impacts on nearby residential receivers.

The frequency of respite is an important consideration to manage impacts to the community and in managing the duration of construction duration. As per environmental management measure CNV1 (refer to Table D2-1 of this submissions report), the construction noise and vibration management plan would include standard and additional mitigation measures from the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016). This guideline includes respite provisions that limit that numbers of nights per week on which a sensitive receivers can be exposed to noise levels in excess of the relevant amenity criteria.

An out-of-hours works protocol would be developed for the construction of the project in accordance with environmental management measure CNV3 (refer to Table D2-1 of this submissions report). The out-of-hours works protocol would minimise the overall duration of noise impacts, while providing respite to impacted receivers during the construction works and ensuring the project construction is completed within a reasonable timeframe.

It is acknowledged that a number of construction activities for the Warringah Freeway Upgrade road surface works would occur outside of standard construction hours, typically commencing in the evening period and continuing into the night period. This is predominantly to protect the safety of workers and road users and to minimise traffic disruptions on Warringah Freeway. Generally, noisy activities such as rock hammering and road sawing would be programmed for periods before midnight, where feasible and reasonable. Where unavoidable or in unforeseen circumstances, these noisy activities may be required to be carried out after midnight. As stated in Section C10.1 of this submissions report, Transport for NSW is currently preparing a Construction Noise Management Framework document which describes the approach the project will take to mitigating and managing construction noise impacts for works outside of standard construction hours for the Warringah Freeway upgrade surface road works.

Community engagement for impacted receivers

Transport for NSW is committed to proactively engaging with the community to help minimise the impact of project construction work. Appendix E (Community consultation framework) will be implemented for the project and will guide the planning and delivery of communication and stakeholder engagement activities across the project, including pre-construction stages. As detailed in Appendix E:

- Community consultation regarding construction noise and vibration would be detailed in the Community Communication Strategy for the project. Where appropriate, this would include details on how community preferences would be identified and taken into account in the design of mitigation measures
- The project team would work closely with sensitive receivers and vulnerable community members to ensure approaches are tailored to best suit individual needs and impacts are limited wherever possible. This includes out of hours construction work
- Notification requirements for out of hours work

- A complaints management system would be developed and implemented before the start of construction activities for the project. This would include a toll-free 24 hour telephone number(s) through which complaints and enquiries can be registered.

Specific noise and vibration mitigation and management responses, as well as communication and engagement with the local community, would be detailed in the construction noise and vibration management plan (environmental management measure CNV1), detailed Construction Noise and Vibration Impact Statements (environmental management measure CNV2) and out of hours works protocol (environmental management measure CNV3). This includes approaches to manage highly noise affected receivers, such as additional consultation and notification, additional respite periods, and alternative accommodation.

Refer to Table D2-1 of this submissions report for the full list of environmental management measures.

Restriction of heavy vehicle movements

Chapter 5 of Appendix G (Technical working paper: Noise and vibration) shows that in most cases construction traffic noise from the project would not result in more than 2 dB(A) increases which is considered a minor impact that is likely to be barely perceptible. Except at Berrys Bay construction support site (WHT7), no additional mitigation measures are considered to be necessary. Refer to Section C10.5 above for further information.

Respite periods

Where feasible and reasonable, to limit the number of highly noise affected receivers, high noise impact activities would only be carried out:

- between 7am and 6pm Monday to Friday; and 8am and 1pm Saturday
- in continuous blocks of up to three hours. Respite would be provided between each block for at least one hour, where no high noise impact activities would take place.

Triggers for respite periods may be also considered to manage construction noise impacts as follows:

- Where residential properties are exposed to ground-borne noise in excess of 65 dB(A), in particular where this is likely to occur for two days or more
- Where residential properties are exposed to ground-borne noise in excess of 10 dB(A) above the relevant noise management levels during out of hours work
- Where receivers are exposed to airborne noise in excess of 75 dB(A) at any period of time
- Where receivers are exposed to airborne noise in excess of 5 dB(A) during out of hours work.

Specific respite provisions are described in the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016).

Transport for NSW is currently preparing a Construction Noise Management Framework document which describes the approach the project will take to mitigating and managing construction noise impacts for works outside of standard construction hours for the Warringah Freeway upgrade surface road works, as stated in Section C10.1 of this submissions report. The construction noise management framework would describe details around the approach to respite periods.

Mitigation for highly noise affected receivers

A number of residential receivers adjacent to construction support sites and surface road work areas may be highly noise affected (ie predicted construction noise is above 75 dB(A)) when high noise activities are occurring), as noted in Section 6.3 of Appendix G (Technical working paper: Noise and vibration).

Typically high noise levels would be due to high noise emitting plant/activities and when the specific plant or activity is not in use or that activity is not occurring (or as it moves away) noise levels would be lower.

Where feasible and reasonable, high noise impact activities would be carried out during standard construction hours to limit the number of highly noise affected receivers, with appropriate respite periods.

Once all feasible and reasonable mitigation and management measures are implemented, receivers that still experience high construction noise levels would be managed through the additional mitigation measures detailed in Section 6.10.1 of Appendix G (Technical working paper: Noise and vibration) in accordance *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016). The guidelines help to mitigate and manage noise impacts depending upon the level of the construction noise above the noise management level and the time of day, in addition to appropriate respite for receivers that may experience levels above 75 dB(A).

Transport for NSW is currently preparing a Construction Noise Management Framework document which describes the approach the project will take to mitigating and managing construction noise impacts for works outside of standard construction hours for the Warringah Freeway upgrade surface road works, as stated in Section C10.1 of this submissions report.

### C10.6.2 Acoustic treatments

***Issue raised***

A number of submissions requested acoustic treatment to mitigate construction noise impacts. These requests were:

- Provide acoustic treatment to properties and schools affected by construction noise such as the installation of double glazed windows, replacement of window frames and installation of air conditioning
- At-property treatments should be considered instead of noise barriers for receivers identified as being potentially eligible for noise mitigation. Noise barriers would not sufficiently mitigate the predicted noise levels of up to 75 dB(A)
- At-property treatment is be provided for all affected residences where work would occur for more than 15 days
- Provide temporary noise barriers as part of the project on both sides of the Warringah Freeway to mitigate noise impacts for receivers. Submitters disagree that noise walls would mitigate noise impacts for receivers and queried how construction noise would be mitigated for residents in close proximity to the Warringah Freeway and the Cammeray Golf Course where the construction support sites are located.

***Response***

<u>At-property treatment</u>

At-property treatments are typically considered and installed to address operational road traffic noise not construction noise, which is temporary. However, the project team would look to progress the operational noise treatment program as early as possible, including treatments to eligible properties before construction starts in an area where practical, as identified in Section 7.4 of Appendix E (Community consultation framework). This would allow eligible residents along the alignment to have the benefits of at-property noise treatments and walls during construction as well as operation. The project team would also work closely with sensitive receivers and vulnerable community members to ensure approaches are tailored to best suit individual needs and impacts are limited wherever possible.

Any installation of operational noise mitigation to the properties is intended to be permanent.

Warringah Freeway construction noise mitigation

Section 6.4 of Appendix G (Technical working paper: Noise and vibration) outlines the mitigation and approaches to manage construction noise impact from surface road works. These include:

- A Construction Noise Management Framework document that describes the approach the project will take to mitigating and managing construction noise impacts along the Warringah Freeway road corridor (refer to Section C10.1 above).
- Early installation of operational noise mitigation such as permanent noise walls and at-property treatment where feasible and reasonable
- Management and mitigation at the noise/vibration source. For example, by selecting quieter plant and equipment and using temporary acoustic screens. The assessment noted temporary acoustic screens can provide 5 to 10 dB(A) noise reduction but only where they can break line of sight between the noise source and the impacted receiver
- Limiting timing of noise-intensive work to provide respite to highly noise affected receivers
- Construction programming to shift the works along the extent of the Warringah Freeway to provide respite to receivers, which means works can take place multiple nights per week while providing respite to receivers
- Development of out of hours work protocols classifying works based on level and duration of impact
- Community consultation and engagement to feed back into the mitigation and management measures.

Construction works generating moderately intrusive to highly intrusive noise levels would utilise temporary noise screens where feasible and reasonable to provide noise mitigation. Where feasible and reasonable, the screens would be located as close as practicable to the work area to provide shielding of the plant/construction works to receivers. These can be in the form of temporary screens installed for the period of the works, or mobile acoustic screens which move along with the noise-generating plant. All acoustic screens need to be installed so that they do not contain holes or gaps. In assessing the reasonableness of acoustic screens, the following would be considered:

- Effectiveness of the screen, especially mobile screens, to ensure that line of sight to the critical receivers is being broken
- Usability of the screen does not result in substantially longer noise-generating works
- Whether a small reduction in noise is outweighed by the substantial increase in overall works duration making the use of acoustic screens unreasonable.

The Cammeray Golf Course construction support sites (WHT10 and WFU8) would typically operate in conjunction with the Warringah Freeway Upgrade surface road works being carried out along the road corridor, which are often impacting the same receiver buildings. In accordance with environmental management measure CNV2 (refer to Table D2-1 of this submissions report), detailed Construction Noise and Vibration Impact Statements for all construction support sites and major construction works would be prepared. The Statements will consider the proposed site layouts and noise and vibration generating activities that will take place during all major stages of the construction support site, assess predicted noise and vibration levels against the relevant management levels, and incorporate feasible and reasonable mitigation and management measures in accordance with the requirements of the *Interim Construction Noise Guideline* (DECC, 2009) and the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016). This would include 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.

Mitigation and management measures to be implemented for the Warringah Freeway Upgrade surface road works would assist to manage construction noise impacts on these receiver locations, and further on-site mitigation in and around the construction support sites would typically not assist in reducing the overall construction noise levels at these receivers.

### C10.6.3 Noise and vibration monitoring

***Issue raised***

A number of submissions outlined requests for noise and vibration monitoring as follows:

- Request for three months of baseline noise and vibration surveys to be completed before construction commences
- Submitters requested a comprehensive assessment of existing noise levels to be monitored, specifically where the background noise is already high and re-assess the predicted noise levels with construction
- Query on how noise and vibration would be monitored at properties and other sensitive receivers, with the suggestion that continuous noise and vibration monitoring should be carried out for the duration of construction where exceedances of noise and vibration levels are predicted
- Noise and vibration monitoring results should be made publicly available
- Noise and vibration monitoring should be carried out as such that necessary actions can be taken to minimise any exceedances as soon as possible
- Vibration monitoring must be provided for properties within 100 metres of the tunnel alignment and construction sites
- Queried if noise measured via a specific mobile app would be acceptable as evidence of noise exceedances
- Request for further detail on how exceedances would be managed. In the case of exceedances, work should be suspended and can only recommence once agreement with all affected receivers is achieved
- Penalties should be enforced for exceedances of noise and vibration criteria. Notifications should also be provided to the community stating exceedances of any noise and vibration criteria.

***Response***

<u>Baseline surveys</u>

Baseline noise monitoring was carried out at 41 locations between June 2017 and November 2017 to establish existing background and existing traffic noise levels within each of the noise catchment areas, as detailed in Section 10.3.2 of the environmental impact statement. The noise monitoring locations, receiver type and noise catchment areas are shown in Figure 10-2 to Figure 10-9 of the environmental impact statement.

Background noise levels determined from the noise monitoring are considered to be representative of the existing background noise within the noise catchment areas surrounding the project. Additional baseline noise monitoring and re-assessment is not considered necessary but additional background monitoring may be considered by the construction contractor.

Existing traffic noise levels were measured at specific monitoring locations along the project corridor. The road traffic noise models were then calibrated using existing measured road traffic noise levels.

Noise monitoring was carried out in accordance with the *Noise Policy for Industry* (NSW Environment Protection Authority, 2017) and *NSW Road Noise Policy* (NSW Environment Protection Authority, 2011).

Monitoring

Construction noise and vibration impacts will be monitored periodically throughout all stages of the construction support sites to ensure that:

- Levels are consistent with the predicted noise and vibration levels detailed in the relevant Construction Noise and Vibration Impact Statements
- Noise and vibration impacts are being appropriately managed
- Mitigation measures are effective.

Refer to environmental management measure CNV4 (refer to Table D2-1 of this submissions report).

Compliance

Should the project be approved, the project would need to comply with the conditions of approval issued by the Minister for Planning and Public Spaces as well as the Environment Protection Licence issued by the NSW Environment Protection Authority. These requirements, in addition to the commitments made in the environmental impact statement and the processes set out in the Construction Noise and Vibration Management Plan, are expected to be sufficient to suitably manage construction noise impacts arising from the project.

Periodic monitoring would be conducted by the construction contractor, as required by environmental management measure CNV4 (refer to Table D2-1 of this submissions report). The method of monitoring and locations would be detailed in the Construction Noise and Vibration Management Plan (refer to environmental management measure CNV1 in Table D2-1 of this submissions report).

All complaints in relation to noise and vibration impacts would be investigated. Where the investigations indicate that there has been a non-compliance with the conditions of approval or Environment Protection Licence, the occurrence would be treated as an environmental incident and reported to the appropriate regulatory authorities. Transport for NSW would provide details of all complaints to regulatory authorities as required by the conditions of approval and Environment Protection Licence. As detailed in Section 3 of Appendix E (Community consultation framework), there would be mechanisms to mediate complaints that cannot be resolved.

The requirement to cease work, issue of penalties and the decision to recommence would be at the discretion of regulatory authorities and would be reflective of the nature of the non-compliance.

NSW GOVERNMENT

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C11 – Operational noise and vibration

SEPTEMBER 2020

# C11 Operational noise and vibration

## Contents

# C11.1 Operational noise and vibration

## C11.1.1 Traffic noise during operation

### *Issues raised*

Submitters raised concerns over the noise impacts of operational traffic noise. Queries, comments and concerns included:

- The environmental impact statement insufficiently considers the impacts of operational noise for residents and the community during operation
- The project would result in additional traffic noise during operation
- The depth of the tunnel would not reduce the expected noise and vibration impacts. The project should be conditioned to ensure no permanent vibration or noise effects from ongoing traffic using the tunnels
- The environmental impact statement does not include a noise map that indicates increases or decreases to receiver buildings.

Operational traffic noise impacts at specific locations along the project included:

- The concentration of additional traffic in the Rozelle area would result in additional traffic noise
- There would be increased noise levels in the White Bay precinct
- Noise impacts from traffic during operation would impact the amenity of Yurulbin Park
- Concern that the noise and vibration assessment has not considered the impacts of noise associated with the increase in traffic, in particular through the North Sydney area
- North Sydney, Neutral Bay and Cammeray would bear the burden of the increased noise during operation. If traffic using North Sydney streets increases as a result of the project, it is unclear how residents would experience less noise than at present
- Increased noise impacts for receivers along the Warringah Freeway included:
    - The operation of the bus lane on the Falcon Street interchange and the dedicated southbound bus lane on the Warringah Freeway directly adjacent to receivers and elevated by eight metres is proposed to operate 24 hours, which would increase levels noise for residents
    - The suburbs surrounding the project already experience high traffic noise 24 hours a day, especially next to the Warringah Freeway. Operational traffic noise would be higher and bring traffic noise closer to receivers by widening the Warringah Freeway, upgrading the Falcon Street interchange and new on and off ramps, specifically near Merlin Street and Alfred Street North.

### *Response*

Chapter 11 (Operational noise and vibration) of the environmental impact statement and Appendix G (Technical working paper: Noise and vibration) provide assessment of operational road traffic noise impacts for surface roads associated with the project. Noise modelling predictions were carried out for all noise-sensitive receiver locations. The environmental impact statement, including all detailed technical studies, was reviewed by the NSW Department of Planning, Industry and Environment and key agencies prior to being placed on public exhibition. The assessment has been completed in accordance with the Secretary's environmental assessment requirements.

Noise from traffic travelling through the tunnels would be contained within the tunnels and would not impact noise sensitive receivers on the surface. Therefore, only operational traffic noise from

surface roads and portals to and from the tunnels has been assessed. Operational ground-borne noise and tactile vibration impacts from traffic travelling within the tunnels are not expected as the road surface within the tunnels would be designed and constructed to avoid road irregularities, as discussed in Section 7.5 of Appendix G (Technical working paper: Noise and vibration).

Operational noise impacts from the proposed operational facilities associated with the project have also been assessed for noise-sensitive receivers surrounding the proposed motorway facilities.

As outlined in Section 11.5.3 of the environmental impact statement, the operational noise assessment finds that:

- The project is predicted to reduce traffic noise for about 57 per cent of receiver buildings within noise catchment areas surrounding the project surface road works
- Forty-two per cent of receiver buildings are predicted to experience traffic noise level increases of less than 2 dB(A), which represents a minor impact that would be barely perceptible
- One per cent of receivers within the noise catchment areas are predicted to experience increases in traffic noise of more than 2 dB(A) as a result of the project.

Detailed predicted operational noise levels without mitigation and operational road traffic noise contour maps are available in Annexure O and Annexure P of Appendix G (Technical working paper: Noise and vibration). Receiver buildings potentially eligible for consideration of additional noise mitigation are included in Annexure R of Appendix G (Technical working paper: Noise and vibration).

Rozelle

The environmental impact statement acknowledges that the project is predicted to increase the number of receiver buildings exceeding the relevant noise criteria during the day and night periods at noise catchment areas surrounding the surface connection to City West Link at Rozelle, when compared to the 'Do minimum' (without the project) scenario. This is due to an anticipated increase in traffic volumes on some surface roads in the area leading to and from the tunnels as motorists travel to and from surrounding areas to utilise the tunnels.

Noise impacts would be managed either through at property treatment (to be provided under the M4-M5 Link project Minister's Conditions of Approval (Condition E87)) or when predicted operational road traffic noise increases greater than 2 dB(A) due to the cumulative effect of multiple projects. At-property treatment requirements would be confirmed during further design development. Annexure R of Appendix G (Technical working paper: Noise and vibration) includes receiver buildings potentially eligible for consideration of at-property treatment, including those within the Rozelle area.

White Bay precinct

There are not expected to be any traffic noise impacts during operation in the White Bay area. Exceedances in noise levels do not extend as far as White Bay. Annexure P of Appendix G (Technical working paper: Noise and vibration) illustrates the operational road traffic noise contours – without mitigation for the 'Do something cumulative 2037' scenario.

Yurulbin Park

There are no expected operational traffic noise impacts at Yurulbin Park. The tunnel would pass under Yurulbin Park and noise from traffic travelling through the tunnels would be contained within the tunnels and would not impact receivers at the surface.

North Sydney, Neutral Bay and Cammeray

Most of the operational noise attenuation measures at North Sydney, Neutral Bay and Cammeray would be provided as part of the Warringah Freeway Upgrade component of the project (refer to Section 5.3.9 of the environmental impact statement).

The operational traffic noise impacts consider the widening of the Warringah Freeway and the elevation of proposed overpasses, on and off ramps. This includes Falcon Street interchange and the new on and off ramps near Merlin Street and Alfred Street North.

Appropriate environmental management measures have been included in the environmental impact statement to mitigate any operational traffic noise, such as noise barriers, consideration of low noise pavements (where appropriate) and at-property treatment where feasible and reasonable.

Receivers within North Sydney, Neutral Bay and Cammeray that are identified as eligible to receive additional noise mitigation with existing noise barriers are summarised in Table 7-6 of the environmental impact statement and presented in Annexure N of Appendix G (Technical working paper: Noise and vibration). Annexure R of Appendix G (Technical working paper: Noise and vibration) includes receiver buildings potentially eligible for consideration of at-property treatment.

The cumulative traffic from the project and other major road projects is predicted to reduce the number of receiver buildings exceeding the relevant noise criteria when compared to the 'Do minimum' (without the project) scenario during the day and night periods at noise catchment areas surrounding the Warringah Freeway. This is due to traffic being moved from the existing surface roads into the proposed tunnels.

## C11.2 Operational noise and vibration environmental management measures

### C11.2.1 Noise and vibration environmental management measures (general)

***Issues raised***

Submitters queried the type of noise mitigation and requested assurances that mitigation would be in place. Concerns included:

- Noise mitigation needs to be a condition of approval and should be appropriate to the level of impact
- Residents want assurance that they would receive appropriate and adequate management measures
- The predicted maximum traffic noise level maps show buildings with noise levels of greater than 65 dB(A) are not accurate enough
- Concern that there would be an increase in noise from trucks using compression breaking on the Alfred Street North off ramp and the freeway adjacent to Alfred Street North and request that signage and noise monitoring be carried out in this location in line with Roads and Maritime's national scheme for imposing noise limits, referencing the Environment Protection Authority booklet
- Managing vehicle noise
- Removal of trees for the construction of the southbound bus lane next to Alfred Street North which screens noise from the Warringah Freeway. Trees removed should be replaced with mature trees to mitigate noise from the Warringah Freeway and proposed bus lane once operational.

***Response***

<u>Implementation of appropriate noise mitigation measures</u>

Conditions of approval are a matter for the Department of Planning, Industry and Environment to consider during its assessment of the project.

The project would seek to comply with noise criteria or reduce operational noise impacts wherever feasible and reasonable as part of further design development. This would include design modification, noise barriers, consideration of low noise pavements (where appropriate) and/or at-property treatments. For fixed facilities the project would select operational equipment with a view to

meeting relevant noise criteria. Residential properties would be considered for at-property treatments where exceedances are predicted by noise modelling prepared on the basis of the detailed design.

Environmental management measures for operational noise are outlined in Table D2-1 of this submissions report. These management measures include a range of commitments to minimise impacts on sensitive receivers including a commitment to carry out measurements of the actual operational noise performance of the project and compare this to the predicted operational noise performance (as reviewed during detailed design) within 12 months of the operation of the project (environmental management measure ONV2). The assessment will include identification of any further feasible and reasonable noise mitigation measures required to meet the relevant operational road traffic noise criteria, and identify timing and responsibilities for implementation.

Noise maps levels of greater than 65 dB(A) not accurate enough

The figures depicted in Appendix P of Appendix G (Technical working paper: Noise and vibration) show the predicted maximum traffic noise levels at receiver buildings for year 2037 for the 'Do something cumulative' scenario (that is, the project plus the Beaches Link and Gore Hill Freeway Connection, all stages of WestConnex, Sydney Gateway and all stages of the M6 (former F6) Extension projects) for daytime and night time.

The figures highlight receiver buildings predicted to experience noise levels from 60 to 65 dB(A), and noise levels greater than 65 dB(A). These two ranges were chosen because daytime noise level of $L_{Aeq(15hour)}$ of 65 dB(A) or higher, or night time noise level $L_{Aeq(9hour)}$ 60 dB(A) or higher are the noise level contribution from the road project considered to exceed the cumulative limit under the Noise Mitigation Guideline (Roads and Maritime Services, 2015). It should be noted that $L_{Aeq(period)}$ is the A-weighted equivalent noise level and is the summation of noise events and integrated over a period of time. The cumulative limit of $L_{Aeq(15hour)}$ 65 dB(A) for daytime or $_{LAeq(9hour)}$ 60 dB(A) for night-time is used to determine a residential property's eligibility for consideration of noise mitigation measures.

Annexure O of Appendix G (Technical working paper: Noise and vibration) shows the predicted $L_{Aeq(15hour)}$ and $L_{Aeq(9hour)}$ traffic noise levels to the nearest integer for each receiver buildings in a tabulated format. The exact value of predicted traffic noise levels was utilised in the environmental impact assessment to inform the extent of exceedance above acceptable noise criteria as well as in the design of noise mitigation measures.

Where a building was found with properties potentially eligible for consideration of noise mitigation, a combination of noise control measures have been assessed including the use of quieter pavement surface (if appropriate), installation of noise barriers, at-property noise treatment, or a combination.

Consistent with other approved major road infrastructure projects, an operational noise and vibration review would be conducted post-approval during detailed design to confirm and re-design, where appropriate, the noise and vibration control measures that would be implemented for the operation of the project. Transport for NSW will compare actual operational noise performance to predicted operational noise performance (as reviewed during detailed design) to analyse the effectiveness of the operational road traffic noise mitigation measures within 12 months of the operation of the project, as stated in environmental management measure ONV2 (refer to Table D2-1 of this submissions report).

At-property noise treatment such as the use of acoustically rated windows and doors is utilised by the NSW State Government to mitigate residual road traffic noise impact impinging on the façade of a building, where eligible. For a road infrastructure development project, the overall goal of the at-property treatment is to provide similar acoustic amenity and internal noise levels to those experienced within a dwelling for which the external traffic noise is deemed acceptable by the NSW Environment Protection Authority. A range of noise control options, which has been designed to be consistent with the Department of Planning, Industry and Environment *Development near rail corridors and busy roads – Interim guideline*, would be made available to properties identified as being eligible for consideration of at-property noise treatment. The acoustic treatment

recommendations are based on how many decibels the predicted road traffic noise levels exceed NSW Environment Protection Authority's noise criteria once noise controls at the source (ie quieter pavement surface, if appropriate) and/or in the path of sound propagation (ie noise barriers) have been exhausted in the design process.

Heavy vehicles and compression braking at Alfred Street North

The project includes a new southbound off ramp to Alfred Street North, and a new overpass along Alfred Street North above the new dedicated southbound bus lane. However, as shown in Figure 5-28 of the environmental impact statement, the new off ramp would comprise the same number of traffic lanes, and would be located in the similar position as the existing off ramp and therefore no closer to receivers than the existing road.

Section 11.5.5 of the environmental impact statement presents the findings of the noise assessment in respect of the maximum road traffic noise level. Maximum noise levels (mainly generated by heavy vehicles) have the potential to cause disturbance to sleep. However, under free flowing traffic conditions on the freeway, the use of compression brakes by heavy vehicles would be unlikely to increase when compared to the existing situation.

Maximum noise levels are not expected to substantially change as a result of the project within other noise catchment areas where no major road realignments or widening would be carried out. The exception of this would be noise catchment area 23.1 where it is predicted an increase in maximum noise levels and the number of events compared to the existing situation due to the widening of the Warringah Freeway resulting in the southbound carriageway moving closer to the receivers in this noise catchment area.

Changes in maximum noise levels are a consideration when prioritising and ranking mitigation strategies and will be considered during further design development in accordance with noise mitigation and management in the *Road Noise Policy* (Department of Climate Change and Water, 2011).

The Environment Protection Authority publication *Managing vehicle noise* can be found at the following link:
*https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/noise/130197vehicle.pdf*

As per the *Managing vehicle noise* booklet a national scheme is being introduced to impose noise limits from engine compression brakes and Transport for NSW is implementing this scheme.

Managing vehicle noise

The *Managing vehicle noise* booklet discusses vehicle noise management strategies and also relevant road rules and legislation. Operators and vehicle owners are responsible for ensuring that noise from their vehicles is kept within reasonable levels. The Protection of the Environment Operations (Noise Control) Regulation 2008 aims to prevent high noise levels from vehicles caused by lack of maintenance or inappropriate use. Police can issue penalty infringement notices for breaches of road rules related to vehicle noise. Transport for NSW has additional noise control legislation that can be used for noise checks on heavy vehicles at heavy vehicle inspection stations.

Vegetation removal and noise mitigation

The removal of vegetation next to Alfred Street North is not expected to change the existing noise levels at nearby sensitive receivers. Vegetation generally does not perform well as a noise attenuator. Revegetation and planting, including tree planting, would be carried out at key locations and would be included in the urban design and landscape plan that will be developed for the project in accordance with environmental management measure V12 (refer to Table D2-1 of this submissions report).

### C11.2.2 Noise barriers

***Issues raised***

Submitters requested sound attenuation measures to control the increased traffic noise during operation. Requests and concerns included:

- An assessment should be carried out with and without noise barriers to identify the height required to ensure existing noise levels are maintained during operation
- Limited information is provided on the design and expected effectiveness of proposed noise barriers
- Noise barriers are required around on and off ramps from the Warringah Freeway
- Suggestion for the inclusion of noise barriers in the middle of the freeway to limit noise received at receivers adjacent to the freeway to only one carriageway
- Concern regarding reflection of noise from noise barriers (including back to properties adjacent to barriers) and the need for barrier surfaces to be sound absorbent or the utilisation of sound absorbent landscape materials along the length of the surface motorway
- A number of submitters raised issues with respect to the proposed Amherst Street and Sexton Place noise barriers including:
    - The new noise barrier would visually obstruct the properties along Sexton Place and properties would be surrounded by noise barriers
    - Preference that established trees are retained due to concerns that the new barrier would reflect noise
    - Preference that the barrier extent is not increased as far to the east
    - Concern that the new barriers would create changes to the micro-climate (eg heat), which should be addressed through changes to height or length of the noise barrier, and replanting
    - Request that the existing Sexton Place barriers are increased in height, or that a barrier is replaced using different materials
    - Suggestion that changes are made to the levels of residual land to the west of Sexton Place to eliminate traffic line of sight and to reflect noise
- Noise barriers do not run the full length of the Warringah Freeway between Miller and West Streets. Noise barriers should continue in sections where they are missing to reduce noise impacts on nearby residents
- A noise barrier should be constructed on the edge of the Warringah Freeway cutting, to the north of the Miller Street off ramp, and east of the Miller Street overpass to mitigate traffic noise for residents of Rosalind Street East. Suggestions includes provision of a five metre noise barrier from Miller Street to Ernest Street and on the overpass from Miller Street
- Gaps in the noise barriers along Rosalind Street between Edwin Street and Miller Street do not effectively mitigate noise
- The proposed noise barrier alongside the on ramp at Miller Street is described as being subject to further investigation due to constructability constraints. It is unclear what constructability constraints have been identified and why the noise barrier stops between two buildings
- Appropriate mitigation measures should be implemented to reduce the impacts to residents from the operation of the bus lane on the Falcon Street Interchange and the southbound bus lane such as quiet pavement surfaces for the bus lane, opaque noise barriers and at-property treatments
- A noise barrier should be installed along Alfred Street North to mitigate the additional operational noise from the bus lane. However, some submitters are concerned about the

installation of a noise barrier due to visual impacts associated with the proximity to residences.

***Response***

General

Operational noise predictions have been made on the basis of the design presented in the environmental impact statement. Further operational noise assessment will be carried out during the detailed design phase in accordance with environmental management measure ONV1 (refer to Table D2-1 of this submissions report), and operational noise mitigation will be confirmed in accordance with relevant policies and guidelines.

The operational noise assessment includes assumptions regarding reflections from existing barriers, structures and cuttings (refer to Table 4-14 of Appendix G (Technical working paper: Noise and vibration)), as well as reflections due to proposed noise barriers.

Noise barrier design

The use of noise barriers has been assessed in Section 7.2.2 of Appendix G (Technical working paper: Noise and vibration). The location and required height of the barriers is illustrated in Figure 7-1 to Figure 7-3 and listed in Table 7-10 of Appendix G (Technical working paper: Noise and vibration).

Noise barriers have been considered where four or more eligible properties are found closely spaced. To have a noticeable effect, noise barriers must break the line of sight between the source and receiver. The acoustic performance depends on the degree to which the noise path is interrupted. The topography (ground elevation) must be taken into account in the noise barrier design as this has a direct effect on the geometry of the source, barrier and receiver. Sources or receivers in an elevated position may tend to overlook a noise barrier, and this is taken into account in the design.

A combination of noise barrier and at-property noise treatment can provide the most reasonable overall reduction for an affected community when consideration is given to urban design, visual impact and engineering constraints. The process of determining the most effective combination of noise barrier height and at-property noise treatment is given in the *Noise Mitigation Guideline*, whereby the process gives preference to a hierarchy of noise control measures that reduce outdoor noise levels as per the *Road Noise Policy*.

At this stage of assessment, maximum noise barrier heights have been identified across the Warringah Freeway corridor to address the localised noise conditions and likely impacts. When optimising the noise barrier height in the noise abatement design, the process described in the *Noise Mitigation Guideline* identifies three heights. These are the maximum barrier height, initial design barrier height and design barrier height. The optimising process is completed in three steps:

- Step 1 – identify the maximum barrier height, which is the barrier height that strives to result in external noise criteria being met at all receivers. Transport for NSW policy is that barrier heights above eight metres would not be assessed as part of the noise abatement design
- Step 2 - define the initial barrier height, which is a height between zero and maximum barrier height, where the trend in noise benefit is characterised by a rapid reduction in the number of properties eligible for consideration of additional noise mitigation
- Step 3 – determine the design barrier height, between the initial barrier and maximum design barrier heights. The design barrier height is identified by also taking into consideration the area of noise barrier and noise reduction benefits across the broader community.

As a guide, noise barriers are considered to be a reasonable noise mitigation option where they are capable of providing a noise attenuation benefit (referred to as an insertion loss) of:

- 5 dBA at representative receivers for barrier heights of up to five metres

- 10 dBA at representative receivers for barrier heights between five and eight metres high.

In certain situations the requirements for the barrier cannot always be met. In this case further feasible and reasonable considerations are carried out in consultation with Transport for NSW.

Barrier heights have been optimised following the process as described in the *Noise Mitigation Guideline* and with consideration of the *Noise Wall Design Guideline*. This includes the identification of the maximum barrier height which represents the barrier height that strives to result in external noise criteria being met at all receivers. A reasonable and feasible assessment of each proposed barrier was carried out taking into account:

- Urban design, overshadowing and visual impacts (refer to Appendix V (Technical working paper: Urban design, landscape character and visual impact) for an assessment of impacts from noise barriers)
- Impacts to private land
- Future uses and development of land where barrier is proposed
- Constructability and engineering constraints
- Other environmental impacts associated with construction of the noise wall (eg removal of vegetation).

Where urban design, overshadowing, constructability and engineering constraints were considered, the barrier analysis process included discussions between Transport for NSW's design team and the project's urban design specialist. This determined maximum allowable heights at locations along the Warringah Freeway (ranging from four to five metres), which would be subject to the consideration of local community preferences, as well as final engineering and urban design outcomes during further design development.

The form of the noise barriers would be subject to further design development and engagement with the local community, guided by the strategic urban design framework for the project and the *Noise Wall Design Guideline*. The *Noise Wall Design Guideline* identifies a number of considerations, including reflected noise and use of adsorptive surfaces, materials, solar access, use of landscaping and integration with the road corridor and surrounding urban form.

Implementing noise barriers in the middle of the freeway would only mitigate noise from one carriageway, while noise from the exposed carriageway would still be present. Given the high traffic volumes along the Warringah Freeway, reducing noise from only one carriageway would not be sufficient and noise impacts at affected receivers would still exceed the relevant criteria.

Further, much of the Warringah Freeway is in a cutting, where receivers are located above the freeway overlooking the traffic. Having barriers in the middle of the freeway would provide minimal benefits as receivers up high would still likely overlook the carriageway that the barrier is meant to shield.

Amherst Street and Sexton Place noise barriers

The noise and vibration assessment concluded that the existing noise barrier at Sexton Place, Cammeray is sufficient to mitigate noise during operation. There are no proposed changes to the existing noise barrier at Sexton Place.

Appendix G (Technical working paper: Noise and vibration) refers to a new noise barrier at Amherst Street, including a combination of existing and modified noise barriers, identified as noise barrier WFNB_008. Construction of a new part of the noise barrier along Amherst Street is proposed to be carried out as part of the Transport for NSW Noise Abatement Program. The location and size of the proposed noise barrier is being developed through consultation with the affected community and North Sydney Council. The Review of Environmental Factors for the Amherst Street Noise wall is on public exhibition from 17 August until 7 September 2020. Construction work to build the noise wall is expected to start in late 2020, subject to approval, and take around four months to complete. Further information can be found at *nswroads.work/amherst*.

A clarification regarding the Amherst Street, Cammeray noise barrier is provided in Section A4.1.5 of this submissions report. The noise barrier proposed to be constructed under the Noise Abatement Program is generally consistent with the project as depicted in the project environmental impact statement. The proposed barrier height of 4.5 metres would provide more than 5 dB(A) of noise attenuation for residents located on Jenkins Street, Cammeray, who currently experience high-level traffic noise originating from the Warringah Freeway and the Amherst Street off ramp.

An assessment of operational noise performance will be reviewed during detailed design of the project to confirm operational noise mitigation requirements, taking into consideration the final form and location of the Amherst Street noise barrier and include consideration of integration with existing structures, impacts to vegetation, visual amenity and urban design considerations, as required by environmental management measure ONV1 (refer to Table D2-1 of this submissions report).

Reflections from the Amherst Noise barrier to the receivers on Sexton Place have been considered in identifying appropriate locations for the new noise barrier.

Miller Street and surrounds

The operational noise assessment has identified the following new noise barriers to the east of the Miller Street overpass, which would be confirmed during further design development and with consideration to community preferences concerning barrier design:

- A noise barrier along the off ramp extending from the existing noise barrier that currently ends at Anzac Avenue to Miller Street. The proposed barrier height would be five metres, which achieves up to 5 dB(A) of noise attenuation
- A noise barrier along the on ramp, extending around 326 metres. The height of 4.5 metres would provide up to 5 dB(A) of noise attenuation and reflects the maximum allowable barrier height for this location. Further refinements to noise barrier design would be investigated based on constraints, such as constructability, impacts to properties, as well as technical, environmental and visual impacts to determine the final barrier height.

A noise barrier on the Miller Street overpass would be considered during further design development. However, the noise and vibration assessment did not consider a noise barrier necessary as noise levels along the overpass are unlikely to result in increased noise impacts at nearby receivers.

There are some existing noise barriers along the southern and northern sides of the Warringah Freeway between Miller Street and West Street. The operational noise assessment determined that barriers for the full length were not considered feasible and reasonable as:

- The existing barriers would not be directly impacted, and
- Spacing of eligible receiver buildings was below the threshold for consideration.

Falcon Street Interchange

The Warringah Freeway in this location is in a cutting (south of Falcon Street Interchange). The assessment of traffic noise impacts was based on traffic noise from all traffic lanes of the Warringah Freeway and not just bus lanes or general traffic lanes.

A noise barrier in this location would be investigated further during design development to determine its feasibility. However, the noise and vibration assessment did not consider a noise barrier necessary as noise levels from the project are unlikely to result in increased noise impacts at nearby receivers. The impacted receivers are apartment buildings, and a noise barrier would protect only the lower levels of those buildings. A barrier was therefore considered not reasonable and at-property treatment would be the recommended noise mitigation option.

Section 11.5.4 of the environmental impact statement and Annexure R of Appendix G (Technical working paper: Noise and vibration) identifies the number of receivers to be considered for at-property treatment after other mitigations such as quiet noise pavement (where appropriate) and

new and existing extended noise barriers have been included. At-property treatment options may include but are not limited to mechanical ventilation, double glazing, window and door seals, sealing of vents and underfloor areas. Noise mitigation options (consideration of quieter pavement, noise barriers, at-property treatment or a combination) would be reviewed and confirmed during further design development taking into consideration community preferences.

Alfred Street North

A new noise barrier is proposed on Alfred Street North between 441 and 389 Alfred Street North (WFB_003). The noise barrier would be five metres high and would provide more than 5 dB(A) of noise attenuation.

The operational noise assessment found no receivers on Alfred Street North between Eaton Street to 339A Alfred Street North have been triggered for consideration of noise mitigation treatment, therefore a noise barrier has not been recommended in this area. Additionally, south of 339A Alfred Street North, the topography and the proposed road design would not allow for noise barriers to be installed in an appropriate location that would provide sufficient noise benefit.

Receiver buildings would be considered on a case-by-case basis for at-property treatment where triggered under the *Noise Criteria Guideline* (Roads and Maritime Services, 2015).

### C11.2.3 At-property acoustic treatment – types, eligibility and requests

#### *Issues raised*

Submitters requested acoustic treatments at their properties and raised other queries regarding at-property acoustic treatment, including:

- Request for at-property treatments. This includes an instance where some residential buildings have been identified for at-property treatment, but adjoining buildings have not. It is unclear why and these properties should be treated
- Operational noise is expected to increase, and many buildings are eligible for noise attenuation however it does not seem to be a condition of approval
- Request that any noise and vibration at-property treatments made to buildings are permanent, not temporary
- At-property treatment for operational noise is unlikely to be effective as windows are left open
- External spaces would be impacted by increased noise and at-property treatment would remove the option to have windows and doors open. Request was made to enclose external areas to enable use of outdoor spaces
- Confirm the long term permanent noise and vibration mitigation measures that are subject to M4-M5 Link's Condition of Approval E87. The operational mitigation must ensure the following:
  - Are architecturally and functionally sympathetic to the style and standard of each home or building
  - Noise increases would be no greater than 2 dB(A) inside the building
  - Provide an effective range of solutions for external living areas which would be impacted by operational road traffic noises such as noise barriers.

#### *Response*

As is normally the case for complex major infrastructure projects progressing through an environmental planning and assessment process, the final design and construction approach will be determined during further design development. As such, the noise and vibration impact assessment has taken a conservative approach to ensure that worst case scenarios are represented.

Operational mitigation measures are subject to refinement once project approval is obtained and the contractor delivering the project have further developed the design and construction methodologies.

The project is predicted to typically reduce road traffic noise at most receiver locations, with additional noise mitigation requirements being triggered as a result of the high existing road traffic noise levels, as described in Section 11.5.3 of the environmental impact statement. In the case of the Warringah Freeway, the project is predicted to reduce traffic noise levels from the Warringah Freeway and surrounds for around 60 per cent of receiver buildings, mainly due to traffic being moved into tunnels. In addition, many of the receivers that experience an increase in noise would not be able to detect the change (ie many of the increases are less than 2dB(A)). Only one per cent of receivers within the impacted noise catchment areas are predicted to experience traffic noise level increases of more than 2 dB(A) as a result of the project.

Priority in noise mitigation is given to the use of quieter road pavement surfaces (where appropriate) and noise barriers in recognition of the importance of providing protection to external and internal areas (refer to Section 4.7 of Appendix G (Technical working paper: Noise and vibration)). However, at-property treatment would be required where receiver buildings would still exceed the *Noise Criteria Guideline* (Roads and Maritime Services, 2015) and are triggered for consideration of additional mitigation.

The *Noise Mitigation Guideline* provides three triggers where a receiver may qualify for consideration of noise mitigation (beyond the adoption of road design and traffic management measures). These triggers are:

- Trigger 1: The predicted Build noise level exceeds the *Noise Criteria Guideline* controlling criterion and the noise level increase due to the project (ie the difference in the noise predictions between the Build and the No Build) is greater than 2 dB(A)
- Trigger 2: The predicted Build noise level is 5 dB(A) or more above the criteria (exceeds the cumulative limit) and the receiver is significantly influenced by project road noise, regardless of the incremental impact of the project
- Trigger 3: The noise level contribution from the road project is acute (daytime $L_{Aeq(15hour)}$ 65 dB(A) or higher, or night time $L_{Aeq(9hour)}$ 60 dB(A) or higher); the receiver qualifies for consideration of noise mitigation even if noise levels are dominated by another road. Note that $L_{Aeq(period)}$ is the A-weighted equivalent noise level and is the summation of noise events and integrated over a period of time.

Receiver buildings that are considered to be potentially eligible for consideration of at-property treatment are identified in Section 7.2.3 and Annexure R of Appendix G (Technical working paper: Noise and vibration). Eligibility would be confirmed during further design development. Where a receiver is confirmed as being eligible for consideration of at-property acoustic treatment, further consultation with the owner of the affected property will be carried out.

The overall goal of the architectural treatment is to provide similar acoustic amenity and internal noise levels to those experienced within a receiver where the external noise criteria have been met.

In most instances, assuming brick construction and standard glazing, this goal equates to internal noise levels that are around 20 dB(A) less than the external noise criteria with windows closed, consistent with the *NSW State Environmental Planning Policy (Infrastructure) 2007* and *Australian Standard 2107*. The at-property noise treatment packages would be tailored to each individual property, and the extent of exceedance over the Environment Protection Authority's traffic noise criteria following the use of quieter pavement (where appropriate) and/or noise barriers.

Building element treatments are more effective when they are applied to masonry structures than lightly clad timber frame structures. The architectural treatments provided by Transport for NSW typically include:

- Upgraded windows and glazing and solid core doors on the exposed facades of the substantial structures only (eg masonry or insulated weather board cladding with sealed

underfloor). These techniques would be unlikely to produce any noticeable benefit for light frame structures with no acoustic insulation in the barriers

- Upgrading window or door seals and appropriately treating sub-floor ventilation
- Fresh air ventilation systems. Note these can only be installed where they can meet the National Construction Code of Australia
- The sealing of wall vents
- The sealing of eaves.

Any installation of operational noise mitigation at properties is intended to be permanent.

Property assessments would be completed to determine if any of the mitigation measures can improve the acoustic resistance of a property before treatment packages are agreed and installed. Treatment packages would only be recommended and considered feasible and reasonable where they are predicted to provide a noticeable improvement in noise reduction (3 dB(A) or greater) compared to the existing scenario. In some instances, partial treatment packages may be considered feasible and reasonable where the existing system forms part of the recommended package.

During the installation phase of the acoustic treatments, ownership details would be obtained for all receivers identified as eligible for consideration of at-property treatment. This phase would also identify the location of internal habitable areas for each dwelling.

The implementation of reasonable and feasible at-property acoustic treatment would be in accordance with Transport for NSW's *At-property Noise Treatment Guideline* (Roads and Maritime Services, 2017). This does not extend to fully rebuilding a dwelling for noise mitigation reasons.

Receivers identified as being eligible for at-property treatment within noise catchment areas surrounding the surface connection at Rozelle would be mitigated either:

- Under the M4-M5 Link project Minister's Conditions of Approval (Condition E87), or
- When predicted operational road traffic noise increases greater than 2 dB(A) due to the cumulative effect of multiple projects.

Properties that are eligible for treatment would be confirmed during further design development. In addition, the operational noise performance of the project would be reviewed, and additional reasonable and feasible mitigation measures would be considered.

Properties identified as being eligible for at-property treatment in accordance with the M4-M5 Link's Minister's Conditions of Approval (Condition E87) would remain eligible irrespective of this project.

NSW GOVERNMENT

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C12 – Air quality

SEPTEMBER 2020

# C12 Air quality

## Contents

# C12.1 Level and quality of air quality assessment

## C12.1.1 Concern regarding adequacy of the operational air quality assessment

### *Issue raised*

Submitters expressed concern about the adequacy and accuracy of the air quality assessment. Specific concerns included:

- Concern that the air quality assessment is misleading, contains incorrect information, omits critical information and underestimates the potential air quality impacts
- Concerns that the environmental impact statement suggests that the higher the ventilation outlet, the more that emissions would be dispersed over a wider spread area and the statement that this would reduce the impact on sensitive receivers is not accurate
- The comparisons to other ventilation systems from tunnels around the world in the environmental impact statement are incorrect and misleading. The project should be compared against overseas tunnels which are filtered, specifically the CWB Hong Kong Bypass Tunnel
- Question the comparison with the E4 Stockholm Tunnel, as the Stockholm tunnel would include proper ventilation. The Stockholm tunnel would have a much greater number of air exchanges and outlets
- The environmental impact statement claim that the M5 East filtration trial failed is misleading. It is widely agreed among experts that the parameters of the scheme were fundamentally flawed
- One graph has results covered by the key and the $PM_{2.5}$ tables do not show the correct criteria level with criterion to be lowered by 2025.

### *Response*

Adequacy of the air quality assessment

The environmental impact statement has been prepared by a team of qualified professionals, including technical specialists, and was reviewed by subject matter experts from Transport for NSW to provide a balanced, merit-based environmental impact assessment in accordance with the *Environmental Planning and Assessment Act 1979*, the Secretary's environmental assessment requirements and applicable NSW assessment policies.

As part of the preparation of the air quality impact assessment for the project, Appendix H (Technical working paper: Air quality) was issued to the Office of the Chief Scientist and Engineer and the Advisory Committee on Tunnel Air Quality (ACTAQ) to carry out a scientific review of the environmental impact assessments relating to ventilation outlets.

To maintain independence and robustness of the review process, two independent reviewers were engaged by the Office of the NSW Chief Scientist and Engineer. The independent reviewers were Åke Sjödin from the Air Pollution and Abatement Strategies Unit at the IVL Swedish Environmental Research Institute, and Ian Longley, Air Quality Scientist from the New Zealand National Institute of Water & Atmospheric Research. The Committee's comments were addressed accordingly, before the environmental impact statement was released. The ACTAQ concluded that Appendix H (Technical working paper: Air quality) constitutes "a thorough review of high quality" and covers "all of the major issues and areas that an environmental impact assessment should for a project of this scale". Further, that "the information presented is of suitable detail and logical in order. The choices made regarding data used and methods followed were logical and reasonable."

Between 2014 and 2016, ACTAQ released a number of reports on motor vehicle emissions, air quality and tunnels, and in 2017 ACTAQ published a study designed to optimise the Graz

Lagrangian Model (GRAL) in the Australian context (Pacific Environment, 2017b). These reports were consulted as part of the assessment for the project.

Emission dispersal

Elevated ventilation outlets are very effective at ejecting tunnel air high into the atmosphere through a combination of buoyancy and speed. This occurs by the warmer tunnel air (heated by vehicles using the tunnel) being ejected upwards at speed through the outlet by axial fans. This warm air continues to rise high into the atmosphere through natural buoyancy as it is warmer than the surrounding air.

Once in the atmosphere, the ejected tunnel air dilutes as it mixes with the surrounding air. Dispersion is improved by winds that tend to become stronger higher up into the atmosphere, while wind and turbulence increase mixing of the emitted and background air resulting in dilution.

A sensitivity analysis carried out based on different outlet heights of between 20 and 40 metres generally demonstrated that the ground level contributions from the higher ventilation outlets were marginally lower than for lower outlet heights. The results were not, however, very sensitive to ventilation outlet height and predicted contributions to air quality at ground level were generally minor compared existing ambient air quality.

Comparison to other tunnel ventilation systems and filtration

The independent NSW Chief Scientist and Engineer has recently released a report in relation to road tunnel air quality. The report found that emissions from well-designed road tunnels cause a negligible change to surrounding air quality, and as such, there is little to no health benefit for surrounding communities in installing filtration and air-treatment systems in such tunnels. Further information is available at *www.chiefscientist.nsw.gov.au* and *nswroads.work/airquality*.

Alternative tunnel ventilation systems and filtration is discussed in Chapter 12 (Air quality) of the environmental impact statement and Section 9.2 of Appendix H (Technical working paper: Air quality). The inclusion of tunnel filtration was evaluated and found not to provide any material benefit to air quality or community health. This is demonstrated in the environmental impact statement, in which the predicted contributions from tunnel ventilation outlets during expected traffic conditions would generally be negligible compared to ambient air quality for all residential, workplace and recreational receivers.

The discussion on tunnel ventilation and filtration in the environmental impact statement reflects the outcomes of the review completed by the ACTAQ (ACTAQ, 2018b). The ACTAQ assessment reviewed options for treating road tunnel emissions (ACTAQ 2018b). The review concluded that:

- Decisions on how to best manage tunnel air can only be made at the project level. Health-based air quality standards must be a priority; however, engineering and economic factors also need to be taken into account
- Air filtration systems in tunnels are rare around the world. They have high infrastructure, operating and maintenance costs
- Although filtration for particulates or Nitrogen dioxide ($NO_2$) is technically feasible, the available technologies would not lower concentrations of other air pollutants
- Alternatives such as portal air extraction (ie no portal emissions) and dispersion via ventilation outlets may achieve the same outcomes as filtration at a lower cost.

The ACTAQ assessment has demonstrated that the appropriate design of ventilation outlets would achieve the same (or better) outcomes as installing air filtration systems – that is, the contribution of tunnel ventilation outlets to pollutant concentrations would be negligible for all receivers.

The environmental impact statement acknowledges that an in-tunnel air treatment system was trialled in the Sydney M5 East tunnel, and is discussed in the context of the high cost of this system given the retrospective design and installation of the system. Regardless, the assessment in the

environmental impact statement demonstrates that appropriate air quality outcomes can be achieved without the need for filtration of emissions.

The environmental impact statement makes no comparison or discussion of the E4 Stockholm Tunnel. The assessment does, however, demonstrate that the proposed tunnel ventilation system conceptual design would achieve appropriate in-tunnel air quality and appropriate contributions to ambient quality at ground level in the vicinity of the tunnel portals and ventilation outlets.

Given the minor contributions to air quality at ground level due to outlet emissions, filtration would require a level of energy usage that is likely to be disproportionate to the benefit it would provide.

Graph correction

Corrections to Figure 12-14 and Figure 12-17 of the environmental impact statement have been included in Section A4.2 to move the legend box.

It is not clear which tables the submitter has made reference to. The NSW assessment criteria for fine particle emissions, being atmospheric particulate matter with a diameter of less than 2.5 micrometres ($PM_{2.5}$) has been correctly shown on figures. It is acknowledged that the National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM) has set 2025 goals for $PM_{2.5}$. Background air quality is predicted to be close to or above these goals irrespective of the project. Predicted changes due to the project would, however, generally be very low compared to existing ambient concentrations. Discussion on changes in $PM_{2.5}$ relative to the NSW assessment criterion and the long term AAQ NEPM goal is provided in Chapter 12 (Air Quality) of the environmental impact statement and is further discussed in Section 8.14 of Appendix H (Technical working paper: Air quality).

### C12.1.2 Concern regarding methodology of the operational air quality assessment

***Issue raised***

Submitters expressed concern about the methodology used for the air quality assessment. Specific queries, concerns and comments include:

- Concern that the air quality assessment does not assess long term impacts of emissions
- Concern that emissions from existing traffic movements have not been factored into the air quality assessment
- The environmental impact statement should present the worst case air quality scenario
- The extensive modelling of air pollution is satisfactory and highlights that the project would reduce carbon emissions due to removing the need for cars to stop and start as often
- Dispersion modelling has not factored in topography and high rise buildings
- The topography of the area surrounding the project would mean that certain pollutants (including carbon monoxide, oxides of nitrogen, sulphur dioxide and volatile organic compounds) would settle in lower lying areas which would magnify impacts to receivers
- The air quality assessment does not consider that there is usually minimal wind in the morning that could result in adverse impacts to receivers in close proximity to ventilation outlets
- Air quality impacts have been averaged across community receivers. The environmental impact statement does not present accurate air quality impacts and areas included in the study area appear unrelated to the project
- Only relevant sensitive receivers should be included in the analysis and results should be weighted by the number of sensitive receivers in the study area
- The air quality assessment reports on the average ventilation outlet emissions and may not be accurate

- The air quality assessment did not include an assessment of the accumulation of micro/nano-particles or the impacts of ultrafine particles (particularly in conjunction with other pollutants).

***Response***

Section 5 of Appendix H (Technical working paper: Air quality) provides a detailed description of the air quality assessment methodology. The operational ambient air quality assessment was based upon the use of the GRAMM-GRAL model system, which consists of two main modules: a prognostic wind field model (Graz Mesoscale Model – GRAMM) and a dispersion model (Graz-Lagrangian Modal – GRAL). As identified in Section C12.1.1 above, the methodology was independently reviewed by the Office of the Chief Scientist and Engineer and the ACTAQ. The ACTAQ concluded that the choices made regarding data used and methods followed were logical and reasonable.

Assessment approach (operational)

The assessment considers the potential air quality impacts of the project in 2027 and 2037 as well as the cumulative impacts of the project in conjunction with other major road projects.

The assessment has:

- Modelled surface road networks within the model domain both with and without the project. This data has been sourced from the Strategic Motorway Project Model, and the assessment has considered future changes in the composition and performance of the vehicle fleet, as well as predicted traffic speeds, traffic volumes, road gradients and the distribution of traffic on the road network
- Considered expected traffic scenarios as well as a regulatory worst case in ambient air quality modelling. The latter represents a theoretical upper bound of the operation of the ventilation outlets. The assumptions underpinning these scenarios are very conservative and would never occur for periods longer than a few hours.

The in-tunnel air quality assessment and ventilation design has accounted for the expected traffic as well as the worst traffic conditions that could conceivably occur in the tunnels during operation. This demonstrated that the tunnel ventilation system can manage in-tunnel air quality even when traffic is at its theoretical maximum capacity in the tunnel and for any given speed.

The air quality impact assessment used a sophisticated meteorological and dispersion model which included local topography and a full year of hourly meteorological data (8760 hours). Meteorological information including wind direction, wind speed, calms (wind speeds less than 0.5 metres per second), and temperature inversions, was used to model the peak concentration of air pollutants that may occur. Accumulation of pollutants under low wind speeds was included in the assessment.

Meteorological data from four sites were selected for use in GRAMM to determine three-dimensional wind fields across the modelling domain. The Match-to-Observation function in GRAMM has also been applied, which refines the order of the predicted wind field in GRAMM to provide a better match to the observations of the four meteorological stations. Annexure F of Appendix H (Technical working paper: Air quality) describes the process of determining suitable meteorological data to be included in the modelling in considerable detail, and this is discussed further in Section B1.6.2 of this submissions report.

When assessing the dispersion of pollutants from vehicles, wind speed and direction are among the most important meteorological parameters to consider. The meteorological and dispersion model has utilised a full year of meteorological data, and considers seasonal and diurnal changes in wind speed.

Study area domain

The study area domain extended well beyond the project itself to allow for the traffic interactions between the project, the Beaches Link and Gore Hill Freeway Connection project and the M4-M5

Link project, as well as changes along affected surface roads in order to satisfy the Secretary's environmental assessment requirements.

Two types of discrete sensitive receivers were considered in the air quality assessment:

- 'Community receivers'. These were taken to be representative of particularly sensitive locations such as schools, child care centres and hospitals within a zone of about 500 to 600 metres either side of the Western Harbour Tunnel and Beaches Link program of works corridor, and generally near significantly affected roadways. In total, 42 community receivers were included in the assessment (refer to Figure 12-3 of the environmental impact statement)
- 'Residential, workplace and recreational receivers'. These were all discrete receiver locations along the Western Harbour Tunnel and Beaches Link program of works corridor and mainly covered residential and commercial land uses. In total, 35,490 residential, workplace and recreational receiver locations (including the 42 community receivers) were considered in the assessment of project air quality impacts.

The main reason for these two types of receivers was to allow for a more detailed analysis of short-term metrics for community receptors. The identified community receiver locations were representative and not exhaustive, and were selected using professional judgement to demonstrate potential impacts at a more detailed level.

The model calculates predicted air quality results at every discrete receiver location based on all input information.

In addition to these discrete receivers, pollutant concentrations were spatially mapped (ie contour plots) across the GRAL domain for $NO_2$, $PM_{10}$ and $PM_{2.5}$. These were based on 1.9 million grid points, spaced at 10 metre intervals across the domain.

Analysis of results

The use of average ventilation outlet emissions, and the averaging periods selected for the assessed pollutants, is informed by the ambient air quality standards or criteria, and is set by the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW Environment Protection Authority, 2016) (the NSW Approved Methods) and the AAQ NEPM. The form of an air quality standard is typically an ambient concentration limit for a given averaging period (eg annual mean, 24-hour mean), which may be stated as a 'not-to-be-exceeded' value or with some exceedances permitted. Several different averaging periods may be used for the same pollutant to address long-term (annual) and short-term (1-hour or 24-hour) exposure.

The air quality assessment in Chapter 12 (Air quality) of the environmental impact statement and the supporting technical working paper (Appendix H) does not use or present weighted results, which would not be in accordance with the NSW Approved Methods and the AAQ NEPM. The discussion and presentation of impacts to air quality are presented for discrete receivers as the maximum change or ranked in order of impact. Additional statistical analysis was completed where broader regional assessments were required to satisfy the Secretary's environmental assessment requirements.

The health impact assessment in Chapter 13 (Human health) of the environmental impact statement and the supporting technical working paper (Appendix I) includes a population exposure assessment based on annual mean $PM_{2.5}$. A population-weighted average $PM_{2.5}$ concentration has been calculated on the basis of the smallest statistical division provided by the Australian Bureau of Statistics, termed 'Mesh Blocks'. These are small blocks that cover an area of around 30 urban residences.

Ventilation outlet emissions – units of measurement

Emissions for the ventilation outlets are provided as hourly averages. This is the generally the shortest averaging period used in assessment of this kind and it provides a reasonable approximation of the variation throughout the day. These variations are driven by such things as

road gradients, air flows, traffic volumes and fleet mix. Hourly average emissions are appropriate and sufficient to compare model predictions with 1-hour, 24-hour and annual criteria.

Elevated receivers

Building data could not be practically included in the modelling, as discussed in in Section 8.4.7 of Appendix H (Technical working paper: Air quality). It is worth noting however, that there are only a small number of tall buildings in proximity to the proposed ventilation outlets.

However, the air quality assessment has assessed impacts at four nominated heights above ground level to reflect the presence of multi-storey buildings in the study area (referred to as 'elevated receivers', refer to Section 12.6.4 of the environmental impact statement). Further assessment has been completed in response to submissions, and is detailed in Section B1.6 of this submissions report.

In summary, it was found that:

- There were no exceedances of the maximum 24-hour or annual average for $PM_{10}$ criteria at elevated receivers
- There were no exceedances of the maximum 24-hour or annual average $PM_{2.5}$ criteria at elevated receivers
- There were no exceedances of the annual average $NO_2$ criterion at elevated receivers
- There was a minor exceedance of the maximum 1-hour average $NO_2$ criterion at 10 metres (of elevation) near Outlet F, however this was due to an elevated background concentration and not the contribution from the outlet.

Ultrafine particles

Ultrafine particles are a subset of $PM_{2.5}$. For the purpose of the air quality assessment it is considered that the effects of ultrafine particles on health are included in the assessment of $PM_{2.5}$. The World Health Organisation recommends (WHO Regional Office for Europe, 2013) that:

*'current efforts to reduce the numbers of ultrafine particles in vehicle emissions should continue and, until there is clearer evidence of the concentration-effect relationship for* ultrafine particles*, management of particulate matter should continue to focus on $PM_{10}$ and $PM_{2.5}$.'*

Section 5.9 of Appendix I (Technical working paper: Health impact assessment) assessed the impacts in terms of the change in incidence of the relevant health effects for $PM_{2.5}$ in the community. The assessment found an overall decrease in incidence as a result of the project. A number of local government areas and suburbs are predicted to have an increase in health incidence of less than one case. Such an increase is not significant, nor would it be measurable within the community.

### C12.1.3 Adequacy of the data used to support the air quality assessment

***Issue raised***

Submitters are concerned about the assumptions and inputs used to model emissions for the air quality assessment. Specific queries, concerns and comments include:

- Surface road induced traffic demand assumptions around Cammeray are incorrect
- Datasets used for the assessment were not representative of real-world conditions
- The air quality monitoring baseline data used for the air quality assessment is deficient to scientifically assess impacts
- The air quality model should use at least 12 months of background air quality monitoring data and a comprehensive network of air monitoring stations along the traffic corridor

- The Environment Protection Authority's ambient or background air quality monitoring is not relevant, and the assessment should use near-road, direct measurement air quality for the assessment
- The lack of air quality data means that the assessment of this project is entirely dependent on air quality modelling results to assess air quality impacts on residents
- Submitters identified air quality monitoring data gaps for Miller Street, Merlin Street, Falcon Street, Morden Street and Bells Avenue.

***Response***

Traffic assessment

The expected traffic scenarios were based on traffic volumes, distribution of traffic across the road network and average traffic speeds forecast by the Strategic Motorway Project Model. This included the impact of induced demand. Induced demand assumed in the Strategic Motorway Project Model is discussed further in Section C9.1 of this submissions report.

Traffic modelling for the project aimed to make best use of available traffic count data and modelling software to identify base and future traffic conditions for the project study area and surrounding road network (in terms of estimating travel demand and traffic volumes). Traffic counts provided actual vehicle volumes and traffic flow data for the baseline year. These traffic conditions were then used to assess the operational performance of the network, in scenarios with and without the project.

Meteorological and air quality data

Meteorological and background air quality data from 2016 was used in the assessment. Background air quality was derived using data from the Department of Planning, Industry and Environment, Transport for NSW and Sydney Motorway Corporation in the study area. These stations are considered to reflect background air quality in the study area accurately and 2016 was concluded to represent typical but probably slightly conservative background concentrations in the future. The selection of these monitoring stations with respect to metrological data is discussed further in Section B3.3.4 of this submissions report.

The approaches for establishing background concentrations in the project assessment, and for combining these with model predictions, is described in detailed in Annexure D of Appendix H (Technical working paper: Air quality).

The performance of the dispersion model (GRAL) to predict concentrations was also evaluated using 2016 air quality data from available monitoring stations (refer to Annexure H of Appendix H (Technical working paper: Air quality)). This compared predicted concentrations from the dispersion model to measured concentrations, and used data from roadside monitoring stations established for the M4-M5 Link alongside the City West Link and a background monitoring station in Rozelle. This found that overall, the results supported the application of GRAL in the assessment and that the results are conservative. The results suggest that the estimated concentrations ought to be conservative for most of the modelling. The Department of Planning, Industry and Environment commissioned independent technical peer reviews of the air quality impact assessment presented in the environmental impact statement to inform its assessment of the project. The background data selected and the manner in which it has been used was found to be appropriate.

For the purposes of establishing background concentrations, the focus is to select stations that do not have a contribution from the road network. Measurements taken near busy roads generally have higher concentrations of pollutants and would not provide an accurate representation of the background air quality experienced at the receivers. The assessment methodology and model evaluation requires use of multiple sources of air quality data that represents a range of conditions across the model domain, including data from road side monitoring stations. Data from a total of 20 urban background (ambient) sites and 17 roadside (peak) sites have been incorporated into the assessment.

### C12.1.4 Air quality assessment

***Issue raised***

Submitters made the following comments about the presentation of air quality assessment and results for specific locations. Specific queries, concerns and comments include:

- Air quality impacts should be presented as the number of hours per year that air quality is above the criteria
- The air quality assessment should present air quality data for residents located close to existing major traffic routes and identify specific local roads that are likely to exceed the air quality criteria. Specific areas of concern included Rozelle, Cammeray and to the north of the Spit Bridge
- Air quality with and without the project is not adequately presented and specific focus should be on sensitive receivers including schools, retirement villages and early learning and childcare centres in Rozelle, Forest Lodge, Waverton, North Sydney, Neutral Bay and Cammeray
- The environmental impact statement does not assess the predicted reduction of total emitted pollutants as a result of the project increasing traffic speed and reducing stops/starts and idling
- The construction air quality assessment underestimates impacts at schools as the number of children at each school is assumed to be 100.

***Response***

Presentation of exceedances of air quality criteria

Air quality is assessed in relation to standards and averaging periods for specific pollutants in accordance with the requirements of the relevant guidelines (the NSW Approved Methods and the AAQ NEPM). The relevant guidelines specify averaging periods as outlined in Table 12-4 of the environmental impact statement. The air quality impact assessment focuses on changes to air quality due to the project, and the resultant air quality is compared to the relevant criteria. The maximum changes due to the project (the project's impact) and the worst-case air quality is of relevance. Assessments in accordance with the relevant guidelines are not required to identify which hours of the year or how often exceedances of air quality criteria might occur.

As air quality is heavily influenced by background levels, measured data, rather than modelling predictions, are a better indicator of hours/times when air quality is poor or criteria are exceeded. The NSW Department of Planning, Industry and Environment makes air quality data for relevant pollutants from a range of air quality monitoring stations publicly available (*https://www.dpie.nsw.gov.au/air-quality/search-for-and-download-air-quality-data*).

To ensure that the assessment remained conservative, conservative values for background concentrations have been assumed.

Presentation of operational air quality impacts

Due to the number of receiver locations included in the air quality dispersion model, it is not practicable to report predicted air quality at each discrete receiver. The results for the modelling instead are presented as contour plots (as outlined in Section 5.4.3 of Appendix H (Technical working paper: Air quality)), and discrete receivers considered in the assessment are shown on Figure 8-10 of Appendix H.

The results of the assessment identifies the maximum change that would occur at any community receivers and residential, workplace and recreational receivers as a result of the project. Further, the contour plots provide an indication of the direct impacts of the project on air quality in the areas surrounding the project alignment including in Rozelle and Cammeray.

Consideration of changes in traffic conditions

Traffic volumes and speeds are inputs to the modelling, and subsequently the changes in traffic conditions are accounted for in the air quality model results. It is noted that generally as a result of the project redistributing traffic underground and improving traffic flow, the project would result in an improvement in air quality for most receivers. Further discussion around traffic modelling inputs is provided in Section C9.1 of this submissions report.

Construction air quality assessment (dust)

The construction dust assessment is based on Guidance on the assessment of dust from demolition and construction (IAQM, 2014), which does not require an exact number of human receivers and recommended judgement is used to determine the approximate number of sensitive receivers within varying distances. While schools in the study area may have an enrolment size greater than 100, this would not alter the classification of sensitivity for the areas within the study area, noting all areas except for the area surrounding the Sydney Harbour crossing are classified as having high sensitivity.

### C12.1.5 Air quality assessment policy and international standards

***Issue raised***

Submitters queried the policies and standards referred to in the air quality assessment methodology. Specific queries, concerns and comments include:

- The project should meet international air quality standards as current NSW and Australian air quality standards are outdated and too low
- The AAQ NEPM standards to 'minimise the risk of adverse health impacts from exposure to air pollution for all people, wherever they may live' have not been implemented
- As the AAQ NEPM goal for $PM_{2.5}$ is being reduced to 7 µg/m$^3$ from 2025, ventilation outlet emissions are unlikely to meet the national standard on opening.

***Response***

The Australian states and territories manage emissions and air quality in relation to source type, and these jurisdictions have legislation or guidance which includes design goals, licence conditions or other instruments for protecting local communities from ground-level impacts of pollutants in residential areas outside site boundaries. In NSW, the NSW Approved Methods sets out the approaches and criteria to be used.

The assessment criteria applied in the assessment are outlined in Table 12-4 of the environmental impact assessment. The criteria are set by the NSW Approved Methods and are consistent with the AAQ NEPM. The 2025 goals set by the AAQ NEPM for $PM_{2.5}$ are also considered in this assessment.

A comparison with other jurisdictions is provided in Annexure B of Appendix H (Technical working paper: Air quality). This found:

- For carbon monoxide, the NSW standards are numerically lower than, or equivalent to, those in most other countries and organisations
- The NSW Approved Methods and AAQ NEPM standards for $NO_2$ are more stringent than other countries and organisations except for the United States
- In the case of $PM_{10}$, the NSW standard for the 24-hour mean is lower than, or equivalent to, the standards elsewhere, whereas the annual mean standard for $PM_{10}$ is in the middle of the range for other locations
- The $PM_{2.5}$ standards are lower than, or equivalent to, those used elsewhere, and in the case of the 24-hour mean, lower than the World Health Organisation.

The relatively low natural background concentrations experienced in Australia means the criteria set for particulates tends to be lower compared to other countries.

The background $PM_{2.5}$ concentrations during 2016 to 2018 were already very close to, or above, the NSW criterion of 8 µg/m$^3$ and above the long-term 2025 goal of 7 µg/m$^3$. The environmental impact statement acknowledges there would be some exceedances of the criterion and NSW 2025 goal as a result of the project, however:

- The predicted exceedances of this criterion and goal also occurs in the 'Do minimum' scenarios (ie without the project)
- For ventilation outlets, the largest contribution from the ventilation outlet any sensitive receiver was 0.18 µg/m$^3$
- When including all sources, the largest predicted increase in concentration at any receiver location as a result of the project would be 0.6 µg/m$^3$, and the largest predicted decrease would be 2.1 µg/m$^3$.

The $NO_2$ standards in the AAQ NEPM and as used in the air quality assessment were based on the understanding of the health effects at the time the AAQ NEPM was introduced (1998). The 2011 AAQ NEPM review concluded there was sufficient evidence to support the review of the $NO_2$ standards (and others). The latest review published in 2019 recommends an initial move to annual mean and 1-hour $NO_2$ standards of 185 µg/m$^3$ and 39 µg/m$^3$ respectively, and then to 164 µg/m$^3$ and 31 µg/m$^3$ (respectively) by 2025.

Figure C12-1 and Figure C12-2 below are taken from Annexure D in Appendix H (Technical working paper: Air quality) and show the general downward trend in annual average $NO_2$ in Sydney, to levels below the proposed 2025 standard of 31 µg/m$^3$. Maximum 1-hour measurements remain steady but are generally below the proposed 2025 standard of 164 µg/m$^3$. NSW air quality assessment criterion is shown as a dashed line on Figure C12-1 and Figure C12-2 (62 µg/m$^3$ for annual mean $NO_2$ concentrations and 246 µg/m$^3$ for maximum one-hour mean $NO_2$ concentration respectively).

Given the small contributions that the ventilation outlets would make to the total ambient air quality, the project is unlikely to affect these trends.

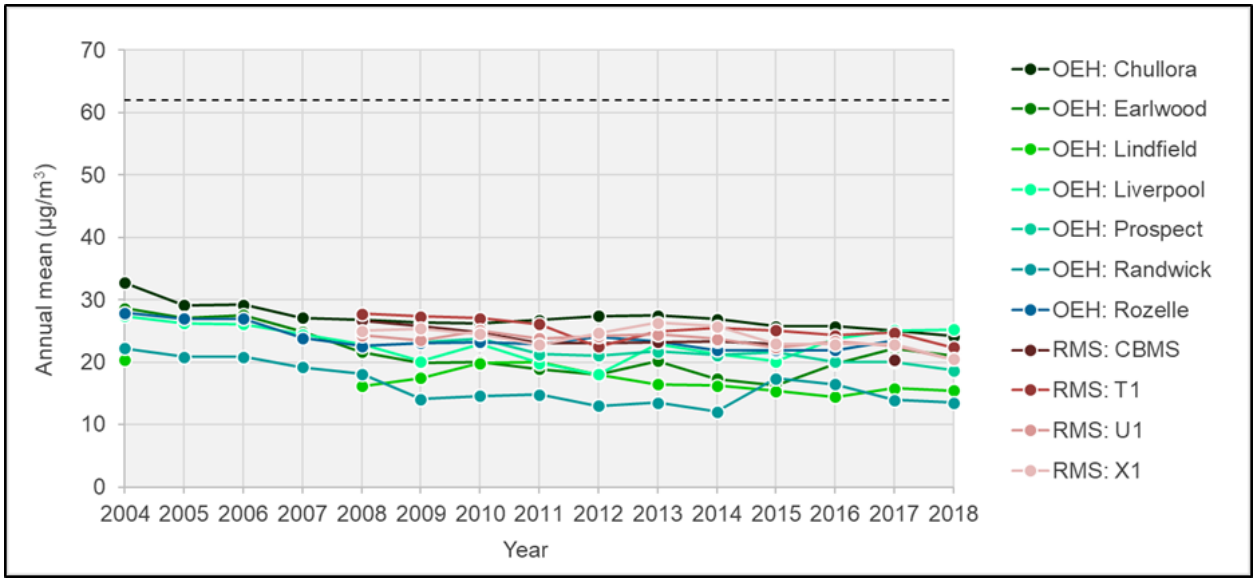


**Figure C12-1 Trend in annual mean $NO_2$ concentration**

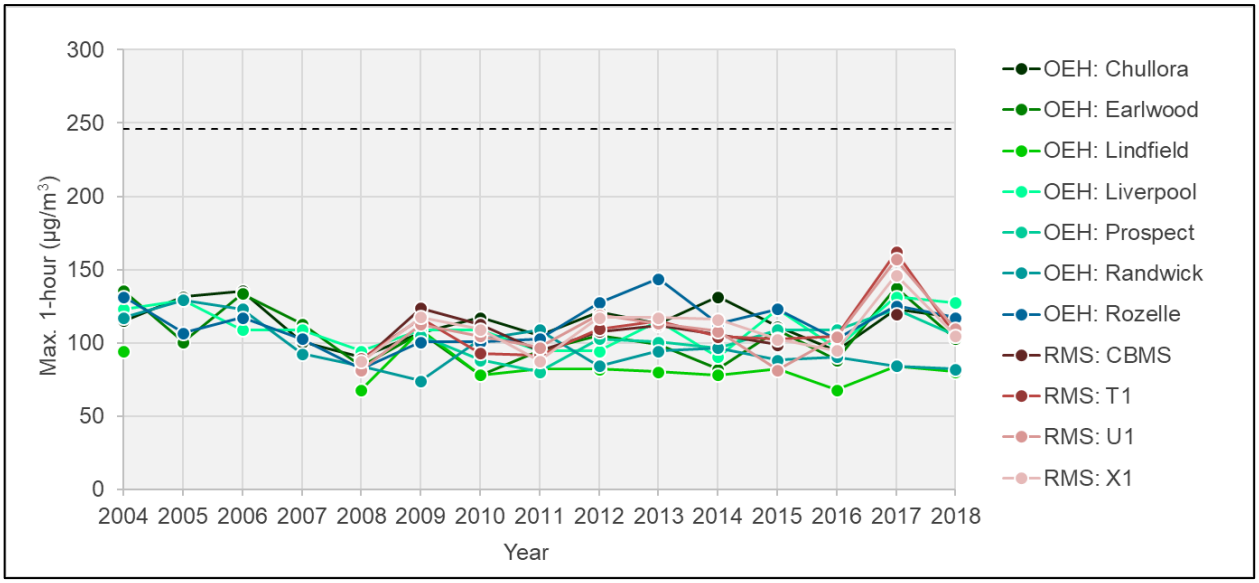


**Figure C12-2 Trend in maximum one-hour mean $NO_2$ concentration**

It is also noted that there were very few sensitive receivers that showed exceedances of either the annual average or 1-hour proposed $NO_2$ standards, and those that did were as a result of emissions from surface roads and not the ventilation outlets.

Figure C12-3 below, which is taken from Appendix H (Technical working paper: Air quality), shows that almost all of the residential, workplace and recreational (RWR) receivers remain below 31 µg/m$^3$ for the 2037 'Do something – cumulative' scenario. The very few that are predicted to exceed do not exceed by much, and only then due to the contributions from surface roads (pink line). It is also likely that there is an element of double counting of surface roads as these will also be picked up to some extent in the background levels (blue line).

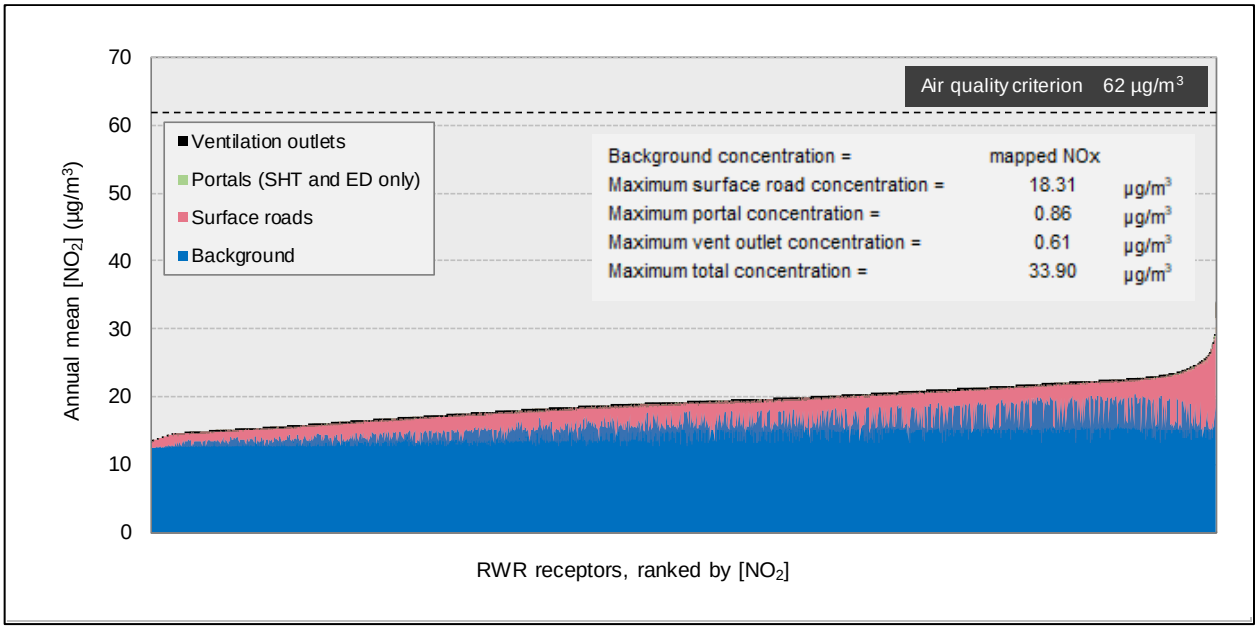


**Figure C12-3 Source contributions to annual mean NO2 concentration at residential, workplace and recreational receivers**

## C12.2 Air quality impacts during construction

### C12.2.1 Generation of dust and other emissions from construction activities

***Issue raised***

Submitters raised concerns about the generation of dust and other pollutants, and the impact to air quality and sensitive receivers, during construction. Specific queries, concerns and comments include:

- Concerns about dust from excavation and tunnelling, including the excavation of access declines, and that these impacts would occur 24 hours a day at tunnelling support sites
- Concerns around dust impacts on remaining vegetation during construction
- Concern about nuisance dust impacts on properties, cars, rainwater harvesting systems and locally grown food, resulting from construction activities
- Impacts to air quality (and amenity) at town centres, active transport infrastructure or recreational areas due to dust generated by construction. This included the perception that these impacts would mean that people are unable to safely use active transport infrastructure or recreational areas close to construction areas
- Concern about dust generation by the Victoria Road (WHT2) and White Bay (WHT3) construction support sites, including impacts on Rozelle Public School
- Objections were raised regarding dust impacts from construction on residents of Merlin Street, Wyagdon Street, Falcon Street, Rose Street, Alfred Street North and Bent Street
- Concern that local topography differences in the vicinity of the Cammeray Golf Course construction support site (WHT10/WFU8) would increase impacts at lower lying residential areas
- Blasting would result in air quality impacts
- Concerns about the exposure to silica dust for surrounding sensitive receivers
- Concerns about emissions from construction areas due to the disturbance of potentially contaminated soils or demolition of buildings and other structures (such as the release of asbestos fibres)
- Cumulative dust impacts in areas already affected by WestConnex, including Rozelle, Balmain and Birchgrove.

***Response***

The project understands how important it is to manage the potential impact of air quality during construction. Measures will be in place to minimise this impact and air quality will be monitored.

The assessment of risk from construction dust is prior to the implementation of any mitigation measures. The risk for construction dust is based on the scale of airborne dust potential of the construction activity, the sensitivity of sensitive receivers (all assumed to be high) and the proximity to construction works.

Based on this assessment, the majority of the construction footprint was considered to be of low or medium risk (if unmitigated). This includes the Victoria Road (WHT2) and White Bay (WHT3) construction support sites. The construction footprint in areas alongside the Warringah Freeway were identified as having a high risk, which is a function of the larger disturbance footprint for these works and scale of activities as well as the sensitivity of the surrounding areas. In reality, construction along the Warringah Freeway and surrounding roads would be staged and progressive.

Airborne dust would be temporary and of relatively short duration and mitigation is considered straightforward because dust suppression measures are routinely employed as ‘good practice’ at

most construction sites and areas of surface disturbance. Environmental management measure AQ1 (refer to Table D2-1 of this submissions report) requires the implementation of dust mitigation measures that would be detailed in the construction environmental management plan. Further, emissions due to tunnelling activities would be minimised once acoustic sheds have been established at the relevant construction support sites. Activities prior to this stage would be of shorter duration and manageable with standard mitigation measures.

It is acknowledged that even with rigorous air quality management in place, it is not possible to guarantee the dust mitigation measures implemented would be wholly effective all the time. There is still the residual risk that sensitive receivers near the construction works might experience occasional dust impacts. This does not imply that impacts are likely, or that if they did occur, that they would be frequent or persistent. Overall, construction dust is unlikely to represent a serious ongoing problem.

Section 7.1.3 of Appendix H (Technical working paper: Air quality) provides a detailed description of the procedure for assessing risk from construction dust.

Controlled blasting

If controlled blasting for the project is required, it would be carried out underground and there would be no direct emissions from blasting to the external air. All underground working areas would have ventilation systems capable of managing dust and other underground emissions to maintain worker safety and prevent unacceptable external emissions that could affect the health and amenity of receivers in adjacent areas. Further analysis and assessment of potential blast impacts would be carried out during development of the detailed construction methodology, which would be prepared by the contractor (once engaged).

Contaminated dust and other hazardous particles

Work will be carried out in accordance with the relevant legislation and guidelines to ensure the safety of communities, workers, and the environment. The following environmental management measures (refer to Table D2-1 of this submissions report) will be implemented to minimise or avoid the disturbance of contaminated, and other hazardous materials (such as asbestos fibres or organic matter) disturbed through the demolition of buildings and other structures:

- SG6 – Potentially contaminated areas directly affected by the project will be investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the *Contaminated Land Management Act 2008*
- SG8 – Asbestos handling and management will be carried out in accordance with relevant legislation, codes of practice and Australian standards
- SG9 – A hazardous materials assessment will be carried out prior to and during the demolition of buildings, and demolition works would be carried out in accordance with the relevant Australian Standards and relevant NSW WorkCover Codes of Practice, including the NSW Work Health and Safety Regulation 2011.

Silica

Through the implementation of measures to suppress dust, it is considered unlikely that silica dust would impact on sensitive receivers surrounding construction support sites.

The majority of sandstone excavation would take place underground. As the tunnelling would mostly involve excavation of rock below the water surface table and dust suppression using water would occur during excavation, the associated spoil would typically be quite moist, limiting dust generation. The tunnel ventilation system would include dust removal apparatus to minimise the potential for dust emissions to affect adjacent areas. Handling of tunnel spoil at the surface would typically occur within an acoustic shed that would further minimise the potential for dust emissions. As such, the risk of silica emissions and exposure in areas adjacent to construction support sites where tunnelling is occurring is very low.

The risk of silica emissions and exposure from other surface works, including activities within the construction support sites, would be minimised using standard mitigation and management measures including dust suppression, selection of excavation methods to minimise dust generation, and adjusting dust generation activities during unfavourable weather conditions, as per environmental management measure AQ1 (refer to Table D2-1 of this submissions report).

### C12.2.2 Impacts on air quality from construction vehicles and barge movements

***Issue raised***

Submitters expressed concerns regarding air quality impacts from construction vehicles. Specific concerns and queries raised included:

- The air quality assessment does not assess vehicle emissions associated with construction vehicles and would contribute to air quality emissions in surrounding areas
- Standard mitigation measures identified in the environmental impact statement would not manage air quality impacts from construction traffic
- Objection was raised for the Rosalind Street east construction support site (WFU9) due to the emissions from idling trucks in proximity to school grounds
- Concerns around dust from heavy vehicles using Balls Hear Road via either Woolcott Street, Bay Road or Crows Nest Road each day
- Concern about the generation of dust from barges transporting dredged material to White Bay and Berrys Bay.

***Response***

Construction vehicle emissions

As discussed in the assessment of operational air quality, local air quality is largely dependent on background air quality which is more heavily influenced by regional emissions in the overall airshed than local emissions. . Increased emissions from project-related construction vehicles would be temporary and would not be at sufficient levels to significantly contribute to emissions and air quality in the local area.

Truck marshalling areas would be identified and used where feasible and reasonable, to minimise potential queueing and traffic and access disruptions near construction support sites, in accordance with environmental management measure CTT11 (refer to Table D2-1 of this submissions report).

Rosalind Street east construction support site (WFU9)

The Rosalind Street east construction support site (WFU9) would be utilised during the construction of the northern portion of the Warringah Freeway Upgrade, as well as local road and intersection upgrades and changes near Miller Street and Amherst Street. This site would not be used as a truck layover, and would generate about 15 heavy vehicle movements per day. Vehicles would access this site via the Warringah Freeway from the Miller Street ramps. Construction vehicles may pass the school grounds to access construction areas, such as intersection works at Miller Street, however, such movements would be minor and not significantly contribute to air quality in the local area. Background air quality in this area is dominated by regional emissions and vehicle emissions from the local surface road network including the Warringah Freeway - a significant contributor to vehicle emissions and air quality in areas around Rosalind Street, Miller Street and Amherst Street.

Air quality impacts from construction vehicles (dust)

Track-out is identified in the dust assessment as a potential dust source, which occurs when dust and dirt by heavy vehicles from work sites is deposited onto the road network, where it may potentially be deposited and re-suspended by other vehicles.

Traffic and transport related dust impacts would be managed in accordance with environmental management measure AQ1 (refer to Table D2-1 of this submissions report) which includes the use

of dust sweepers, site exit controls (eg wheel washing systems and rumble grids) and the covering of vehicle loads.

Dust from barges transporting dredged material at Berrys Bay and White Bay

Dredged material would not be transported to the Berrys Bay construction support site (WHT7). Dredged material that is unsuitable for offshore disposal would be transported directly to the White Bay construction support site (WHT3). Dredged material transported to the White Bay construction support site (WHT3) by barges is unlikely to result in dust impacts due to the sediment material being wet.

### C12.2.3 Odour impacts during construction

#### *Issue raised*

Submitters identified concerns about impacts from odour during construction. Specific queries, concerns and comments include:

- Odour impacts on residents due to the storage, handling and treatment of dredged material at the White Bay construction support site (WHT3) has not been assessed in the environmental impact statement, the impacts have been underestimated or the assumptions were not sufficiently conservative
- The environmental impact statement does not refer to any odour emission testing from excavated sediments completed as part of the assessment, or does not provide detail on which odours were modelled to predict odour emissions at the White Bay construction support site (WHT3)
- The environmental impact assessment did not identify odour suppression mitigation for excavated contaminated sediments and soils. Environmental management measures should include the application of foams across the surface of the sediments, mist sprays at the boundaries of the works and covers on stockpiles, barges and heavy vehicles
- A spoil handling shed should be constructed at the White Bay construction support site (WHT3) to manage odour impacts
- The environmental impact statement does not address offensive odours emitted when acid sulfate soils are disturbed and exposed to air (such as sulphide gas) and impacts to nearby receivers. Sediments from the upper reaches of Sydney Harbour (and estuaries), Snails Bay and Birchgrove Oval were identified as being known to release such odours. Wetting the soils would not sufficiently mitigate odours.

#### *Response*

The odour assessment completed for the handling, storage and treatment of dredged material that is unsuitable for offshore disposal is provided in Section 12.5.4 of the environmental impact statement. Further detail on the assessment methodology and assessment is provided in Section 7.2 of Appendix H (Technical working paper: Air quality).

While on the barges near the dredging activity or in transit to the offshore disposal location, dredged material would be covered with water which would significantly reduce any odour emissions. The potential for any odour impacts from this material would be low, given it would remain wet and located at some distance from any sensitive receiver.

After arriving at the White Bay construction support site (WHT3), lime and/or an inorganic polymer would be mixed with the dredged material while in the barge, prior to unloading, for management of acid sulfate soils and odour (as required), and to make the material spadeable. Refer to Appendix C2 of this submissions report for further information on the management of dredged material.

Odour modelling methodology and odour emission samples

The assessment carried out for the environmental impact statement to inform potential odour impacts resulting from dredging activities concluded the predicted odour concentrations at the nearest receivers are well below the theoretical level of detection of 1 OU (odour unit).

The assumption in the modelling was that the total treatment area would be exposed with odorous material for every day of the year which generates conservatism in the assessment.

To obtain site-specific odour emission rates, odour samples were taken from dredged material from Sydney Harbour near Birchgrove. Samples were taken for freshly extracted and undisturbed sediment, freshly extracted and disturbed sediment and a disturbed sample that was allowed to settle and dry after extraction. This enabled a range of different potential odour emissions.

Sampling was carried out and the samples analysed in accordance with the Australian Standard for odour measurement 'Determination of odour concentration by dynamic olfactometry' (AS/NZS 4323.3:2001). Once odour concentrations for each sample were determined, a specific odour emission rate was calculated for use in the dispersion modelling.

Section 7.2 of Appendix H (Technical working paper: Air quality) outlines the modelling methodology used for the odour assessment.

Odour management at White Bay construction support site (WHT3)

The results of odour modelling show that the predicted 99$^{th}$ percentile odour concentration at the nearest receivers is 0.1 Odour Unit (OU). This is below 1 OU, the theoretical level of detection. Therefore, the modelling indicates that odour would be undetectable for all sensitive receivers near the site. Predictions were well below both the level of detection and the most stringent odour criterion and it is unlikely that any mitigation would be required, including a spoil handling shed.

Environmental management measure AQ1 (refer to Table D2-1 of this submissions report) has been revised to provide a clearer link to managing odour in the construction environmental management plan. This will include the implementation of contingency measures.

The dispersion modelling results for odour from dredging are shown in Section 7.2 of Appendix H (Technical working paper: Air quality).

Odour from acid sulfate soil

The environmental impact statement recognises the risk of acid sulfate soils being disturbed by the project. Testing will be carried out to determine the presence of acid sulfate soils. This includes testing at Sydney Harbour tunnel crossing, as provided by environmental management measure SG12 (refer to Table D2-1 of this submissions report).

If acid sulfate soils are encountered, they would be readily manageable (for odour control) with the implementation of typical management measures to be outlined within the construction air quality management plan (refer to Section D1 of this submissions report).

### C12.2.4 Construction air quality environmental management measures

***Issue raised***

Submitters raised concerns that the management measures proposed within the environmental impact assessment were not sufficient to manage construction impacts to air quality and suggested a number of additional measures. Specific concerns included:

- There should be an appropriate plan to manage air quality impacts during construction
- The conditions of approval should include strict mitigation measures for dust. This should include independent inspection of all measures

- Environmental management measures included in the environmental impact statement to mitigate air quality impacts would not sufficiently manage the impacts from contaminated dust
- Additional dust suppression measures to manage dust generated by demolition, earthworks and track-out should be proposed and include:
  - All dust generating works should be ceased during periods of strong winds
  - Real time dust monitors should be installed for impacted residents, schools (indoors and playground/sports fields) and businesses
  - Loose material should not be left uncovered on roadways or within vehicles
  - Water sprays should be deployed to minimise impact from dust generating works
  - Dust generating activities should cease at 6pm on weekdays and 1pm on weekends and when in proximity of schools, these activities should not occur during lunch breaks
  - Schedule of staged works should be included as a condition of approval to avoid cumulative impacts on air quality resulting from construction of various components of the project
  - Adequate and timely pre-advice should be provided to residents of upcoming particularly dusty activity works and a 'dust' hotline be established
  - The construction phase tunnel ventilation outlet should be filtered to remove dust
  - Construction sites should be fully enclosed to minimise air quality impacts
- Environmental management measures to control dust would not be adhered to
- Real time air quality monitoring during construction should be made publicly available, particularly if pollution reaches unsafe levels
- Request for the following mitigation measures to be included to manage construction vehicle emissions:
  - Limit the use of diesel vehicles and use non-diesel powered trucks
  - Audit all vehicles for exhaust emissions within acceptable limits
  - Divert heavy vehicles away from Miller Street or ban all diesel vehicles from using Miller Street
  - Ban diesel vehicle movements during school travel times
- Building upgrades for properties, including façade upgrades and dust filtration, were requested for residential buildings and schools in proximity to the Warringah Freeway including Wyagdon Street, Rose Avenue, Alfred Street North, and Merlin Street to enable windows to remain closed and reduce the impact of dust and pollution
- During construction, schools should be moved to healthier locations or a plan should be established for alternative sports field arrangements and air quality criteria above which children must be moved indoors
- Queried the proposed mitigation to manage air quality impacts at heritage listed properties where changes cannot be made.

***Response***

The project understands the importance of managing the potential impact of air quality during construction. Measures will be in place to minimise this impact and air quality will be monitored.

<u>Environmental management plan</u>

Environmental management measures would be implemented through a construction environmental management plan, as outlined in Section 28.5 of the environmental impact statement and in Section D1 of this submissions report. The plan would provide a framework for establishing how these measures would be implemented and who would be responsible for their implementation.

The plan would be reviewed and certified by Transport for NSW and the Department of Planning, Industry and Environment prior to the commencement of any on-site work. The construction environmental management plan would include a framework for the management of environmental impacts during construction, including air quality management.

Dust management measures

The effects of airborne dust during construction would be temporary and of relatively short duration, as discussed in Section C12.2.1 of this submissions report. As such, mitigation is considered straightforward because dust suppression measures are routinely employed as 'good practice' at most construction sites where there is surface disturbance. The standard construction air quality measures required by environmental management measure AQ1 (refer to Table D2-1 of this submissions report).

As required by environmental management measure AQ2 (refer to Table D2-1 of this submissions report), dust and air quality complaints would be managed in accordance with the overarching complaints handling process for the project (refer to Appendix E (Community consultation framework)).

Air quality monitoring and compliance

The monitoring and management of dust emissions during construction would need to comply with the conditions of approval and would be regulated under an Environment Protection Licence prescribed under the *Protection of the Environment Operations Act 1997*. Whether the results of monitoring would be made publicly available would be subject to the requirements of the conditions of approval and/or Environment Protection Licence for the project.

Construction equipment emissions

Emissions from on-site diesel-powered vehicles, equipment or plant would be minor compared to pollutants in background air quality, which is influenced by regional emissions within the airshed, and vehicle emissions from the local surface road network. Therefore, no specific environmental management measures are proposed.

At property treatments

Potential air quality impacts during construction are anticipated to be readily manageable using site and activity based measures. The provision of at-property treatment or the relocation of schools or sporting fields is not considered feasible, nor warranted.

## C12.3 Air quality impacts during operation

### C12.3.1 General

***Issue raised***

Many submitters expressed their concerns and disagreement with the project due to the increases in emissions that would impact air quality for the community including residents, schools, aged care facilities, sports grounds and other community receivers. Specific queries, concerns and comments include:

- The project should seek to maintain and/or reduce air emissions
- The needs of the local community for clean air are not recognised as project benefits
- The project should not proceed given the contribution to air pollution from the existing road network

- The project would result in induced demand (particularly heavy vehicles) and would increase air pollution to unacceptable levels
- Opinion that the project would have an adverse impact on schools, retirement villages and early learning and childcare centres in Rozelle, Forest Lodge, Waverton, North Sydney, Neutral Bay and Cammeray area due to reductions in air quality
- Concerns related to changes in air quality in the vicinity of tunnel portals:
  - Operational traffic at tunnel portals would generate substantial air pollution in surrounding areas
  - Air pollution from vehicles in the tunnel would be concentrated at the portals at a much higher concentration compared to the current levels distributed along the roads
- Background air pollution levels already exceed the AAQ NEPM national goal of 8 µg/$m^3$ for $PM_{2.5}$ at a number of areas such as North Sydney and Rozelle. The project would further exacerbate this and is therefore not justified
- Increased air pollution would discourage pedestrians along Berry Street and the Pacific Highway
- Users of active transport along the Warringah Freeway have not been assessed and these users of would be impacted due to reductions in air quality. Objection was raised to the current and proposed changes to cycleways adjacent to the freeway due to health risks to users
- Tree removal would result in a loss of filtration and further exacerbate pollution impacts
- Concerns about the cumulative impact of the project with bushfires which are becoming more frequent.

***Response***

Impacts to air quality

The project has been designed to minimise air emissions during operation. This includes minimising road gradients as far as reasonably possible. As discussed in Section C12.1.4 of this submissions report, the air quality impact assessment has considered two sets of discrete sensitive receivers, and traffic volumes, vehicle types and traffic conditions are based on the SMPM. The SMPM accounts for induced demand.

The air quality assessment, as presented in Section 12.6 of the environmental impact statement and Appendix H (Technical working paper: Air quality) demonstrates that:

- Air quality at residential, workplace and recreational receivers is dominated by background air quality, and for some pollutants, there was a significant contribution from the modelled surface road network ($NO_2$ annual mean)
- Under expected traffic conditions, the contribution from ventilation outlets at all residential, workplace and recreational receivers was negligible
- Any predicted changes in air quality at residential, workplace and recreational receivers is due to the redistribution of traffic on the modelled surface road network.

The air quality assessment acknowledges that air quality is predicted to be above maximum 1-hour $NO_2$, maximum $PM_{10}$ 24-hour average, the $PM_{2.5}$ annual mean, and the maximum $PM_{2.5}$ 24-hour average criteria at some residential, workplace and recreational receivers when considering all sources of emissions and background air quality. In these instances, background air quality is close to or above the assessment criteria irrespective of the project. Further, the total number of residential, workplace and recreational receivers with exceedances of the criterion generally decreased slightly with the project, or program of works. This is due in part to the predicted shift in traffic from surface to sub-surface roads and also due to improved traffic flow on surface roads.

As discussed in Section 8.4 of Appendix H (Technical working paper: Air quality), there would be noticeable reductions in pollutant concentrations along some major roads as a result of the project (or program of works) and some increases on other roads. However:

- Where there are increases in pollutant concentrations at sensitive receivers as a result of the project (or program of works), these were mostly small. A small proportion of residential, workplace and recreational receivers were predicted to have larger increases, however, the predictions at these locations were overly conservative
- There would be no marked redistribution of air quality impacts. Where increases are predicted, these would not be significant and would occur at residential, workplace and recreational receivers locations which would already have a relatively high concentration in the 'Do minimum' scenarios (ie without the project).

Further, the assessment found that the potential regional impacts of the project would be negligible (refer to Section 12.6.5 of the environmental impact statement).

Changes in local air quality in the vicinity of portals

Vehicles emissions that occur within the tunnel would not be emitted via the tunnel portals as the tunnel ventilation system has been designed to draw fresh air into the tunnels through the tunnel portals (against the flow of traffic) and emit air from the tunnels only via ventilation outlets, with the exception of during emergency operation.

As discussed earlier in this section, the project would result in changes to traffic distribution on the surface road network, including the point of connection of the proposed tunnels, which would result in increases or decreases in local air quality along these roads. These changes can be seen on the contour plots presented in Section 8.4.11 of Appendix H (Technical working paper: Air quality) (including Annexure I of that appendix). Given the position of the project portals relative to the nearest sensitive receivers, changes to concentrations at the nearest residential, workplace and recreational receivers are likely to be primarily driven by changes on the broader road network than the project portals.

$PM_{2.5}$ emissions

The environmental impact assessment acknowledges that the background air quality levels of $PM_{2.5}$ is close to annual mean assessment criterion of 8 µg/m$^3$, and exceeds the maximum 24-hour average criterion of 25 µg/m$^3$, as well as the AAQ NEPM longer term goal of 20 µg/m$^3$.

While the project would increase concentrations at some sensitive receivers, these contributions would be small – specifically:

- For annual average, the largest predicted increase at any residential, workplace and recreational receivers was 0.6 µg/m$^3$ and the largest decrease was 2.1 µg/m$^3$. Increases above 0.1 µg/m$^3$ occurred at only at four to five per cent of the residential, workplace and recreational receivers, with the exception of the 'Do something cumulative 2027', where this increased to 23 per cent of sensitive receivers. These increases were observed mainly in the Rozelle, in the vicinity of the Gore Hill Freeway and Manly Road at the Spit
- For the maximum 24-hour average, the changes in the maximum 24-hour mean $PM_{2.5}$ concentration would be very small at most residential, workplace and recreational receivers. The largest predicted increase in concentration at any residential, workplace and recreational receiver as a result of the project is predicted to be 2.2 µg/m$^3$, and the largest predicted decrease is 6.3 µg/m$^3$. Where increases are predicted, they are greater than 1 µg/m$^3$ at less than one per cent of residential, workplace and recreational receivers.

As discussed in Chapter 13 (Human health) of the environmental impact statement, health effects of these changes in $PM_{2.5}$ in the community would not be measurable and the impacts are considered to be negligible.

Impacts to active transport users

Sensitive receivers for the purposes of the air quality and human health impact assessment represent where people would likely be present for some period of the day, and predicted concentrations are reported against short or long term averaging periods (eg 1-hour, 24-hour or annual averages). This does not capture transient receivers that pass through the study area, such as cyclists or pedestrians.

As demonstrated in the environmental impact statement, there would be decreases and increases in concentrations along the Bradfield, Warringah and Gore Hill freeways and other surface roads due to changes in surface traffic distribution. Exposure to users of active transport would be highly dependent on route selection, travel distance and duration. Changes to air quality along these routes would not be noticeable. As demonstrated in the environmental impact statement, the project would have an acceptable impact to residential, workplace and recreational receivers that have been assessed who reside, work or play immediately adjacent to road corridors.

Reduction in air quality due to tree removal

Regional changes in air quality as a result of the project would be negligible.

Around 7.29 hectares of vegetation would be removed, which primarily consists of roadside vegetation. A review of research on the effectiveness of vegetation in reducing air pollution was carried out as part of an economic analysis of potential air pollution abatement measures to inform the *National Plan for Clean Air (Particles)* (Boulter and Kalkarni, 2013). The conclusion of the review was to advise against the use of vegetation to reduce pollution concentrations in built-up areas at short distances from busy roads. The conclusion was based on the following findings:

- Although some studies reported beneficial effects, these were small and mainly due to the turbulence produced by small-leaved evergreen trees and tall shrubs
- The particle sizes captured in densely planted trees were in the range between $PM_{2.5}$ and $PM_{10}$
- The filtering effect for particles smaller than one micrometre was negligible
- Closely planted trees act as a windbreak which can reduce dispersion and increase local concentrations, and some research models assumed that the increase in concentration due to reduced air circulation is much greater than the filtering effect of the vegetation
- Some vegetation, and Australian vegetation in particular, for example eucalyptus species, is a source of volatile organic compounds due to the oils in the leaves.

Changes in background air quality due to bushfires

Section 6.6 of Appendix H (Technical working paper: Air quality) stated that emissions from natural sources, such as bushfires, have substantially contributed to ambient ozone and particulate matter concentrations. Appendix H (Technical working paper: Air quality) also stated that domestic, commercial and industrial activities contribute the majority of $PM_{10}$ and $PM_{2.5}$ emissions (62 and 69 per cent respectively). While bushfire activity would result in elevated background concentrations in the short-term, their unpredictable nature (for example location, intensity, duration, frequency) renders them difficult to assess in terms of their impact, particularly in the long term.

Recent experience during the 2019-2020 NSW bushfires, however, showed that under severe bushfire conditions, concentrations of ambient ozone and particulate matter are overwhelmingly sourced from bushfire smoke and the contributions from vehicle emissions and other sources have little overall bearing on the prevailing air quality conditions.

### C12.3.2 Ventilation outlets

***Issue raised***

Submitters raised concerns relating to the design and operation of ventilation outlets for the project. Specific comments and concerns included:

- Request for more stringent design specifications for the ventilation outlets to demonstrate that air pollution would be adequately dispersed by the ventilation outlets
- Ventilation outlets should be constructed so that air being released into the atmosphere is released at standard of 'very good' levels as set by the Department of Planning, Industry and Environment air quality index
- Air quality impacts from ventilation outlets are hard to establish and could be equivalent of being next to a freeway and would raise the air quality index to dangerous levels
- Localised emissions from portals and ventilation outlets would lead to localised breaches of the National Environmental Standards for $PM_{10}$ and $NO_2$, as well as exceedances of Regional Air Quality Guidelines
- Concern that unfiltered ventilation facilities at Rozelle and Cammeray are located close to a number of education establishments, and requests for installation of filters in ventilation outlets or relocation of ventilation outlets away from schools
- Emissions modelling suggests that there would be less air quality impacts in the local area if ventilation outlets were 40 metres in height
- The increase in background air quality levels as a result of the project conceals the air quality impacts from the proposed ventilation facilities
- Odour from ventilation outlets could result in unacceptable odour impacts
- Query on how the extraction of smoke during and post emergency conditions would impact the surrounding area and communities.

***Response***

Ventilation outlet design

The independent NSW Chief Scientist and Engineer has recently released a report in relation to road tunnel air quality. The report found that emissions from well-designed road tunnels cause a negligible change to surrounding air quality, and as such, there is little to no health benefit for surrounding communities in installing filtration and air-treatment systems in such tunnels. Further information is available at *www.chiefscientist.nsw.gov.au* and *nswroads.work/airquality*.

Emissions from the ventilation outlets would be regulated by the NSW Environment Protection Authority. Further design development of ventilation outlets would be carried out in accordance with any NSW Environment Protection Authority requirements and conditions of approval for the project.

Jet fans within the tunnels would direct tunnel air to the outlets to prevent portal emissions. Portal emissions are not permitted for new tunnels in NSW and would therefore occur only in the case of an emergency (refer to Section 5.2.7 of the environmental impact statement). Portal emissions that have been included in the air quality assessment are for existing tunnels in the model domain (the Eastern Distributor and the Sydney Harbour Tunnel).

The assumptions for the ventilation outlet design, including heights, as applied in the assessment are detailed in Annexure G of Appendix H (Technical working paper: Air quality).

Outlet performance

The independent NSW Chief Scientist and Engineer has recently released a report in relation to road tunnel air quality. The report found that emissions from well-designed road tunnels cause a negligible change to surrounding air quality, and as such, there is little to no health benefit for

surrounding communities in installing filtration and air-treatment systems in such tunnels. Further information is available at *www.chiefscientist.nsw.gov.au* and *nswroads.work/airquality*.

The tunnel ventilation system would operate to maintain in-tunnel air quality and to optimise emission rates from tunnel ventilation outlets to achieve maximum dispersal for any given atmospheric conditions, rather than to achieve an air quality index rating.

The air quality assessment acknowledges that air quality is predicted to be above maximum 1-hour $NO_2$, maximum $PM_{10}$ 24-hour average, the $PM_{2.5}$ annual mean, and the maximum $PM_{2.5}$ 24-hour average criteria at some receivers when considering all sources of emissions and background air quality. In these instances, background air quality is close to or above the assessment criterion, irrespective of the project. There are no predicted exceedances of the annual mean $NO_2$ and annual mean $PM_{10}$ criteria. Refer to Section C12.1.5 above for the discussion on air quality standards.

However, the assessment demonstrates that the ventilation outlets would operate in a manner that would result in negligible to small contributions to the local air quality at sensitive receivers during expected traffic conditions. The largest contribution at any residential, workplace and recreational receiver (which includes educational receivers) in any assessed scenario for key assessed pollutants from the ventilation outlets represented:

- For $PM_{10}$ annual mean and the maximum 24-hour mean, 1.2 per cent of the criterion (25 µg/m$^3$) and 3.2 per cent of the criterion (50 µg/m$^3$)
- For $PM_{2.5}$ annual mean and the maximum 24-hour mean, 2.3 per cent of the criterion (8 µg/m$^3$) and four per cent of the criterion (25 µg/m$^3$)
- For the annual mean of nitrogen oxide ($NO_2$), one percent of the criterion (62 µg/m$^3$)
- For the maximum $NO_2$ 1-hour mean (246 µg/m$^3$), outlet contributions to the maximum 1-hour $NO_2$ criterion cannot be calculated directly. However, the outlets would not lead to an exceedance of the criterion given the maximum contribution from ventilation outlets at any receiver was 60 µg/m$^3$ which did not coincide with the maximum contribution from the surface roads.

As such, the contributions from the ventilation outlets would be relatively small compared to the contribution of emissions from traffic on surface roads and other background sources. For example, the largest predicted concentration from modelled surface roads (which includes the Warringah Freeway) with the project or program of works at any residential, workplace and recreational receiver for $PM_{2.5}$ annual mean was 4.1 µg/m$^3$, whereas the largest ventilation outlet contribution at any residential, workplace and recreational receiver was 0.18 µg/m$^3$.

As demonstrated in the air quality impact assessment, the proposed ventilation outlets would provide an effective means of dispersing the polluted air from a tunnel, and predicted impacts on local air quality would be very small even without a filtration system. As such, the provision of a filtration system or relocation of the ventilation outlets is not proposed.

Background air quality

Total vehicle emissions from the tunnels via the outlets would be small compared to overall regional emissions (ie in the entire airshed), such that any changes in overall background air quality as a result would be negligible and undetectable in ambient air quality measurements at background locations.

Filtration of ventilation outlets

The independent NSW Chief Scientist and Engineer has released a report in relation to road tunnel air quality. The report found that emissions from well-designed road tunnels cause a negligible change to surrounding air quality, and as such, there is little to no health benefit for surrounding communities in installing filtration and air-treatment systems in such tunnels. Further information is available at *www.chiefscientist.nsw.gov.au* and *nswroads.work/airquality*.

The Western Harbour Tunnel and associated ventilation systems would be built and operated in compliance with any conditions of approval set by the Department of Planning, Industry and Environment. Further, the monitoring of ventilation outlet emissions during operation would be regulated under an Environment Protection Licence prescribed under the POEO Act.

Air quality index

The Department of Planning, Industry and Environment air quality index provides a comparison of air pollutants, standardising measurements of ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, airborne particles and visibility into an easy-to-understand index. The air quality index helps to understand the level of pollution in the air within the Sydney metropolitan area and how current air quality might affect human health.

An air quality index of 100 corresponds with the AAQ NEPM and levels above 100 signify 'poor' air quality. The impact assessment criteria applied in the assessment are from the NSW Approved Methods and the AAQ NEPM (as discussed earlier in this section).

As demonstrated in the environmental impact statement, emissions from the ventilation outlets would result in small contributions to the local air quality for some residential, workplace and recreational receivers, and potential health impacts from the project are considered to be negligible to acceptable.

Odour

The change of concentration in odours from pollutants from motor vehicles as result of the project is unlikely to be an issue.

Section 8.6 of Appendix H (Technical working paper: Air quality) provides an assessment of the change in odours for concentrations of the pollutants Toluene, Xylenes and Acetaldehyde as a result of the project, and is based on the maximum change at a residential, worker and recreational receiver within the model domain. The assessment predicted the change in concentration of each pollutant was an order of magnitude below the corresponding odour assessment criterion.

Emergency conditions

The tunnel would be equipped with emergency smoke extraction infrastructure. In the case of a fire, jet fans would be used to propel the smoke downstream to the nearest ventilation outlet, or exit portal(s), depending on the location of the fire. The ventilation system combined with the deluge system, would be able to control the heat and smoke in the tunnel so as to maintain a usable air supply permitting safe evacuation of occupants, and to provide the emergency services with a safe route to deal with the fire and to rescue any trapped or injured persons. While smoke is being extracted from the tunnel, air pollutant levels may exceed the relevant guidelines at nearby residential and community receivers. Any such incident has a low expected frequency of occurrence.

### C12.3.3 In-tunnel air quality

***Issue raised***

Submitters raised issues around the air quality within the tunnels. Specific queries relate to the following:

- The environmental impact assessment did not provide an assessment of in-tunnel air quality and the impact of exposure of tunnel users given the length of the tunnel, and extended travel in the tunnel motorway network (WestConnex)
- In tunnel air quality criteria should use specific limits for $PM_{2.5}$ and $PM_{10}$ instead of a general visibility criteria.

***Response***

In-tunnel air quality assessment

The in-tunnel air quality assessment predicted in-tunnel pollutant levels under various traffic scenarios including a worst case scenario with onerous traffic conditions. The assessment demonstrated that the tunnel ventilation system would be designed to maintain in-tunnel air quality within acceptable limits for all scenarios.

The predicted in-tunnel $NO_2$ (rolling 15-minute average) emissions for the worst case vehicle breakdown or major incident in the tunnel confirms that the tunnel ventilation system would achieve the $NO_2$ emissions criteria during all breakdown scenarios. The in-tunnel operational air quality limits for $NO_2$, CO and visibility would also be achieved during all breakdown or major incident scenarios (refer to Annexure K of Appendix H (Technical working paper: Air quality)).

Section 12.6.1 of the environmental impact statement summarises the assessment of in-tunnel air quality, and further detail is provided in Annexure K of Appendix H (Technical working paper: Air quality). An assessment of health impacts to users of the project and the motorway tunnel network is provided in Section 13.5.2 of the environmental impact statement, and is discussed further in Section C13.3.1 of this submissions report.

In-tunnel air quality criteria

The project's ventilation system would be operated to achieve the in-tunnel air quality criteria for CO, $NO_2$ and visibility for various averaging periods. The in-tunnel air quality limits for the project reflect those identified by the ACTAQ (ACTAQ, 2016 and ACTAQ, 2018a) and are consistent with the limits imposed on recent motorway projects in NSW.

The presence of particulate matter (derived from exhaust emissions and non-exhaust emissions, such as tyre and break wear) in the air leads to reduced visibility within the project tunnels. Visibility criteria has been applied in the design of the ventilation system for the purposes of road safety. There are no health based guidelines available for the assessment of short-duration exposures to particulates within a tunnel.

Exposures that may occur within the tunnels would be consistent with expected variability of exposure to particulate matter throughout any day where a range of activities are carried out in an urban setting. Keeping windows closed and switching ventilation to recirculation has been shown to reduce exposures inside the vehicle by up to 80 per cent (NSW Health, 2003). While noting no guidelines are available for very short duration exposures, this would further reduce exposure to motorists.

### C12.3.4 Operational traffic emissions

***Issue raised***

Submitters raised concerns regarding the assessment of operational traffic emissions in the environmental impact statement. Specific comments included:

- The assessment has relied on the implementation of Euro 6 standards, which are currently not committed to
- The air quality assessment underestimates emissions from the project as it assumes an uptake in electric vehicles and underestimates the volume of traffic that would use the project
- The emissions modelling used best case emissions assumptions rather than worst case assumptions for the Sydney vehicle fleet
- Recent Transport Emission/Energy Research reports stated that Australia fleet vehicle emissions have actually increased in the last few years due to longer trips and the sale of large SUVs. The Transport Emission/Energy Research stated that there is little reliable data

about actual or real world Australian fleet emissions which calls into question the data used in the assessment

- The assessment assumes that combustion engine technology would reduce emissions of nitrogen oxide but does not consider prevailing fuel standard. Improvements would not occur without an advance in fuel standards
- The assumption that air quality impacts of this project would reduce over time as fuel efficiency standards are increased is incorrect as there is no commitment by government to implement any efficiency or fuel quality standards for vehicles.

***Response***

In all cases, the ventilation system would be designed and operated to maintain in-tunnel air quality under all traffic scenarios, including breakdown and congested scenarios.

The ventilation analysis assumes that there would be a transition of the passenger car and light duty vehicle fleet towards Euro 6 vehicle emissions standards in NSW, as outlined in Section 6.2.4 of Annexure K to Appendix H (Technical working paper: Air quality). This assumption was not applied to the wider air quality assessment.

The composition of the fleet assumed in the ventilation analysis is provided in Section 6.2.4 of Annexure K to Appendix H (Technical working paper: Air quality) and consists of a range of emissions standards for different vehicle types and includes the proportion of high emitting pre-Euro emissions standards through to ADR79/04 (Euro 6). The in-tunnel air quality and surface road emissions factors do not account for or factor in the continued shift towards alternative fuelled low emission vehicles such as hybrids and battery electric vehicles.

Vehicle emission standards assumed in the ventilation analysis are consistent with the NSW Advisory Committee on Tunnel Air Quality (ACTAQ) technical paper *TP-01 Trends in Motor Vehicles and their Emissions*, prepared by the NSW Environment Protection Authority in November 2018. Conservatively, the ventilation analysis assumes that ADR80/04 (Euro VI for Heavy vehicles) would not be implemented in Australia.

To assess the impact of a potential delay in adoption of ADR/79/04 (Euro 6) in NSW on the ventilation system, a sensitivity analysis was carried out which demonstrates the capability of the ventilation system to manage in-tunnel air quality, in the event that Euro 6 vehicle emission standards not be implemented in NSW by the year 2027 (refer to Annexure K to Appendix H (Technical working paper: Air quality)).

With regard to ventilation outlets, an emission increase would not affect the in-tunnel concentrations since these are subject to regulatory limits and managed as such. However, the mass emission rate of $NO_X$ through the outlet would increase.

Given the small contribution that outlets make to the total ambient concentrations at ground level, when considered in conjunction with surface roads and background concentrations, there is likely to be no difference in outcomes when applying more conservative Euro 5 assumptions for tunnel emissions. Even when the maximum allowable emissions are used (as shown in the regulatory worst case analysis), the outlets are not predicted to generate for exceedances of air quality assessment criteria.

Further discussion regarding operational traffic modelling is provided in Chapter 9 (Operational traffic and transport) of the environmental impact statement and Section C9.1 of this submissions report. Potential future government strategies and policies are considered out of scope for the project.

The most detailed and comprehensive source of information on current and future emissions in the Sydney area is the emissions inventory that is compiled periodically by the NSW Environment Protection Authority. The base year of the latest published inventory is 2008 and projections are available for 2011, 2016, 2021, 2026, 2031 and 2036. The importance of road transport as a source of pollution in Sydney can be illustrated by reference to sectoral emissions (anthropogenic and

biogenic). The data for anthropogenic and biogenic emissions in Sydney, as well as a detailed breakdown of emissions from road transport, were extracted from the inventory by the NSW Environment Protection Authority and are presented in Section 6.6 of Appendix H (Technical working paper: Air quality).

The projections of sectoral emissions show that the road transport contribution to emissions CO, VOCs and $NO_X$ is projected to decrease substantially between 2011 and 2036 due to improvements in emission control technology. For $PM_{10}$, $PM_{2.5}$ and $SO_2$ the road transport contributions are also expected to decrease, but their smaller contributions to these pollutants mean that these decreases would have only a minor impact on total emissions.

### C12.3.5 Operational air quality environmental management measures

***Issue raised***

Submitters requested increased mitigation measures and commitments for mitigating air quality during construction. Specific requests included:

- Recommendations in relation to air quality monitoring:
  - Air quality monitoring should be established at sensitive receivers within 150 metres of pollution sources. Ongoing air quality monitoring in the tunnel and at surrounding sites should extend for longer than two years from commencement
  - Real time air quality monitoring should be made publicly available, particularly if pollution reaches unsafe levels
- Recommendations in relation to in-tunnel traffic restrictions:
  - As a condition of approval, the tunnel and the Warringah Freeway should be closed on days where the air quality index reaches the danger level of 200 or more
  - Questioned the likelihood that the project would be closed in the event that air quality monitoring identified exceedances
  - Diesel vehicles should be banned from the tunnels at all times or at least when particulates reach unacceptable levels. This should be benchmarked from the Paris Duplex Tunnel and Istanbul's Eurasia Tunnel. Motorcyclists should be banned from using the tunnels to avoid exposure
  - The conditions of approval should include a vehicle mass limit
  - Air quality improvements could come from limiting the use of private vehicles in the tunnel at peak times
  - A response plan should be in place to manage impacts if air quality targets are not met. This should include warning systems when health-based air quality protection levels are reached, limiting or closing the tunnel to traffic, communication and controls at sensitive receivers (such as schools) and adjustments to ventilation outlets including retrospective installation of filtration
  - A pollution toll should be introduced
- Recommendations related to project design features:
  - The environmental impact assessment should include measures to mitigate deteriorating air quality, particularly nitrogen oxides and particulate matter
  - A green overpass over the Warringah Freeway between Miller and Ernest Streets should be built as a condition of approval to mitigate the increase in surface road pollution. The air within this short overpass should be redirected to the ventilation stack for subsequent filtration and distribution through the ventilation outlet

- The Northern Sydney bus fleet should be replaced by electric buses to help reduce air pollution impacts.

***Response***

Proposed operational air quality environmental management measures are provided in Section 12.7.2 of the environmental impact statement and Table D2-1 of this submissions report. At the decision of the Minister to approve the project, the Department of Planning, Industry and Environment would prepare the conditions of approval following a review of project documentation. Specific responses are provided in the following sections.

Air quality monitoring

As described in Section 5.2.11 of the environmental impact statement, continuous emission monitoring and ambient air quality monitoring would be carried out during operation of the project to monitor:

- In-tunnel air quality
- Air quality within ventilation outlets
- Ambient air quality at representative locations for a defined period of project operation.

Continuous emissions monitoring equipment for key contaminants ($NO_2$ and CO), visibility and potentially other pollutants would be installed at appropriate locations within tunnels and ventilation outlets to ensure the project is operating within the prescribed emission limits for the project set by the conditions of approval, and as set by the NSW Environment Protection Authority. Periodic manual monitoring of ventilation outlet emissions would also be carried out as required, to validate the accuracy of the continuous emission monitoring equipment.

Continuous ambient air quality monitoring of key contaminants (particulate matter ($PM_{2.5}$ and $PM_{10}$), oxides of nitrogen (NO and $NO_2$) and carbon monoxide would also be provided at representative locations in the vicinity of the ventilation outlets to allow for the review of the predicted air quality outcomes. Monitoring would be in accordance with the NSW Approved Methods or as otherwise agreed with NSW Environment Protection Authority. Ambient air quality monitoring would occur at least 12 continuous months prior to operation and continue for two years following the commencement of operation. At the conclusion of the two year operational monitoring period, the need for continued use of ambient air quality monitoring stations would be reviewed in consultation with the NSW Environment Protection Authority and the Department of Planning, Industry and Environment.

Transport for NSW would provide public access to real time air quality monitoring data as required by the conditions of approval.

In-tunnel traffic restrictions

An air quality index of 100 corresponds with the AAQ NEPM and levels above 100 signify ‘poor’ air quality. An air quality index rating of 200 represents hazardous air quality and would occur in extreme events, such as the recent bushfires. The environmental impact statement demonstrates that the contribution from the ventilation outlets represents a small percentage of the air quality standards. Closing the project or the Warringah Freeway on days of atypical air quality activity or a regional event (such as a bushfire) would not contribute to improved air quality and would only result in traffic using alternative surface roads, which would worsen traffic conditions and cause a corresponding worsening of air quality at ground level in the vicinity of the affected road network. The use of the tunnel by vehicles and the improved atmospheric dispersion of emissions through the tunnel ventilation system and outlets is preferable to closing the tunnel at all times, including when the air quality index reaches the danger level of 200 or more.

The ventilation system would be designed and operated to maintain in-tunnel air quality under all traffic scenarios, including breakdown and congested scenarios. As such, retrospective correction to the system, as well as any access ban or partial restrictions on diesel vehicles, motorcyclists,

vehicles of certain mass or private vehicles in order to maintain or improve in-tunnel air quality are not necessary. There could be exceptional events when traffic conditions require a temporary tunnel closure, such as a major incident or emergency. In these events, there may be broader communication to manage further congestion or to enable an emergency response.

As discussed in Appendix I (Technical working paper: Health impact assessment), motorcyclists using tunnels have no opportunity to minimise exposures through the use of ventilation and would be exposed to $NO_2$ and particulate levels higher than passenger vehicles and trucks. These exposures, under normal conditions, are not expected to result in adverse health effects. When the tunnels are congested it is expected that motorcyclists would spend less time in the tunnels than passenger vehicles and trucks, limiting the duration of exposure and the potential for adverse health effects. However, it is also considered common practice to discourage motorcyclists to use any motorway tunnel during periods of congestion.

Motorcyclists have the option to use the surface road network, including bus lanes on the Sydney Harbour Bridge, to avoid the sub-surface roads and minimise their exposure to associated elevated vehicle emission levels within the tunnels.

The possibility of introducing a pollution toll at motorway tunnels is a policy matter beyond the scope of this project.

Project design features

The project would deliver reductions in contributions along sections of the Warringah Freeway as a consequence of traffic travelling underground.

The project has been designed such that the generation of pollutant emissions by traffic would be minimised. This is demonstrated by the modelling and assessment presented in Appendix H (Technical working paper: Air quality).

A green overpass over the Warringah Freeway between Miller Street and Ernest Street and diversion of the vehicle emissions from within to the resultant 200 metre long tunnel would have minimal effect on local air quality, which is largely due to background concentrations and vehicle emissions generally along the motorway corridor.

Electric bus fleet

The introduction of an electric bus fleet is outside the scope of this project. However, the NSW Government has recently called for expressions of interest to participate in trials of zero emission buses and associated technologies in the Sydney metropolitan area.

NSW GOVERNMENT

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C13 – Human health

SEPTEMBER 2020

# C13 Human health

## Contents

# C13.1 Level and quality of the health impact assessment

## C13.1.1 Adequacy of the health impact assessment

### *Issue raised*

Submitters raised concern over the adequacy of the health impact assessment. Specific concerns include:

- Submitters commented that they would like to see a higher standard applied to acceptable outcomes than the conclusion in the assessment that air quality impacts "are considered to be tolerable/acceptable" to ensure the safety of the community
- The environmental impact statement does not directly assess current or future health impacts of those residing near roads. There is a lack of publicly released studies and data related to air quality and health impacts on communities exposed to traffic emissions on previously approved, constructed and operational transport infrastructure projects in Sydney
- The assessment does not evaluate the long-term health impacts from fine particulate matter
- Sensitive receivers used in the assessment did not include the total number of students attending educational establishments located in the North Sydney area. The assessment incorrectly assumes 100 students at the primary schools near the ventilation outlets. Primary schools in the area have closer to 1000 children
- Comment on the Chief Health Officer statement with specific regard to the comments made by the NSW Advisory Committee on Tunnel Air Quality (ACTAQ) on the air quality assessment with regard to the application of Euro 6 engine standards in the in-tunnel assessment. Submitters also commented on the currency of the advice of the State's Chief Health Officer based on the current medical research, which may pose health risks to the most vulnerable members of the community
- Query as to why there was no independent research and health assessment of NSW schools, long day care centres and other sensitive receivers.

### *Response*

Acceptable risk levels

Ambient air quality standards are a major consideration during road tunnel design and operation, as discussed in Section 4.5 of Appendix H (Technical working paper: Air quality). Standards are designed to protect human health, including sensitive populations such as children, the elderly, and individuals suffering from respiratory disease (refer to Section 4.5 of Appendix H (Technical working paper: Air quality) for more details). The standards adopted for the project are considered appropriate in terms of human health.

Section 6.8.1 of Appendix H (Technical working paper: Air quality) noted that while concentrations of nitrogen dioxide, sulfur dioxide and carbon monoxide continue to be below national standards, concentrations of ozone and particulate matter ($PM_{10}$ and $PM_{2.5}$) still exceed the standards on occasion, irrespective of the project. As shown in Section 8.4 of Appendix H (Technical working paper: Air quality), the total number of residential, workplace and recreational receivers with exceedances of 1-hour nitrogen dioxide, 24-hour $PM_{2.5}$ and 24-hour $PM_{10}$ criteria generally decreased slightly with the project, or program of works. This is due in part to the predicted shift in traffic from the surface roads into the tunnel and also due to improved traffic flow on surface roads.

There is no rigid definition of acceptable risk provided by government agencies, due to the complex and context driven nature of the issues. However, it is possible to propose some general guidelines as to what an acceptable risk for specific development projects might be.

If the level of one chance in a million ($10^{-6}$) were retained as a level of increased risk that would be considered as a negligible risk in the community, then the level of risk that could be considered to

be tolerable or acceptable would lie between this level and an upper level that is considered to be unacceptable.

While there is no guidance from government agencies available on what level of risk is considered to be unacceptable in the community, a level of one chance in 10,000 ($10^{-4}$) for increased risk has been generally adopted by health authorities internationally as a point where risk is considered to be unacceptable in the development of drinking water guidelines (that impact on whole populations for exposure to carcinogens as well as for annual risks of disease (Fewtrell & Bartram, 2001)) and in the evaluation of exposures from pollutants in air (NSW DEC, 2005).

Between an increased risk level considered negligible ($10^{-6}$) and unacceptable ($10^{-4}$) lie risks that may be considered to be tolerable or even acceptable.

Tolerable risks are those that can be tolerated and where the best available, and most appropriate, technology has been implemented to minimise exposure in order to realise some benefit. In a societal context, risks are inevitable and any new development would be accompanied by risks which are not amenable or economically feasible to reduce below a certain level. It is not good policy to impose an arbitrary risk level to such developments without consideration of the myriad factors that should be brought into play to determine what is 'tolerable' (ie the benefits to human health as well as potential impacts).

When considering the impacts associated with this project, it is important to note that there are a range of benefits associated with the project and the design of the project has incorporated measures to minimise exposures to traffic-related emissions. Hence for this project the calculated increased risks have been considered to be tolerable when in the range of $10^{-6}$ and $10^{-4}$ and where the increased incidence of the health impacts are considered to be insignificant.

Appendix I (Technical working paper: Health impact assessment) describes the methodology applied to defining risks and the assessment of impacts on human health from changes in air quality. Annexure C of that technical working paper provides further detail on the risk levels applied in the assessment.

Exposure to traffic emissions

The health impact assessment considers:

- Existing air quality as well as the health status of the existing population
- Short-term (acute) and long-term (chronic) impacts during operation of the project.

The methodology for the assessment is in accordance with national and international guidance that is endorsed / accepted by Australian health and environmental authorities. Further, the assessment of exposure to chemicals released during combustion (namely nitrogen dioxide and particulates) and has considered:

- The most robust health outcomes are where a relationship has been firmly established (based on sound studies and statistical analysis) between exposure to particulate matter and a specific health effect
- Exposure-response relationships that are derived from published peer reviewed sources and relate to the identified health effects
- The health effects and associated exposure-response relationships that have been adopted by previous NSW road tunnel projects and that follow previous NSW Health advice.

For other pollutants and stressors, national guidelines based on the protection of public health have been adopted.

The release of information on air quality and health impacts from other projects is not part of the environmental impact assessment scope.

NSW Health provides information on air quality monitoring and health studies related to Sydney motorway tunnels. This information is publicly available via the NSW Health website: *https://www.health.nsw.gov.au/environment/air/Pages/reports-studies.aspx*

Particulate matter

Long term effects of changes in $PM_{2.5}$ are considered through this assessment by looking at the change in chronic incidence of assessed health endpoints (eg changes in mortality due to all causes in persons 30 years of age and older).

Further, assumptions adopted for the characterisation of exposure would have overestimated exposure as it has assumed that:

- All exposures to changes in air quality assumes that all residents are at home all day, every day for a lifetime
- The maximum change in air quality affects a receiver, regardless of where this may occur (eg industrial area, in a roadway, open space area or residential area). This means that the assessment assumed a person may be present at the location where the maximum change in air quality occurs even if the location is not where people will live or walk (eg in the middle of a road).

The calculated changes in risk (associated with individual mortality; cardiovascular illness, respiratory or asthma hospitalisations; and lung cancer) associated with the expected operation of the project in 2027 and 2037 ('Do something' scenario), including the cumulative scenarios ('Do something cumulative' scenario) indicates the maximum risks associated with the changes to particulate matter ($PM_{2.5}$ and $PM_{10}$) concentrations would be below $1x10^{-4}$ (1 in 10,000) for the worst case locations for homes, workplaces, schools, childcare centres, aged care homes and open space areas. Most locations for these land uses would have lower risks than the maximum values. This is considered to be tolerable or acceptable.

Student numbers used in the assessment

The reference made in the submission to an assumed enrolment size of schools in the study area was only applied in the risk assessment for construction air quality impacts (dust). As discussed in Section C12.1.4 of this submissions report, an increase in enrolment size does not alter the assessment outcome for the risk assessment.

The human impact assessment for the changes in air quality during operation has considered non-residential sensitive receivers, such as schools, on a location basis and has assumed the maximum exposure at this type of receiver. The assessment was not adjusted to assume a certain number of children would be present at the site; the assessment assessed the location and the potential risk to an individual at that location. As the potential impact to an individual is not affected by how many individuals are present, the number of students at each school would not change the assessment outcome.

Chief Health Officer statement

The Chief Health Officer statement on potential health impacts of emissions from road tunnel ventilation outlets is based on a review of the environmental impact assessment and on a report from the independent expert members of the NSW Advisory Committee on Tunnel Air Quality who have appraised the draft air quality assessments.

The statement is factual in nature and supported by current evidence of the health effects of $PM_{2.5}$ and nitrogen dioxide which has been reviewed by groups such as the World Health Organization, the United States Environmental Protection Agency and the International Agency for Research on Cancer.

As discussed in Section C12.3.5 of this submissions report, given the small contribution that outlets make to the total ambient concentrations, when considered in conjunction with surface roads and background concentrations, there is likely to be no difference in outcomes when applying more

conservative Euro 6 assumptions for tunnel outlet emissions as these would apply to emissions from all vehicles.

In relation to health impacts, where a greater proportion of the vehicle fleet may meet Euro 6 emissions, this would result in lower levels of risk from emissions from vehicles on surface roads as well as from the outlets of the road tunnel, as the current assessment has not included Euro 6 compliant vehicles comprising a significant proportion of the fleet.

Independent research and health assessment

The health impact assessment has been carried out in accordance with the Secretary's environmental assessment requirements, and is consistent with state, national and international guidance that is endorsed / accepted by Australian health and environmental authorities. Further, the health impact assessment as it relates to tunnel outlet emissions was reviewed by NSW Health and a statement released by the Chief Health Officer prior to the exhibition of the environmental impact statement.

Independent research and health assessment of sensitive receivers is beyond the scope for the project.

## C13.2 Health impacts during construction

### C13.2.1 Construction fatigue

***Issue raised***

A number of submitters raised concern over the duration of the construction period, including:

- Concern that the long construction timeframe and associated impacts, including dust and noise, would result in construction fatigue, decreased liveability, mental and physical health, and increased stress and anxiety
- Concern that the five years of construction work near the North Sydney educational precinct would adversely affect children's opportunities to learn and play, aggravate pre-existing respiratory conditions and result in adverse learning outcomes for those children suffering learning disabilities
- Request for a plan to manage the six years of construction impact (and continuing with the Beaches Link and Gore Hill Freeway Connection project) given the number of receivers and community facilities near the Warringah Freeway.

***Response***

The most effective way to minimise potential health impacts associated with extended duration construction is to manage all the individual aspects that can affect the amenity and health of the affected community. The environmental management measures that would be implemented to manage amenity and health risks for the community are presented in Table D2-1 of this submissions report.

Section 6.5 of Appendix G (Technical working paper: Noise and vibration) provides consideration for longer duration construction noise and vibration impacts arising from construction activities that are not considered to be transient and/or short-term. The key areas where these impacts may be of concern, both from consecutive and overlapping construction periods, were identified and mitigation measures proposed to minimise these impacts.

The mitigation and management measures related to construction fatigue are intended to address issues for all members of the community, including school children. Transport for NSW acknowledges that construction activities in locations near educational facilities, and in particular noise and vibration from those activities, would have the potential to affect the amenity of students. The potential for impact would vary depending the type of construction activities occurring, the distance from the educational facility and the frequency.

Where potential noise and vibration levels would exceed the relevant criteria, the contractor would provide appropriate mitigation as outlined in *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016) which may include respite periods. The potentially impacted educational facilities would also have the option of contacting the construction contractor to discuss actual and potential amenity impacts.

In accordance with Transport for NSW's commitments in the community consultation framework (refer to Appendix E of the environmental impact assessment) the outcomes of this consultation would be taken into account in the selection of mitigation measures, which could include equipment and activity substitution, limiting the timing of noise-intensive works and scheduling to minimise potential amenity impacts. In this manner, the potential for long term noise and vibration impacts to the amenity of students within the affected educational facilities would be minimised.

The assessment of potential exposure and risk to changes in air quality associated with the construction of the project is conservative as it has not assumed the implementation of mitigation measures. Any effects would be temporary and relatively short-lived, and would only arise depending on weather conditions (dry and wind direction), activity and when mitigation measures are not being fully effective (refer to Section 12.5.1 of the environmental impact statement). With the implementation of standard construction air quality mitigation and management measures (refer to Table D2-1 of this submissions report) that are routinely implemented on major construction projects, the risk of construction fatigue due to air quality impacts over the long term would be low.

The design and construction methodology has been developed with consideration given to minimising impacts to the community. The contractor would be required to further develop the design and construction methodology in accordance the environmental performance outcomes for the project (refer to Section 28.6 of the environmental impact statement, which include protecting the amenity and health of the affected community to the greatest extent practicable.

The community consultation framework presented in Chapter 7 (Stakeholder and community engagement) of the environmental impact statement and Appendix E (Community consultation framework) has also been developed with consideration of complaint fatigue and includes procedures to proactively manage this issue where possible.

### C13.2.2 Air quality during construction

***Issue raised***

Submitters raised concerns over potential for impacts to health due to changes in air quality during construction, including concerns over dust, vehicle emissions and odours. Specific queries, comments and concerns include:

- Request for additional dust mitigation at the Victoria Road construction support site (WHT2) to protect the health of residents in adjacent properties
- Query the statement in the environmental impact statement that health effects from construction dust in Cammeray and Berrys Bay would be not significant, as this is not supported from experience on similar construction projects
- Recent tunnelling projects have had significant issues with dust control despite mitigation measures being in place. The health risks from construction dust are high. Request for the Chief Health Officer to reassess dust related health outcomes with reference to the risk assessment completed showing dust risks are high on the North Shore
- Concern over the risk of silicosis due to disturbance of high-quality Hawkesbury sandstone which would be encountered for the majority of the proposed tunnel alignment
- Concern over construction diesel vehicle emissions, particularly at tunnel portals
- Concern that standard environmental management measures are insufficient to manage the high risks due to likelihood of carbon monoxide, nitrous oxides, sulfur dioxide and volatile

organic compounds levels in construction air quality assessment zone 4 (Sydney Harbour crossing) and zone 5 (Warringah Freeway Upgrade and motorway control centre)

- Request for no heavy vehicle movements near schools, childcare and preschools from 7.30am to 9.30am and from 2.30pm to 4pm given the risks of increased diesel exhaust
- Concern that disturbance of land previously used as a landfill and quarry would generate odours which would increase the risk of health impacts.

***Response***

Dust

The assessment of construction dust impacts considered the risk associated with dust generated during the four key stages of construction without mitigation, and considered the risk of health effects due to an increase in exposure to particulate matter. Activities associated with Victoria Road construction support site (WHT2) and Berrys Bay construction support site (WHT7) prior to mitigation is considered to have a low to medium risk of impact, depending on the stage of construction. The highest risk activities in relation to dust would be the handling of tunnel spoil, which would happen underground and inside the acoustic sheds at the surface to minimise potential emissions.

The construction footprint in areas alongside the Warringah Freeway were identified as having a high risk, which is a function of the larger disturbance footprint for these works and scale of activities as well as the sensitivity of the surrounding areas. In reality, construction along the Warringah Freeway and surrounding roads would be staged and progressive.

Minimising dust emissions from construction location and support sites is considered manageable through the implementation of standard dust mitigation measures (refer to environmental management measure AQ1 in Table D2-1 of this submissions report), and the health impacts are not considered to be significant. The assessment acknowledges that dust mitigation measures may be less effective under changing conditions (for example when there is dry weather with the wind blowing towards a receptor) however such changing conditions are unlikely to be persistent or frequent and more likely to be short term. The likely scale of this incidence is not considered sufficient to change the conclusion that the potential for health effects would not be significant.

Silica

Through the implementation of measures to suppress dust, it is considered unlikely that silica dust would impact on sensitive receivers surrounding construction support sites as the majority of sandstone excavation would take place underground, and handling of spoil would be contained within the acoustic sheds proposed for construction support sites, which would minimise the emission of dust. Silica dust, if generated, would therefore be contained and would be subject to *Workplace Health and Safety Act 2011* to provide a safe working environment to construction workers. This would effectively manage any potential impact to surrounding receivers (as per Section 7 of Appendix H (Technical working paper: Air quality)).

Issues related to crystalline silica dust are being raised by communities more often since the lack of proper controls in some workplaces was identified in the media. Exposure to high levels of uncontrolled silica dust has been associated with health effects for workers involved in dry sanding of silica containing materials (eg granite bench tops) and other similar activities. Such health effects have not been seen for community exposures where the levels that could be present in air are much lower. As noted, it is essential to control worker exposure on the construction sites and this would also control community exposure outside the construction sites.

Other emissions

Areas of high risk, as discussed earlier in the section, relate to the risk of dust impacts without mitigation. This rating does not apply to other emissions, such as those from construction plant and equipment.

The use of on-site diesel-powered vehicles, generators and construction equipment, and the handling and/or on-site storage of fuel and other chemicals, may result in localised increased concentrations of airborne particles, carbon monoxide, nitrous oxides, sulphur dioxide and volatile organic compounds.

However, exhaust emissions generated during construction from construction plant, barges and vehicles would be temporary and not significantly contribute to emissions in the local area, given the high existing levels of vehicle use within Sydney's airshed and the contribution associated emissions make to existing background air quality (Appendix H (Technical working paper: Air quality)).

Truck marshalling areas would be identified and used where feasible and reasonable, to minimise potential queueing and traffic and access disruptions in the vicinity of construction support sites, in accordance with environmental management measure CTT11 (refer to Table D2-1 of this submissions report).

Table 16-9 of the environmental impact statement assesses the potential contamination risks on a site by site basis, including the risk of landfill gas which can cause odours. Potentially contaminated sites identified in Table 16-9 of the environmental impact statement would be subject to further investigation, with the exception of the Rozelle Rail Yards, where contamination is already well known.

No excavation of former waste landfills is proposed during construction, limiting the potential for significant emissions of landfill gases and associated odours.

The environmental impact assessment notes some locations that would be excavated as part of the project have been subject to past infill practices and there is potential for excavations in these locations to release landfill gas and odours if putrescible organic material is present. However, significant excavations of large amounts buried putrescible material, such as might be found in a former landfill, are unlikely. The potential for releases of landfill gases and odour at volumes significant enough to result in amenity of health impacts at adjacent sensitive receivers is therefore very low.

The potential for emissions of landfill gases and odour due to material present below the surface in areas to be excavated and identified as having moderate to high exposure risk to contamination would be determined based on further contamination investigations carried out by the construction contractor. The potential exposure pathways for adjacent sensitive receivers would be considered on a case by case basis and appropriate measures implemented during excavations to minimise potential health risk (if present).

Environmental management measure AQ1 (refer to Table D2-1 of this submissions report) has been revised to provide a clearer link to managing odour in the construction environmental management plan. This will include the implementation of contingency measures. Any areas of contamination would be managed in accordance with the requirements of guidance endorsed under section 105 of the *Contaminated Land Management Act 2008* (refer to environmental management measure SG6 in Table D2-1 of this submissions report).

### C13.2.3 Construction noise and vibration

***Issue raised***

Submitters raised concerns over potential impact to health from exposure to high levels of construction noise and vibration. Specific issues, concerns and comments include:

- Night-time construction noise exceedances would impact on sleep, causing stress and reducing quality of life
- Request for strict curfews of 6pm on weekdays and 1pm on Saturdays for all noisy work and tunneling work within 300 metres of any residential building, and no noisy construction work on Sundays to allow respite for nearby residents.

***Response***

Out of hours work noise exceedances

The contractor would aim to work during standard daytime construction hours wherever possible. However, a large amount of work would require access to parts of the Warringah Freeway and other busy roads, which require a road occupancy licence from the Transport Management Centre. When proposed construction activities have the potential to cause significant and widespread traffic disruption, the Transport Management Centre typically requires the works to be carried out at night when traffic volumes are low.

The contractor would be required to further develop the construction methodology to ensure that construction noise is effectively managed to minimise adverse noise impacts on the community, in accordance the environmental performance outcomes for the project (refer to Section 28.6 of the environmental impact statement). This would include the implementation of management measures as appropriate, such as substituting noise intensive equipment and activities with less noise intensive ones, changing the location of works outside standard construction hours to provide respite, and carrying out the most noise intensive activities as early as possible during the work shift where reasonable and feasible.

Night-time noise management level exceedances over 15 dB(A) are predicted to occur at locations near the project. Construction noise levels and the number of impacted receivers would vary over the duration of construction. Exceedances would be temporary and intermittent. The highest noise levels at a receiver would occur when highly noise intensive equipment is in use or activities are occurring in close proximity. When the noise intensive equipment is not in in use, or the construction activity moves away from the affected receiver, construction noise levels would reduce.

Noise impacts associated with works outside standard daytime construction hours would be regulated by the NSW Environment Protection Authority through an Environment Protection Licence for the project. The NSW Environment Protection Authority would consider the need to protect the amenity of adjacent sensitive receivers such as residents when deciding the conditions contained in the licence.

Curfew for noisy construction work

The measures implemented to manage construction noise are typically selected based on the predicted construction noise levels associated with the specific activity, rather than on a distance basis.

The majority of noise intensive activities would occur within standard construction hours. As stated above, however, some noise intensive activities across the project, particularly on the Warringah Freeway, would be required to take place outside of standard construction hours to maintain the operational functionality of the road network, and for other appropriate reasons such as safety.

The contractor would be required to develop a detailed construction methodology to ensure construction noise is effectively managed to minimise adverse impacts on the community. This would include measures such as carrying out the most noise intensive activities as early as possible in the work shift where reasonable and feasible. However, as these works must occur outside standard construction hours to avoid significant and widespread traffic disruption, it is not appropriate to set curfews. Potential amenity impacts to adjacent sensitive receivers due to noisy works at night would typically be managed by providing appropriate respite, as described in *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016).

### C13.2.4 Construction traffic, access and public transport arrangements

***Issue raised***

Some submitters raised concern about the health impacts of changes to traffic, access and public transport arrangements, including:

- Concern that increased traffic volumes due to construction traffic would adversely impact the health of local residents
- Concern that the loss/relocation of bus stops during construction would cause stress and anxiety for commuters.

***Response***

Construction support sites and haulage routes have been identified to minimise use of local roads, where possible. As acknowledged in the environmental impact statement, construction traffic has the potential to impact the performance of some roads and road intersections particularly during morning and evening peak hours. Some bus stops may also require adjustment during construction. Without mitigation, these matters may impact community perceptions about safety for users, or levels of stress and anxiety in the community.

Traffic impacts will be managed through standard communication and traffic control management measures, which would limit delays and disruptions to road users as well as ensuring the safety of motorists, cyclists and pedestrians. This includes environmental management measure CTT10 (refer to Table D2-1 of this submissions report), which requires any adjustments to existing bus stops to be determined in consultation with relevant stakeholders including other divisions of Transport for NSW, and advanced notification will be provided to affected bus customers. Relocations will be as close as feasible and reasonable to their existing position.

Increased vehicles emissions associated with construction traffic would be unlikely to significantly impact local air quality due to the high levels of existing vehicle emissions along the proposed construction traffic routes.

### C13.2.5 Potentially contaminated soils and sediments

***Issue raised***

A number of submissions raised concerns in relation to potential health impacts from the disturbance of potentially contaminated soils and dredged sediments. Specific queries, comments and concerns include:

- Concern about health impacts due to disturbance of soils potentially contaminated from historical land uses
- Concern about contamination identified as ‘high risk’ at the Rosalind Street construction support site. Contaminants include heavy metals which can be detrimental to children’s health
- Concern that potentially contaminated sediment from dredging in Sydney Harbour would increase pollutant levels on the Parramatta River foreshore which has potential community health risks
- Concern over health impacts due to disturbance of potentially contaminated sediments on Sydney Harbour users such as fishermen, people who swim in the Harbour (Dawn Fraser baths, Greenwich baths, Birchgrove Oval Beach and Northbridge Baths), divers, sailors and rowers. Sedimentation levels during dredging are reported to be at the same level as after a rain event. It is already a standard recommendation by NSW Beachwatch that people should not swim for three days after rain events due to likely poor water quality
- Query about impacts to users of the North Sydney Olympic Pool, given that it draws water from the harbour and the potential risk of contamination being mobilised from dredging

- Concern over the potential for disturbance of seabed contaminants to bioaccumulate through the food chain if particles are eaten by fish and other marine life consumed by humans
- Concern over potential odours and health risks related to the storage and treatment of potentially contaminated sediments at the White Bay construction support site (WHT3) on an open hardstand area for a period of at least three years
- Concern about contaminants becoming airborne and being transported to nearby residential and recreational areas
- Concern over transport of potentially contaminated sediments through residential streets.

***Response***

Contaminated soils

Section 16.4 of the environmental impact statement identified areas of environmental interest with moderate to high risk potential for containing contaminated and potentially contaminated soils. These areas would be further investigated during further design development. This would potentially include further detailed site investigations and data analysis.

Risks of exposure to construction workers, the public and environmental receivers due to the disturbance of contaminated material would be managed in accordance with requirements of the *Contaminated Land Management Act 1997*. A remediation action plan will be implemented in the event that site remediation is warranted prior to construction, as stated in environmental management measure SG6 (refer to Table D2-1 of this submissions report). The remediation action plan will be prepared and implemented in accordance with *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and EPA, 1998). An independent NSW Environment Protection Authority Accredited site Auditor will be engaged, where contamination is complex, to review applicable contamination reports and evaluate the suitability of sites for a specified use as part of the project.

For situations where there is the discovery of previously unidentified contaminated material, this would be managed in accordance with an unexpected contaminated lands discovery procedure, as outlined in the *Guideline for the Management of Contamination* (Roads and Maritime Services, 2013) and detailed in the construction environmental management plan.

Provided the implementation of these environmental management measures, the risk to public safety is considered low.

Sediment disturbance in Sydney Harbour

The proposed dredging technique in conjunction with the behaviour of sediment bound contaminants would make it unlikely that water quality would be significantly impacted from dredging and marine construction activities.The risks to human and environmental health from contaminated sediments were considered in Appendix I (Technical working paper: Health impact assessment). Elutriate testing carried out on sediment samples collected from within the proposed dredge zone indicates that contaminants would typically remain bound to the sediment if it is disturbed and becomes suspended in the water column. The suspended sediment would generally settle out in close proximity to the location from where it is dredged. This is discussed further in Section 5.1.3 of Appendix Q (Technical working paper: Marine water quality). Therefore, the dredging activity is unlikely to increase the bioavailability of contaminants in the water column. With the adopted management measures proposed in the environmental impact statement for dredging and marine construction, there would be negligible impacts to human health in the event that recreational exposures occur in areas surrounding the proposed works.

It is also unlikely that pollutant levels on the Parramatta River foreshore would increase as a result of the project construction due to the significant distance between the proposed works (where sediments will be managed) and the Parramatta River. Water quality monitoring indicates that suspended sediment levels vary greatly within Sydney Harbour and the Parramatta River. The

sediment dispersion modelling predicts that outside the locations where dredging is occurring and the immediately adjacent areas, suspended sediment concentrations are likely to be similar to existing background levels, and significantly less than suspended sediment concentrations during wet weather events. Therefore, the dredging activities are unlikely to significantly affect water quality at Dawn Fraser baths, Greenwich baths, Birchgrove Oval Beach and Northbridge Baths, or the quality of water that is drawn into North Sydney Olympic Pool. Further discussion is provided in the Royal HaskoningDHV memorandum in Appendix C.1 of this submissions report. Any impacts would be temporary and limited to when the dredging is actually occurring. Outside of the locations where dredging is occurring and the immediately adjacent areas, the dredging activity is unlikely to have a substantial impact on the amenity and health of primary and secondary contact users of Sydney Harbour and the Parramatta River.

Similarly, as the bioavailability of contaminants would be unlikely to increase significantly as a result of the disturbance of seabed contaminants during dredging, there is minimal potential for increased bioaccumulation of contaminants in marine fauna (and the food chain). In any case, the NSW Department of Primary Industries advises that "*no fish or crustaceans caught west of the Sydney Harbour Bridge should be eaten*". As a result, the risk of increased human exposure to contamination due to consumption of marine food caught in the vicinity of the dredging activities is very low.

Odour

The assessment for potential odour impacts during the handling, storage and treatment of dredged material that is unsuitable for offshore disposal at the White Bay construction support site (WHT3) is discussed in Section 13.4.1 of the environmental impact statement. Polymers and lime would be added to sediment not suitable for offshore disposal, which would substantially reduce the potential for odour emission. Further detail is available in Section 7.2 of Appendix H (Technical working paper: Air quality).

The odour assessment predicted odour levels at the nearest receptor would be lower than 0.1 OU and are unlikely to be detectable. The *Technical framework: Assessment and management of odour from stationary sources* (Environment Protection Authority, 2016) indicates that adverse health effects are likely where an individual is exposed to ambient odour levels greater than 7 OU (odour units). Management measures would be implemented to ensure any unforeseen odorous material is appropriately handled, stored and treated to minimise any potential risk in accordance with environmental management measures AQ1 (refer to Table D2-1 of this submissions report).

Sediment handling and transport

Dust management measures routinely implemented on infrastructure construction projects (refer to environmental management measure AQ1 of Table D2-1 of this submissions report) would be sufficient to also ensure that the risk of exposure of the adjacent community to contaminated dust would be minimal. Any specific risks associated with contaminated soils becoming airborne during land-based activities would be considered on a case by case basis based on the contaminants present prior to those activities occurring, in accordance with environmental management measure SG6 (refer to Table D2-1 of this submissions report). Measures to address the risk and potential exposure pathways, including during road-based transport, would be identified and implemented in accordance with the processes for addressing contamination risks described above.

Dredged sediments would be wet and therefore unlikely to result in any dust emissions. Dredged sediments would be temporarily stored and transported in appropriate containers to minimise the potential for environmental release.

Refer to Section B1.5 and Appendix C.2 of this submissions report for further discussion regarding the management of dredged material not suitable for offshore disposal.

### C13.2.6 Emergency management

***Issue raised***

Submitters queried what measures will be in place to protect open space users and residents around construction support sites, so they are alerted in real time to potential health issues.

Submitters requested that local councils with local government areas along the harbour foreshore should be immediately alerted where water quality targets are exceeded to enable any required responses, including notification to the local community, of any risks posed to recreational activities.

***Response***

Impacts to the community due to construction support site activities will be minimised through the implementation of appropriate mitigation and management measures (refer to Table D2-1 of this submissions report).

As described above, suspended sediment concentrations outside of dredging locations and immediately adjacent areas are unlikely to be substantially greater than background levels and are unlikely to pose a health risk to primary and secondary contact users of Sydney Harbour and the Parramatta River.

Where required, noise mitigation and management approaches will require monitoring of construction activities, development of site-specific responses as well as communication strategies with the affected community.

As a general overarching approach, construction activities will be managed and potential impacts mitigated to a level where real time warning systems are not warranted.

In the event that an environmental incident does occur, the contractor would be required to follow the *Environmental Incident Classification and Reporting Procedure* (Roads and Maritime Services, 2018), as well as meet the obligations of any conditions of approval, the conditions of any applicable Environment Protection Licence and the *Protection of the Environment Operations Act 1997*. Incident notification, including to local councils and the community, would occur as required by law. These laws relate to the prevention or minimisation of harm, to human health and the environment.

## C13.3 Health impacts during operation

### C13.3.1 Air quality

***Issue raised***

Submitters raised concern over the potential impact to human health from changes in air quality. Queries, comments and concerns raised include:

- Concern that changes to air quality from increased road traffic along Miller Street may affect children's ability to learn and impact on their long-term health
- Concern over the effects of pollution from vehicle emissions on health. Comment that there is international and Australian medical research to show this link. Health studies have identified respiratory issue and other medical issues associated with ventilation outlets on other NSW road tunnel projects
- Potential for diesel emissions to cause irritation to the eyes, nose, throat, and lungs and cause light headedness, coughing and nausea
- Concern that safe vehicle emission limits are likely too high for young children and other vulnerable people
- Concern over the statement in the environmental impact statement that the maximum total concentrations of $PM_{2.5}$ would be more than double the national standards for both a 24-hour average and the annual average

- Concern over exposure to particulate matter by school children, given there are no safe exposure levels, and queried whether the air quality in proximity to the project would be safe for children and local residents
- Query over potential impacts to health on pedestrians, joggers and cyclists that currently use the cycle pathways directly adjacent to parts of the Warringah Freeway
- Standards do not address the issue of ultrafine particles which can have even more damaging health impacts than $PM_{2.5}$ particles and above
- Requests for the following to be included as conditions of approval:
  - Further assessment of health impacts on children and schools
  - Closure of the tunnel to all traffic on days when Air Quality Index indicates air quality is at danger levels
  - A response plan in place to make sure community members are safe if an incident were to occur
  - Air emissions from the project to be continuously monitored during and after construction.

***Response***

Local road traffic pollution

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 tolerable/acceptable.

Chapter 13 (Human health) of the environmental impact statement describes the impact of changes in air quality from all vehicle emissions including emissions from the traffic on the surface road network. The assessment found that for much of the community, the redistribution of traffic volumes on surface roads would result in no change or a small improvement (ie decreased concentrations and health impacts). However, for some areas located near key surface roads, a small increase in pollutant concentration may occur. Such increases are very small and would not have significance or be measurable within the community or at a local government area or suburb level.

The air quality impact assessment confirms that air quality in the vicinity of major road corridors is most influenced by background air quality, which is a product of regional emissions across the entire airshed, and the emissions from existing traffic on the surface road network. While the project is predicted to result in some changes to air quality, the changes are typically very small compared to existing air quality. The project alone cannot address pollutant concentrations where they currently exceed the relevant criteria or substantially change existing air quality generally in the locality.

Research on vehicle emissions

The methodology used for the health impact assessment included current available research on effects on human health from vehicle emissions. The assessment methodology was in accordance with national and international guidance that is endorsed or accepted by Australian health and environmental authorities.

The *Respiratory health study findings released on Lane Cove Tunnel* (NSW Health, 2012) examined the respiratory health of residents living near the Lane Cove Tunnel and the impact from pollutants found that ‘any risk to respiratory health is minimal’. The study authors concluded that pollutant concentrations decreased in the immediate area of the ventilation outlets after the tunnel opening, specifically:

- The respiratory health effects were identified among residents only for the eastern ventilation outlet, and only for one of the two years examined. No health effects were identified for the western ventilation outlet

- Although the identified health effects are difficult to explain given the levels measured, the authors noted that they are unable to be attributed to the ventilation outlet.

A study completed by Pacific Environment Limited in 2014 comparing the emission rates to pollutant concentrations measured in the ventilation outlets of the Lane Cove Tunnel determined that the emission factors previously modelled had overestimated emissions of carbon monoxide by 1.3 to 1.7 times, emissions of nitrogen dioxides by 1.6 to 1.8 times, and $PM_{2.5}$ by 2.8 to 4.4 times. While it is noted that the Lane Cove Tunnel has different dimensions and ventilation characteristics to that of the project, the results for the project are considered to be conservative.

Further, NSW Health conducted health/epidemiological studies on populations surrounding the M5 East ventilation outlet in 2002 and 2003 (NSW Health, 2004), with re-analysis carried out in 2004 (HSW Health, 2006) to account for portal emissions that have occurred during the time of the study in response to incidents in the tunnel. These studies found no evidence of an association between health symptoms reported and emissions from the ventilation outlet. An additional study was carried out by NSW Health (2012) to specifically evaluate community concerns over a “cancer cluster” in the population close to the M5 East ventilation outlet and tunnel portals. This study concluded that it was unlikely that there was causal association between emissions from the M5 East tunnel and cancer.

The health impact assessment considered health effects related to pollution from vehicles, as raised by the community near the M5 East and considered in the NSW Health assessments.

Vehicle emissions safe limits are too high for children and vulnerable people

The guideline values used to assess changes in air quality on community health are found in Chapter 5 of Appendix I (Technical working paper: Health impact assessment).

These guideline values account for vulnerable people in the community such as children and the elderly and have been accepted in Australia by the National Health and Medical Research Committee (NHMRC), the National Environment Protection Council (NEPC) and the Environmental Health Committee (enHealth).

The guidelines adopted are based on large epidemiological studies that include populations with children, the elderly and those with pre-existing health conditions. It is expected that the statistical associations identified in the studies and used in risk assessment (and the development of guidelines) are largely dominated by these more sensitive individuals as they would be the first to present to hospital with the health effects of concern, which is the basis for the relationships adopted.

Particulate matter

Chapter 13 (Human health) of the environmental impact assessment described the impact of changes in particulate matter on community health.

The health impact assessment has considered total exposures (ie with background) and the incremental exposure to particulates as a result of the project and with consideration of other major road projects (‘Do something cumulative’ scenario). This assessment acknowledges that there are elevated background levels of $PM_{2.5}$ irrespective of the project and that these levels are above guideline levels (including the 2025 goal). However, as discussed in Section 5.9.4 of Appendix I (Technical working paper: Health impact assessment), the total concentrations for particulates is essentially unchanged to slightly lower in most cases within the local community with the operation of the project along with the operation of all road tunnel projects.

Current air quality in the project area is influenced by the large amounts of traffic on the surface road network. In many areas related to this project, the air quality would improve due to the movement of traffic from the surface road network to the tunnel, and the use of ventilation outlets to control in-tunnel concentrations and to ensure that vehicle emissions are discharged higher in the atmosphere, further minimising people’s exposure at ground level.

With regard to the incremental exposure or change in exposure for $PM_{2.5}$, the maximum risks calculated for exposures in residential areas are less than one in 10,000 which is considered to be tolerable/acceptable while all maximum risks calculated for continuous exposures in childcare centres, schools, aged care homes and open space areas are below one in 10,000 which is considered to be tolerable/acceptable. The change in incidence of the relevant health effects associated with exposure to $PM_{2.5}$ in the community is very small and would not be measurable within the community or at a local government area or suburb level.

Based on the above, potential health impacts associated with changes in particulate matter within the local community are considered to be tolerable/acceptable.

Impacts to active transport users

As demonstrated in the environmental impact statement, there would be decreases and increases in concentrations of vehicle emission related pollutants along the Bradfield, Warringah and Gore Hill freeways and other surface roads due to changes in surface traffic distribution. The changes, however, would typically be small compared to existing levels along the corridor. Exposure to users of active transport would be highly dependent on route selection, travel distance and duration.

The project would have an acceptable impact to residential, workplace and recreational receivers that have been assessed who reside, work or play immediately adjacent to road corridors. In many locations, such receivers would be exposed to lower levels of these pollutants compared to the current situation. Therefore, the change in air quality as a result of the project would be unlikely to substantially increase or alter exposure risks to active transport users on and adjacent to the new and upgraded road infrastructure.

Ultrafine particles

The levels and potential health risks associated with ultrafine particles (being particulate matter less than 0.1 microns in diameter, $PM_1$) have not been studied extensively in most urban air environments due to a lack of robust methods to carry out such measurement. Measurement of $PM_{2.5}$ includes all particles less than 2.5 micrometres (µm) including all the particles less than 0.1 µm.

As a result, while there are no robust epidemiological studies that relate changes in ultrafine particle levels and health effects that can be used in a quantitative risk assessment, the associations developed for $PM_{2.5}$ would include a significant contribution from $PM_1$ (as $PM_1$ comprises a significant proportion of $PM_{2.5}$) and health effects observed for $PM_1$ would be included in the studies that have been conducted on the basis of $PM_{2.5}$. Further detail is available in Section 5.9.1 of Appendix I (Technical working paper: Health impact assessment).

Approval conditions

Conditions of approval are a matter for the Department of Planning, Industry and Environment to consider during its assessment of the project.

The heath impact assessment prepared for the project has taken into consideration community receivers including schools as well as vulnerable members of the community including children; refer to Section 12.2.3 of the environmental impact statement. Reassessment of health impacts on children and schools is not warranted as they have been included.

Emissions from the ventilation outlets would result in small contributions to the local air quality for some residential, workplace and recreational receivers, and potential health impacts from the project are considered to be negligible to acceptable. The closure of the tunnel on days when Air Quality Index levels are very poor or hazardous is not practical nor required (and could actually cause higher levels of air pollutants (ie worse air quality) if vehicles are returned to travel on the surface roads). The diversion of traffic from the tunnels where the ventilation systems would facilitate effective atmospheric dispersion of the pollutants, reducing impacts at ground level, would force traffic onto the surface road network, with corresponding worsening of air quality in adjacent areas.

The response to incidents within the tunnel would be managed in accordance with the memorandum of understanding between Transport for NSW and the NSW Police Service, NSW Rural Fire Service, NSW Fire and Rescue and other emergency services. In these events, there may be broader communication to manage further congestion or to enable an emergency response.

As described in Section 5.2.11 of the environmental impact statement, continuous emission monitoring and ambient air quality monitoring would be carried out during operation of the project to monitor:

- In-tunnel air quality
- Air quality within ventilation outlets
- Ambient air quality at representative locations for a defined period of project operation.

Further detail is provided in Section 5.2.11 of the environmental impact statement.

### C13.3.2 Ventilation facilities

***Issue raised***

Submitters raised concerns that emissions from ventilation outlets would result in changes to air quality and affect the health and wellbeing of the community, and outlets should be filtered. Specific concerns and queries include:

- Potential for long term health issues for those living close to ventilation outlets, particularly people with pre-existing health problems
- Concern about health impacts on students from emissions where ventilation outlets are located close to educational establishments. Submitters request ventilation outlets to have filters installed or be moved away from educational establishments.

***Response***

The independent NSW Chief Scientist and Engineer has recently released a report in relation to road tunnel air quality. The report found that emissions from well-designed road tunnels cause a negligible change to surrounding air quality, and as such, there is little to no health benefit for surrounding communities in installing filtration and air-treatment systems in such tunnels. Further information is available at *www.chiefscientist.nsw.gov.au* and *nswroads.work/airquality*.

The project has been designed to minimise air emissions during operation. The air quality impact assessment demonstrates that the ventilation outlets would operate in a manner that would result in negligible to small contributions to the local air quality at sensitive receivers during expected traffic conditions.

Chapter 13 (Human health) of the environmental impact statement describes the impact of changes in air quality on community health including local residents and school children, and has considered health status of the existing population. The assessment concluded that potential community health impacts associated with changes in air quality within the local community are considered to be tolerable/acceptable.

The air quality assessment predicts air quality to be above criteria at some receivers when considering all sources of emissions and background air quality. However, in these instances, background air quality is close to or above the assessment criteria, irrespective of the project. The assessment demonstrates that the contributions from the ventilation outlets would be small compared to the contribution of emissions from traffic on surface roads and other background sources. Refer to Section C12.3.2 of this submissions report for more details.

Filtration systems or changes to outlet locations are not proposed for the project because the modelling carried out demonstrates that the contributions to air quality at ground level due to emissions from the ventilation outlets would be minimal as discussed above. The inclusion of tunnel filtration was evaluated and found not to provide any material benefit to air quality or community

health as discussed in Chapter 12 (Air quality) of the environmental impact statement. This is further discussed in Section B2.1 of this submissions report.

### C13.3.3 Road traffic noise and vibration

#### *Issue raised*

Submitters raised concerns that increased noise levels from additional road traffic after completion of the project would impact on the sleep of residents nearby. Sleep deprivation can have detrimental effects on health and wellbeing of nearby communities.

Submitters raised concern that the operational noise assessment criteria may not adequately protect the health of the children.

Concern was also raised over the potential for vibration to cause health issues.

#### *Response*

Road traffic noise impact on sleep

The project is predicted to reduce traffic noise for about 60 per cent of receiver buildings within noise catchment areas surrounding the project surface road works, as existing traffic on the surface road network is transferred into the tunnel (refer to Section 11.5.3 of the environmental impact statement). Forty-two per cent of receiver buildings are predicted to experience traffic noise level increases of less than 2 dB(A) which represents a minor impact likely to be barely perceptible. Only one per cent of receiver buildings are predicted to experience increases greater than 2 dB(A) due to the project.

Receivers exceeding the relevant traffic noise criteria would be considered for at-property treatment after low noise pavement (where appropriate) and new and existing extended noise barriers have been included.

In areas where there is a reduction in traffic noise, there would be associated health benefits in these communities (refer to Section 13.5.3 of the environmental impact statement).

Section 7.6 of Appendix I (Technical working paper: Health impact assessment) concluded that the number of properties where increases in noise at levels that may be of concern to health as a result of the project is minimal (three to six properties). Where noise mitigation measures proposed are implemented, no significant health impacts are expected for these properties. For the majority of the community road noise impacts would be reduced as a result of the project, resulting in some health benefits.

Operational noise assessment criteria and health of children

In NSW, contemporary environmental noise assessment criteria for addressing noise annoyance and sleep disturbance are specified by the NSW Environment Protection Authority. Potential road traffic noise impact is assessed in accordance with the *NSW Road Noise Policy* (Department of Climate Change and Water, 2011). For motorway and ventilation facilities that are permanently fixed, and associated noise emissions are long-term in nature, noise criteria have been adopted in accordance with the *Noise Policy for Industry* (Environment Protection Authority, 2017). The same criteria apply to children as well as adults.

According to the World Health Organisation's systematic review on environmental noise and the NSW Environment Protection Authority's *Road Noise Policy*, the results from sleep studies in children have suggested that children are less likely to be awakened by discrete noise events than adults.

In relation to health effects specific for children, the more recent review from the World Health Organisation (2018) reported that while there was limited data available, there was no statistically sound evidence that road traffic noise has any additional health impacts than for adults. The effects in adults are considered in the guidelines adopted, so these guidelines are also considered to be adequately protective of children.

Health issues from operational vibration

Section 11.6 of the environmental impact statement concluded that vibration impacts from traffic travelling on the tunnels and portals are considered negligible and are unlikely to result in ground-borne noise or tactile vibration impacts to sensitive receivers directly adjacent to tunnels and portals. This is because the tunnel road would be designed and constructed to avoid road irregularities. Health impacts from vibration during the operation of the project are not expected.

## C13.4 Other health impacts raised

### C13.4.1 Impact on mental health

***Issue raised***

Submitters raised concern over potential impacts of the project to mental health due to increased bus travel times, loss of visual amenity, temporary reduction in green space and additional pollution levels. Queries were raised as to what assumptions were made in determining the effect on physical and mental health of tunnel users and residents near the tunnel.

Submitters raised concerns that children and the elderly would be more heavily affected over the five to six year construction period, with particular concern raised about increasing existing anxiety due to recent bushfires, severe storm events and outages, and the COVID-19 pandemic.

***Response***

The potential for amenity impacts to the affected community is recognised and has been considered in the assessment of the various aspects of the project that could affect community amenity (for example noise, vibration, traffic disruption, air quality and visual amenity). Where potential amenity impacts have been identified, Transport for NSW proposes environmental management measures to minimise the impacts (refer to Table D2-1 of this submissions report). The implementation of these management measures would reduce the potential for mental health issues and increased anxiety in the affected community during construction.

Urbanisation, or increased urbanisation, regardless of specific projects has been found to affect levels of stress and mental health (Srivastava, 2009). These impacts are greater where there is urbanisation without improvements in infrastructure to increase equitable access to employment and social areas/communities (Srivastava, 2009), as noted in Appendix I (Technical working paper: Health impact assessment).

The role of either acute or long-term environmental stress on the health of any community, in general and for specific project(s) including the project, cannot be quantified. There are a wide range of complex factors that influence health and wellbeing, including mental health. It is not possible to determine any specific outcomes that may occur as a result of a specific project, or number of projects. However, it is noted that within any urban environment there would be a wide range of stressors present from infrastructure projects as well as other urban developments that may or may not contribute to the health effects outlined above.

Assumptions made in determining the physical and mental health impact to tunnel users and residents are in Appendix I (Technical working paper: Health impact assessment). Key assumptions included:

- All members of the population (residents, workers and recreational users) are exposed to air emissions all day, every day for a lifetime
- When assessing carcinogenic risks of exposure to diesel particulates the assessment has further considered that workers may be exposed to air emissions eight hours per day, 240 days per year for 30 years
- All $PM_{2.5}$ emissions predicted in the local community are derived from diesel vehicles and comprise diesel particulate matter

- Maximum predicted changes in air quality, regardless of where this may occur (eg industrial area, in a roadway, open space area or residential area) are assumed to affect a resident.

The project along with the other approved road tunnel projects aims to improve infrastructure, connections and access within the urban environment. Hence on a broader scale, such projects, while requiring long-term management to minimise construction impacts, may assist in reducing stress and associated physiological and mental health impacts within the urban environment.

The health impact assessment has considered the exposure risk for users of the project and broader motorway tunnel network. The cumulative assessment also considered frequent tunnel users such as taxi drivers, courier drivers and some truck drivers. Further detail is available in Section 6 of Appendix I (Technical working paper: Health impact assessment).

### C13.4.2 COVID-19

***Issue raised***

Submitters requested that no new projects commence which could increase air pollution or locate air pollution near residential areas until the COVID-19 disease and its effects on humans are fully studied and known, due to the risk posed to people affected by the virus.

***Response***

The COVID-19 pandemic is unprecedented and could not be foreseen in the programming of the project. New South Wales' pipeline of infrastructure projects have been identified as one of the key levers to drive economic growth following the COVID-19 pandemic. The project is part of this pipeline.

As demonstrated in the environmental impact statement, the project would result in no change or a small improvement to local air quality (ie reduced concentrations and fewer health impacts) for most of the community, 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.

### C13.4.3 Local food production

***Issue raised***

Submitters raised concerns that locally produced food (eg community and private owned veggie gardens or areas that support livestock, such as chickens) would be negatively affected by changes to air quality as a result of the project and potentially have a long term impact to human health.

***Response***

As stated above, potential changes in air quality due to changes in traffic volumes, distributions and conditions as a result of the project are predicted to be very minor and likely to have a negligible effect on locally produced food and livestock.

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C14 – Non-Aboriginal heritage

SEPTEMBER 2020

# C14 Non-Aboriginal Heritage

## Contents

## C14.1 General comments

***Issue raised***

Submitters raised the following general queries, concerns and comments about non-Aboriginal heritage:

- Alternatives should have been investigated further to avoid or minimise impacts on heritage items and areas, including:
  - Exploring options for traffic travelling from Drummoyne eastbound to enter the tunnel from Victoria Road, after the Iron Cove Bridge, without going down the hill to Lilyfield. This would help avoid impacts to historical buildings on Darling Street
  - Realigning the tunnel under Montague Street to enter the harbour at Birchgrove, avoiding heritage listed areas on the Balmain peninsula
  - Realigning the tunnel slightly to the left at Balls Head to avoid impact to green spaces
- Query as to how the Burra Charter was considered in the environmental impact statement
- Concern that the project would require years of work which would impact heritage sites and areas
- The environmental impact statement does not address how the project would impact many heritage buildings
- Submitters believe the project would have unacceptable and significant impacts upon numerous heritage items of State and local significance including items of maritime and convict heritage. The project would disturb the harbour sea floor significantly and submerged heritage items would be impacted.

***Response***

<u>Avoiding and minimising non-Aboriginal heritage impacts</u>

During design development, opportunities to avoid temporary and permanent impacts to heritage items have been considered alongside other design considerations including:

- Avoidance of direct impacts by design
- Reduction in the footprint or scale of project components
- Mitigation in the potential scale of impacts through the selection of construction methodologies.

A discussion of alternative locations and design options to reduce heritage impacts is given in Section 5.1, 5.2 and 5.4 of Appendix J (Technical working paper: Non-Aboriginal heritage) and Section 4.4 and 4.5 of the environmental impact statement. The project has avoided or minimised impacts to State and local heritage in the following ways:

- The majority of the project would be located underground and would avoid impacts through tunnelling
- Birchgrove Oval would not be used as a construction support site, but the use of Yurulbin Park, which is also a heritage item, is required. A tunnel construction support site was needed in Birchgrove close to the driven tunnel and immersed tube tunnel interface. Birchgrove Oval has been avoided due to its high community usage. Yurulbin Park would be reinstated following use, in consultation with the original landscape architect, Bruce McKenzie
- At Sydney Harbour, the mainline tunnel alignment and cofferdam structure at Balls Head have been located to avoid and minimise impacts to the Coal Loader Wharf

- Heritage buildings within Woodleys Shipyard would not be demolished but would be reused where suitable to support construction (eg site offices)
- The Warringah Freeway Upgrade component of the project has been designed to require only minor works within the Sydney Harbour Bridge curtilage
- The Warringah Freeway and Falcon Street interchange has been designed along the existing road alignment as much as possible to avoid and minimise impacts on the State heritage curtilage of St Leonards Park or the North Sydney Sewer Vent. Permanent infrastructure within St Leonards Park would be limited to kerb and footpath adjustments on Miller Street near the intersection with Falcon Street. Further review of the impacts in this area is currently being carried out and permanent impacts on St Leonards Park would be minimised or where possible eliminated. Areas temporarily disturbed during construction would be returned to open space use at the completion of construction
- At Cammeray, the construction and permanent footprint for the program of works has been designed to utilise as much as possible the existing Warringah Freeway corridor and to enable the remaining land to continue to function as a recreational area (golf course).
- Works within ANZAC Park have been designed as much as possible to minimise impacts to the potential heritage item. Permanent infrastructure at this location would be subsurface only.

Specific to the alternatives suggested in submissions:

- The Victoria Road construction support site (WHT2) would be required only during the construction period. The site was selected as it minimises acquisition of private properties (including those with potential heritage significance) in the Balmain and Rozelle area, including residential dwellings. The site also provides direct access to Victoria Road to avoid heavy vehicles on local roads. The project would connect to the Rozelle Interchange (part of WestConnex, which was subject to a separate approval), and connections to the surface road network have been determined as part of that design
- The tunnel alignment, including ventilation tunnels, has been informed by a number of factors, primarily the need to interface with the Rozelle Interchange as well as geology. The assessment of heritage items in the study area above the tunnel alignment concluded that the project would have no impact or a negligible impact. The ultimate alignment of the Western Harbour Tunnel would join with the now finalised M4-M5 Link design, and changes would be reflected in the project design (refer to Section 2.3 of the environmental impact statement for further detail)
- The project alignment does not directly impact green spaces at Balls Head. However, a construction support site (WHT7) would be required at Berrys Bay which would have direct and indirect impacts to heritage items. This site has been identified as a construction support site as it is NSW Government owned land, maximises opportunities for water-based transport, and would be returned to the community as public open space following completion of construction.

Impacts to heritage items

Of the 247 terrestrial heritage items identified within the study area, the majority have been assessed as having no impact or a negligible impact from the project due to either the low impact activities proposed or the distances between these items and the construction works (refer to Section 14.4.1 of the environmental impact statement). These types of impacts would be limited to ground movement, vibration and/or visual impacts, and would be managed through the implementation of environmental management measures as detailed in Table D2-1 of this submissions report. A further 12 maritime heritage items would not be impacted by the project (refer to Section 14.4.2 of the environmental impact statement).

However, as identified in the environmental impact assessment, the project would have varying degrees of impact on a limited number of terrestrial heritage items. These impacts are typically associated with key construction works or support activities occurring at or immediately adjacent to heritage items and which could not be relocated. Some of these activities would result in permanent or irreversible impacts to terrestrial heritage items. However, these would be limited to nine heritage items across the construction footprint. The project would require the demolition of a small number of buildings that form part of heritage conservation areas. Buildings to be demolished would include:

- The former Balmain Leagues Club (part of The Valley Heritage Conservation Area) which is technically outside the current curtilage of the conservation area as identified in the Leichhardt Local Environmental Plan 2013, but was previously included within the curtilage of the conservation area in the *Leichhardt Local Environmental Plan 2000*
- Three residential buildings (part of the Cammeray Conservation Area) of which only one is considered to have characteristics that contribute to the conservation area.

All of the buildings to be demolished are situated on the margins of their respective heritage conservation areas and would not equate to demolition of the entire heritage place or result in impact to the heritage significance of the areas. Direct impacts on the overall significance of the heritage conservation area due to the demolition of these buildings would be negligible to minor. A clarification is provided in Section A4.2 of this submissions report to clarify that no buildings would be demolished within the Holtermann Estate A Conservation Area.

Burra charter

The *Charter for Places of Cultural Significance* (Burra Charter) (Australia ICOMOS, 2013) is referenced in both Chapter 14 (Non-Aboriginal heritage) and Chapter 15 (Aboriginal heritage) of the environmental impact statement. The assessment of non-Aboriginal heritage, detailed in Appendix J (Technical working paper: Non-Aboriginal heritage) and Appendix K (Technical working paper: Maritime heritage), and assessment of Aboriginal cultural heritage (Appendix L: Technical working paper: Cultural heritage assessment) carried out for the project are based upon the four values of the Burra Charter, being:

- Social values
- Historical values
- Scientific values
- Aesthetic values.

For Non-Aboriginal heritage, this is also reflected in the use of the significance assessment criteria from the *Heritage Act 1977* (which are based on the Burra Charter values), and the NSW Heritage Office *Assessing Heritage Significance guidelines* (2001) and *Investigating Heritage Significance guidelines* (2004) (which are also based on the Burra Charter values and articles).

Environmental management measures to mitigate impacts on items of heritage significance have been developed taking into consideration the fundamental principles of the Burra Charter, which are detailed in the Charter's articles. For example, the impact assessment and management measures take into consideration the Burra Charter Conservation Principles (eg consideration of the importance of the setting of a place in assessing impact), Conservation Processes (eg managing change to heritage places to minimise impact on cultural significance), and Conservation Practice (eg providing written statements of cultural significance which provide the fundamental underpinning of management measures and decisions).

Maritime heritage

Impacts to potential non-Aboriginal heritage items on the bed of the harbour have been considered in Appendix K (Technical working paper: Maritime heritage). For maritime heritage, six heritage items would be potentially impacted, as well as areas of archaeological potential. These impacts would range from negligible to minor, and may result in partial loss of site integrity and reductions in

heritage values. Impacts to maritime heritage are considered to be not significant, and would be minimised and managed through the implementation of environmental management measures.

Environmental management measures

A suite of environmental management measures have been proposed to ensure that ongoing consideration would be given to further minimise the impacts to terrestrial and maritime heritage items of local and State significance. These include:

- Further design development in consultation with key stakeholders to avoid and minimise impacts on the Sydney Harbour Bridge due to tolling infrastructure (environmental management measure NAH1)
- All works potentially affecting the Sydney Harbour Bridge, including any operational noise mitigation measures, will be carried out in accordance with the *Sydney Harbour Bridge Conservation Management Plan 2007* (environmental management measure NAH1)
- Incorporation of heritage interpretation into the urban design of the project (environmental management measure NAH2)
- At-property noise treatments that are sympathetic to heritage values of any heritage item that is eligible for noise treatment (environmental management measure NAH4)
- Investigation and implementation of opportunities to temporarily remove, store and reinstate heritage elements of Yurulbin Park, if these elements require removal (environmental management measure NAH6)
- If at any time during construction of the project, historical heritage materials, features and/or deposits are encountered, the *Standard Management Procedure: Unexpected Heritage Items* (Roads and Maritime Services, 2015e) will be followed, which provides direction on when to stop work, where to seek technical advice and how to notify the regulator, if required (environmental management measure NAH10)
- Rehabilitation of the BP site at Berrys Bay to an equivalent state as soon as practicable, and investigation into adaptive reuse of the site for the wider community benefit (environmental management measure NAH13)
- Reinstatement of the North Sydney bus shelters where required following completion of construction (environmental management measure NAH14)
- Further consideration of construction footprints or support site layouts to minimise impacts to heritage items, or avoid key components of a heritage item, for example at St Leonards Park and Berrys Bay (environmental management measures SE1 and NAH15), or the provision of marine exclusion zones (environmental management measure NAH21)
- Adjustments to construction methodologies, based on building condition investigations and with involvement of a heritage specialist, where ground movement is predicted or where construction vibration exceeds the conservative screening criterion of 2.5 millimetres per second (environmental management measures CNV6 and SG1)
- Completion of archaeological investigations where impacts cannot be avoided as well as pre-dredge clearance (environmental management measures NAH3, NAH9, NAH17 and NAH18).

These measures would be supported further by preparation of a construction environmental management plan specific to heritage, as well as archival recordings completed in accordance with relevant guidelines (environmental management measures NAH5 and NAH18) and the completion of a thematic study of golf courses (environmental management measure NAH8). The full list of environmental management measures is in Table D2-1 of this submissions report.

Convict heritage item impacts

The BP site at Waverton (located within the Berrys Bay construction support site (WHT7)) contains a range of extant industrial relics which date from each phase of occupation, including features attributed to the occupation of the site by Wollstonecraft and Berry (including salvaged sandstone convict blocks). Further discussion of the BP site is included in Section B8.3.2 of this submissions report.

While some of these components would not be directly impacted, there remains the potential for impacts including to areas of archaeological potential (refer to Section 5.4.7 of Appendix J (Technical working paper: Non-Aboriginal heritage)). These impacts are likely to be minor, however the level of impact would be subject to the implementation of mitigation measures, the conditions of any archaeological remains, and the need for excavation in close proximity to those remains.

Implementation of the environmental management measures would involve protection of existing heritage components (stone cuttings, masonry walls), completion of archival recordings (environmental management measures NAH5 and NAH18) and salvage of any land-based or maritime archaeology (environmental management measure NAH9).

Opportunities to further minimise incremental impacts to heritage components, through careful initial worksite preparation and siting, or construction methods that could encourage sympathetic adaptive reuse would be explored during detailed design. This includes adjustments to the location of the new wharf structure or methodologies to avoid direct impacts to heritage components (environmental management measure NAH15). Further, reinstatement of the site would include investigation of the adaptive reuse of the site for the wider community (environmental management measure NAH13).

## C14.2 Impact to heritage listed private property

***Issue raised***

Submissions raise concerns regarding the proximity of heritage listed houses to construction sites and claims that these buildings would be impacted by construction. Queries, concerns and comments included:

- It is believed that older heritage listed houses are more susceptible to cracking due to settlement of the ground and that the impact assessed in the environmental impact statement is conservative at best
- Concern that many of the heritage buildings on the Balmain peninsula do not have sound footings, if any at all, and would be at high risk of damage from tunnelling
- Concern regarding impacts to sensitive heritage suburbs of Rozelle, Balmain and Birchgrove
- Concern over the visual impact and potential overshadowing the project may cause to the Whaling Road Heritage Precinct, North Sydney. The buildings along Kurraba Road, Darley and Bray Streets, Neutral Street and others in the area which are heritage listed would be impacted by the project and should be considered
- Preliminary and post-construction condition surveys should be conducted at heritage properties susceptible to construction activity including documentation and photographic/ video evidence.

***Response***

Settlement impacts to heritage listed properties

Settlement (or ground movement) impacts on heritage items has been considered in the heritage impact assessment presented in Chapter 14 (Non-Aboriginal heritage) of the environmental impact statement and the corresponding technical working paper Appendix J (Technical working paper:

Non-Aboriginal heritage). For the purposes of the heritage assessments, the study area in Appendix J considered all areas within 50 metres of the project construction footprint. Appendix J was informed by the ground movement assessment presented in Appendix N (Technical working paper: Groundwater).

As identified in Section 6.1.3.8 of Appendix N (Technical working paper: Groundwater), ground movement predicted at heritage items would vary according to their location relative to the project. As clarified in Section A4.2 of this submissions report, heritage items are generally in the risk category of 'slight' severity of impact, which would represent aesthetic impacts to the building that can be rectified (refer to Table 16-7 and 16-8 of the environmental impact statement).

As required by environmental management measure SG1 (refer to Table D2-1 of this submissions report), during detailed design, detailed predictive settlement models will be developed for areas of concern to guide tunnel design and construction methodology, including the selection of options to minimise settlement where required. Groundwater drawdown during construction will be further managed through environmental management measure SG14 which requires that feasible and reasonable measures are applied where groundwater inflows in the tunnel exceed one litre per second per kilometre (refer to Table D2-1 of this submissions report).

For all private properties at risk of settlement:

- An Independent Property Impact Assessment Panel, comprising geotechnical and engineering experts, will be established prior to the commencement of works to independently verify building condition survey reports, resolve any property damage disputes and establish ongoing settlement and vibration monitoring requirements. (refer to environmental management measure SG3 in Table D2-1 of this submissions report)
- Pre-construction building/structure condition surveys will be prepared for properties (and heritage assets) within the zone of influence of tunnel settlement (for example within the five millimetres predicted surface settlement contour and within 50 metres of surface works) and within the minimum working distances for cosmetic and structural damage due to vibration. Any damage caused by the project will be rectified (refer to environmental management measure SG4 in Table D2-1 of this submissions report).

Impacts to Rozelle, Balmain, Birchgrove

The potential impact of the project on heritage items, conservation areas and areas of archaeological potential within 50 metres of the project footprint including those above the tunnel alignment has been assessed in Appendix J (Technical working paper: Non-Aboriginal heritage). This includes a number of items in Rozelle, Balmain and Birchgrove. The assessment concluded that impacts to heritage properties within Rozelle, Balmain and Birchgrove would range from negligible to minor with the exception of Yurulbin Park, which was assessed as being subject to a major impact. Impacts on Yurulbin Park are discussed in more detail in Section C14.3 of this submissions report.

Impacts to Whaling Road Heritage Conservation Area and other heritage items in North Sydney

The study area for the heritage assessment included areas within 50 metres of the project construction footprint. The Whaling Road Conservation Area and a number of individually listed heritage items are located immediately adjacent to or within 50 metres of the construction footprint for the Warringah Freeway Upgrade component of the project, specifically, the new Alfred Street North overpass bridge. Potential impacts to the heritage conservation area and individual heritage items would include visual impacts.

The *North Sydney Local Environmental Plan 2013* and *Development* Control Plan 2013 identify the Whaling Road heritage conservation area as being of significance for the following reasons:

- As a largely intact late nineteenth and early 20th century subdivision retaining much of the urban detail and fabric in its gardens, fencing, street formations, use of sandstone and sandstone kerbing, with a strong relationship to the topography

- As a consistent and intact Victorian and Federation residential area consisting of modest housing on small lots
- For its unity derived from its subdivision history, which is still clearly seen in the development of the area
- For the integrity and quality of the majority of the buildings (*North Sydney Development Control Plan 2013*, Character Statements).

The proposed Alfred Street North overpass bridge and Western Harbour Tunnel project works are outside the heritage curtilage of the Whaling Road heritage conservation area. While the planning provisions in the *North Sydney Local Environment Plan* and *Develop Control Plan* do not apply to the project, the heritage provisions in the *North Sydney Development Control Plan* have been considered as a guideline to assessing impacts of development in the vicinity of heritage items. The guidelines discuss the importance of curtilage, setbacks, bulk, architectural scale and form, of maintaining streetscapes and public domain views, and retaining important landscape features that contribute to the item's setting.

The provisions of the *Development Control Plan* are aimed at the development of buildings within the Whaling Road heritage conservation area. In considering these provisions in the assessment of impacts on the Whaling Road heritage conservation area, the proposed overpass bridge is not of a similar bulk, mass, or scale to the contributory items in the heritage conservation area due to their very different natures (residential buildings vs transport infrastructure), while the provisions are aimed at the development of buildings within the heritage conservation area. Regardless, the overpass location would be immediately adjacent to the substantial retaining wall and formation of the existing Warringah Freeway. The overpass bridge would be no higher than the existing formation and would sit in front of it when viewed from the heritage conservation area. Views from the heritage conservation area to the overpass bridge would therefore be similar to the existing. Further, tree planting near the Kurraba Road/Alfred Street intersection, as illustrated in Figure 22-26 and Figure 22-27 of the environmental impact statement would potentially improve the view towards the current Warringah Freeway concrete wall. Any views from the public domain along the western edge of the heritage conservation area would be maintained and would not be obstructed. There would still be a full width roadway (as currently exists) between the overpass bridge and the edge of the heritage conservation area in the vicinity.

The height of the overpass bridge in comparison to the similar existing Warringah Freeway formation, and the north-south orientation of the overpass bridge, would suggest that there would be little difference between the current shadowing cast by the existing Freeway, and that from the overpass bridge, in terms of how far it would extend into the heritage conservation area.

The construction of the overpass bridge would not impact on the ability to understand the heritage significance of the Whaling Road heritage conservation area, and would not impact on the detail and fabric of the late 19th/early 20th Century subdivision, the consistent and intact modest Victorian and Federation housing on small lots, the unity of the development of the area, nor the integrity or quality of the buildings. As such, the visual impacts on the Whaling Road Heritage Conservation Area as a result of the overpass bridge would be considered low.

As specified in Appendix V (Technical working paper: Urban design. Landscape character and visual impact), the visual impact from Kurraba Road/Alfred Street North's residential area is Moderate/High as where visible the overpass presents a major new infrastructure element with nearby receivers. Screening vegetation and high quality urban design of the bridge would likely reduce the impact over time.

Existing residential blocks along Darley Street in close proximity to Alfred Street are orientated East away from the new Overpass, whilst blocks further along the street are orientated north-south. Only residential block on Darley Street faces the new overpass directly, however there will be little difference between the visual impact of the existing infrastructure and the overpass.

The visual impact from both Bray and Neutral street is limited due to the downhill position of receivers and existing residential block acting as screening elements to the overpass.

The construction of the overpass bridge would not impact on the ability to understand the heritage significance of the Whaling Road heritage conservation area, and would not impact on the detail and fabric of the late 19th/early 20th Century subdivision, the consistent and intact modest Victorian and Federation housing on small lots, the unity of the development of the area, nor the integrity or quality of the buildings. As such, the visual impacts on the Whaling Road Heritage Conservation Area as a result of the overpass bridge would be considered negligible.

Vibration impacts on heritage items

Vibration generating activities will be managed through the establishment of minimum buffer distances to achieve screening levels, as described in environmental management measure CNV6 (refer to Table D2-1 of this submissions report). Where vibration levels are predicted to exceed the screening levels, a more detailed assessment of the impacted structure and attended vibration monitoring will be carried out to ensure vibration levels remain below appropriate limits for that structure. For heritage items, the more detailed assessment will specifically consider the heritage values of the structure in consultation with a heritage specialist to ensure sensitive heritage fabric is adequately monitored and managed.

As described in environmental management measure NAH5 (refer to Table D2-1 of this submissions report), archival recording will be carried out in accordance with the *Photographic Recording of Heritage Items Using Film or Digital Capture* guideline for areas/items subject to change within the following terrestrial (privately) owned property items, in accordance with Appendix J (Technical working paper: Non-Aboriginal heritage):

- Item 2: The Valley Heritage Conservation Area, Rozelle and Balmain
- Item 15: Cammeray Conservation Area, Cammeray.

Archival recording will be completed prior to any works that have the potential to impact upon the items and deposited with appropriate stakeholders as determined during detailed design (for example, local councils).

## C14.3 Impact to heritage items and areas

***Issue raised***

Submitters raised concern that public heritage items and heritage listed parks would be affected by the project. Queries, concerns and comments include:

- Comment that the project has not considered impacts to the harbour foreshore
- Concern over the use of Yurulbin Park as a construction support site, the proposed removal of native trees and the impacts on community values associated with the changes to the park
- The cofferdam is too close to the edge of the Former Coal Loader facility and the environmental impact statement has not addressed the berthing dolphins that are offset from the face of the facility. These dolphins are considered part of the heritage fabric of the item. It is suggested to move the cofferdam around two metres to avoid any damage
- Concern regarding possible vibration damage from tunnelling on the Former Coal Loader facility at Waverton and that the use of vibration intensive equipment be limited in this area
- Concern over the potential impact on heritage listed Woodleys Shipyard and NSW Torpedo Corps remains, and that the environmental impact statement did not adequately describe these items or address the potential impacts. These items should be assessed and protected as part of early works

- The loss of green space at Cammeray Park and construction on Cammeray Golf Course would impact its significant historical importance
- Naremburn Central Township conservation area is identified as historically significant and should be protected during construction. The project route should be reconsidered to avoid the Naremburn Central Township conservation area.

***Response***

Harbour Foreshore

Section 14.4.2 of the environmental impact statement and Appendix K (Technical working paper: Maritime heritage) considers the impacts of the project on all items listed on heritage registers that are located at or near the foreshore of the study area. Of the 18 maritime heritage items identified within the study area, 12 would not be impacted by the project. Of the remaining six heritage items located on within the Sydney Harbour foreshore, impacts would range from negligible to minor.

Yurulbin Park

As detailed in Section 5.4.4.4 of Appendix J (Technical working paper: Non-Aboriginal heritage), the proposed works within Yurulbin Park would be of medium/large scale and moderate intensity, with some of the changes being permanent and irreversible. As such, the level of impact on the heritage item overall would be major.

Opportunities to minimise and manage impacts of the construction support site on elements that contribute to the heritage value of the park have been identified in consultation with the park's original landscape architect (Mr Bruce MacKenzie AM). This has resulted in:

- A design that minimises impacts to significant features and changes to the permanent landform at Yurulbin Park. Further detailed site planning would occur to avoid direct impacts to the slipway associated with the 1920s shipyard
- Exclusion zones to retain and protect certain mature trees during construction, and provision of replacement plantings on completion of construction
- 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 (environmental management measure NAH6)
- Reinstatement works following the completion of construction, which would be designed in consultation with Mr Bruce MacKenzie AM. 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 use-ability of the park.

While the park would be unavailable to the general public for around four years, the site would be reinstated in line with the vision provided by the original landscape architect (Mr Bruce MacKenzie AM) and made available again for public use. While permanent impacts would occur to areas of archaeological potential during site establishment, investigations would provide an opportunity to obtain information about the archaeology and history of the site that is not available from other sources (refer to environmental management measure NAH9 in Table D2-1 of this submissions report).

Former Coal Loader, Waverton

The project would have no direct impacts on the former coal loader at Waverton, as discussed in Table 14-3 of the environmental impact statement. However, potential direct and indirect impacts would result in an impact rating of minor on the heritage item following the implementation of the relevant environmental management measures.

As detailed in Section 5.4.5.2 of Appendix J (Technical working paper: Non-Aboriginal heritage), the cofferdam and supporting infrastructure has been positioned to avoid direct impacts on the lower walkway and dolphins of the heritage item.

Vibration due to construction activity immediately adjacent to, or below the heritage item is predicted to be above the screening criterion of 2.5 millimetres per second, which is a criterion applied to unsound structures. This exceedance requires that further assessment is completed during detailed construction planning, with consideration of alternative construction methodologies (including the selection of less vibration intensive equipment) and the heritage values of the structure, and monitoring to ensure vibration levels remain below appropriate limits for the structure (refer to environmental management measures NAH22, NAH23 and CNV6 in Table D2-1 of this submission report).

Ground movement due to tunnelling and groundwater drawdown in the vicinity of the Balls Head Coal Loader has been predicted to have a maximum settlement of 25 to 30 millimetres and is considered to be at a 'slight' risk of damage. To minimise impacts to the structural integrity of the heritage item, environmental management measures would be implemented, including design responses to minimise risks posed by ground movement (refer to Section B8.2 and environmental management measure SG4 in Table D2-1 of this submissions report).

Woodleys Shipyard, Waverton

Woodleys Shipyard is located within Berrys Bay construction support site (WHT7). The heritage item and impacts of the project are summarised in Table 14-3 of the environmental impact statement, and further described in:

- Sections 5.4.6 of Appendix J (Technical working paper: Non-Aboriginal heritage), with further supporting detail in Annexure A of that technical working paper (Section A6)
- Section 5 of Appendix K (Technical working paper: Maritime heritage).

The design of Berrys Bay construction support site (WHT7) has, where possible, maximised the retention and protection of significant heritage components of the heritage item. However, the project would have the following direct, potential direct and indirect impacts on the heritage item:

- Temporary direct impacts to existing structures within the heritage boundary due to the establishment and operation of the construction support site, including direct impacts to maritime heritage elements and areas of archaeological potential within the heritage boundary due to the construction of a temporary wharf. This includes the partial removal of a slipway, and the earlier remains of the NSW Torpedo Corps slipway
- Potential direct impacts associated with general construction activities within the heritage item's curtilage (eg anchoring, turbulence from operation of vessels)
- Indirect impacts due to temporary visual impacts, vibration impacts and settlement.

The proposed works would be of medium-large scale and of low intensity, with the majority of the areas being temporarily modified by the project. The implementation of environmental management measures would ensure that the overall impact rating for Woodleys Shipyard is minor. The environmental management measures include:

- Should heritage buildings be changed externally, such as by adding cladding or extensions, further assessment will be carried out to identify approaches to retain heritage fabric and/or minimise impact on heritage significance. This will include consideration of how works can be carried out to facilitate subsequent adaptive reuse or to minimise incremental impacts (environmental management measure NAH7 in Table D2-1 of this submissions report)
- Investigation into the relocation of the redesign of the temporary new wharf structure to avoid direct impacts to heritage components, such as the earlier remains of the NSW Torpedo Corps slipway structure and any archaeological remains from that period (environmental management measure NAH15 and NAH7 in Table D2-1 of this submissions

report). Where this impact cannot be avoided or minimised, measures will be implemented as detailed in the Maritime Heritage Management Plan and will include archaeological excavation and monitoring (environmental management measure NAH16 in Table D2-1 of this submissions report).

Cammeray Park (including golf course)

Cammeray Park is a locally listed heritage item, and encompasses the Cammeray Golf Course and surrounding open space uses bound by Cammeray Road, Park Avenue, Ernest Street and the Warringah Freeway. The item is of heritage significance due to its social value as general recreational facilities and open space, as well as its historical interest as a relatively intact early reservation to protect water supply.

The project has been designed to minimise the extent of temporary and permanent impacts to the golf course, and the Cammeray Golf Course would be retained in a modified form (such as changes to the length of some fairways). Transport for NSW will continue to collaboratively engage with the Cammeray Golf Club with a view to address the impacts of the project and maintain the long term viability of Cammeray Golf Course (environmental management measure LP7 in Table D2-1 of this submissions report).

The impacts to the heritage item would be of small-medium scale and of moderate intensity, with the changes to the heritage item being permanent and irreversible. The area of open space to be acquired at Cammeray Golf Course was conservatively presented as 25,000 square metres in the environmental impact statement, however this also includes area to be acquired for the Beaches Link project. Refined analysis shows the area of open space at Cammeray Golf Course that would be permanently required for the Western Harbour Tunnel and Warringah Freeway Upgrade project is actually about 15,000 square metres. Despite this acquisition, there would remain a large section of relatively intact open space that is representative of its heritage significance. With the implementation of environmental management measures, the level of impact on the heritage item would be moderate, and the main existing recreational uses of Cammeray Park (golf course, tennis courts, croquet club, soccer pitch, skateboard park) would not be affected. The environmental management measures are described in Table D2-1 of this submissions report and include an archival recording of the heritage item (environmental management measure NAH5) and a thematic heritage study of golf courses in Sydney for the region north of Sydney Harbour (environmental management measure NAH8). Environmental management measure SE1 requires that where reasonable and feasible the extent of permanent impact on Cammeray Golf Course will be minimised in further design development.

Naremburn Central Township conservation area

The assessment found that there would be no project impact to the Naremburn Central Township heritage conservation area, as detailed in Table 5-6 of Appendix J (Technical working paper: Non-Aboriginal heritage. The Naremburn Central Township conservation area is listed under the *Willoughby Local Environmental Plan 2012* and is located outside of the project footprint. A small portion of the Naremburn Central Township conservation area is located in the study area within 50 metres of the construction footprint and was assessed as part of Appendix J (Technical working paper: Non-Aboriginal heritage). Construction work in this area is limited to surface construction works associated within the Warringah Freeway including the construction of a communications cable within the freeway.

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Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C15 – Aboriginal cultural heritage

SEPTEMBER 2020

# C15 Aboriginal cultural heritage

## Contents

## C15.1 Impact on significant sites

***Issue raised***

Submitters expressed concern over the impact to significant Aboriginal heritage sites and areas. Specific queries, concerns and comments include:

- Concern that potential impact to Aboriginal heritage sites in the project footprint was not properly assessed
- Surveys were completed in 2017 and excluded heritage items on private properties. Submitters request that the survey should be updated to reflect the current status of heritage sites
- Concern that the proposed construction in Yurulbin Park would impact or damage Aboriginal heritage including middens and rock art
- Comment that Birchgrove wharf has irreplaceable sandstone formations and Aboriginal sites
- Concern that Aboriginal heritage sites would be impacted at Balls Head including rock engravings such as Whale Rock
- Comment that the environmental impact statement did not survey the submerged heritage sites in the harbour.

***Response***

Assessment process

The impact assessment for the project has been completed in accordance with *Procedure for Aboriginal and Cultural Heritage Consultation and Investigation* (PACHCI) (Roads and Maritime Services, 2011), which is consistent with and gives effect to the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010). The PACHCI outlines a four stage process for investigating potential impacts on Aboriginal cultural heritage, and includes consultation with Aboriginal people that hold cultural knowledge relevant to the study area at relevant stages of the PACHCI process.

As part of this assessment, a site survey was completed in consultation with a nominated representative of the Metropolitan Local Aboriginal Land Council (LALC). The areas inspected focused on areas where the assessment identified that there was the potential for harm to Aboriginal cultural values, but was limited to areas where access was permitted. As detailed in Section 6.1 of Appendix L (Technical working paper: Cultural heritage assessment report), the areas identified for inspection were identified through the use of a predictive model, based on a desktop assessment that considered previous archaeological research and investigations specific to the study area, searches of the Aboriginal Heritage Information Management System (AHIMS) database and a review of applicable Local Environmental Plans.

These areas of potential Aboriginal archaeological sensitivity and archaeological survey results are described in Section 15.3.5 of the environmental impact statement and included Yurulbin Park, Balls Head and surrounds, St Leonards Park North Sydney, ANZAC Park Cammeray and Cammeray Golf Course. Inspections of shorelines was also carried out to inform the assessment.

No previously unrecorded Aboriginal cultural heritage places, objects or areas of potential archaeological deposits were identified during the surveys.

Potential impacts to items of Aboriginal cultural heritage during construction of the project considered include:

- Direct impacts such as the removal or destruction of an Aboriginal site

- Indirect impacts associated with construction vibration generated by surface works in proximity to Aboriginal sites
- Indirect impacts associated with vibration and settlement from tunnelling works beneath or near to Aboriginal sites
- Indirect impacts associated with Aboriginal site setting (visual impacts, changes to vistas/ landscapes), dust, changes to ongoing use or environmental association.

The potential for these impacts to occur at known Aboriginal sites is summarised in Table 15-7 of the environmental impact statement. Based on the results of this assessment and in consultation with the Registered Aboriginal Parties:

- No verified Aboriginal heritage sites are located within the surface construction footprint of the project, and therefore no known sites would be directly impacted by the project
- One archaeological site (45-6-2180, Quarantine Cave: Waverton) is located within 50 metres of surface works and may be subject to indirect impacts associated with vibration and settlement
- One archaeological site (45-6-2181, Waverton Park Cave) is located directly above the tunnel alignment and may be subject to indirect impacts associated with vibration and settlement.

As stated above, the project would not have any direct impact on verified Aboriginal heritage sites. The potential for indirect impacts on known Aboriginal heritage sites have been identified, and mitigation measures would be implemented to manage this risk (refer to Table D2-1 of this submissions report).

The project's potential impacts on Aboriginal cultural heritage are discussed further in Chapter 15 (Aboriginal cultural heritage) of the environmental impact statement and in further detail in Appendix L (Technical working paper: Cultural heritage assessment report).

Additional inspections

Additional inspections (refer to Section A4.1.7 and Appendix A of this submissions report) were completed in February 2020 for the following previously known AHIMS sites that could not be inspected prior to the exhibition of the environmental impact statement due to private property access constraints:

- Shed Cave (45-6-2672): shelter with midden and art
- Yerroulbin Cave (45-6-2287): shelter with midden and art
- 5 Hands Shelter (45-6-2967): shelter with midden and art
- Long Nose Point (45-6-1901): shelter with midden and art.

Following the site inspection, only one of the four sites was determined to be within 50 metres of construction works, Shed Cave (AHIMS 45-6-2672).

Shed Cave is identified as being of high significance as the site has an intact midden deposit and is located within 50 metres of the tunnel alignment and surface works. There would be no direct impacts to the site, however it may be subject to potential indirect impacts associated with vibration and settlement.

Transport for NSW will consult with the landowners of the private property where the Shed Cave (45-6-2672) AHIMS site is located, in accordance with environmental management measure AH10 (refer to Table D2-1 of this submissions report). Subject to private landowner consent and access, vibration management measures AH2, AH3 and AH4 will apply to the site (refer to Table D2-1 of this submissions report).

Yurulbin Park

Yurulbin Park was surveyed as part of the assessment, as detailed in Table 15-5 of the environmental impact statement. Based on this survey, the park was identified as having a moderate Aboriginal archaeological sensitivity with significant Aboriginal cultural heritage sites located nearby. The closest site is located within 50 metres of Yurulbin Park (Shed Cave (45-6-2672)). However, there are no previously recorded Aboriginal heritage sites located within Yurulbin Park and no Aboriginal cultural heritage places, objects or areas of potential archaeological deposits in Yurulbin Park were identified during the surveys.

Birchgrove Ferry Wharf

There are no previously recorded Aboriginal heritage sites in the immediate vicinity of the Birchgrove Ferry Wharf. All known sites are located on adjoining private properties, with the closest site being within 50 metres of Birchgrove Ferry Wharf (Shed Cave (45-6-2672) (refer to Section A4.1.7 of this submissions report)). The shoreline of Yurulbin Point was also inspected by boat in February 2018 with a representative of the Metropolitan LALC, and no additional potential sites were identified. Potential submerged Aboriginal sites are discussed below.

Whale Rock, Waverton

Whale Rock is identified in Table 15-2 of the environmental impact statement as containing culturally important rock engravings and having high Aboriginal archaeological sensitivity. There would be no direct impact to Whale Rock as a result of the project. Table 15-7 of the environmental impact statement identifies the risk of potential indirect impacts (vibration and settlement) to Whale Rock as being negligible. Vibration impacts would be outside the minimum working distance for unsound structures and settlement is predicted to be less than 10 millimetres.

Environmental management measure AH2 (refer to Table D2-1 of this submissions report) sets out the process to confirm whether vibration monitoring at terrestrial AHIMS sites would be required and environmental management measures AH3 (refer to Table D2-1 of this submissions report) requires monitoring to be carried out at all sites that have been identified by the process required under AH2. Where possible, works will be conducted in a manner to minimise vibration levels to less than 2.5 millimetres per second at all structurally unsound sites. If vibration monitoring identifies that vibration levels exceed 2.5 millimetres per second at AHIMS sites that have been identified as requiring monitoring, environmental management measure AH4 (refer to Table D2-1 of this submissions report) commits to organising a site visit from a representative from Metropolitan LALC to record any changes to the integrity of the site that may have resulted from construction vibration.

Potential submerged Aboriginal sites

An assessment of potential submerged Aboriginal sites forms Annexure E of Appendix L (Technical working paper: Cultural heritage assessment report).

The potential submerged sites assessment considers the potential for presence of submerged landscapes with the higher potential for having Aboriginal sites based on modelling, geophysical data and the application of a predictive model. The extent to which sites may have survived inundation is also dependent on the length and intensity of exposure to water movement and wave action. Areas of particular sensitivity include former rock shelters near the shorelines and some submerged landforms.

As discussed in Section 15.4.2 of the environmental impact statement, should potential submerged sites be confirmed to be present and depending on the type of construction activity, the project would potentially have direct impacts of negligible to moderate significance (without mitigation).

A monitoring protocol has been developed to minimise the risk of inadvertent impacts to any surviving Aboriginal objects or sites. Environmental management measures AH7, AH8 and AH9 (refer to Table D2-1 of this submissions report) address potential submerged Aboriginal sites. Prior to the commencement of construction, further investigations would be required to confirm the

presence of these sites. If confirmed to be present, any resource collected would be considered to be very valuable in managing this resource.

## C15.2 Management of potential impacts during construction

***Issue raised***

Submitters raised the following queries, concerns and comments about the management of potential impacts to Aboriginal heritage during construction:

- Concerns about the treatment of any human remains that are discovered during excavation. While protocols for discovering unexpected heritage items are covered in the appendices, it is imperative that these are enforced
- Damage to sites should be minimised during construction and any new findings of cultural archaeological sites should be investigated in consultation with relevant experts, Aboriginal leaders and groups
- Suggestions that indigenous traditional management practices should be used for this project.

***Response***

Environmental management measures for Aboriginal cultural heritage

If any items of potential Aboriginal archaeological or cultural heritage conservation significance or human remains are discovered during construction of the project, they would be managed in accordance with the *Standard Management Procedure: Unexpected Heritage Items* (Roads and Maritime Services 2015e) (environmental management measure AH5 - Table D2-1 of this submissions report). This guideline is available in Annexure B of Appendix L (Technical working paper: Cultural heritage assessment report)).

The project would not have any direct impacts on verified Aboriginal heritage sites, as identified in Section 15.4.1 of the environmental impact statement. Further field investigations were completed following the completion of the report for sites that could not be accessed (refer to Appendix B of this submissions report). Potential vibration impacts to these sites would be managed in accordance environmental management measures CNV2, AH3 and AH4 as discussed in Section C15.1 above and as detailed in Table D2-1 of this submissions report.

Cultural and historic heritage awareness training will be carried out for personnel engaged in work that may impact heritage items before commencing works for the project in accordance with environmental management measure AH6 (refer to Table D2-1 of this submissions report).

Environmental management measures have been presented to relevant registered Aboriginal parties during the consultation periods and Aboriginal focus group meetings, and their comments have been considered and where possible incorporated into the recommendations.

Indigenous traditional management practices

Aboriginal stakeholder consultation was carried out in accordance with the PACHCI guideline and was used to inform the cultural values assessment, as detailed in Appendix L (Technical working paper: Cultural heritage assessment report). Section 5.2 of Appendix L states that the assessment involved consultation through several methods with knowledge holders as identified by the registered Aboriginal parties for the project. This included consultation with knowledge holders for the region during Aboriginal Focus Group meetings and consulting with Aboriginal site officers during fieldworks regarding Aboriginal objects and cultural values.

Knowledge holders have provided information about the traditional presence of Aboriginal people in the landscape, ceremonial sites and the impact of European land management practices on their traditional land, and subsequently their culture. No knowledge holders for the project were disclosed by the site officers or registered Aboriginal parties.

The application of traditional management practices to the project was not raised during consultation. The construction of the project is described in Chapter 6 (Construction work) of the environmental impact statement and is unlikely to be consistent with traditional management practices.

Consultation with the Metropolitan LALC would be ongoing throughout construction as described in Appendix E (Community consultation framework).

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# Western Harbour Tunnel and Warringah Freeway Upgrade

## C16 – Geology, soils and groundwater

SEPTEMBER 2020

# C16 Geology, soils and groundwater

## Contents

## C16.1 Geology

***Issue raised***

Submitters noted there are various geological investigations carried out for other tunnelling projects and queried whether such information was used in fault line and dyke mapping. Submitters also queried whether unknown fault lines and dykes encountered by the project would be a risk.

***Response***

Mapped and inferred dykes and faults along the project alignment are presented in Figure 5-4 of Appendix N (Technical working paper: Groundwater), based on information from project investigations and investigations completed as part of Sydney Metro Chatswood to Sydenham, North West Rail Link (now Sydney Metro North West) and WestConnex (in particular the M4-M5 Link) tunnelling projects.

The investigations indicate that there are dykes that cross the project alignment at Balls Head. Another dyke also runs parallel with the alignment at Yurulbin Park. Other known dykes are projected to intercept the alignment at Waverton and Rozelle. The investigations also revealed the Luna Park Fault Zone is of most relevance to the project. This fault comprises of up to three metres wide crushed zones with closely spaced jointing and faulting.

Although it is likely that dykes would be encountered by the project, it is unlikely the project alignment would encounter unidentified faults.

Encountering dykes and faults is not uncommon in large tunnelling projects. The construction tunnelling methodology would have measures in place to manage risk associated with elevated inflows, or a sudden in-rush potential where barriers to flow, and depressurisation, are penetrated.

## C16.2 Soils and erosion

***Issue raised***

Submitters raised concerns about soils and potential for erosion, in particular that soils could be washed into surrounding waterways.

Further information on the measures to be implemented to manage spoil to avoid adverse impacts to the environment was requested.

***Response***

Potential for erosion

The potential for erosion and sedimentation impacts during construction of the project is discussed in Section 16.4.1 of the environmental impact statement. It is acknowledged that there is the potential for exposed soils – and other unconsolidated materials, such as spoil, sand and other aggregates – to be transported from the construction footprint, including construction support sites, into surrounding waterways via stormwater runoff if appropriate mitigation measures are not put in place.

The highest potential for soil erosion would be associated with the disturbance of soils on existing slopes during construction, particularly at the Berrys Bay (WHT7), Arthur Street east (WFU4), Berry Street east (WFU5) and Ridge Street east (WFU6) construction support sites. The majority of construction support sites are not characterised by significant undulating topography and the soil erosion hazard is unlikely to be significant.

The management and control of erosion and sedimentation for major construction projects is well known, tried and proven. Standard management and mitigation measures in accordance with the principles and requirements in *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom, 2004) and *Volume 2D* (NSW Department of Environment and Climate Change, 2008),

commonly referred to as the 'Blue Book', and as required by environmental management measure SG5 (refer to Table D2-1 of this submissions report) are expected to be adequate in controlling any potential impacts.

Spoil management

Tunnel spoil would be handled within sheds located at Victoria Road (WHT2), Yurulbin Point (WHT4), Berrys Bay (WHT7) and Cammeray Golf Course (WHT10) construction support sites. Marine spoil would be handled at the White Bay (WHT3) construction support site. There would be also other smaller laydown areas within the Warringah Freeway Upgrade construction support sites used for surface road works spoil stockpile and handling. As prescribed by environmental management measure F5 (refer to Table D2-1 of this submissions report), spoil stockpiles will be located in areas which are not subject to frequent inundation by floodwater, ideally outside the 10% Annual Exceedance Probability (AEP) flood extent.

Further information on the measures to be implemented to manage spoil would be developed in the project construction environmental management plan.

## C16.3 Groundwater

### C16.3.1 Groundwater quality

***Issue raised***

Submitters raised concerns about the potential impact of the project on groundwater quality. Specific queries, comments and concerns include:

- Submitters queried what impacts to groundwater quality are anticipated and how these would affect nearby properties
- Concern over the risk to groundwater due to known contamination located along the project alignment and suspected at Cammeray Golf Course, combined with the local geology
- Submitters commented that stringent safeguards are required to prevent contaminated sediments leaching and contaminating soils/groundwater
- Submitters requested further information on the performance specifications for the wastewater treatment plants, which would treat groundwater prior to discharge
- Submitters queried whether contaminants within salt water can find their way into fresh water.

***Response***

Groundwater quality

The potential for contaminated groundwater to migrate from contaminated sites is discussed in Section 16.4.5 of the environmental impact statement. The groundwater model was used to assess the potential groundwater level drawdown at regulated/notified sites and areas of environmental interest, assessed to have a moderate or high risk of existing groundwater contamination within 500 metres of the project alignment.

The levels of drawdown at regulated/notified contaminated sites and areas of environmental interest during and following construction would be minor for all sites under consideration for the 'project only' scenario and would not be expected to cause significant migration of contaminants. Due to the small predicted drawdowns below these sites, contaminant migration into areas of good quality groundwater is unlikely to occur. Hence properties are unlikely to be affected by groundwater contamination.

The Cammeray Golf Course site was not identified as an area of environmental interest for contamination (Section 6.6 of Appendix N (Technical working paper: Contamination)).

Potential impact of the project on groundwater quality during construction and operation is presented in sections 16.4.6 and 16.5.3 of the environmental impact statement and Appendix N (Technical working paper: Groundwater).

Safeguards to prevent contamination

The groundwater monitoring will be in accordance with environmental management measures SG17, SG19, SG20, and SG21 (refer to Table D2-1 of this submissions report). The groundwater quality monitoring program will take into consideration the location of areas subject to medium and high risk of groundwater contamination during construction and operation. Further, additional investigations would be completed for areas of environmental interest in the construction footprint). Any areas of contamination would be managed in accordance with the requirements of guidance endorsed under section 105 of the *Contaminated Land Management Act 2008* (environmental management measure SG6 in Table D2-1 of this submissions report).

Wastewater treatment plant performance

The wastewater treatment plants used during construction and operation would be designed such that discharges would comply with the ANZG (2018) water quality guidelines. Refer to environmental management measures WQ3 and WQ9 (refer to Table D2-1 of this submissions report), and Chapter 17 (Hydrodynamics and water quality) of the environmental impact statement for further details.

Saltwater intrusion

Saltwater intrusion is discussed in Section 16.4.5 and Section 16.5.1 of the environmental impact statement. Groundwater quality impacts due to saltwater intrusion would be unlikely during construction of the project due to the low hydraulic conductivity of the Hawkesbury Sandstone formation and the naturally saline groundwater due to tidal mixing. Intrusion of saline water from the coast into fresher groundwater, and migration of already contaminated groundwater, would not impact the long term viability of dependent ecosystems or significant sites.

### C16.3.2 Groundwater drawdown

***Issue raised***

Submitters raised concern about the potential impacts of the project arising from groundwater drawdown. Specific queries, comments and concerns include:

- It is requested that any negative impacts associated with drawdown due to the project are mitigated
- The environmental impact statement does not consider the potential groundwater impacts to general vegetation of Rozelle and other areas, such as the trees in Easton Park and within peoples' backyards, including under drought conditions.

***Response***

Groundwater drawdown

The degree of groundwater drawdown would be dependent on a number of factors including the geology intersected, the hydrogeology and the tunnel configuration and depths.

The project would mitigate drawdown at existing registered groundwater bores that are potentially being used for water supply, as noted in environmental management measures SG2 (refer to Table D2-1 of this submissions report). The viability of these registered domestic bores will be confirmed prior to construction, and if viable monitoring would be carried out during and post construction to assess a water level response due to dewatering. Make good provisions will be implemented from any loss in yield from these bores.

Predicted groundwater drawdown as a result of the project is presented in sections 16.4.5 and 16.5.2 of the environmental impact statement and Appendix N (Technical working paper: Groundwater).

Groundwater drawdown has the potential to migrate contaminants within areas of environmental interest for contamination. However, Appendix N (Technical working paper: Groundwater) concluded such migration is unlikely to impact groundwater users, groundwater dependent ecosystems or baseflow dependent watercourses. Any migration of contaminants towards the tunnel would be managed by collecting tunnels inflows and treating them at the project construction and operation wastewater treatment plants as per environmental management measures WQ3 and WQ9 (refer to Table D2-1 of this submissions report).

Impacts of groundwater drawdown on vegetation

A search of the National Atlas of Groundwater Dependent Ecosystems (Bureau of Meteorology, 2017) did not identify any groundwater dependent ecosystems in the study area, as identified in Section 16.3.4 of the environmental impact statement.

There are no mapped groundwater dependant ecosystems in the predicted groundwater drawdown extents. Due to the depth to the groundwater table that would be impacted by the project, potential impacts on vegetation at Rozelle, Easton Park and within peoples' backyards are not considered likely as vegetation would be accessing groundwater in shallow aquifers not impacted by the project.

## C16.4 Settlement and subsidence

### *Issue raised*

Submitters raised concern about the potential for ground settlement and subsidence. Specific queries, comments and concerns include:

- Submitters request further information as to the length of time when their property would be at risk of subsidence
- Request for further information on the location where settlement and subsidence impacts may occur
- Submitters raised concerns over the level of potential subsidence (up to 30 millimetres) under North Sydney Council's Coal Loader Facility at Waverton
- Concern over the potential for settlement at Waverton Park and Woolcott Street due to the depth of the tunnel at these locations
- Submitters raised concerns that properties would be subject to settlement due to groundwater drawdown, particularly within the Waverton area and in Rozelle
- Further information on what measures are in place for homes and apartments that may be affected by settlement
- Concern that the criteria for assessing the severity of settlement does not reflect the impacts that would be experienced
- Concern that older houses within Rozelle, Balmain, Birchgrove and North Sydney are more susceptible to impacts from settlement
- Concern that experience with other tunnelling projects has shown that settlement may be larger than predicted by modelling.

### *Response*

Transport for NSW understand and acknowledge the concern about the potential for vibration and settlement from tunnelling to cause damage to homes. Building condition surveys will be prepared

for properties along the tunnel alignment in accordance with environmental management measures SG4 (refer to Table D2-1 of this submissions report).

In the unlikely event of property damage caused by construction, the damage would be rectified by the project at no cost to the property owner.

Ground movement

Ground movement may occur as a result of:

- Tunnel induced movement caused by the relief of stress from tunnelling through intact rock
- Settlement induced from groundwater drawdown.

Ground movement caused by excavation of rock for the tunnels would most likely occur during construction, whereas ground movement caused by groundwater drawdown would be gradual and generally occurs at a slower rate (possibly over years). The latter can sometimes also be difficult to distinguish from settlement due to changes in soil moisture that may be naturally occurring; or occurring due to another influence; or occurring as a result of seasonal variations which can cause swelling or shrinkage of the soil.

The risk to individual structures would be dependent on the localised geotechnical conditions, the depth of the tunnel, the number of storeys of the building, and the position, condition, and masonry of the structure itself.

The assessment of potential construction impacts due to ground movement is presented in Section 16.4.2 of the environmental impact statement.

Table 16-8 of the environmental impact statement outlines the maximum predicted surface settlement for various locations along the project alignment. Settlement contours for the project alignment are provided in Figure 16-7 and Figure 16-8 of the environmental impact statement.

As discussed in Section 16.4.2 of the environmental impact statement, all project components are expected to experience ground surface settlement impacts of over 10 millimetres. The tanked section (ie the areas that require control of higher levels of groundwater ingress) of the mainline tunnel alignment from Rozelle to the Western Harbour Tunnel crossing is predicted to experience a maximum of 55-60 millimetres long term settlement, and the Warringah Freeway portal is predicted to experience maximum long-term surface settlement of 50-55 millimetres. This long-term surface settlement would be considered to have a severity degree of ‘moderate’. All other project components are anticipated to be subject to total long-term settlement measurements of 40 millimetres or less, considered to be a ‘slight’ degree of severity under relevant guidelines. As shown in Figure 16-8 of the environmental impact statement, settlement in the vicinity of the Western Harbour Tunnel at Waverton is predicted to be approximately 35-40 millimetres which is considered to be a ‘slight’ degree of severity.

As outlined in Section 16.4.2 of the environmental impact statement, impact to residential buildings above or in the vicinity of the tunnels would be classified as:

- Negligible, comprising of hairline cracks less than 0.1 millimetres
- Very slight, where typical damage is generally restricted to internal wall finishes. Cracks (0.1 to one millimetres) may be visible on external brickwork or masonry
- Slight, where cracks are easily filled; redecoration probably required. Recurrent cracks can be masked by suitable linings. Cracks may be visible externally and some repointing may be required to ensure weather tightness. Doors and windows may stick slightly. Typical crack widths between one to five millimetres.

For specific areas or items identified in submissions:

- The (Balmain) Birchgrove Colliery (A9), including interiors, the predicted settlement would be between zero at the western side to 15 millimetres at the eastern side and closer to the tunnel alignment. This ranges from ‘very slight’ to ‘slight’. The overall level of impact on the

colliery assessed as negligible as detailed in Chapter 14 (Non-Aboriginal heritage) of the environmental impact statement and Appendix J (Technical working paper: Non-Aboriginal heritage)

- The Former coal loader, Waverton (I1040), the predicted settlement would be up to 30 millimetres which has the potential for 'slight' impacts due to ground movement. However, with the implementation of environmental management measures including measures to minimise settlement risks, the overall impact rating on the coal loader is assessed as minor (refer to Section C14.3 of this submissions report for a more detailed response to issues raised in relation to impacts to the Former coal loader)
- The predicted settlement is around 25 to 30 millimetres at Waverton Park and Woolcott Street. This would fall within the 'slight' damage category.

Settlement due to groundwater drawdown

The inflow of groundwater into the tunnels would result in depressurisation of the groundwater surrounding the tunnels, leading to some settlement. Another cause of settlement due to groundwater drawdown is where groundwater levels are within areas of fill, consolidation of the fill material may occur. Three areas of potential for fill settlement have been identified, however groundwater drawdown is not predicted to lead to significant settlement. They are:

- Birchgrove Park: identified as having five metres of fill material and groundwater depth of two metres
- Waverton Park: identified as having up to 16 metres of fill and groundwater is at a depth of 14 metres
- Cammeray Golf Course: identified as having fill of about four metres on the western side of the golf course and groundwater depth of four metres at this .

Building and structure condition

Section 16.4.2 of the environmental impact statement also provides an assessment of risk to buildings or assets within the area that could be impacted by ground movement induced by the project. The purpose of this risk assessment was to identify where and when more detailed assessments would be required. The assessment used a building settlement damage classification that describes typical impacts resulting from level of settlement.

Property damage from settlement (including that generated by groundwater drawdown) would be managed as per environmental management measures SG3 and SG4 (refer to Table D2-1 of this submissions report). Refer to Section C20.3 of this submissions report for matters related to rectification of damage to property caused by settlement.

Settlement larger than predicted

Ground movement predictions are initially based on detailed numerical modelling of ground behaviour, coupled with calibration against ground movement from previous projects so that the designers are able to predict with reasonable level of accuracy potential impacts as a result of tunnel excavation. Further, the modelling was conservative, with maximum settlement values presented. Any impacts to property as a result of ground movement would be managed in accordance with environmental management measures SG3 and SG4 (refer to Table D2-1 of this submissions report). As has been the case for other major infrastructure projects, this project would comply with any conditions of approval set by the Department of Planning, Industry and Environment with regards to ground movement impacts.

## C16.5 Marine contamination

### C16.5.1 Sediments unsuitable for offshore disposal

***Issue raised***

Submitters raised issues and concerns with the excavation and transport of dredged material that is unsuitable for offshore disposal and potential risks to the surrounding environment. Specific queries, comments and concerns include:

- Characterisation of contaminated sediments:
  - Contaminants of concern include polycyclic aromatic hydrocarbons (PAHs), total recoverable hydrocarbons (TRHs), organochlorine pesticides (OCPs), tributyltin (TBT), arsenic, copper, mercury, lead, silver, zinc, dioxins and per- and polyfluoroalkyl substances (PFAS)
  - Comment that the environmental impact statement did not provide characterisation of potential contaminants in Balls Head Bay or Berrys Bay, which may be disturbed during establishment of Berrys Bay construction support site (WHT7) and Sydney Harbour north cofferdam (WHT6)
  - Requested for further testing of the contaminated marine sediments be carried out prior to excavation
  - Request for information on the testing to be carried out to determine the suitability of sediments for disposal at sea
  - Request for a desktop study to assess whether bio-accumulative contaminants identified in sediments, such as dioxins, OCPs, mercury and PAHs, would allow offshore disposal of sediments from depths exceeding 1.5 metres, considered in the environmental impact statement to be uncontaminated
- Disturbance of contaminated materials:
  - Concern over dredging activities that may disturb contaminated sediments. Concern that disturbed sediments may cause a plume that would pollute the harbour and affect marine water quality and marine life
  - Concern that contaminated sediments in the western part of Berrys Bay construction support site (WHT7) would be disturbed by vessels travelling to and from the construction support site
  - Concern that contaminated sediments may be released into the Parramatta River, the Lane Cove River and across the harbour onto the northern shoreline of the harbour
- Concern that dredging of the sediment would disturb acid sulfate soils which would result in localised reductions in the pH of marine water and increase the bioavailability of contaminants
- Submitters queried what management measures would be put in place to minimise general public contact with contamination from exposed sediments
- Query over the volume of contaminated sediments stated in the environmental impact statement that would not be suitable for offshore disposal and understood there to be a discrepancy of the volumes and the source of the material.

***Response***

<u>Characterisation of contaminated sediments</u>

Characterisation of contamination within Sydney Harbour, including Balls Head Bay and Berry's Bay is provided in Section 16.3.5 of the environmental impact statement and Appendix M (Technical

working paper: contamination). In response to requests from the community, Transport for NSW has made the *Contamination Factual Report – Marine Investigations* Rev B (Douglas Partners and Golder Associates (DPGA), 2017) and *Contamination Factual Report – Marine Investigations* Rev C (DPGA, 2018) available on the project website *nswroads.work/whtbl*. Details of the methods of collection of data, analysis, sample size, contaminant concentrations and location and quality assurance/quality control documentation is provided in these documents.

Marine sediment samples were collected from a range of depths and analysed for a range of contaminant compounds including heavy metals, hydrocarbon compounds (TRH, BTEX and PAH), OCP, PCB, tributyltin (TBT) poly-fluoroalkyl substances (PFAS) and dioxins.

The nominated contamination guidelines (*International Standard for Quality Control, National Environmental Protection Measures Ecological Investigation Levels* and *National Assessment Guidelines for Dredging*) detailed in the Golder/Douglas (9 August 2018) *Contamination Factual Report – Marine Investigations* do not include criteria for per- and poly-fluoroalkyl substances (PFAS) and/or dioxins.

Since the completion of Appendix M (Technical working paper: Contamination), the NSW Environment Protection Authority have endorsed the Heads of the Environment Protection Authority Australia and New Zealand (January 2020) Per- and Poly-Fluoroalkyl Substances National Environmental Management Plan, Version 2.0 (PFAS NEMP). The PFAS NEMP details PFAS guidelines for different media with the exception of sediments. With the absence of endorsed PFAS sediment investigation criteria, the sediment results have been compared against the 'open space' human health criteria which represents the most likely exposure scenario as there would be minimal opportunity to access the sediments and it is not within a garden setting, and criteria for the protection of ecosystems in soils.

PFAS (Perfluorooctanoic acid – PFOA, Perfluorooctane sulfonic acid – PFOS, Perfluorohexane sulfonic acid – PFHxS and Perfluorobutanoic acid – PFBA) and dioxins were detected above laboratory levels of reporting in sediment samples collected for the Western Harbour Tunnel crossing, as part of the geotechnical investigations carried out for the project. All PFAS compounds detected above laboratory levels of reporting were below the human health criteria for open space and criteria for the protection of ecosystems in soils. PFAS and dioxin analysis was not carried out on Berrys Bay sediment samples. It should be noted that there would be no dredging carried out in the Berrys Bay (or White Bay) areas of the project.

Marine contamination risk is described in Section 16.4.4 of the environmental impact statement. Contamination has been reported in sediments present within Sydney Harbour and associated with inputs from the surrounding urbanised catchments, historical industrial operations, and the general maritime use within the harbour. The sediments pose a high contamination risk to construction given that contamination is known to be present within sediments which are likely to be excavated and exposed during construction of the Sydney Harbour south cofferdam (WHT5) and Sydney Harbour north cofferdam (WHT6) and dredging for the immersed tube tunnel.

Subsequent to the characterisation of contamination within Sydney Harbour provided in Section 16.3.5 of the environmental impact statement and Appendix M (Technical working paper: Contamination), Royal HaskoningDHV have been engaged by Transport for NSW to carry out additional sediment coring, sampling and testing at the harbour crossing to better understand the level and extent of contamination in sediments. Investigations have been carried out and are ongoing. The purpose of these investigations is to assess the suitability of dredged sediments for offshore disposal. Further information is included in the Royal HaskoningDHV memorandum in Appendix C.2 of this submissions report.

Disturbance of contaminated materials

Appendix P (Technical working paper: Hydrodynamics and dredge plum modelling) considered the behaviour of sediment-bound contaminants when resuspended into the water column to determine the potential for adverse environmental effects from dredging. Tests carried out for the nearby Sydney Metro City project (Geochemical Assessments, 2015) demonstrated that trace metals and

all organic contaminants are likely to remain bound to sediment particles and are not likely to dissociate and be released into the water column as dissolved phases. The small amount of contaminants released from dredging operations would be expected to re-bound to suspended sediments and resettle to the bed of the harbour. Annexure G of Appendix T (Technical working paper: Marine ecology) acknowledges that while concentrations of polychlorinated dibenzodioxins and polychlorinated dibenzofurans would exceed a safe sediment value, most contaminants are likely to remain bound to sediment during dredging and have limited potential for uptake by biota resulting in a moderate risk level.

Similarly, given most contaminants are likely to remain bound to sediment during dredging, mobilisation into the Parramatta River, the Lane Cove River or in Sydney harbour foreshore areas is unlikely. Further discussion on modelling the fate and transport of dissolved contaminants is provided in Section 2 of Appendix C.2 of this submissions report.

Relatively few vessel movements are expected to and from the Berrys Bay construction support site (WHT7), approximately 18 vessel movements per day. Vessels travelling to and from the construction support site are likely to lead to some mobilisation of bed sediments within shallower waters and formation of short lived localised plumes that disperse rapidly into the ambient waters. Vessel activities and the plumes generated are likely to lead to elevated total suspended solids concentrations over small areas and for periods less than 10 minutes. These small plumes are unlikely to lead to any measurable effects.

Disturbance of acid sulfate soils present in sediments

There is the possibility of potential acid sulfate soils (PASS) being present within marine sediments within Sydney Harbour and Berrys Bay. However, actual acid sulfate soils (ASS) can only occur if the sulfides in the sediments are exposed to air and oxidised. Where sediments remain underwater, there would be no chance of any PASS being oxidised.

Dredged material would be exposed to air once it is placed on the hopper barges. The time between excavation and acid generation depends on the texture, temperature, minerology and bacterial activity of the excavated material but it is very unlikely that oxidation would occur at this point as the material would remain wet in transit to the White Bay construction support site (WHT3). After berthing of the barges at White Bay, lime and/or an inorganic polymer would be mixed with the dredged material while in the barge, prior to unloading, for management of any acid sulfate soils and to make the material spadeable. Mixing would take place by means of an excavator located on the adjacent wharf. Material would then be appropriately disposed of at a licenced landfill.

Additional testing will be carried out where disturbance is required in high risk acid sulfate areas to determine the presence of acid sulfate soils, as required by environmental management measure SG12 (refer to Table D2-1 of this submissions report). This includes Sydney Harbour (tunnel crossing and Berrys Bay). If acid sulfate soils are encountered, transfer of dredge material and its disposal will be managed in accordance with the *Acid Sulfate Soil Manual* (Acid Sulfate Soil Management Advisory Committee, 1998b).

Public contact with contaminated marine sediments

The dredging methodology and proposed controls described below would minimise the risk of sediments, and contaminants within the sediments, being mobilised into the water during dredging. Once the proposed management measures are adopted it is expected that there would be negligible impacts to human health among swimmers, divers, rowers, sailors and other harbour users in the event that recreational exposures occur in areas surrounding the proposed works, as described in Section 13.4.3 of the environmental impact statement.

The dredging methodology for the project and process for transfer of dredged sediments to the White Bay construction support site (WHT3) is presented in Section 6.4 of the environmental impact statement and Section 7.2 of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling). Soft sediments not suitable for offshore disposal would be dredged using a backhoe dredge that is fixed to a pontoon or work barge with a closed environmental clamshell

bucket. The dredged material would be loaded into hopper barges positioned next to the dredge (with no overflow allowed), and transported to the White Bay (WHT3) construction support site. The methodology described has been developed to minimise potential environmental impacts and, while the methodology leads to lower production rates and hence longer construction timeframes, the loss of sediment into the water column would be significantly reduced.

Potential impacts on site workers and/or the local community through the disturbance of contaminated material including sediments would be managed by the implementation of environmental management measures SG10 and SG11 (refer to Table D2-1 of this submissions report). This would include the preparation of a construction waste management plan including procedures for handling and storing potentially contaminated substances along with the application of the unexpected contaminated lands discovery procedure, as outlined in the *Guideline for the Management of Contamination* (Roads and Maritime Services, 2013a).

Further information on management of dredging to occur as part of the project is outlined in a dredge management plan (refer to Section D1 of this submissions report) which would form part of the construction environmental management plan. The dredge management plan would describe the management of dredge operations including contamination management and contingency measures and the mitigation of impacts including the use of silt curtains and dredge plume monitoring requirements.

Volume of contaminated sediment

Chapter 24 (Resource use and waste management) of the environmental impact statement identifies that about 142,500 cubic metres of dredged material would be unsuitable for offshore disposal. The 142,500 cubic metres of material would be dredged from the footprint of the immersed tube tunnel and transported to White Bay construction support site (WHT3) for treatment so it is spadeable, prior to disposal to an appropriately licensed facility. There would be no dredging carried out in the White Bay area for the project. A clarification has been included in Section A4.2 of this submissions report with regards to the source of the dredged material not suitable for offshore disposal identified within the first row of Table 24-8 of the environmental impact statement.

As a result of the ongoing Royal HaskoningDHV investigations, the original anticipated quantity of 142,500 cubic metres identified in the environmental impact statement is subject to further work and is likely to be revised by the project. It is expected that the final quantity of dredged material not suitable for offshore disposal will be less than this originally anticipated number. This is further discussed in Appendix C.1 of this submission report.

### C16.5.2 Treatment and disposal of sediments unsuitable for offshore disposal

***Issue raised***

Submitters raised issues and concerns with the proposed treatment and disposal of dredged material that is unsuitable for offshore disposal due to the presence of contaminated sediments. Specific queries, comments and concerns include:

- Concerns that there is insufficient information on the management and methods proposed to treat the dredged material prior to disposal. Further details were requested on the following:
  - Methods for transport and transferring sediments and water from barges to the treatment area
  - Whether an adequate, secure space for dewatering and treatment of the large volumes of dredged materials at the White Bay construction support site (WHT3) would be provided
  - Methods for treatment of sediments and criteria agreed to by regulatory authorities
  - Handling and management of contaminated water from the treatment process, including identification of the discharge location

- How NSW EPA requirements for landfill disposal would be met for disposal of treated sediments, for example compliance with leachability limits
- Query as to the applicable guidelines for treatment and disposal of the dredged sediment at the White Bay construction support site (WHT3)

- Further details requested regarding the duration of activities at White Bay construction support site (WHT3). Concern that the three year operational time proposed for White Bay construction support site (WHT3) may be longer as the site may not be large enough to accommodate treatment of the dredged sediment, or may take longer to meet regulatory requirements.

***Response***

Sediment handling and treatment approach

The dredging methodology for the project and the process for the transfer of dredge sediments to the White Bay construction support site (WHT3) is described in Section C16.5.1 above. Further information on management of dredged material not suitable for offshore disposal would be included in a dredge management plan (for handling in transit to White Bay) and the construction waste management plan (detailing management at White Bay and landfill disposal requirement), which would form part of the construction environmental management plan (refer to Section D1 of this submissions report).

As identified in Section 2.2.1 of the environmental impact statement, the *Marine Pollution Act 2012* includes provisions to protect the sea and waters from pollution by oil and other noxious or harmful substances discharged from vessels. The use of barges and marine vessels in the construction of the project would comply with the requirements of this Act and the Marine Pollution Regulation 2014 to prevent marine pollution.

After berthing of the barges at White Bay, lime and/or an inorganic polymer would be mixed with the dredged material while in the barge, prior to unloading, for management of acid sulfate soils (if any) and to make the material spadeable. Mixing would take place by means of an excavator located on the adjacent wharf. The dredging process would not add any significant quantities of water to the material (being a mechanical process with closed environmental clamshell bucket) and the addition of lime and/or the inorganic polymer would significantly reduce moisture content. Accordingly, management of water/leachate in the dredged material at White Bay would be minimal or may not be required. Following the mixing process, material within the barges would be loaded either directly into trucks for transport to landfill or temporarily stockpiled on the wharf deck within a bunded area prior to loading into trucks for transport to landfill. The bunded area would incorporate a leachate collection and treatment system in the event of any leachate from the temporary stockpile. Further information is provided in Section 4 of Appendix C.2 of this submissions report.

Any required excess water would be managed in accordance with the relevant Environment Protection Licence for the project. Material would be appropriately classified, stored, handled and transported in accordance with the *NSW EPA Waste Classification Guidelines 2014* (NSW EPA, 2014) and in a manner than prevents pollution of the surrounding environment in accordance with environmental management measure WM4 (refer to Table D2-1 of this submissions report). As described in Section 24.3.3 of the environmental impact statement, contaminated spoil would be loaded into sealed and covered trucks for disposal at a suitably licenced landfill.

White Bay construction support site (WHT3) program

The site area of the White Bay construction support site (WHT3) is 112,000 metres squared and would consist of a combined land and water-based site, and would make use of the existing wharf areas to the north and south of White Bay as well as the berthing facilities. The site would be used for spoil handling, treatment and transport of dredged material not suitable for offshore disposal along with spoil handling and transport of excavated material from tunnelling at the Yurulbin Point (WHT4) and Berrys Bay (WHT7) construction support sites. The indicative layout of the site including the separate tunnel spoil and dredge material handling areas are shown on Figure 6-28 of

the environmental impact statement and is considered appropriate for the anticipated volumes of material to be handled at the site during construction. Further discussion around volumes in provided in Section C16.5.2 above.

Tunnel spoil handling would occur at the site for about three years between Q4 2021 and Q3 2024. Treatment of material not suitable for offshore disposal would also occur during this period but would not need be carried out for the full three year period. Transport for NSW is confident that the area allocation is appropriate and would facilitate meeting this schedule and that adequate allocation has been made to ensure regulatory requirements are met.

### C16.5.3 Monitoring of dredging

***Issue raised***

Submitters raised concerns about the proposed monitoring and mitigation measures in the environmental impact statement. Specific queries, comments and concerns include:

- Submitters requested monitoring of sediment plumes throughout the construction period
- Query regarding monitoring of the contaminants on the harbour bed would be conducted during and after the dredging process.

***Response***

Accurate dredging would be achieved by the real time monitoring and control systems and because the environmental clamshell closes horizontally to provide a level cut as opposed to a conventional semi-circular or arched cut, as described in Section B1.7.1 of this submissions report. In this way, relatively thin layers of contaminated material can be removed in a controlled manner. Ongoing monitoring of dredge plumes will be carried out in accordance with environmental management measure WQ6 (Refer to Table D2-1 of this submissions report) to validate the dredge plume dispersion predictions.

Additional measures to manage potential impacts from dredging operations are discussed in Section B1.7 of this submissions report.

## C16.6 Land contamination

### C16.6.1 Land contamination risk

***Issue raised***

Submitters raised issues over impact to the surrounding environment due to potential land contamination. Specific queries, comments and concerns include:

- Concern about the quantity and nature of contaminated material that may be disturbed during construction of the project, and in particular construction of the Warringah Freeway Upgrade component of the project, works at Cammeray Golf Course and Rosalind Street, and the potential impacts on the community
- Concern that the use of Merlin Street Reserve construction support site (WFU7) would present health and safety risk to surrounding residents due to possible contamination from heavy metals, hydrocarbons and asbestos
- Question regarding the potential for contaminants to be mobilised in air or water through the disturbance of contaminated soils, and other hazardous materials (such as asbestos fibres or organic matter) during demolition of buildings and other structures
- Concern that the use of Merlin Street Reserve (WFU7) which has possible contamination from heavy metals (lead) and hydrocarbons (PAH and asbestos) is an unacceptable risk for the health and safety of the surrounding residents

- Comment that the environmental impact statement did not address the impact of contamination from the former Waverton gasworks located adjacent to Balls Head Bay approximately 600 metres north of the Former coal loader at Waverton
- Concern that storage of dangerous goods at construction support sites would increase the risk of contamination to the environment
- Concerns about the potential for disturbance of acid sulfate soils and the risk to the environment (including leachate from acid sulfate soil material). Requested that if acid sulfate soils are encountered, they would be effectively managed in accordance with the *Acid Sulfate Soil Manual* (Acid Sulfate Soil Management Advisory Committee, 1998b)
- Concern that the excavation of soil/spoil at construction sites poses a risk of heavy metal contamination to Flat Rock Reserve, Flat Rock Creek and surrounding homes and sports fields.

***Response***

Management of disturbed materials

A Stage 1 contamination investigation was carried out for the project in accordance with the *Guidelines for Consultants Reporting on Contaminated Sites* (OEH, 2000) and *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (DUAP & NSW EPA, 1998). Most sites within and/or adjacent to the project area were identified as representing a low contamination risk. The assessment identified nine areas as having a moderate to high risk rating and are considered to be potential areas of environmental interest.

Potential contamination risks for the project, including Warringah Freeway, North Sydney to Cammeray area, are outlined in Table 16-9 of the environmental impact statement. The unsealed areas adjacent to the Warringah Freeway (including at St Leonards Park) represent a potential source of contamination (including potential heavy metals, hydrocarbons, pesticides, PCBs and asbestos contamination). This is due to the filling of unsealed areas of the site with materials of unknown quality during construction of the Warringah Freeway, in addition to current and historical deposition of particulates from large volume traffic flows using the Warringah Freeway. These areas pose a moderate to high contamination risk to construction given that contamination is known and potentially present within soil which is likely to be excavated and exposed during construction of surface works, the pedestrian bridge and several construction support sites (Ridge Street north (WHT9), Berry Street north (WHT8), Cammeray Golf Course (WHT10 and WFU8), High Street south (WFU2), Arthur street east (WFU4), Berry Street east (WFU5), Ridge Street east (WFU6), Merlin Street (WFU7) and Rosalind Street east (WFU9)).

Results from the Stage 1 contamination investigation is included in Appendix M (Technical working paper: Contamination) and summarised in Chapter 16 (Geology, soils and groundwater) of the environmental impact statement. Potential contamination impacts are discussed in Section 16.4.3 of the environmental impact statement.

Potentially contaminated areas directly affected by the project will be investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the *Contaminated Land Management Act 2008,* as required by environmental management measure SG6 (refer to Table D2-1 of this submissions report). Subject to the outcomes of the investigations, a Remediation Action Plan will be implemented in the event that site remediation is warranted prior to construction. The Remediation Action Plan will be prepared and implemented in accordance with *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and EPA, 1998). An independent NSW Environment Protection Authority Accredited site Auditor will be engaged where contamination is complex to review applicable contamination reports and evaluate the suitability of sites for a specified use as part of the project.

The discovery of previously unidentified contaminated material will be managed in accordance with an unexpected contaminated lands discovery procedure, as outlined in the *Guideline for the*

*Management of Contamination* (Roads and Maritime Services, 2013a) and as required by environmental management measure SG11 (refer to Table D2-1 of this submissions report).

During demolition of buildings and structures containing hazardous building materials, works would be managed to reduce the potential for contamination and ensure appropriate handling and waste disposal. In accordance with environmental management measure SG9 (refer to Table D2-1 of this submissions report) and Australian Standard (AS 2601-2001) *The demolition of structures*, a hazardous building materials audit would be carried out prior to the demolition of any structure and/or building. Demolition works will be carried out in accordance with the relevant Australian Standards and relevant NSW WorkCover Codes of Practice. Implementation of these measure would ensure risks to the community and workers are managed.

Waverton gasworks

Several sources were referenced, and investigations were carried out to determine the potential for land contamination within 500 metres of the project. The sources and investigations included:

- Historic and current aerial photographs
- NSW EPA Contaminated Sites Register and Record of Notices
- Yellow Pages business directory search
- Contaminated site investigations.

The former Waverton gasworks is located more than 500 metres from the project footprint, and as such was not included in the assessment.

A notice for maintaining remediation is currently regulated by the NSW Environment Protection Authority (notice 28011 issued on 26 August 1998). The notice information suggests contamination is land based and is unlikely to be a significant off-site migration issue.

Management of dangerous goods at construction support sites

Activities that have the potential to impact downstream water quality, if unmitigated, through spills of pollutants flowing to downstream watercourses include:

- Storage of chemicals
- Vehicle wash down areas
- Vehicle refuelling areas.

The anticipated types and quantities of dangerous goods and hazardous substances that would be stored and used within the project construction support sites are outlined in Table 23-2 of the environmental impact statement. Dangerous goods and hazardous substances will be stored in accordance with supplier's instructions and relevant legislation, Australian Standards and applicable guidelines, as outlined in environmental management measure HR1 (refer to Table D2-1 of this submissions report).

Potential impacts due to spills and leakages at construction support sites would be managed through the implementation of emergency spill procedures as required by environmental management measure WQ2 (refer to Table D2-1 of this submissions report) and the requirements of the relevant Environment Protection Licence.

Acid sulfate soils disturbance

The potential for acid sulfate soils is discussed in Section 16.4.1 of the environmental impact statement, including where acid sulfate soils risks have been mapped in the vicinity of the project. Further investigations into areas identified as high risk of acid sulphate soils would be carried out in accordance with environmental management measure SG12 (refer to Table D2-1 of this submissions report).

In accordance with environmental management measure SG12, if acid sulfate soils are encountered, they would be effectively managed in accordance with the *Acid Sulfate Soil Manual* (Acid Sulfate Soil Management Advisory Committee, 1998b). The manual includes procedures for the investigation, handling, treatment and management of such soils (refer to environmental management measure SG12).

Impacts to Flat Rock Creek

The project does not propose to excavate material at Flat Rock Reserve.

The project has one construction support site within the Flat Rock Creek catchment (Waltham Street construction support site (WHT11) in Artarmon). The Waltham Street construction support site (WHT11) would be used for the construction of the motorway control centre for the project, including equipment laydown, car parking for construction workers and temporary site office buildings, as described in Table 6-25 of the environmental impact statement. The current and historical use of the site and the adjoining properties may have caused localised contamination associated with the commercial/industrial uses of this area.

Further investigation of the site will be carried out in accordance with environmental management measure SG6 (refer to Table D2-1 of this submissions report) and actions identified to manage any contamination identified at the site to minimise the exposure risk to the environment and communities.

### C16.6.2 Request for further assessment

#### *Issue raised*

Submitters requested further information on the contamination investigations completed for the project or requested further assessments. Requests included:

- Request for further assessment of contamination within the construction footprint and preparation of a remediation action plan (RAP) in accordance with the guidelines under the *Contaminated Land Management Act 1997* and review by an approved site auditor
- Request that further geotechnical testing of underlying sub soil and rock stratum be carried out to determine the composition of rock and soil types likely to be present within excavation areas.

#### *Response*

Further assessment of contaminated land

The *Contaminated Land Management Act 1997* (NSW) outlines the circumstances in which the notification of the NSW Environment Protection Authority is required in relation to contamination of land. Environmental management measures SG6 (refer to Table D2-1 of this submissions report) requires that potentially contaminated areas directly affected by the project will be investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the *Contaminated Land Management Act 2008*.

Further site investigations (Stage 2 contamination investigation) are currently underway (as at August 2020), to be completed prior to construction. These site investigations are being carried out on sites with moderate to very high potential contamination risk in accordance with the environmental management measure SG6 (refer to Table D2-1 of this submissions report).

A NSW Environment Protection Authority accredited Site Auditor would be engaged for specific sites where contamination is highly complex, such as where there is significant groundwater contamination; contamination that requires specialised remediation techniques; or contamination that requires ongoing active management during and beyond construction.

Geotechnical investigations

While several geotechnical investigations which included testing for contaminants were carried out during the preparation of the environmental impact statement, a Stage 2 contamination investigation is currently in underway and would be completed prior to the commencement of construction.

Geotechnical testing of underlying sub soil and rock stratum would be carried out during design development to determine the composition of rock and soil types likely to be present within excavation areas.

## C16.7 Assessment approach

***Issue raised***

Submitters raised issues with the assessment approach in the environmental impact statement approach. Specific comments and concerns include:

- Comments that the environmental impact statement cites ANZECC (2000) *Interim Sediment Quality Guidelines* rather than the current guidelines, which are from 2013 (Simpson et al. 2013)
- Concern that Appendix M (Technical working paper: Contamination), Table 4-2 describes the contaminants listed as "potential".

***Response***

Section 4.4.2 of Appendix M (Technical working paper: Contamination) states that the results of the laboratory analysis of harbour sediments were compared against the guideline criteria established in the ANZECC (2000) *High and Low Interim Sediment Quality Guidelines* (ISQS), the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (as revised 2013) Ecological Investigation Levels (EIL) and the Commonwealth of Australia (2009) *National Assessment Guidelines for Dredging* (NAGD). Appendix M (Technical working paper: Contamination) includes a tabulation (refer to Annexure B of Appendix M) of sediment sample locations and whether concentrations of a range of contaminant compounds at locations exceed the criteria under these various guidelines.

The NSW Environment Protection Authority has recommended application of the Revision of the ANZECC/ARMCANZ *Sediment Quality Guidelines* (Simpson SL, Batley GB and Chariton AA (2013)). However it should be noted that the guideline values in the ANZECC/ARMCANZ *Sediment Quality Guidelines* (2013) are in fact identical to the guideline values in NAGD (2009), as noted in Part II Section 3.8 of ANZECC/ARMCANZ *Sediment Quality Guidelines* (2013). The ANZECC/ARMCANZ *Sediment Quality Guidelines* involve a tiered, decision-free approach, in keeping with the risk-based approach introduced in the ANZG water quality guidelines. Following this framework, the total concentrations of contaminants are compared to sediment quality guideline values (SQGVs) and if the contaminant concentrations exceed one or a number of the SQGVs, further investigation is initiated to determine whether there is indeed an environmental risk associated with the exceedance. As discussed in these guidelines, the SQGVs are not to be used on a pass/fail basis.

The objective of the contamination investigation was to identify potential areas of environmental interest which would assist in identifying construction limitations/constraints and management options for the project with respect to contamination. Potential contamination issues with respect to the project were identified based on a desktop review, site inspection of the project area and the results of contamination testing completed for the project. This is why the terminology “potential” was used to describe contamination sources and distribution within the technical working paper, including Table 4-2 of Appendix M (Technical working paper: Contamination).

Subsequent to the characterisation of contamination within Sydney Harbour provided in Section 16.3.5 of the environmental impact statement and Appendix M (Technical working paper:

Contamination), Royal HaskoningDHV have been engaged by Transport for NSW to carry out additional sediment coring, sampling and testing at the harbour crossing to better understand the level and extent of contamination in sediments. Investigations have been carried out and are ongoing. The purpose of these investigations is to assess the suitability of dredged sediments for offshore disposal. Further information is included in the Royal HaskoningDHV memorandum in Appendix C.2 of this submissions report.

NSW GOVERNMENT

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C17 – Hydrodynamics and water quality

SEPTEMBER 2020

# C17 Hydrodynamics and water quality

## Contents

## C17.1 Policy and guidelines

***Issue raised***

Submitters provided feedback and comment on the application of relevant policies and guidelines to the project. Specific issues, concerns and comments include:

- Submitters recommend that the where appropriate, that the *Water sensitive urban design guideline 2016* (Roads and Maritime Services, 2016) be recognised in the chapter as an appropriate benchmark to assist in guiding appropriate land use responses to stormwater considerations, especially with regard to water sensitive urban design considerations
- Submitters noted that both the Parramatta River Catchment Group and the Greater Sydney Harbour Coastal Management Plan focus on improving waterway health and the reduction of sediment laden stormwater runoff is critical to making Parramatta River swimmable again by 2025. The project should consider the focus and objectives of these programs in determining final environmental controls
- The project should consider the objectives of the *NSW Marine Estate Management Strategy 2018-2028*, including the key objectives to improve water quality and to deliver healthy coastal habitats. All current strategies and programs in both the Sydney Harbour and Parramatta River catchments are directed at improving water quality.

***Response***

Water sensitive urban design:

The *Water sensitive urban design guideline* (Roads and Maritime Services, 2016) was considered during the development of the project, as outlined in Section 2.1.2 of Appendix V (Technical working paper: Urban design, landscape character and visual impact). A new environmental management measure, WQ12 (refer to Table D2-1 of this submissions report), has been included to consider opportunities for Water Sensitive Urban Design during the development of the design for the stormwater management system for the new and upgraded road infrastructure, as well as the urban design and landscape plans. Water sensitive urban design will be implemented where feasible and reasonable. This will include the consideration of passive stormwater quality solutions, permeable pavements for paths or car parks, and opportunities for water re-use.

Water quality objectives

The project has been developed with consideration to the *NSW Water Quality and River Flow Objectives* (DECCW, 2006). The objectives are consistent with the *National Water Quality Management Strategy* (Australian Department of Agriculture and Water Resources, 2018) and *Guidelines for Managing Risks in Recreational Water* (NHMRC, 2008), as required by the Secretary's environmental assessment requirements The water quality objectives are the agreed environmental values and long-term goals for NSW surface water. This recognises the primary and secondary contact recreational objectives for the Parramatta River and Sydney Harbour catchments, including the long term objective to make more areas available for primary contact recreational activities.

The Parramatta River catchment extends from Blacktown in the west to the western side of the Birchgrove peninsula. The *Greater Sydney Harbour Coastal Management Plan Scoping Study* (BMT, 2018) has the stated vision to support the coordinated management and ecologically sustainable development of Greater Sydney Harbour to maintain its exceptional social, cultural, economic and environmental values, and symbolic status as Australia's most globally iconic waterway.

The project would not impact the ability to achieve the outcomes of the *Parramatta River Masterplan* or the vision of the *Greater Sydney Harbour Coastal Management Plan Scoping Study* as:

- Dredge plume modelling indicates that the dredging program would not have a significant impact on marine water quality. The 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 are not likely to result in significant water quality impacts. These elevated levels of suspended sediment would occur only in the dredging phase of the project (temporary) and would not influence achieving the long term aspirational goals for the Sydney Harbour and Parramatta River catchment
- Runoff from construction works would be managed in accordance with the principles outlined in the Blue Book as required by environmental management measure WQ1 (refer to Table D2-1 of this submission report)
- All construction and operational wastewater treatment plants would be designed to meet appropriate discharge criteria as per ANZG (2018) or as otherwise established under an Environment Protection Licence as per environmental management measures WQ3 and WQ9 (refer to Table D2-1 of this submissions report).

With the implementation of the construction methodology and management measures outlined in Section 17.6 of the environmental impact statement, and in the context of the overall catchment, any potential short-term or longer term impacts would be unlikely to affect the realisation of the above water quality goals for the Parramatta River catchment.

## C17.2 Hydrodynamics and marine water quality

### C17.2.1 Modelling of suspended sediments and marine water quality

***Issue raised***

Submitters raised issues over the modelling of suspended sediments and marine water quality, including the modelling of sediments unsuitable for offshore disposal. Specific queries, concerns and comments include:

- The dredging plume assessment does not include any background ambient suspended sediment concentrations
- Query on the extent of the plume modelling completed for the project and that all the bays that may be affected should be modelled, with the observation that:
  - Modelling only shows the area north of Sydney Harbour north cofferdam (WHT6)
  - Modelling does not account for the dispersion of sediments (particularly sediments not suitable for offshore disposal) around Yurulbin Point eastwards into Snails Bay and westward into the Parramatta River given the known strong tidal and wind currents in this area
- Submitters commented that suspended sediment is released into the bottom water layer for the trailer suction hopper dredge and cutter suction dredge for all soil types, however the backhoe dredge model releases sediment uniformly throughout the water column
- The assessment understates the impact of strong winds on activities, including the potential for malfunctions of equipment, accidental spillage of dredged sediments, or release of suspended sediments from within the shallow floating silt curtain. Strong southerly wind gusts exceeding 30 kilometres per hour occur regularly within Sydney Harbour and may result in suspended contaminated sediments being swept from the project site and may prevent dredging or barging operations
- The quantity of microplastics in the sediments has not been quantified or considered as at risk of resuspension during dredging activities

- There has been no quantification of pathogenic bacteria or resting dinoflagellate cysts (a major cause of red tides) in the sediments that might be released during dredging activities and pose a human health risk, or result in a harmful algal bloom.

***Response***

Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling) documents the assessment of hydrodynamics and the dredge plume modelling conducted for the project. The results of this modelling also informed Appendix Q (Technical working paper: Marine water quality), which in turn informed Appendix T (Technical working paper: Marine ecology).

Background turbidity

The assessment presented in Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling) considered the tidal dispersion of the suspended sediment that would be introduced into the water column by the dredging activities (ie the impact of the project).

Appendix Q (Technical working paper: Marine water quality) considers the natural variability in the concentration of total suspended solids (sediments) in the vicinity of the project and outlines modelling used to simulate the dispersal and deposition of sediments due to dredging.

The dredge plume model does not include any background ambient suspended solids concentration, as outlined in section 7.4.21 of Appendix Q (Technical working paper: Marine water quality). For the impacts of dredging to be considered alone and isolated from background levels, suspended solids concentration was considered more appropriate than total suspended solids for the modelling variables. It is possible to consider the total suspended sediment loads by adding background concentrations which would be variable depending on weather conditions, for example Sydney Harbour is characterised by elevated values during wet weather runoff events that decline to very low values during the subsequent dry period.

In Sydney Harbour, total suspended solids generally have a median of 3.1 milligrams per litre during extended dry periods and peaks to around eight to 40 milligrams per litre, depending upon the rainfall intensity producing catchment runoff. The marine ecosystems within Sydney Harbour are therefore adapted to this natural variability.

The dredge plume model predicts suspended sediment concentrations due to the project without direct reference to natural variability in the system. However, the potential impact to water quality of the additional suspended sediment concentrations generated by the project relative to natural ambient conditions is assessed in Appendix Q (Technical working paper: Marine water quality). That assessment determines whether the total suspended sediment concentrations (dredge generated, as determined by the plume model, plus ambient background) would be at levels likely to cause adverse impacts to ecosystems. Thresholds of total suspended sediment concentrations for various levels of impacts were determined from analysis of background concentrations, as measured through in situ loggers and considering other sources of data.

Modelling coverage

The extent and configuration of the hydrodynamic model used to assess potential plumes from dredging associated with the project is shown in Figure 4-1 of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling) and extends from Silverwater in the west to greater than five kilometres east of Sydney Heads. This model was refined to provide additional resolution in the vicinity of the harbour crossing. The model covers all the bays in the vicinity of the proposed dredging activities and uses information related to tidal currents and wind as inputs to dispersion calculations.

The model, therefore, estimates predicted dispersion of suspended sediment around Yurulbin Point eastwards into Snails Bay and westwards into the Parramatta River.

Sediment release assumptions

It is acknowledged that the different dredging methods and construction equipment release sediment at different depths in the water column. Accordingly, Section 7.2.2 of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling) notes that the depth layer at which material is released into the model is dependent on the type of dredge plant being used.

The model predictions, therefore, take into account the depths at which the sediment would be released based on the proposed dredging methodology.

Winds

The sensitivity of dredge plumes to winds is provided in Section 5.4 and Section 7.4.2 of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling). A hydrodynamic simulation was completed which included wind forcing based on measured wind at Fort Denison. The hydrodynamic simulation with both tide and wind forcing (tide plus wind) was then used to simulate the dredge plume suspended sediment concentrations for the first 16 weeks of the dredging activity. The results indicate that sensitivity to wind is limited to brief periods at selected locations in the off-channel embayments.

Intense winds are generally only short term, with the more relevant winds for effects on plumes being longer prevailing steady winds (as modelled), as discussed in Appendix C.1 of this submissions report. When winds become intense and exceed a threshold magnitude, activities such as dredging, barge transport and unloading would cease due to workability and safety or environmental risks, in accordance with the dredge management plan which would form part of the construction environmental management plan.

In addition, the dredge management plan prepared under the construction environmental management framework (refer to Section D1 of this submissions report) would consider potential incidents that could result in inadvertent releases of sediment, and would include appropriate contingency measures to address the causes and impacts of the incident. This would include temporarily ceasing the relevant activity as appropriate until the issues are addressed.

Microplastics

Microplastics have been found in the top sediments of many parts of Sydney Harbour and therefore may occur in approximately the top metre of the dredge profile. Below one metre, the sediment is generally free of any man-made contaminants as the material dates to the pre-industrial era. As is the case for sediment bound contaminants, there would be very little potential for microplastics to be resuspended and dispersed during dredging given the top layer of sediment would be dredged using a closed environmental clamshell bucket methodology. There would be very little leakage from the closed environmental clamshell bucket during transit of material from the seabed to the hopper barge.

It is possible that a small amount of material on the bed of the harbour would be resuspended in the process. As a result, floating silt curtains are proposed as a further safeguard against the majority of this resuspended material from being dispersed to other areas. An additional shallow silt curtain would also be installed adjacent to ecologically sensitive areas to provide additional protection. Although the very small amount of resuspended material that leaks from the closed environmental clamshell bucket on the dredge and through the floating silt curtains would potentially contain microplastics, the concentrations are expected to be negligible and not of a concern to the ecology of surrounding areas, the duration of resuspension was therefore not considered.

Release of pathogenic bacteria

It is acknowledged that there is a connection between the extent of pollution and the abundance and diversity of pathogenic organisms in marine sediments. Hence, it is possible that the top metre of the dredge profile, which is known to include contaminants, may harbor pathogenic organisms. As is the case for sediment bound contaminants, there would be very little potential for pathogenic

bacteria to be resuspended and dispersed during dredging given the top layer of sediment will be dredged using a closed environmental clamshell bucket.

As outlined above, there would be very little leakage from the closed environmental clamshell bucket during transit of material from the seabed to the hopper barge, but a small amount of seabed material may be resuspended in the process and floating silt curtains are therefore proposed to prevent the majority of this resuspended material from being dispersed to other areas. If a small amount of pathogenic bacteria or resting dinoflagellate cysts in the sediments (a major cause of red tides) was to be released during dredging of the top layer, it would be expected to be dispersed rapidly by tidal flushing so that they are not in harmful concentrations to humans or other biota in any part of the harbour. The dredging is to be done in the main channel of the harbour where tidal currents are strong and flushing occurs rapidly. The concentration of any resuspended bacteria was therefore not a key consideration.

### C17.2.2 Background data

***Issue raised***

Concerns were raised about the locations and timeframes of water quality monitoring to establish marine water quality, including:

- The time periods chosen to sample the water quality should be justified since the periods were short and only included one wet weather event, noting that the duration and volume of rainfall was not described
- It should be clarified if the measurements collected were spot samples or continuously logged to understand tidal change
- Submitters commented that water quality monitoring was carried out for eight weeks at eight locations, but there was no monitoring of any sites along the north/west shore of Birchgrove Peninsula where the Dawn Fraser Baths are located (refer to Figure 17-1 of the environmental impact statement).

***Response***

While useful to include wet weather events to understand natural variability in water quality (eg suspended solids and turbidity), it is more important to include dry weather water quality as this represents more typical ambient concentrations and when the potential for water quality impacts to occur due to dredging to be the greatest.

Water quality monitoring was carried out at locations in Sydney Harbour that could be potentially affected by dredging and construction activities. Monitoring activities involved:

- Four fixed water quality continuous loggers with a number of sensors to monitor turbidity, photosynthetically available radiation, chlorophyll-a, salinity, pressure and temperature (from 5 December 2017 to 31 January 2018). Sample frequencies are detailed in Table 2-2 of Appendix Q (Technical working paper: Marine water quality)
- Snap shot sampling and profiling carried out at eight sites over two days (18 and 31 January 2018) to monitor water quality parameters (turbidity, photosynthetically available radiation, conductivity, temperature, depth, fluorometric chlorophyll-a, pH and dissolved oxygen) through the water column from the water surface to the harbour bed. Water samples were also collected at a depth of 1.5 metres below the water surface at each site for laboratory testing of total suspended solids (turbidity) and chlorophyll-a concentrations.

The period of monitoring at each location reported was 76 days, as outlined in Annexure A of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling). Physical processes at the site are dominated by tide and therefore the desirable minimum duration for monitoring tidal behaviour is approximately 28 days corresponding to a lunar cycle. Hence the monitoring duration reported in Annexure A was almost three times this minimum period and data collected allowed suitable calibration of the hydrodynamic model.

The combined information sources (including historical data and long term simulations from the comprehensive Sydney Harbour Ecological Response Model) were used to develop an understanding of the spatial and temporal trends in marine water quality and the likely impacts of the planned dredging program. The combined data sets cover two annual cycles, a three year simulation period and the eight weeks of project data and includes significant rainfall events. Data incorporated time series measurements (typically less than 30 minute sampling frequency) from in-situ water quality sensors spanning at least one month deployments to capture tidal variability. Spot measurements were collected during dry and post rainfall events to assess variability associated with the catchment runoff and tidal flushing.

The monitoring locations as detailed in Appendix Q (Technical working paper: Marine water quality) were informed by preliminary results of the estimates of the dredge plume footprint to provide a representative dataset. The western shore of the Birchgrove Peninsula is located outside of the current harbour channel and as indicated in the technical working paper, sedimentation is unlikely to impact this area with the majority occurring north west from the project at roughly one millimetre per day and over a short period. A monitoring location on the western shore of Birchgrove Peninsula where the Dawn Fraser Baths are located was therefore not considered to be required for an understanding of the dynamics of the dredging plume.

As part of this submissions report, further information regarding predicted water quality as a result of dredging at specific locations such as Dawn Fraser Baths and North Sydney Pool has been provided by Royal HaskoningDHV in Appendix C.1 of this submissions report.

Data used to support the plume predictions are summarised in Section 2.3 in Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling), and further detailed in Annexure A of that technical working paper and Appendix Q (Technical working paper: Marine water quality).

### C17.2.3 General

***Issue raised***

Submitters raised general concerns relating to marine water quality, the disturbance of sediments in Sydney Harbour and the subsequent impacts to users of the harbour and the environment. Specific queries, concerns and comments include:

- A large number of submitters stated that protection of Sydney Harbour's water quality needs to be a top priority, with some submitters identifying that the health of the harbour has improved significantly in recent years and that this is at risk due to the project
- Concern that activities at the Berrys Bay construction support site, including construction of temporary wharfs, would disturb sediments and result in the suspension of sediments into the water column, and transport to other parts of Berrys Bay and to Sydney Harbour
- Concern that impacts to the water quality of Sydney Harbour would impact recreational activities and the liveability of harbour suburbs, particularly for users that are concerned about poor water quality. This includes concern around how people can safely swim with reference to the predicted dredge plume and current guidance to swimming activities in Sydney Harbour after rain events (Beachwatch)
- The environmental impact statement does not address how heavy rain events during the construction period would be managed given that construction support sites are located immediately adjacent to waterways
- Suggestion that the project is conditioned to release full details of the expected contamination, and means are found to keep harbour waters clean
- Objection to facilities at Snails Bay due to the activities required to establish or operate the facility.

***Response***

Responses to submissions relating to marine ecology impacts is considered in Section C19.3 of this submissions report.

The disturbance and mobilisation of bed sediments would occur only during the installation and removal of the coffer dams, during dredging and during the installation of the immersed tunnel tubes. Considering the temporary nature of these activities and the results of the dispersion modelling based on the proposed construction methodology, the project would have minimal influence on water quality in the Sydney Harbour and Parramatta River catchment or achieving the aspirational water quality objectives, including primary contact recreational activities, over the medium to long term.

Further discussion regarding the potential for the project to impact upon the focus or objectives of the Parramatta River Catchment Group and the Greater Sydney Harbour Coastal Management Plan to improve waterway health and make the Parramatta River swimmable again is provided in Section C17.1 above.

Berrys Bay construction support site and sediment disturbance

The majority of activities that would occur at the proposed Berrys Bay support site (WHT7) would occur on the land adjacent to the water and would therefore have minimal potential to disturb marine sediments. Construction activities associated with piling, construction of temporary wharf facilities and vessel movements at the Berrys Bay support site are likely to lead to mobilisation of bed sediments within shallower waters and the formation of short-lived localised plumes that disperse rapidly into the ambient waters. These activities and the plumes generated are likely to lead to elevated total suspended sediment concentrations over small areas and for periods less than 10 minutes. These small intermittent plumes are unlikely to lead to any significant or widespread impacts.

Relatively few vessel movements are expected to and from the Berrys Bay construction support site (WHT7), approximately 18 vessel movements per day and it is noted that the bay is already subject to boat movements hence the impact of these additional movements on sediments are unlikely to lead to any measurable effects, as discussed in Section C16.5.1 of this submissions report.

Stormwater runoff and water quality

All construction activities and support sites would be established and managed in accordance with the principles and guidance in the Blue Book to minimise onsite erosion and potential sedimentation in receiving water bodies down gradient from project locations, as required by environmental management measure WQ1 (refer to Table D2-1 of this submissions report).

Environmental management measure WQ1 also requires that a soil conservation specialist be engaged by both Transport for NSW and the contractor for the duration of construction of the project to provide advice regarding erosion and sediment control including review of Erosion and Sediment Control Plans.

Other matters

Transport for NSW has released the contamination factual reports for marine sediments which were completed in support for the environmental impact statement. These are available at *nswroads.work/whtbl*.

Specific conditions of approval relating to the release of environmental and construction documentation are a matter for the Department of Planning, Industry and Environment to consider in their assessment of the project.

It is noted that the temporary mooring facility would use existing infrastructure at Snails Bay.

## C17.3 Water quality – Freshwater

### *Issue raised*

Submitters raised concern over the impact of the project on the water quality of freshwater waterways. Specific issues, concerns and comments include:

- The project is considered to have a negative impact on water quality and waterways, or that impacts had not been adequately assessed
- Concern about the impacts to Willoughby Creek, Quarry Creek and Flat Rock Creek due to the discharge of wastewater from the Cammeray Golf Course construction support site (WHT10) and earthworks within these catchments, including the disturbance of contaminated soils, given these waterways already have poor water quality and contain sensitive fish habitats
- Concern that the mitigation measures proposed would not adequately mitigate the risk to water quality
- Concern that the communications cable to support the motorway control centre at Waltham Street, Artarmon would directly impact Flat Rock Creek and the water quality of this creek
- Due to the potential for spills, construction traffic should avoid the Flat Rock Catchment area
- The increase in impervious surfaces would result in an increase in stormwater runoff, increasing the risk of water quality impacts to receiving waterways.

### *Response*

<u>Water quality in construction</u>

Existing water quality conditions of Willoughby Creek, Quarry Creek and Flat Rock Creek are provided in Table 17-9 of the environmental impact statement. This identifies that these creeks generally have high levels of heavy metals, nutrient concentrations and pH with varied levels of dissolved oxygen and other contaminants including microbial contamination. Willoughby Creek has been highly modified and is not considered to be a sensitive receiving environment. Quarry Creek and Flat Rock Creek are considered to be sensitive receiving environments, primarily due to the presence of downstream Type 1 highly sensitive Key Fish Habitat values.

Section 17.4.3 of the environmental impact statement outlines the potential impacts to surface water quality and the associated risks to aquatic environments that could occur during construction, if unmitigated. This includes the wastewater treatment plant discharges from the Cammeray Golf Course construction support site (WHT10) and the mobilisation of soils offsite due to erosion and earthworks, including the potential for contaminated soils to be mobilised, if present.

Discharges from the Cammeray Golf Course wastewater treatment plant into Willoughby Creek via the local stormwater system would occur during construction. The reach of Willoughby Creek which is expected to receive project discharges comprises entrenched bedrock with limited potential for bank/bed erosion. The potential for alterations to waterway geomorphology within the reach and further downstream as a result of increased flows associated with project construction is considered to be low.

Environmental management measure WQ3 has been updated (refer to Table D2-1 of this submissions report) to include specific discharge criteria for wastewater treatment plants. Discharges will be required to meet relevant physical and chemical stressors set out in of the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000), the ANZG (2018) 90 per cent species protection levels for toxicants generally, and the draft ANZG default guideline values for iron (in fresh and marine water) and zinc (in marine water) which are likely to be finalised in October 2020. With the implementation of WQ3 potential impacts on the water quality of Willoughby Creek and ultimately Middle Harbour due to these discharges would be minimal and readily manageable.

The majority of construction works are not located within or in close proximity to freshwater waterways, and the areas are already highly modified urban environments. The risks to water quality would be readily managed through standard mitigation and management measures, such as erosion and sediment controls developed in accordance with the principles and guidance in the Blue Book, and other measures routinely implemented on Transport for NSW projects.

Soil and water management measures would be documented in the construction environmental management plan (refer to Section D1 of this submissions report) and would be supported by a monitoring program as per environmental management measure WQ4 (refer to Table D2-1 of this submissions report). Environmental management measures would include:

- WQ1 – Erosion and sediment measures would be implemented in accordance with relevant guidelines, procedures and specifications, such as *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom, 2004) and *Managing Urban Stormwater: Volume 2D Main Road Construction* (NSW Department of Environment and Climate Change, 2008). A soil conservation specialist would also be engaged, to provide advice regarding erosion and sediment control including review of Erosion and Sediment Control Plans
- WQ3 (revised) – Discharge criteria from wastewater treatment plants during the construction phase
- SG6 – Further investigations to confirm the presence of contaminated soils, and implementation of any additional actions to address contamination, if present
- SG11 – An unexpected finds procedure in the event unexpected contamination is discovered during construction
- WQ2 and SG23 – Emergency spill measures to avoid and manage accidental spillages of fuels, chemicals, and fluids to minimise the risk to human health and the environment.

With the implementation of these measures, any pollutant loading to receiving waterways due to construction of the project would be considered to be low compared to the existing pollutant loading, and therefore likely to have a negligible influence on existing water quality.

The preferred construction method for the communications cable to the motorway control centre in Artarmon would be through the use of existing conduits within the Warringah and Gore Hill Freeway corridors. This would not directly impact Flat Rock Creek. Where the use of existing conduits is not feasible, trenching within the road corridor may be required but would not be to a depth that would result in direct impacts, noting Flat Rock Creek passes under the Gore Hill Freeway within a concrete channel. Trenching, if required, would be managed through standard mitigation measures as detailed earlier in this section.

Construction heavy vehicle routes were selected to minimise heavy vehicles on local roads. The majority of construction works are outside the Flat Rock Creek catchment. Key roads used by construction vehicles within the Flat Rock Creek catchment would primarily consist of major arterial roads and freeways, such as the Warringah Freeway and Gore Hill Freeway. The use of these major roads by construction vehicles does not significantly increase the risk to the water quality of the catchment when compared to the types of vehicles that currently use these roads. Potential impacts associated with a construction support site at Flat Rock Reserve is a matter for the future Beaches Link and Gore Hill Freeway Connection project and environmental impact assessment.

Water quality in operation

The project would result in marginal increases in pavement surfaces exposed to direct rainfall, with most additional pavement being within tunnels and not contributing to increases in stormwater runoff. The project would integrate with surface road and drainage upgrades completed by the M4-M5 Link project along the City West Link. For areas north of the harbour, there would be with localised changes in road catchment areas within the Warringah Freeway area (ranging from a decrease of six per cent to an increase of 2.3 per cent). However, this would unlikely change the pollutant loading from the surface road network when compared to the existing arrangement.

Treatment of these discharges has not been proposed for a number of reasons, including the marginal change in impervious surfaces, the complexity of the drainage network and the difficulty in maintaining any devices. Warringah Freeway discharges would continue to be managed with end-of-line solutions as part of the *Sydney Harbour Catchment Management Authority strategy* (refer to Section 6.2.1 of Appendix O (Technical working paper: Surface water quality and hydrology).

Embankments and operational areas of project that are required for operational infrastructure (eg car parking or buildings) would be landscaped to minimise impervious surfaces.

The permanent wastewater treatment plant at Rozelle would treat wastewater generated from tunnel groundwater ingress and rainfall runoff in tunnel portals. Discharges from the Rozelle operational wastewater treatment plant would be designed to meet specific discharge criteria as per ANZG (2018) 95 per cent species protection levels; ANZG (2018) 99 per cent protection levels for contaminants that bioaccumulate and the NHMRC (2008b) recreational guidelines water quality criteria for iron (environmental management measure WQ9 of Table D2-1 of this submissions report).

With the proposed treatment and management measures, residual impacts on ambient water quality are expected to be negligible. For at least one year after project opening, freshwater waterways would be monitored to confirm the performance of the project (including stabilisation of disturbed areas) and to identify if any additional measures are required (environmental management measure WQ4 of Table D2-1 of this submissions report).

In accordance with environmental management measure WQ10 (refer to Table D2-1 of this submissions report), the capacity for the local stormwater system to receive operational wastewater treatment plant inflows will be confirmed during further design development. In the event that there is a stormwater infrastructure capacity issue with existing infrastructure, mitigation measures such as storage detention to control water outflow during wet weather events will be implemented at the Rozelle Rail Yards.

The overall impacts on ambient water quality are likely to be negligible and the project is considered to have a negligible influence on the goals to achieve the water quality objectives for NSW waterways.

## C17.4 Monitoring, management and compliance

***Issue raised***

Submitters provided feedback and comments on the monitoring, management and compliance of the project with respect to water quality. Specific issues, concerns and comments include:

- Request that water quality data collected for assessment and monitoring for the project be provided for use in the Greater Sydney Harbour Coastal Management Program
- Comment that there do not seem to be any contingency measures for extreme weather events, or in the event of equipment failure or accidental spills. This included concern that the construction methodology for the harbour crossing did not include contingencies for equipment malfunctions, accidental spillage of dredged material or the effectiveness of silt curtains during strong winds
- Submitters requested that local councils with local government areas along the harbour foreshore should be immediately alerted where water quality targets are exceeded to enable any required responses, including notification to the local community of any risks posed to recreational activities
- Concern over how compliance with the mitigation measures for managing water quality outlined in the environmental impact statement would be monitored, as the measures rely on the performance of the contractor

- Concern around the accountability in the event construction works result in unacceptable impacts
- Submitters queried if the proponent intends to discharge any polluted water into the environment and how this would be controlled, noting an Environment Protection Licence would need to cover any discharge point(s). The public need to be given the opportunity to comment on any Environment Protection Licence sought by Transport for NSW or its contractor(s) prior to that licence being issued, given the environmental impact statement does not provide this detail.

***Response***

Monitoring

Transport for NSW will consult with the owners of the Greater Sydney Harbour Coastal Management Program to ascertain whether the data collected as part of the project is useful for the program.

Contingency measures

The project's construction environmental management plan (refer to Section D1 of this submissions report) would detail measures to minimise the risk of incidents occurring during construction, including modified responses to construction methodologies and activities to reflect weather conditions.

An incident and emergency response plan would be prepared by the contractor that would cover matters such as unauthorised discharges and spills. Further, as detailed in Section C17.3 above, emergency spill procedures would be implemented to avoid and manage accidental spillages of fuels, chemicals, and fluids to minimise the risk to human health and the environment (refer to environmental management measures WQ2 and SG23 in Table D2-1 of this submissions report).

The dredging management plan would be prepared in accordance with the construction environmental management framework presented in Section D1 of this submissions report. The plan would consider potential incidents that could result in inadvertent releases of sediment, and would include appropriate contingency measures to address the causes and impacts of the incident. This would include temporarily ceasing the relevant activity as appropriate until the issues are addressed.

If an environmental incident does occur, the contractor would be required to follow the *Environmental Incident Classification and Reporting Procedure* (Roads and Maritime Services, 2018), as well as meet the obligations of any conditions of approval, the conditions of any applicable Environment Protection Licence and the *Protection of the Environment Operations Act 1997*. Incident notification, including to local councils and the community, would occur as required.

Compliance

If approved, contractor would be responsible for the implementation of the conditions of approval, overseen by the proponent (Transport for NSW). Typical conditions of approval include all the environmental management commitments in the environmental documentation submitted in support of the State significant infrastructure application, including this submissions report, as compliance requirements.

As detailed in Section D1 of this submissions report, the environmental management measures related to construction will be included in a construction environmental management plan. The plan will provide a framework for establishing how these measures would be implemented, who would be responsible for their implementation, and monitoring the performance of these measures.

Transport for NSW will ensure the compliance with environmental management measures and conditions of approval is monitored through the implementation of a compliance tracking program through independent environmental auditing. The Department of Planning, Industry and Environment compliance team carry out inspections to ensure projects approved by the Minister (or

his delegate) meet approval requirements and would investigate potential breaches and carry out enforcement where necessary. Enforcement can range from negotiating practical solutions to issuing penalty notices and, in serious cases, criminal prosecutions.

Environment Protection Licence

The application process for obtaining an Environment Protection Licence is managed by the NSW Environment Protection Authority. Community engagement during the preparation of Environment Protection Licence is a matter for the NSW Environment Protection Authority.

## C17.5 Stormwater storage dam at Cammeray Golf Course

***Issue raised***

Submitters provided a large number of comments in relation to the direct impact of the project on the stormwater storage dam at Cammeray Golf Course, and its replacement. Specific issues, concerns and comments include:

- Objection to the loss of the dam at Cammeray Golf Course, particularly given the recent extreme drought and climate change and the use of the dam to nearby parks and sporting fields. Submitters state that a permanent replacement to the storage dam should be provided prior to construction and at no cost to North Sydney Council
- An interim solution is required if a permanent solution cannot be provided given construction would be underway for around five years
- Queried how the new location would be selected.

***Response***

Subject to a timely agreement with Cammeray Golf Club and North Sydney Council regarding a suitable alternate location, Transport for NSW will install a new permanent replacement storage dam (and associated infrastructure) within the golf course prior to decommissioning of the existing dam to maintain ongoing operational functionality of the water harvesting scheme, as discussed in Section B14.16.2 of this submissions report.

If a suitable location cannot be agreed prior to the commencement of construction, Transport for NSW will come to an interim arrangement with Cammeray Golf Course and North Sydney Council regarding compensation for additional water usage, for the period until the replacement dam is operational.

NSW GOVERNMENT

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C18 – Flooding

SEPTEMBER 2020

# C18 Flooding

## Contents

# C18.1 Flooding impacts

## C18.1.1 Flooding impacts during construction

### *Issue raised*

Submitters raised concerns about the potential risk of flooding due to construction works that would impact drainage infrastructure, and the requirement for interim arrangements while new and existing surface water drainage are established and upgraded. Specific areas of concern for submitters included:

- Run off and debris from the Whaling Road and High Street North parks currently results in the local stormwater system becoming blocked and causes water to flow into the Little Alfred Street Tennis Courts parking area, which may be exacerbated by construction of the project
- Risk of stormwater run-off during rain events from the Cammeray Golf Course construction support site (WFU8 and WHT10) and that flooding may be exacerbated on Warringa Road by unmanaged dirt or debris leaving the site creating blockages in existing drainage networks
- Concern that the project would increase stormwater run-off on Kurraba Road. Submitters have requested appropriate stormwater and sediment controls to be implemented and no net increase in stormwater run-off down Kurraba Road due to the project during construction.

### *Response*

Construction impacts on flood behaviour

To ensure that construction of the project avoids or minimises the risk of adverse impacts from infrastructure flooding, flooding hazards, or dam failure, the project has been developed such that:

- Construction would be carried out in a manner that minimises the potential for adverse flooding impacts, through staging of works and the implementation of environmental management measures
- Construction support sites and construction sites would be laid out such that flows are not significantly impeded.

Section 18.5 of the environmental impact statement provides an assessment of potential impacts of construction activities on flood behaviour.

Section 6.5.4 of the environmental impact statement describes the methodology for installation of stormwater drainage. Detailed construction planning will consider flood risk at construction sites and during construction activities, including installation of new, or replacement of existing, drainage infrastructure. This will be carried out in accordance with environmental management measure F8 (see Table D2-1 of this submissions report), including:

- A review of site layout and staging of construction activities to avoid or minimise obstruction of overland flow paths and limit the extent of flow diversion required
- Identification of measures to not worsen flood impacts on the community and on other property and infrastructure during construction up to and including the 1% Annual Exceedance Probability (AEP) flood event where reasonable and feasible
- Measures to mitigate alterations to local runoff conditions due to construction activities
- Measures to mitigate flooding during construction are to be incorporated into the construction environmental management plan for the project.

In addition to these measures, environmental management measure SG5 (refer to Table D2-1 of this submissions report) requires erosion and sediment control measures to be implemented at all work sites in accordance with the principles and requirements in *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom, 2004) and *Managing Urban Stormwater: Volume 2D Main Road Construction* (NSW Department of Environment and Climate Change, 2008). The implementation of these measures would minimise the potential impacts to flooding behaviour during construction. Erosion and sediment control plans would aim to stage construction works to confine land disturbance areas and pass 'clean' water through the site without mixing it with 'dirty' sediment-contaminated runoff from the works. These measures would minimise the offsite migration of materials, limiting the potential for downstream blockages that result in in flooding.

All spoil stockpiles will be located in areas not subject to frequent flood inundation, ideally outside the 10% AEP flood extent, in accordance with environmental management measure F5 (see Table D2-1 of this submissions report). This would minimise potential stormwater and sediment runoff impacts in areas adjacent to construction sites and construction support sites.

Flood impacts at Cammeray Golf Course

Section 18.5.1 of the environmental impact statement outlines the potential impacts of construction activities on flood behaviour and identifies that the greatest potential for adverse impacts on flood behaviour in adjacent development is associated with the Cammeray Golf Course construction support sites (WFU8 and WHT10).

Appropriate connections to existing trunk drainage systems would need to be incorporated into the design of the project and the Cammeray Golf Course construction support site (WFU8), to avoid flooding impacts at nearby residential developments. As identified in environmental management measure F8 (refer to Table D2-1 of this submissions report) and outlined above, further investigation would be carried out during further design development.

Flood impacts to Kurraba Road

No impacts to Kurraba Road or surrounding locations were identified in this assessment (refer to Appendix R (Technical working paper: Flooding)).

Further flood investigations would be carried out during detailed design. Should impacts be identified at Kurraba Road, additional measures would be developed to mitigate the impacts of construction activities on flood behaviour and existing stormwater capacity, as noted in environmental management measure F8 (refer to Table D2-1 of this submissions report).

## C18.2 Operational flooding impacts

### *Issue raised*

Submitters raised concerns about the operation of the project causing impacts to flood behaviour and exacerbating areas already known to experience flooding, including:

- Localised flooding in North Sydney, such as the large storm event that occurred on 8 February 2020. Flooding on Kurraba Road was raised as a specific example
- Localised flooding at the carpark for the Little Alfred Street tennis courts in North Sydney.

### *Response*

The project would generally result in a neutral or beneficial effect on flood behaviour external to the road corridor for storm events up to 1% AEP in intensity, as identified in Section 18.6 of the environmental impact statement. The assessment concludes that if the flood environmental management measures as set out in Section 18.8 of the environmental impact statement (updated in Table D2-1 of this submissions report), are incorporated into the design of the project, then operation of the project would not increase the flood hazard in existing development for all events up to the probable maximum flood (PMF) event. Table 28-4 of the environmental impact statement identifies the desired performance outcomes for flooding are:

- The project minimises adverse impacts on existing flooding characteristics
- Construction and operation of the project avoids or minimises the risk of, and adverse impacts from, infrastructure flooding, flooding hazards and dam failure.

To achieve these outcomes, the project has been designed to maintain or reduce flood levels within and adjacent to the project footprint. Changes to flooding within the North Sydney local government area due to operation of the project in the 1% AEP event are shown in Figure 18-12 and Figure 18-13 of the environmental impact statement. These figures show that within North Sydney, in most areas the project would not result in a change to the depth of flooding outside the project footprint during the 1% AEP event. Figure 18-12 shows that the change to flood levels in the car parking area at the Alfred Street Tennis courts is expected to be negligible when compared to existing conditions.

In the 1% AEP event, the eastern most extent of Kurraba Road would be above the 1% AEP event level due to improvements made by the project (Figure 18-13 of the environmental impact statement). The remaining areas of Kurraba Road would experience negligible change in flood levels compared to existing conditions.

Where flood levels in the 1% AEP event are predicted to increase at any residential, commercial and/or industrial buildings as a result of operation of the project, a floor level survey will be carried out, in accordance with environmental management measure F1 (refer to Table D2-1 of this submissions report). If the survey indicates existing buildings would experience above floor inundation during a 1% AEP event as a result of the project, further refinements will be made (as required) to the design of permanent project components to minimise the potential for impacts.

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C19 – Biodiversity

SEPTEMBER 2020

# C19 Biodiversity

## Contents

# C19.1 Terrestrial flora and fauna

## C19.1.1 Threatened and protected species - Flora

### *Issue raised*

Submissions raised concerns about the impact of the project on threatened flora species. Comments include:

- Concerns about the number of threatened flora species that would be impacted by the project, and that several threatened flora species are located within the construction footprint
- The impacts to Rose Avenue Reserve which has endangered and protected Wallangarra White Gum trees (*Eucalyptus scoparia*), which provide valued amenity to the local community.

### *Response*

The construction footprint is located within a highly urbanised area which has a long history of modification and disturbance, and almost all vegetation in the footprint has been planted as part of landscaping of roadside or parkland areas. Threatened flora habitat values in the construction footprint are very low, and for most local threatened flora species there is no suitable habitat present.

The biodiversity assessment indicates that the project would not result in significant impacts to threatened flora species. As discussed in Section 19.3.1 of the environmental impact statement, four threatened flora species were identified within or adjacent to the construction footprint (refer to figures 19-6 to 19-10 of the environmental impact statement). Three of these species (*Eucalyptus nicholii, Eucalyptus scoparia, Syzygium paniculatum*) are assumed to have been planted as they are well outside their known geographic range and/or known natural habitat, and are commonly planted landscape species in the Sydney region. A single individual of the native species Sunshine Wattle (*Acacia terminalis subsp. terminalis*) was identified within the construction footprint of the project and was considered as possible natural regrowth. As shown in Table 19.5.1 of the environmental impact statement, two species credits would be required for this individual as part of the biodiversity offsets for the project, under the NSW Biodiversity Offsets Scheme.

Trees in Rose Avenue Reserve, on the corner of Rose Avenue and Alfred Street North, North Sydney would be retained, as shown in Figure A-19 of Appendix W (Technical working paper: Arboricultural impact assessment). Field surveys carried out for the biodiversity assessment and arboricultural impact assessment did not identify the presence of Wallangarra White Gum (*Eucalyptus scoparia)* individuals in Rose Avenue Reserve. Sydney Blue Gum (*Eucalyptus saligna*) was the only tree species recorded at this location, although other tree species may be present in the north of the reserve.

While the biodiversity assessment indicates that the project would not result in significant impacts to threatened flora species, the project is committed to minimising the removal of vegetation, and opportunities to further minimise impacts will be explored where feasible and reasonable, as required by environmental management measure B1 (refer to Table D2-1 of this submissions report). Environmental management measure B12 (refer to Table D2-1 of this submissions report) requires pre-clearing surveys to be carried out in accordance with *Guide 1: Preclearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011). This guide requires the use of qualified ecologists to conduct flora searches as part of the pre-clearing process. Further, the unexpected species find procedure included in the guide will be followed if threatened ecological communities, flora, or fauna species not assessed in the biodiversity assessment, are identified in the construction footprint, as required by environmental management measure B3 (refer to Table D2-1 of this submissions report).

### C19.1.2 Threatened and protected species – Fauna

***Issue raised – Impacts to threatened fauna habitat***

Concern that the project would impact foraging habitat as well as known roosting sites of threatened species.

***Response***

Most of the vegetation to be removed for the project is highly modified and would be located within the Warringah Freeway corridor and the Cammeray Golf Course construction support sites (WHT10 and WFU8), as outlined in Section 19.4.2 of the environmental impact statement, Additionally, a small area of vegetation would be removed from the Yurulbin Point construction support site (WHT4).

Impacts would be negligible since the habitat to be removed does not comprise a significant proportion of habitat available to species in the locality or wider bioregion. Further to this, the limited extent of vegetated fauna habitat within the construction footprint occurs as small, isolated patches that do not maintain habitat connectivity with any large areas of native vegetation in the wider locality. Much of the vegetation which would be removed is currently subject to regular and on-going disturbance and maintenance (ie pruning and mowing).

Direct impacts to man-made structures and the built environment would be limited to some structures at Yurulbin Park and Berrys Bay, which offer limited and marginal potential roosting habitat for some bat species including the Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*), Little Bentwing-Bat (*Miniopterus australis*), and Southern Myotis *(Myotis macropus*) (refer to Section 19.4.2 of the environmental impact statement). Impacts to these structures would be unlikely to adversely impact these species. Refer to discussion below regarding the Large Bent-winged Bat and other threatened bat species for more details.

Environmental management measures would be implemented to further minimise any impacts to vegetation and other habitat features for threatened fauna species (refer to environmental management measures in Table D2-1 of this submissions report). This includes:

- B1 – The clearing of native vegetation and fauna habitat will be further minimised where feasible and reasonable
- B2 and B4 – The removal and re-establishment of vegetation will be carried out in accordance with *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011)
- B5 and B12 – Pre-clearing surveys for threatened species, including microbat roosts for structures that will be demolished at Yurulbin Point (WHT4) and Berrys Bay (WHT7) construction support sites
- B28 – A vegetation buffer will be retained on the northern portion of the Berrys Bay (WHT7) construction support site. Where appropriate this will involve replacement of existing weeds with native species that enhance fauna habitat values.

***Issue raised – Powerful Owl***

Request that the project minimise the removal of large dense tress to ensure no habitat loss for the Powerful Owl (*Ninox strenua*) and demonstrate how construction work would be timed or modified to ensure Powerful Owls are not adversely disturbed during roosting times.

***Response***

An assessment of the potential impacts of the project on the Powerful Owl (*Ninox strenua*) is included in Section 3.6.2.4.6 of Appendix S (Technical working paper: Biodiversity development assessment report). The Powerful Owl has been previously recorded within the construction

footprint and surrounding areas. A small area of native vegetation within an exclusion zone adjacent to the location of the Berrys Bay construction support site (WHT7), adjoining a larger tract of bushland at Balls Head Reserve, provides potential foraging habitat for this species. This area of vegetation would be retained. The biodiversity assessment did not identify preferred nesting or roosting habitat for the Powerful Owl within the construction footprint. Therefore, impacts to this species due to the project would be considered negligible.

In the unlikely event that this species is identified on site during pre-clearing surveys, the unexpected threatened species find procedure in the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011) would be followed, as per environmental management measure B3 (refer to Table D2-1 of this submissions report).

***Issue raised – Light spill***

Concern that light spill from the project would impact potential roosting sites or foraging areas for threatened bat species. There was a request that the project be made to comply with the Commonwealth's *National Light Pollution Guidelines for Wildlife: Including marine, turtles, seabirds and migratory shorebirds* (Department of the Environment and Energy, 2020) during construction and operation, which identifies the potential for light spill to impact food availability and behaviour of insectivorous bats.

***Response***

Potential light spill impacts to fauna are not expected to be significant given that most construction works would occur in already highly urbanised areas, as advised in Section 19.4.2 of the environmental impact statement. Indirect impacts from light spill from construction support sites which could affect fauna have been considered in Appendix S (Technical working paper: Biodiversity development assessment report).

The environmental impact statement was submitted prior to the finalisation of the *National Light Pollution Guidelines for Wildlife: Including marine turtles, seabirds and migratory shorebirds* (Department of the Environment and Energy, 2020). Nonetheless, the guidelines have been considered in the context of developing mitigation to minimise any impacts where it recommends always using best practice lighting design to reduce light pollution and minimise the effect on wildlife.

To minimise potential impacts on the Balls Head Coal Loader Large Bent-winged bat as a result of construction lighting, a new environmental management measure (B30) has been committed to (refer to Table D2-1 of this submissions report). This requires measures to minimise light spill impacts to nearby fauna habitats with consideration of meeting requirements for worker safety, navigation and security. Refer to Section B12.15.2 of this submissions report for details.

***Issue raised – Large Bent-winged Bat***

Submissions raised concerns about the impact of the project on the Large Bent-winged Bat (*Miniopterus orianae oceanensis*). Submissions included:

- Concern that the impacts to the Large Bent-winged Bat roost site at the former coal loader at Waverton would require further mitigation and identification of other roost sites
- Request that construction activities for the project be scheduled to avoid periods when the Large and Little Bent-winged bats are not present within the Sydney metropolitan area
- Request that the assessment of impacts on the Large Bent-winged Bat and the identification of mitigation measures is completed by local councils and a qualified expert in microbat biology.

***Response***

One of the former coal loader tunnels is generally occupied by Large Bent-wing Bats (formerly the Eastern Bentwing-Bat) (*Miniopterus orianae oceanensis*) during autumn, winter and early spring

(refer to Section 3.7.2.1 of Appendix S (Technical working paper: Biodiversity development assessment report)). Construction impacts on Large Bent-winged Bats at the former coal loader are addressed in detail in Section B5.2.3 of this submissions report.

The Large Bent-winged Bat is known to roost within the former coal loader for around seven months each year over the winter period, with individuals detected at the roost site as early as March and as late as September. It would not be feasible to suspend construction work for up to seven months of the year to avoid the roosting season without substantial impact on the construction program for works within Sydney Harbour, and for the total project. This impact to program would have significant program and cost implications, as well as extended environmental and social impacts. While the key stages of construction cannot be scheduled outside the roosting season, Transport for NSW and its contractor will investigate what opportunities are available to manage discrete activities at the surface or underground to minimise impacts to the roosting habitat. Refer to Section B5.2.3 of this submissions report for further discussion.

Consultation with North Sydney Council and microbat experts Brad Law and Leroy Gonsalves occurred during the development of Appendix S (Technical working paper: Biodiversity development assessment report), to inform the impact assessment, management and mitigation strategies.

Impacts on the Large Bent-winged Bat associated with light, noise and vibration would be managed through the environmental management measures outlined in Table D2-1 of this submissions report. Environmental management measures B6 and B8 require inspections of Large Bent-winged Bat roosting sites in the locality (eg concrete box culverts and jetties) and monitoring of Large Bent-winged Bats in the coal loader tunnel to be conducted both prior to, and during construction. Environmental management measures B6, B8 and B9 have been revised to clarify that the monitoring program and adaptive management measures, to be included in an adaptive management plan, will be developed prior to construction and in consultation with Department of Planning, Industry and Environment (Environment, Energy and Science, and Regions, Industry, Agriculture and Resources divisions), North Sydney Council and an appropriately qualified expert in microbat biology and behaviour. Refer to Table D2-1 of this submissions report for the full list of environmental management measures.

The adaptive management plan will be prepared in accordance with the requirements of Section 2.7 of the *Biodiversity Assessment Method Operational Manual Stage 2* (Department of Planning, Industry and Environment, 2019). Baseline monitoring of bats at the coal loader tunnel and inspections of roosting sites in the locality will be carried out in 2020 in accordance with environmental management measures B8 and B6, respectively (refer to Table D2-1 of this submissions report). The results of these surveys will inform the adaptive management plan. The plan will be continuously updated in response to construction monitoring results. Refer to Section B5.2.4 of this submissions report for more details about the adaptive management plan requirements and how they will be addressed.

***Issue raised – Other threatened bat species***

Submissions raised concerns about the impact of the project on threatened bat species. Submissions included:

- Noise and vibration impacts need to be considered in the context of multiple stressors and an overall loss of secure roost sites for threatened bats in the Sydney Basin. Submitters requested that the proposed monitoring be updated to reflect a precautionary approach to impacts on threatened bat species
- Request for additional monitoring to be carried out to understand the distribution of threatened bats, including foraging activity, in the areas surrounding the construction footprint
- Request that monitoring be carried out prior to construction to enable the identification of changes to bat behaviour, and that this monitoring be carried out by councils and an appropriately qualified expert in microbats

- Concerns that the local bat colony(s) may be displaced
- Concern that impacts to the Southern Myotis (*Myotis macropus)* that live and fish near the construction footprint have not been sufficiently considered as the roosting site for the species is outside the construction footprint.

***Response***

Monitoring of other threatened microbat species is not proposed given potential impacts as a result of the project, and cumulative impacts from other projects in the locality, are likely to be minor (refer to sections 5.4.1.2 and 5.4.2 of Appendix S (Technical working paper: Biodiversity development assessment report). Broader considerations of threats to microbat species in the Sydney basin are a matter for conservation management by the Department of Planning, Industry and Environment (Environment, Energy and Science).

Indirect impacts to threatened fauna species habitat, including that of the Southern Myotis (*Myotis macropus)*, in the construction footprint and adjacent areas of Sydney Harbour have been considered in Section 5.2.2 of Appendix S (Technical working paper: Biodiversity development assessment report). Indirect impacts would be temporary and localised throughout the construction period and are not anticipated to have a significant impact on these species.

### C19.1.3 Removal of vegetation

***Issue raised***

Submitters raised concerns about the impacts to vegetation that provides habitat and connectivity for native species, including food and shelter resources. Comments include:

- Request that the project minimises the removal of native vegetation and hollow bearing trees
- Concern about the loss of habitat provided by vegetation at Berrys Bay, Cammeray Golf Course, St Leonards Park, ANZAC Park and the wider North Sydney local government area, and subsequent impacts to local biodiversity and ecosystems
- Concern that street trees and verge plantings that would be removed by the project may reduce connectivity between parks and reserves for native fauna
- Request that removed vegetation be re-established with local native plants and maintained for a period of 12 months by suitably qualified ecological contractors to ensure the sites are appropriately restored. Replacement planting should use mature plants
- Request that the project provides a net increase in native vegetation to mitigate impacts to biodiversity
- With reference to specific locations:
  - Request that two fig trees located on Bay Road, Waverton be preserved as they provide shade and house a wide variety of birds and local fauna. Impacts to the root systems may damage the trees and the depth of the tunnel at this location should have consideration of the tree roots
  - The existing row of Plane Trees in Alfred Street North should be preserved as they have a limited but positive biodiversity benefit.

***Response***

Transport for NSW is committed to minimising the project's impact on biodiversity, including impacts on vegetation.

Minimising vegetation removal

The project development to date has sought to limit clearing of native vegetation to the minimum extent required to construct the project (as presented in the environmental impact statement). Table 4-1 of Appendix S (Technical working paper: Biodiversity development assessment report) outlines how the project design has been developed to avoid and minimise impacts on biodiversity. Environmental management measure B1 (refer to Table D2-1 of this submissions report) also requires Transport for NSW and its contractor to explore further opportunities to minimise impacts to native vegetation and fauna habitat.

The only area of mapped native vegetation within the construction footprint is located in the south west of the Berrys Bay construction support site (WHT7), as outlined in Section 2.2.1 of Appendix S (Technical working paper: Biodiversity development assessment report). This mapped native vegetation occurs within an exclusion zone and no vegetation clearing would occur in this area.

The vegetation that would be removed from Cammeray Golf Course occurs as planted native and exotic horticultural specimens or isolated remnant trees within otherwise planted areas, as noted in Section 5.1.3 of Appendix S (Technical working paper: Biodiversity development assessment report).

A single potential hollow-bearing tree which would be impacted by the project is located in Jeaffreson Jackson Reserve at Cammeray. Should the tree contain hollows, it may support common urban fauna such as Brushtail Possum (*Trichosurus vulpecula*) and Sulphur-crested Cockatoo (*Cacatua galerita*). The removal of this tree would be unlikely to impact any threatened fauna species.

Environmental management measures B1, B2, B4, B10, B11 and V9 (refer to Table D2-1 of this submissions report) will be implemented to further avoid or minimise impacts to vegetation, or native fauna that use these areas.

Habitat connectivity

The project is located within a highly urbanised landscape, which currently contains numerous barriers and hostile gaps for species movement, including the Warringah Freeway. Most native fauna species, including threatened species, in and adjacent to the construction footprint are mobile bird or bat species, and the existing level of connectivity for these species would not be changed by the project. Refer to Table 4-1 of Appendix S (Technical working paper: Biodiversity development assessment report).

Table 4-2 of Appendix S (Technical working paper: Biodiversity development assessment report), notes that small, isolated patches of fauna habitat in the construction footprint do not maintain habitat connectivity with any large areas of native vegetation in the wider locality. The project would not further increase habitat fragmentation and would therefore not adversely impact the movement of threatened species across their range.

Re-vegetation

Vegetation will be re-established within the project footprint, where feasible, in accordance with *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011), as required by environmental management measure B4 (refer to Table D2-1 of this submissions report). The guidelines require that revegetated areas be monitored and maintained for a period that ensures that plants have sufficiently established. This period and responsibilities will be specified in the urban design and landscape plan which will be prepared and implemented in line with the strategic urban design framework for the project (refer to environmental management measure V12 in Table D2-1 of this submissions report). Environmental management measure V11 (refer to Table

D2-1 of this submissions report) also notes that early planting works will be considered to allow vegetation to mature before the project is operational.

In response to submissions, the project has committed to offset the loss of trees at a ratio equal to or greater than 1:1 (per environmental management measure B4 in Table D2-1 of this submissions report). Where replacement trees cannot be accommodated within the project footprint, locations outside the project footprint shall be identified for compensatory plantings.

Landscape plantings may in some cases involve the use of advanced stock (where an immediate visual impact or screen is particularly important). Generally however, tubestock would outperform advanced stock in the long term and would generally be favoured for this reason. The use of mature trees where appropriate would be determined during further design development.

Bay Road fig trees

There are no heritage listings within the North Sydney Local Environmental Plan that indicate any heritage-listed trees. Due to the depth of the mainline tunnels beneath Bay Road ranging from 30 to 50 metres below ground level to the top of the tunnel crown, impact to tree roots is considered to be unlikely.

Alfred Street North

Most of the trees adjoining the eastern side of Alfred Street North between Whaling Road and Bent Street would be retained, as shown on Figures A-14, A-15 and A-18 of Appendix W (Technical working paper: Arboricultural impact assessment). Some trees between Whaling Road and Mount Street may potentially be impacted. Although these trees are exotic and provide limited habitat and connectivity value for fauna, they would be retained wherever possible for their amenity value. Further discussion of the amenity impacts associated with potential removal of some of these trees is provided in Section C22.1 of this submissions report.

### C19.1.4 Other terrestrial habitat impacts

#### *Issue raised*

Submitters raised concerns about the impacts on other terrestrial habitat features for native fauna. This includes:

- The park at the north-eastern corner of Alfred Street North and High Street is habitat for a flock of brush turkeys and includes a nesting mound. The nesting mound and the flock would be impacted by the project
- Concern that the removal of the stormwater harvesting dam at the Cammeray Golf Course would impact on local wildlife and vegetation.

#### *Response*

Brush turkey habitat

The Australian Brush-turkey (*Alectura lathami*) is a native species that is protected from harm under the *Biodiversity Conservation Act 2016*. The nesting mounds of this species are seasonal and are not permanent (built in spring and chicks hatched by February). The area identified in the submissions is required to facilitate construction and would be directly impacted by the project. As required by environmental management measures B10 and B11 (refer to Table D2-1 of this submissions report), pre-clearing surveys would be carried out prior to the commencement of construction and fauna encountered would be managed in accordance with *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011).

Cammeray stormwater harvesting dam

The stormwater storage dam at Cammeray Golf Club cannot be avoided and would be directly impacted by the widening of the Warringah Freeway at this location. Environmental management measure WQ8 has been updated to require Transport for NSW to provide a permanent replacement

for the storage dam for North Sydney Council's stormwater harvesting scheme (refer to Table D2-1 of this submissions report).

A site inspection was conducted on 24 February 2020 which noted that the dam provides habitat for native and exotic disturbance-tolerant aquatic fauna (fish), foraging habitat for native and exotic aquatic birds and a water source for local terrestrial fauna. It is unlikely that the native bird species identified would use the dam for foraging, and due to limited fringing vegetation, breeding is unlikely. Nonetheless, a pre-clearing check will be completed for nesting birds. If any nests are found, they will be managed in accordance with *Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011). Fauna handling management measures will be included in the dewatering plan, in accordance with environmental management measure B29 (refer to Table D2-1 of this submissions report). This is further discussed in Section B5.2.8 of this submission report.

Due to the limited habitat provided by the dam and urban locality, it is unlikely that any threatened flora or fauna species listed under the *Biodiversity Conservation Act 2016*, the *Environment Protection and Biodiversity Conservation Act 1999* or the *Fisheries Management Act 1994* would inhabit the dam.

### C19.1.5 Impacts to biodiversity values of Yurulbin Park

#### *Issue raised*

Submitters raised concerns about the use of Yurulbin Park for a construction support site as it is unique for flora and fauna in the area. Comments included:

- Requests for further information on the number of trees to be removed and the plan to redevelop the area and requested that trees be replaced with mature trees
- Submitters requested that two fig trees on the left hand side of the path leading to the ferry wharf that provide habitat for flying foxes and other native fauna be protected
- Requests that a plan be developed for the relocation of native fauna.

#### *Response*

A small area of vegetation would be removed from the location of the Yurulbin Point construction support site (WHT4), as discussed in Section 19.4.1 of the environmental impact statement. This site was used as a shipyard from 1917 until the 1970s and was subsequently landscaped using typical native foreshore species. The vegetation in Yurulbin Park currently consists of planted native trees and shrubs with a mown ground layer dominated by exotic grass species. No vegetation consistent with any native plant community types or threatened ecological communities would be removed from Yurulbin Park.

The arboricultural impact assessment presented in Appendix W (Technical working paper: Arboricultural impact assessment) identifies trees that are likely to be affected by the project. The assessment identified 48 trees at Yurulbin Park (varying in health and retention value), of which 18 would be retained. As shown on Figure A-4 and Table A-2 of Appendix W (Technical working paper: Arboricultural impact assessment), no fig trees (*Ficus macrophylla*) would be removed at Yurulbin Park.

As discussed in Section C22.1 of this submissions report, the design and rehabilitation of Yurulbin Park would be determined in consultation with the park's original landscape architect (Bruce MacKenzie). The redesign of the park is also discussed in Section 5.4.6 of Appendix V (Technical working paper: Urban design, landscape character and visual impact assessment). Landscape plantings may in some cases involve the use of advanced stock (where an immediate visual impact or screen is particularly important). Generally however, tubestock would outperform advanced stock in the long term and would be favoured for this reason. As such, vegetation selected will consist of both established and juvenile species and landscaping will be maintained until vegetation is successfully established.

Environmental management measure B11 (refer to Table D2-1 of this submissions report) commits to carrying out pre-clearing surveys for native fauna before construction works commence and will follow *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011). Pre-clearing surveys will be carried out for microbat roosts on the wharf structures that will be removed at the Yurulbin Point construction support site (WHT4). If microbats are identified roosting in these structures, individuals will be excluded from this roosting habitat, as required by environmental management measure B12 (refer to Table D2-1 of this submissions report).

Environmental management measure B10 (refer to Table D2-1 of this submissions report) advises that fauna will be managed in accordance with *Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011). This requires the use of a licensed fauna ecologist or wildlife carer to capture and/or remove fauna that have the potential to be disturbed, injured or killed as a result of clearing activities. Fauna will be released into a pre-determined habitat identified for fauna release.

### C19.1.6 Impacts to biodiversity values of Balls Head, Waverton

#### *Issue raised*

Submitters raised concern that the Berrys Bay construction support site (WHT7) would impact local wildlife within Balls Head Reserve due to vegetation clearance and/or indirect impacts.

Submitters identified that although many areas of the project are highly urbanised, the area next to Balls Head Reserve is not highly urbanised and as such, the potential noise, vibration, dust and light spill impacts to Large Bent-winged Bats (*Miniopterus orianae oceanensis*) and Powerful Owls *(Ninox strenua)* should be considered in this context.

#### *Response*

No vegetation in Balls Head Reserve would be removed for the project. Native vegetation within the construction footprint would be retained and protected within an exclusion zone, to ensure no clearance of this vegetation would occur, as stated in Section 19.4.1 of the environmental impact statement.

The Berrys Bay foreshore is characterised by public recreation and industrial maritime uses, as identified in Section 20.3.4 of the environmental impact statement. The Waverton Peninsula includes Balls Head Reserve, commercial/industrial buildings and infrastructure owned by the NSW Government on the eastern side of the peninsula, including an existing Sydney Water asset and a number of disused buildings. The Royal Australian Naval base, HMAS Waterhen, is on the western side of Waverton Peninsula. Although Balls Head Reserve is a bush reserve, given this context, the construction footprint is considered to be located within a highly urbanised environment.

Noise, vibration, dust and light spill from construction support sites could affect fauna inhabiting vegetation in nearby terrestrial habitats. Indirect impacts to fauna habitat would have the potential to occur within Balls Head Reserve and along the edge of the foreshore at Berrys Bay (close to Berrys Bay construction support site (WHT7)) and Balls Head Bay (close to Sydney Harbour north cofferdam (WHT6)). Built structures within or near Berrys Bay construction support site (WHT7) that provide potential habitat for roosting/nesting fauna, including threatened species, could also be indirectly impacted. These indirect impacts would occur throughout construction, however, because of the urbanised nature of this environment, any resident fauna would already be well adapted to noise and light disturbance, and the intensity of impact would decrease with increasing distance from the construction activities.

Further, as construction activities would be concentrated in the more highly urbanised areas (as discussed above) that are already subject to ambient noise, noise and vibration generated by the project is not expected to have a significant impact on native fauna.

Impacts and environmental management measures relating to light spill, dust, noise and vibration (including impacts to the Large Bent-winged Bat (*Miniopterus orianae oceanensis*) and Powerful Owl (*Ninox strenua)*) are discussed in Section C19.1.2 of this submissions report.

While there would be a requirement for some additional site sheds and buildings at the Berrys Bay construction support site (WHT7), the site offices that are located nearest to native vegetation would be established in existing buildings, minimising impacts during site establishment (as per Section 5.2.2 of Appendix S (Technical working paper: Biodiversity development assessment report).

## C19.2 Aquatic biodiversity

### *Issue raised*

Submitters are concerned that the project would impact the aquatic biodiversity of downstream waterways in Cammeray and Naremburn due to potential reductions in water quality associated with construction work. The types of water quality impacts identified by submitters includes erosion and siltation due to earthworks, the mobilisation of potentially contaminated soils and the discharge of treated wastewater.

### *Response*

The potential for aquatic biodiversity impacts due to degradation of water quality due to construction activities is considered in Section 19.4.3 of the environmental impact statement. As discussed in Section 17.3.5 of the environmental impact statement, Willoughby Creek, Quarry Creek and Flat Rock are located downstream of the project and may be indirectly impacted by the project. These waterways are in very poor condition and are representative of their location within highly urbanised areas. Willoughby Creek has been highly modified and is not considered to be a sensitive receiving environment. Quarry Creek and Flat Rock Creek are considered to be sensitive receiving environments, primarily due to the presence of downstream Type 1 highly sensitive Key Fish Habitat values. No threatened fauna species were identified within these waterways.

No instream works would be carried out in these waterways and construction works would not be located in close proximity to the waterways. Potential impacts to water quality during construction would be temporary and manageable through standard soil and erosion controls (refer to Table D2-1 of this submissions report). The likelihood of sediment and contaminants entering the waterways as a result of the project is low and impacts to aquatic biodiversity are expected to be minimal.

Discharges would occur from the Cammeray Golf Course wastewater treatment plant into Willoughby Creek during construction, via the local stormwater system. The project would not have adverse impacts on the aquatic biodiversity of Willoughby Creek, as:

- The treatment plant would treat wastewater to a suitable standard such that the water quality downstream of Willoughby Creek is not adversely impacted (refer to environmental management measure WQ3 in Table D2-1 of this submissions report)
- The potential for scour and erosion of watercourse bed and banks will be considered during the design of new and augmented discharge outlets. Construction work activities within or next to the watercourses and drainage lines will be minimised as much as reasonably practicable to minimise disturbance of sediments in or near the waterway (refer to environmental management measure WQ7 in Table D2-1 of this submissions report).

Monitoring of water quality at discharge points during construction will ensure that corrective action is implemented in the event that a pollutant exceeds the discharge criteria, as required by environmental management measure WQ4 (refer to Table D2-1 of this submissions report).

## C19.3 Marine biodiversity

### C19.3.1 Marine species and habitats

***Issue raised***

Submissions raised concerns about the potential for impacts to threatened marine species by the project, including seagrasses, seahorses and seadragons. Concerns regarding marine species and habitats raised by submissions include:

- Submissions were concerned that the project would potentially impact the marine biodiversity of Sydney Harbour
- Request that impacts to marine habitats are minimised, with specific reference to subtidal rocky reef, intertidal rocky shore habitats and intertidal mudflats
- Concerns about impacts to seagrass habitat between Yurulbin Park and Sydney Harbour south cofferdam and request that impacts to seagrass be avoided due to the small size of remaining patches. Where impacts cannot be avoided, replanting of seagrasses is requested
- Concern that construction of the project would impact water quality, kelp and seagrasses within the construction footprint
- Concerns that the tunnel may cause changes to tidal flows and impact on species diversity
- Concerns about the ability of marine species to avoid collision with vessels used for construction of the project
- Concerns about the impacts to marine flora and fauna from run-off during construction
- Concerns that construction activities would result in an increase in the colonisation of invasive marine species which may impact on the marine ecosystem
- Request that the National Light Pollution Guidelines for Wildlife to be considered alongside those for terrestrial assemblages identified under the guidelines.

***Response***

Transport for NSW is committed to minimising the project's impact on marine biodiversity.

Removal of marine habitat

The project has been designed to avoid and minimise potential impacts on marine ecology. This has included the development of the design to minimise the project footprint as far as practicable to reduce the area of impact to marine vegetation and habitat. Refer to Section 1.7 of Appendix T (Technical working paper: Marine ecology).

The project would result in the removal of a small area of subtidal rocky reef habitat and intertidal rocky shore habitat along the shoreline of the crossing at the Sydney Harbour south cofferdam (WHT5) and the Sydney Harbour north cofferdam (WHT6), as outlined in Section 6.7 of Appendix T (Technical working paper: Marine ecology). Environmental management measure B21 (refer to Table D2-1 of this submissions report) requires these habitats to be rehabilitated and restored as close as possible to pre-construction conditions where feasible and reasonable. Following the rehabilitation of these habitats, it is expected that marine assemblages in these habitats would recover rapidly.

Seagrass habitat does not occur within the construction footprint, and no seagrass would be removed as part of the project (refer to Section 5.2.1.1 of Appendix T (Technical working paper: Marine ecology)). Some small patches of seagrass are located adjacent to the construction footprint and could be affected by dredging and other construction activities. However, these activities would be temporary and controls would be implemented to mitigate turbidity and sedimentation impacts

(discussed in more detail below). Environmental management measures to be implemented include silt curtains being placed around the seagrass patches, vessel exclusion zones and monitoring of seagrass condition and potential project-related threats during construction. Monitoring is to include triggers that would require the implementation of adaptive or contingency dredging as required.

Although all syngnathids (seahorses and seadragons) in NSW are protected from harm, the only threatened syngnathid with potential for occurrence in the construction footprint is Whites seahorse (*Hippocampus whitei*). Syngnathids have potential to occur in marine vegetation (seagrass and algae on rocky reef) habitat. As only very small areas of seagrass and rocky reef habitat are expected to be impacted, very few syngnathid individuals, if any, would have the potential to be harmed.

Environmental management measures would be implemented to minimise harm to marine biota during construction. Environmental management measure B25 (refer to Table D2-1 of this submissions report) requires that fish, including syngnathids, be captured from the temporary cofferdams during dewatering and released to suitable habitat nearby. To manage potential impacts to syngnathids, a new environmental management measure, B27 (refer to Table D2-1 of this submissions report), commits that prior to construction, areas of rocky reef and seagrass potentially impacted by the project are searched for seahorses, and that any specimens found are relocated to suitable unaffected areas nearby. This process will be planned and executed in consultation with the Department of Planning, Industry and Environment (Regions, Industry Agriculture and Resources).

Indirect impacts to marine habitats

As outlined in Section 19.4.4 of the environmental impact statement, turbidity (suspended sediment) and sedimentation caused by dredging during the project's construction has the potential to impact about 0.01 hectares of rocky reef habitat and about 0.03 hectares of seagrass habitat. However the predicted sedimentation load modelled for the project indicates that the project is unlikely to substantially impact these habitats. Impacts associated with turbidity and sedimentation would be temporary and limited to the construction phase of the project, and would not adversely impact the broader ecological functioning of marine communities, including sensitive seagrass or rocky reef kelp communities.

There are a number of environmental management measures, including B17 and B19 (refer to Table D2-1 of this submissions report), that would be implemented to minimise any potential indirect impacts of construction on water quality in the harbour that may affect marine habitats.

Hydrodynamics

The seabed at the immersed tube tunnel crossing would be restored to the existing profile after construction, which means there would be no permanent alterations to hydrodynamics in the operation phase of the project (refer to Section 19.4.4 of the environmental impact statement). Temporary alterations to tidal currents associated with the presence of cofferdams in the harbour during construction would not be sufficient to cause scour or erosion to adjacent sensitive nearshore habitats.

Vessel movements

Vessel strike to marine reptiles, marine mammals and elasmobranchs would be unlikely as very few individuals, if any, would occur within the project area during construction, as noted in Section 5.2.3.2 of Appendix T (Technical working paper: Marine ecology). The risk of boat strike on marine mammals and reptiles will be minimised by the implementation of a stop-work procedure upon sighting marine mammal and reptile activity, as required by environmental management measure B24 (refer to Table D2-1 of this submissions report).

Construction runoff

Section 17.3.1 of the environmental impact statement notes that the project would be located within the Sydney Harbour and Parramatta River regional catchment. The Sydney Harbour catchment is a highly-urbanised catchment (86 per cent) which results in rapid runoff during high rainfall events.

The main waterways in proximity to the project are first order streams that discharge directly to the harbour. Any construction runoff would be minor in the context of this highly urbanised catchment.

Potential impacts of construction activities on water quality and surface flows would be managed by the implementation standard environmental management measures including erosion and sediment controls for all work sites and surface work areas. With the implementation of appropriate measures during construction, the risk of construction runoff would be minimised. Refer to Section 19.4.3 of the environmental impact statement.

Invasive species

Vessels and movement of offshore equipment have potential to act as carriers for introduced species, as discussed in Section 4.6 of Appendix T (Technical working paper: Marine ecology). Introduced species may be brought into the study area through the release of ballast water (in the case of planktonic larvae or species) or via reproduction from individuals attached to the hull of a vessel. However, the number of additional vessels associated with project activities is likely to be small relative to the total number of commercial vessels in the estuary. In terms of marine mammals, no invasive species harmful to marine mammals are likely to be released or have their populations enhanced as a consequence of the project. Section 5.2.1.4 of Appendix T (Technical working paper: Marine ecology) provides a risk-based assessment of impacts on seagrass and subtidal rocky reef habitat.

The risk of marine pest introductions will be managed through the implementation of environmental management measure B22 (refer to Table D2-1 of this submissions report). Locally sourced vessels and equipment will be used where feasible and reasonable, but where they are sourced internationally, the contractor will need to demonstrate that due diligence has been taken to avoid introducing marine pests, pathogens or diseases. Environmental management measure B23 (refer to Table D2-1 of this submissions report) also requires targeted surveys of the dredge footprint for the marine algal pest *Caulerpa taxifolia.*

Light spill

The *National Light Pollution Guidelines for Wildlife: Including marine turtles, seabirds and migratory shorebirds* (Department of the Environment and Energy, 2020) provides guidance specifically relating to artificial light impacts on marine turtles and seabirds. With respect to marine turtles, the guidelines identify that impacts of light pollution are specific to nesting, hatchling orientation, sea-finding and dispersal of marine turtles. The open water habitat of Sydney Harbour is not a preferred habitat for wandering seabirds with no species identified as having a high likelihood of occurrence within the construction footprint. Sydney Harbour would also not be considered important habitat for marine turtles in the context of the guidelines. Any changes to the light environment that would potentially affect the marine environment of Sydney Harbour would be temporary during construction.

### C19.3.2 Impact of contaminated sediments on marine biodiversity

#### *Issue raised*

Submitters raised the following concerns regarding the impacts of dredging activities on marine biodiversity:

- Concern about impacts on seagrass and kelp from the project as they are considered highly sensitive habitats for fish and invertebrates and are important for biodiversity in general
- Concerns about dredging at Snails Bay and the potential loss of seagrass and impacts to marine life
- Concern about the potential release of contaminants during dredging causing impacts to marine life including the availability and suitability of food sources for threatened biota
- Concerns about impacts to listed marine species as a result of contaminants released through dredging activities.

***Response***

The management of contaminated sediments has been outlined as a management priority for the project. As described in Chapter 6 (Construction work) and Table 6-4 of the environmental impact statement, the dredging methodology has been designed to minimise impacts on the marine environment depending on the material being dredged. In addition to using a backhoe dredge with a closed environmental clamshell bucket for contaminated sediments to avoid the spread of potentially contaminated material into the water column, dredging operations would also be carried out within a floating silt curtain enclosure to a depth of two to three metres. Shallow silt curtains would also be installed next to ecologically sensitive areas to provide additional protection.

This methodology, in conjunction with the behaviour of sediment-bound contaminants, means it is unlikely that water quality would be significantly impacted by contaminants mobilised from dredging and marine construction activities. For further information refer to Section 2 of Appendix C.1 of this submissions report.

The highest level of sedimentation caused by dredging during the construction of the project has the potential to settle on about 0.01 hectares of rocky reef habitat and two small patches of seagrass (totalling about 0.03 hectares). However, the majority of the dredge-induced accumulations of sediment would likely be uncontaminated sediment that has dispersed during the dredging phases of deeper uncontaminated sediment (as per Section 5.1.3 of Appendix Q (Technical working paper: Marine water quality)).

Consequently, impacts from contaminants on foraging habitat for threatened species that may use the habitats in the project area very occasionally would be minor, as discussed in Section 5.4.3.1 of Appendix S (Technical working paper: Biodiversity development assessment report).

### C19.3.3 Marine ecology assessment – methodology

***Issue raised***

There are concerns regarding the methodology of the marine biodiversity impact assessment. Specific concerns are outlined below.

- The Marine Estate Management Authority (MEMA) *Sydney Harbour Background Report* (2014) should be acknowledged in the environmental impact statement
- Recent biodiversity studies of the harbour should have been used, including more recent research on the impacts of dredging on marine ecosystems
- Concerns were raised that little sampling occurred and much of the data presented is based on a desktop study
- The risk assessment in Appendix T (Technical working paper: Marine ecology) did not use the best available data in the modelling and did not incorporate the impacts of chemical mixtures, fine particulates with metals in the water column, or disturbance of pore water on biota, and bioaccumulation of toxicants by local species. Further, the assessment lacks toxicity data
- Concern that the precautionary principle has not been adopted when assessing risks to foreshore environments and marine ecology resulting from construction.

***Response***

The marine ecology assessment considered previous investigations and includes a combination of desktop and field studies, based on the results of initial screening of existing information about key habitats and biota relevant to the project (ie from the previous studies). Desktop studies were considered sufficient for the assessment of the project on ‘fish passage’, ‘deeper water fish communities’ and ‘marine mammals and marine reptiles’. However, field-based data collection (of habitat condition and biota) was required in some habitats in areas that could be impacted by the

project, alongside nearby areas for context (the study area), due to the lack of suitable, existing site-specific information for many key habitats.

The report *Sydney Harbour. A systemic review of the science 2014* (Sydney Institute of Marine Science, 2014) was a key piece of information in the desktop study process. This report was the basis for the *Sydney Harbour Background Report 2014* (Sydney Institute of Marine Science, 2014) for the Marine Estate Management Authority. The two reports contain similar information about the marine habitats and biota of Sydney Harbour.

The potential for direct and indirect impacts of the project on the locality and quality of habitats and biota within the study area (as determined from the combination of desktop and field data) was assessed by determining tolerances of habitats and biota to potential impacts from the project during its construction and operational phases. A risk assessment assisted with this process. The precautionary principle was applied where there was a lack of scientific certainty, or limitations in survey data and precautionary approaches have been taken in the identification of environmental management measures (such as exclusion zones).

As discussed in Section 1.10 of Appendix T (Technical working paper: Marine ecology), the marine ecology assessment has been informed by predictions of changes to marine water quality, sedimentation, hydrodynamics, underwater noise and mobilisation of contaminants during construction as documented in other technical working papers that supported the environmental impact statement. As discussed in Section C19.3.2 above, the most relevant study describing potential impacts of disturbed contaminants entering the water column was done for the nearby Sydney Metro City & Southwest project (Geotechnical Assessments, 2015).

The methodology adopted for the marine ecology assessment is outlined in Section 2 of Appendix T (Technical working paper: Marine ecology). The assessment was carried out to meet the requirements of the Secretary's environmental assessment requirements and in accordance with relevant guidelines.

### C19.3.4 Marine ecology assessment – existing environment

#### *Issue raised*

There are concerns regarding the assessment of the existing marine environment. Specific concerns are outlined below.

- Concern that the project footprint is within an area considered biologically diverse by Australian Museum records
- Queried the statement that the marine communities present in the project area may already be "adapted" to some of the potential impacts from the project and commented that this should be supported by data on the tolerance of local species
- Queried the conclusion that marine biota are well adapted to the suspended solids in Sydney Harbour because the nature of these solids has changed markedly due to the improvements to Sydney Harbour.

#### *Response*

The Sydney Harbour estuary has a wide range of marine habitats which support one of the most biodiverse estuarine ecosystems in Australia, as acknowledged in Section 3.5 of Appendix T (Technical working paper: Marine ecology). The habitats in the study area have been classified according to the *Policy and Guidelines for Fish Habitat Conservation and Management* (NSW Department of Primary Industries, 2013). This requires consideration of the waterway 'sensitivity' (Type), which refers to the importance of the habitat to the survival of fish and its robustness (ability to withstand disturbance).

The effects of dredging are mapped in terms of zones of impact and influence, as discussed in Section 2.7 of Appendix T (Technical working paper: Marine ecology). To delineate these zones, the potential impact of dredging-related excess turbidity and excess sedimentation (considered to be

greater than five millimetres) on a particular type of habitat or biota, an assessment of estimated ecological tolerance limits for each habitat type or biota is required. Tolerance limits for habitats are generally derived in two ways, as outlined in *Technical Guidance: Environmental Impact Assessment of Marine Dredging Proposals* (Western Australia Environment Protection Authority, 2016):

- Tolerance limits for turbidity are derived from water quality monitoring data, with the argument that resident flora and fauna are adapted to local conditions but would be stressed if exposed to conditions that regularly exceed normally prevailing background concentrations
- Tolerance limits for sediment deposition are derived from habitat-specific dose-response experiments and field observations reported in the scientific literature.

Given dose-responses were unavailable for most species in the study area, tolerance limits for habitats were derived from marine water quality monitoring data (Cardno, 2020).

Existing sediment and water quality in Sydney Harbour is considered in the context of the existing environment and is documented in Section 3.3 of Appendix T (Technical working paper: Marine ecology). While efforts to improve the marine water quality of Sydney Harbour are being carried out, fluctuations in light and rates of sedimentation occur naturally in Sydney Harbour due to regular resuspension of particulate matter by tidal currents, wind-driven mixing and runoff events. Modelling of natural turbidity used data from recent years that considers the benefits of recent clean up efforts. Field data to augment existing water quality data were collected at a number of sites in Sydney Harbour spanning the area that might be affected by the project over a two month period, and were used to inform the marine ecology impact assessment (as outlined in Section 2.1 of Appendix Q (Technical working paper: Marine water quality)).

### C19.3.5 Impacts of contaminated sediments on marine ecology

#### *Issue raised*

Submissions raised concerns regarding the impacts of disturbed contaminated sediments on marine ecology. Specific concerns include:

- Concerns were raised that the impact of bioaccumulation in species and biomagnification in food webs caused by the disturbance of the bed of the harbour and newly transported sediment were not assessed
- Concerns were raised that the concentrations of contaminants in sediments were not provided in the environmental impact assessment and that the impacts to marine ecosystems could not be assessed
- Concern about impacts from dredged material and the potential release of contaminants on waterbirds and marine fauna, including the risk of bioaccumulation of contaminants.

#### *Response*

Appendix Q (Technical working paper: Marine water quality) notes that sediment sampling found that contaminants were found within the top 1.5 metre of sediments. Appendix Q (Technical working paper: Marine water quality) and Appendix T (Technical working paper: Marine ecology) were informed by marine contamination reporting based on geotechnical investigations carried out for the project which included the specific concentrations of contaminants for samples collected.

The most relevant study describing potential for bioaccumulation and biomagnification of disturbed contaminants entering the water column was done for the nearby Sydney Metro City & Southwest project (Geotechnical Assessments, 2015). The study by Geotechnical Assessments (2015) found that most contaminants are likely to remain bound to sediment during dredging and have limited potential for uptake by biota. Further information on this assessment is provided in Section 5.2.1.3 of Appendix T (Technical working paper: Marine ecology).

A backhoe dredge with a closed environmental clamshell bucket supported by silt curtains has been proposed for removal of the top layer of sediment so that leakage of potentially contaminated material is minimised. These buckets have been specifically designed for dredging material with elevated levels of contaminated sediments and provide three significant advantages compared to conventional open buckets, including, minimisation of suspended sediments, minimisation of spill and precision (accurate dredging). With the implementation of these safeguards, in conjunction with the very small expected deposition level from the dredging stage for sediment, the behaviour of sediment bound contaminants, and their bioavailability, there would be limited potential for bioaccumulation or biomagnification of contaminants from dredging.

### C19.3.6 Impacts of noise and vibration on marine ecology

***Issue raised***

There are concerns regarding the impacts of underwater noise and vibration from the project on marine ecology. Specific concerns are outlined below.

- Request for more information on the effects of underwater noise on seahorses and further assessment of the impacts of underwater noise
- Submissions comment that the methodology described for understanding the impacts of underwater noise and vibration on marine assemblages also appears inappropriate as visual monitoring from the harbour surface is not appropriate to determine impacts.

***Response***

Underwater noise would be caused by dredging and piling during the construction of the project in Sydney Harbour, as outlined in Section 19.4.4 of the environmental impact statement. As different species have different tolerance thresholds to underwater noise, there would be a range of potential responses to these impacts. Potential responses may include physical impacts, changes in foraging behaviours or changes to the behaviour of marine species to avoid underwater noise generated by the project. A more detailed assessment of the impacts of underwater noise on marine species is provided in Appendix T (Technical working paper: Marine ecology).

Underwater noise impacts to marine species would be managed in accordance with environmental management measure B26 (refer to Table D2-1 of this submissions report) which requires visual monitoring from the harbour surface to be carried out to identify any underwater noise related impacts on fish. If required, additional at-source protection measures will be considered. Measures could include considering noise in the selection of plant and acoustic testing to validate noise from construction activities.

Little is known about the impacts of underwater noise on seahorses. One study by Anderson et al. (2011) found a chronic stress response in housed captured lined seahorses (*Hippocampus erectus*) in noisy tanks for one month. The results of the study indicate that seahorses in general could be adversely affected by very loud underwater noise. While the estimated number of individual seahorses impacted by noise due to the project is likely to be small, new environmental management measure B27 (refer to Table D2-1 of this submissions report) commits to a pre-construction survey of seagrass and rocky reef habitat by suitably qualified marine ecologists in areas potentially affected by impact piling noise to search for, locate and translocate Syngnathid species that may be present to nearby unaffected habitat.

## C19.4 General – Transparency, adequacy and accuracy

***Issue raised***

Submissions raised concerns about how information was presented in the environmental impact statement, including:

- Concern that Chapter 19 (Biodiversity) of the environmental impact statement minimises impacts in relation to biodiversity
- Request for further information on how impacts to threatened species would be mitigated.

***Response***

The environmental impact statement was prepared in accordance with division 6.2 (formerly Part 5.1) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) to meet the Secretary's environmental assessment requirements which are issued by the Department of Planning, Industry and Environment.

The project's potential impacts on terrestrial flora and fauna, aquatic biodiversity and marine biodiversity including threatened species, are assessed in Section 19.4 of the environmental impact statement. Impacts to biodiversity have been assessed by suitably qualified subject matter experts in accordance with federal and State legislation including the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and NSW *Biodiversity Conservation Act 2016*. Methodology for the biodiversity assessment has followed guidelines prescribed by the NSW Government including the *Biodiversity Assessment Method* (Office of Environment and Heritage, 2017) and *Policy and Guidelines for Fish Habitat Conservation Management – Update 13 (*NSW Department of Primary Industries, 2013).

Prior to public exhibition the environmental impact statement and the biodiversity development assessment report were submitted to the Department of Planning, Industry and Environment and relevant government agencies for review as to their adequacy prior to being placed on public display. The review concluded that the environmental impact statement and biodiversity development assessment report were adequate in meeting the Secretary's environmental assessment requirements.

Environmental management measures to address the potential impacts of the project on biodiversity are identified in Table D2-1 of this submissions report. Environmental management measures would be developed in additional detail as part of further design development. Further details of the assessments carried out are included in Appendix T (Technical working paper: Marine ecology) and Appendix S (Technical working paper: Biodiversity development assessment report).

In accordance with the Secretary's environmental assessment requirements and the biodiversity assessment method, the NSW Biodiversity Offsets Scheme has been applied to the project. This is discussed further in Section C19.5 of this submissions report.

## C19.5 Monitoring and mitigation

### C19.5.1 Terrestrial habitats – offsets

***Issue raised***

Submitters requested the inclusion of offsets for biodiversity impacts. This included a suggestion to protect a Large Bent-winged Bat (*Miniopterus orianae oceanensis*) roost in the Inner West local government area as part of an adaptive management strategy.

***Response***

The NSW Biodiversity Offsets Scheme which is established under Part 6 of the *Biodiversity Conservation Act 2016,* has been applied to the project. Based on the assessment as presented in Appendix S (Technical working paper: Biodiversity development assessment report), threatened species offsets are required for a single Sunshine Wattle (*Acacia terminalis subsp. terminalis*) individual impacted by the project. No other offsets were identified as being required.

The consideration of additional offsets would be determined in consultation with the Department of Planning, Industry and Environment (Environment, Energy and Science).

The protection of a known Large Bent-winged Bat (*Miniopterus orianae oceanensis*) roost in the Inner West local government area was raised by Inner West Council. This proposal would be considered during the development of the Large Bent-winged Bat adaptive management plan (refer to Section B12.15.2 of this submissions report for further details).

### C19.5.2 Marine habitats – monitoring, rehabilitation and offsets

***Issue raised***

Submitters provided the following comments and recommendations regarding monitoring and mitigation measures for marine habitats:

- Request the requirement for ongoing monitoring of marine water quality and ecology impacts during and following the completion of construction to confirm the potential impacts
- Concern that monitoring would not be conducted during dredging, and no contingency measures have been identified
- Concern that the increase turbidity in the water would mean that visual monitoring of marine biota would not be possible from the surface
- Support for the rehabilitation and restoration of subtidal rocky reef and intertidal rocky shore habitats impacted by the project
- Suggestion for community representation in the rehabilitation of the site, through participation on an advisory committee
- Comment that the restoration of seagrass beds through planting is required
- Request that seawalls do not replace intertidal sand and mudflats
- Request for details on how environmental offsets would be achieved
- Request that the use of 'living seawalls', an initiative led by the Sydney Institute of Marine Science, be adopted to offset the impacts to marine biodiversity.

***Response***

Transport for NSW is committed to minimising the project's impact on marine biodiversity, including implementing monitoring programs.

<u>Monitoring</u>

Monitoring of marine vegetation and sensitive habitat would use water quality indicators to determine threats to these habitats but would be followed by underwater visual assessment of these habitats if indicators are suggestive of potential impact.

Monitoring programs and management of marine vegetation and sensitive habitat would be detailed in the construction environmental management plan (refer to Section 28.5 of the environmental impact statement), and would relate to:

- Seagrasses
- Intertidal and subtidal rocky reef
- Marine mammals and reptiles
- Marine water quality.

The monitoring program will be developed and implemented prior to and during construction for sensitive marine habitats within the Moderate Zone of Influence. Information from the monitoring program will be used to inform the adaptive management of impacts to marine habitats and water quality (environmental management measure B20, refer to Table D2-1). Also refer to environmental mitigation measure B27 in Table D2-1 of this submissions report.

As detailed above, adaptive management of marine vegetation and sensitive habitat would include monitoring and rehabilitation throughout construction.

Offsetting

The NSW Government's *Biodiversity Offsets Policy for Major Projects* (Office of Environment and Heritage, 2014) provides guidance for compensating unavoidable losses to aquatic biodiversity after all possible avoidance and mitigation measures have been applied. Some aspects of the project would result in the unavoidable removal of nearshore habitats, and as such must be managed through compensatory activities to comply with the 'no net loss' requirements of the *Policy and Guidelines for Fish Habitat Conservation and Management – Update 13* (NSW Department of Primary Industries, 2013).

The removal of a small amount of subtidal rocky reef habitat and intertidal rocky shore habitat would occur along the shoreline of the crossing at the Sydney Harbour south cofferdam (WHT5) and the Sydney Harbour north cofferdam (WHT6). This impact could be mitigated through re-instatement of habitat of a similar nature to the habitat removed.

As outlined in Section 6.7 of Appendix T (Technical working paper: Marine ecology), the exact design of reef rehabilitation and mitigation works for the subtidal rocky reef habitat and intertidal rocky shore habitat would be dependent on constraints at the site and would be determined during further design development. The following approaches could be considered:

- Re-instatement of the intertidal and subtidal rocky reef using natural reef materials, such as the rock removed during construction, or natural sandstone, so that it would imitate as closely as possible the pre-existing habitat. As indicated above, if natural materials are used and original complexities in habitat structure can be replicated with reasonable similarity, then there would be no net loss in habitat structure and ecological assemblages (once re-established)
- Design of project elements at the nearshore areas of the crossings so that they provide sufficient structural complexity to that of natural intertidal rocky shore or subtidal rocky reef habitat (ie an artificial reef environment), with guidance provided by *Environmentally Friendly Seawalls: A Guide to Improving the Environmental Value of Seawalls and Seawall-lined Foreshores in Estuaries* (Sydney Metropolitan Catchment Management Authority and Department of Environment and Climate Change NSW, 2009).

Rehabilitation of the impacted areas of subtidal rocky reef habitat and intertidal rocky shore habitat following construction would avoid any residual impacts on key fish habitat from the project. As such, offsets are not anticipated to be required for the project.

The project would not directly impact intertidal sand and mudflat habitat. Indirect impacts, such as from sedimentation, would be addressed through the environmental management measures detailed in Table D2-1 of this submissions report.

### C19.5.3 Marine species management

***Issue raised***

Submitters raised concerns about the management of marine species during construction:

- Concern about the methodology for salvaging and relocating species during dewatering of cofferdams due to the stress caused to marine species
- Concern about risk of vulnerable Black Rockcod becoming trapped within cofferdams
- Concern that threatened and other more common species would not fly or swim away from construction activities and may be impacted.

***Response***

Potential impacts on marine species including the Black Rockcod will be managed in accordance with environmental management measure B25 (refer to Table D2-1 of this submissions report), which requires the salvage of live fish, including Black Rockcod, during cofferdam dewatering and will be carried out by a suitably qualified marine ecologist. All salvaged organisms will be immediately relocated to suitable release locations that will be identified in consultation with the Department of Planning, Industry and Environment (Regions, Industry, Agriculture and Resources). The marine ecologist would carry out an inspection of the cofferdams prior to the commencement of dewatering. Mesh covers would be placed over pumps and the rate of dewatering would be limited to prevent injury and mortality.

Construction of the project would be carried out in a relatively small area when compared to Sydney Harbour as a whole. Highly mobile marine species located in the construction footprint would be able to temporarily alter their distribution to other areas of the harbour in response to the construction activities. It is acknowledged that the construction of the project would likely result in mortality of some individuals of marine species. However, the project has been designed to minimise potential impacts on marine biodiversity.

NSW GOVERNMENT

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C20 – Land use and property

SEPTEMBER 2020

# C20 Land use and property

## Contents

## C20.1 Loss of public open space

### *Issue raised*

Submitters raised concerns over loss of green space or public open space. Queries, comments and concerns included:

- Opposition to the amount of open space being impacted across the project. Request a condition of approval that the project is 'green space neutral'
- The loss of open space at Cammeray Golf Club/Cammeray Park
- The loss of green space at Merlin Street Reserve, ANZAC Park and Rosalind Street East
- Request that there be publicly available plans and funding agreements detailing the rehabilitation of construction areas following construction
- Request for further information regarding the return to the community of the construction support site at Berrys Bay. Request that the land will be rehabilitated at the expense of the State government and restored to North Sydney Council for the purposes of community use as an extension to Carradah Park. Suggestion that a public wharf (non-commercial) be included in the restoration of the Berrys Bay site near Woodley's Marina
- Concern the project would impede the implementation of the NSW Green Grid strategy, which has an objective to connect green spaces
- Request for an extension of Artarmon Park over the motorway to improve recreation space in West Artarmon.

### *Response*

Impacts to open space

Transport for NSW recognises that parks and open space areas play an essential role in the health and wellbeing of neighbouring communities. Given the limited availability of space in the project area and the desire to minimise acquisition of private property, some public land, including public recreation areas, would be required to facilitate construction of the project, resulting in the temporary occupation or permanent acquisition of public land.

An assessment of the project's impacts on land use and property, including impacts to open space during construction and operation is provided in Chapter 20 (Land use and property) of the environmental impact statement. The majority of open space used for construction of the project would not be required to operate the project and would be rehabilitated and returned to an equivalent state. Land subject to temporary use, including areas of public open space, will be rehabilitated as soon as practicable to an appropriate land use (discussed further below).

As outlined in Table 20-3 of the environmental impact statement, part of Cammeray Golf Course would be temporarily required for use as a construction support site (WHT10 and WFU8). Part of the golf course would also be permanently acquired for permanent operational facilities for the project and the Beaches Link and Gore Hill Freeway Connection project. The acquisition of open space at Cammeray Golf Course was conservatively presented as 25,000 square metres in the environmental impact statement (this also included loss due to the Beaches Link and Gore Hill Freeway Connection project). Refined analysis shows that the permanent loss of open space at Cammeray Golf Course associated with the Western Harbour Tunnel and Warringah Freeway Upgrade project is about 15,000 square metres.

The project has been designed and developed to minimise impacts to Cammeray Golf Course and Transport for NSW will continue its collaborative engagement with Cammeray Golf Club to maintain the long term viability of the Cammeray Golf Course. The project would not impact on the site's feasibility as a nine hole golf course and for public recreation and open space purposes, either during construction or operation.. the adjoining Cammeray Park sports ground, tennis club, croquet

club and skate park would not be directly impacted and would remain operational during construction and operation, as outlined in Chapter 20 (Property and land use) of the environmental impact statement.

While the project operation would require the permanent use of some existing public open space, it would also present opportunities to increase public open space. The environmental impact statement presented a conservative view by reporting only the largest single parcel of open space proposed to be acquired (at Cammeray Golf Course). The environmental impact statement did not provide any details on the size of opportunities to increase public open space.

Public open space opportunities currently considered in the design include provision of new public open space at Berrys Bay (about 15,800 square metres) and provision of the new Ernest Street shared user bridge (about 1800 square metres), which would link Cammeray Golf Course with ANZAC Park. Further opportunities to increase public open space would be investigated during further design development.

Merlin Street Reserve, ANZAC Park and Rosalind Street East

While some open space at ANZAC Park and Rosalind Street East, along with all of the Merlin Street Reserve would be used for the purposes of construction, the long term viability of these areas of public open space would not be compromised by the project.

Rehabilitation of land following construction

Residual land that is required for construction but not for operation of the project will be rehabilitated as soon as practicable at the completion of the construction period (refer to environmental management measures LP2 and LP6, refer to Table D2-1 of this submissions report and Chapter 20 (Land use and property) of the environmental impact statement. Rehabilitation will take into consideration the location, land use characteristics, area and adjacent land uses. The project conditions of approval issued by the Department of Planning, Industry and Environment would be publicly available and detail the project requirements in relation to rehabilitation of land. Interface agreements with Councils would also include arrangements regarding rehabilitation of residual land.

NSW Government-owned waterfront land at Berrys Bay in Waverton would be temporarily required for use as a construction support site (WHT7). This site would not be required on a permanent basis to operate the project. As stated above, once the project is completed, Transport for NSW would return 15,800 square metres of land at Berrys Bay to the community as new public open space. As part of this process, Transport for NSW and the Department of Planning, Industry and environment would jointly establish a reference group, to include representation of key stakeholders, the community and independent experts, to support the development of the final layout.

A community update was provided by Transport for NSW in November 2019 about the future use of Berrys Bay, including the opportunity to be involved in the development process.

Green grid

The following green grid links are located in the vicinity of the project.

- Rozelle and surrounds
  - Sydney Harbour Foreshore and Parramatta River Walk
  - The Bay Run and Iron Cove Creek
  - White Bay and Blackwattle Bay Foreshore and Open Space
  - Tom Uren Trail, Balmain
  - Sydney Harbour Bays Green Links: Balmain and Rozelle
- Warringah Freeway and surrounds
  - Parramatta River and Sydney Harbour Foreshore
  - M2 Active Transport Corridor

  - North Sydney CBD Open Spaces and Green Streets
- Gore Hill Freeway and Artarmon
  - St. Leonards Open Space and Green Streets
  - Lane Cove and Artarmon Green Street Links.

These green grid links form part of the active transport links assessed in each respective study area in the environmental impact statement. Where there are impacts on active transport during construction or operation, these are described for each study area in Appendix F (Technical working paper: Traffic and transport). Table 5-13 of the environmental impact statement outlines active transport infrastructure provided as part of the Warringah Freeway Upgrade component of the project. Replacement or renewal of facilities following construction would seek to provide a like-for-like replacement of, and in some cases an improvement of, existing facilities in terms of connectivity and serving existing desire lines, where possible. By providing new and upgraded active transport infrastructure, the project would improve connections between green spaces on either side of the Warringah Freeway. This would include the replacement of the Ridge Street shared user bridge, a new shared user path along the southern side of the High Street bridge at North Sydney, and an improved dedicated cycleway between Ernest Street and Miller Street.

The project provides for an accessible and useable community public open space along the Ernest Street shared user bridge. This would include seating, improved pathways, lookouts, lighting, and landscaping that connects to the adjacent public space. Further information on the Ernest Street shared user bridge is included in Appendix V (Technical working paper: Urban design, landscape character and visual impact) of the environmental impact statement. Additional discussion on a land bridge option at Cammeray Park is included in Section B14.20.5 of this submissions report.

As outlined in Appendix V (Technical working paper: Urban design, landscape character and visual impact), the urban design framework includes urban design requirements to ensure the delivery of well-designed and attractive shared user bridges that provide safe access for all pedestrians and cyclists. The urban design framework would be used to inform further design development to ensure high quality links.

Active transport is discussed further in Section C9.6 of this submissions report.

Artarmon Park

An extension of Artarmon Park across the Warringah Freeway is outside the footprint and scope of this project.

## C20.2 Property acquisition and compensation

***Issue raised***

Submitters raised concerns in regard to property acquisition and compensation for impacts to private property. Specific queries, comments and concerns include:

- Suggestion that properties located above the tunnel alignment are acquired and redeveloped as parkland
- Concern and opposition to substratum acquisition. Request for further information as to where along the tunnel alignment substratum acquisition would occur. Comment that there is no compensation to landowners, despite likely impacts to home values and building rights given the potential for development at properties above the tunnels to be limited
- Comment that residents along the Warringah Freeway that are negatively affected due to the project bringing the freeway closer to their property should be compensated
- Request that a proposed acquisition notice (PAN) be issued to the current owners of the former Balmain Leagues Club, which forms part of the Victoria Road construction support site (WHT2), to begin the compulsory acquisition process under the *Land Acquisition (Just*

*Terms Compensation) Act 1991*. Also request due to the complexity of the site, that the Department of Planning, Industry and Environment make no new orders or conditions that would remove any flexibility the State Government might choose to assert in disposing of the site and its seven land parcels, after project construction. Suggestion that outright acquisition of the seven properties comprising the former Balmain Leagues Club site would be a better choice for the people of NSW, as any future resale would turn the NSW Government a profit, for and on behalf of the people of NSW

- Query as to the removal of the entire lane of Alfred Street North. This land use and property impact is not assessed in the environmental impact statement.

***Response***

The project has been designed and developed to minimise property acquisitions and has prioritised the use of NSW Government-owned land for construction support site establishment where possible. As there would be negligible impact to properties located above the tunnel alignment, the acquisition of these properties is not required.

The construction and operation of the project would require the acquisition of land below the surface (substratum acquisition) of the ground to accommodate the mainline and ramp tunnels. As stated in Chapter 20 (Land use and property) of the environmental impact statement, Transport for NSW has the authority to acquire the subsurface land, under the *Roads Act 1993*. The *Land Acquisition (Just Terms Compensation) Act 1991* provides that compensation is not payable for substratum acquisition of land or easements unless specific circumstances as detailed in that Act apply. Appendix C of the Transport for NSW *Land Acquisition Information Guide* (Roads and Maritime Services, 2014a) sets out in detail the compensation provisions of the Act relating to substratum acquisition. Where substratum acquisition is required, Transport for NSW would contact owners of affected properties. This would happen during the detailed design phase of the project.

In areas where the project would result in the Warringah Freeway being closer to residents, the environmental impact statement contains a number of commitments to manage and mitigate impact. Consultation with affected residents and the community will be ongoing throughout the design development and construction phase in accordance with the Community consultation framework (Appendix E of the environmental impact statement).

The Victoria Road construction support site (WHT2) would be located adjacent to Victoria Road in Rozelle, at the former Balmain Leagues Club site. The site would be temporarily used as a construction support site for the duration of construction (either acquired or leased). The site is currently occupied by a vacant two-storey building, car parking areas, as well as vacant and occupied residential and commercial properties. Further consideration would be given by Transport for NSW into whether compulsory acquisition or leasing the site would be the best course of action. The temporary occupation of this land would not affect the existing land use zoning or development controls that are applicable to the site.

The removal of some of the northbound parking on Alfred Street North is required to support additional southbound traffic along the Warringah Freeway. This reconfiguration of the road does not constitute a land use change as the land would still be used as a road and so has not been considered in Chapter 20 (Land use and property) of the environmental impact statement. The impacts of the reconfiguration of Alfred Street North on traffic have been considered in Chapter 9 (Operational traffic and transport) of the environmental impact statement.

## C20.3 Property damage

### *Issue raised*

Submitters raised concerns in regard to property damage. Specific queries, comments and concerns include:

- Concern over potential property damage from vibration and ground settlement. Request dilapidation reports supported by a photographic survey are completed prior to and following construction to confirm no structural or cosmetic damage has occurred to private property. Request assurance any damage will be repaired, or owners compensated accordingly. Request for community representation on an independent panel assessing the damage claims
- Concern that the current zone of influence of 50 metres is insufficient to cover damage to homes. Request that the zone of influence for assessment be increased from 50 to 250 metres
- Request for information on the maximum period allowed for property damage claims due to project settlement.

### *Response*

Transport for NSW understand and acknowledge the concern about the potential for vibration and settlement from tunnelling to cause damage to homes. Building condition surveys will be prepared for properties along the tunnel alignment in accordance with environmental management measure SG4 (refer to Table D2-1 of this submissions report). In the unlikely event of property damage caused by construction, the damage would be rectified by the project at no cost to the property owner. This is further discussed below.

During construction, some properties located above or near the tunnel alignment may experience minor impacts due to vibration or ground settlement as described in Chapter 10 (Construction noise and vibration) and Chapter 16 (Geology soils and groundwater) of the environmental impact statement. For most properties, vibration levels would generally be below levels that may cause potential risk to buildings or structures, including minor cosmetic damage. However, there is potential risk of cosmetic damage to a small number of properties closest to vibration intensive construction activities.

Pre-construction building/structure condition surveys will be prepared for properties (and heritage assets) within the zone of influence of tunnel settlement (for example within the 5 millimetre predicted surface settlement contour and within 50 metres of surface works) and within the minimum working distances for cosmetic and structural damage due to vibration, in accordance with environmental management measures SG3 and SG4 and environmental management measure CNV6 (refer to Table D2-1 of this submissions report).

Within three months of the completion of construction activities that have the potential to impact on the subject surface/subsurface structure, a post condition survey will then be offered to property owners of buildings where a pre-construction building condition survey was carried out. The results of the surveys will be documented in a building condition survey report and provided to the owners within one month of the survey being completed.

While any property damage caused by the project will be rectified, an Independent Property Impact Assessment Panel, comprising geotechnical and engineering experts, will be established prior to the commencement of works to independently verify building condition survey reports, resolve any property damage disputes and establish ongoing settlement and vibration monitoring requirements. The Independent Property Impact Assessment Panel will be independent of both Transport for New South Wales and property owners.

The use of a zone of influence for the project is consistent with recent tunnel projects in NSW such as WestConnex and NorthConnex. Based on the assessment of potential impacts and the depth of the tunnel in this location, there is no justification for extending this zone.

## C20.4 Impact on mooring facilities

***Issue raised***

Submitters raised queries regarding mooring facilities, including:

- Concern over loss or change of access to boat mooring sites near the proposed construction support site in Berrys Bay (WHT7) and access to dinghies on the small beach adjacent to Woodley's Shipyard. If mooring is required to be re-located, request that it be in a sheltered position, close to shore or another bay close by such as Wollstonecraft Bay
- Comment that if private mooring buoys are moved or damaged, replacements must be yellow and of the preferred conical shape
- Concern over the potential damage to boats if they need to be moved to alternative mooring locations.

***Response***

Moorings in the vicinity of the Berrys Bay construction support site (WHT7), including dinghies on the small beach adjacent to Woodley's Shipyard, would require temporary relocation (refer to Chapter 8 (Construction traffic and transport) of the environmental impact statement)).

Transport for NSW will improve the access to the beach next to the former quarantine station and work with North Sydney Council to provide boat and kayak storage options before construction starts, in accordance with environmental management measure, LP9 (refer to Table D2-1 of this submissions report).

Moorings within the vicinity of Berrys Bay construction support site (WHT7) would require temporary relocation during the construction period. These moorings would be relocated elsewhere in Sydney Harbour in consultation with the lease holders prior to the commencement of construction, in accordance with environmental management measure CTT2 (refer to Table D2-1 of this submissions report). At that time Transport for NSW would liaise with and consider any concerns raised by lease holders relating to mooring locations, potential damage to boats during the relocation process, and the type and colour of replacement buoys.

NSW GOVERNMENT

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# Western Harbour Tunnel and Warringah Freeway Upgrade

## C21 – Socio-economic

SEPTEMBER 2020

# C21 Socio-economic

## Contents

## C21.1 Impacts to local business

### *Issue raised*

Submitters raised concerns over impacts to local businesses during both construction and operation of the project. Specific queries, comments and concerns include:

- Concern over the potential reduction in foot traffic and passing trade on local shops, cafes and restaurants caused by disruption to access arrangements, changed traffic conditions, pedestrian movements and loss of parking during construction. Submitters request compensation for loss of business during construction of the project. Particular areas of concern were Rozelle, North Sydney and Cammeray
- Concern over amenity impacts due to construction traffic, noise and decreased air quality
- Suggestion to provide shuttle bus transport to work sites and designated off-site parking for workers so local businesses and residents do not lose access to their on-street parking
- Concern that a third of Cammeray Park and Golf Course would be used for construction and operational use, and impact the club's ability to maintain business during and post construction
- Request for further consultation with local business owners before construction starts to understand local needs
- Concern that the project may further impact businesses already affected by COVID-19 and the recent drought
- Concern that converting Berry Street into a four-lane road would affect passing trade to shops and cafes.

### *Response*

Transport for NSW acknowledge a project of this scale will change the local community during construction and operation. Transport for NSW is committed to continuing to engage with businesses potentially impacted by construction to identify specific impacts and reduce or manage these throughout construction.

Businesses may be affected during the construction phase by temporary changes in passing trade, access and travel time (for employees, customers, deliveries and/or servicing), parking, serving and deliveries and amenity. Depending on the nature of the business, the actual impact on businesses may vary (positively or negatively). These impacts may be a temporary inconvenience for some businesses. There may also be benefits for businesses due to increased passing trade and business exposure. Section 6.5.2 of Appendix U (Technical working paper: Socio-economic assessment) and Section 21.4.7 of the environmental impact statement outlines potential impacts on businesses near the project.

Construction of the project would have the potential to affect the amenity of an environment, as a result of increased noise, vibration and dust, or reduced visual outlook and business visibility. Construction impacts on amenity as it affects local businesses were assessed as being of moderate significance in the Victoria Road/Darling Street Centre, moderate to low for North Sydney CBD and low for Artarmon Industrial local businesses. At other business centres the impacts would generally be low or insignificant (negligible).

During the development process, a key priority has been to reduce project impacts. The project would implement a range of mitigation measures to limit and manage the temporary impacts of construction on businesses and the local community. The project will continue to work with the business community to understand their concerns and implement strategies to support business during construction. Based on consultation with businesses, specific feasible and reasonable measures to maintain business access, visibility and parking, and address other potential impacts

as they arise through the construction process will be identified and implemented, in accordance with environmental management measure BU3 (refer to Table D2-1 of this submissions report).

Car parking for the construction workforce would be provided at most construction support sites as detailed in Chapter 8 (Construction traffic and transport) of the environmental impact statement. Where on-site parking is not provided or where provision of on-site parking cannot accommodate the full construction workforce, feasible and reasonable management measures that minimise impacts on parking and local roads will be identified and implemented. Depending on the location, management measures may include workforce shuttle buses and the use of public transport as per environmental management measure CTT9 (refer to Table D2-1 of this submissions report).

Construction and operation of the motorway and other project support infrastructure would require reconfiguration of Cammeray Golf Course and relocation of maintenance and water storage facilities. The project would allow for a reconfigured nine-hole golf course to be maintained throughout construction and operation. The operation of the pro-shop and function centre during construction would not be impacted. Regardless, it is acknowledged that changes to the golf course may impact on the use of the golf course for some members. Ongoing engagement will be carried out with managers of social infrastructure about the timing and duration of construction works and management of potential impacts, in accordance with environmental management measure SE3 (refer to Table D2-1 of this submissions report). As discussed in further detail in Section C21.6 below, Cammeray Park would not be directly impacted by construction or operation.

Transport for NSW recognises that many businesses have experienced a downturn in economic activity associated with the recent drought, bushfires and the COVID-19 pandemic. As per environmental management measure BU2 (refer to Table D2-1 of this submissions report), specific consultation will be carried out with businesses potentially impacted during construction. Consultation will aim to identify specific potential construction impacts for individual businesses. As outlined above, per environmental management measure BU3 (refer to Table D2-1 of this submissions report), based on consultation with businesses, specific feasible and reasonable measures to maintain business access, visibility and parking and address other potential impacts as they arise through the construction process will be identified and implemented. A phone hotline will be maintained throughout construction, enabling businesses to find out about the project or register any issues.

Potential operational impacts to businesses located near the project are presented in Section 21.5.6 of the environmental impact statement. Localised impacts on passing trade at the North Sydney CBD are expected to be negligible. The net increase in traffic flows to North Sydney throughout the day would also contribute to offsetting any potential impact. Refer to Section A4.1.3 of this submissions report for discussion on the North Sydney Integrated Transport Program, an ongoing multi-agency collaboration aiming to deliver a shared place-based vision for the North Sydney CBD.

## C21.2 Impacts on community amenity

***Issue raised***

Submitters raised concerns over amenity impacts to the local community during construction of the project. Specific queries, comments and concerns include:

- Concern over the impact of the project on liveability and local amenity due to increased traffic, ventilation outlets and air quality impacts, noise pollution, and increased traffic, with no foreseeable benefit to the Cammeray community
- Concern over sleep disturbance and general disruption to amenity due to proposed 24-hour construction and noise from construction traffic. Request a strict 6pm curfew on all noisy work within 300 metres of any residential building on weekdays (and 1pm on Saturdays), together with a ban on all noisy work on Sundays
- Berrys Bay is a quiet marine area in McMahons Point/Waverton and the scale of this operation would negatively impact the local community

- Concern that the project would impact on the visual amenity of North Sydney and that the acquisition and demolition of properties within a heritage conservation area would result in loss of liveability in North Sydney and Cammeray.

***Response***

Noise, dust, vibration, traffic, and visual impacts from construction activities may temporarily impact on the amenity for some residents and social infrastructure closest to surface works, including construction support sites. Potential impacts to local amenity and character during construction and operation are assessed in Section 6.7.1 and 6.7.2 of Appendix U (Technical working paper: Socio-economic assessment). These potential amenity impacts would be temporary, and will be mitigated as per the various environmental management measures in the relevant chapters of the environmental impact statement, and included in Table D2-1 of this submissions report. The environmental management measures related to construction would be included in a construction environmental management plan. The plan would provide a framework for establishing how these measures would be implemented and who would be responsible for their implementation. After construction, communities such as Cammeray would experience benefits relating to improved access and connectivity to destinations across the Greater Sydney region.

Chapter 10 (Construction noise and vibration) of the environmental impact statement provides an assessment of potential construction noise and vibration impacts, including assessment against sleep disturbance screening and awakening reaction levels. Exceedances of the noise management level and the number of impacted residential receiver buildings would vary over the duration of construction. For example, the predicted air-borne noise levels are only likely to occur when works are at the closest point to each receiver building. Airborne noise impacts assessed in the environmental impact statement are considered conservative because the assessment has assumed all construction equipment would be operating simultaneously, at a worst case intensity, and with a worst case orientation during a 15-minute period. For many work areas, construction activities are mobile and so construction noise impacts may be lower than predicted.

Mitigation and management measures as identified in Chapter 10 (Construction noise and vibration) of the environmental impact statement would be implemented to minimise potential impacts on the surrounding community. As per environmental management measure CNV1, a construction noise and vibration management plan will be developed for the project (refer to Table D2-1 of this submissions report). Monitoring will also be carried out throughout all stages of construction to ensure that noise and vibration impacts are being appropriately managed, and the effectiveness of implemented mitigation and management measures (environmental management measure CNV4 in refer to Table D2-1 of this submissions report). Construction noise and vibration impacts on the community are discussed in more detail in Section C10 of this submissions report.

Proposed construction work hours, including tunnelling works, construction traffic and surface construction activities, are outlined in Section 6.8.1 of the environmental impact statement. Standard construction hours are 7am to 6pm Monday to Friday, 8am to 1pm Saturday and no construction works on Sundays of public holidays. Spoil haulage would be carried out during standard construction hours. Some activities, as outlined in Table 6-36 of the environmental impact statement, would be carried out outside of standard construction hours. An out of hours works protocol will be developed for the construction of the project in consultation with the Department of Planning, Industry and Environment, and independently endorsed, as per environmental management measure CNV3 (refer to Table D2-1 of this submissions report). The protocol will be implemented during the duration of the construction of the project. The protocol will include:

- Details of works required outside standard construction hours, including acceptable justifications for works outside of standard construction hours, what types of works are allowed to take place outside of construction hours, and justifications of why the activities are required outside standard construction hours
- Details of the assessment and approval process (internal and external) for works proposed outside standard construction hours

- Noise and vibration mitigation and management measures that are to be considered and implemented where appropriate to manage potential impacts associated with works outside standard construction hours
- The noise and vibration impact assessment processes that will be followed to identify potentially affected receivers, clarify potential impacts and determine appropriate mitigation and management measures.

There would be an increase in marine traffic to and from Berrys Bay construction support site (WHT7) during construction, as outlined in Table 6-38 of the environmental impact statement. However, the delivery of construction materials, removal of spoil, and transportation of the construction workforce by water would reduce on-road construction traffic, and its associated noise, safety and amenity impacts, to a minimum. These impacts would be relatively short term compared to the overall construction program.

Chapter 14 (Non-Aboriginal heritage) of the environmental impact statement identifies that the project would require the demolition of three buildings within the Cammeray Conservation Area. The buildings to be demolished would equate to less than two per cent of the entire stock of contributory buildings within the heritage conservation area. The buildings are located on the periphery of the heritage conservation area and the demolition of these buildings would not result in the loss of liveability for these suburbs. Further information is provided in Section 5 of Appendix J (Technical working paper: Non-Aboriginal heritage). As per environmental management measure NAH5 (refer to Table D2-1 of this submissions report), prior to demolition of the buildings, an archival photographic recording of the contributory building would be carried out in accordance with the guidelines *Photographic Recording of Heritage Items Using Film or Digital Capture* (Heritage Council of NSW, 2006).

The environmental impact statement also stated that one building within the Holtermann Estate, a Conservation Area in Crows Nest, would be demolished. However, the building identified is not proposed for demolition. A clarification is provided in Section A4.2 of this submissions report.

## C21.3 Impacts on sensitive receivers

***Issue raised***

Submitters raised concerns over the impact of the project on sensitive receivers, particularly schools. Specific queries, comments and concerns include:

- Concern over potential health and safety impacts on children attending the schools along the project route. Further consultation required due to interruptions to the environmental impact statement consultation process caused by COVID-19.

***Response***

Transport for NSW will use a range of measures to reduce the impact of construction work when working close to communities. The range of measures would include using temporary noise barriers and acoustic sheds, using quieter equipment where possible, and staging work to avoid extended periods of disruption.

As identified in Chapter 21 (Socio-economics) of the environmental impact statement, a number of schools and childcare facilities would be located near the project. Increased construction traffic may impact on perceptions of safety for children and students, particularly during school drop-off and pick-up times. Vehicle access to and from construction sites would be managed to ensure pedestrian, cyclist and motorist safety, in accordance with environmental management measure CTT7 (refer to Table D2-1 of this submissions report). Other possible traffic management measures would include limiting heavy vehicle access near schools and childcare centres during drop-off and pick-up times, or during community events that attract large numbers of visitors.

Ongoing engagement and communication with managers of social infrastructure about the timing and duration of construction works and management of potential impacts will be carried out in accordance with environmental management measure SE3 (refer to Table D2-1 of this submissions report). The implementation of education and awareness programs for construction workers and transport operators about potential road safety impacts would also help to maintain safety for children and local communities.

Transport for NSW would continue to consult with the community and other key stakeholders during further design development, with a view to further minimise impacts of the project on communities, as outlined in Section A2.5 of this submissions report. A detailed community consultation strategy would be developed prior to the start of construction pending project approval. This would be based on the framework developed and included in Appendix E (Community consultation framework).

## C21.4 Community health and wellbeing

***Issue raised***

Submitters raised concerns over the health and wellbeing of community members during construction and operation of the project. Specific queries, comments and concerns include:

- Concern over the wellbeing of residents whose homes would be compulsorily acquired. Query as to how residents are being assisted through this process and how are the community's needs being addressed in a proactive rather than a reactive way
- Concern that the project may add further stress and anxiety to a community already suffering from high levels of anxiety due to recent bushfire events and the COVID-19 pandemic
- Concern over the long construction timeframe and the potential impact on physical and mental health living in and around this project during construction. Suggest a condition of approval that would ensure sufficient compensation is offered to those that are seriously impacted by the project
- The social assessment in the environmental impact statement did not consider community health issues associated with increased air pollution, land use changes adversely affecting stormwater runoff, or impacts to recreational sites due to contaminated sediment disturbance in the Parramatta River.

***Response***

Some residents and communities near the project may experience stress and anxiety due to uncertainty about potential property impacts, property acquisition and proposed changes that may be associated with the project. Transport for NSW acknowledges that this could be exacerbated by the impacts associated with the recent bushfires and COVID-19 pandemic. Transport for NSW has started consultation with affected property owners about the acquisition process. Land acquisition for the project will be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* (NSW) and other relevant NSW Government and Transport for NSW guidelines (per environmental management measure LP1, refer to Table D2-1 of this submissions report). Consultation would continue throughout the project development.

There is potential for community members to experience consultation fatigue due to the number of concurrent and consecutive projects in areas such as Rozelle. The project would build a working relationship with the project teams for other major projects in the area to identify those who may be susceptible to consultation fatigue. The project team would work to develop an integrated approach to contacting persons or organisations which may experience consultation fatigue, and would identify which communication mechanisms stakeholders prefer.

Impacts of air quality and pollution on human health and community wellbeing are summarised in Chapter 21 (Socio-economics) and Chapter 13 (Human health) of the environmental impact

statement. Further details are provided in Appendix I (Technical working paper: Health impact assessment) and Appendix U (Technical working paper: Socio-economic assessment). Potential risks to human health from construction dust would be minimal with the implementation of dust management measures in accordance with environmental management measure AQ1 (refer to Table D2-1 of this submissions report.

Chapter 18 (Flooding) of the environmental impact statement assesses potential flooding impacts associated with the project. Measures to mitigate alterations to local runoff conditions during construction would be implemented in accordance with new environmental management measure, F8 (refer to Table D2-1 of this submissions report). Long term changes to flood behaviour due to the project would be confirmed during further project development, and would be minimised if buildings would experience inundation during the 1% AEP event as a result of the project (environmental management measure F1 in Table D2-1 of this submissions report).

The risk of exposure due to the disturbance and exposure to contaminated soil, sediment or groundwater would be managed to prevent impacts to the community. Further investigations would be completed where areas of potential contamination have been identified and would be suitably managed as required (environmental management measure SG6 in Table D2-1 of this submissions report). Further, procedures would be in place to respond in the event that unexpected contamination is uncovered during construction (environmental management measure SG11 in Table D2-1 of this submissions report).

Where sediments require excavation within Sydney Harbour, the use of silt curtains and a backhoe dredge with a closed environmental clamshell bucket attachment would minimise the risk of sediment, and contaminants within the sediments, being mobilised into the water during dredging. This control in conjunction with the behaviour of sediment bound contaminants means it is unlikely that water quality would be significantly impacted. The use of recreational sites on the Parramatta River in proximity to the project is unlikely to be adversely affected. Refer to Sections C16 and C17 of this submissions report, and Chapter 16 (Geology, soils and groundwater) and Chapter 17 (Hydrodynamics and water quality) of the environmental impact statement for more information.

## C21.5 Economic impacts

### *Issue raised*

Submitters raised concerns over the economic impact of the project. Specific queries, comments and concerns include:

- Concern over the negative impact on property values, with no financial compensation, due to construction, increase in local traffic, loss of green space, reduced amenity and visual impacts
- Request that conditions of approval include a waiver of annual council rates for residents residing in affected councils
- Comment that toll roads increase inequity as they are only available to those with the ability to pay the tolls
- Objection to the project due to impact on economic productivity. The project would induce new traffic and lead to further congestion, costing billions of dollars. Road congestion also adds significantly to the health budget due to increased air pollution, resulting in increased rates of illness.

### *Response*

Property values are driven by a range of economic, social and amenity factors. For example, housing supply and demand, interest rates, economic growth, local amenity and accessibility to such things as employment and social infrastructure. It is likely that broader external factors would influence property values more than perceived or actual impacts resulting from the project.

Furthermore, improvements to transport access, reduced travel times and reduced congestion on surface arterial roads delivered by the project are likely to improve liveability in many areas. Refer to Chapter 21 (Socio-economics) of the environmental impact statement and Appendix U (Technical working paper: Socio-economic assessment) for further information.

Conditions of approval are a matter for the Department of Planning, Industry and Environment to consider during their assessment of the project. Transport for NSW generally does not provide financial compensation for impacts during construction as these are temporary in nature, and impacts will be minimised through mitigation measures. The project would continue to work closely with the community throughout this process.

Although Western Harbour Tunnel would be tolled, no decision on tolls has yet been made for northbound traffic using the Sydney Harbour Bridge and Sydney Harbour Tunnel. Works for the Warringah Freeway Upgrade include provision for tolling gantries should the government elect to introduce a northbound toll. One potential impact of a new toll is an increase in traffic volumes on alternate routes as a result of toll avoidance. Depending on the travel route choices of individuals, and their individual economic situations, there would be a proportion of motorists who would avoid tollways for affordability reasons. In July 2019, the NSW Government implemented a toll relief initiative to ease the cost of living for frequent NSW toll road users through the provision of half-priced or free vehicle registration.

The Western Harbour Tunnel and Beaches Link Program has followed the Infrastructure NSW processes to achieve an investment decision. Through this process the Program has demonstrated its economic merit and successfully passed the Infrastructure NSW Assurance Review Process. In addition to independent review of the design, constructability, environmental impacts, and traffic and transport benefits, this assurance review process included a review of the economic merit of the Program. As part of this governance and rigorous review process, the Western Harbour Tunnel and Warringah Freeway Upgrade project has undergone extensive scrutiny throughout its development.

Infrastructure NSW has estimated that the economic risk to growth and productivity posed by traffic congestion in the Eastern City District would be $8 billion annually in 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). The project would encourage heavy and commercial vehicle movements into the tunnel, due to the increased efficiencies and reduced freight costs associated with improved travel speeds and reliability and reduced travel distances.

The transport modelling carried out for the project (which includes an allowance for induced demand) highlighted that the project would result in substantial travel time savings for freight vehicles, improving their productivity and increasing the efficiency of the freight network particularly for trips that currently use Sydney Harbour Bridge. Improvements in the efficiency and reliability of these transport networks would likely result in increased productivity, reduced costs and broader economic benefits for these workforces. 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 Sydney CBD. The combination of freight and business travel time savings as a result of the project would generate significant productivity benefits for the Sydney CBD and wider region. The operational benefits of the project in relieving congestion and improving travel times are discussed in detail in Section C9.2 of this submissions report. The strategic benefits of the project to overall transport in Sydney are discussed further in Section C3 and Section C4 of this submissions report. Refer to Section C9.1.3 of this submissions report for further discussion on induced demand.

## C21.6 Community safety and connectivity

### C21.6.1 Construction safety and connectivity

***Issue raised***

Submitters raised concerns over impacts to the community cohesion both construction and operation of the project. Specific queries, comments and concerns include:

- Concern over safety due to traffic from construction vehicles and presence of unfamiliar construction workers, changes to cycling and pedestrian access
- Concern over changes to, and loss of, public transport modes and routes such as the Birchgrove Ferry Wharf
- Concern over potential impacts to access for emergency vehicles along Balls Head Road due to construction traffic
- Opposition to the impact on the local village of Naremburn due to the tunnel.

***Response***

Management of safety issues due to changed traffic conditions due to construction vehicles are described in Section C8.4 of this submissions report. Changes to the existing active transport network are described in Section 8.4 of the environmental impact statement. The overall significance of these changes on active transport is considered low and limited to minor increases in travel time. These changes are not considered likely to impact on safety.

During construction potential disruptions to bus services, including temporary changes to road conditions and the temporary relocation of some bus stops near to construction works for safety reasons, may result in possible delays and disruptions for bus users and changes in bus access. Early and ongoing engagement with bus operators and bus users about changes to local bus routes and bus stops would assist in managing potential impacts on commuters.

The closure of Birchgrove Ferry Wharf would be temporary for the duration of construction at Yurulbin Point construction support site (WHT4). As discussed in Section A3.3.1 of this submissions report, a replacement service for these commuters will be determined during further design development and implemented prior to closure of the existing wharf (environmental management measure CTT3 in Table D2-1 of this submissions report). Early notification of proposed changes to the ferry network would be provided to allow customers to plan their journeys. Appropriate signage would also be provided at the ferry wharf informing patrons of any changes.

Access for emergency vehicles along Balls Head Road would be maintained. Ongoing consultation would be carried out with (as relevant to the location) Transport Coordination within Transport for NSW, the Port Authority of NSW, local councils, emergency services and bus operators to minimise traffic and transport impacts during construction, as per environmental management measure CTT4 (refer to Table D2-1 of this submissions report).

Impacts on the local village at Naremburn as a result of the project would be minor and limited to minor construction noise and a slight increase in traffic on local roads.

### C21.6.2 Operational safety and connectivity

***Issue raised***

Submitters raised concerns over impacts to community cohesion during operation of the project. Specific queries, comments and concerns include:

- Concern over the relocation of the Falcon Street shared user bridge with regards to pedestrian safety. Concern that the new start point is in an area that does not have any buildings and is not visible from the freeway. The new bridge would also only have ramp access, unlike the existing which has stairs and ramps. Having alternative accesses allows for the ability to avoid unsafe situations
- Request that existing pedestrian access to North Sydney from the eastern side of Alfred Street North via the Mount Street overpass is maintained or enhanced and safe design/crime prevention features are included

- Concern that no consideration has been given to improving the connectivity and cohesion of the community divided by the Warringah Freeway. Greater connectivity could be provided through safe and well-designed pedestrian and cycle links across and adjacent to the project, broadening of overpasses to include green space, and building over the top of the freeway
- Concern traffic changes to North Sydney would turn streets into on-ramps and residential blocks into traffic islands, dissect the CBD and erode social cohesion
- Concern this project would turn North Sydney CBD into a series of isolated commercial islands bordered by high speed thoroughfares instead of the connected, pedestrian friendly and sustainable CBD that North Sydney Council has been working towards
- Concern about the impact the project would have on streets and amenity around North Sydney, noting that North Sydney has been developed with shared use for residents, workers, students, and traffic, and was an early adopter of low speed limits. In addition, North Sydney Council has plans to increase the pedestrian amenity in the CBD by closing through traffic between the Pacific Highway and Berry Street
- Concern that Berry Street would create a new north south divide through North Sydney
- Concern the project would divide Cammeray and affect the 'village feel' of the suburb. The proposed noise barrier in Amherst Street would cut residences off from rest of the Cammeray suburb.

***Response***

Crime prevention through environmental design principles are fundamental to the project's strategic urban design framework and would be implemented wherever the project interfaces with the public domain. Further details regarding the urban design requirements related to crime prevention through environmental design, which would be followed for pedestrian and shared user bridges such as the Falcon Street shared user bridge, is provided in Section C22.2 of this submissions report.

Modification and minor widening of the Mount Street bridge would also be carried out in accordance with the principles of crime prevention through environmental design. Existing pedestrian access to North Sydney from Alfred Street North via the Mount Street bridge would be maintained following the completion of construction.

Community cohesion is encouraged by connectivity or discouraged by barriers to movement. Transport for NSW recognises that increased traffic volumes on roads leading to and from interchanges may increase perceived barriers to local movements for pedestrians and cyclists. As a result, in some locations this may influence some people's ability to access services and meeting places. In other locations, the project would improve community cohesion and cyclist and pedestrian connectivity along the project corridor through increased provision of dedicated cyclist and pedestrian links. This includes the provision of new and upgraded pedestrian and cyclist infrastructure around surface connections and along the upgraded Warringah Freeway. It is anticipated that these improvements in connectivity would encourage greater use of this infrastructure by pedestrians and cyclists. Potential impacts to community cohesion is discussed in Section 21.5.4 of the environmental impact statement.

The configuration of Berry Street would be changed to provide four eastbound lanes. Pedestrian access across Berry Street would be maintained via the existing intersection of Berry Street and Miller Street. Conversion of the existing pedestrian crossings to a scramble crossing with a pedestrian only phase would allow pedestrians to access any leg of the intersection during the pedestrian only phase.

The North Sydney Integrated Transport Program (the North Sydney Program) is a multi-agency collaboration between Transport for NSW, North Sydney Council, Greater Sydney Commission and the Government Architect of NSW, to guide future integrated transport planning and investment in

the North Sydney CBD and interconnected areas, as described in Section A4.1.3 of this submissions report. Led by Transport for NSW, it aims to deliver a shared place-based vision for the North Sydney CBD. The development of the North Sydney Program is ongoing and as part of the collaboration, the Western Harbour Tunnel and Warringah Freeway project will ensure opportunities for a future integrated and multi-modal transport network in the area.

Transport for NSW will continue to work closely with North Sydney Council and other key stakeholders through agreed governance structures to investigate options to improve movement and place outcomes within North Sydney, further leveraging the strategic benefits of the program of works.

The project does not propose any noise barriers along Amherst Street. Noise barriers nearby would be located along Warringah Freeway and along the slip road leading to Amherst Street. These noise walls would reduce operational noise impacts associated with traffic along Warringah Freeway and would not cut off any residents from the rest of Cammeray.

## C21.7 Recreational activities

### *Issue raised*

Submitters raised concerns over impacts to recreational activities during both construction and operation of the project. Specific queries, comments and concerns include:

- Concern over potential restrictions on water-based activities, such as sailing and swimming, during construction activities on the harbour
- Concern over loss of access to land and water around Berrys Bay during construction and the impact of this on local people who use the foreshore area and have boats moored nearby
- Concern over the impact on community facilities such as the netball/basketball courts on the southern side of the Greens Bowling Club
- Concern over the impact to local recreational activities such "Parkrun", a local, free community run which currently operates at in St Leonards Park, North Sydney and Flat Rock Creek Park in Willoughby
- Concern that the project would disrupt school sporting activities due to loss of green space and sporting facilities during construction
- Concern that there would be loss of the Park Avenue tennis courts and other facilities at Cammeray Park which would impact local clubs that operate within the park. Request that full restoration of the park occur after the project has been completed
- Request for an extension of Artarmon Park over the motorway to improve recreation space in West Artarmon.

### *Response*

The inner harbour (between Birchgrove and Waverton) would not be closed to community groups and clubs other than during the placement of the immersed tube tunnel. Typically the immersion process for each of the tube tunnel would take between 24 and 48 hours. Sailing clubs impacted by the proposed works would be consulted and encouraged to alter sail racing courses that would be impacted by the works. Harbour closure scheduling will be carried out in consultation with Port Authority of NSW, other divisions of Transport for NSW and other relevant stakeholders, in accordance with environmental management measure CTT17 (refer to Table D2-1 of this submissions report).

The Berrys Bay construction support site (WHT7) would be located on NSW Government-owned land that is zoned for working waterfront uses for about four years. This would not preclude the long term use of the area for public open space and/or working waterfront activities. About 10 swing-

moorings in the vicinity of the Berrys Bay construction support site (WHT7) would be temporarily relocated to provide safe access to and from the site. Moorings impacted during construction will be relocated elsewhere in Sydney Harbour in consultation with the lease holders, in accordance with environmental management measure CTT2 (refer to Table D2-1 of this submissions report). All efforts will be made to relocate mooring facilities as close to their original locations as possible (refer to environmental management measure LP4 in Table D2-1 of this submissions report).

The Ridge Street north construction support site (WHT9) would temporarily occupy the south eastern portion of St Leonards Park between the North Sydney Bowling Club (The Greens) and the Warringah Freeway corridor. The adjoining netball/basketball courts would not be directly impacted and would remain operational during construction.

Transport for NSW recognises that communities in the project area host a variety of local events, including sports, festivals, exhibitions and markets. Ongoing engagement will be carried out with managers of social infrastructure located near to surface construction works/construction support sites and sensitive social infrastructure above the tunnel alignment (for example, schools, places of worship, aged care, child care, health and medical facilities) about the timing and duration of construction works and management of potential impacts, in accordance with environmental management measure SE3 (refer to Table D2-1 of this submissions report). Transport for NSW is committed to continuing to work closely with local councils, sporting facilities and clubs, and cultural organisations to minimise the project's impacts on cultural and sporting events.

The adjoining Cammeray Park sports ground, tennis club, croquet club and skate park would remain operational during construction and would not be directly impacted during construction or operation, as outlined in Chapter 20 (Property and land use) of the environmental impact statement.

Extension of Artarmon Park over the Gore Hill Freeway is outside the scope of the project.

## C21.8 Loss of green space

***Issue raised***

Submitters raised concerns over loss of green space. Specific queries, comments and concerns include:

- Concern over the loss of green space, both permanently and temporarily during construction, particularly during the COVID-19 pandemic. Green spaces are vital to the well-being of the community and the project should be looking to preserve, restore and develop additional and improved green spaces for the benefit of the community
- Concern over the lack detail in the environmental impact statement for returning construction sites to the community. Request further details on plans and funding regarding how construction areas would be remediated once the construction is over
- Loss of open green spaces and trees would negatively impact both the physical and mental wellbeing of the community.
- Concern over loss of green space near Merlin Street construction support site (WFU7) and ANZAC Park, which are used by local families
- The project would undo years of work by Bushcare regeneration programs to restore Naremburn bushland.

***Response***

Transport for NSW recognises that parks and open space areas play an essential role in the health and wellbeing of the neighbouring communities. Given the limited availability of space in the project area and the desire to minimise acquisition of private property, some public land, including public recreation areas, would be required to facilitate construction of the project, resulting in the

temporary occupation or permanent acquisition of public land, as described in Chapter 20 (Land use and property) of the environmental impact statement.

The following public open space areas would be temporarily impacted during construction:

- Yurulbin Park, Birchgrove
- Rose Avenue Reserve, Neutral Bay
- St Leonards Park, North Sydney
- ANZAC Park, North Sydney
- Cammeray Golf Course
- Merlin Street Reserve.

Alternate green spaces are available in the project area and are accessible by the community, and so the potential effects on community wellbeing associated with the temporary use of parks and open space areas during construction is considered to be minimal. For example, current users of Merlin Street Reserve could potentially relocate activities to Forsyth Park.

The majority of open space used for construction of the project would not be required to operate the project and would be rehabilitated and returned to an equivalent state. Land subject to temporary use, including areas of public open space, will be rehabilitated as soon as practicable to an appropriate land use, taking into consideration the location, land use characteristics, area and adjacent land uses (refer to environmental management measure LP2 in Table D2-1 of this submissions report). These rehabilitation and landscaping works would be designed and implemented with the aim of enhancing local amenity and public recreational values where possible and would be carried out in consultation with the relevant council and/or landowner. In these areas, the project would not have any ongoing impact on the use of land for public recreation purposes.

Further discussion on rehabilitation of construction support sites is provided in Section C6.3.4 of this submissions report. Removal of trees is discussed in further detail in Section C22.1 of this submissions report. Vegetation will be re-established within the project footprint where feasible, and trees removed by the project will be replaced at a ratio equal to or greater than 1:1, as per environmental management measure B4 (refer to Table D2-1 of this submissions report).

Loss of open space and urban design are considered in further detail in Section A4.1.8 and C20.1 of this submissions report. Transport for NSW has identified a number of opportunities for additional public open space that is being considered in the design and are discussed in Section A4.1.8 of this submissions report, there may be additional other opportunities to increase public open space which would be investigated during further design development.

While the project would impact areas of roadside vegetation within or near to Naremburn due to construction works in the Warringah Freeway, it is not anticipated to impact Bushcare sites in Naremburn.

NSW GOVERNMENT

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C22 – Urban design and visual amenity

SEPTEMBER 2020

# C22 Urban design and visual amenity

## Contents

## C22.1 Removal of trees

### *Issue raised*

Submitters raised concerns over the impact on visual amenity due to loss of green space and trees. Specific queries, comments and concerns include:

- Concern over impacts to Yurulbin Point due to loss of greenspace and removal of trees, including two old Moreton Bay Figs. Details requested on how many trees would be removed and any plans to replace them or rehabilitate the area
- Concern that removal of native trees, including a large gum around 30 metres tall, for the noise barrier in Amherst Street would have an impact on the amenity of the neighbourhood. Request to reconsider the length of the wall to retain all or some of these trees
- Opposition to the loss of Moreton Bay Fig trees at St Leonards Park, established trees in Alfred Street and Alfred Street North, and other trees along the Warringah Freeway. These are part of the character of the area and often provide a visual buffer for residents close to the Warringah Freeway
- Opposition to removal of large, established native trees for the Rosalind Street East construction support site (WFU9). Suggestion that the construction support site be re-located to either the eastern end of ANZAC Park, or to the strip of land to the north of the Miller Street off-ramp (between the Warringah Freeway and the Miller Street off-ramp) to preserve the established native trees and provide a buffer for residents in Rosalind Street East
- Opposition to the loss of mature trees in Rose Avenue Park. The trees form a visual barrier to the freeway and the environmental impact statement is unclear why this needs to be permanently acquired. Request for further details regarding the future of this park
- Objection to loss of trees from ANZAC Park as this is an important visual buffer between local schools and the Warringah Freeway
- Concern over impacts on urban heating due to the removal of trees and the addition of concrete surfaces
- Request for further information regarding plans and funding for returning construction sites to the community
- Request that where replacement planting is proposed, mature trees are used rather than saplings.

### *Response*

Appendix W (Technical working paper: Arboricultural impact assessment) provides a precise assessment of tree removal across the project. Transport for NSW is committed to offsetting vegetation removed as part of the project, resulting in no net loss of vegetation, as discussed in further detail below.

<u>Yurulbin Park</u>

The design of the project works at Yurulbin Park have been developed in consultation with Mr 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 28 mature trees would be directly impacted (removed) but areas of exclusion have been identified and replacement plantings will be provided on completion as part of the redesign (refer to environmental management measure V11 in Table D2-1 of this submissions report).

The project would not require the removal of any of the Moreton Bay Figs within Yurulbin Park. Tunnelling depth at this location is 42 metres, which is unlikely to impact on tree roots. Of the 28

trees to be removed, two have been identified as having a high retention value (*Eucalyptus saligna* and *Eucalyptus botryoides*), seven have a medium retention value, and the remaining trees are categorised as having a low retention value (based on significance and useful life expectancy). Trees adjacent to works will be retained and protected where possible, as per environmental management measure V8 and V9 (refer to Table D2-1 of this submissions report). If trees are to be impacted, they will be trimmed rather than removed where possible. An initial landscape design showing the rehabilitated Yurulbin Park post-construction, is provided in Figure 5.8 of Appendix V (Technical working paper: Urban design, landscape character and visual impact assessment).

Removal of established trees

The retention of trees has been a major consideration in the design of the noise barrier near Amherst Street at Cammeray and the noise barrier would not require the removal of any mature eucalypt trees. Some tree removal may however be unavoidable in this area. Noise mitigation options (including noise barriers) will be reviewed and confirmed as part of the further design development (as outlined in Chapter 11 (Operational noise and vibration) of the environmental impact statement), taking into consideration community preferences and the retention of vegetation (refer to environmental management measure V8 in Table D2-1 of this submissions report).

Some tree removal would be necessary at St Leonards Park (including a Port Jackson Fig (*Ficus rubiginosa*)). It is not proposed to remove any Moreton Bay Fig trees at St Leonards Park. Some tree removal would also be necessary at Alfred Street North (including a Moreton Bay Fig (*Ficus macrophylla*) and a Chinese banyan (*Ficus microcarpa)* of low retention value), and elsewhere along the Warringah Freeway. The contribution of existing trees to the landscape character of the area is acknowledged, however it is envisaged that landscape plantings associated with the project will enable these landscape values to be maintained (refer to environmental management measure V11 in Table D2-1 of this submissions report).

A new noise barrier is proposed to be constructed at the Rosalind Street east construction support site (WFU9) within the Warringah Freeway corridor at Cammeray and as such the existing trees at the site would be removed. Once construction is complete, as per environmental management measure V11 (refer to Table D2-1 of this submissions report) replacement planting will be carried out, providing a visual buffer to replace the one created by the existing trees at this location. Relocating the site to the northern side of the Miller Street off-ramp or to ANZAC Park would have similar or greater landscape impact. Further the site on the northern side of the Miller Street off-ramp is not suitable for use as a construction support site due to its size and change in height compared to the Warringah Freeway.

The project would not require the removal of any vegetation from within the small park at Rose Avenue, North Sydney. However, there is a potential impact to a small number of trees adjacent to Rose Avenue. Construction works on Rose Avenue would include some minor kerb adjustments. The park may also be used for parking temporarily during construction. Following completion of construction, as per environmental management measure V10 (refer to Table D2-1 of this submissions report), the park will be restored to existing condition or in accordance with the urban design and landscape plan where applicable (environmental management measure V12).

Construction at ANZAC Park would be required to augment the existing drainage network in the vicinity of the park to reduce flooding risk in this area. The removal of vegetation at ANZAC Park would be to facilitate these works. Replacement vegetation of an appropriate maturity would be planted, minimising the long-term landscape change. The temporary lease of this area during construction would not impact on the long term viability of the site, which would continue to be used for public recreation and open space.

Urban heating

Transport for NSW recognise that the urban heat island effect is an important issue to be addressed in the planning, design and construction of new infrastructure. The environmental impact statement includes a strategic urban design framework that provides for a range of initiatives that would contribute to the management of the urban heat island effect. The following objective is an important

part of the framework: *Embed sustainability considerations into the design and delivery of the project to minimise environmental social impacts while delivering positive economic outcomes for the people of NSW*. To achieve this objective, urban design requirements will include ensuring vegetation removal is further minimised (where possible), that vegetation and canopy removal is offset by replacement planting and that landscaping provides opportunities to ameliorate heat island effects. The urban design framework would be used to inform further design development.

Vegetation will be re-established within the project footprint where feasible, and trees removed by the project will be replaced at a ratio equal to or greater than 1:1, as per environmental management measure B4 (refer to Table D2-1 of this submissions report). Where replacement trees cannot be accommodated within the project footprint, locations outside the project footprint shall be identified for compensatory plantings. The replacement trees will comprise local native provenance species from the vegetation community that once occurred in the locality (rather than planting exotic or non-local native trees).

Construction support site rehabilitation

Information on the return of construction support sites to the community is provided in Chapter 20 (Land use and property) of the environmental impact statement, specifically Table 20-4. As per environmental management measure LP2 (refer to Table D2-1 of this submissions report), land temporarily used during construction such as parks and open space areas will be rehabilitated as soon as practicable to an appropriate land use taking into consideration the location, land use characteristics, area and adjacent land uses. This will be carried out in consultation with the relevant council and/or the land owner. An example of this is at Berrys Bay; the Berrys Bay construction support site (WHT7) would be located on NSW Government-owned land that is currently zoned for working waterfront uses. Once the project is completed, Transport for NSW would return the Berrys Bay area (approximately 15,800 square metres) as public open space. As part of this process, Transport for NSW and the Department of Planning, Industry and Environment would jointly establish a reference group, to include representation of key stakeholders, the community and independent experts, to support the development of the final layout.

Landscape plantings may in some cases involve the use of advanced stock (where an immediate visual impact or screen is particularly important). However, tubestock would outperform advanced stock in the long term and would generally be favoured for this reason. The most appropriate landscape plantings will be determined for each location during further design development.

## C22.2 Urban design

***Issue raised***

Submitters made the following comments and suggestions in regard to urban design:

- Request that *Beyond the Pavement* (Roads and Maritime Services, 2014b) be acknowledged to offer a level of assurance to the community that all associated land use impacts are being considered in line with internal Transport for NSW Urban Design policy, and are aspiring to be best practice, especially with regard to Water Sensitive Urban Design considerations
- Suggestion to use sandstone landscaping for external freeway retaining walls Alfred Street North to fit in with the extensive use of sandstone in the houses and exterior walls in the area
- Request for sympathetic design of the Alfred Street North overpass. Concerns regarding the visual impact of the concrete support columns shown in the environmental impact statement
- Request that pedestrian access and safe design/crime prevention features must be a part of the precinct around the proposed Alfred Street North overpass (or any alternative) and Falcon Street shared user bridge.

***Response***

Transport for NSW has developed a strategic urban design framework for the Western Harbour Tunnel and Warringah Freeway Upgrade project to inform the urban design and establish benchmarks for achieving a well-planned and integrated road alignment through a high-quality urban design response. The framework is provided in Appendix V (Technical working paper: Urban design, landscape character and visual impact assessment), and would be used to inform further design development.

The framework has been informed by numerous NSW Government policies including the urban design policy *Beyond the Pavement* (Roads and Maritime Services, 2014b) which helps set the urban design direction for road projects within NSW, defining project outcomes and the criteria for success; and *Better Placed* (NSW Government Architect, 2017), the NSW Government Architect's policy to provide direction for high quality design of the urban environment in NSW. Other Transport for NSW design and biodiversity guidelines, including the *Water sensitive urban design guideline: Applying water sensitive urban design principles to NSW transport projects* (Roads and Maritime Services, 2017), in addition to local government planning documents, such as local environmental plans and development control plans, have also been considered in the preparation of the urban design framework.

Section 3.3 "Project objectives" of Appendix V (Technical working paper: Urban design, landscape character and visual impact assessment) outlines the overall objectives for the project's Urban Design, Architecture and Landscape Design elements. These objectives align with the same principles in the design of the built environment set out by *Better Placed* and in particular the seven distinct objectives set out in *Aligning Movement and Place* (Government Architect NSW, 2019).

These include contextual, integrated, sustainable, durable, inclusive, connected, safe and functional design values and positive user experience which are embedded in the new elements within the Western Harbour Tunnel and Warringah Freeway Upgrade project objectives.

In line with the guideline documents, precincts have been assessed at a broader scale, and individual urban design elements and design requirements are outlined in Appendix V (Technical working paper: Urban design, landscape character and visual impact assessment) as follows:

- Section 3.4: Urban Elements - this section expands on the project objectives by outlining the individual infrastructure elements of the project and their specific urban design requirements
- Section 4: Precinct Assessment – this section outlines each precinct's context, urban design principles and existing landscape and urban design character.

In terms of the design outcomes, these principles would be followed moving on into development of the urban design and landscape plans in accordance with environmental management measure V12 (refer to Table D-2 of this submissions report). Environmental management measure WQ12 (refer to Table D2-1 of this submissions report) commits to the consideration of opportunities for water sensitive urban design during further design development for the new and upgraded road infrastructure, and also during development of the urban design and landscape plans.

The strategic urban design framework includes a range of urban design principles and requirements. This includes requirements to use materials that are sympathetic with the surrounding environment, including specific requirements regarding the design of retaining walls.

The design of bridge structures such as the Alfred Street North overpass would be subject to urban design input during detailed design and would be consistent with the requirements of the strategic urban design framework and *Bridge aesthetics* (Roads and Maritime Services, 2017).

Detailed urban design and landscape plans would be developed as part of the strategic urban design framework for the project (environmental management measure V12 in Table D2-1 of this submissions report).

Crime prevention through environmental design (CPTED) is a multi-disciplinary design approach that aims to find solutions that deter criminal behaviour and unsafe situations, specifically in an

urban environment. CPTED principles are fundamental to the project's strategic urban design framework and would be implemented wherever the project interfaces with the public domain. Specific CPTED principles would be further developed during future design development stages of the project. Bridges such as the proposed Alfred Street North overpass and Falcon Street shared user bridge, would follow the urban design requirements related to CPTED, including:

- Allowance for natural surveillance that keeps potential intruders under observation where feasible
- Tree species selection and landscape treatments that maximise clear sightlines within areas of high public use
- Design of public realm to be a clutter-free environment
- Effective lighting to public spaces that eliminates dark spaces
- Lighting that is consistent and of a lux level to enhance CCTV imagery and designed to Australian Standards
- The design of all public spaces to avoid blind/dark corners which may provide hiding or ambush spots
- Design which allows for easy maintenance to upkeep a high level of amenity that discourages unwanted behaviour.

## C22.3 Visual amenity – construction

***Issue raised***

Submitters raised concerns over the impact on visual amenity during construction. Specific concerns include:

- Concern that the storage of barges in Snails Bay would impact on the privacy of residents
- Concern over the visual impact for residents with views of the proposed sediment treatment site at White Bay
- Concern that the construction support sites located near the foreshore would impact on foreshore views
- Concern that the environmental impact statement did not properly identify the impact of night lighting from Victoria Road (WHT2), Yurulbin Point (WHT4), and Ridge Street (WHT9) construction support sites
- Concern that acoustic sheds would be visually unappealing. Submitters suggested a local group or school should be given the opportunity to apply a mural to any area visible to the public.

***Response***

There would be limited opportunity for activity associated with the storage of barges in Snails Bay to impact the privacy of nearby sensitive receivers. Barges would be consistent with the current mooring of boats within Snails Bay.

Chapter 22 (Urban design and visual amenity) of the environmental impact statement provides a summary of the results from the visual impact assessment, which adopts an objective and detailed approach that carefully considers the sensitivity of views and the magnitude of visual change. The visual impact for residents with views of White Bay and nearby foreshore areas were assessed as moderate to low during day-time hours. This is due to a potential increase in the number of truck and boat movements. However, while the sensitivity of these views is moderate, the magnitude of the impact is considered to be low because the nature and scale of the construction elements are not anticipated to be substantially different to those that currently exist (given White Bay's industrial

character). Night-time visual impacts are expected to be negligible. Impacts on the Yurulbin Park open space area are assessed as high due to the increase in built form on both water and land, combined with the removal of vegetation within the park itself. The landscape character of Sydney Harbour is expected to be moderately impacted during construction as a result of the temporary presence of additional built form by way of a floating docks and cofferdam structures within the harbour. Impacts to landscape character and visual amenity will be mitigated through environmental management measures V1 to V12 (refer to Table D2-1 of this submissions report).

The impacts of night lighting from construction site are described in Chapter 22 (Urban design and visual amenity) of the environmental impact statement. A broad assessment of the impact of night lighting during construction was carried out by determining the existing night time level of light (sensitivity of receivers) for each site and comparing that against the expected brightness of light generated by the project (magnitude of change).

The visual impact assessment included various construction support sites including Victoria Road (WHT2), Yurulbin Point (WHT4) and Ridge Street (WHT9) construction support sites. Any impacts at these sites will be managed in accordance with environmental management measure V5 (refer to Table D2-1 of this submissions report). Site lighting will be designed to minimise glare issues and light spillage into adjoining properties and be generally consistent with the requirements of Australian Standards and Guidelines 4282 – 1997 *Control of the obtrusive effects of outdoor lighting*.

Acoustic sheds are enclosed noise mitigation structures constructed over access declines or shafts that access the tunnel for construction. Any noisy works required to support out of hours tunnelling, including spoil handling, would take place within the acoustic shed, reducing impacts on nearby receivers. Acoustic sheds also minimise visual impacts to nearby sensitive receivers as they accommodate stockpiles and other construction materials within the shed. Acoustic sheds are generally constructed of dark coloured steel to minimise their visibility. Murals may be considered in some situations, but would need to consider whether the increased visibility that results from a mural is appropriate for the specific landscape setting.

## C22.4 Visual amenity – operation

***Issue raised***

Submitters raised concerns over the impact on visual amenity during operation. Specific queries, comments and concerns include:

- Concern that views to and from Yurulbin Park would be impacted due to the ventilation outlet
- Opposition to the height of ventilation outlets due to visual impacts. Statement that the environmental impact statement only includes a select number of viewpoints of the ventilation outlet and from a distance
- Clarification over width of ventilation outlet
- Disagreement with the moderate level of impact given to viewpoints 11 and 12 (North Sydney precinct) in the environmental impact statement due to tree removal
- Concern that the project, including removal of green space and mature trees would impact on the existing landscape, visual amenity and ‘leafy suburb’ feel of areas such as Cammeray
- Request that the motorway facilities are underground rather than above ground at Cammeray Park and Cammeray Golf Course to reduce noise and visual impacts, and open up additional green space

- Concern over the visual impact on residents from new infrastructure elements such as the Alfred Street overpass, Falcon Street shared user bridge, new on/off ramps and noise walls. Request that redesign be considered to reduce impacts to residents
- Query as to why alternate viewpoints were not selected to assess the Alfred Street North bridge
- Concern over the visual impact and overshadowing of residential areas due to the Warringah Freeway upgrade and query as to how these impacts would be mitigated
- Query as to how long-term visual impacts would be addressed for affected residents near portals at Rozelle
- Request that the Western Harbour Tunnel northbound off ramp portal be designed to minimise loss of views for users of St Leonards Park including the bowling greens and the club building
- Request that landscaping consider impacts to residents near the project and the landscaping is appropriately maintained
- Request that the project consider opportunities for greater connectivity and more green spaces. Suggestions include more shared bridges across the Warringah Freeway, landscaped areas along the edges of the new construction, and ensuring interfaces of the freeway with local streets are well considered by urban designers
- Request that a green overpass be considered for inclusion within the project.

***Response***

Ventilation outlets

The locations of ventilation outlets are described in Chapter 5 (Project description) of the environmental impact statement. There would be one outlet located at the Rozelle Interchange (the civil construction of which was approved as part of the M4-M5 Link project), and one located within the Warringah Freeway corridor to the north of Ernest Street, Cammeray. The ventilation outlets would not be visible from Yurulbin Park.

Appendix V (Technical working paper: Urban design, landscape character and visual impact assessment) acknowledges that the ventilation outlet within the Warringah Freeway corridor would be the most visible elements of the project with visibility above the tree line from several areas within the precinct, resulting in moderate to high visual impacts experienced by residential and public open space receivers nearby. The visual impact assessment provided in Appendix V (Technical working paper: Urban design, landscape character and visual impact assessment) evaluates a wide range of views of the ventilation outlet at Cammeray. Viewpoint locations were selected to capture representative views for the largest number of receivers. The visualisations correspond to these viewpoints and as such are at varying distances to the ventilation outlet.

While the specific dimensions of the ventilation outlet in Warringah Freeway would be determined during further design development, it can be expected that the footprint (including both Western Harbour Tunnel and Beaches Link outlet structures) would be around the size of a tennis court.

Viewpoints 11 and 12

The moderate visual impact rating for viewpoint 11 (Cammeray Avenue residential) and viewpoint 12 (Rosalind Street residential) in the operational phase of the project takes into account vegetation and trees removed during construction along the eastern boundary of Cammeray Avenue, and the boundary of Rosalind Street (respectively) that would increase visual exposure to the Warringah Freeway. Viewpoint 10 has a higher visual impact rating (moderate/high) due to both the removal of vegetation and trees along the eastern boundary of the park, which would increase the view to both the surrounding road corridor and the ventilation outlet.

Cammeray landscape character

The impacts on green spaces and the leafy character of Cammeray are assessed in the environmental impact statement with impacts in Cammeray ranging from moderate/high to high. The strategic urban design framework contained in Appendix V (Technical working paper: Urban design, landscape character and visual impact assessment) identifies a range of landscape treatments that would ensure that impacts on the landscape values of Cammeray are minimised. This would include:

- Providing landscape design that maximises an increase of vegetation improvements inside the project construction footprint where possible
- Reinstating vegetation where removed due to construction activity inside the construction footprint
- Providing median planting where possible to soften road infrastructure
- Retaining and protect vegetation along Warringah Freeway where possible
- Investigating measures to retain the mature trees of high retention value such as along the boundary of Cammeray Golf Course
- Providing screen planting to replace vegetation lost during construction at key locations
- Providing a landscape design that maximises an increase of tree canopy cover within Cammeray Park where feasible.

Motorway facilities

The location of the motorway facilities has been chosen to minimise impacts on the adjacent landscape. The design of the motorway facilities and ventilation outlet would be guided by the urban design objective to minimise the physical footprint and visual impact of these structures while ensuring they are designed as high quality pieces of well-integrated architecture. As noted in Appendix V (Technical working paper: Urban design, landscape character and visual impact assessment), the motorway facilities would developed as an integral component of the larger open space component. This means that the design of the motorway facilities at Cammeray Golf Course would respond to the landscape character of the area (Cammeray Park open space landscape character zone).

During design development, the option to locate motorway facility buildings underground at the Cammeray Golf Course was considered. Analysis of major construction and cost impacts associated with this option ultimately resulted in this option not being pursued. Further, while the alternate design would provide a superior urban design outcome by reducing permanent visual impacts, it provided negligible additional open space that was accessible by the community or usable by Cammeray Golf Course. This is because the land immediately above the below ground motorway facility buildings would be required for project infrastructure, along with maintenance access for the tunnel.

Warringah Freeway structures

The visual impact of the various proposed structures in the Warringah Freeway corridor is assessed in the environmental impact statement. These assessments, including the operational landscape character impact assessment in addition to assessment of representative viewpoints, included all operational infrastructure associated with the project including ancillary surface reconfigurations.

The visual impact of these structures are moderated by the fact that they would be located within the context of a major freeway, with large scale road infrastructure already dominating the views. Further design development of these structures would however aim to further minimise visual impacts, in particular considering the strategic urban design framework. The urban design requirements of the project have been informed by the urban design vision and objectives and encompass the requirements for the spatial and functional design of the urban and public domain, and the built elements of the project. The architectural treatments for surface connections and other

operational infrastructure would be guided by the urban design requirements and finalised during further design development of the project.

This would include:

- Ensuring further design development of bridges is in accordance with the information contained within *Bridge Aesthetics* (Roads and Maritime Services, 2019)
- Designing holistic, coherent and symmetrical road bridge structures considering the proportion of all elements of the structure
- Designing with smooth, clean lines and a minimum structural depth that is consistent with bridge spans and method of construction
- Designing a slender, symmetrical, visually uncluttered and well-ordered profile that incorporates additional elements such as protection screens, barriers, lighting elements and fencing as part of the overall elevation composition
- Designing a strong, horizontal form with visual emphasis of concrete retaining structures associated with the road bridge
- Minimising traffic signage and apply this strategy consistently to all bridges
- Designing bridge upgrades to complement existing bridge design language.

Selection of viewpoints

Representative viewpoints with the potential to be visually impacted by elements of the project were identified objectively for further analysis. Viewpoints were selected to show:

- A range of receptor types including public and private domain views (including residents, motorists and users of public open space)
- A range of view types including elevated, panoramic and filtered views
- A range of viewing distance from the project
- Key or protected views identified in planning documents.

The Alfred Street North bridge is depicted in Viewpoint 27. Viewpoint 27 is an illustration of the worst case scenario, at close proximity to the road traffic and adjacent residences (sensitive receivers). It is unlikely that further visualisations or assessment from Kurraba Road would identify any ‘major’ impacts due to the following:

- Views from Kurraba Road are limited to pedestrians walking towards Alfred Street North (not traffic as one-way)
- The views of the overpass are not in the direction of houses (orientated north-south).

Views from Anderson and Warringa Parks would be negligible due to the distance from the overpass and intervening housing, vegetation and topography.

Tunnel portals

The long-term operational visual amenity impacts in Rozelle are described in Chapter 22 (Urban design and visual amenity) of the environmental impact statement. The assessment concluded that the impacts would be negligible, including during both day-time and night-time hours, with project components being consistent with that of the existing environment. This has taken into consideration the cumulative landscape character and visual amenity impacts at Rozelle associated with the Rozelle Interchange (constructed as part of the M4-M5 Link project).

Operational elements at Rozelle would be developed in accordance with strategic urban design framework contained in Appendix V (Technical working paper: Urban design, landscape character and visual impact assessment). Further enhancement of the landscape at Rozelle would be

associated with the new open space areas being created above the Rozelle Interchange which are being developed as part of the M4-M5 Link project.

The location of the Western Harbour Tunnel northbound off ramp portal is shown in Chapter 5 (Project description) of the environmental impact statement. The portal would not result in any loss of views for users of St Leonards Park. Land within the part used for construction will be returned to public use once construction is complete (refer to environmental management measure LP2 in Table D2-1 of this submissions report).

Landscaping

The impact and benefit to adjacent residents would be an important part of the detailed design of landscape plantings. Trees adjacent to works will be retained and protected where possible, as per environmental management measure V8 and V9 (refer to Table D2-1 of this submissions report). If trees are to be impacted, they will be trimmed rather than removed where possible. Early planting works will be considered to provide a screening buffer that has time to mature before the project is fully operational, as per environmental management measure V11 (refer to Table D2-1 of this submissions report). As identified in Appendix V (Technical working paper: Urban design, landscape character and visual impact assessment) the use of native species in landscaping would ensure that maintenance and irrigation requirements are kept to a minimum.

Land bridge

The design for the Warringah Freeway Upgrade includes a new land bridge, north of the existing Ernest Street overpass. The proposed land bridge would be around 10 metres wide and accommodate new shared user paths and planting – improving connectivity and amenity for pedestrians and cyclists traveling across the Warringah Freeway corridor. This would add around 1800 square metres of public open space to the project and includes seating, improved pathways, lookouts, lighting, and landscaping that connects to the adjacent public space. Further information on the Ernest Street shared user bridge is included in Appendix V (Technical working paper: Urban design, landscape character and visual impact assessment).

During development of the design, Transport for NSW considered several concepts to expand the land bridge proposed at Ernest Street. While the alternate land bridge design would improve urban design outcomes by reducing permanent visual impacts associated with the Western Harbour Tunnel and Beaches Link motorway facilities and increasing public open space, the construction impacts and cost of delivering this alternative would be significant. For this reason, it was decided not to proceed with this option. Further detail on the benefits and impacts of an expanded land bridge are provided in Section B14.20.5 of this submissions report.

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C23 – Hazards and risk

SEPTEMBER 2020

# C23 Hazards and risks

## Contents

# C23.1 Dangerous goods

## C23.1.1 Storage of dangerous goods

### *Issue raised*

Submitters raised concerns over dangerous goods being stored in proximity to residential areas and schools. Specific queries, concerns and comments included:

- Concerns that sites close to homes and parks/sporting facilities would be used for storage of potentially dangerous items
- Request there to be no storage of dangerous goods at construction sites.

### *Response*

Chapter 23 (Hazards and risks) of the environmental impact statement provides an overview of how dangerous goods would be stored and handled during construction.

As stated in Section 23.2.1 of the environmental impact statement, *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development* (SEPP 33) does not apply to the project however, the principles of SEPP 33 have been followed to consider potential hazards associated with the project. The screening thresholds specified in *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33* (Department of Planning, 2011) have been applied to inventories of dangerous goods to be stored at each construction support site. The thresholds represent the level which goods may present a credible off-site risk, requiring further assessment. The inventory thresholds would not be exceeded for any material on any site (refer to Table 23-2 of the environmental impact statement). The storage and use of dangerous goods and hazardous materials on the project construction support sites would therefore not pose an unacceptable risk of harm beyond the construction support site boundary.

Storage of dangerous goods and hazardous substances will be in accordance with the supplier's instructions, and will comply with applicable legislation, guidelines and Australian Standards, as per environmental management measure HR1 (refer to Table D2-1 of this submissions report). Storage areas will be located in cleared and otherwise disturbed areas away from residential areas where feasible and reasonable, in accordance with environmental management measure V2 (refer to Table D2-1 of this submissions report). An incident response plan would also be developed and incorporated into the construction environmental management plan, as outlined in Section D1 of this submissions report.

The design of the project has included careful consideration of the construction methodology and selection of materials and resources to ensure fitness for purpose and minimise resource consumption, as discussed in Chapter 24 (Resource use and waste management) of the environmental impact statement. Where possible, resource consumption would be further minimised during construction in accordance with the resource management hierarchy of the *Waste Avoidance and Resource Recovery Act 2001*.

Managed in accordance with the measures in Table D2-1 of this submissions report, these materials would not pose a substantial risk to the general public during construction of the project.

## C23.1.2 Transportation of dangerous goods

### *Issue raised*

Submitters raised concerns over the transportation of explosives.

### *Response*

Table 23-3 of the environmental impact statement states that the transportation of explosives would only be done as required if blasting is carried out. The transport of dangerous goods along local

roads would be avoided where possible, as noted in Section 23.2.2 of the environmental impact statement.

As required by environmental management measure HR2 (refer to Table D2-1 of this submissions report), explosives will be transported in accordance with relevant legislation, codes and Australian Standards, including *NSW Explosives Act*, *Work Health and Safety Act 2011* and *Australian Code for the Transport of Dangerous Goods by Road and Rail (7th edition)* (National Transport Commission, 2007).

Further, a Blast Management Strategy will be developed for the project in accordance with environmental management measure CNV9. This will detail transport, storage and handling arrangements for explosive materials. Environmental management measures are listed in Table D2-1 of this submissions report.

## C23.2 Settlement risk

***Issue raised***

Submitters raised concerns over risks associated with settlement, including:

- The collapse of tunnels under the Balmain peninsula that are linked to historic natural gas and coal mining activities
- The risk of a collapse similar to what happened with the Lane Cove Tunnel project.

***Response***

Balmain peninsula mine tunnels

The presence of tunnels and shafts from the former (Balmain) Birchgrove Colliery in the vicinity of the tunnel alignment is acknowledged by Transport for NSW. Investigations to date suggest that there would be no shafts directly in the alignment. This would be confirmed during further design development. The maximum predicted settlement at the (Balmain) Birchgrove Colliery site, as identified in Figure 16-7 of the environmental impact statement, would be between zero millimetres at the western side to 10 millimetres at the eastern side and closer to the tunnel alignment.

Risk of collapse

The project tunnels would generally be excavated in good quality Hawkesbury Sandstone. A number of major design and construction method reviews have been carried out to better understand the Lane Cove Tunnel collapse in 2005. Consequently, the risks of a similar incident occurring during a Sydney tunnelling project are extremely low. The reasons for this include:

- Vastly improved geotechnical assessment and modelling
- Improved predictive two dimensional and three dimensional modelling of geology, excavation spans, temporary and permanent loads
- Fit for purpose design to develop the appropriate type of ‘support’ to match the ground conditions as the excavation progresses on a day to day basis
- Continuous independent review of the temporary and permanent works design and construction methods
- Continual construction verification that tunnel support is installed and performing as per the design
- Robust change management processes for conditions that are out of the ordinary or unexpected, including probe drilling and ground treatment through suspected poor ground zones

- Continuous assessment of likely excavation and groundwater conditions
- Detailed survey monitoring of surface roads, buildings and structures in the tunnel vicinity.

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C24 – Resource use and waste management

SEPTEMBER 2020

# C24 Resource use and waste management

## Contents

# C24.1 Resource use

## C24.1.1 Fill material

### *Issue raised*

Submitters raised concerns that the source of fill material, and in particular the source of material to be used for backfill/infill after trenching and installation of the immersed tube tunnel, is not stated in Chapter 5 (Project description) of the environmental impact statement.

### *Response*

Backfill material would be sourced from a variety of areas and specific sources would be determined prior to the commencement of construction. The material proposed to be used to backfill the immersed tube tunnels would comply with relevant engineering and environmental requirements and obligations.

## C24.1.2 Water use and wastewater

### *Issue raised*

Submitters raised concerns over the amount of water required during construction of the project and the management of wastewater generated by the project. Comments and concerns included:

- Concerns about the amount of water (200,000 litres) to be used each day in connection with the project
- Request for further information than provided in Table 24-5 on the proposed treatment and discharge of wastewater. Specifically, what would happen in the event of a breakdown of the plant and would untreated water be discharged, and what are the proposed operational protocols should the treatment plant not be able to operate such as during flood events
- Following the removal of the stormwater harvesting scheme at the Cammeray Golf Course, a better solution for irrigating the playing fields and parks is needed than using water sourced from the drinking water supply. If potable water is used for the estimated five plus years during the construction phase North Sydney Council will have to pass the cost of the increase in water rates onto rate payers. Any costs involved in disrupting then restoring Council's infrastructure should be borne by the project.

### *Response*

<u>Average water demand</u>

Section 24.3.1 of the environmental impact statement outlines water use for construction of the project. The average total water demand during construction is estimated to be 1327 kilolitres per day. About 837 kilolitres per day would be sourced from mains supply (potable water) with the remainder coming from treated wastewater from the project wastewater treatment plants or harvested rainwater (non-potable water). Measures to avoid and minimise water consumption, particularly of potable water, have been included in the design and construction planning for the project. Examples of these measures include:

- Use of dust extraction and ventilation systems to control dust in tunnels during construction to minimise the use of water as a dust suppressant
- Capture, treatment and use of wastewater and rain water at construction sites to minimise the use of potable water during construction
- Water for construction of the project would be sourced according to the following hierarchy, where feasible and reasonable, and where water quality and volume requirements are met:
  - Stormwater harvesting (non-potable water)

- On-site construction water treatment and reuse, including groundwater (non-potable water)
- Mains supply (potable water).

Opportunities for treated wastewater reuse would be investigated and pursued where feasible and reasonable, and subject to meeting water reuse quality requirements. Options for wastewater reuse may include on-site reuse, such as dust suppression or toilet flushing.

Wastewater treatment and discharge

Temporary construction wastewater treatment plants would generally consist of settling tanks/ponds, flocculation tanks (which bind small particles suspended in the water together to make them easier to remove) and filtration. The temporary construction wastewater treatment plants would be designed to treat wastewater generated from tunnel groundwater ingress, rainfall runoff in tunnel portals, heat and dust suppression water and washdown runoff generated in the tunnel during construction.

Section 17.4.3 of the environmental impact statement discusses the treatment of water during construction of the project.

As noted in Section A3.3.4 and Section B1.2 of this submissions report, the environmental impact statement proposed to discharge to site-specific trigger values developed to represent background concentrations of a suitable reference site or the ANZG (2018) guidelines. In the absence of suitable reference site data to develop site-specific trigger values, it is proposed to treat the construction wastewater at wastewater treatment plants located along the project alignment to a quality that meets the ANZG (2018).

Construction discharges from the project would be subject to an Environment Protection Licence issued by the NSW Environment Protection Authority and any breach of licence conditions would be subject to regulation under the *Protection of the Environment Operations Act 1997* (NSW), as identified in Section 2.2.1 of the environmental impact statement. This Environment Protection Licence would apply to both wet and dry weather, flood events and in the event of wastewater treatment plant breakdowns. Various options may be applied in the event of a plant breakdown, depending on the situation. These options could include temporary cessation of pumping, holding of water on site until repairs are complete or use of water tankers to dispose of wastewater offsite at a licenced disposal facility. Further details on management of water treatment plants would be included in the construction environmental management plan. In accordance with environmental management measure WQ5 (refer to Table D2-1 of this submissions report), further design development will confirm if additional mitigation measures such as storage detention to control water outflow during wet weather events would be required.

During operation, the permanent wastewater treatment plant at Rozelle would be designed to treat wastewater generated from tunnel groundwater ingress and rainfall runoff in tunnel portals to meet specific discharge criteria as per ANZG (2018) as stated in environmental management measure WQ9 (refer to Table D2-1 of this submissions report). Should any of the criteria be exceeded, for example as a result of wastewater treatment plant malfunction or breakdown, a management response will be triggered. The management response will be documented within the Water Quality Monitoring Program.

Treated wastewater use

Environmental management measure WM5 (refer to Table D2-1 of this submissions report) commits to investigate off-site opportunities for wastewater reuse and recycling.

Cammeray Golf Course stormwater harvesting scheme

The existing storage dam at Cammeray Golf Club for the North Sydney stormwater harvesting scheme would be directly impacted and replaced as part of the project. As discussed in Chapter 5 (Project description) of the environmental impact statement, an indicative location for the replacement basin was identified, however this is subject to further consultation with North Sydney

Council and Cammeray Golf Club in accordance with environmental management measure WQ8 (refer to Table D2-1 of this submissions report). Further discussion is provided in Section B14.16 of this submissions report.

## C24.2 Waste generation and reuse

### C24.2.1 Spoil generation and disposal

***Issue raised***

Submitters raised concerns over the amounts of general waste that would be generated by the construction of the project and the amount of contaminated waste to be disposed of at the offshore sea disposal location. Submitters were concerned about the period of time that disposal at sea would go on for, the safety of offshore disposal and the impact on the environment.

A number of submitters also expressed concern about the amount of spoil generated by the proposed tunnelling method.

***Response***

General waste generation

Table 24-3 of the environmental impact statement summarises indicative solid and liquid waste streams that would be generated during construction, including examples of these waste streams, estimated waste stream quantities and anticipated waste classifications. These waste streams are typical of construction and demolition activities and can be adequately managed with the implementation of the environmental management measures included in Table D2-1 of this submissions report. The contractor would revise the estimates provided and follow the *Waste Avoidance and Resource Recovery Act 2001* to ensure generated waste is minimised. A waste management plan would be prepared as part of the construction environmental management plan and would provide detail on the management of spoil and waste disposal during construction.

Offshore disposal

In accordance with environmental management measure SG15 (refer to Table D2-1 of this submissions report), the appropriateness of offshore disposal will be assessed in accordance with the *National Assessment Guidelines for Dredging* (Department of Environment, Water, Heritage and the Arts, 2009). Offshore disposal will only be appropriate for material that meets the criteria set out in the guidelines.

As required under the *Environment Protection (Sea Dumping) Act 1981* (refer to Section 2.2.2 of the environmental impact statement), an offshore disposal permit application for potentially suitable materials for offshore disposal has already been submitted to Commonwealth Department of Agriculture, Water and the Environment for review. Included within this application is a detailed assessment of the potentially suitable sediments and impact analysis of the disposal activities.

Material that is deemed suitable for offshore disposal, and for which a permit has been issued under the *Environment Protection (Sea Dumping) Act 1981*, would be taken by barge to the designated offshore disposal site for unconfined sea disposal. The designated offshore disposal site is be located about 10 to 15 kilometres east of Sydney Heads and is be regulated by the *Environment Protection (Sea Dumping) Act 1981* and the Commonwealth Department of Agriculture, Water and the Environment.

The indicative program for construction activities is presented in Table 6-3 of the environmental impact statement. While construction of the immersed tube tunnel would continue for about four years, dredging for the harbour crossing would occur for only around 12 months within this period. Movements to and from the offshore disposal location would be limited to the period during which dredge material is being produced. Discussion on the potential impacts associated with barge movements to navigational channels that lead to Sydney Heads, and loading activities at

construction support sites are considered in Chapter 8 (Construction traffic and transport) and Chapter 10 (Construction noise and vibration) of the environmental impact statement.

Tunnelling waste generation

The roadheader tunnelling method was selected as the preferred method in part due to the significantly lower spoil volumes generated in comparison to the alternative tunnel boring technique. The use of roadheaders reduces spoil generation due to the ability to cut an exact cross section. Tunnel boring machines, require significant over excavation due to their size and circular cross section resulting in increased spoil volumes for the rock tunnelling and associated heavy vehicle hauling or barging and disposal, as well as a need to backfill within the tunnel to build the road level back up. Figure 4-12 of the environmental impact statement illustrates the comparison between the tunnelling methods.

Section 4.5.1 of the environmental impact statement outlines the various technical and environmental factors considered in the selection of tunnelling methods.

As noted in Section 4.4.3 of the environmental impact statement, the preferred corridor has the shortest harbour crossing, minimising the quantity of dredged material to be treated and disposed of offsite.

### C24.2.2 Reuse

***Issue raised***

Submitters raised the following queries, concerns and comments in regard to the reuse of materials:

- The environmental impact statement stated that contaminated water may be reused for dust suppression and wheel washing. Submitters commented that it would not be acceptable to irrigate using contaminated water without an environmental assessment of what is being irrigated and where. The use of contaminated water for “other uses” needs to be subject to regulation
- Suggestions that the excess tunnel spoil could be beneficially reused at other locations
- A number of submitters objected to 200,000 litres of water being released into Willoughby Creek each day instead of filtering it for reuse.

***Response***

Treated wastewater reuse

The project construction wastewater treatment plants would treat wastewater to a level that is representative of background concentrations at the receiving environment. As stated in Section 17.4 of the environmental impact statement, some of the treated wastewater would be utilised for non-potable water uses such as roadheader supply, dust suppression, plant wash-down and rock bolting.

Construction discharges from the project would be subject to an Environment Protection Licence issued by the NSW Environment Protection Authority and any breach of licence conditions would be subject to regulation under the *Protection of the Environment Operations Act 1997* (NSW), as identified in Section 2.2.1 of the environmental impact statement. This licence would prescribe water quality criteria to be met prior to reuse. There would be no reuse of contaminated water by the project.

Spoil reuse

The final destination for excess spoil from construction of the project would be confirmed by the contractor prior to construction commencing. A range of sites within the Sydney basin have been identified in Section 23.3.3 of the environmental impact statement that require fill material. Additional sites may become available prior to the commencement of construction.

Willoughby Creek treated wastewater discharges

As noted in the water balance presented in Section 17.4.5 of the environmental impact statement, there would be an opportunity to reuse 84 kilolitres of treated wastewater per day from the Cammeray Golf Course wastewater treatment plant. However, as treated wastewater volume generation would be greater than the amount that can be reused on-site, water must be discharged from the Cammeray Golf Course wastewater treatment plant into Willoughby Creek. This volume is estimated to be 196 kilolitres per day on average. The treated wastewater discharged into Willoughby Creek will be required to meet ANZECC/ARMCANZ, 2000, ANZG (2018) as stated in environmental management measure WQ3 (refer to Table D2-1 of this submissions report).

Additional treated wastewater reuse opportunities would be further investigated during design development and construction planning, in accordance with environmental management measure WM5 (refer to Table D2-1 of this submissions report).

## C24.3 Handling, transport and storage

### C24.3.1 Storage of spoil and waste

***Issue raised***

Submitters have raised concerns over the storage of spoil and waste during construction of the project, including:

- Objection to waste being stored outside acoustic sheds, including contaminated wastes and acid sulfate soils, due to possible pollution of the local air via dust
- Request that stockpiles be stored in enclosures, or other proposed controls implemented to manage odour and air quality from potentially contaminated sediments
- Request that no stockpiling be allowed at Cammeray Golf Course due to risk associated with contamination
- The probable storage of materials and equipment on parkland at the harbour's edge including Yurulbin Park.

***Response***

Stockpiling and storage of contaminated waste

Section 24.3 outlines the assessment of potential construction impacts relating to the storage of spoil and waste.

Spoil from tunnelling works would be transported from the tunnel face to the surface using dump trucks. Where required, tunnel spoil stockpiles would be largely contained within acoustic sheds. Other earthworks such as those required for surface road works, cut-and-cover tunnels and trough structures may require the stockpiling of material on site if the material cannot be loaded directly into trucks. These stockpiles (for example, stockpiles at the Cammeray Golf Course construction support site (WHT10)) would be located outside of acoustic sheds; however, appropriate measures, including bunding, would be in place to avoid potential impacts associated with runoff and sedimentation.

Contingency measures would be implemented to manage unexpected waste volumes and types of waste materials generated from the construction of the project (refer to Section 24.6.1 of the environmental impact statement). Suitable areas would be identified, where feasible, to allow for contingency management of unexpected waste materials, including contaminated materials. These areas would be hardstand or lined areas that are appropriately stabilised and bunded, with sufficient area for stockpile storage and segregation. Stockpiles would be managed appropriately to avoid potential impacts associated with runoff and sedimentation.

Section 24.5 of the environmental impact statement outlines the management measures relating to storage of wastes. Wastes would be appropriately stored and handled according to their waste classification and in a manner that prevents pollution of the surrounding environment, in accordance with environmental management measures WM4 and WM7 (refer to Table D2-1 of this submissions report). Waste would be managed and disposed of in accordance with relevant applicable legislation, policies and guidelines, including the *Waste Avoidance and Resource Recovery Act 2001* and the *NSW Waste Avoidance and Resource Recovery Strategy 2014–21* (NSW Environment Protection Authority, 2014b).

Stockpiling requirements would be included within the construction waste management plan as required by environmental management measure SG10 (refer to Table D2-1 of this submissions report). The construction waste management plan would be prepared accordance with the requirements of the *Protection of the Environment Operations Act 1997* (NSW) and the Protection of the Environment Operations (Waste) Regulation 2014 (NSW) which mandates specific controls for the handling, transportation and disposal of contaminated materials. Further detail on the management plans that would form part of the construction environmental management plan are included in Section D1 of this submissions report.

A detailed discussion around concerns relating to air quality and dust impacts is provided in Section C12 of this submissions report.

Storage of materials and equipment on parkland

Table 6-15 and Figure 6-29 of the environmental impact statement detail the key features of the Yurulbin construction support site (WHT4). All excavated material from tunnelling activities would be loaded into an enclosed shed and would be transported by barge to the White Bay construction support site (WHT3) for storage ahead of removal from site. The White Bay construction support site (WHT3) would also store a majority of the plant and equipment required for the Yurulbin construction support site (WHT4).

Table 6-19 and Figure 6-31 of the environmental impact statement detail the key features of Berrys Bay construction support site (WHT7), including indicative laydown areas. All excavated material from tunnelling activities at this site would be transported by barge to the White Bay construction support site (WHT7) for storage ahead of its removal from site. Some plant and equipment would be stored at the Berrys Bay construction support site (WHT7).

### C24.3.2 Transport of waste in trucks

#### *Issue raised*

Submitters raised concerns over the transport of waste via heavy vehicles during the construction phase.

Specific comments included that the transport of hazardous waste in covered heavy vehicles, as stated in the environmental impact statement, is not acceptable. Hazardous waste must be transported in sealed and fully enclosed vehicles. ‘Spadeable’ wastes become liquid when being transported and leak through the rear seal onto the roadway.

#### *Response*

Section 24.3.2 of the environmental impact statement details the indicative quantities of waste, including material containing asbestos and heavy metals, expected to be generated during construction. All wastes for land disposal will be classified, transported, stored and handled in accordance with *Waste Classification Guidelines: Part 1 Classifying Waste* (NSW Environment Protection Authority, 2014a) and in a manner that prevents pollution of the surrounding environment, in accordance with environmental management measures WM3 and WM4 in Table D2-1 of this submissions report.

As required by environmental management measure SG10 (refer to Table D2-1 of this submissions report), a construction waste management plan will be prepared in accordance with the

requirements of the *Protection of the Environment Operations Act 1997* (NSW) and the Protection of the Environment Operations (Waste) Regulation 2014 (NSW). The construction waste management plan would include strategies to transport and dispose of contaminated and hazardous materials. As required by the legislation, waste, including any material containing asbestos and heavy metals would be transported by appropriate persons in a manner that avoids the waste spilling, leaking or otherwise escaping and would be covered and/or sealed at all times during transportation.

As described in Appendix C.2 of this submissions report, material dredged from the harbour that is not suitable for offshore disposal, once treated, would meet the classification of 'general solid waste' under the *Waste Classification Guidelines: Part 1 Classifying Waste* (NSW Environment Protection Authority, 2014a). Due to the existence of tributyltin in the dredged material proposed for land disposal, the disposal would need to be in accordance with the NSW Environment Protection Authority *Organotin Waste Materials Chemical Control Order 1989*. As such, the selected landfill would need to be a controlled landfill approved by the NSW Environment Protection Authority.

Further information on management of dredged material that is not suitable for offshore disposal would be included in a dredge management plan (for handling in transit to White Bay) and Waste Management Plan (detailing management at White Bay and landfill disposal requirement), which would form part of the construction environmental management plan.

A detailed discussion around concerns relating to the transport of waste is provided in Section C8 of this submissions report.

### C24.3.3 Waste management costs

#### *Issue raised*

Comment that the cost for treatment and disposal of stabilised treated sediments cannot be assessed reliably from the information provided in the environmental impact statement, and the cost may be high.

#### *Response*

The environmental impact statement describes the project, identifies the project impacts and includes appropriate environmental management measures. Project costs are not included in the environmental impact statement.

The costs associated with mitigating project impacts, including treatment and disposal of contaminated materials will be borne by the contractor and would be factored into the budget for the project.

NSW GOVERNMENT

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C25 – Sustainability

SEPTEMBER 2020

# C25 Sustainability

## Contents

## C25.1 General sustainability

***Issue raised***

Submitters raised concerns in relation to sustainability, including:

- Concern about the sustainability outcomes of the project as a sustainable option to support the growth of Sydney
- Concerns about the project due to environmental and sustainability issues for the Lower North Shore area during and after construction
- Concerns that impacts to Cammeray are not considered sustainable in the long term.

***Response***

The project would be designed, constructed and operated to maximise sustainability outcomes. In accordance with the Secretary's environmental assessment requirements, the sustainability of the project has been (and will continue to be) assessed in accordance with the Infrastructure Sustainability Council of Australia Infrastructure Sustainability rating tool. Environmental management measure SU2 in Table D2-1 of this submissions report commits the project to achieving 'Design' and 'As Built' ratings of 'Excellent' under the Infrastructure Sustainability Council of Australia rating scheme.

As outlined in Section 25.2.2 of the environmental impact statement, the sustainability of the project has been developed with consideration of a number of guidelines, including:

- *Transport Environment and Sustainability Policy Framework and Statement* (Transport for NSW, 2015)
- *Environmental Sustainability Strategy 2019-2023* (Roads and Maritime Services, 2019)
- *Sustainability Design Guidelines v4.0* (Transport for NSW, 2017).

Project development and alternatives are discussed in Chapter 4 (Project development and alternatives) of the environmental impact statement. Table 25-2 of the environmental impact statement sets out how the project was developed as part of a broad strategy and in line with key NSW transport policies to meet the needs of a growing Sydney, in a manner that balances economic, environmental and social issues. As a result of an expanding future population, employment and urban growth, Sydney can expect worsening road network and traffic conditions if integrated transport solutions are not implemented. The project will deliver infrastructure that provides long term benefits to the community by supporting Sydney's economic and population growth through improving the accessibility, functionality and safety of the transport network, while minimising negative environmental, social and economic impacts.

It is recognised that the project would have some unavoidable impacts to the Lower North Shore community, generally these impacts would be temporary in nature and would be minimised through the implementation of the environmental management measures set out in Table D2-1 of this submissions report.

The project would provide a number of long term benefits to the Lower North Shore community. In particular, it would:

- Improve the functionality and performance of the bus network, in particular the reliability and optionality for both long distance and inner North Shore services, and efficiency of the Warringah Freeway and Sydney Harbour Bridge bus lane, which services about 80,000 bus commuters each week
- Improve active transport links through the provision of a new dedicated bicycle path along the eastern side of the Warringah Freeway between Miller Street at Cammeray and Ernest

Street, as well as a number of new and upgraded shared user bridges which would provide connectivity across the Warringah Freeway

- Reduction in traffic noise at a significant number of receivers, most notably around Warringah Freeway, due to the redistribution of traffic. The project is expected to lead to an overall improvement in noise levels within the community (compared with the existing situation)
- Provide opportunities to regenerate green space such as in Berrys Bay and create new green space. The tunnel would relocate a significant volume of through traffic on surface arterial roads underground, improving urban amenity.

## C25.2 Implementation of sustainability targets

***Issue raised***

Submitters queried how the project will hold employees and contractors accountable for proactively meeting their environmental and sustainability responsibilities and what measures will be implemented to enforce accountability. There is concern that the sub-contracting of works could dilute the responsibility of any mitigation or conditions of approval on the project.

***Response***

Should the project be approved, Transport for NSW as the proponent, and the contractor for the project must both comply with all requirements of the conditions of approval set out by Department of Planning, Industry and Environment. The contractor would be responsible for managing impacts from their activities, and the impacts of any subcontractors, in accordance with an approved construction environmental management plan.

The project is committed to achieving an ‘Excellent’ 'Design' and ‘As Built’ Infrastructure Sustainability rating under the Infrastructure Sustainability Council of Australia rating scheme, as stated in Section 25.2.4 of the environmental impact statement. The contractor would be required to propose project-specific sustainability initiatives and implementation protocols to support achievement of the project’s target 'Excellent‘, 'Design' and ‘As Built’ Infrastructure Sustainability rating. This will ensure consistency with the *Environmental Sustainability Strategy 2019–2023* (Roads and Maritime Services, 2019).

A sustainability management plan will be prepared for the project and will detail measures to meet the project's sustainability objectives and targets and Infrastructure Sustainability rating. The sustainability management plan will be prepared prior to construction of the project and reviewed and certified by Transport for NSW and the Department of Planning, Industry and Environment. Compliance with the sustainability management plan will be monitored throughout design and construction.

## C25.3 Inconsistency with Roads and Maritime Services Environmental Sustainability Strategy

***Issue raised***

Submitters considered the project does not align with the Roads and Maritime Services sustainability principle to minimise the air quality impacts of road projects and support initiatives that aim to reduce transport-related air emissions.

***Response***

Table 28-4 of the environmental impact statement establishes the design performance outcomes and project outcomes for the key impacts identified in the Secretary’s environmental assessment requirements. In respect to air quality, the desired performance outcome is that the project is designed, constructed and operated in a manner that minimises air quality impacts (including

nuisance dust and odour) to minimise risks to human health and the environment to the greatest extent. This is consistent with the Roads and Maritime Service's *Environmental Sustainability Strategy 2019-2023* objective to minimise the air quality impacts of road projects. To deliver this outcome, the project has been developed such that:

- It would effectively manage dust, odour and other emissions during construction
- It would result in zero portal emissions during normal operations
- It would provide effective dispersion of emissions from the tunnels
- In-tunnel air quality would be maintained in accordance with relevant criteria.

Air quality impacts of the project are described in Chapter 12 (Air quality) of the environmental impact statement. The air quality assessment identifies that generally as a result of the project redistributing traffic underground and reducing stops, the project would result in an improvement in air quality for most receivers.

The project design has considered strategies to facilitate the reduction of road emissions. These are further discussed in Section C5.3 and C12.3.4 of this submissions report and include improvements to congestion and vehicle efficiency and provision of active transport options such as cycle paths and pedestrian facilities. This project would also adhere to relevant NSW Government sustainability policies to minimise emissions during construction and operation.

As discussed in C25.1 above, the project would also reduce transport-related emissions by improving the functionality and performance of the bus network, establishing a dedicated bicycle path along the eastern side of Warringah Freeway between Miller Street at Cammeray and Ernest Street, as well as a number of new and upgraded shared user bridges which would provide connectivity across the Warringah Freeway. Reduced congestion on the arterial road network during the operation of the project would also result in further improvements to air quality and a reduction in vehicle emissions.

## C25.4 Ecologically sustainable development

***Issue raised***

Submissions raised concerns regarding how the project addressed sustainable development principles and disputed whether the project is 'sustainable development'. Submitters disagreed with the statement that 'the principles of ecologically sustainable development have been an integral part of the design and assessment of the project', and that the proposed project meets the four principles set out in the *Protection of the Environment Administration Act 1991* (NSW). Other specific queries, concerns and comments included:

- Concerns that the environmental impact statement does not meet the Infrastructure Sustainability Council of Australia's definition of sustainable infrastructure development
- Assessment of the project against the precautionary principle has not considered sensitivity of the aquatic, foreshore and land environments, the risks posed by air pollution to local communities, the contamination risks of the project and the construction methods proposed
- Assessment of the project against intergenerational equity has not considered that future generations in the areas affected by the project would have less green space and more car use resulting in higher levels of congestion and pollution including reduced air quality
- Submitters raised concerns that the project does not meet the definition of sustainability within the environmental impact statement "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" as it encourages motor vehicle use
- Concerns that there would be impacts on biological diversity and ecological integrity, particularly threatened species

- Concern that ventilation outlets and increased traffic in and around parks would devalue environmental resources for the community
- Comment that consideration needs to be given to the long term and investments that will reduce waste and carbon emissions.

***Response***

Infrastructure Sustainability Council of Australia

Infrastructure Sustainability Council of Australia defines sustainable infrastructure as being that which is 'designed, constructed and operated to optimise environmental, social and economic outcomes over the long term'. Section 25.2 of the environmental impact statement describes the project's sustainability vision and policy and commits to improving quality of life for current and future generations by maximising social, economic and environmental value.

Principles of ecologically sustainable development

Chapter 25 (Sustainability) of the environmental impact statement describes how sustainability principles have been applied to the design and assessment of the project, including application of the principles of ecologically sustainable development. Table 25-5 of the environmental impact statement identifies how the principles of ecologically sustainable development have been integrated into the design and development of the project. A summary of how each of these principles has been demonstrated by the project follows.

*Precautionary principle*

The precautionary principle was applied during the design and development of the project through:

- Inclusion of environmental impacts during the alternatives and options analysis
- Identification of opportunities to avoid or minimise surface disturbance
- Using a risk based approach to identify environmental impacts through detailed specialist studies
- Adopting a conservative approach to the evaluation of environmental impacts
- Selection of proven construction methodologies that aim to minimise environmental impacts.

Specific examples of the application of the precautionary principle during preparation of environmental assessments for the project include:

- Air quality: Appendix H (Technical working paper: Air quality) includes modelling scenarios based on the 'regulatory worst case' to demonstrate the air quality performance of the project under the worst operating conditions
- Construction noise: Appendix G (Technical working paper: Noise and vibration) of the environmental impact statement includes an assessment of construction noise due to typical and reasonable worst case construction activities at construction support sites and surface road upgrades
- Human health: Appendix I (Technical working paper: Health impact assessment) assessed the human health impacts for air quality from the worst case operating conditions and for construction noise from the worst case construction scenarios
- Traffic and transport: Appendix F (Technical working paper: Traffic and transport) of the environmental impact statement includes an assessment of worst case construction traffic movements, including worst case cumulative construction impacts.

Environmental management measures for the project, included in Table D2-1 of this submissions report, have been developed to manage and reduce environmental impacts identified in these assessments.

*Intergenerational equity*

Section 25.3 of the environmental impact assessment identifies how the project has considered intergenerational equity. The project has been designed to meet the needs of both current and future generations, with a design life of about 100 years. The project would be designed with consideration of future climate change and the adaptation measures identified in Chapter 26 (Climate change risk and greenhouse gas) of the environmental impact statement.

The project commits to minimising the extent of permanent impact on public open space areas, demonstrating the project's commitment to maintaining these resources for future generations (refer to environmental management measure SE1,refer to Table D2-1 of this submissions report). Public open space opportunities currently considered in the design include provision of new public open space at Berrys Bay and a new shared user bridge at Ernest Street, linking Cammeray Golf Course with ANZAC Park. Further opportunities to increase public open space would be investigated during further design development.

Section 25.3 of the environmental impact assessment notes that the operation of the project would provide improved capacity, access and connectivity across the Sydney transport network, supporting Sydney's long term economic growth. Additionally, the project would ease future congestion on the road network, supporting future urban regeneration. The project has been designed, to provide opportunities for public and active transport improvements, connecting currently disconnected communities and facilitating greater access to community infrastructure. This improved access and connectivity is anticipated to benefit multiple future generations as Sydney continues to grow.

*Conservation of biological diversity and ecological integrity*

The project has been designed and assessed with the aim of identifying, avoiding, minimising and mitigating impacts to biodiversity. The assessment of the project's impacts on biodiversity considers potential impacts on endangered, threatened and vulnerable species which are likely to reside within the project area. The project's potential impacts on terrestrial flora and fauna, aquatic biodiversity and marine biodiversity including threatened species, are assessed in Section 19.4 of the environmental impact statement and Appendix S (Technical working paper: Biodiversity development assessment report) and Appendix T (Technical working paper: Marine ecology). Impacts to biodiversity have been assessed by suitably qualified subject matter experts in accordance with federal and State legislation including the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and NSW *Biodiversity Conservation Act 2016*.

A range of environmental management measures have been developed to minimise impacts in accordance with legislation and where necessary biodiversity offsets would be implemented for residual impacts, as detailed in Table D2-1 of this submissions report.

*Improved valuation and pricing of environmental resources*

Table 25-5 of the environmental impact statement outlines how the design of the project has incorporated the principle of improved valuation and pricing of environmental resources. Opportunities identified in the design development to improve local amenity, public transport access and active transport connections and create additional green spaces demonstrate that the project has considered the value of environmental resources. In addition, the costs associated with planning, design and implementation of the environmental mitigation measures have been included within the overall project costs.

Reducing waste and carbon emissions

The design performance outcomes and project outcomes, listed in Table 28-4 of the environmental impact statement, identify the following outcomes for reduction of material use and use of materials with low embodied environmental impact, where practical:

- Water efficiency measures would be implemented where possible, with the reuse of non-potable water from stormwater harvesting and on-site reuse of treated water from groundwater inflows, where water quality and volume requirements are met
- The design of the project has included careful consideration of the construction methodology and selection of materials and resources to minimise resource consumption
- Consistent with the resource management hierarchy under the *Waste Avoidance and Resource Recovery Act 2001*, solid wastes would be reused and recycled where feasible and reasonable.

## C25.5 Economic impacts

### *Issue raised*

Submitters raised concerns in regard to the long-term economic impact of not further considering more sustainable solutions. Specific queries, concerns and comments included:

- Submitters stated that all project options considered in the environmental impact statement should be publicly priced and assessed from a community, environmental and sustainability perspective. A cost benefit analysis which includes the options impact on the environment and health should be carried out
- Concern about the long term economic impact of the project and the 'burden' on future generations.

### *Response*

Consideration of project options

The Secretary's environmental assessment requirements state that the environmental impact assessment must include a description of all feasible alternatives to the project and describe how alternatives to the options were analysed to inform the selection of the preferred option. Chapter 4 (Project development and alternatives) of the environmental impact statement includes a summary of the comprehensive options assessment and project development process which was carried out. The project has undergone extensive evaluation of alternatives from pre-feasibility and strategic investigations through to design development and refinement. Each of the project options were assessed against a number of criteria to identify the solution that best balanced technical, social and environmental outcomes while meeting the transport objectives. Refer to Section C4.1.2 above for discussion on the project's business case.

Economic burden on future generations

Infrastructure 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, 2014), as described in Section 3.2 of the environmental impact statement. The Business Case for the project is further discussed in Section C4.2 of this submissions report. The NSW Government is proposing to deliver a range of transport infrastructure projects including road, public transport and active transport projects to address the transport challenges associated with a growing Sydney. However, even with this investment, Transport for NSW has forecast that rising congestion on parts of the road network and crowding on sections of the rail network will increase travel times and affect the reliability of the transport system. These trends will impair the productivity of the city, with congestion alone expected to cost over $12 billion per annum by 2030.

The project would enable long-term development of Sydney's motorway network, including facilitating new cross-harbour capacity and relieving pressure on the critical cross-harbour road network, providing improved traffic conditions, safety and efficiency for motorists and freight vehicles using Sydney's motorway network. The combination of freight and business travel time savings using the Harbour CBD and wider Eastern Economic Corridor as a result of the project would generate substantial productivity benefits for the Harbour CBD and the wider region for existing and future generations.

Costly solution to traffic on Military Road

This matter relates to the Beaches Link and Gore Hill Freeway project and is out of scope for this project.

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C26 – Greenhouse gas and climate change

SEPTEMBER 2020

# C26 Greenhouse gas and climate change

## Contents

## C26.1 Climate change impacts

### *Issue raised*

Submissions raised concerns that the project would make the wider Sydney community less climate change resilient. Submissions acknowledged that measures have been put in place to make the project resilient to climate change.

### *Response*

The design of the project and assessment of climate change risks has been prepared in accordance with Australian Standard AS 5334-2013 *Climate change adaptation for settlements and infrastructure – A risk based approach* and guided by the draft *Technical Guide: Climate Adaptation for the Road Network* (Roads and Maritime Services (unpublished).

While adhering to the above guidance documents, the following key steps were carried out to complete the climate change risk assessment:

- Determination of the climate change context, including greenhouse gas emissions scenarios and projections, data on climate variables and past meteorological record
- Identification of the climate risks and assessment of the likelihood and consequence of each risk
- Identification of adaptation responses.

To assist with the determination of climate change context as well as the identification of climate change risks and the likelihood of such risks, a risk workshop was held with multidisciplinary members of the project team (ie members of the design and environmental assessment teams) early in the design phase.

Section 26.1.4 of the environmental impact statement identifies that a number of medium climate change risks are anticipated for the project, such as increased ambient temperatures and heatwaves, rainfall and surface flooding, concrete carbonation and sea level rise.

To address the identified climate change risks, a number of adaptation measures have been incorporated into the design of the project, as outlined in Table 26-3 of the environmental impact statement. Following the incorporation of the identified adaptation measures into the design of the project, the assessment considered that all climate change risks were reduced to a rating of 'low', with the exception of the exacerbation of flooding (inclusive of climate change projections) in flood risk areas surrounding the project. Flood modelling, including future climate change risk, is also discussed in Section 18.6.4 of the environmental impact statement.

Environmental management measures have also been developed to ensure climate change is addressed effectively during further design development and construction. These include the following (refer to Table D2-1 of this submissions report):

- The following actions will be carried out during further design development to ensure climate change is adequately addressed (environmental management measure CC1):
  - Flood modelling will continue to use sea level rise projections and rainfall projections
  - The extent of scour protection will be refined
  - Sensitivity testing for climate change will be carried out for drainage channels and culverts. Increased capacity will be provided where feasible and reasonable
  - Any specific property impacts from flooding will be addressed where feasible and reasonable
- Impact of the project on flood behaviour during operation will be confirmed during further project development in accordance with environmental management measure F9. This will

include the consideration of future climate change and a partial blockage of the local stormwater drainage system. The design of the project will incorporate measures that are aimed at mitigating the impact of the project on flood behaviour in properties where existing buildings would experience above-floor inundation under present day conditions during storms of up to 1% AEP in intensity (environmental management measure F1)

- Where feasible and reasonable, the hydraulic capacity of the existing transverse drainage of the Warringah Freeway will be designed to comply with relevant guidelines and standards (environmental management measure F2).

## C26.2 Greenhouse gas emissions

### C26.2.1 General

***Issue raised***

Submissions raised concerns that the greenhouse gas emissions from construction and operation of the project would contribute to climate change and that the project is inconsistent with the NSW Government's commitment to move towards net zero emissions by 2050. Comments raised include:

- Submissions raised concerns that the project does not meet the objective of minimising energy use and greenhouse emissions and suggest that the project would increase greenhouse gas emissions during its operation because it facilities and promotes the use of private motor vehicles over public transport and increases carbon dioxide emissions
- Submissions suggested that there should be a greater focus on reducing waste and carbon emissions
- Greenhouse gas emissions generated during construction of the project would be more than emissions reduced during the operation of the project.

***Response***

Net Zero Plan Stage 1

Greenhouse gas emissions are projected to increase as traffic numbers across the road network grow (irrespective of the minor increase in induced demand expected to result from the project), as outlined in Section 26.2.4 of the environmental impact statement. However, the expected reduction in congestion and increase in vehicle efficiencies due to fewer stop and start movements as a result of the project, in addition to expected improvements in fuel efficiency and increased use of electric vehicles, in line with the Net Zero Plan Stage 1, are expected to assist in reducing emissions.

Priority 4 of the Net Zero Plan Stage 1 would be met through the implementation of the Western Harbour Tunnel and Warringah Freeway Upgrade sustainability vision and policy, outlined in Chapter 25 (Sustainability) of the environmental impact statement. The Sustainability Management Plan would include objectives and targets to minimise energy use and greenhouse gas emissions during construction and operation, as well as optimising resource efficiency and waste management during construction. The project would also adhere to relevant NSW Government sustainability policies to minimise emissions during construction and operation.

Assessment of operational greenhouse gas emissions

Greenhouse gas emissions attributable to the project during operation are discussed in Section 26.2.4 of the environmental impact statement. Detailed estimates of greenhouse gas emissions associated with operation of the project are provided in Appendix X (Technical working paper: Climate change and greenhouse gas).

The greenhouse gas assessment methodology for estimating the net greenhouse gas effect of the project during operation from road traffic considered how the project would influence traffic over a broad area. The project would result in an increase in road traffic and estimates of greenhouse gas emissions from vehicles included the forecast traffic volumes from the Sydney Motorway Planning

Model (described further in Appendix F (Technical working paper: Traffic and transport)). The model considered all factors influencing traffic growth, including induced demand due to the project. Greenhouse gas emissions were estimated based on an assessment of the changes in traffic and network performance on the road network in the vicinity of the project for future modelled scenarios.

As outlined in Section 26.2.4 of the environmental impact statement, greenhouse gas emissions from vehicles are projected to increase as traffic numbers across the road network grow when compared to the 'Do minimum' (without project) scenario. Despite these projected increases, the greenhouse gas emissions from road traffic with the project are projected to only slightly increase relative to the without project scenario, both in 2027 (year one of project opening) and 2037 (year 10 of project opening). The estimated annual road user emissions due to the project represent less than one per cent of the greenhouse gas emission inventory for New South Wales (based on 2016 data).

Consideration of public transport alternatives

The NSW Government is proposing to deliver a range of transport infrastructure projects including road, public transport and active transport to address the transport challenges associated with a growing Sydney. These new and upgraded transport projects and initiatives are consistent with the *Future Transport Strategy 2056* and include a number of key public transport projects (further information on these projects can be found on the Transport for NSW website).

Chapter 4 (Project development and alternatives) of the environmental impact statement includes a discussion of the project development and alternatives including improvements to public and active transport. While public transport projects already committed by the NSW Government, such as the Sydney Metro City & Southwest project, will deliver much needed capacity for commuters, strategic transport modelling completed by Transport for NSW indicates that the need to provide additional cross-harbour motorway capacity would remain to cater for future transport demand.

As discussed in Section C3.1 above, the project is one part of a complementary and integrated multi-modal strategy being implemented by the NSW Government.

Reducing waste

Measures to avoid, minimise or manage resource consumption and waste generation as a result of the project are detailed in Table 24-10 of the environmental impact statement. This includes consideration of the construction methodology and selection of materials and resources to ensure they are fit for purpose and minimise resource consumption. In line with the project's sustainability vision, during construction and operation of the project, opportunities would be taken to reduce material use and maximise the use of materials with low embodied environmental impact, where feasible. All resources consumed for the project would be managed in accordance with the *Waste Avoidance and Resource Recovery Act 2001* waste management hierarchy of avoid, recover, dispose.

The project would generate greenhouse gas emissions during construction and operation. This includes greenhouse gas emissions associated with construction materials, energy consumption and fuel consumed by vehicles using the future road network, as detailed in Section 26.2 of the environmental impact statement.

Energy consumed by operational infrastructure for the project was identified as a key contributor to the annual contribution to greenhouse gas emissions. Energy efficiency would be considered during further design development with energy efficient systems installed where reasonable and practicable, as identified in environmental management measure GHG1 (refer to Table D2-1 of this submissions report).

Collectively, the sustainability management plan and environmental management measures identified in Table D2-1 of this submissions report will target approaches to minimise the greenhouse gas emissions generated by the project.

### C26.2.2 Greenhouse gas emissions during construction

***Issue raised***

Submissions raised concerns that the project would have adverse impacts due to an increase in greenhouse gas emissions during construction contributing to climate change. Submissions suggest that the proposed construction methodology is emissions intensive. Submissions were concerned with the following sources and impacts of greenhouse gas emissions:

- The amount of energy in construction and the materials of the project, with specific reference to the amount of concrete required for construction and the associated carbon dioxide emissions
- The use of diesel powered plant and heavy vehicles and whether greenhouse gas models have considered the use of diesel fuel
- The impacts of loss of green space and tree removal on carbon absorption and the mitigation of heat island effect due to climate change.

***Response***

Sources of greenhouse gases during construction

The estimated greenhouse gas emissions associated with construction of the project are detailed in Section 26.2.3 of the environmental impact statement and Section 3.1.4 of Appendix X (Technical working paper: Climate change and greenhouse gas). The assessment was carried out in accordance with global, national and state guidelines and tools.

The greenhouse gas emissions associated with construction of the project are expected to total about 784 kilotonnes of $CO_2$ equivalent ($ktCO_{2e}$) of which the majority are Scope 3 (indirect) emissions. Appendix X (Technical working paper: Climate change and greenhouse gas) identified that construction emissions are expected to be much higher than the annual increase in operational emissions over the network as a result of the project (in 2027 and 2037), when considering change in fuel based emissions as a result of the project. The estimated construction emissions constitute a one-off event compared with the estimated operational emissions which would be annual.

Section 26.2.3 of the environmental impact statement details the key sources of greenhouse gas emissions during construction.

During construction, the primary source of greenhouse gas emissions would be associated with the offsite mining, production and transport of construction materials (about 50 per cent of emissions). Construction would require large quantities of materials such as concrete and steel. As required by environmental management measure WM1 (refer to Table D2-1 of this submissions report), construction materials will be sourced in accordance with the project's sustainability framework and with a preference for Australian materials and prefabricated products with low embodied energy, where feasible and reasonable.

The second largest source of greenhouse gas emissions during construction would be associated with electricity consumption, mostly associated with power required for the use of the roadheaders. This would account for about 26 per cent of the project's emissions during construction. It is noted that Section 4.5.1 of the environmental impact statement outlines that tunnelling method alternatives were developed and assessed by a multidisciplinary team of design, construction and environmental specialists considering various technical and environmental factors including reducing whole of life emissions. Section 24.3.1 of the environmental impact statement outlines measures to avoid and minimise electricity consumption that have been included in the design and construction planning for the project. Measures to minimise emissions related to electricity use include the consideration of installation of energy efficient systems where reasonable and practicable, as required by environmental management measure GHG1 (refer to Table D2-1 of this submissions report).

Construction greenhouse gas emissions assessment methodology

Section 3.1.4 of Appendix X (Technical working paper: Climate change and greenhouse gas) presents the methodology used to estimate greenhouse gas emissions associated with construction of the project. The method used to calculate the greenhouse gas emissions resulting from fuel combustion by construction equipment and plant assumed that all plant and equipment, generators, marine vessels and vehicles used during construction would operate on diesel fuel. The greatest quantity of greenhouse gas emissions due to fuel combustion during construction would be generated through the transport of waste, dredged material and spoil. As required by environmental management measure GHG2 (refer to Table D2-1 of this submissions report), greenhouse gas emissions during construction will be managed and minimised as part of the sustainability management plan which would include the requirement for consideration of fuel efficient plant for construction activities.

Loss of green space

The removal of vegetation (and the resulting lost carbon sink) due to construction has been considered in the greenhouse gas assessment, as discussed in Section 3.2.1 of Appendix X (Technical working paper: Climate change and greenhouse gas). Total projected greenhouse gas emissions associated with the removal of vegetation would be about 0.6 ktCO2e and represents a small portion of the construction emissions.

The project would result in both loss of and opportunities to increase public open space, as described in Section C20.1 of this submissions report. Additional opportunities to increase public open space would be investigated during further design development. Following completion of construction, land would be rehabilitated (refer to environmental management measure LP2 in Table D2-1 of this submissions report) which would restore a portion of the lost carbon sink. Environmental management measure B4 (refer to Table D2-1 of this submissions report) also requires that vegetation will be re-established, where feasible, in accordance with *Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011). Trees removed by the project will be replaced at a ratio equal to or greater than 1:1.

Heat island effect

Urban areas, comprising a greater density of hard surfaces such as roads, pavements and buildings, absorb and retain more heat compared with areas of natural land cover. This is known as the urban heat island effect and results in increased average temperatures experienced within areas of high urban development.

The urban heat island effect is not considered to contribute directly to global warming. However, the urban heat island effect results in localised warming around urban centres and is likely to be exacerbated by increasing temperatures due to climate change. This in turn may result in increased requirements for cooling and energy use associated with air conditioning. The majority of the project is located underground in tunnels or involves replacing existing hard surfaces with new hard or previously cleared surfaces. As a result, the project is considered to have only a minor impact on the urban heat island effect in the long term.

### C26.2.3 Greenhouse gas emissions during operation

#### *Issue raised*

Submissions raised doubts that there would be a reduction in operational greenhouse gas emissions through the implementation of this project. The 2016 emissions inventory identified that road transport was the second largest contributor to emissions of carbon dioxide (34 per cent) and the largest contributor to oxides of nitrogen ($NO_X$) (47 per cent) in Sydney and submissions were concerned that even under optimistic scenarios the project would increase overall emissions by the late 2020s and early 2030s when compared to a “Do Nothing” approach.

Other specific comments include:

- Doubt regarding the environmental impact statements contention that increased volume of traffic would flow more freely and result in improved fuel efficiency
- Concerns about the amount of fuel combustion and electricity consumption for this project and their contributions to greenhouse gas emission.

***Response***

Benefits of the project

Although traffic numbers across the road network in the vicinity of the project are projected to grow, the efficiency of vehicles using the road network is forecast to improve, due to fewer vehicle stop and start movements, less congestion and a greater average vehicle speed. Greater vehicle efficiency would also be provided by the project as it would allow for a greater number of vehicles to bypass existing roads and use the more direct vehicle routes and operationally efficient tunnels delivered by the project. Traffic flow benefits would also be delivered through improved road layouts and road widening. The improvements for vehicle efficiency provided by the project, as well as analysis of the benefits of future fuel efficiency and increases in electric vehicles, suggests that efforts to support the free flow of traffic along the project would likely have beneficial outcomes for greenhouse gas emissions associated with road vehicle use. This is consistent with the methodology outlined in the *Guide to Project Evaluation* (Austroads, 2005) which states that increases in average vehicle speeds would result in improved fuel efficiency and therefore assist in providing annual savings in greenhouse gas emissions.

Greenhouse gas emissions from operational electricity sources

Operational emissions would be associated with electricity consumption required to power operational infrastructure facilities including tunnel ventilation, surface and tunnel lighting, motorway control centre, wastewater treatment plant and substations. About 63 per cent of emissions from the project are expected to be contributed from operational electricity consumption. Operational electricity consumption is projected to increase over time, due to the projected increase in traffic volumes using the project, increasing tunnel ventilation requirements. Section 26.2.4 of the environmental impact statement provides an assessment of operational greenhouse gas emissions.

Measures to minimise energy consumption and maximise energy efficiency during operation have been included in the project design (refer to Section 24.4.1 of the environmental impact statement). This includes using low heat emission LED lighting and solar panels in operational facilities. Environmental management measure GHG1 in Table D2-1 of this submissions report commits the project to consider energy efficiency in the project design.

### C26.2.4 Changed access leading to increase greenhouse gas emissions

***Issue raised***

Concern that the operational greenhouse gas assessment did not consider the generation of greenhouse gases from increased lengths to local trips due to the closure of access to and from the Warringah Freeway and Brook Street, Crows Nest.

***Response***

As detailed in Chapter 5 (Project description) of the environmental impact statement, certain connections between the Warringah Freeway and Brook Street would be maintained, however the project would remove:

- Access between the tolled north facing ramps at Falcon Street and Brook Street
- Access between the Sydney Harbour Tunnel and Brook Street.

Projections of traffic emissions in the operational greenhouse gas assessment were modelled using Tools for Roadside Air Quality (TRAQ), which takes outputs from Transport for NSW's Sydney

Motorway Planning Model (SMPM) (refer to Section 3.1.5 of Appendix X (Technical working paper: Climate change and greenhouse gas)). The SMPM provides estimates of the traffic volumes on around 6000 road links, for each assessment scenario (ie with and without the project), across a domain that covers an area in the order of 20 kilometres by 20 kilometres.

The SMPM outputs reflect predicted changes in travel behaviour as a result of the project. This includes the use of alternative routes as a result of changes to access to and from the Warringah Freeway.

## C26.3 Adequacy and accuracy

***Issue raised***

Submissions raised concerns regarding the adequacy and accuracy of the climate change risk and greenhouse gas assessment in the environmental impact statement. Specific concerns include:

- The environmental impact statement did not consider induced demand and the consequential impact on emissions and climate change.

***Response***

Greenhouse gas assessment methodology

The methodology for the greenhouse gas assessment described in Section 22.1 of the environmental impact statement has been based on relevant greenhouse gas reporting legislation and international reporting guidelines, including:

- *Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard* (World Council for Sustainable Business Development (WBCSD) and World Resources Institute (WRI & WBCSD, 2004)
- *Greenhouse Gas Assessment Workbook for Road Projects* (the TAGG Workbook) (Transport Authorities Greenhouse Group (TAGG), 2013)
- *Infrastructure Sustainability Materials Calculator* (Infrastructure Sustainability Council of Australia, 2016b)
- *Tools for Roadside Air Quality* (Roads and Maritime Services, 2005).

The TAGG Workbook provides a consistent methodology for estimating the greenhouse gas emissions from activities that may contribute significantly to the overall emissions associated with the construction, operation and maintenance of road projects. The TAGG workbook has been adopted for the project.

To calculate the potential greenhouse gas emissions associated with the project, the following steps were followed:

- Define the assessment boundary and identify potential sources of greenhouse gas emissions associated with the project
- Determine the quantity of each emission source (fuel and electricity consumed, vegetation cleared, construction materials used and waste produced)
- Quantify the potential GHG emissions associated with each greenhouse gas source using equations and emission factors specified in the TAGG Workbook.

Induced demand

Induced demand due to the project was factored into Transport for NSW's SMPM, which forms the basis for the estimation of greenhouse gas emissions due to fuel consumption by vehicles on the road network, as discussed in Section 3.1.5 of Appendix X (Technical working paper: Climate change and greenhouse gas). The SMPM acknowledges that the project would induce demand as a result of improved travel times between homes and destinations, such as workplaces, shopping

centres and education facilities, which cause changes to region-wide trip patterns. The SMPM has considered induced demand equating to an increase in daily trips in the Sydney metropolitan area of 0.3 per cent by 2037. Further information on the SMPM is available in Section 3.3 of Appendix F (Technical working paper: Traffic and transport).

Table 3-28 of Appendix X (Technical working paper: Climate change and greenhouse gas) and Table 26-5 and Table 26-6 of the environmental impact statement outline the total greenhouse gas emissions resulting from construction and operation of the project and includes the difference between existing traffic levels and traffic levels with the project.

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C27 – Cumulative impacts

SEPTEMBER 2020

# C27 Cumulative impacts

## Contents

## C27.1 Geology, soils and groundwater

***Issue raised***

Concerns were raised about the cumulative loss of groundwater below Rozelle and other areas from the approved M4-M5 Link and the project.

***Response***

Groundwater modelling was carried out to assess the impacts of the construction and operation of the project, including cumulative impacts due to other major tunnel projects such as the approved M4-M5 Link, Sydney Metro City & Southwest (Chatswood to Sydenham) and the proposed Beaches Link and Gore Hill Freeway Upgrade project. Groundwater drawdown was modelled for the end of tunnelling construction (beginning of 2026) and for groundwater levels around 100 years after operation (2126) as described in sections 16.4.5 and 16.5.2 of the environmental impact statement, and in further detail in Appendix N (Technical working paper: Groundwater).

With respect to the cumulative impacts on groundwater levels at the end of construction:

- Given the number of underground tunnels associated with the M4-M5 Link project situated nearby, maximum expected drawdown in Rozelle is predicted to be about 40 metres. Groundwater drawdown at Easton Park and White Bay Power Station (areas of environmental interest for contamination) are predicted to be up to 38 metres and 12 metres respectively during this period
- North of the harbour, maximum water table drawdown of about 10 metres is predicted at the northern dive structure. A maximum cumulative drawdown of 18 metres is predicted above the North Sydney Metro Station.

There is potential for cumulative drawdown impacts to a domestic groundwater bore in Birchgrove (GW109209) due to the number of tunnelling projects in close proximity, as stated in Table 27-5 of the environmental impact statement. Based on existing groundwater monitoring, the water table is likely to be 14 metres below the base of this bore, as noted in Section 16.5.2 of the environmental impact statement. As a result, it is likely that this bore may be accessing a shallow perched groundwater system that is not connected to the water table. If a loss of yield exceeding two metres is attributed to the project, make good provisions under the *NSW Aquifer Interference Policy* (DIPNR, 2012) would be implemented in accordance with environmental management measure SG2 (refer to Table D2-1 of this submissions report).

## C27.2 Construction traffic and transport

***Issue raised***

Submitters raised concerns about the cumulative effects of traffic from the White Bay construction support site (WHT3) in addition to the approved Multi-User Facility and proposed Glebe Island concrete batching plant (Hanson Construction Materials Pty Ltd).

***Response***

Cumulative construction traffic impacts are discussed in Section 5.6 of Appendix F (Technical working paper: Traffic and transport). The environmental impact statement assesses the cumulative traffic impacts of WestConnex, Sydney Metro City & Southwest, and the project in the White Bay/Glebe Island area. The assessment assumed a cumulative construction peak at 2022-23. The assessment of cumulative projects is based on information available in the public domain at the time of the analysis.

The traffic and transport assessment indicated potential for impacts to travel times during peak construction of up to five minutes in the Rozelle and surrounding area, and a general decrease in intersection performance along Victoria Road and City West Link. It is noted however that predicted

impacts represent a worst case and are only likely for a short period of the overall construction program. Overall, the cumulative project impacts in the Rozelle and surrounding area would be moderate and manageable.

At present there are two formal groups in the project area which meet regularly to manage potential cumulative impacts. This includes:

- The Bays Precinct Working Group consisting of Government agency representatives from the Western Harbour Tunnel and Beaches Link, WestConnex Rozelle Interchange, Sydney Metro West, Infrastructure NSW, Port Authority of NSW and Transport for NSW teams
- The Glebe Island and White Bay Community Liaison Group, coordinated by Port Authority, consisting of representatives from the local community and the current tenants at Glebe Island and White Bay. Any future tenants of proposed projects such as Hanson Glebe Island Concrete Batching Plant and Aggregate Facility and the Glebe Island Multi-User Facility using the area would be invited to this group.

Construction of the Glebe Island Multi-User Facility was anticipated to be complete by 2021, prior to the 2022-23 cumulative construction peak and was therefore not included in the cumulative assessment presented in the environmental impact statement. The *Glebe Island Multi-User Facility Review of Environmental Factors* (AECOM, 2018) was prepared to assess the environmental impact of the construction and operation of a multi-user facility at Glebe Island, for the import, storage and distribution of bulk materials including sand, aggregate, and other dry bulk construction materials delivered by ship. The *Glebe Island Multi-User Facility Review of Environmental Factors* builds upon a previous Part 5 determination for the multi-user facility issued in 2013.

The 2018 *Glebe Island Multi-User Facility Review of Environmental Factors* outlines that the construction of the Glebe Island Multi User Facility is estimated to generate a peak of 500 trucks per day, which is below the movements approved and assessed under the 2013 Part 5 determination for the multi-user facility. The assessment carried out includes assumed background growth from planned and approved developments such as the Glebe Island Multi User Facility; no further material impacts are anticipated as a result of the further development of the Glebe Island Multi-User Facility, given that there is no proposed increase in traffic generation compared to the 2013 conditions of approval.

In regard to the Hanson Glebe Island Concrete Batching Plant and Aggregate Handling, the environmental impact statement (Ethos Urban, 2018) states that given the early stage of the project at the time of assessment, accurately determining the impacts of the construction process was not possible. Details of the construction program and staging, and number, type, origin/destination of vehicles expected during the construction process were not available to assess and would be provided by the contractor once the development is approved. The Glebe Island Concrete Batching Plant and Aggregate Handling was therefore not included in the cumulative assessment. It is noted that while the publicly available information at the time of assessment also assumed an opening year of 2019, its current planning approval status is ‘more information required’.

Potential issues will be mitigated in accordance with environmental management measure CI1 (refer to Table D2-1 of this submissions report), including multi-party engagement and cooperation to ensure all contributors to impacts are working together to minimise adverse impacts.

## C27.3 Operational traffic and transport

***Issue raised***

Submitters were concerned about the cumulative traffic and transport impacts during project operation. Specific issues include:

- Submitters questioned how the project would cater for growth in private vehicles to the CBD as a result of WestConnex and associated projects

- Concerns about impacts caused by the combined effects of the M4-M5 Link and the Western Harbour Tunnel to the road network in and around the Balmain Peninsula, and Victoria Road and on roads approaching the ANZAC Bridge
- Concern that there would be an increase in traffic demand concentrated in the Rozelle area, on top of the impacts resulting from the M4-M5 Link project
- The predicted poor performance of the Ben Boyd Road/Military Road intersection at Neutral Bay under both the Western Harbour Tunnel and Warringah Freeway Upgrade project and the Beaches Link and Gore Hill Freeway Connection project, and the effect this would have on traffic congestion up to and beyond the Spit Bridge
- Potential additional traffic caused by the reconfiguration of the Warringah Freeway access points at Brook Street, Miller Street and Willoughby Road would be exacerbated by the planned residential re-development of the Channel 9 site on Artarmon Road
- Journeys from Dee Why to Sydney Kingsford Smith Airport are expected to be 56 minutes faster, submitters believe this has not been backed up in the detailed analysis. These savings are based on peak hour travel times which is not when people usually travel to the airport. Even if time savings between Dee Why and Cammeray are realised due to Beaches Link, drivers would still have to use the Harbour Tunnel and Eastern Distributor to get the airport. Any time savings would therefore be attributable to Beaches Link not the Western Harbour Tunnel – which is the subject of the environmental impact statement.

***Response***

Cumulative impact of WestConnex projects

All operational road traffic modelling scenarios (including the 'Do minimum' scenario) have included consideration of the NorthConnex, WestConnex, and Sydney Metro City & Southwest projects. The 'Do something' scenario has considered the project in addition to those considered in the 'Do minimum' scenario. The 'Do something cumulative' scenario has considered the projects in the 'Do something' scenario as well as the Beaches Link and Gore Hill Freeway Connection, Sydney Gateway and M6 (Stage 1) Motorway (formerly F6 Extension) projects. Table 9-3 of the environmental impact statement outlines the operational road traffic modelling scenarios.

The project has been designed to substantially improve accessibility, travel times and travel reliability across the Sydney Harbour. This includes improved vehicle travel times along key traffic routes through Rozelle, resulting from changes in traffic demands and patterns with trips using the Western Harbour Tunnel component of the project in preference to existing surface routes including City West Link, ANZAC Bridge, and the Western Distributor. The underground connections between Western Harbour Tunnel and WestConnex would also enable traffic to avoid the surface road network in the Rozelle area altogether.

While traffic demand is predicted to increase in both the 'Do something' and 'Do something cumulative' scenarios, average travel speeds through the Rozelle area would improve by up to 60 per cent as a result of the project, despite the increase in demand, as described in Section 8.4.2 of Appendix F (Technical working paper: Traffic and transport). This is a result of the large volume of traffic that would be diverted from the ANZAC Bridge and Western Distributor to the Western Harbour Tunnel, substantially reducing delays on this part of the existing motorway network and connecting roads.

Additional local traffic

Table 8-22 and Table 8-23 of Appendix F (Technical working paper: Traffic and transport) acknowledges that the performance of the intersection of Military Road/Ben Boyd Road intersection during morning and evening peaks would decrease during both the 'Do something' and 'Do something cumulative' scenarios when compared with the 'Do minimum' scenario in both 2027 and 2037. It is acknowledged that this decrease in performance would result in some localised delays. This is not expected to impact the Spit Bridge. Localised impacts to the road network would be

offset by more significant strategic benefits, such as significant improvements to the capacity and reliability of the critical cross harbour road corridors near the CBD, improving travel times on these links across the broader Sydney road network.

Freeway access points and redevelopment of former Channel 9 site

The traffic and transport assessment in Appendix F (Technical working paper: Traffic and transport) included the use of traffic demand data taken from the SMPM, following assessment of the model calibration and validation by independent peer reviewers and agreement that the model was suitable for this purpose. The SMPM is a network-wide model that includes recently completed and future infrastructure projects and population and employment growth forecasts provided by the Transport for NSW Transport Performance and Analytics division, consistent with demographics released by NSW Department of Planning, Industry and Environment. The project therefore allows for planned population and employment demand and growth throughout Sydney over the next 20 years.

More detailed operational modelling was also carried out to provide a more accurate understanding of the forecast future performance of the road network. The extent of the operational traffic modelling is shown in Figure 9-2 of the environmental impact statement and is considered sufficient to identify operational traffic impacts of the project on the surrounding road network. The operational modelling takes into account the impacts of the project design, including the proposed access restrictions.

The planning and design of the project assumes and allows for planned population and employment growth in the project area and more broadly throughout Sydney. The traffic and transport assessment in Appendix F (Technical working paper: Traffic and transport) also considered the project's cumulative impacts with other projects being planned and delivered in the vicinity of the project, including the proposed Beaches Link and Gore Hill Freeway Upgrade Project.

With respect to future traffic on Willoughby Road in the vicinity of the proposed redevelopment of the former Channel 9 site in Artarmon Road, traffic modelling shows that in the 'Do minimum' scenario (ie without the project), the Willoughby Road interchange with the Gore Hill Freeway would be expected to perform at Level of Service (LoS) F in the 2037 morning and evening peaks, with traffic and congestion expected to increase due to population and employment growth (Table 8-22 and Table 8-23 of Appendix F (Technical working paper: Traffic and transport)). However, in both the 'Do something' and 'Do something cumulative' scenarios, the Willoughby Road interchange with the Gore Hill Freeway is modelled to perform at LoS A in morning and evening peaks in 2037 (Table 8-22 and 8-23 of Appendix F (Technical working paper: Traffic and transport)). The Warringah Freeway Upgrade is expected to improve performance and reduce queuing on the Warringah Freeway. In the absence of the project, queuing is anticipated to extend to and through the Willoughby Road interchange, impacting the performance of the interchange and resulting in LoS F.

The modelling showed similar results for both the Brook Street and Miller Street connections to and from the Warringah Freeway.

Travel time savings

The project would improve journey times for freight, public transport and motorists, and alleviate pressure on some of Sydney's most critical transport corridors.

Trips that currently travel from the Northern Beaches to Sydney Airport and south Sydney would have the option in the future to travel to these destinations via Beaches Link, Western Harbour Tunnel, M4-M5 Link and Sydney Gateway instead of via Sydney Harbour Tunnel, the Eastern Distributor and Southern Cross Drive, as outlined in Section 8.2.1 of the environmental impact statement. Hence the travel time saving cited in the submission includes the benefits of the Western Harbour Tunnel and Beaches Link program as part of the future integrated motorway network.

Difference plots showing changes in forecast traffic demands across the road network in the study area between the 'Do minimum' and 'Do something cumulative' scenarios are provided in Annexure B of Appendix F (Technical working paper: Traffic and transport).

## C27.4 Air quality

### *Issue raised*

Submitters were concerned about the cumulative air quality impacts during project operation. Specific issues include:

- The combined impacts of multiple road infrastructure projects in Sydney on air quality were not addressed in the environmental impact assessment
- Cumulative dust impacts in areas already affected by WestConnex, including Rozelle, Balmain and Birchgrove
- Schedule of staged works should be included as a condition of approval to avoid cumulative impacts on air quality resulting from construction of various components of the project
- Concerns about the cumulative impact of the project with bushfires which are becoming more frequent
- The assessment should consider the cumulative impact from the Beaches Link and Gore Hill Freeway Connection project which has ventilation outlets at the same location
- Queried why the increase in maximum $NO_2$ 1-hour mean concentrations appears to get substantially worse if only the project is constructed, but would improve if Beaches Link and Gore Hill Freeway Connection is built as well
- The project would have cumulative impacts with a potential floating dry dock about 500 metres away in Berrys Bay.

### *Response*

The environmental impact statement does contain a cumulative air quality assessment which accounts for proposed or future road projects (and where relevant, ventilation outlets). The influence of these projects are represented in the 'Do something cumulative' scenarios in 2027 and 2037, and the results are presented in Section 12.6.2 of the environmental impact statement and Section 8.4 of Appendix H (Technical working paper: Air quality). Future road projects including the Beaches Link and Gore Hill Freeway Connection, Sydney Gateway and the M6 (Stage 1) Motorway (formerly F6 Extension). WestConnex, including the M4-M5 Link, are considered in all assessed scenarios.

Cumulative impacts associated with WestConnex

While tunnelling support and other general construction activities would be carried out in the Rozelle, White Bay and Birchgrove areas, the project does not propose to carry out any significant dust generating activities, or earthworks at a similar scale to the M4-M5 Link project. Dust generating activities, such as spoil handling, would be carried out within acoustic sheds which would limit dust impacts on nearby receivers.

Further, the peak dust generating activities from the construction of the WestConnex project (eg site establishment works and tunnelling) are not expected to overlap with the peak construction of the project and therefore would not increase the risk for dust impacts in areas such as Rozelle, Balmain and Birchgrove. Subject to the implementation of mitigation measures, the cumulative air quality impacts resulting from the construction of the projects considered, including M4-M5 Link are expected to be negligible.

Dust management measures

The effects of airborne dust during construction would be temporary and of relatively short duration, as discussed in Section C12 of this submissions report. As such, mitigation is considered straightforward because dust suppression measures are routinely employed as 'good practice' at most construction sites where there is surface disturbance. The standard construction air quality measures required by environmental management measure AQ1 (refer to Table D2-1 of this submissions report).

As required by environmental management measure AQ2 (refer to Table D2-1 of this submissions report), dust and air quality complaints would be managed in accordance with the overarching complaints handling process for the project (refer to Appendix E (Community consultation framework)).

Changes in background air quality due to bushfires

Section 6.6 of Appendix H (Technical working paper: Air quality) states that emissions from natural sources, such as bushfires, have substantially contributed to ambient ozone and particulate matter concentrations. Appendix H also states that domestic, commercial and industrial activities contribute the majority of $PM_{10}$ and $PM_{2.5}$ emissions (62 and 69 per cent respectively). While any bushfire activity would result in elevated background concentrations in the short-term, their unpredictable nature (for example location, intensity, duration, frequency) renders them difficult to assess in terms of their impact, particularly in the long term.

Recent experience during the 2019-2020 NSW bushfires showed that under severe bushfire conditions, concentrations of ambient ozone and particulate matter are overwhelmingly sourced from bushfire smoke and the contributions from vehicle emissions and other sources have little overall bearing on the prevailing air quality conditions.

Ventilation outlets

Section 12.6.2 of the environmental impact statement considered cumulative impacts from ventilation outlets from other projects. Eleven separate tunnel ventilation outlets were included in the assessment and included outlets associated with the project as well as existing tunnels such as the Cross City Tunnel and Lane Cove Tunnel, the approved M4-M5 Link and the proposed Beaches Link and Gore Hill Freeway Connection project.

Maximum $NO_2$ 1 hour concentrations

The results for the maximum 1-hour mean $NO_2$ concentrations for the project and cumulative (ie with the Beaches Link and Gore Hill Freeway Connection) scenarios are shown in Figure 12-6 of the environmental impact statement.

For residential, workplace and recreational receivers, the maximum 1-hour $NO_2$ concentrations results showed NSW criterion exceedances were lower in the cumulative scenario (88 receivers, 0.2 per cent) when compared to the project only scenario (183 receivers, 0.5 per cent). The majority of the exceedances are located along the Warringah Freeway in all scenarios, however, a small number of exceedances would occur near Victoria Road at Rozelle and Manly Road at The Spit. Changes in the level of exceedances along the Warringah Freeway as well as notable reductions along roads such as Manly Road at The Spit occur as a consequence of traffic shifting from surface roads where emissions contribute to local air quality at ground level, to sub surface roads where the ventilation system assists with atmospheric dispersion and limits contributions to local air quality at ground level. These differences are visually shown in Figure I-18 and Figure I-20 in Annexure I of Appendix H (Technical working paper: Air quality).

Floating dry dock

The potential for cumulative air quality impacts as a result of the project and the proposed floating dry dock proposal at Berrys Bay (North Sydney Council development application DA 57/19) is not expected. The floating dry dock proposal is located in an area that would not experience a change in operational air quality due to the project. Further, the air quality assessment carried out for the dry dock (as reported in the development application) concluded that the predicted concentrations of air pollutants due to emissions from the floating dry dock would be well below the assessment criteria prescribed in the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA, 2016).

## C27.5 Health

### *Issue raised*

Submitters raised concerns over health impacts from long-term noise exceedances from out of hours work due to consecutive construction of the project and the Beaches Link and Gore Hill Freeway Connection project.

### *Response*

Chapter 27 (Cumulative impacts) of the environmental impact statement assessed the cumulative noise impacts on receiver locations in proximity to the project from other construction projects being carried out in the same area at the same time. The cumulative noise assessment assumes project construction works would overlap with construction works from the Beaches Link and Gore Hill Freeway Connection and Sydney Metro City & Southwest (Chatswood to Sydenham) projects.

If both projects proceed it is largely unavoidable that construction noise would extend over a longer duration. As described above, the contractor would be required to develop a detailed construction methodology that ensures that construction noise is effectively managed to minimise adverse impacts on the acoustic amenity of the affected community. This would include minimising potential amenity impacts associated with construction noise outside standard daytime construction hours. Transport for NSW would commit to similar environmental performance outcomes for the Beaches Link and Gore Hill Freeway Connection project. If potential amenity impacts associated with works outside standard daytime construction hours are effectively managed on each project, the overall potential for amenity impacts for the affected community over the extended construction duration would be minimised.

Potential cumulative impacts will be mitigated in accordance with environmental management measure CI1 (refer to Table D2-1 of this submissions report), including multi-party engagement and cooperation to ensure all contributors to impacts are working together to minimise adverse impacts.

## C27.6 Biodiversity

### *Issue raised*

Request that the assessment considers the cumulative effect to native vegetation from multiple projects across Sydney.

Concern that the cumulative impacts of multiple stressors to marine ecosystems and the potential for symbiotic effects have not been considered.

### *Response*

Native vegetation

Cumulative impacts to biodiversity resulting from the construction of the projects considered in this chapter are expected to be negligible. Areas where projects may overlap are heavily urbanised (ie Rozelle and surrounds) where vegetation is absent. Mapped native vegetation in the south-west of the Berrys Bay construction support site (WHT7) would be protected during construction of the project. An additional small area of native vegetation is present within Yurulbin Park and would require clearing (refer to Section A4.2 of this submissions report). No other areas of mapped native vegetation are within the project footprint.

Relevant major projects in the locality that have been considered in the cumulative impact assessment (outlined in Chapter 27 (Cumulative impacts) of the environmental impact statement) include:

- Sydney Metro City & Southwest (Chatswood to Sydenham)
- M4-M5 Link

- Sydney Metro West
- Beaches Link and Gore Hill Freeway Connection.

These projects are located in urban areas, and most would have minimal impacts on native vegetation. Any vegetation impacts from the Beaches Link and Gore Hill Freeway Connection would be assessed in the Beaches Link and Gore Hill Freeway Connection environmental impact statement, in addition to any required management measures. Locations where other identified projects overlap with the project footprint are generally in cleared, urbanised areas and would therefore have minimal cumulative impacts.

Environmental management measure B4 (refer to Table D2-1 of this submissions report) requires that the project re-establishes vegetation within the project footprint, where feasible. Where replacement trees cannot be accommodated within the project footprint, locations outside the project footprint shall be identified for compensatory plantings. Trees removed by the project will be replaced at a ratio equal to or greater than 1:1. The replacement trees will consist of local native provenance species from the vegetation community that once occurred in this locality where available and subject to the urban design and landscape plan. Exact species choice for revegetation would be determined during further design development.

Marine ecosystems

As noted above, Chapter 27 (Cumulative impacts) of the environmental impact statement discusses cumulative impacts, including impacts to biodiversity resulting from the construction of the project and other projects within its vicinity. The assessment found that the cumulative impacts to biodiversity are expected to be negligible.

Section 5.2 of Appendix T (Technical working paper: Marine ecology) describes the impact assessment approach. The assessment of impact to key issues to biodiversity values is based on the risk assessment and the results of field surveys that identify any unique attributes of particular habitats or biota and regional extent. The assessment is based on whether there has been direct loss of habitat or modification of their physical attributes (eg hydrodynamics) but also indirect effects on biota through loss of prey or physiological changes to biochemical processes. The relative importance of each potential risk to biodiversity values is also considered. The precautionary principle was considered where there was lack of scientific certainty.

## C27.7 Urban design

### *Issue raised*

Concern that visual impacts on the Rozelle/Birchgrove area during construction would be more significant than what is stated in the environmental impact statement, particularly given cumulative impacts as a result from the M4-M5 Link project.

### *Response*

Cumulative visual amenity impacts resulting from the M4-M5 Link project are discussed in Chapter 27 (Cumulative impacts) of the environmental impact statement. For Rozelle, additional and prolonged moderate to high visual impacts are anticipated for residential and recreational receivers during construction in the vicinity of Rozelle Rail Yards, the Glebe foreshores, and residential receivers around Annandale and Lilyfield. Cumulative visual amenity impacts at Birchgrove are expected to be minor.

Considered and tailored multi-party engagement and cooperation will be established prior to construction to ensure all contributors to impacts are working together to minimise adverse cumulative impacts, as per environmental management measure CI1 (refer to Table D2-1 of this submissions report). Visual impacts during construction will also be managed through environmental management measures V1 to V11 (refer to Table D2-1 of this submissions report).

NSW GOVERNMENT

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C28 – General

SEPTEMBER 2020

# C28 General

## Contents

## C28.1 General queries and comments

***Issue raised***

Submitters raised queries over the proposed names of the new roads. Request that the roads should be named the Warringah Freeway for the freeway component and the new Beaches Link Tunnel for the tunnel component.

***Response***

At this stage, the name of the freeway component of the project will remain as the Warringah Freeway and the tunnel component of the project will be called the Western Harbour Tunnel.

The alpha-numeric numbering and/or future renaming of the project would be carried out in accordance with applicable road naming legislation and policy.

## C28.2 General support

***Issue raised***

Submitters expressed general support for the project, including the following comments:

- The project should have been implemented decades ago. There is no amount of public transport that is feasible that would preclude the need for a major road upgrade like this
- The project is a critical development contributing to the amenity and modernity of Sydney. It would make Sydney more liveable and enhance its profile as a modern metropolis
- The project's approval, construction, operation and then possible privatisation would deliver huge benefits to the people of Sydney and NSW
- The Western Harbour Tunnel and Beaches Link project team have carefully selected the proposed route of the tunnel to avoid impacts to houses, businesses and the community between Rozelle and the North Shore. The team has tried hard to provide a well-considered and pleasing outcome.

***Response***

The support for the project is noted.

## C28.3 General concerns

***Issue raised***

Submitters raised general objections to the project in whole and/or in part, due to the potential negative impacts described in the environmental impact statement. Concerns were raised that the project would not provide any positive outcomes for the local communities affected by the project or deliver any of the benefits stated in the environmental impact statement.

***Response***

The Western Harbour Tunnel and Beaches Link program is a major transport infrastructure program that will make it easier, faster and safer to get around Sydney. By creating a western bypass of the Sydney CBD, the Western Harbour Tunnel will take pressure off the congested Sydney Harbour Bridge, Sydney Harbour Tunnel and ANZAC Bridge; while Beaches Link will create an alternative to the Military Road and Warringah Road corridors to relieve traffic pressure on the North Shore.

A program of this scale is expected to support up to 15,000 full-time equivalent jobs during its construction.

The Western Harbour Tunnel and Warringah Freeway Upgrade project is an important part of the NSW Government's vision to create an integrated road and public transport network, which balances the needs of motorists and local communities.

The project would relieve congestion, improve travel times, improve road safety and enhance and expand capacity on key road corridors. In particular, the project would relieve congestion on the Sydney Harbour Bridge and Sydney Harbour Tunnel, enabling faster, more reliable journeys for bus customers, freight and private vehicle users on all road corridors crossing Sydney Harbour. It would also deliver improved transport connections with quicker access to public transport interchanges, and improvements to walking and cycling routes to provide more shared transport options.

The strategic need for the project is discussed in Chapter 3 (Strategic context and project need) of the environmental impact statement.

The project would deliver a large number of benefits and opportunities to the community and surrounding suburbs. The benefits to traffic during operation of the project are outlined in Section C3 and Section C9 of this submissions report.

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C29 – Other projects

SEPTEMBER 2020

# C29 Other projects

## Contents

## C29.1 Development related to the Beaches Link and Gore Hill Freeway Connection project

***Issue raised***

Submitters were concerned about the impacts of the Beaches Link and Gore Hill Freeway Connection project, including the following concerns, issues and queries:

- Concerns that the Beaches Link and Gore Hill Freeway Connection project is not guaranteed to go ahead due to it being separated as a stand-alone project. However, impacts of the Beaches Link and Gore Hill Freeway Connection project are included in the environmental impact statement
- Concerns that analysis/modelling of traffic movements has not been completed for Spit Bridge and the impact on local roads to the north of the Spit
- Concern over impacts to ecology and water quality at Manly Dam
- Concern over impacts to wildlife corridors and bushland in Flat Rock Gully
- Concerns that North Balgowlah would be highly impacted by the tunnel shafts and construction support sites
- Query over the size of the tunnel portals for the Beaches Link and Gore Hill Freeway Connection project
- Request a direct link between the Pacific Highway and the Beaches Link roads to reduce already congested Reserve Road ramps.

***Response***

The issues raised relate to the Beaches Link and Gore Hill Freeway Connection project. As noted in Section 1.1 of the environmental impact statement, the project and the Beaches Link and Gore Hill Freeway Connection project are subject to separate environmental assessment and approval processes.

The Beaches Link and Gore Hill Freeway Connection project is discussed in the environmental impact statement for this project in relation to the overall strategic context of the Western Harbour Tunnel and Beaches Link program of works, and the potential cumulative impacts of the program of works.

The Beaches Link and Gore Hill Freeway Connection project environmental impact statement will describe the project design, and will detail the potential environmental impacts and any required environmental management measures to further mitigate and/or manage any adverse impacts. This environmental impact statement will consider matters relating to the matters identified in submissions, such as the potential traffic, biodiversity and water quality impacts of the project.

## C29.2 Development related to other projects

***Issue raised***

Submitters commented that removal of the trees around Victoria Road and the western side of the ANZAC Bridge in Rozelle have resulted in an increase in noise level. It was noted that no ambient noise levels were carried out before WestConnex started so the full impacts are not understood.

Comment that the project fails to honour its commitment in relation to the pedestrian and bicycle overpass at the junction of The Crescent and the City West Link.

***Response***

The removal of the trees at Rozelle was assessed and approved as part of the M4-M5 Link project. Ambient noise monitoring was completed as part of the noise and vibration assessment included in Chapter 10 (Noise and vibration) of the WestConnex M4-M5 Link environmental impact statement.

The design of the pedestrian and bicycle overpass at the junction of The Crescent and the City West Link forms part of the WestConnex M4-M5 Link project and is beyond the scope of this project. Further information relating to pedestrian and bicycle infrastructure being constructed as part of the WestConnex M4-M5 Link project can be found in the environmental impact statement, response to submissions report and modification reports found at *www.planningportal.nsw.gov.au/major-projects/project/3611*.

NSW GOVERNMENT

Transport for NSW

# Western Harbour Tunnel and Warringah Freeway Upgrade

## C30 – Out of scope

SEPTEMBER 2020

# C30 Out of scope

## Contents

## C30.1 Issues outside the scope of the project

### C30.1.1 Road upgrades and parking

***Issue raised***

Submitters raised comments about road upgrades outside the scope of the project, including:

- Request to upgrade the Ben Boyd Road/Military Road intersection, and request for further information as to when Military Road will reach capacity after project completion
- Concern that the NSW Government has a track record of closing free roads or limiting lanes on free roads to push traffic into tolled roads and tunnels
- Request to provide an underground parking facility beneath the freeway site next to Alfred Street North to offset the loss of street parking along Alfred Street North and Merlin Street
- Request to provide a car park at the end of Balls Head Road inside the bund wall that could serve as a long term parking area for events held on the nearby coal loader platform, or visitors and construction parking during the project
- Comment the efforts of Willoughby City Council to improve amenity and zoning opportunities around Willoughby Road and Penshurst Street centres would be affected by any increase of traffic. The project needs to consider the Willoughby Council Local Centres Plan
- Queried the improvement provisions for the Sydney CBD streets as a consequence of less traffic due to the use of the project. Recommendation for the NSW Government to formally commit to, and provide funding to reduce road capacity for vehicles and improve streets for people in the city
- Excess space from removal of the Cahill expressway tollways should be converted to shared paths.

***Response***

Ben Boyd Road/Military Road

Upgrading the Ben Boyd Road/Military Road intersection is outside the scope of the project. Modelling of Military Road traffic is outside the scope of this project.

Closing free roads

Restrictions on vehicle movements in the surrounding road network to encourage use of the Western Harbour Tunnel (beyond local adjustments included in the environmental impact statement) are not considered necessary. Notwithstanding, the performance of the project will be monitored over time and adjustments made to the surrounding road network as deemed appropriate (refer to environmental management measure OT1 in Table D2-1 of this submissions report).

No adjustments would be made to surface roads beyond what has been described in the environmental impact statement which would be concentrated around the Warringah Freeway Upgrade component. However, the project would provide the opportunity for other stakeholders including Councils and Transport for NSW network management teams to investigate other opportunities for local road improvements.

Parking facilities

The provision of an underground car parking facility under the Warringah Freeway next to Alfred Street north is considered outside the scope of the project. Transport for NSW acknowledge the loss of parking along Alfred Street North and the limited alternative parking. Generally, projects involving surface road upgrade works will result in impacts to parking during the construction period. The loss

of parking during construction has been considered and Transport for NSW has endeavoured to identify as much alternative parking as possible.

Opportunities to reduce or offset the permanent loss of long stay parking spaces along Alfred Street North due to the project will be investigated during further design development (refer to environmental management measure OT3).

The provision of a car park at the end of Balls Head Reserve is outside the scope of the project. Parking for construction workers would be provided within the Berrys Bay construction support site (WHT7). At the completion of construction, the construction support site will be rehabilitated and converted to open space. Parking is further discussed in Section C9.7 of this submissions report.

Willoughby Council local centre plans

Changes proposed by Willoughby City Council to the Willoughby Road and Penshurst Street local centres are outside the scope of the project and the responsibility of Willoughby City Council.

However, the planning and design of the project has adopted a Movement and Place philosophy, minimising the potential to induce traffic on lower order roads by focusing on upgrades to strategic routes. In addition to the direct benefit of moving bypass traffic underground, reduced congestion on the arterial road network offers flow-on benefits to the adjoining local network, reducing the impact of queuing on local high streets and local roads. Reduced congestion on the arterial road network would result in further improvements in amenity related to physical safety, air quality and noise levels. This would be consistent with the aims of Willoughby City Council's strategic planning including the aim of creating liveable cities and strong communities supported by public and active transport to minimise traffic and promote healthier transport.

Sydney CBD streets

Changes to traffic arrangements in the Sydney CBD are outside the scope of the project.

Cahill Expressway toll booths

The removal of the Cahill Expressway toll booths is outside the scope of this project. Transport for NSW is proceeding with this as a separate project with work having started on 31 July 2020.

### C30.1.2 Public transport

#### *Issue raised*

Submitters raised comments about public transport issues outside the scope of the project, including:

- Request to consider replacing the northern Sydney bus fleet with electric buses to assist in reducing noise impacts
- Request for additional ferry services from Balmain East, Balmain and Yurulbin Point to the North Shore and Circular Quay
- Request for improved public transport in the Northern Beaches, particularly in the vicinity of the new Northern Beaches Hospital
- Suggestion to consider converting the Cahill Expressway lanes on the Sydney Harbour Bridge to rail use as the first stage of a Northern Beaches railway between Wynyard and Neutral Bay. A further extension of the Northern Beaches line may alleviate the need for the Beaches Link and Gore Hill Freeway Connection project.

#### *Response*

Replacing the northern Sydney bus fleet by electric buses is outside the scope of the project.

Provision of additional ferries between Balmain and the North Shore is outside the scope of the project.

Alternatives to the Beaches Link and Gore Hill Freeway Connection project and improvements to public transport including in the vicinity of the Northern Beaches Hospital are outside the scope of the project.

### C30.1.3 Active transport

***Issue raised***

Submitters raised comments about active transport changes outside the scope of the project, including:

- Request to provide an additional dedicated cycle lane in each direction on the Sydney Harbour Bridge deck
- Query as to whether a dedicated bicycle path will be constructed between Naremburn and the Sydney Harbour Bridge part of this project
- Request for a commitment from the NSW Government to reallocate road space for public transport and active transport on major road access routes to and from the city including ANZAC Bridge, Sydney Harbour Bridge and the Western Distributor
- Request for provision of the HarbourLink cycleway from Falcon Street/Military Road to the Harbour Bridge at Milsons Point
- Request to reinstate the walking and cycling route on the southern side of the ANZAC Bridge which was removed in 2005 when the bridge was widened for additional capacity
- Request for a substantial increase in active transport options as part of the project and on Roseville Bridge and Military Road.

***Response***

The above listed active transport suggestions identified in submissions are outside the scope of the project.

The proposed scope of the project complements other active transport planning being carried out by Transport for NSW. Councils can apply for funding for cycleways under the NSW Government's Walking and Cycling Program. In line with the NSW Government's *Future Transport Strategy 2056*, this program focuses on improving the convenience of walking and cycling for short trips to key destinations and within centres, and making walking and cycling safe and reliable by prioritising infrastructure that supports pedestrian and cycling movement. Further information is available at *transport.nsw.gov.au*.

### C30.1.4 North Sydney CBD

***Issue raised***

Submitters raised issues relating to the North Sydney CBD, including:

- Request for an urban design investigation and redesign for North Sydney CBD to reduce congestion and improve amenity through projects such as footpath widening, upgrades and other public domain improvements with consideration given to the North Sydney Council's *Public Domain Strategy Stage 2*
- As a condition of approval, a separate bus tunnel should be implemented at North Sydney and Victoria Cross Stations
- Complete a traffic design review of the project to seek modifications that would protect and improve the built environment in North Sydney
- The NSW Government did not respond or acknowledge a campaign for a civic space in the North Sydney CBD.

***Response***

The redesign of the North Sydney CBD, including provision of bus lanes, additional active transport improvements or other built environment is outside the scope of the project. North Sydney Council currently has a number of Council-led projects proposed for the North Sydney CBD and surrounding areas. The details of these projects can be found on North Sydney Councils website: *www.northsydney.nsw.gov.au/Projects_Infrastructure/Council_Projects*.

Notwithstanding, the North Sydney Integrated Transport Program (North Sydney Program) is an ongoing multi-agency collaboration between Transport for NSW, North Sydney Council, Greater Sydney Commission and the Government Architect of NSW, to guide future integrated transport planning and investment in the North Sydney CBD and interconnected areas.

The North Sydney Program considers strategic public transport connections to the North Sydney CBD, land use and public domain objectives, improved pedestrian amenity and safety, road network changes, improved access for cyclists to and through the CBD, convenient interchanges between bus and rail services, management of kerbside access to support business activity across the day and place outcomes within the CBD. As such, a key focus of the North Sydney Program is to ensure major projects, such as the Western Harbour Tunnel and Beaches Link program, integrate with the North Sydney CBD in a manner that supports the globally connected 'Harbour CBD' and enables delivery of befitting place-based outcomes.

Development of the North Sydney Program is ongoing and as part of the collaboration, the Western Harbour Tunnel and Warringah Freeway project will ensure opportunities for a future integrated and multi-modal transport network in the area. Refer to Section A4.1.3 of this submissions report for further information.

### C30.1.5 Tolling

***Issue raised***

Submitters raised concerns or suggestions about tolling or toll operators, including:

- A government-owned tolls collection company should be created whose purpose is purchase, placement and maintenance of NSW road tolling infrastructure, and receipt and distribution of road tolls
- Motorway tolls should be redesigned to be based on a per kilometre charge, eliminating the present charges for passing toll points and to adjust tolls for vehicle weight classes and zone of metropolitan area in which the toll is collected
- Consider funding via a northbound toll on the Sydney Harbour Bridge and Sydney Harbour Tunnel
- Tolls on the Sydney Harbour Bridge and Sydney Harbour Tunnel should remain the same and the introduction of additional tolls on these roads is unfair. Submitters also objected or had concerns about the increase in these tolls to match those proposed for the project stating that the community should not have to pay more for existing facilities.

***Response***

The management of tolling across NSW is outside the scope of this project.

Travel demand management is discussed in Section 4.3.2 of the environmental impact statement. These initiatives are viewed as complementary initiatives and are outside the scope of this project.

As stated in Section 5.3.5 of the environmental impact statement, a decision on tolls has not yet been made. However, the project does include provision for tolling gantries for northbound traffic on the Sydney Harbour Bridge and Sydney Harbour Tunnel should the NSW Government elect to introduce a northbound toll.

### C30.1.6 Sale of the asset

***Issue raised***

Submitters raised concerns about the potential sale of the asset, including:

- Public transport on the parallel routes must not be precluded in any sale/lease clause of any contract with future owners of the interconnecting motorways. There is concern that buyers of the motorway would not want competition from public transport taking away profits
- The project would require heavy Government subsidy to cover and compensate the operators for losses to make it viable.

***Response***

As with all tolled motorway projects, alternative cost free routes and public transport options always exist for commuters and the provision of new public transport routes are not precluded through contractual arrangements. This project would be no different.

The project would create opportunities to reduce congestion and improve travel times and reliability across the Sydney Harbour Bridge, including for B-Line services travelling to and from the Sydney CBD. The project would also provide the opportunity to increase the coverage of potential future B-Line services by extending the potential coverage of any services using the Western Harbour Tunnel.

The project would also compliment the Sydney Metro City & Southwest project, which is a committed project under construction by Transport for NSW. The Sydney Metro City & Southwest project will deliver cross harbour capacity for commuters, connect new nodes, and deliver faster and more reliable train journeys to and from the north-west of Sydney. While this project will contribute to reducing congestion on the existing cross-harbour road connections it is only one part of an integrated transport network that is required to service the needs of a very diverse range of origins, destinations and journey purposes.

The project has undergone a rigorous and robust review process with detailed consideration of the projects economic merit and successfully passed the Infrastructure NSW Assurance Review Process, as described in Section C1.2 of this submissions report. Infrastructure NSW has released a summary of the Final Business Case for the project, which is available online: *www.infrastructure.nsw.gov.au/media/2528/western-harbour-tunnel_bc-summary-may-2020.pdf*.

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This document contains important information about public transport projects in your area. If you require the services of an interpreter, please contact the Translating and Interpreting Service on **131 450** and ask them to call Transport Projects on **1800 931 189** The interpreter will then assist you with translation.

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